EXCAVISION

Excavator Grade Control System

Users Manual

Digging a 4 ft deep hole

Surveyor's stake
Press zero here

4 ft

Surveyor's stake
Press zero here
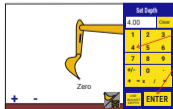
4 ft

---
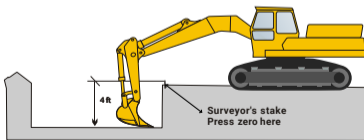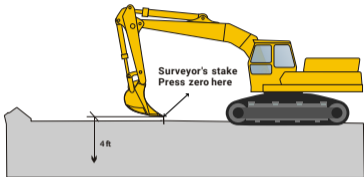
① **Set the reference:**
1. Place the tip of the bucket on the surveyor's stake
2. Press Zero on Bucket
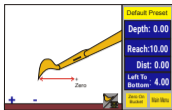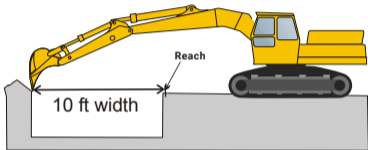3. Press Main Menu

② **Set alarm depth:**
1. Press Set Depth

③
1. Press 4
2. Press Enter then Measure

Digging a 4 ft deep hole 10 ft wide

Understanding the display

Reach

10 ft width

④

From surveyor's stake the Reach is 10 ft.

Default Preset
Depth: 0.00
Reach:10.00
Left To Bottom: 4.00

Zero
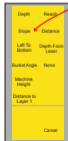
⑤

From surveyor's stake the Reach is 3.50 ft and the bucket is at 4 ft depth, left to bottom 0.00 Alarm sounds if bucket goes below 4 ft.

Default Preset
Depth: 4.00
Reach: 3.50
Dist: 0.00
Left To Bottom: 0.00

Zero

Understanding the display:
Choose what to see by pressing one of the 4 measuring windows: Depth, Slope, Left To Bottom, Bucket Angle, Reach, Distance, Depth From Laser or etc.

Distance   Depth

Bucket Angle   Reach   Slope = 100 X $\frac{Depth}{Reach}$

Depth	Reach
Slope	Distance
Left To Bottom	Depth From Laser
Bucket Angle	None
Machine Height	
Distance to Layer 1	

Cancel

Moving the excavator without losing the reference

1
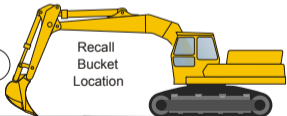
1. Place the tip of the bucket on the ground close to excavator
2. Press Main Menu
3. Press Store Bucket Location

2

1. Press Store Bucket Location
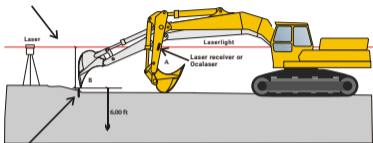2. Move the excavator and place bucket tip on the same spot.

3

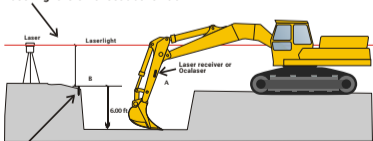1. Press Recall Bucket Location then Measure. Start digging.

Digging a 6 ft basement with a laser

Laser light is 5.46 feet above hub

Laser

Laserlight

Laser receiver or Ocalaser

A

B

6.00 ft

Surveyor's stake (Hub)

Laser light is 5.46 feet above hub

Laser

Laserlight

Laser receiver or Ocalaser

A

B

6.00 ft

Surveyor's stake (Hub)

①

Default Preset
Depth: 0.00
Reach: 0.00
Dist: 0.00
Left To Bottom: 0.00

1. Press Main Menu

②

Rebenching

1. Press Laser as Ref
2. Press Set Depth

③

Rebenched
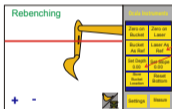
Set Depth
11.46

1. Key in 11.46 (6 ft depth + 5.46 ft from laser light to the Hub)

2. Press Enter then Measure.
3. Catch the laser.
Move the Ocalaser automatic receiver in to the laser beam and wait for long beep. Start digging.

