User Manual
ISO Cutting and Transplanter

ISO GROUP

Version 1.1

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User Manual
ISO Cutting and Transplanter

This user manual belongs to the ISO Cutting and Transplanter

Typenumber: ISO-STP-XXX

Year of construction: 2018

The above-mentioned machine is manufactured by:

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Edition: 01

Foreword

This user manual is a part of the machine and, as prescribed by law, must be kept until the machine is discarded.

It is essential that anyone who works with or on the machine reads and understands the documentation associated with the machine and follows the instructions given. In the case of professional use, it is the employer's responsibility to ensure that these instructions are known and observed by anyone who works with or on the machine

This User Manual contains information which is necessary for the safe operation and most efficient use of the machine. Please read this User Manual carefully before you start up the machine. The instructions given must be followed to the letter.

This User Manual must be kept by the owner in a safe and dry location, away from direct sunlight, preferably close to the machine. It must be available for consultation at all times. It is recommended to safeguard a copy, in the archives of your technical department for instance. A copy of the electric diagram must be placed in the control box for quick consultation. Were the User Manual to get damaged or become illegible, a new copy of the manual should be requested from ISO Group.

Texts in this manual that deserve special attention, are displayed in the following form:

 Tip for the reader.

 Beware! A comment with additional information.

 Warning! User can severely damage injure or machine itself (seriously)

Table of contents

1 Introduction

ISO Group expects that every person who comes in contact with the machine is aware of the normal way of handling the machine as described below.

- Unauthorised personnel may not carry out activities with or on the machine.
- Were it to experience fault, the machine must not be switched on unless otherwise instructed explicitly.
- It is necessary to make sure that the protective screens are positioned correctly and that all the required precautionary measures have been taken before the machine is turned on.
- The workplace must be kept clean and free of obstacles.
- The keys and/or tools that were supplied in order to limit the access to certain parts or functions should not continue to stand/lie on/by the machine.

ISO Group is not liable for the consequences of:

- Unqualified use;
- A use other than for the purpose described in this User Manual;
- Ignoring warnings;
- Changes to or adaptations of the machine or the safety system for which no written approval was given by the manufacturer;

ISO Group ensures the transport, positioning, assembly, adjustment, and testing of the machine unless agreed otherwise. Because of this, as standard there are no instructions for assembly, installation, and commissioning.

It is necessary to first contact ISO Group if the machine has to be moved, modified, or disassembled. If not, ISO Group cannot be held responsible for any damage resulting from any of the aforementioned activities. A good and regular maintenance extends the service life of your machine and ensures its safety as a result.

1.1 Warranty

The machine is delivered in accordance with the standard delivery, warranty and payment conditions of Koninklijke Metaalunie (the Dutch organisation for small and medium-sized enterprises in the metal industry), unless agreed otherwise.

The warranty no longer applies if, among other things:

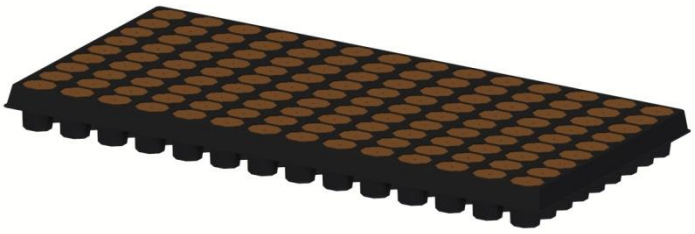
- The damage caused is the result of a use other than which the machine is intended for, cf. **Error! Reference source not found.**
- The machine has been handled unwisely, carelessly, incorrectly and/or negligently;
- Cleaning and maintenance have not been carried out in strict compliance with the instructions;
- The necessary repairs have not been carried out by ISO Group staff or have been carried out without the prior written authorisation of ISO Group;
- Modifications have been made to the equipment delivered without the prior written authorisation of ISO Group;
- Components other than the original components of ISO Group (or components with a similar specification) have been mounted on the machine;
- The machine is not properly connected to the supply mains;
- The defect occurred is due to an external circumstance which is beyond our control.

☞ **All wear parts are excluded from the warranty!**

Warranty claims must be submitted within 3 months of the occurrence of the incident.

