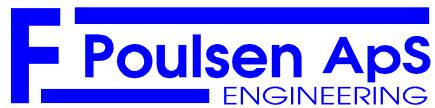


**Manual
For
Mechanical Weeding Robot**

ROBOVATOR

Version 09 -2015



Manual
ROBOVATOR

Contents

side	
Before you start.....	3
Connecting the machine to the tractor.....	3
Driving to and from the field	4
Start and Stop	5
START:.....	5
STOP:.....	5
PAUSE:.....	5
Adjusting the machine before you start.....	6
Adjusting the No of rows:	6
Adjusting the row spacing:.....	6
Understanding the operation parameters.....	6
Setting of “acceptsize”	6
Setting of the camera height:.....	6
Setting of the “Centre Override”:.....	7
Settting of “Minimum Protected”	7
The red arrow indicates the “Minimum Protect” parameter.....	7
The black arrows indicate the “Safezone” parameter. (positive outside the plant and negative inside the plant.	7
The blue arrow indicates where the tools are open.	7
Operating mode: Area Centre.	8
Operating mode: Area Centre.	9
Setting of “Safe Zone”	10
Initialise:	16
Driving in the crop rows.....	16
Start weeding:	16
Optimizing the machine while driving.....	17
Displacement to the side:	17
Optimizing steering.....	17
Adjusting the working position of the knives:	17
Setting the soilline and maxsoilline, darksoil and sunfactor	18
Adjusting the sensitivity of the cameras	20
Soilline	21
Sunfactor	24
Adjustment of the working depth:	26
Other settings:	26
Information:	26
Alarms and warnings:	26
WIFI COMMUNICATION	27

Manual
ROBOVATOR

Profiles	29
Maintenance	30
Cleaning air filter:	30
Cleaning of the Camera lens	30
Belt tension:	30
Battery:	30
Hydraulic:.....	30
Transport on trailer or truck.....	31
Limitations	31
TROUBLESHOOTING	32
Boot problems	32
Camera image:	35
Procedure:	35
Computer/display	36
<i>Cams lost but the machine is still working:</i>	36
Lamp not burning.....	36
Tool not working (one row)	36
Tool not working (more rows)	37
Steering not working.....	38
Glossary:.....	39
Fitting new tools on the machine	40

Before you start

When fitting the Power Take Off shaft connecting the machine to the tractor, take care that this shaft is cut to the correct length. Please be aware that the hydraulic cylinder at the top of the 3-point linkage will automatically move the machine closer to the tractor when the machine is lifted. If the shaft is too long, there will be serious damage to the machine the first time the machine is lifted!

Check if the bolts holding the implements are tight. Do not over tighten.

The machine must be vertical when fitted on the tractor.

Check oil level. Surface should be in the middle of the window.

Connecting the machine to the tractor.

Connect the lower lift arms of the tractor to the machine.

Connect the PTO axle to the machine.

Start the PTO and switch the machine on.

Wait until displays say: "Press ENT to start".

You can now use the [move toplink] tool to adjust the length of the top hydraulic cylinder to fit the length to the tractor.

Driving to and from the field

**Be very careful when driving over bumps or dents in the road.
Too high speed will cause damage to the sensitive cameras because of
the chocks.**

Drive carefully!

It is also important that the lift arms of the tractor is blocked against side movements. The shocks when the swing of the machine is stopped can cause damage to the machine.

When driving in the field it can be advantageous that the lift is freely moving approximately 10 cm from side to side.

When the machine is working in the field, the automatic side movement will make sure that the machine is perfectly aligned over the row even if the tractor is up to 15 cm off track.

Start and Stop

START:

First: lift the machine off the ground. **It is not advisable to lift the machine as high as possible because this will cause unnecessary strain on the PTO-shaft.**

FIRST: Start the machine by turning the red switch.

SECONDLY: Start the PTO and make sure that the speed of the shaft is at least 420 rpm.

(too slow speed will cause excessive wear on the driving belt and lack of cooling)

If the speed falls below 320rpm the lamps and the hydraulic pressure are switched off and a warning message is displayed in the control box.

After the computers has finished start-up, wait additionally 10 sec before you press the “ENT” button.

(This is to make sure that all the computers are ready)

STOP:

Before you stop the machine you must decide if you want to save some parameters you might have changed.

To save the values: choose **other, commands, save values** press “enter”

Stop the PTO from turning. Wait one minute.

Turn the red switch off.

PAUSE:

You can at any time stop driving and start again without loosing track of the plants. Just stop driving. When you resume driving the machine will continue working.

However, the plant under the camera may be lost.

If you want to make a short pause, stop the PTO from turning. When the lamps have gone out, you can lift the machine and press the ESC button.

The reason for this is that when you pres the esc button, the machine will go to the centre position. This should only be done when the machine is lifted from the ground.

You must take care that nothing is in the way when pressing the esc button since this movement of 10 cm is executed automatically and cannot be stopped.

If the pause is longer than a few minutes, turn off the red switch because otherwise the battery will be quickly drained.

Adjusting the machine before you start

Adjusting the No of rows:

If a 5-row machine is used in a 4-row crop, block the camera No1 or 5 with tape and remove the implements.

Adjusting the row spacing:

It is important that the cameras are positioned above the middle of the row. It must be ensured that the line of sight (painted on the camera) points to the middle of the row. Move the cameras if necessary. Be sure that all cameras are positioned correctly; otherwise the steering will be impaired, especially at large plants.

Move the hydraulic actuators so they are positioned exactly above the middle of the rows.

After a test drive, stop the machine and adjust the two screws on the front of the actuator to adjust how far the tool should open.

Adjust the two screws on the rear of the actuator to adjust how far the tools should close.

Understanding the operation parameters

Setting of “acceptsize”

This value can be seen as the smallest crop plant or the biggest weed plant. The system uses this value to discriminate between crops and weed. Plants smaller than this value will be categorised as weed and will be removed.

If the weed is comparable to the crop size, the machine can not work.

Setting of the camera height:

The normal position of the camera above the ground is always 45cm.

For plants larger than 10cm the camera should be positioned 50 cm above the ground.

This distance is measured from the bottom of the camera to the soil.

Average plant diameter cm	5	10	15	20	25	30	35	40	50
Height from bottom of camera to ground	45	45	45	45	55	65	75	90	110

However, the camera must also be at least 35cm above the average top of the plants.

After positioning the camera, you must tell the system the distance to the plants. Navigate to: *Main menu/Cam Setup/Camera Height* and type in the display the distance from the bottom of the camera to the average top of the largest plants.

Make sure that the cameras are exactly vertical.

Setting of the “Centre Override”:

This parameter specifies how the plants are detected and how the knives operate.

When this parameter is set to “Area centre” (1), the the knifes open and closes according to photo No1.

The middle of the plans is defined where the leaf area is the same on each side of the plant.

The *centre override* can be found in the Setup menu. When working with *centre override* set to *Areacenter*, the parameter *safe zone* should always be 0 to avoid confusion or at least less than half the “minimum protect” parameter

The default factory setting is *centre override = Area Center*

Setting of “Minimum Protected”

The *minimum protect* is a value which specifies that the knifes must stay out of the row at least this distance when they move out because of a crop plant. If this value is set too high, the tool never moves in. You can use this parameter to adjust how close to the plants the tools should operate.. The photo No 1 – 2 shows how the *minimum protect* operates.

If you want the knifes to operate under the leaves, you can set a smaller value for *the minimum protect*.

The red arrow indicates the “Minimum Protect” parameter.

The black arrows indicate the “Safezone” parameter. (positive outside the plant and negative inside the plant.)

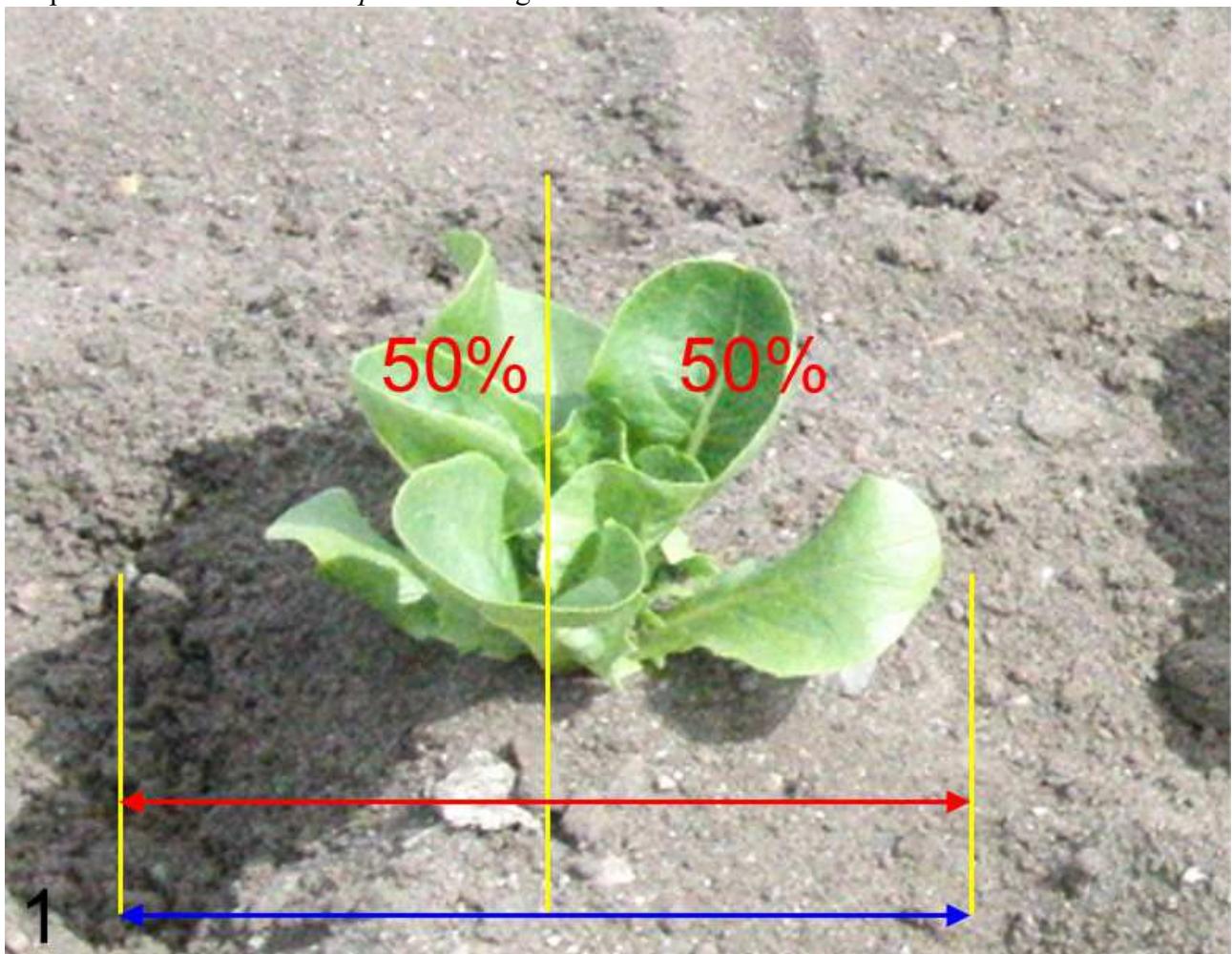
The blue arrow indicates where the tools are open.

The root of the plant is often close to the position of the yellow line, but not always.

The parameter *Minimum protect* controls how close to the plant the knifes will work.