Moving the excavator when using the laser as reference

When excavator is moved, the tracks go to a lower or higher location and you need to rebench, do the rebenching just before reaching the bottom then you can fine grade the bottom

Rebenching

Default Preset	
Depth:	0.00
Reach:	0.00
Dist:	0.00
Left To Bottom:	0.00
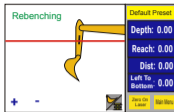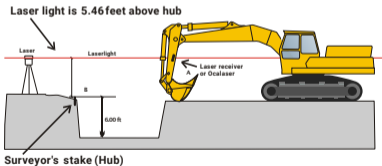
① Move the Ocalaser automatic receiver into the laser beam until you see 3 green lights you see Rebenching appear on the screen.

Rebenched

Default Preset	
Depth:	0.00
Reach:	0.00
Dist:	0.00
Left To Bottom:	0.00

② When the system finish rebenching, Rebenched appear on the screen.

Laser light is 5.46 feet above hub

Laser

Laserlight

Laser receiver or Ocalaser

A

B

6.00 ft

Surveyor's stake (Hub)

Ocalaser

Digging a trench with slope using a rotating laser

Example: Rotating laser above manhole. Dig to 8.75 ft below laser beam with 2% slope, deepest near manhole.

Rotating laser light with slope
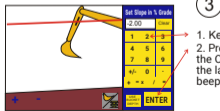
Ocalaser

Laser height from bottom.

8.75 ft
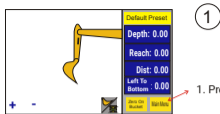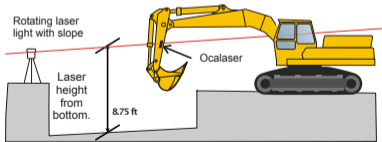
①
1. Press Main Menu

②
1. Press Laser As Ref
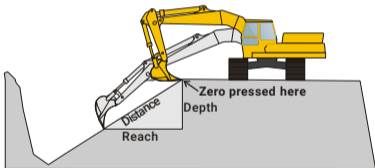2. Press Set Depth and key in 8.75 then Enter 3. Press Set Slop

③
1. Key in - 2
2. Press Enter then Measure. Move the Ocalaser automatic receiver into the laser beam and wait for long beep. Start digging

Digging perfect embankments

Example:

Dig a 50% Slope

Zero pressed here
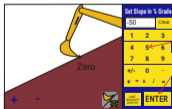Distance
Depth
Reach

①
1. Place tip of bucket on embankment and press Zero on Bucket
2. Press Main Menu
3. Press Set Dept
4. Press 0 then Enter
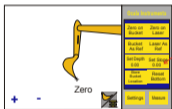
②
1. Press Set Slope

③
1. Key in -50
2. Press Enter then Measure
Alarm sounds if bucket tip goes below embankment.

Using both laser and bucket tip as reference

When digging a ditch embankment you can make sure the bottom is at the correct depth by using the laser as reference and simultaneously use the bucket tip as reference for the embankment

1. Set up the rotating laser and determine the depth of the ditch, as on page 7.

2. Set up embankment with proper slope, as on page 8.

3. Select Bucket as Ref
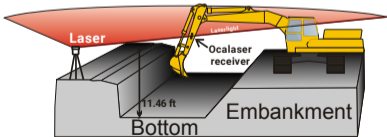
4. Set up an easy-to-read screen:
   A. Press here and select Left To Bottom
   B. Press here and select None
   C. Press here and select Depth From Laser

Monitor these to work on the embankment (as on page 8)

Monitor this to check the bottom as measured from laser (as on page 7)
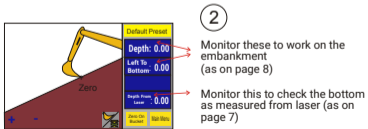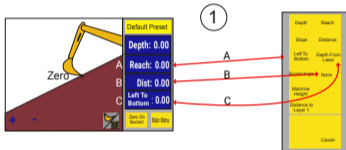
Ditch profiler - Ditches, swimming pools, etc.

You can define a profile by using the bucket tip or entering coordinates of break points
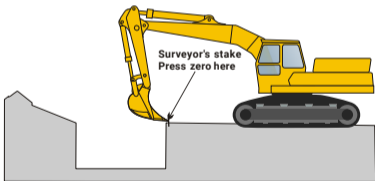
Surveyor's stake
Press zero here

1

Depth: 0.00
Reach: 0.00
Dist: 0.00
Left To Bottom: 0.00

1. Place the tip of the bucket on the surveyor's stake
2. Press Zero on Bucket
3. Press Main Menu

2

1. Press Bucket As Ref
2. Press Set Depth and key in 0 then Enter
3. Press Settings

3

1. Press Ditch Profiles

Ditch profiler - Ditches, swimming pools, etc.