1.2 Intended use

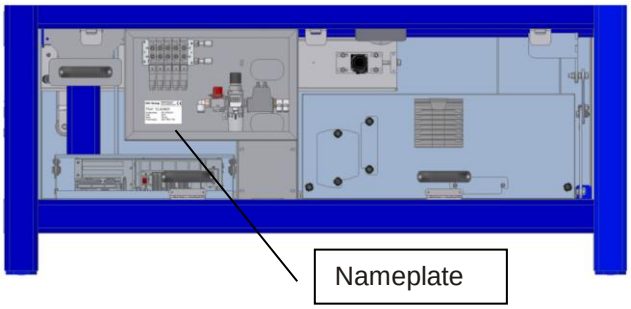
1. The machine is suitable for the automatic planting of cuttings and the transplanting of plants.
2. The maximum width of the tray is 400mm. The length is unlimited.
3. During the cutting planting process, the robot has a capacity of appr. 2,200 cuttings per hour. The capacity of the robot in the transplanting process depends on the number of grippers and is about 1,500 plants per hour, per gripper.

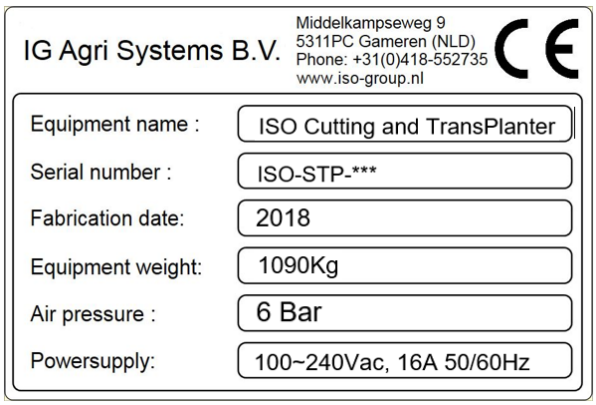


Any other use is not permitted and can lead to the cancellation of the warranty and of the validity of the CE marking.

1.3 Nameplate

The nameplate is located behind the cover of the control box.





2 Safety

2.1 Introduction

This machine complies with the machinery directives and standards in accordance with the CE Certificate supplied.
This machine is designed and built in such a way that it can be used and serviced safely. This applies to the application, the circumstances, and the instructions as described in this User Manual.
It is essential that anyone who works with or on the machine reads and understands the documentation associated with the machine and follows the instructions given.

Please contact your dealer or supplier should there be any questions or ambiguities as regards this User Manual.

There may be additional safety measures prescribed by the company or the country where the machine is in use. This User Manual does not describe how these must be complied with here. When in doubt consult your local authority or safety officer.

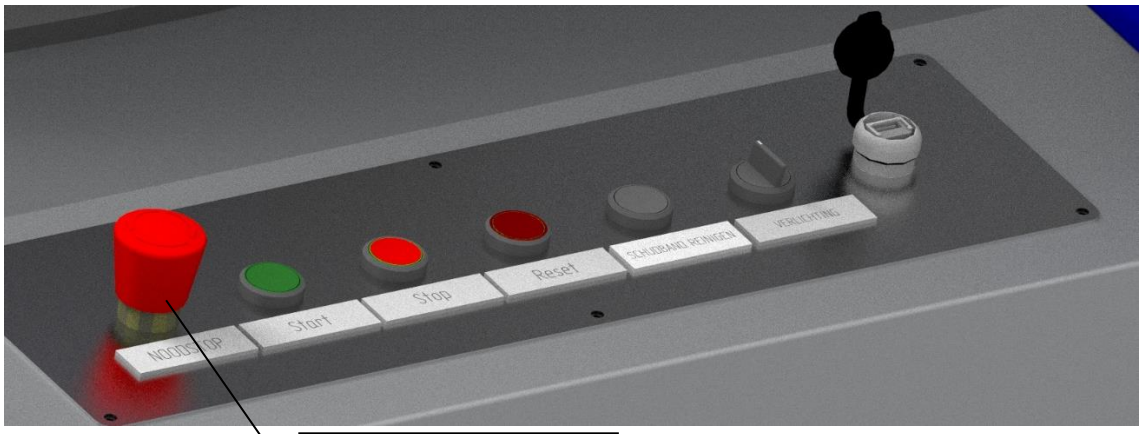
2.2 Health and safety risks

In spite of all the care and attention given to safety during the design phase, there are still a number of health and safety risks that should be emphasized:
Users who have not read thoroughly and understood the User Manual may pose a risk. The responsibility in this respect lies with the purchaser of the machine.
Removing the safety features from the machine may create a dangerous situation.
The moving parts of the machine may constitute a risk.

