DIGPILOT

Start digging
Version 1.6.1.2

Welcome

Congratulations on your new DigPilot.

You are now ready for quicker, safer and more accurate work with your new workmate, DigPilot.

This manual contains descriptions of the user interface and ideas for working with DigPilot. But don't let this limit your use of DigPilot. DigPilot can almost certainly be used in ways we have not thought of or described in this manual.

When on site, you are the expert – all we have done is offer you the best workmate an excavator driver could wish for.

Enjoy your work!

Operating principle

DigPilot has been created to give you all the information you need about the work you are carrying out, just by glancing at the screen. Some of the information, such as the height alarm, can also be provided by DigPilot in the form of sound signals.

To give you this information DigPilot needs your help. To get started you first have to tell DigPilot what type of work or project you intend to carry out. You then tell DigPilot where this work is to be done by referencing.

With this complete, the excavator is able to sit with its undercarriage in one place while you dig and swing the superstructure to your heart's content. DigPilot has complete control over where the machine is in relation to the project.

If the undercarriage moves, for instance because you have transferred to a new location, you will need to tell DigPilot this by referencing again. Once you have done the referencing, you just continue digging and DigPilot continues to make the right measurements.

This is how daily work proceeds, and in this way DigPilot helps you by displaying the excavator in terms of work, height, length, slope and whatever else you need to carry out your work to a centimetre's precision.

Types of work/projects

DigPilot allows you to select the following types of work:

- Flat plane
- Single slope
- Dual slope
- Trench
- Profile
- Channel
- Embankment
- Bucket-defined slope

The type of work is also called a project. The following sections contain a description of the different projects and what settings need to be entered.

Flat plane

A flat plane is a horizontal surface without gradient in any direction. This means you only need to set two things in DigPilot:

- The referencing method
- The reference height (vertical distance from reference point to digging depth)

In flat-plane digging the digging window does not show the machine from above. On a flat plane the vertical distance from the bucket tip to the digging depth is the same whatever direction the superstructure is facing.

Single slope
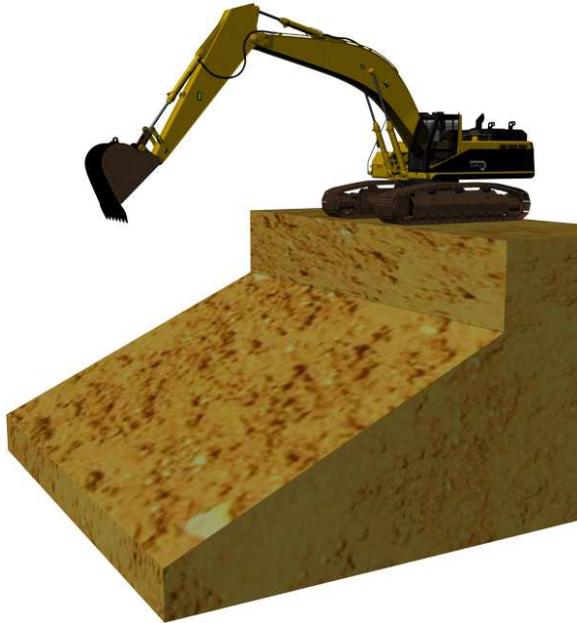
A single slope is a surface with a gradient in one defined direction. In DigPilot you need to set the following to work on single slopes:

- The referencing method
- The reference height (vertical distance from reference point to digging depth)
- The gradient/slope
- Direction of gradient/slope (if compass is turned on)

Dual slope

A dual slope is a surface with a gradient both lengthways and sideways. In DigPilot you need to set the following to work on dual slopes:

- The referencing method
- The reference height (vertical distance from reference point to digging depth)
- Gradient/slope in lengthways direction
- Gradient/slope to the side
- Direction of gradient/slope in lengthways direction (if compass is turned on)

Note that if you enter the sideways gradient as zero, the project will be the same as a single slope.