Moving location of Surveyor's stake

You can enter the location of the "Zero on Bucket" of an existing profile. Use these keys to move stake location on profile.

Surveyor's stake

④

You can choose pre-stored profiles here

1. Press Create New Profile With Bucket
2. Key in the Profile Name
3. Press Enter

⑤

1. Press Add Point. Move bucket down 2. Press Add Point. Move the bucket forward
3. Press Add Point. Move the bucket forward and up
4. Press Add Point
5. Press Finished
6. Press Measure. Start digging

Ditch Profiler

Creating New Profile by entering the break points
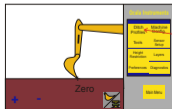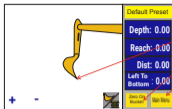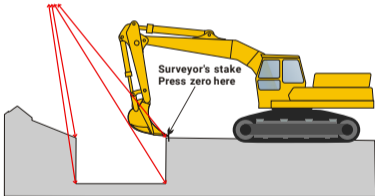

Surveyor's stake
Press zero here

①
1. Place the tip of the bucket on the surveyor's stake
2. Press Zero on Bucket
3. Press Main Menu

②
1. Press Bucket As Ref
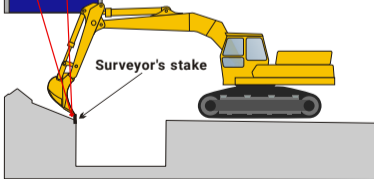2. Press Set Depth and key in 0 then Enter
3. Press Settings
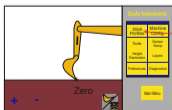
③
1. Press Ditch Profiles

Ditch Profiler

Creating New Profile by
entering the break points
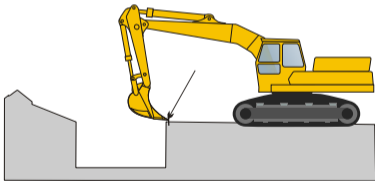
④

1. Press Create New Profile By Hand
2. Key in the Profile Name
3. Press Enter
4. Press Add New Point
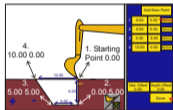
⑤

1. Key in 0.00 in both windows
2. Press Add New Point then key in
   0.00 and 5.00
3. Press Add New Point then key in
   5.00 and 5.00
4. Press Add New Point then key in
   10.00 and 0.00
5. Press Done then Press Main
   Menu To delete point Press Remove

⑥

1. Press Measure. Start
   digging.After moving excavator
   along the ditch, put the bucket tip on
   start point of ditch and press Zero
   On Bucket

Layers (Backfill)

To fill material on bottom of trench to right thickness

1. Press Main Menu, then Settings
2. Press Layers

Default Preset
Depth: 0.00
Reach: 10.00
Dist: 0.00
Left To Bottom: 4.00
Zero On Bucket

Depth   Reach
Slope   Distance
Left To Bottom   Depth From Laser
Bucket Angle   None
Machine Height
Distance to Layer 1
Cancel

Example:
1. Press Distance
2. Press Distance to Layer 1

Default Preset
Depth: 0.00
Reach: 10.00
Layer: 0.20
Left To Bottom: 4.00
Zero On Bucket   Main Menu

1. Press Layer 1 Thickness, then key in the thickness
2. For more layers, do same for Layers 2,3,4
3. Press Done, Main Menu and Measure

Layers and bottom will flash when tip of bucket reaches them
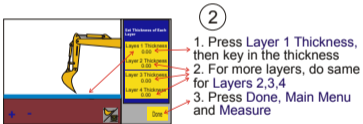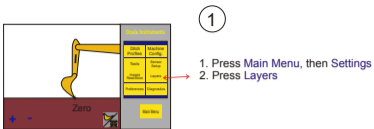
Using Tilt sensor on Bucket
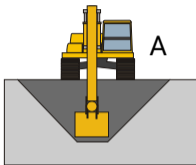
A The depth is correct when bucket blade is horizontal

Bucket blade tilts to Right

Bucket blade tilts to Left

-45.00

45.00
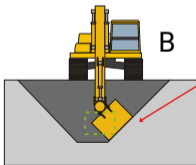
Bucket blade

B When you tilt the bucket, the depth shown is as in figure A. Bucket tilt angle in figure B. shown here