These risks were reduced as much as possible during the development of the machine. Safety features have been introduced (see Section **Error! Reference source not found.**) to that effect. Moreover, the user of the machine must observe a number of safety rules to protect himself/herself against the other risks (see Section 2.4.1)

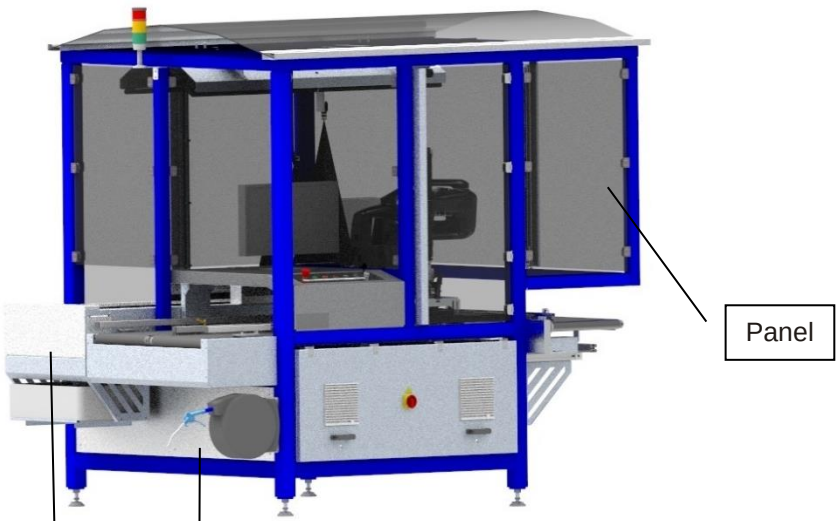
2.3 Safety features

Emergency stop button:
Used to bring the machine to a speedy halt in cases of emergency.
The machine will stop immediately if the emergency stop button is pushed. The switch remains mechanically locked and the machine cannot restart. Once the danger is over, the emergency stop can be unlocked by turning the button.
It is then possible to start the machine in the usual way.
The machine has one emergency stop button that can be used to shut down the machine.
This button is located on the control panel.



Emergency stop button

Protective covers:
The moving parts of the machine are shielded by protective covers and panels where possible. These safety features may not be removed.
Warning symbols have been affixed to the machine where necessary to inform the users on possible dangers (see Section **Error! Reference source not found.**).



Panel

Cover plate

Protective cover
for transport belt

2.4 Safety rules to be observed

2.4.1 General safety rules

- Children and pets are not allowed near the machine.
- Only people who have read and understood the User Manual are permitted to operate the machine.
- The machine may only be operated by people who are qualified to use the machine.
- The safety features may not be removed, disabled or circumvented.
- Do not wear any jewellery or loose fitting clothes (such as ties or open overalls) that could get caught by moving parts.
- Do not wear your hair long for fear that it might get caught by moving parts.
- Keep the workplace clean and free of obstacles.
- The CE Certificate is no longer valid if the intended use is changed and/or if the machine is operated under other physical conditions of use.
- Always observe the safety measures mentioned in the User Manual as well as the safety rules in effect in the country of installation!
- Allow new operators, under the supervision of a person qualified to do so, to practice using the emergency stop a few times.
- Do not use the emergency stop to turn off the machine in normal conditions.
- Once a week, check that the emergency stop is working.
- Do not unlock an emergency switch if you don't know by whom and why it has been actuated.
- Start by identifying the reasons why the emergency stop was pushed!
- It should not be possible to turn the machine on unintentionally.
- Do not wear rubber gloves when you work on rotating cylinders and conveyors.
- Before the machine is switched on after it has been shut down, check its operation and condition!
- Do not use the machine if it presents serious damage.
- The machine is intended exclusively for the use described under Section 1.2

2.4.2 Safety rules during operation

- Make sure that there aren't any objects on or inside the machine when the machine is started.
- Stay out of reach of moving components.
- Do not intervene on the machine while it is working or powered on. Even when the machine is not in operation, it can be powered on and start up automatically.