Manual
ROBOVATOR

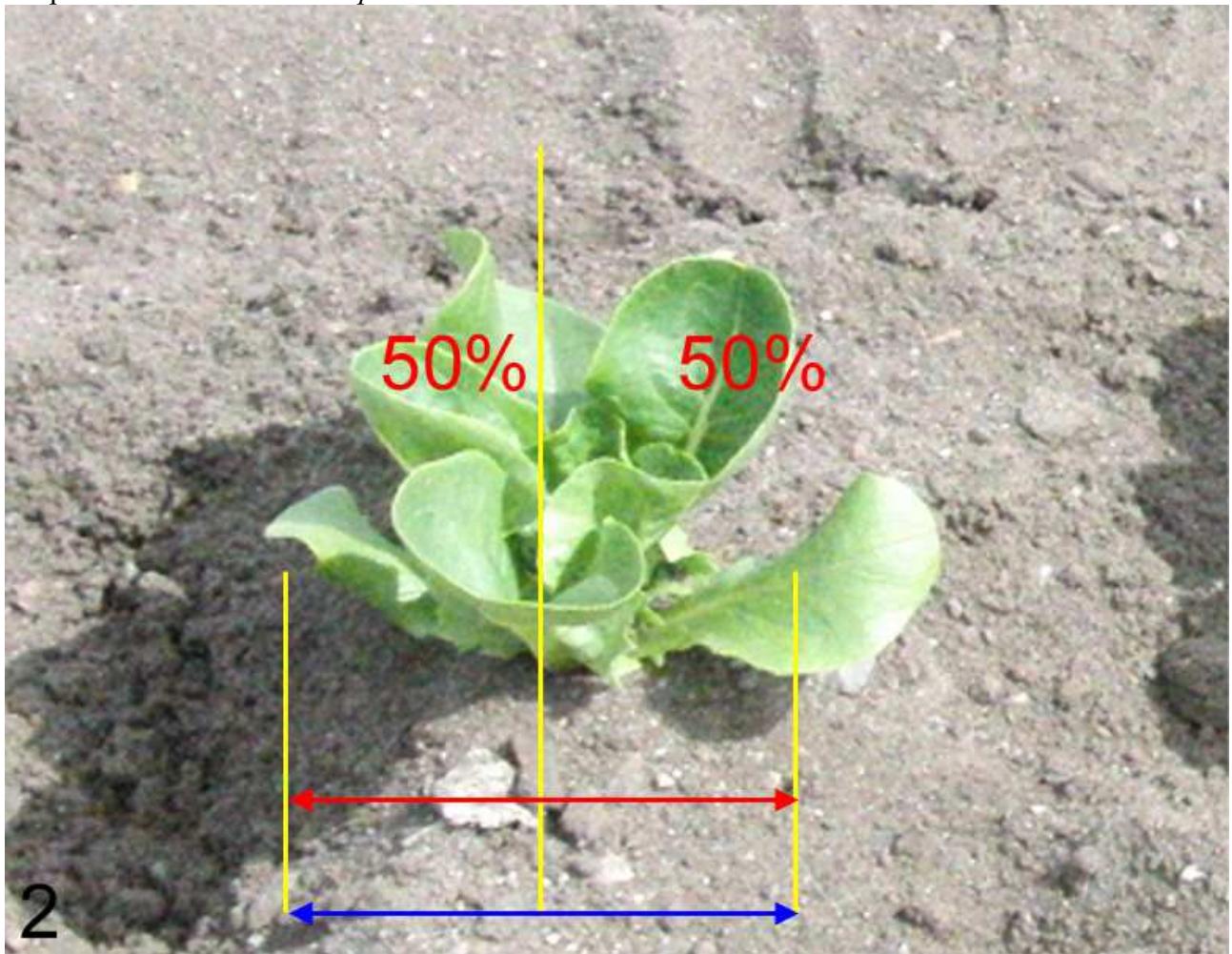
On photo No 1 the *minimum protect* is large.



Operating mode: Area Centre.

Manual
ROBOVATOR

On photo No 2 the *minimum protect* is small.



Operating mode: Area Centre.

The *centre override* can also be set to *Edges* (0). To do this: Navigate to: the *Setup* menu. and find the *centre override* menu with the arrow key. Press enter and change the value to *Edges*.

The program then uses the first-last method to detect the plants.

The setting of the parameter *centre override* set to *Edges* should be used when the plants starts to overlap. The overlapping plants will be detected as one big plant and the tools will stay open.

However, if the *centre override* is set to *Area Center* and the plants are overlapping, only the common centre will not be cut by the knifes, but both plants will be taken away.

When the *Centre Override* parameter is set to *Edges*, you can work with both *safezone* and *minimum protect* to control how close to the plants the knifes should work.

Photo No 3 – 7 shows how the knifes operate as a result of different combinations of *Minimum protect* and *safe zone*

Setting of “Safe Zone”

The *safe zone* is the distance between the outermost parts of the plant and the middle of the knife. There is a safe zone of same size before and after the plant. The *safe zone* controls how close to the crop the machine will work.

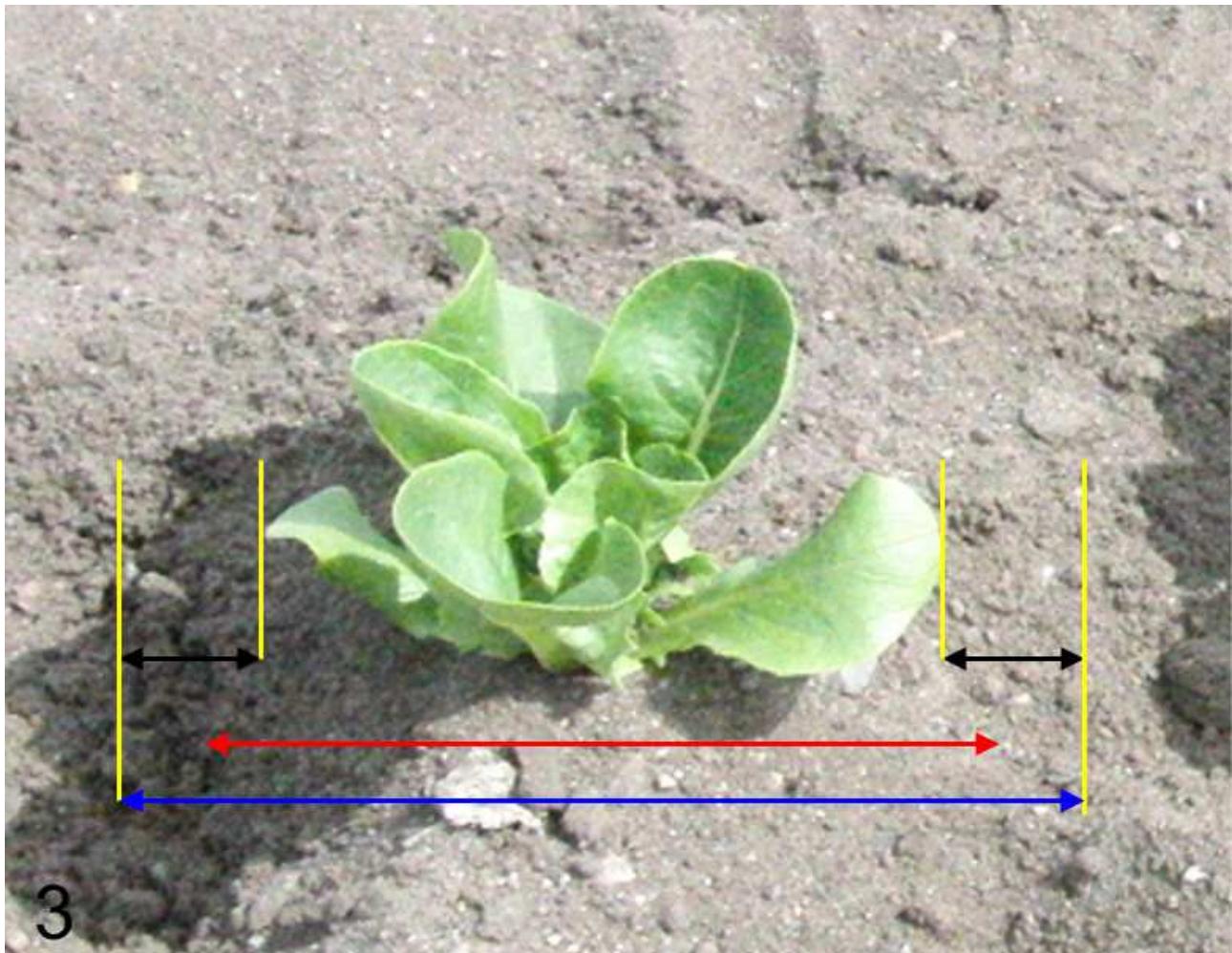
Please notice that the cameras cannot see the block, but only the green leaves. If there is a weed plant close to the plant and the leaves overlap, the position of the plant will be calculated as photo No 7 shows.

If you want the knifes to operate under the leaves of the crop, you can set a negative value for the *safe zone*.

However, if the plant is small or asymmetrical there is a risk that the knife will hit the block by choosing a too negative value, see photo No 6. In this case setting a suitable value for the *Minimum protect* will save the plant.

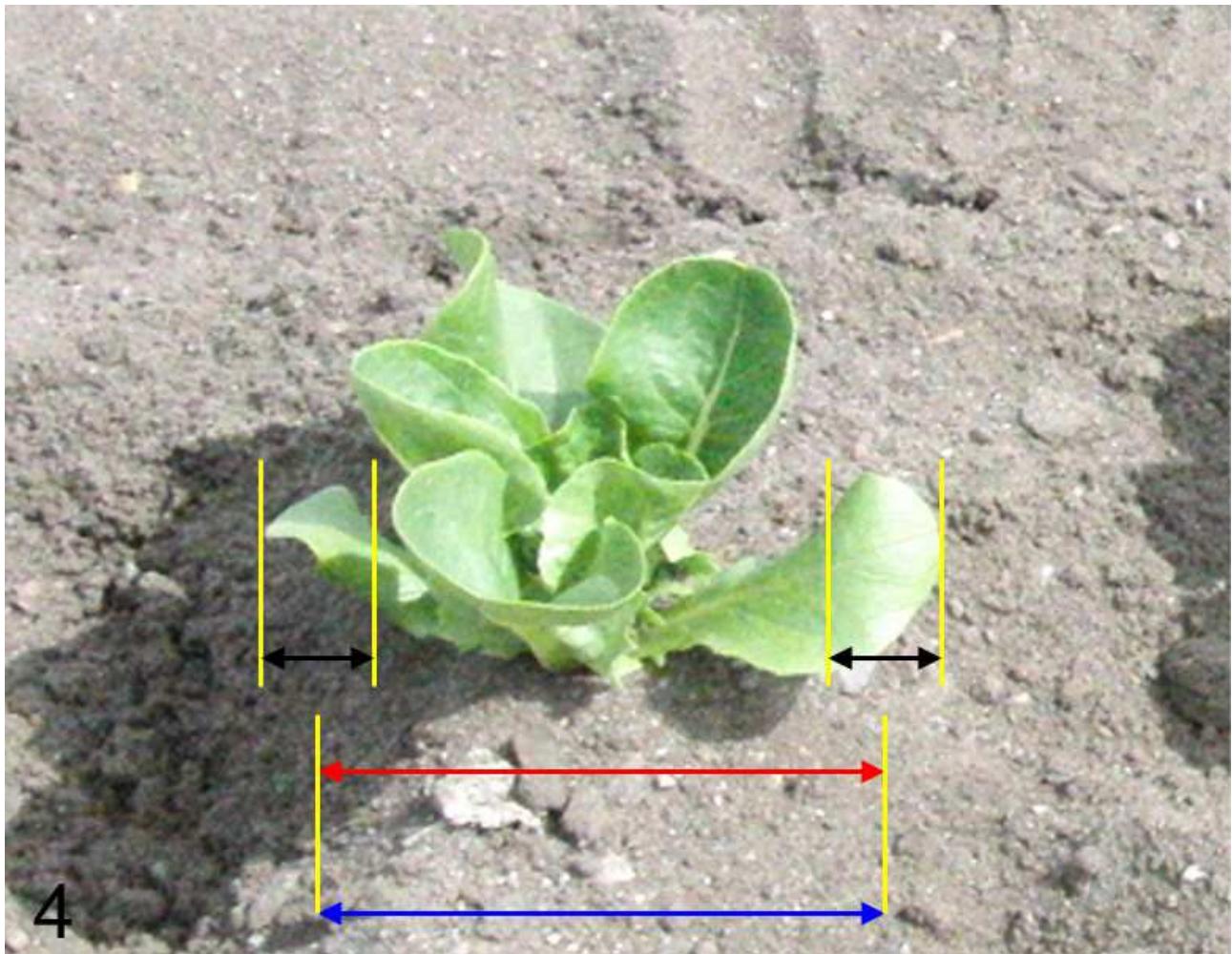
The safe zone is calculated from the first/last leave of the plant if the parameter *centre_override* is set to Edges. Otherwise it is calculated from the Area centre of the plant.