+ Zero

Default Preset

Depth: 3.12

Reach: 7.28

Dist: 7.92

Left To Bottom: 0.88

-45.00

Zero On Bucket

Main Menu

Height Alarm

Avoid hitting power lines or ceilings

Stick clearance 1

Stick clearance 2

Boom Pivot
to ground

Bucket clearance
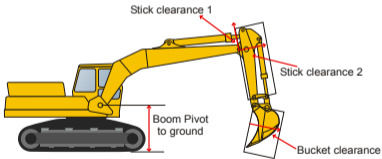
(1) 1. Press Main Menu, Settings, then Height Restriction

(2)

1. Press Height Alarm, then key in the height of the ceiling or power line from the ground (excavator tracks).
If height is set to 0 then the height alarm is disabled.

See Installation Manual for height alarm calibration.

Using Calculator

To use calculator, press either
Set Depth or Set Slope.

Set Depth

```
4.00        Clear

1   2   3
4   5   6
7   8   9
+/-  0   .
+   -   x   /   =

USE
BUCKET    ENTER
DEPTH
```

Set Depth
0.00   **or**   Set Slope
0.00

Example 1
Convert 5 feet 7 inches to feet and hundreds
Press **7, /, 12, =**
Result is 0.58 (7 inches are 0.58 feet)
Press **+, 5, =** (Add 5 to 0.58 and get 5.58)
So, 5ft, 7 inches is same as 5.58 feet.

Example 2
Convert a 1-to-6 slope into percentage.
Press **100, /, 6, =** (Enter first number with two extra zeroes to get percent)
Result is 16.67, so a 1 to 6 slope is same as 16.67%

Example 3:
Convert 51 inches to feet and hundreds:
Press **51, /, 12, =** Result is 4.25
So, 51 inches is 4.25 feet

Example 4
Convert 12.34 feet to meters
Press **12.34, x, 0.3048, =.** Result is 3.76132.
So 12.34 feet is the same as 3.76 meters

Installation of ExcaVision System

① Start here

1) Install the display: clean the window with a de-greaser. Make sure the display will not be in the way of sliding window. Peel of the backing from the mounting base and press the bracket firmly to the window.

2) Install the receiver box where it gets good reception from the sensors, for example on front window or right hand side window of cab. Clean the window with a de-greaser, peel off the backing from the Velcro and press receiver box firmly to the window.

*3) To install the **optional** body sensor: clean the surface with a degreaser, make sure the sensor is parallel to the boom sensor. Peel off the backing from the mounting plate and press sensor firmly to the surface.

② Boom sensor installation and boom length
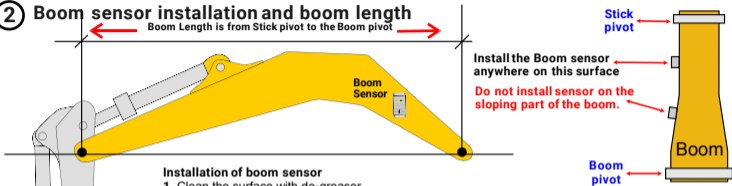
Boom Length is from Stick pivot to the Boom pivot

Boom Sensor

Stick pivot

Install the Boom sensor anywhere on this surface

Do not install sensor on the sloping part of the boom.

Boom

Boom pivot

Installation of boom sensor
1. Clean the surface with de-greaser
2. Peel the backing off the boom sensor mounting
   plate and press the sensor firmly to the boom.
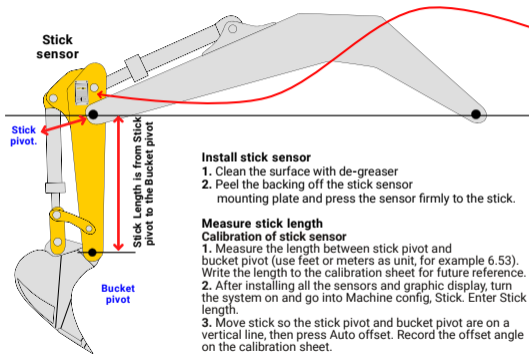
Measure boom length
Measure the length between boom pivot and stick
   pivot (use feet or meters as unit, for example
   9.35). If using feet, use hundreds of a foot (NOT
   INCHES). Write the length on the calibration
   sheet.