Trench
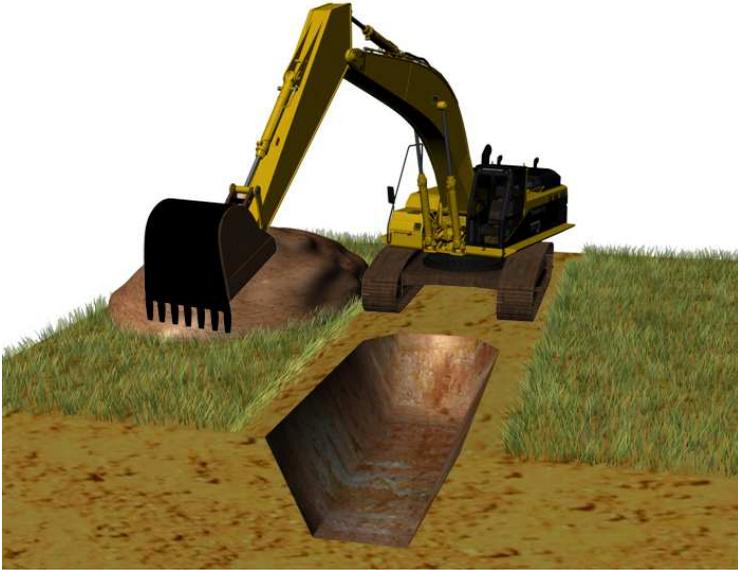
A trench is a single slope of limited width. The limitation lies in the width of the trench base and the walls sloping up from the base. A trench has the following settings:

- The referencing method
- The reference height (vertical distance from reference point to trench bottom)
- Gradient/slope in lengthways direction
- Width of trench
- Gradient/slope of trench walls
- Direction of gradient/slope in lengthways direction (if compass is turned on)

Profile

A profile consists of two horizontal surfaces of different height with a single slope between them. In DigPilot you need to set the following to work on a profile:

- The referencing method
- The reference height (vertical distance from reference point to digging depth)
- Gradient/slope in lengthways direction
- Height from starting point to base of profile
- Direction of gradient/slope in lengthways direction (if compass is turned on)

Channel

A channel consists of three horizontal surfaces with single slopes between them as shown on the illustration opposite, and has the same gradient on both sides of the channel base. With a channel the following settings must be entered:

- The referencing method
- The reference height (vertical distance from reference point to digging depth)
- Gradient/slope in lengthways direction
- Length of channel base
- Height from starting point to base of channel
- Direction of gradient/slope in lengthways direction (if compass is turned on)

Embankment

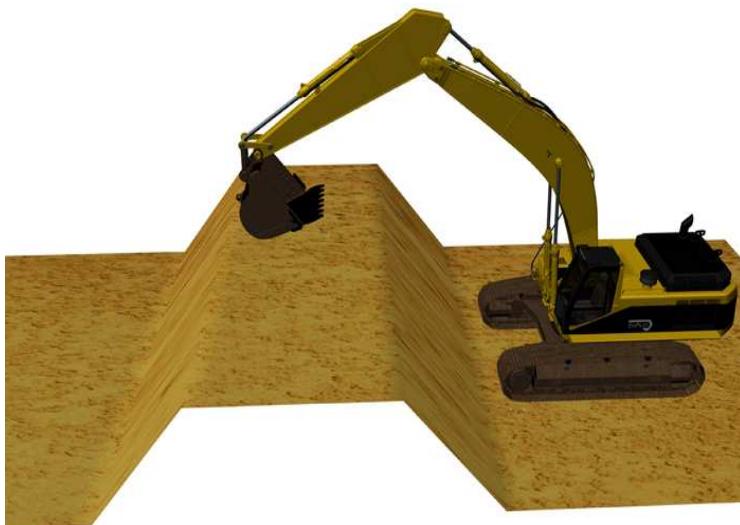An embankment consists of three horizontal surfaces with single slopes between them as shown on the illustration opposite, and has the same gradient on both sides of the embankment top. With an embankment the following settings must be entered:

- The referencing method
- The reference height (vertical distance from reference point to digging depth)
- Gradient/slope in lengthways direction
- Length of top of embankment
- Height from starting point to top of embankment
- Direction of gradient/slope in lengthways direction (if compass is turned on)

Bucket-defined

Bucket-defined is used to indicate a single slope using the bucket tip. This can be useful, for instance when forming a single slope up to the foundations of a garage.

By referencing the bucket tip to two different points, DigPilot will calculate the gradient, direction of gradient and digging depth and store these settings in the same way as for a single slope.

! **Do not rotate the superstructure until you have referenced both points.**

Digging slopes

All projects except *"Flat plane"* include surfaces with a slope.

The gradient/slope is entered in DigPilot as a percentage (%), unless *"Bucket-defined"* project is selected. If the gradient/slope has been specified as a ratio (e.g. 1:8) or in degrees (e.g. 12.5˚) you can use DigPilot's integral calculator to translate these values into percentages.

Enter the direction of the slope by pointing the boom in the lengthways direction of the slope.