2.4.3 Safety rules during maintenance and repair work

- Maintenance work can only be carried out by technical staff who are familiar with the machine and qualified to perform these activities.
- Repair work can only be carried out by certified, specialised staff who are familiar with the machine.
- Disconnect the machine from all energy sources (power, compressed air, etc.) and bring all moving components to a halt before any cleaning, maintenance, and repair work is carried out, unless instructed otherwise explicitly.
- When carrying out cleaning, maintenance and/or repair activities always remove the two blades.
- When carrying out cleaning, maintenance and/or repair activities always observe the safety measures mentioned in the User Manual as well as the safety rules in effect in the country of installation.
- Reset the safety features to their original state or to the original position before the machine is reconnected to the energy sources.
- Carry out the cleaning and maintenance work in accordance with the schedule given in this User Manual. If this is not done, then this becomes overdue maintenance, which cancels out the manufacturer's liability.
- Maintenance and repair activities which are not described in this User Manual , can only be carried out by ISO Group service fitters or by other qualified technical staff who have received ISO Group Machinebouw's written authorisation.
- Never clean the machine with water and chemical or aggressive (cleaning) products.
- Make sure that the electrical system does not come in contact with water!
- When the machine is shut down for a longer period of time, it needs to be powered on in order to prevent the build-up of condensation.

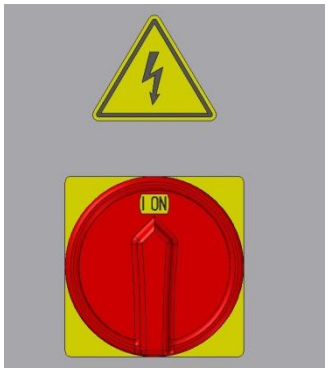
Should the above rules appear not to be observed, then ISO Group cannot be held liable in whatever capacity. Similarly, the CE Certificate is no longer valid as a result.

2.6 Warning labels on the machine

Labels with the following warning symbol have been placed on the machine:

Danger electricity

The figure below shows where the warning symbol is applied.



☞ Replace the warning labels when they are no longer legible!

3 Maintenance

The safety rules for maintenance and cleaning are given in Section 2.4.3.

- Never use chemicals or aggressive cleaning agents to clean the machine.
- The machine can be cleaned with a moist cloth or sponge.
- Electrical parts such as the electric motor, control box and sensors, etc. must not get damp. Clean these parts with a dry cloth or a brush or with air.
- Only lubricate the cylinders (with pneumatic oil, type number ISO VG 32) when they begin to move stiffly.

3.1 After each batch

The parts that come into intensive contact with the plant and plant saps must be disinfected after each batch of sorted plants.

3.2 Daily

Before the machine can be turned on with the main switch, the following actions must be performed:

- Check the machine's surroundings for anything that may be out of place.
- Clean all the sensors and mirrors on the entire machine.
- Remove dirt that is in or around the machine.

Follow the start-up procedure as described in Section 7.

3.3 Weekly

The following actions must be performed every week:

- Check the cables and hoses in the machine for damage.

☞ Clean the machine regularly to prevent dirt build-up.

☞ Depending on your maintenance contract, ISO Group will perform servicing, periodic maintenance and overhauls of the machines.

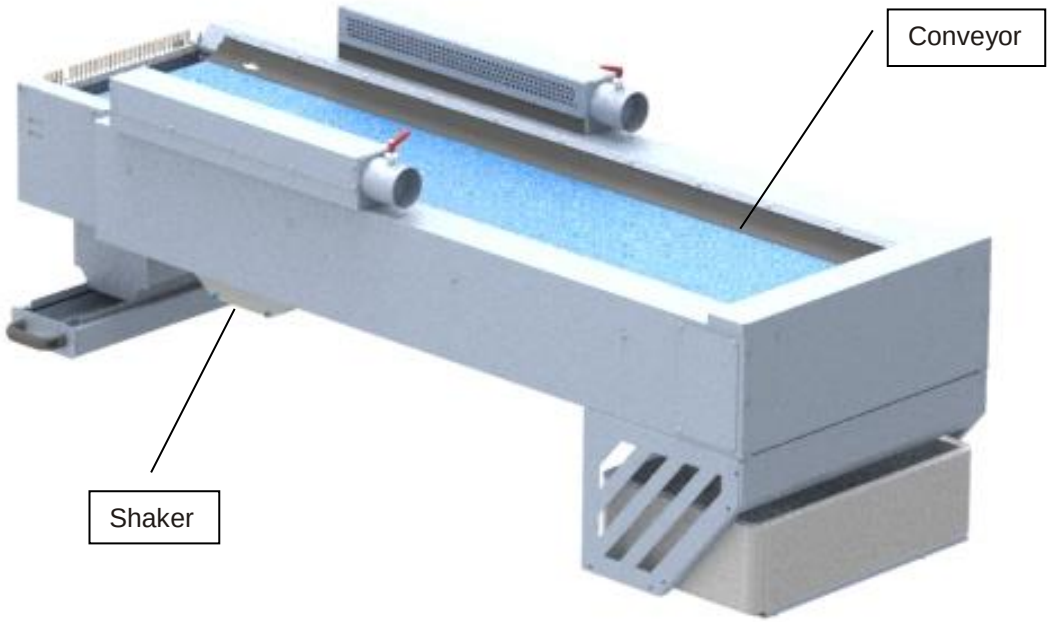
4 Cutting and Transplanter

The Cutting and Transplanter consists of the following components:

1. Supply system to single out cuttings.
2. Supply system for trays to transplant.
3. Camera's for detecting the cuttings.
4. Robot to take a cutting or plant.
5. Supply system for trays or pots.

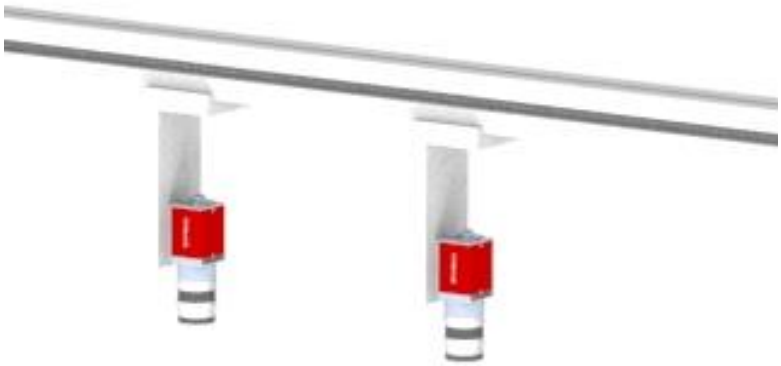
4.1 Supply system to single out cuttings

The supply system consists of a conveyor with an integrated shaker.
The signal to start the supply and the shaking motion originates from the robot controller.



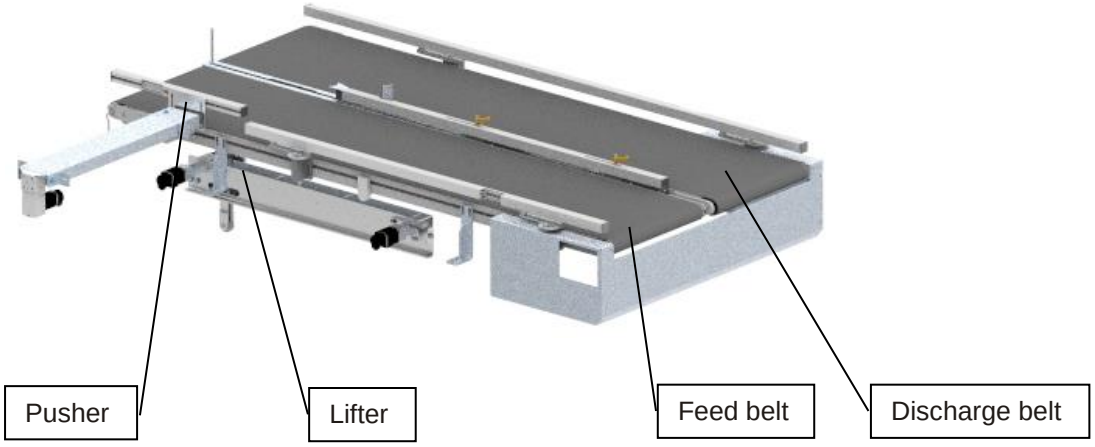
4.2 Camera's for detecting the cuttings

The camera system consist of 2 camera's which determinates where the cuttings are on the shaking belt and where the robot can pick them up.