Note: If measuring tape is in inches, divide length by 12 to obtain feet.Example: 106 inches is 8.833feet.

Clean surface before gluing the mounting plate

③ **Stick sensor installation and stick length**

Stick sensor

Stick Length is from Stick pivot to the Bucket pivot

Stick pivot.

Bucket pivot

Clean surface before gluing the mounting plate

Install stick sensor
1. Clean the surface with de-greaser
2. Peel the backing off the stick sensor mounting plate and press the sensor firmly to the stick.

Measure stick length
Calibration of stick sensor
1. Measure the length between stick pivot and bucket pivot (use feet or meters as unit, for example 6.53). Write the length to the calibration sheet for future reference.
2. After installing all the sensors and graphic display, turn the system on and go into Machine config, Stick. Enter Stick length.
3. Move stick so the stick pivot and bucket pivot are on a vertical line, then press Auto offset. Record the offset angle on the calibration sheet.
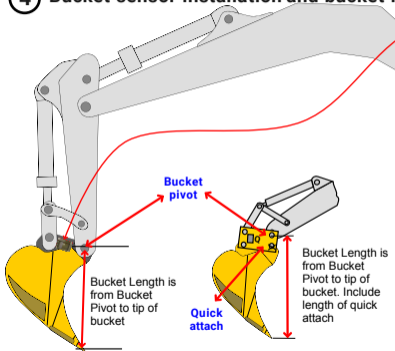
④ Bucket sensor installation and bucket length

Weld the Bucket Guard to the side of the bucket close to the pivot, or on the quick release.

Installation of bucket sensor
1. Weld bucket guard to the bucket or to the quick release if there is one.

2. After the bucket guard has cooled down, screw the bucket sensor into the guard using the 3 mm Hex screw driver.

Calibration of bucket sensor
1. Measure the length of the bucket. If a quick attach is installed, include it in the measure, i.e. measure from tip of bucket upto the lowermost pivot on the stick (i.e. the bucket pivot). Write the length to the calibration sheet for future reference.

2. After installing all the sensors and graphic display, turn the system on and go into Machine config, Bucket. Enter Bucket length.

3. Move bucket so the bucket pivot and bucket tip are on a vertical line, then press Auto offset. Record the offset angle on the calibration sheet.
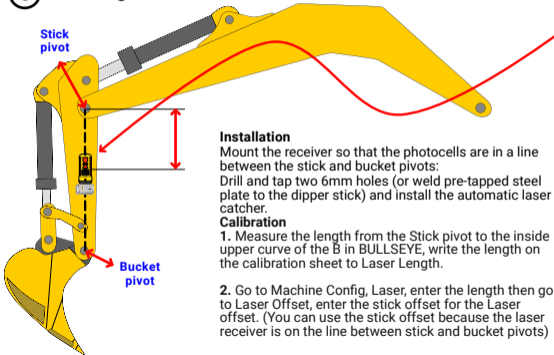

Bucket pivot

Bucket Length is from Bucket Pivot to tip of bucket

Quick attach

Bucket Length is from Bucket Pivot to tip of bucket. Include length of quick attach

⑤ **Installing the Automatic laser catcher**

Stick pivot

Bucket pivot

Installation
Mount the receiver so that the photocells are in a line between the stick and bucket pivots:
Drill and tap two 6mm holes (or weld pre-tapped steel plate to the dipper stick) and install the automatic laser catcher.

Calibration
1. Measure the length from the Stick pivot to the inside upper curve of the B in BULLSEYE, write the length on the calibration sheet to Laser Length.

2. Go to Machine Config, Laser, enter the length then go to Laser Offset, enter the stick offset for the Laser offset. (You can use the stick offset because the laser receiver is on the line between stick and bucket pivots)

Sensor Setup

Enter serial numbers of the sensors into the graphic display
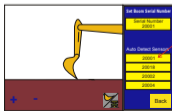

EXCAVISION

OFF | ON
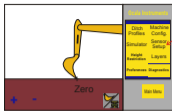
200001

①
1. Press Main Menu then Settings 2 Press Sensor Setup
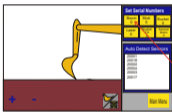
②
1. After you have installed all the sensors, write the serial numbers of each sensor down on the calibration sheet 2. Turn on the sensors
3. Press Boom