! **A slope has the gradient which you enter, in the lengthways direction you enter. Using its compass DigPilot constantly calculates the gradient in the boom direction as the superstructure swings round. This applies to all projects with a slope.**

This is illustrated by a single slope on the next page. In the first screen image the superstructure is in line with a single slope of 30% gradient and in the second image, the superstructure has rotated through 90 degrees. As can be seen from the images, the gradient/slope in the boom direction displayed under the machine changes from 30% to zero.
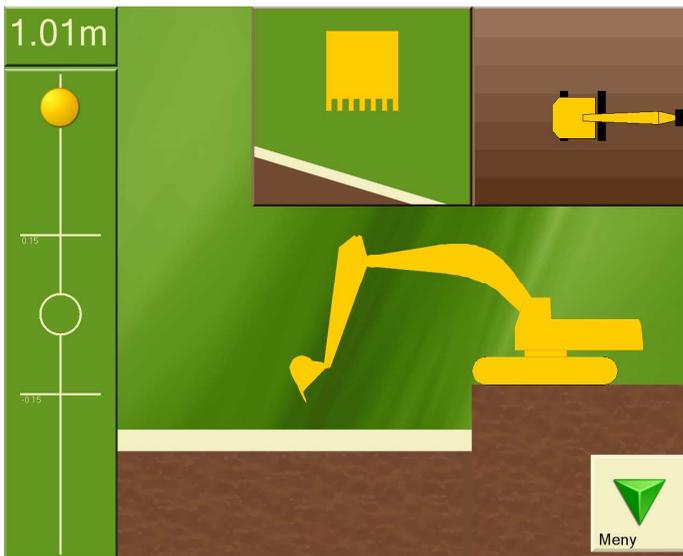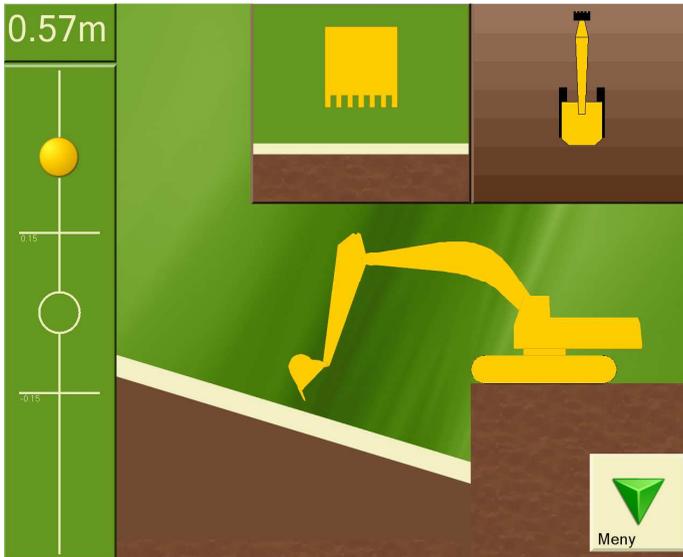
Work/project settings

Many of the settings entered are the same for the different projects. When you select a new project in DigPilot you will be guided through the setup procedure for these settings with images and text. This chapter also gives a closer description of the most important project settings so there is no doubt as to what is meant.

Reference height

The reference height is the vertical distance from the reference to the digging depth. If you use a rotating laser for referencing, the laser plane will be the reference and if you use the bucket tip for referencing, the benchmark you place the bucket tip on will be the reference.

Notice that the reference height will be positive if the digging height lies below the reference. A reference height of 1.0 m will thus result in a digging depth of 1.0 m below the reference.

You can use the reference height actively when working on a project. Say you have set the reference height to 1.0 m and have finished levelling out a site foundation. If your next task is to lay 10 centimetres of crushed stones on the foundation base, you can change the reference height to 0.9 m and use DigPilot to check that the layer of crushed stones has the correct height/thickness.

If you have been given the heights as elevations and have benchmarks at a particular elevation, you can use DigPilot's integral calculator to work out the reference height.

Gradient/slope in lengthways direction

This is the gradient in the direction of the boom when *"Direction of slope"* is entered.

Gradient/slope to the side

This applies only to *"Dual slope"* and is the gradient perpendicular (90 degrees) to the lengthways direction. For all other projects, the gradient/slope to the side is zero.

Direction of slope

This is the lengthways direction of the slope and is indicated by pointing the boom in the lengthways direction of the slope. When you press *"OK"* on the screen, DigPilot will store this direction using the compass.

Referencing

DigPilot always knows where the bucket tip is in relation to the rotation centre of the undercarriage, but in order to know where the rotation centre and thus the bucket tip is in relation to the project, DigPilot must be referenced. This is done with a benchmark or a rotating laser.

! **If the excavator is standing in loose material, the machine may creep. DigPilot will not notice this and you should therefore re-reference if the machine is creeping a great deal.**

Once you have created a new project you will automatically be invited to reference when you go into the digging window. To perform a new reference, press the button marked "*Reference*" in the digging window menu.