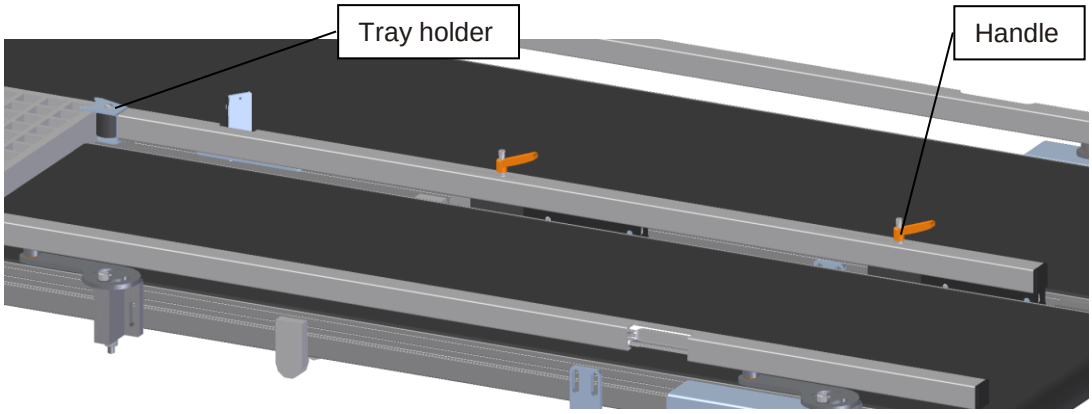


4.3 Supply system for transplanting

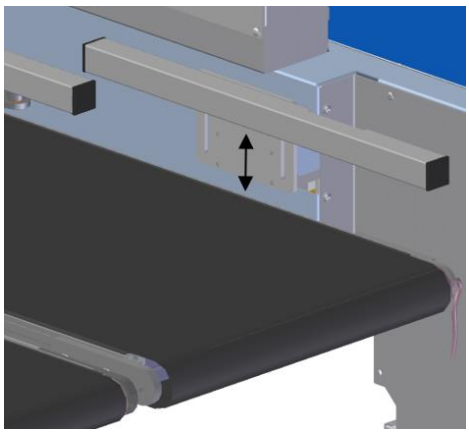
The supply system consists of 2 conveyor belts, a pusher and the lifter. The trays containing plants to be transplanted are supplied on the feed belt. The tray is shifted with the help of the pusher in such a way that there is always a row of plants above the lifter. When the tray is completely empty, it is pushed fully onto the discharge belt, allowing for its subsequent removal.

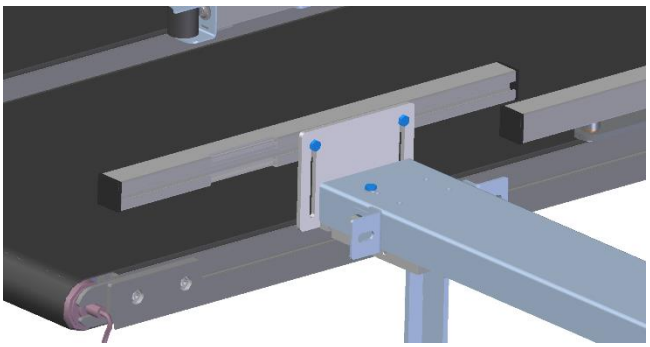


The height of the guide between the feed belt and the discharge belt can be easily adjusted. To adjust the height, loosen the two handles. Position the guide in such a way that the tray slides down just below the tray holder. This makes sure the tray is held in place when the plants are pushed up.

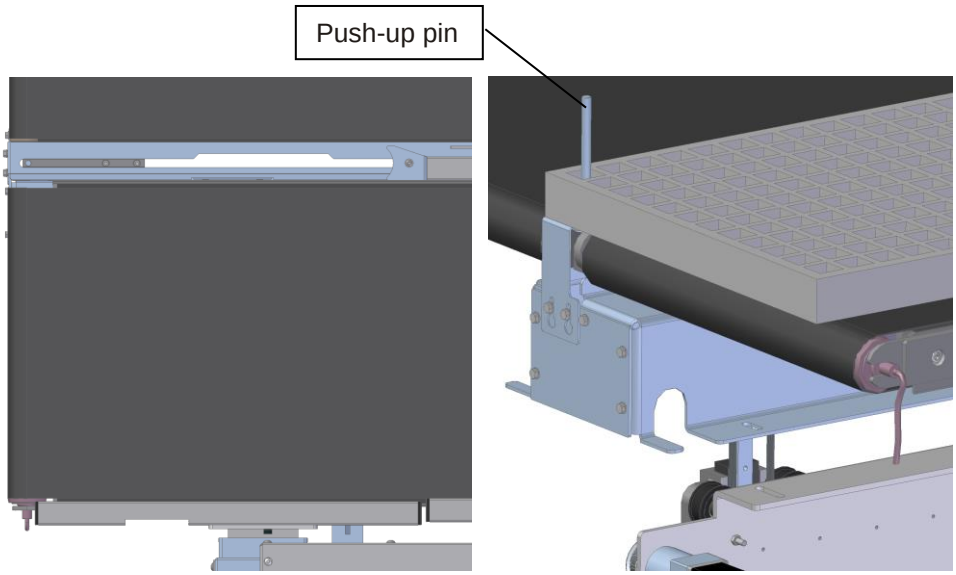


The pusher can be adjusted to the correct height with the two bolts on the back of the pusher.