Manual
ROBOVATOR



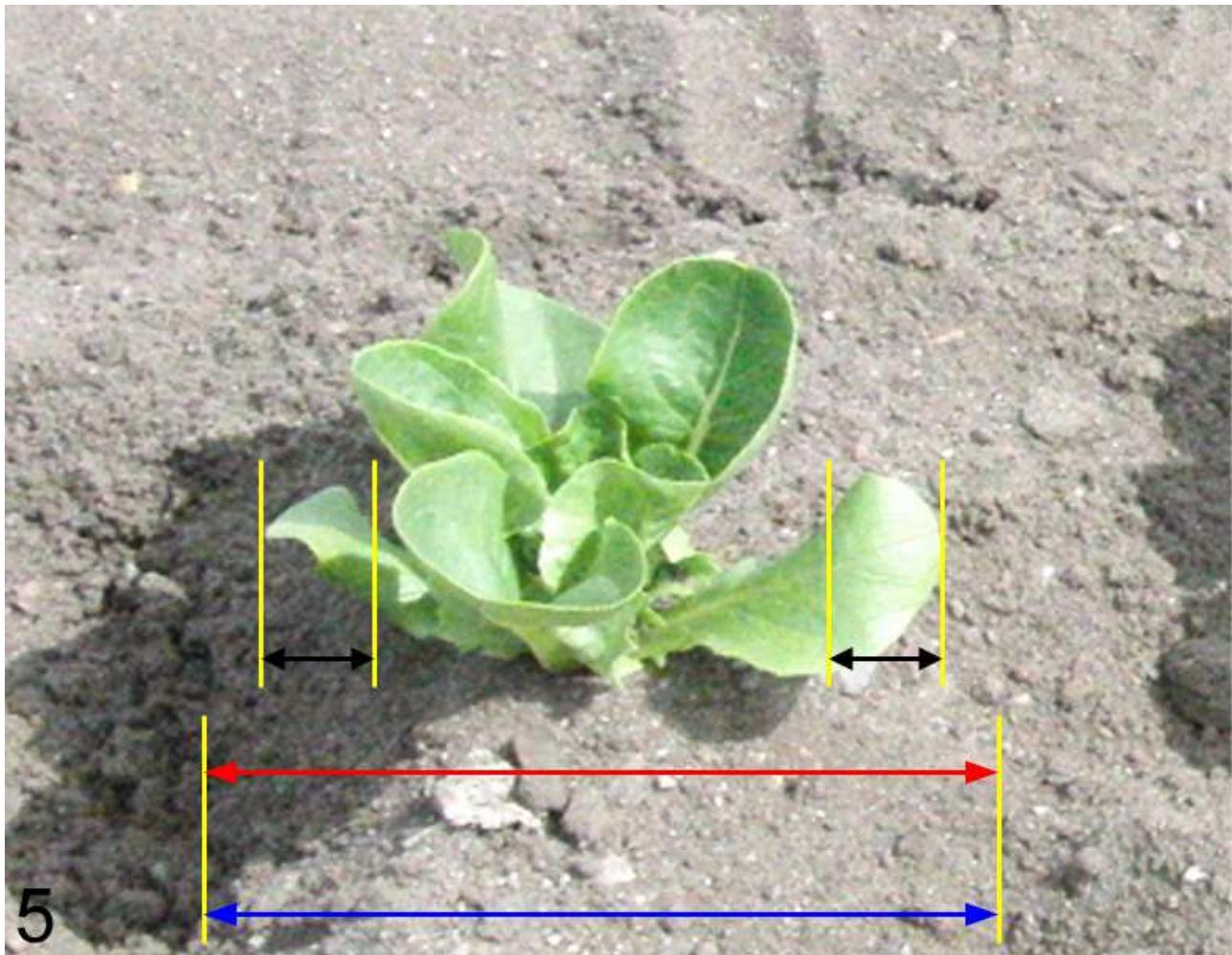
Operating mode: EDGES.

Manual
ROBOVATOR



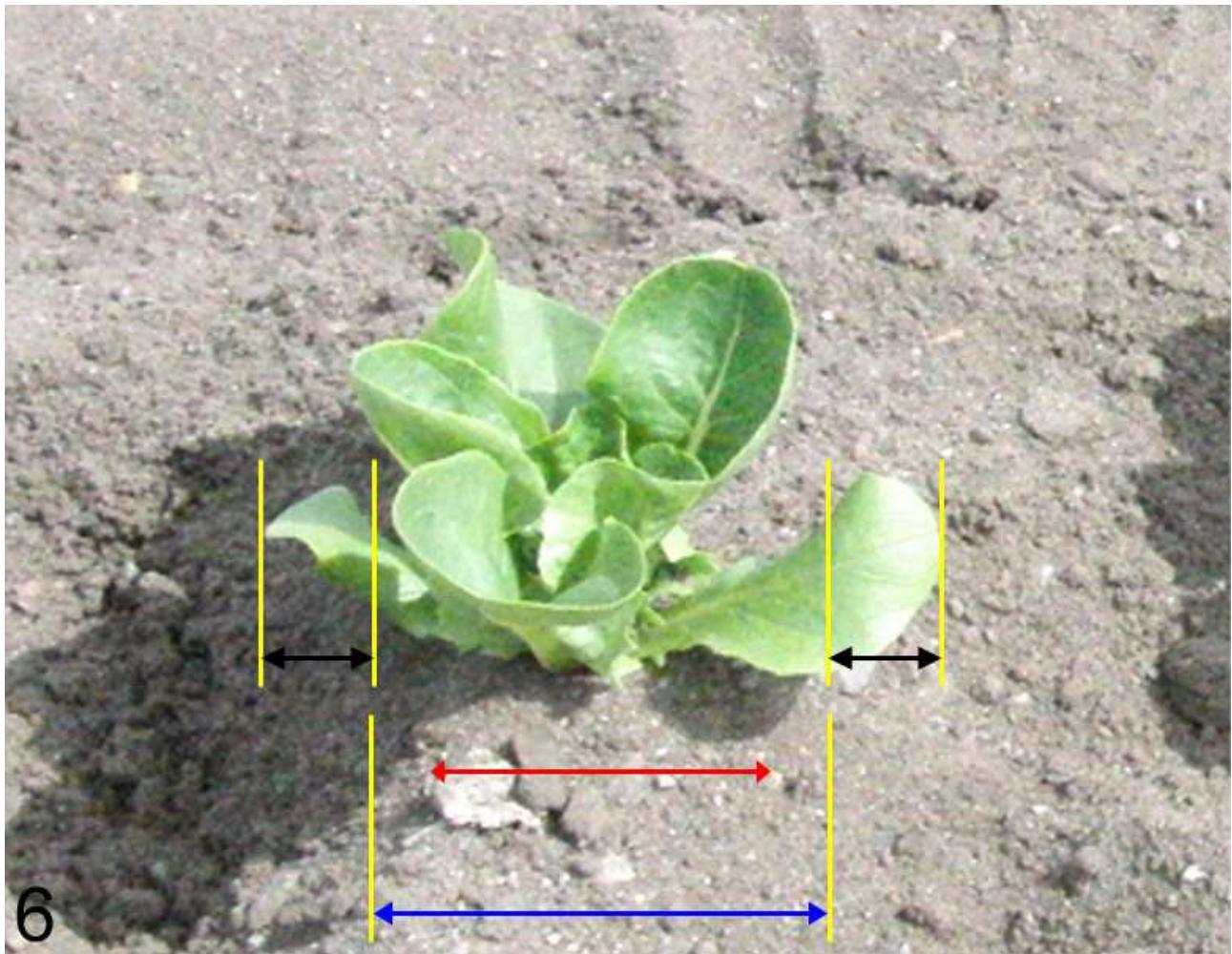
Operating mode: EDGES.

Manual
ROBOVATOR



Operating mode: EDGES.

Manual
ROBOVATOR



Operating mode: EDGES.

Manual
ROBOVATOR



Operating mode: EDGES.

Initialise:

Before you start to drive into the row, the machine must be initialized.

Procedure:

1. Lift the machine a little off the ground until the wheel is free
2. Press and hold the left arrow key and the “Enter” key

**The machine will now start a series of movements which will stop if you release the keys.
It is important that no persons are close to the machine while it is doing this Initialisation.**

First the machine will move the parallelograms to the left. Then 300 mm to the right and finally move to the centre position.

When the machine has finished the movements, you can release the keys.

The machine is now ready for operation

Driving in the crop rows

Start weeding:

In the main menu: choose “activate tools” and press “ENTER”. After 10 seconds a message is displayed informing if any of the lamps a defective. (indicated by an “E”)

Drive carefully and as accurate as possible into the rows while lowering the machine 1 – 2 meters before the first plant.

If the machine is too much offset to one side when entering the rows, there is a risk of damaging the plants.

Use the “Sideshift Override” function to adjust the position of the machine before putting it down on the row.

After driving about one meter, the machine will “lock” onto the position of the row.

You can stop and start the work at any time. The machine will automatically resume the work when you start driving.

If you press “ESC” during the stop, then after pressing “activate tools” the first meter will not be weeded correctly. This is because the memory is cleared by pressing “ESC”

Only press “ESC” when the machine is lifted off the ground otherwise there is a risk of damaging the implements by the automatic sideways movement of the machine.

Optimizing the machine while driving

In order to ensure that the quality of the weeding is as high as possible, it is important that the machine is carefully adjusted.

Displacement to the side:

You can adjust the position of the machine to the left and to the right during operation: Use the arrow keys and choose *move right*. The displacement takes effect when you press “Ent”.

“Left” is as seen from the tractor looking back.

Be careful not to press “ESC” because then the machine will stop weeding.

Do not use a value for *move right* greater than 10 because this will impair the steering.

Optimizing steering

You can use the *Sideshift factor* to adjust how fast the machine should respond.

A higher value will make the steering more prompt; a too high value however will cause the machine to oversteer causing oscillations.

Adjusting the working position of the knives:

While driving it is possible to adjust the precise point at which the knife moves in and out of the row. This gap, in which the crop plant must be in the middle, can be moved forward and backwards. Use the arrow keys and choose “Tool Offset #” to move. The changes take effect when the “ENT” key is pressed. To move the knife forward, increase the value; to move the tool backwards, decrease the value

If a tool is replaced, it would be advisable to adjust its position as described above because there can be small variations in the shape of spare knifes.

However, it can be difficult to asses whether the knife works symmetrically around the crop only by looking at the crops passing. If soil is being thrown at the leaves, it can look as if the plant is being moved by the knife.

To determine exactly where the knife has been, you should do this:

1. Stop the machine.
2. Reposition the implements operating between the rows so they will not touch the soil.
3. compact the soil a little around 3 – 4 plants ahead of the machine. Clear all plants and remove all green leaves one meter before and after this spot.
4. Drive past this site and brush the loose soil carefully away with a soft brush (better than using your fingers)
5. If the knife operated above the ground because it have been compacted, lover the parallelograms a little, lift the machine and drive backwards and try again.
6. Examining the track of the knife, to see if the knife operated symmetrically around the middle of the plants.
7. Measure any deviation and adjust accordingly in the display and on the screws on the actuators. (see section “Adjusting the movement of the knives”

It can seem a little tedious to do this calibration, but the result will be effective for many millions of plants!

Manual
ROBOVATOR

Please remember that all changes will be cleared next time the machine is switched off unless the changes are saved. Navigate to the *Other* menu and select *commands* , *Save Values* to do this.

Setting the soilline and maxsoilline, darksoil and sunfactor

Changing these parameters can sometimes be necessary – but usually the values set from the factory will work just fine.