Referencing with benchmark

A benchmark is a point with a known height in relation to the digging depth of your current project.

! **If you have chosen** *"Profile", "Channel"* **or** *"Embankment"* **the benchmark must also have a known position in relation to the project. See the screen images for the current project for further details.**
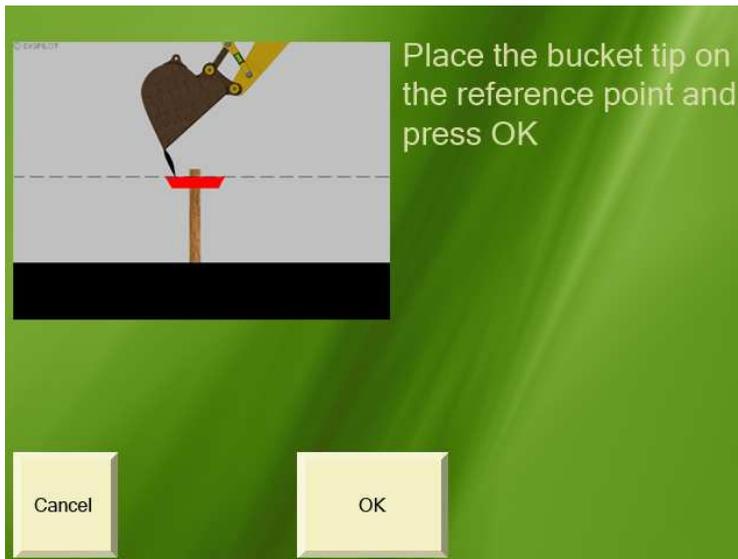

Place the bucket tip on the benchmark and press *"OK"*.

Referencing with laser

DigPilot can also be referenced by detecting the laser ray from a rotating laser with the laser receiver on the arm sensor.

! **The laser must be set with exactly the same gradient/slope and direction as entered for the project in DigPilot.**

During referencing, the screen will show where the laser ray has hit the laser receiver.
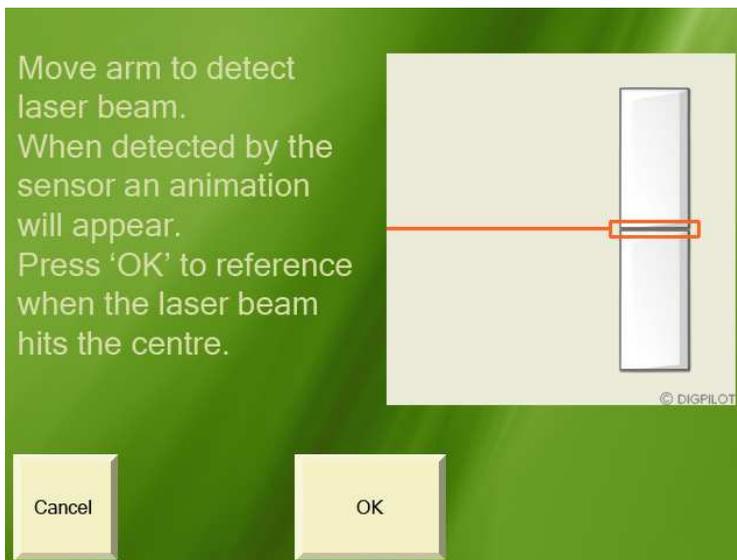
Press *"OK"* when the laser ray touches the centre point.

! The advantage of a rotating laser is that it can cover large areas with very high accuracy. You avoid having to use many benchmarks and avoid the risk of losing accuracy when moving the excavator. Contact your dealer for offers of DigPilot quality lasers.

To find the laser plane as quickly as possible, you can first move the arm relatively quickly through the area you expect to find the laser ray in, while simultaneously watching the screen for a hit. When the laser ray hits its target, go back to the correct height and adjust until the laser ray touches the centre.
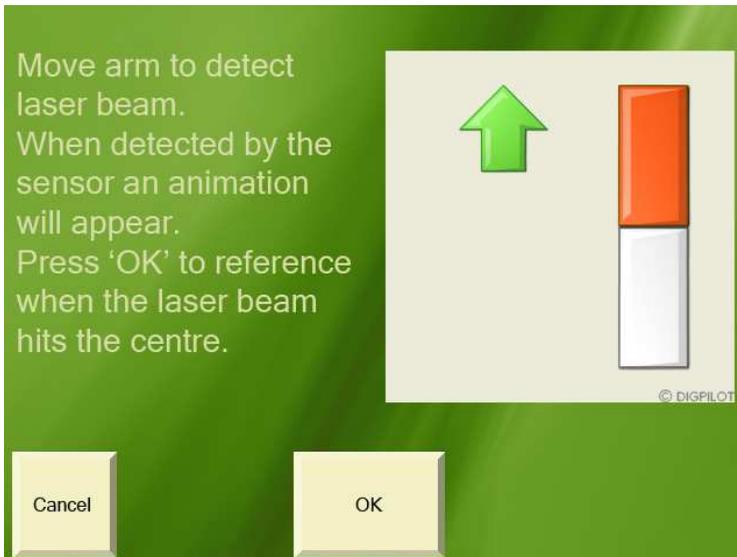
Moving the undercarriage