③
Sample:
1. Press 20001 for the Boom sensor. Or: if you want to key in the serial number, press Serial Number and key in the number then Enter, Back

Machine configuration

The computer can store any number of different excavators and attachments. Key in length of Boom, Stick, Bucket and adjust Sensor offsets

(4)

1. Press Main Menu then Settings, Machine Config, Modify, Continue anyway

Boom

(5)

1. Press Boom
2. Press Length then key in the length of the boom from pivot to pivot
3. Position the boom from pivot to pivot perfectly horizontal. Press Auto Offset
Or: If you know the offset you press Offset and key in the offset number
4. Press Left if the sensor is mounted on the left side
5. Press With of arm, key in the width
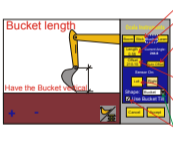6. Press Use Secondary Boom

Stick
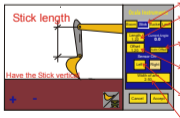
(6)

1. Press Stick
2. Press Length then key in the length of the stick from pivot to pivot
3. Position the stick from pivot to pivot perfectly vertical. Press Auto Offset.
Or: If you know the offset you press Offset and key in the offset number
4. Press Left if the sensor is mounted on the left side
5. Press Width of arm, key in the width
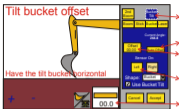
Machine configuration

Bucket / Breaker (7)

Bucket length

Have the Bucket vertical

1. Press Bucket
2. Press Length then key in the length of the bucket from pivot to tooth tip
3. Position the bucket so that bucket pivot and bucket tip are plumb. Press Auto Offset
Or: If you know the offset you press Offset and key in the offset number
4. Press Left if the sensor is mounted on the left side
5. Press Use Bucket Tilt
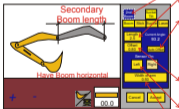Press to change to Front load Bucket or Breaker.

Optional: Bucket Tilt (8)

Tilt bucket offset

Have the tilt bucket horizontal

1. Press Bucket Tilt Have 2 sides Vertical and bucket edge horizontal
2. Press Auto Offset
Or if you know the offset then you press Offset and key in the offset number
3. Press Left if the sensors on the front side
Tilt Bucket angle

## Optional: 2nd Boom (9)

Secondary Boom length

Have Boom horizontal

1. Press 2nd Boom
2. Press Length then key in the length of the boom from pivot to pivot
3. Position the boom from pivot to pivot perfectly horizontal. Press Auto Offset or if you can't have the boom horizontal then position the boom vertical and L-add or R-retract 90°
Or: If you know the offset you press Offset and key in the offset number
4. Press Left if the sensor is mounted on the left side
5. Press Width of arm, key in the with

Page 25

Optional: Body Sensor
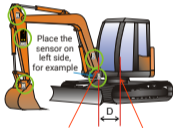
Place the sensor on Boom pivot, for example

Distance from Boom pivot to the center pivot of the excavator cap, called "2nd Boom" on display

0 ————————— 180 degrees

Rotate the excavator 180 degrees

Installation and Calibration of Body Sensor

A body sensor compensates for distance D. It is needed only if distance D is more than a few inches and excavator works in uneven terrain. If tracks are horizontal and D is small, body sensor is not needed.
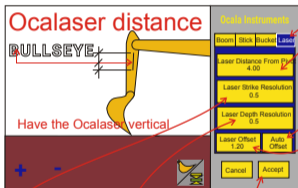
1. Measure distance D (Boom pivot to the center pivot of the excavator) and write this number to 2nd Boom, Length on calibration sheet.

2. Install the Body sensor (2nd Boom sensor) on the side of the excavator on surface that does not vibrate. Turn the sensor on, then go to Sensor Setup and dial in the sensor serial number to Body Sensor (2nd Boom).

3. Go to diagnostics and watch Body Sensor (2nd Boom). Write down the angle, then rotate the 180 degrees and write down the new angle. Take the average of these two angles by adding them and dividing by 2. Go to Machine Config - 2nd Boom. Press Offset and key in the angle into 2nd Boom, Offset. Example:
First angle 83.91, second angle 95.21. Average is (83.91+95.21)/ 2= 88.06, so enter 88.06 into 2nd Boom, Offset, Offset. Dial in the length of 2nd Boom into Length then press Left if the sensor is on the left side.

Note: The machine does not have to be level during this operation.