There is no rule of thumb for how to set these values as they complement each other and there can be more than one correct solution.

However – leave darksoil at 0-5 normally. Usually a value of 3 or 4 is good. Darksoil control the noise in the darkest parts of the image. That is, in deep shadows behind rocks or below leaves. Or if the soil is very black and/or wet.

Soilline can be thought of as controlling the level where background (soil) is seen as foreground (plants) and effectively controls the noise in between the bigger plants. It is an upper limit to what is soil.

Maxsoilline controls the fragmentation of the plants – the higher the value – the more fragmentation.

Maxsoilline MUST ALWAYS be BIGGER than soilline. Try to keep 10 or 15 units between those two.

Sunfactor is a compensating value for conditions with lots of sun OR complete darkness. Usually set it to 0 in normal overcast summer day. If it then becomes sunny, there will usually begin to be fragmentation of plants – in this case You could lower soilline and maxsoilline – but it is easier to just raise sunfactor to 2.0 (20 in the wifi). Running at night or very early spring can use a value of -1.0..-2.0 (-10..-20 in the wifi)

Normal procedure for setting soilline and maxsoilline.

Make sure that maxsoilline is only a few units above soilline. Decrease those two values until noise begins to appear in the background. Plants will look fat and part of the background will touch. Space between inner parts of leaves becomes foreground. Now increase soilline and maxsoilline a little bit – leave a bit of noise in the background.

Now raise only maxsoilline until plants are sharp and welldefined. It is ok to have a little bit of red in the plants. If there is still noise in the background – then raise soilline a little bit. Only rule to obey is that soilline < maxsoilline.

If you cannot get into a situation where plants are well defined without fragmentation and at the same time there is no or only little noise in the background – then increase darksoil a few steps until background noise disappears. The effect is very abrupt so be gentle. Max value of 10-15 should only be used in extreme cases. Fine tune soilline and maxsoilline.

Manual
ROBOVATOR

Images below shows some situations with hi and low combinations:

SUNFACTOR:

Too low sunfactor: sunfactor-minus20.jpg

OK sunfactor: sunfactor_0.jpg

Hi sunfctor: sunfactor_20.jpg

DARKSOIL:

Too low darksoil: darksoil_low_4.jpg

OK darksoil: darksoil_OK.jpg

Too hi darksoil: darksoil_hi_24.jpg

SOILINE and MAXSOILINE

Both too low: lowsoilandmax:15_25.jpg (lots of background noise and plants big and fat spills into background)

soiline a little to low: lowsoiline_15_70.jpg (plants are ok, but there is elevated noise inbetween plants. Typical red patches between plants)

soiline too low, but maxsoiline too high: himaxlosoil_15_180.jpg (there is elevated noise in the background between plants, but at the same time plants are fragmented)

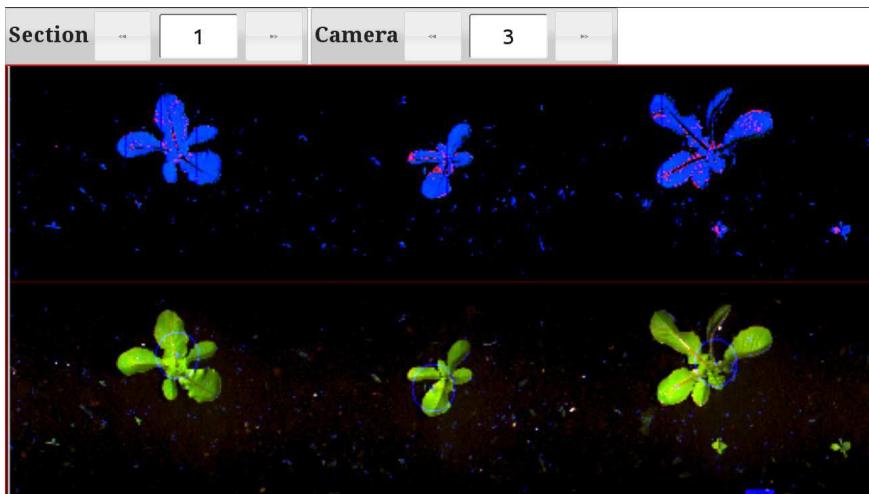
The PERFECT image: perfectvalues_55_65.jpg (can be VERY hard to achive, be happy when it happens)

little to hi maxsoiline: himax_55_170.jpg (plants are beginning to fragment, but just a little. A goo value for soiline prevents complete fragmentation despite maxsoiline beeing way to hi – so it is ok to have maxsoiline very hi, but not Soiline)

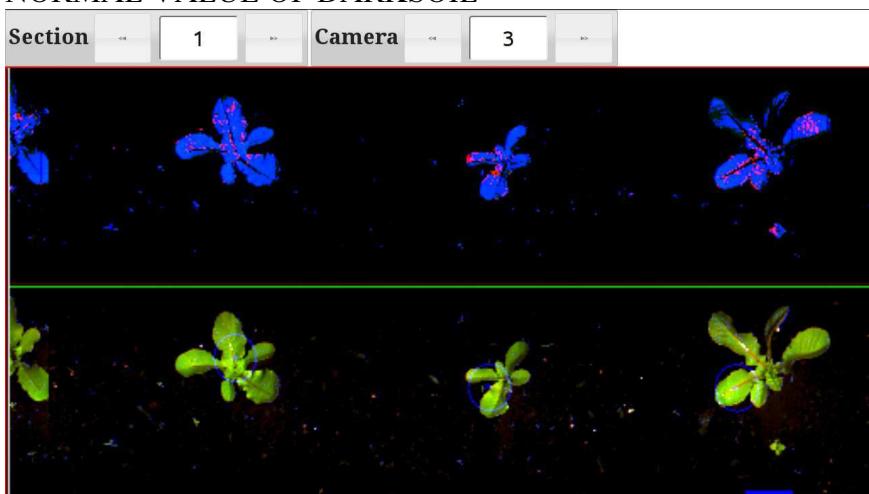
Both values to hi: hisoilandmax_130_140.jpg. (when soiline begins to be too hi also – things get very bad quickly and foreground disappears completely or almost. - But be carefull, this could also just mean that sunfactor is set at the hi value and there is deep shade or no sun.

Manual
ROBOVATOR

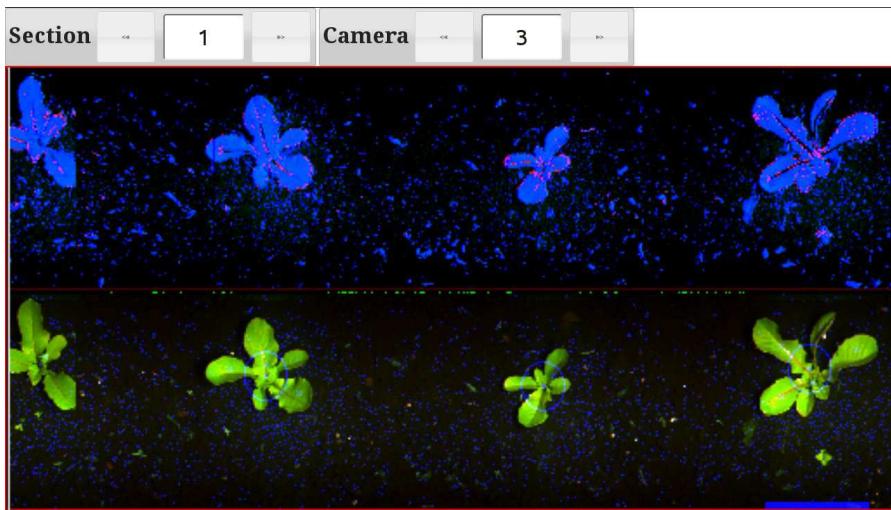
Adjusting the sensitivity of the cameras



NORMAL VALUE OF DARKSOIL



TOO HIGH VALUE OF DARKSOIL



TOO LOW VALUE OF DARKSOIL

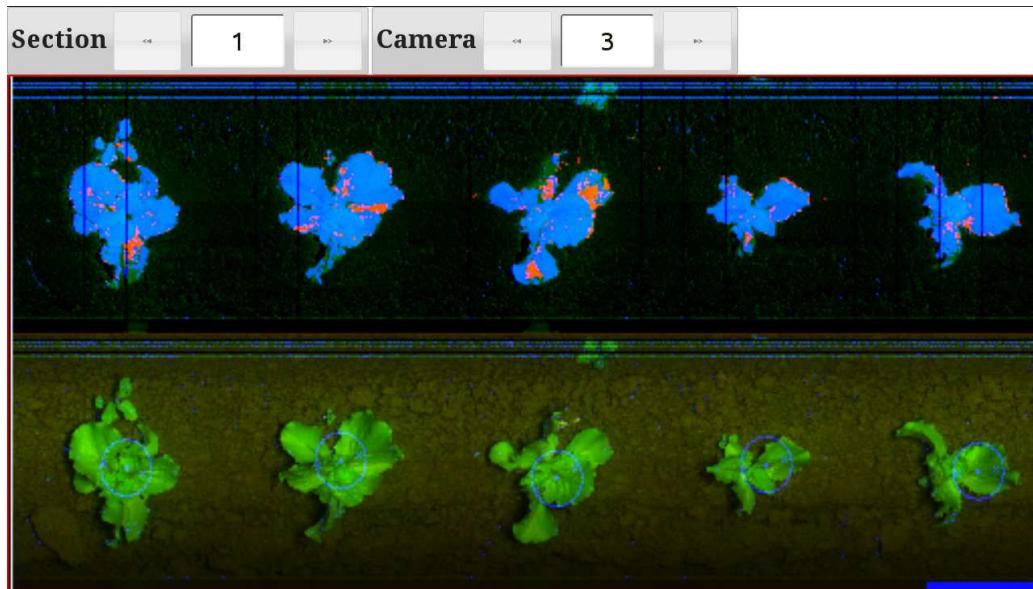
Manual
ROBOVATOR

Soilline

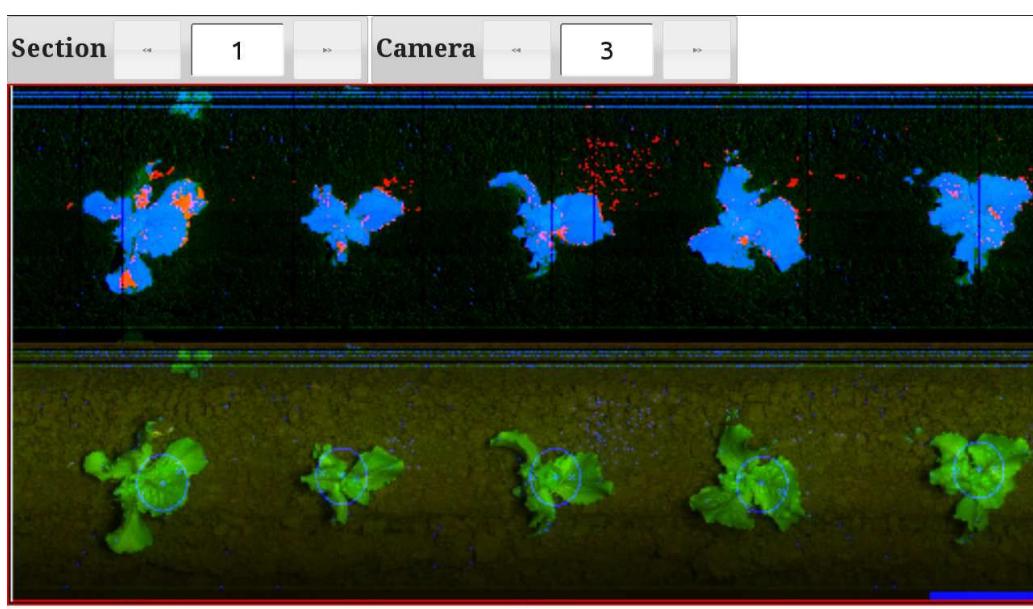
You can use the Soilline, see expertmenu, to control the image.

A high value means that only the parts of the image with high values are being processed.