When you have referenced and finished digging at the point where the undercarriage is standing and need to move to a new location, you will need to inform DigPilot. The following describes three ways you can do this.

Alternative 1: New reference

After moving the undercarriage to a new position you can re-reference to a benchmark or laser plane.

## Alternative 2: Retain the same height

If you have been digging down to the desired depth, you can continue referencing this digging depth instead of the benchmark or laser plane you started with. You can do this be altering the reference height in the project to zero, selecting benchmark as the referencing method and then referencing the bucket tip on the excavated area after moving the machine.

Alternative 3: Swap point function

The swap point function is available for projects *"Flat plane", "Single slope" and "Dual slope".* Before you move the undercarriage, place the bucket tip on a point which can also be reached from the place you will be moving the undercarriage to. Press "OK" on the screen. Move the undercarriage and position the bucket tip on the same point. Press *"OK"* on the screen again.

The digging window
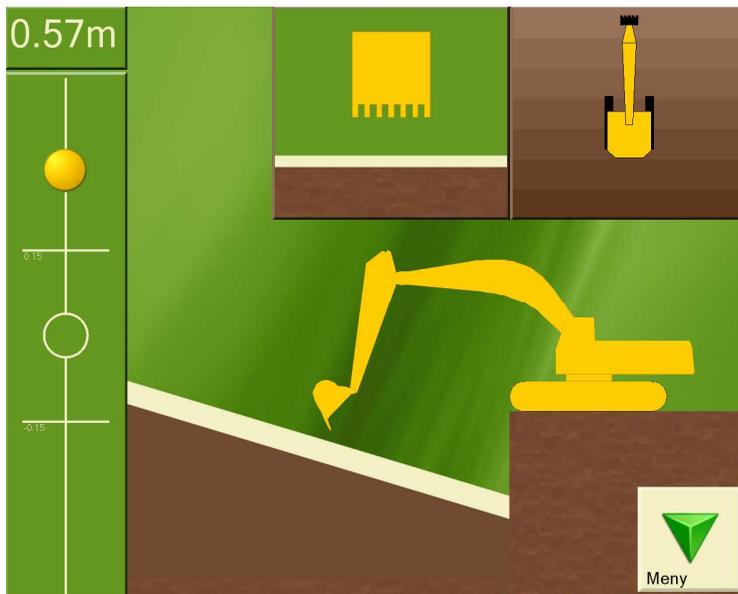
In the digging window you will find all the information you need for digging. You can also choose what you would like to see displayed for optimal adaptation of the screen to you and your needs. This chapter describes what you will see in the digging window and how you can use it.

Target ball

On the left side of the digging window you will see the target ball. This functions as a zoom. As the bucket tip approaches the digging depth, the ball begins to move. When the target ball is in the centre

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of the circle, the bucket tip is exactly at the desired digging depth. The two horizontal lines show the working area.

Bucket height

The top left-hand corner shows the vertical distance from the measurement point on the bucket tip to the entered digging depth.

Top view of machine

At the top right hand of the digging window the excavator and the project are viewed from above. This can be very helpful for returning to a lengthways direction, for example in the case of a trench.

Bucket

In the top centre of the digging window the bucket is displayed as viewed from the driver's cab with the project below. This window is particularly useful if you have a tilting bucket and tilting sensor. It shows both the tilt angle on the bucket and the gradient/slope of the project perpendicular (90 degrees) to the direction of the boom. The bucket in the window can also change colour to show that the tilt angle on the bucket is too small, too large or correct for the project.

Length

You can also bring up the length from a given point to the bucket tip. The length will be shown in yellow text under the bucket height. Length is a separate referencing system which measures the horizontal distance from the length referencing point to the bucket tip. The distance is measured with respect to the circle centre on the undercarriage, so that the measured length does not alter as the superstructure swings round.

This can be very useful when laying pipes for example. Press *"Graphics"* and then choose *"Visible elements"* to turn on length referencing.