Machine configuration

Mount the Ocalaser with photocell array pointing to the stick pivot. Move stick to get Ocalaser plumb

Ocalaser ⑩


Ocalaser distance

BULLSEYE

Have the Ocalaser vertical

+   -

Ocala Instruments

Boom Stick Bucket **Laser**

Laser Distance From P...
4.00

Laser Strike Resolution
0.5

Laser Depth Resolution
0.5

Laser Offset   Auto
1.20   Offset

Cancel   Accept

1. Press Laser
2. Press Laser Distance From Pivot. Key in the length from the stick pivot to inside edge of the **B** in the Ocalaser BULLSEYE BULLSEYE
3. Press Auto Offset

Or: If the Ocalaser lines up with stick and bucket pivots you can use the stick offset as laser offset. Press Offset and key in the stick offset number

4. Press Laser Strike Resolution and key in 0.03 (0.01 for Metric)
5. Press Laser Depth Resolution and key in 0.03 (0.01 for Metric)
6. Press Accept then Main Menu, Measure

Machine configuration

(11)

Labels in figure: Depth, Reach, Place mark to measure from
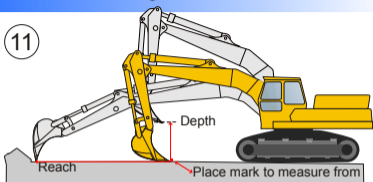
You have now calibrated the system

Horizontal, Reach Check: Place the tip of the bucket on the ground and press Zero On Bucket, then move the bucket forward 4ft then check with measuring tape. Display will show 4ft Reach

Vertical Depth Check: Place the tip of the bucket on the ground and press Zero On Bucket, then lift the bucket up 3ft then check with measuring tape. Display will show -3ft Depth.

(12)
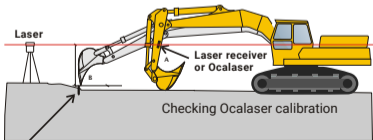
Labels in figure: Laser, Laser receiver or Ocalaser, Checking Ocalaser calibration, Surveyor's stake (Hub)

Test laser receiver calibration
Press **Main Menu, Laser as Ref, Measure.** Move receiver into laser light (position **A** in figure) and wait until unit rebenches (2 to 4 seconds) Move tip of bucket to a hub (position **B** in figure) Use conventional laser rod and receiver to find depth of hub from laser. Reading should be same as on the display.
Note: The dipper stick does not have to be vertical during rebenching but for best results have dipper stick as vertical as possible.
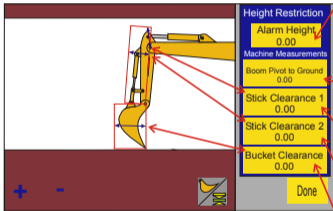**Note:** To work properly, the basic calibration has to be correct. If the unit passes the depth and reach test and the laser receiver calibration fails, then go into calibration (Main menu - Settings - Machine Configuration - Laser) and recheck "Laser distance from stick pivot" and "Laser offset". (Laser offset is usually the same as stick offset).

Adjusting the settings for Height Alarm

It is essential to set the ExcaVision height alarm parameters for height alarm to work properly

1. Press Main Menu, Settings, then Height Restriction

(See picture below for definition)

Add 6 to 12" (15 to 30 cm) to: all measure to get early warning. Register the measurements for each excavator in the sheet below for later reference.

Height Restriction
Alarm Height
0.00
Machine Measurements
Boom Pivot to Ground
0.00
Stick Clearance 1
0.00
Stick Clearance 2
0.00
Bucket Clearance
0.00
Done

1. Press Height Alarm, then key in the height above tracks when alarm is to sound. Choose the default parameters for ExcaVision.
2. Press Boom Pivot to Ground, then key in the length
**3.** Press Stick Clearance 1, then key in the length
4. Press Stick Clearance 2, then key in the length
5. Press Bucket Clearance, then key in the length, Done, Main Menu and Measure

	Excavator 1	Excavator 2	Excavator 3	Excavator 4	Excavator 5	Excavator 6	Excavator 7
Write name of excavator →							
Boom Pivot to Ground							
Stick clearance 1							
Stick clearance 2							
Bucket clearance							

Stick clearance 1

Stick clearance 2

Boom Pivot to ground

Bucket clearance
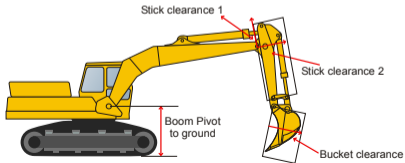
Alarm settings and Preferences