A too low value (too high sensitivity) also causes a signal from the soil and stones.

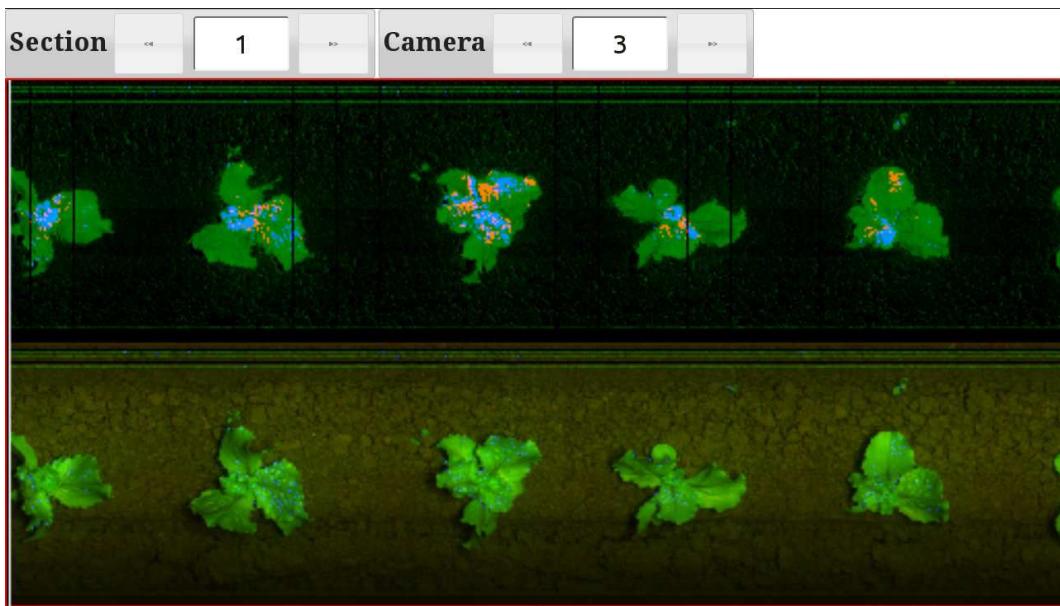


Figur 1 HIMAX_55_170

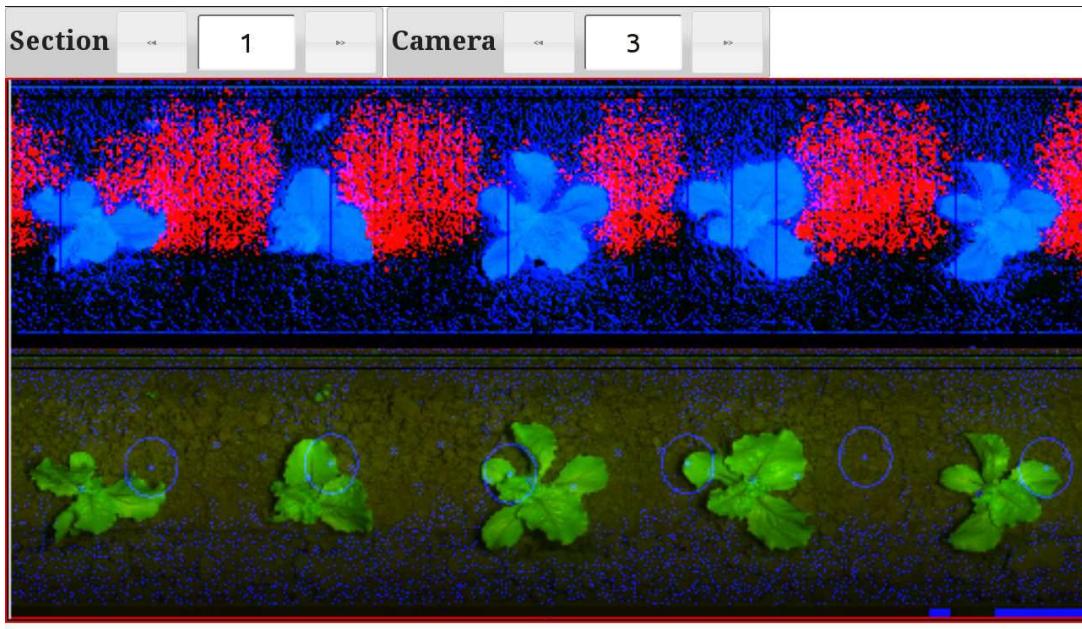


Figur 2 HIMAXLOSOIL_15_180

Manual
ROBOVATOR

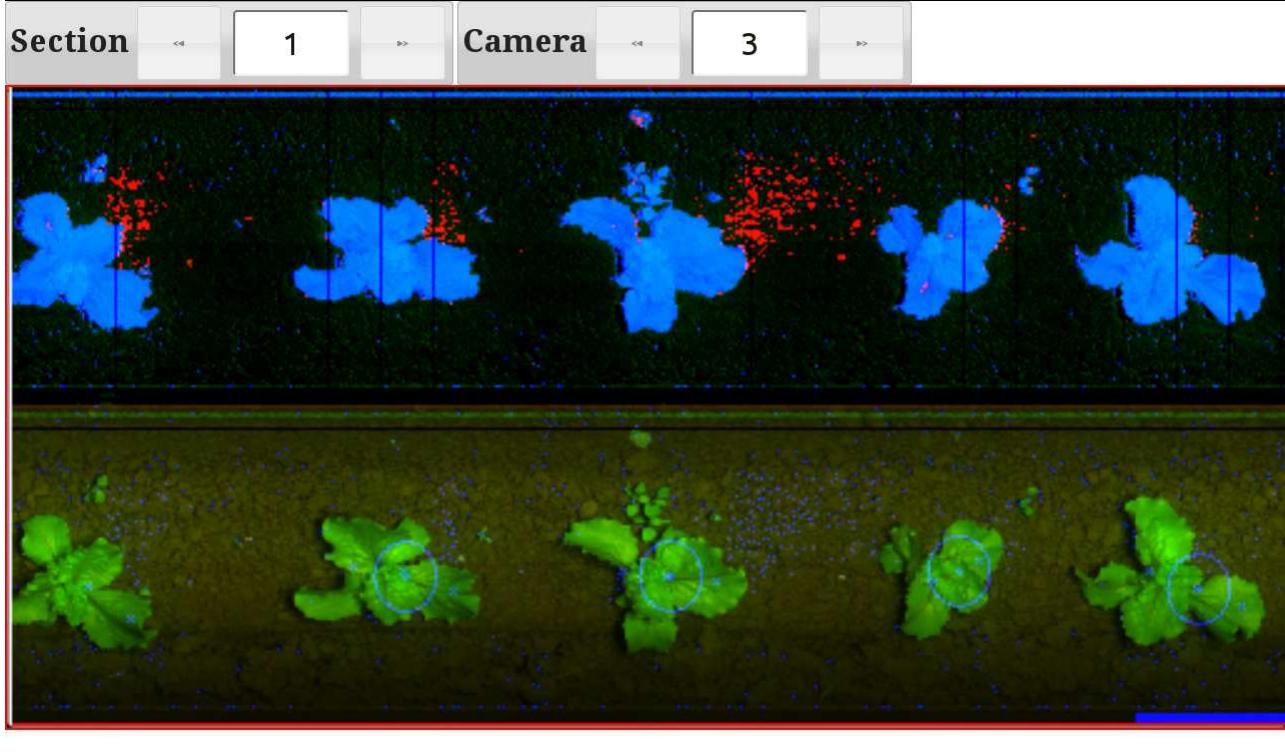


Figur 3 HISOLANDMAX_130_140

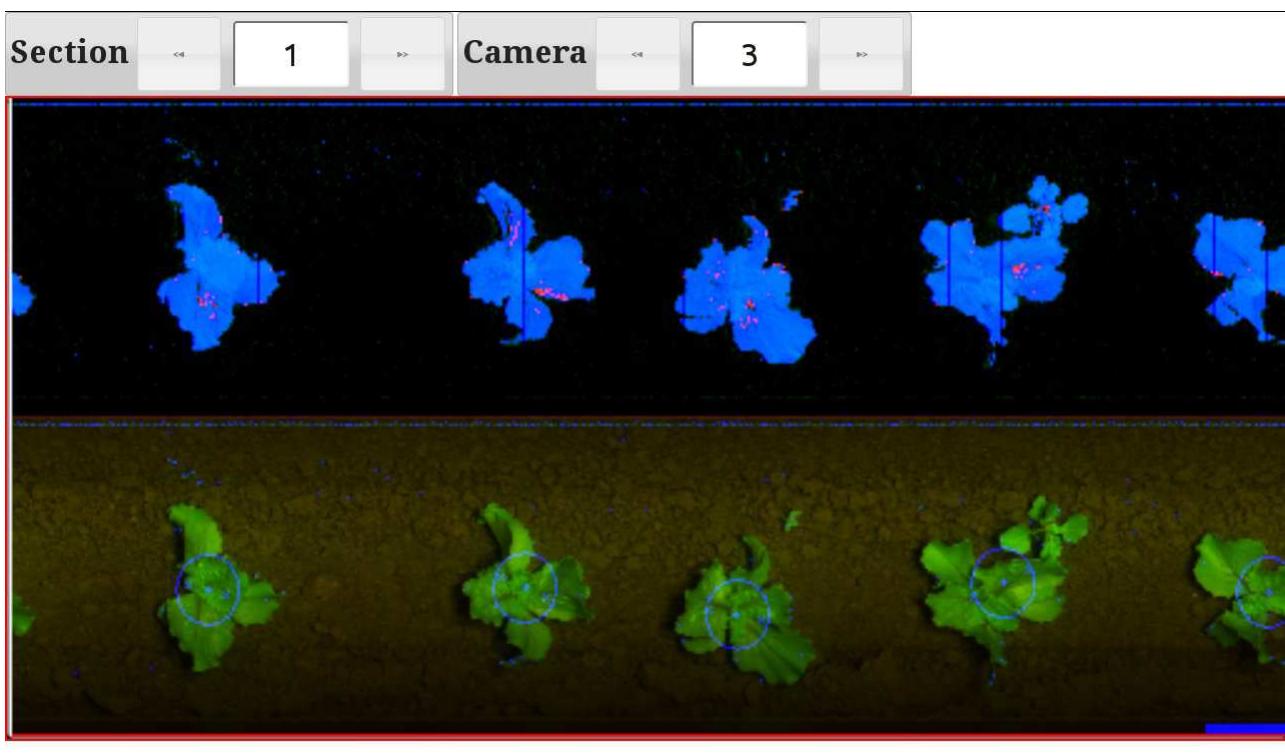


Figur 4 LOWSOILANDMAX_15_25

Manual
ROBOVATOR



Figur 5 LOWSOILLINE_15_70



Figur 6 PERFECTVALUES

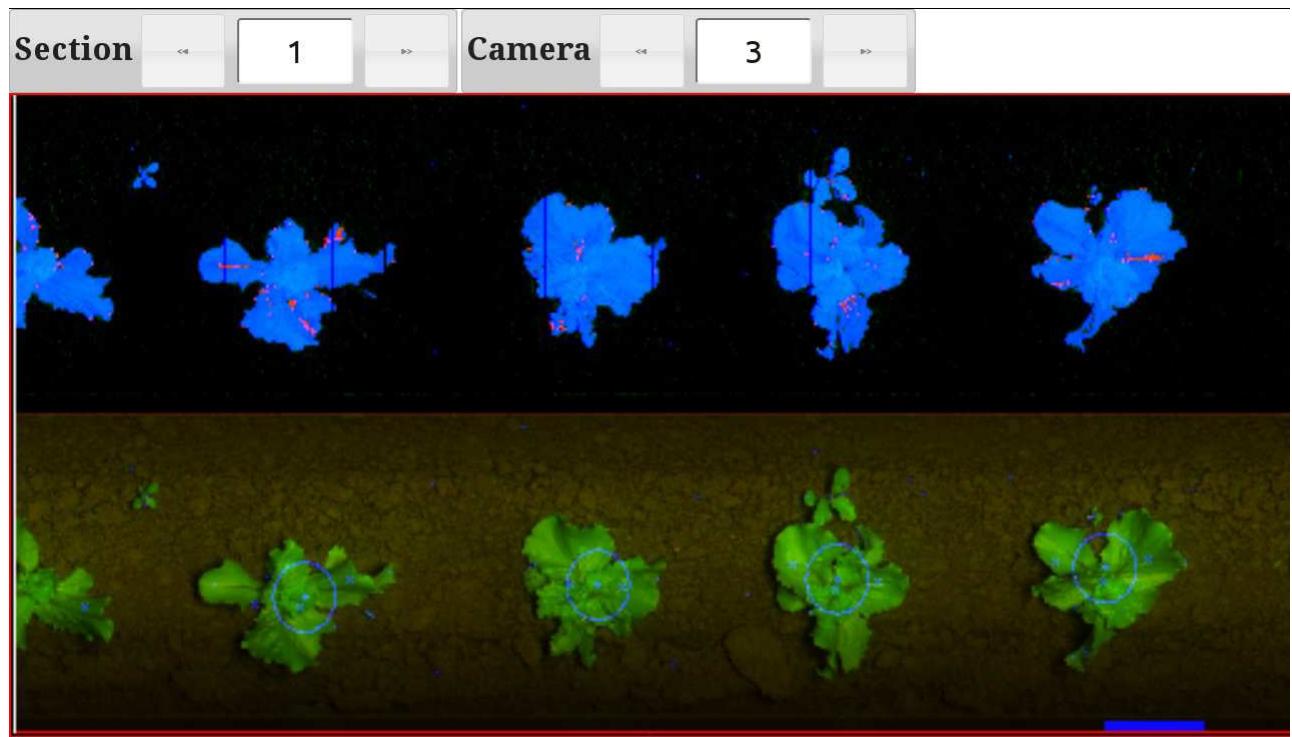
Manual
ROBOVATOR

Sunfactor

You can use the *Sunfactor* to change the sensitivity of the cameras.

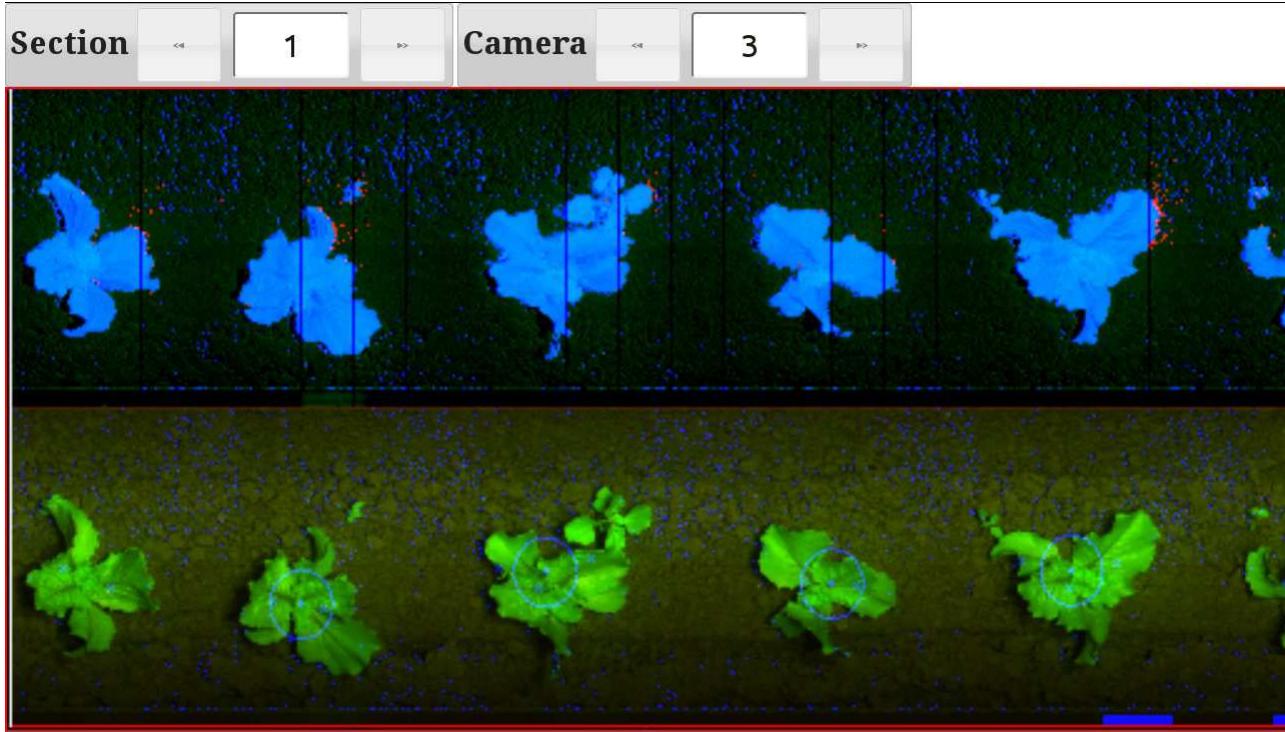
If the machine fails to recognize the crop, because of strong sunlight, use a setting of +2.

In the evening or when overcast, use a setting of 0 or -2

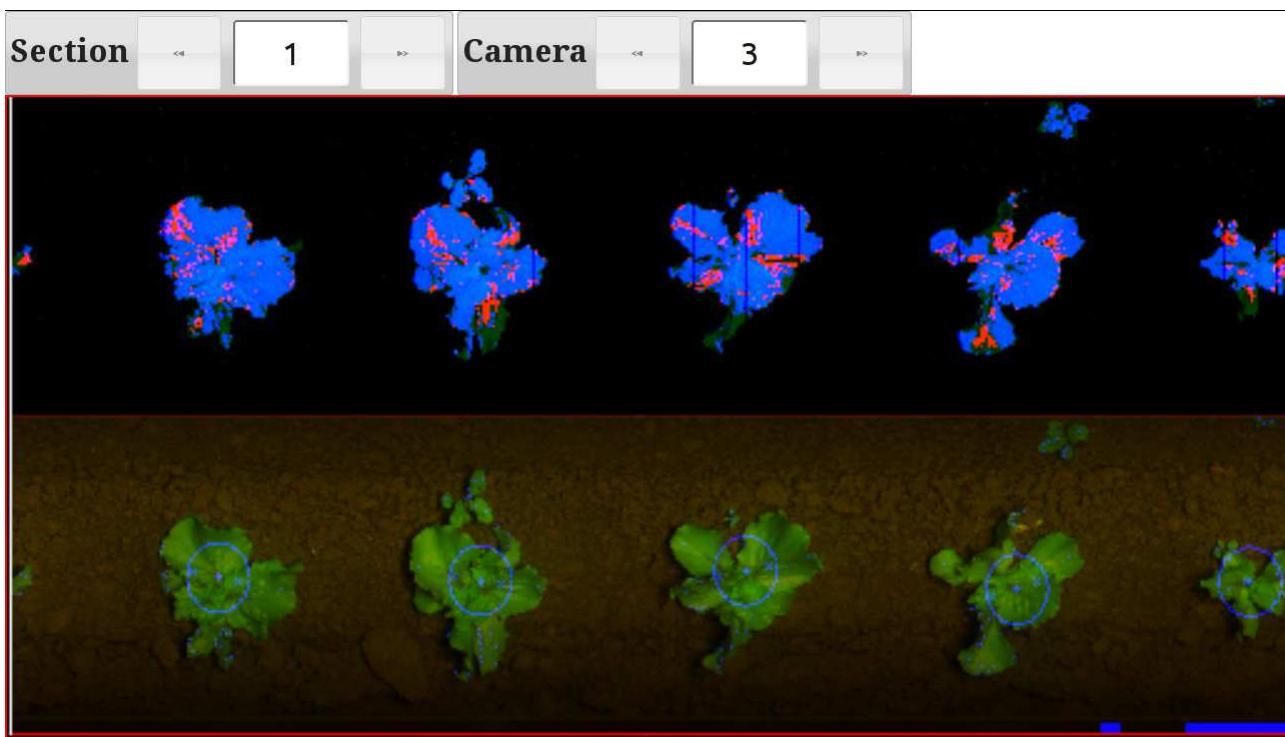


Figur 7 SUNFACTOR_0

Manual
ROBOVATOR



Figur 8 SUNFACTOR +20



Figur 9 SUNFACTOR -20

Adjustment of the working depth:

The working depth of the whole machine is controlled by the sensor at the measuring wheel at rear of the machine. The length of the hydraulic rod at the top of the machine controls the tilt of the machine and thereby the working depth of the implements. The working depth is controlled by the hand wheel at the section carrying the measuring wheel.

The working depth of the actuators can be controlled by a handle on each actuator. The angle of attack can be adjusted at the actuators by a screw located on the front of each actuator.

The max and the min movement of the tools can be controlled by the screws with hexagonal nuts on the actuator blocks.