Sideways view of machine

Being able to see the excavator from the side during the project is probably the most important function for you as driver, and is therefore the main focus in the digging window. The project below is shown in relation to the reference point on the bucket (left, middle or right).

Buttons on digging window

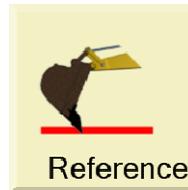The menu in the digging window has a large number of functions just a click away.
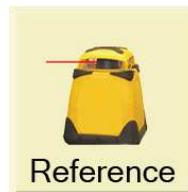
Menu

This button opens and closes the menu.
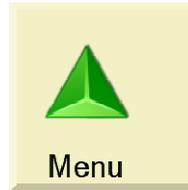
Reference

If you have chosen benchmark as your referencing method, the reference button will show the image of a bucket.
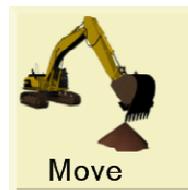
If you have chosen laser as your referencing method, the reference button will show the image of a laser.

Press the reference button to perform a new referencing, and follow the instructions on the screen.
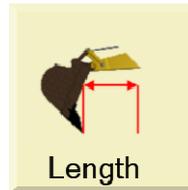
Swap point

Press this button to use the swap point function and follow the instructions on the screen.

Length referencing

Place the bucket tip on the
reference point and press this
button to start measuring the
horizontal distance from the
reference point to the bucket tip.

This button will only appear on the menu when
length referencing is turned on. Press *"Graphics"*
and then choose *"Visible elements"* to turn on length
referencing.

Measure

Place the bucket tip on the
reference point and press this
button to start measuring length,
height, distance and gradient/slope
from the reference point. Press the button once
more to return to the project you are working on.

Verify

Pressing this button gives you
access to a procedure which lets
you verify whether DigPilot is
measuring accurately or not. If it is
not doing so, you can also go in here and select
"Troubleshooting" to identify and correct any errors.

Work/project

Press this button to view and alter settings on the project you are working on. If you wish to start a new project, this can also be done here.

Graphical settings

By pressing this button you can change what is displayed in the digging window and how it is displayed.

Sound settings

Press this button to change when DigPilot will give a sound signal during digging. The settings for the height alarm are also located here.

! **The sound integrated in DigPilot is very quiet. External beeper with a loud sound can be purchased from your dealer.**

Graphical settings

By pressing "Graphics" you access a menu on which you can choose the appearance of the digging window in order to adapt it optimally to you and your needs at any time.

Measurement point of bucket

Here you can choose whether to use the middle of the bucket tip, or the left or right bucket tip as reference point.

The bucket measurement point is used everywhere in DigPilot where you are asked to use the bucket tip.

Visible elements

Here you can select which elements are to be shown in the digging window.

Brightness of digging window

DigPilot has a so-called transreflective screen to give you the best possible picture when sunlight is directly on the screen. If it is dark outside and you find the light from the screen too bright, you can dim it here. Note that it takes approx. 10 seconds to open the digging window while the screen is being dimmed.

Angular difference for bucket warning

You can use this function if you have a tilting bucket and tilting sensor. In the window showing the bucket from the driver's cab, the colour of the bucket will change to show that the sideways angle of the bucket blade is too large, too small or correct for the project. Here you can enter how large an angular difference you will accept before the bucket changes colour.

Working area

The size of the working area determines when the target ball will start to move and when the *"Colour warning"* will be given. By increasing the size of the working area you make the target ball less sensitive.

! **If DigPilot is correctly installed, it will measure to an accuracy of one centimetre on a normal excavator. The size of the working area will not affect measurement accuracy.**

Focus

Here you can choose whether you want the excavator undercarriage to be stationary while you work or if you want the bucket to remain stationary while the rest of the excavator and the project move around.

Colour warning

Here you can select whether DigPilot will give you a colour warning when the measurement point on the bucket tip is above or below the indicated working area. You can choose between a colour change on the background to the screen, to the whole excavator or just the bucket.

Size of excavator

Here you can select how much space the excavator will take up on the screen by increasing or reducing its size.

Position of excavator

Here you can move the excavator round the screen.

Appearance of excavator

Here you can select how the excavator will look from the side. Change the appearance to a small machine if you have a small excavator with the boom fixed in front of the driver's cab.

Sound settings

Sound signals can be a useful aid in addition to the screen display. Here you can decide whether you want a sound signal when the measurement point on the bucket tip is in or under the working area. The height alarm also has a sound signal.

Height alarm

The height alarm will warn you if the top of the arm or bucket is over a certain height above the underside of the tracks. To turn the height alarm on, you need to enter two extra excavator dimensions and indicate the alarm height.