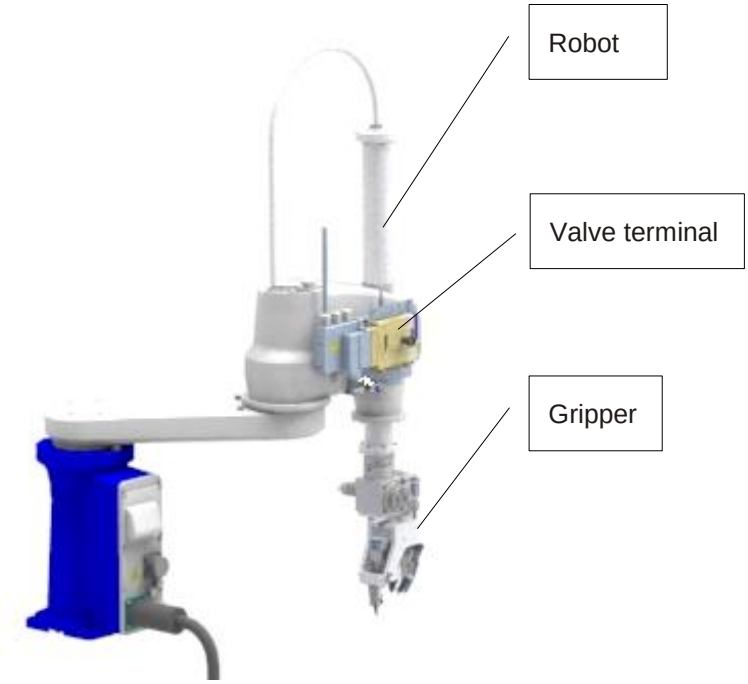


The lifter always pushes one or more plants up, depending on the number of lifters. The pusher moves the tray a bit further to ensure that the lifter is always exactly under a row of plants. The lifter may be provided with one or more push-up pins.



4.4 Robot

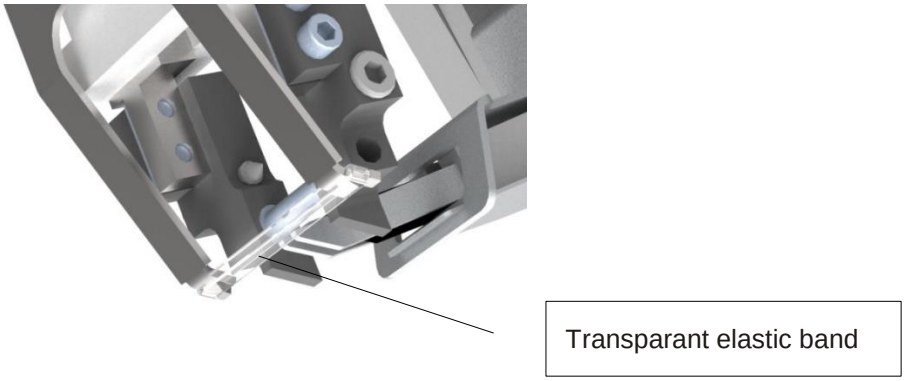
The robot arm is equipped with a gripper unit. A choice of two different gripper units may be installed in the robot: a gripper unit for planting cuttings and a gripper unit for transplanting plants.



4.4.1 Gripper unit to take a cutting

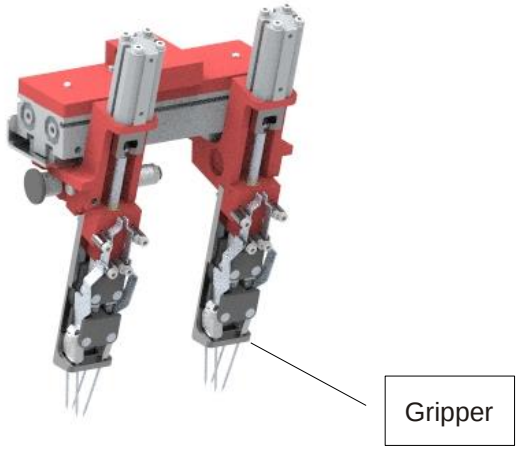
Each time one cutting is taken from the belt and planted into a tray or pot.
When the gripper misses a plant, the grip movement is started again.
The pinching force of the gripper can be controlled by the pressure regulator on the valve terminal. This procedure is described in the “Service manual”.
Calibration of the robot relative to the camera's is described in the “Calibration procedure” document.