Other settings:

You can try to increase the “*accept size*” until the machine begins to take away the smallest crop plants and then decrease the value somewhat. In this way it is possible to adjust the machine to weed relatively large weed. However, the changing of plant size should be done at the end of the rows because you will have to press “ESC” to go to the “plant setup” menu. When the work in the row is resumed, the first meter will not be weeded correctly.

Information:

While working you can get the following information from the display:

- Distance Driven
- Speed
- No of cams online
- Error status of the lamps
- Battery voltage
- Hydraulic pressure
- Oil temperature (on some models)

Alarms and warnings:

- If there is a serious leak in the hydraulic system or if oil level is too low and air is being sucked into the pump, you will get an alarm and the system will not start.
- If the hydraulic pressure accumulator is defect or has too low pressure, there will be a message in the display.
- If the tractor is too much off course and the sideshift is at its maximum, there will be a warning in the display
- If a bulb is defect, there will be a warning in the display 10seconds after activation.
- If the revolution of the PTO is too low, there will be a warning in the display and the lamps and all hydraulic valves will be turned off to save power.

Manual
ROBOVATOR

WIFI COMMUNICATION

PRELIMINARY

Turn on the Robovator and start the PTO.

Connect to the WIFI (Name of network = Serial No of the machine)

Passw = ROBO2015 (capital letters)

Or:

Network name= netis

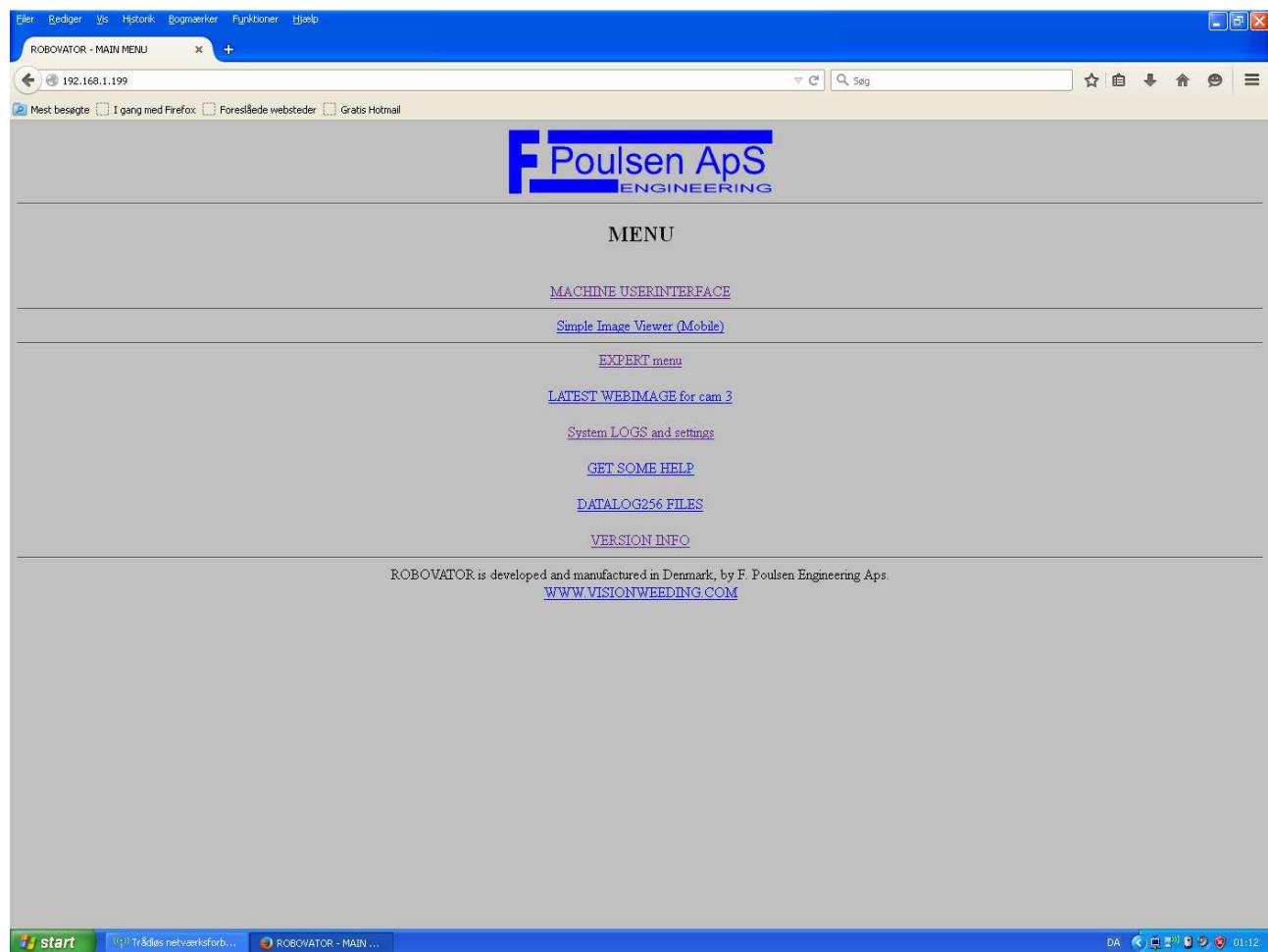
Passw= password

To connect with the ROBOVATOR open a browser (Firefox or Chrome, not Explorer) on your device.

In the address field type the address below and press enter. Save the address.

<http://192.168.1.199>

A window should open like this:



Manual ROBOVATOR

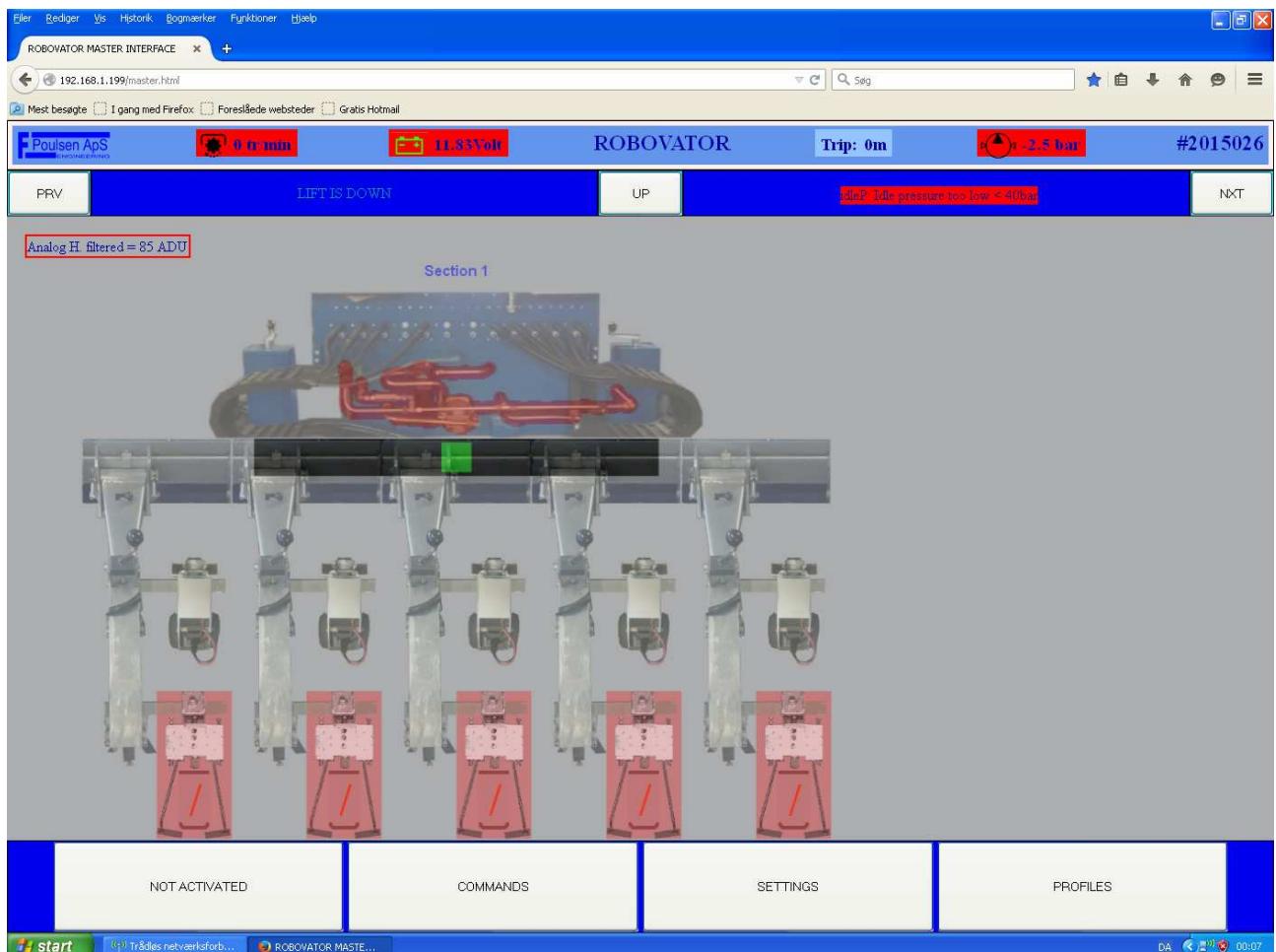
The main menu gives you several options:

If you access the machine via a tablet or computer, use "MACHINE USERINTERFACE"

If you use a smart phone, use "SIMPLE IMAGE VIEWER"

DO NOT use the "EXPERT MENU"

The "MACHINE USERINTERFACE" looks like this: (in a one-section system)



In the top line there is displayed some information like:

PTO speed, Battery voltage, Trip count, Hydraulic pressure, Serial No.

Note: if the field is coloured red it indicates an error state.

In the next line you can press "PREV" or "NEXT" to go to another section (in a multisection system) The "UP" button takes you to the main section.

Some additional information like the status of the cultivator and the hydraulic system is also displayed.

A picture of the machine is displayed in the main section of the screen. If an error is present, the part related to the error is coloured red.

Note the sideshift bar; When the machine operates, the sideshift position is displayed. If the sideshift is close to the maximum movement, it will be indicated by a red colour.

Manual
ROBOVATOR

At the bottom of the screen 4 buttons are displayed.

The “ACTIVATED/NOT ACTIVATED” lets you control the status of the machine.

The “COMMANDS” button opens the “COMMANDS WINDOW”

The “SETTINGS” button opens the “SETTINGS WINDOW” The options in this menu is content dependant.

To see the image from a camera, simply click on the camera and the “CAMERA WINDOW” opens.
When you click on the image, it will reload after a few seconds.

To see the image from another camera, click “NEXT” or “PREVIOUS”

Profiles

The “PROFILES” Button opens the “PROFILES WINDOW” where you can store and recall user settings. This feature is useful when you have a specific combination of parameters for a specific crop or field.

It is possible to save and recall 10 Profiles. Each profile can be labelled individually, f. ex. : “Large lettuce on dark soil” or “Small lettuce in sunshine”

DESCRIPTION OF PROFILES

The menu “Profile” provides an interface for saving and loading a backup of certain parameter sets. When you say “Save To”, then you choose a slot to put a copy of the current values of some parameters. Values are NOT automatically loaded from this slot on the next startup. For this you also have to use the “Other”->”Commands”->”Save values”.

When you say “Load From”, then you choose a slot from where new values for some of the parameters are read. The new values are NOT stored over a restart UNLESS you go to “Other”->”Commands”->”Save values”.

In the Wifi interface you can change the slot names and give it a note.

Currently the following parameters are saved within the profiles:

Acceptsize

Plantdistance

Minimum Protect;

sunfactor;

safezone;

centremoe;

Darksoil;

Maintenance

Cleaning air filter:

Depending on the amount of dust it is necessary to clean the air intake filter of the compressor (on some models).

Remove the filter and clean it with a vacuum cleaner.

Cleaning of the Camera lens

If the lens of the camera is dirty, it can be cleaned with a clean rag with some window-cleaning detergent.

Belt tension:

The tension of the generator drive belt must be checked every 500 hours.

Replace if worn and retighten if too loose.

Battery:

Check the level of water in the battery every 500 hours and replenish with distilled water if necessary.

Hydraulic:

Check the level of hydraulic oil, replace with standard hydraulic oil. Eg AGIP OSO 46

For every 500 hours replace the hydraulic filter.

Transport on trailer or truck

Protect the cameras from water by covering with a plastic bag which must be secured with tape.
Adjust the supporting wheels so that the weight of the machine is distributed on both the wheels and the supporters.
Adjust the wheels of the parallelograms so the weight is distributed evenly on both the wheels and the implements.
Secure the machine on the truck.

Limitations

What the machine can **not** do:

The machine can not distinguish between weed and crop. It can only distinguish between small and large plants (lettuce software)

If there are too many small weed plants closely spaced they will be recognised by the camera as large plants and the machine will treat them as crop plants and not take them away.
This is why the machine will only work on transplanted crops and only when the weed plants are still small.

If the soil is covered with moss or algae, the machine may not work properly because the moss or algae can be detected as large plants.

If plant distance is larger than half the distance between camera and actuator there can be problems with tool movements when plants are very big and nearly touching in the row.

TROUBLESHOOTING

Boot problems

This Section only troubleshoots boot problems - it does not verify the correct function of the machine in the field.

In order to test the computers, it is *necessary* first to verify that the startswitch is working properly; therefore please follow this procedure:

1: How to test startswitch startup :

Turn on machine with a computer in slot 1.

The diode closest to the edge with 4 blue connectors on the startswitch should be blinking slowly (0.5Hz)

After 1-2 minutes it should start blinking faster (2Hz) indicating that computer 1 has established connection to the startswitch.

If OK then startswitch is OK and slot 1 can be used to verify other computers.

IF not, Make sure powerled on computer 1 comes on! (if not - reinsert computer, check fuses, check voltage (12-14.8V), reinsert CFA card)

THEN IF that does not help - change the cable to startswitch.

THEN IF that does not help replace the computer number 1 with another one.

IF that helps, the original computer has a fault. If it fails try yet another one

Otherwise - startswitch has a problem. - verify that jumper JP2 is present.

2: How to test if a computer is booting:

IF you think that one or more specific computer(s) does not work/boot:

THEN please insert the computer into slot 1 (nearest startswitch circuit board on the rightmost wall looking into the cabinet) and start up the machine.

The topmost diode on the startswitch should be blinking slowly (0.5Hz)

After 1-2 mnutes it should start blinking faster (2Hz)

If it does so, The computer in slot 1 is OK and can communicate on its serial bus (startswitch/display/servo).

(we assume that the connection to the start switch is ok and that startswitch is working - ie. fast blinking with another computer inserted in slot 1)

If the start switch does not start blinking at 2 Hz, pls proceed

IF the blinking does NOT go to the 2 Hz:

Verify that the diode labelled "POWER" on the computer (at the edge, topmost on circuit board with fan) is lit and stable (not blinking).

IF NOT - either voltage is not in range (11.7-14.8V) OR there is loose connection at either 12V or Ground at the backplane, preventing sufficient current for the startup of the computer.