Note that the height alarm is indicated in relation to the underside of the excavator tracks and not in relation to the project.

Use of compass

In order to make full use of DigPilot when excavating sloping projects, it is essential that the compass gives an accurate measurement. It is therefore important that the compass is well calibrated.

Note that the compass is at its most accurate when the undercarriage is horizontal.

However, sometimes the compass may not give an accurate reading even when the undercarriage is level. The greater the gradient/slope in the project, the greater the error in bucket height will be if the compass is measuring wrongly.

When excavating across large slopes you should therefore consider turning off the compass and keeping track of the direction yourself. You can turn off the compass by selecting "*Main menu>Setup>Hardware >Sensors"* and marking the PitchRollCompass sensor. Select "*Details*". Then select "*Compass on*" and press "*Change*".

Speed of sensors

Excavators may vibrate a great deal or very little, depending on rpm, size, age, make etc. and this will affect the sensors' angular measurements. DigPilot has been designed to ensure the sensors give the optimum in stable, quick and accurate angular measurements in all types of excavators.

It is therefore possible to alter the sensitivity and damping of the sensors for the best possible match with your excavator. At the factory the sensors are set with the aim of being stable when the excavator is stationary, but reacting immediately when the machine moves.

To make changes to this, select *"Main menu>Setup>Hardware >Sensors"* and press the button *"Sensitivity"*.

Sensitivity

Sensitivity indicates how strong the vibrations in the excavator must be before DigPilot interprets this as a movement of the machine.

By increasing the sensitivity, smaller vibrations in the machine may be interpreted as a movement of the machine.

Reducing the sensitivity means that it will take larger vibrations to be interpreted as a movement of the machine.

Damping

Damping indicates how much the angular measurements will be filtered when the excavator is stationary. Filtering makes the angular measurements stable and accurate despite vibrations.

By increasing the damping, DigPilot will react more slowly to small and limited movements in the machine.

By reducing the damping, DigPilot will react more quickly to small and limited movements in the machine.
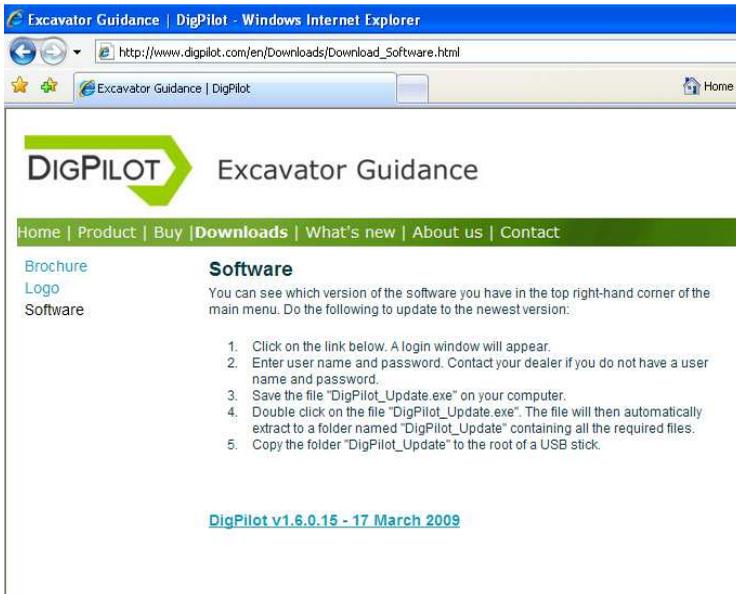
Damping is set high at the factory and can thus be probably adjusted downwards.

Keeping the software up to date

You can see which version of the software you have in the top right-hand corner of the main menu (e.g. "v1.6.0.1").
If your dealer has your email address, you will be notified when a new version of the software is released. You can also check if you have the latest version by visiting

You will find the latest version of the software under "*Downloads*" and "*Software*". We recommend that you always use the latest version of the software.