Here you can choose Alarm, Display rounding, Units of Measure, Language, Zoom Mode, Dead Zone and Warning Layer
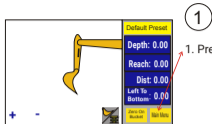
1. Press Main Menu then Settings
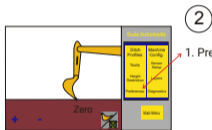
1. Press Preferences

1. Alarm on and off
2. Display Rounding
3. Feet or Meters
4. System Type: Wireless or wired sensors
5. Language
6. Zoom Mode: Manual, auto
7. Dead Zone
8. Warning Layer

Alarm settings and Preferences

Setting the warning layer and dead zone

Warning layer: When bucket is less then the warning layer from set bottom alarm beeps to warn operator the bottom is approaching


④

Warning Layer:
1. Press Warning Layer then key in for example 1 for 1ft.
2. Press Enter
Alarm beeps slow high pitch beep for Warning Layer when bucket tip is within 1.00 ft

⑤

Dead Zone:
1. Press Dead Zone then key in 0.02
2. Press Enter
Alarm beeps fast high pitch beep for Dead Zone when bucket tip is within 0.02 above bottom, when the bucket tip goes below bottom the beep has lower pitch and slower beep.
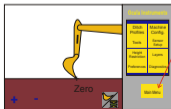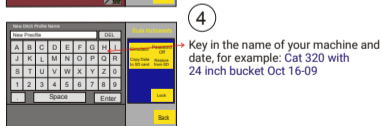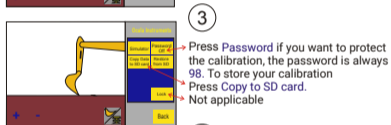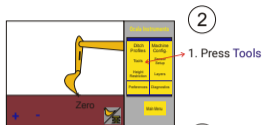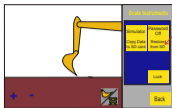

⑥

1. Press Main Menu then Measure

Tools

You can store the calibration
to the SD card for safekeeping

1. Press Main Menu then Settings

1. Press Tools

Press Password if you want to protect
the calibration, the password is always
98. To store your calibration
Press Copy to SD card.
Not applicable

Key in the name of your machine and
date, for example: Cat 320 with
24 inch bucket Oct 16-09
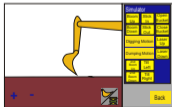
Tools

Restoring the calibration from SD card

(5)

If you loose your calibration, you can restore it.
Press Restore from SD

(6)

Press Cat 320 with 24 inch bucket Oct 16-09 then press OK and Back then Main Menu and Measure

Simulator

Press any button to move arms.

Diagnostics

You can see if the sensors are working properly

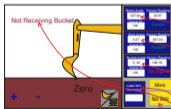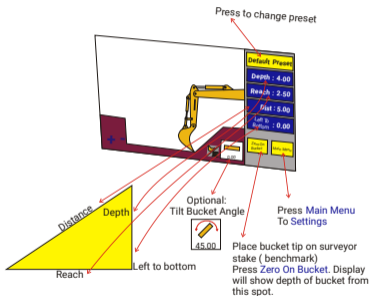1. Press Main Menu then Settings

1. Press Diagnostics

1. Boom Angle, Sensor Reading, Signal Strength. Sensor Awake
2. Stick Angle, Sensor Reading, Signal Strength. Sensor Awake
3. Bucket Angle, Sensor Reading, Signal Strength. Sensor No Signal
4. Laser Not Receiving
5. Not Receiving Bucket Sensor
6. Press Main Menu then Measure to go back

ExcaVision Key Functions

Press to change preset

Default Preset

Depth : 4.00
Reach : 2.50
Slot : 5.00
Left to bottom : 0.00

Optional:
Tilt Bucket Angle

45.00

Left to bottom

Press Main Menu
To Settings

Place bucket tip on surveyor
stake (benchmark)
Press Zero On Bucket. Display
will show depth of bucket from
this spot.

Distance

Depth

Reach

Arrow view

Toggle between
arrow view and
excavator view

The Ocalaser automatic
laser receiver on dipper stick

Rotating laser
light with slope

Ocalaser

Laser
height
from
bottom

8.75

EXCAVISION

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