IF diode is lit and you are unsure wether the startswitch is working - then please turn off and put the computer at slot 3 and startup and verify that Display is staying at the "Robovator...please wait" message. This confirms a faulty computer.

If display however works - then there is a problem with the connection to the startswitch - hence this double check - proceed below "How to test the startswitch"

Note: this test can also be done at slot 3 - if display continues to the "Loading System...100% Done"

Manual
ROBOVATOR

message, then the computer as such IS working. However if it does not, there can be problems with display and/or Servo and the cables to these units. Therefore testing in slot 1 is somewhat more likely to be trusted. Testing in both slots is the safest!

Few things to do with faulty computer (one thing at a time !!)

0. Verify basic hardware boot by removing ALL computers from the cabinet except the one under test.

When powered up there should be a short beep from the computer board (not the display). If this beep does not come

 goto step 5 or replace the computer.

1. take out CFA card and reinsert
2. Replace CFA card with one from another computer that works - if this helps, get a new one from the manufacturer.
3. take off and reinsert jumper JP3 on the middle circuit board (only applies to versions 8 to 11) iokort version 12 does not have this jumper.
3. verify the insertion and orientation (stripe furthest away from backplane) of the wide grey ribbon cable connecting the motherboard with the middle circuit board.
4. Replace the ribbon cable with one from another computer that does work
5. reset cmos by moving jumper JP4 on motherboard (it might need to boot once without USB key before working correctly)

3: Testing slot 3

First verify that you have a working computer by placing it in slot 1 (assuming that startswitch is working).

Now, put a working computer (one which have passed the test No 2) in slot 3 and start up.

Because you have tested it to work with the startswitch - it MUST also work with display and servo. Therefore after 1-2 minutes it will change from "Robovator...Please wait" message, to "Loading System...100% Done" message.

(NOTE: In this situation - the blinking diode on the startswitch should go into its fastest blinking mode (10Hz) if everything else is working)

IF it does NOT do so - then there is a problem with either the display, the cable on the display, the plug on the cabinet, the internal cable from backplane to the cabinet plug OR a short circuit in the cable to the servo.

IF display is stuck at the "Loading System...100% Done" - then there is problems with the USB key or the files therein. Check that the USB cable is connected to the computer number 3 and that the USB stick is seated. If this does not help - then USB key or usb cable is faulty.

The startswitch diode will NOT start blinking at 10Hz.

IF display continues but stops at the "syncing power controller", then go to "Testing if communication from slot 3 to 1 is working"

4: Testing communication from slot 3 to slot 1

1. Verify that you have a working computer in slot 1 (How to test if a computer is booting)
2. Verify that startswitch is working (how to test startswitch)

THEN IF display continues to stop at the "syncing power controller" then there must be problems with the LAN connection and/or the synchronization of the software:

Manual
ROBOVATOR

1. Verify/check/replace the LAN cables to/from computer 1+3 and the power to the LAN switch. Try using another socket in the LAN switch. Please note any change in the number of lights on the LAN switch. There should be as many lights as there are computers connected + 1 for power.
2. Check/replace the narrow ribbon cable on first computer 3 - then on computer 1. Orientation is stripe furthest away from backplane on both connectors.
3. use a correctly configured computer with the SW_interface program running before startup to see numbers changing during boot in the "ROBOVATOR Segment STAUS" window. (1) means loading files. (2) means main program loading and running. a Filled/black/green dot means that user has pressed ESC and ENT and computer is at the main menu. a (3) means that main program has failed and ended.

(Note: IF you recently have made changes to the USB key OR updated software and problems arose at first boot after change - then there is problems with missing or faulty files on the usb key. Recreate from backup. Always make backup before manual changes.)

--

After succes with these steps - system should boot fully and ask to start PTO. - Please do NOT be Too fast on the buttons at this stage. When asked to press ENT to continue, it is adviseable to wait at least one second before pressing ENT to get to the main menu.

Go into "Other"->Cams online to verify that all 1-8 cams show an "A". (this only applies to machines with up to 8 rows). Those with 0 has either not booted or cannot communicate via LAN. Please put them one after another in slot 1 to verify them. computer 1 is the rightmost "A".

If this is ok - do tests in the field. If one computer fails - move it to another position and test again to verify if problem is related to computer or backplane.

Tools not moving can be either electric failure on computer, backplane, hydraulic, cables or camera. Using sw_inspector software will help eliminating the camera.

Moving computer with error following, identifies computer as problem.

(Remember to start at the top of this manual at each boot)

Camera image:

To verify that the cameras are working correctly, it is possible to download a recording of what the cameras have seen. This image can be saved on a laptop and subsequently sent to:
develop@visionweeding.com for analysis.

Procedure:

In the main menu choose: "other", "commands", "enable web interface"

Driving with "tools activated" the computers will now record an image of what is seen by the cameras. This image is constantly overwritten so that only the last 20 m at any time is being saved. Stop the machine, lift it and press "ESC" and choose "update web image" in the *other/commands* menu. For best result, stop the machine 1 – 2 meters after an error.

If your laptop has not got a fixed IP address do the following (windows computer):

In the control panel choose network connections, settings, settings for TCP/IP protocol.

Check "use this IP-address"

Type in: 192.168.1.221

In "subnet" type: 255.255.255.0

Click OK

Now is the computer set to a fixed address (192.168.1.221) Remember the old settings so you can undo the changes to your laptop

Connect the laptop with the machine with a patch cable. The LAN connector is located inside to the right at the bottom of the gray box. Or you can use the Ethernet switch in the upper compartment (on machines from serie No 04)

Start the browser on the laptop and write 192.168.1.11 in the address field and press enter.

The addresses of the cameras are 192.168.1.11 to 192.168.1.16

You are presented with a menu – please select the bottom one called Datalog 256 files.

This opens a new page – there will be a link called "testfil_#####.raw" – Right click this link and select "Save link as". Give the file a new name that you can remember and which is descriptive for error you are trying to document. Make sure that the filename has an ending of ".raw"

The images should be saved and sent to develop@visionweeding.com in an email explaining the problem and a description of the circumstances.

Computer/display

If the display says “waiting.....” and nothing happens:

Check cable to display (including connection from connector to backplane and grey flat cable on board)

If the display says “loading system....” and nothing happens:

Check USB

If display says “internal communication....” and nothing happens:

Check LAN if startswitch flashes speed 2

Check computer 1 if startswitch flashes speed 1

If display says “oil leak” and the machine can not work:

Check that the oil level is visible in the window of the tank.

Check that there is no serious oil leak.

Tell the machine to ignore this error. Start the machine but not the PTO. Go to: Main

menu/Other/Commands/Safe PTO and press enter.

Start the PTO.

Cams lost but the machine is still working:

The LAN switch is defect or the LAN cables/connectors have problems. Check/replace the narrow grey cable from mainboard to IO-board

Lamp not burning

If “lamp error” is indicated in display/tablet, check bulb, check fuse on lampswitch, check cables on lampswitch and lamp.

If “lamp error” is not indicated in display/tablet, check the computer (refer to chapter....)

Tool not working (one row)

Check if computer is on-line (use display/tablet)

Check the image on the tablet, verify that there is a blue line in the left side of the picture indicating the opening of the tool. If image/blue line is OK, check the cable from the backplane to the actuator. If blue lines are missing change the settings to smaller plant size.

If the image is not ok, look for loose connections of the 3 cables between the camera and the backplane of the computer. Take out the cables and inspect the connectors for dirt and insert the connectors again. Do this also on the camera end of the cables. Be careful not to put the cables in the wrong sockets. If problem persists switch the computers to see if problem stays on this row.

Check that the tools can operate: In the menu “toolmode” choose “calibrate”

Go to the main menu and activate the machine: The tools should close. Deactivate the machine: The tools should open. If the tools fails to operate, check the glass fuses on the startswitch.

Check the hydraulic valve by connecting 12 V to the solenoid to see if the tool moves.

Tool not working (more rows)

Check if computer is on-line (use display/tablet)

Check the image on the tablet, verify that the blue lines in the left side of the picture indicating the opening of the tool is OK. If there is a lot of black stripes in the images, check the speed cables/speed sensor wheel. Check that the wheel is allowed to run on the ground at all times and not lifted into the air. Check the cables from the wheel to the machine.

Remove the speed connectors from the backplane one at a time and put them back into their sockets.

Remove and replace the 2 black jumpers on the backplane with the jumpers installed.

To check if there is a problem with the speed signal do this:

In the display go to "trip menu" read the display. Mark the position of the wheel. Turn the wheel 10 revolutions forward. Turn the wheel 10 turns backward to the same position. Read the display. The reading should be very close to the first reading.

If the error is more than 3% there is a problem with the wheel, cables or other hardware.

Note: The speed signal was reversed from PWR version 003C to 003D.

Check that there is not too much weed.

Steering not working

Verify that the pressure is ok. Verify that the machine can do the initialisation.

If machine moves to the center, check the up/down sensor.

Check the images on all rows.

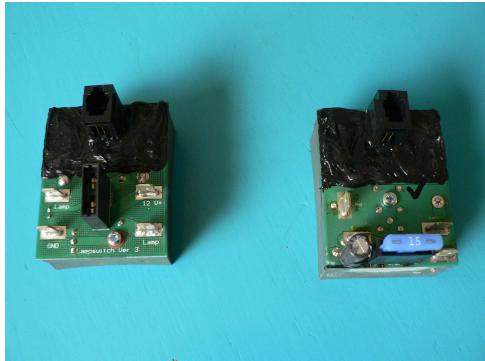
Check that there is not too much weed.

Unprecise steering can be due to problems with camera or servocontroller.

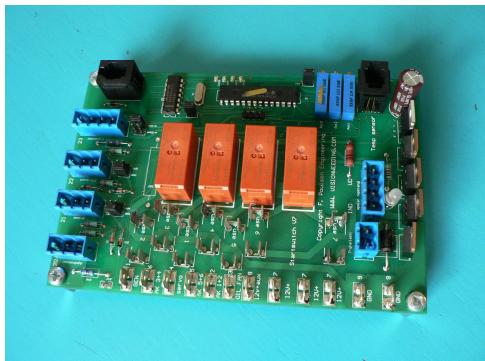
Servocontroller troubleshooting:

1. does the display give a message like "no servo connect) at startup? If yes, check all cables to servocontroller. If this does not solve the problem, replace servocontroller
2. Does display give a message like "pls lift machine" if yes, check that the sensor sensing the that the machine is lifted functions properly, check that the signal is present at the startswitch. (see that the diode comes on and off when the machine is lifted and lowered)
3. Does the display give a message like "error at initialisation? When the machine is initialised? If yes, check the ball bearings allows free movement of the frame.
4. Read the system pressure on the display, is it between 60 and 100 bar? If not, check the cables to the hydraulic valve controlling the pressure. (bottom of machine close to electric battery) If no pressure, hydraulic valve maybe defect)
5. If still problem with servocontroller, remove the connectors (mark the positions) and connect a wire from battery to the valves (right valve at bottom of tank looking into the machine). If you connect the outer spool to the battery, the frame should move in the one direction , when you connect the other spool to the battery, the frame should move in the other direction. If the frame does not move, and the pressure is ok, the frame is stuck or the valve is clogged.

Glossary:



The Lampswitch is used for turning the lamps on and off and for monitoring the status of the lamps. It is connected to the backplane with a flat 4-wire telephone cable.



The startswitch is used for controlling power to the tools, for controlling the hydraulic pressure, the generator, the depth control and for other functions.
It is connected to backplane 1 with a flat 4-wire telephone cable



The LAN (Local Area Network) switch is used for connecting the computers and the router with each other.

Fitting new tools on the machine

Put the toolarms with the worn blades in an oven at 350 degr for 10 min. An ordinary kitchen oven can be used. If the oven is not available, use a hot air blower with a controlled temperature.

Remove the nut, blade and the retainer.

Clean the thread with a steel wire brush.

Apply Loctite 603 on the thread.

Fit the retainer, blade and nut. If the old nut is worn, use a new nut.

Mount the toolarm in the actuator on the machine and adjust the position of the blades.