How to update the software

1. Click the link to the latest program version on www.digpilot.com . Contact your dealer if you have not been given a username and password.
2. Download and store the file "DigPilot_Update.exe"
3. Double-click the file "DigPilot_Update.exe". This will then be automatically unpacked in a directory/folder called "DigPilot_Update" containing all the files you need.
4. Copy the directory/folder "DigPilot_Update" to the root directory of a USB memory stick.
5. Plug the memory stick into the DigPilot PC and select "*Main menu> Setup> Hardware> Computer> Update software*".
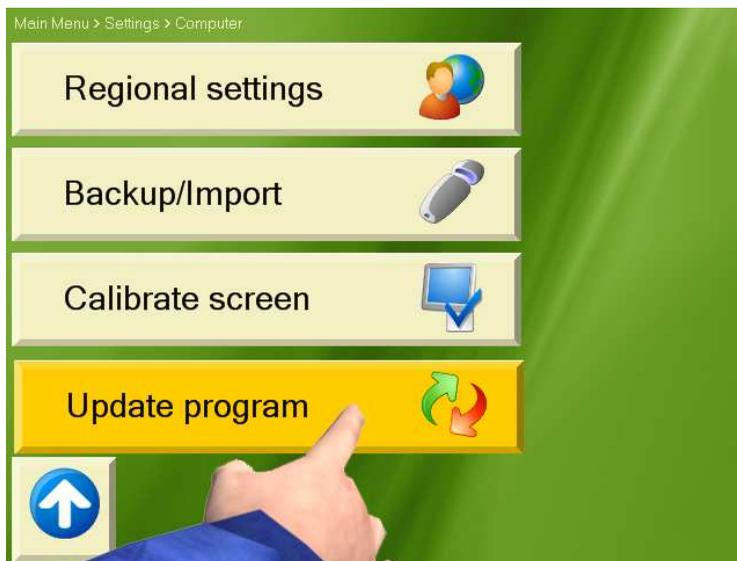
FAQ

In this section you will find answers to the following questions:

The DigPilot PC is not responding, what should I do?

Most DigPilot problems can be solved by turning the DigPilot PC off and on.

The sensors are not responding, what should I do?

If you are having problems making contact with the sensors, proceed as follows: Turn the DigPilot PC off and put all the sensors in the charger for a few minutes. The sensors will then be reset while they

are being charged. Take all the sensors out of the charger and turn the DigPilot PC back on.

A sensor is damaged, what should I do?

You can obtain a new sensor by contacting your dealer. Delete the damaged sensor from the DigPilot PC before entering the new one.

How do I recalibrate a sensor?

If you have already calibrated the sensors and want to recalibrate one, proceed as follows: Select "*Main menu >Setup >Hardware >Sensors*" and highlight the sensor you want to calibrate. Select "*Details*". Then select "*Calibrated*" and press "*Change*".

The system is not measuring accurately, what should I do?

If the system is not measuring accurately, a dimension or calibration value is probably wrong. Select "*Validate*" from the menu in the digging window and press "*Troubleshooting*". DigPilot will then help you identify the problem and rectify it. Follow the on-screen instructions.

The compass is measuring incorrectly, what should I do?

The compass in the PitchRollCompass sensor is magnetic and has to be calibrated in order to measure correctly.

Therefore try recalibrating the compass to see if this helps. Select "*Main menu> Setup> Hardware >Sensors> PitchRollCompass> Details*". Then select "*Calibrated*" and press "*Change*".

If you want to check how well the compass is calibrated, you can select "*Main menu >Setup >Hardware >Sensors> PitchRollCompass>Verify*". When the machine is stationary and the superstructure is rotated, the compass measurements should ideally form a perfect circle with the centre at the origin.

In certain special circumstances the magnetic compass can be disrupted so much that it should not be used. In this situation the heading on the screen can change even if the machine is at a complete standstill.

If this happens, the compass should be turned off. Select "*Main menu >Setup >Hardware >Sensors*" and highlight the PitchRollCompass sensor. Select "*Details*". Then select "*Compass on*" and press "*Change*". All the software functions that use the heading measurements from the compass will now

disappear and you will have to keep track of the heading yourself.

In situations where there are large fluctuations in the magnetic field around the machine all the time, the compass calibration will not be able to compensate for the disturbances. An example of such a situation is if the machine is close to a railway line that is in use: Trains are surrounded by a strong magnetic field, which will badly disrupt the compass measurements whenever a train goes past. In this case the heading displayed on the screen could change even if the machine is at a complete standstill.

Working in the vicinity of high-voltage cables can also cause problems for the magnetic compass.

The laser sensor is not working, what should I do?

The laser sensor may have problems detecting the laser beam in strong sunlight, particularly if the sun is shining straight into the photoelectric cell. If this happens, the amount of sunlight hitting the cell will have to be reduced by turning the sensor away from the sun, for example.

If the laser sensor is exposed to strobe lighting, a rotating flashing light or the like, the sensor may be misled into thinking that it has detected the laser.

If the laser sensor does not respond to the laser beam at all, even at close range, the photoelectric cell has probably been damaged. In this case you will have to contact your dealer to have the sensor replaced.

Responsibility

DigPilot cannot be held responsible in any way for any damages or costs to the customer, like wrong heights or slopes on work sites, even if it can be traced back to faults in the DigPilot hardware or software. The customer is sole responsible to make sure that the system is working correctly before and during operation.