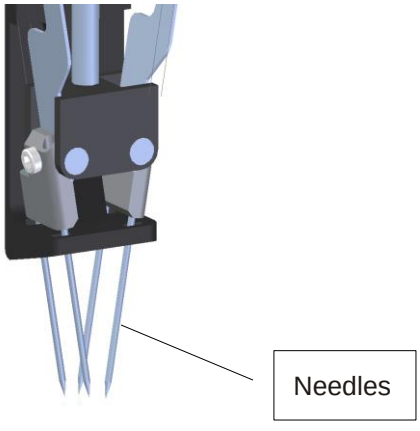
The gripper is provided with a transparant elastic band to hold down the plant stem on the band during grab movement of the robot gripper. Replace this if necessary.



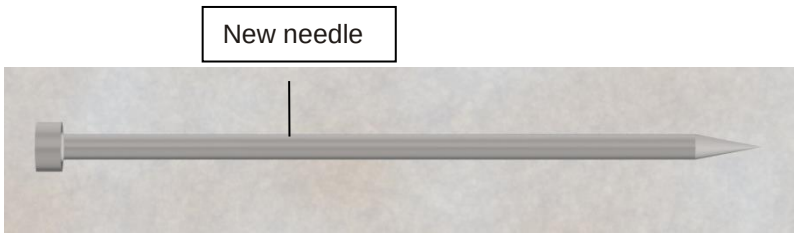
4.4.2 Gripper unit for transplanting

The gripper unit for transplanting can be fitted with one or more grippers.



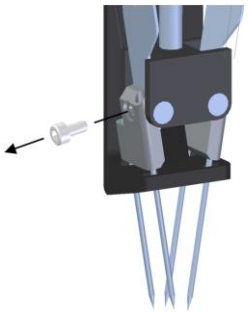


The bottommost part of the gripper must regularly be checked for wear. The play caused by wear way cause plant picking to become less effective. Replace the needles when unacceptable wear has been detected.

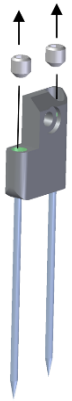


The following steps must be taken in order to replace the needles correctly:

- Unscrew the bolt with which the locking plate is connected to the gripper.



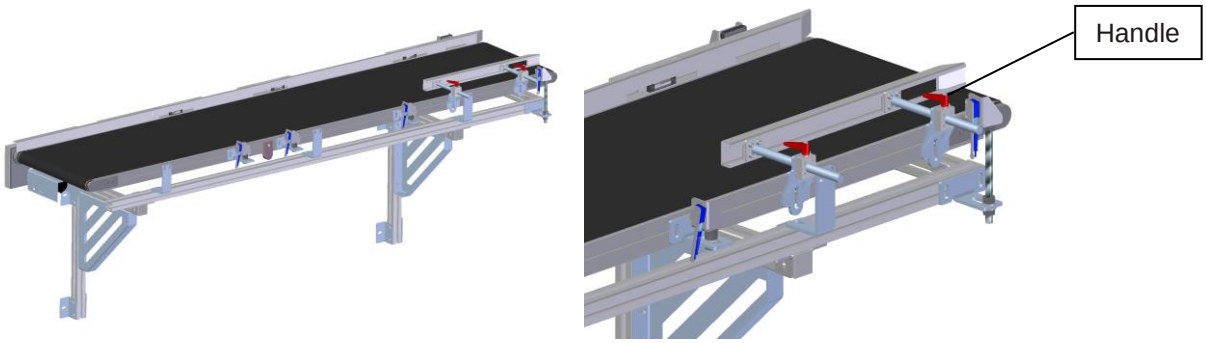
- Unscrew the two set screws from the locking plate. It is now possible to remove the needles from the locking plate.



- Place new needles in the locking plate, and secure the needles with the set screws.
- Now you can reattach the locking plate with the new needles to the gripper.

4.5 Positioning/discharge belt for trays or pots

The positioning/discharge belt is fitted with adjustable side guides. Correctly adjusting these guides makes sure the pots or trays are always presented the right way on the conveyor belt. The guides can be adjusted by loosening a number of handles.



Never make your own changes to the system. For example, moving the sensors.
In the event of problems, please contact ISO Group.

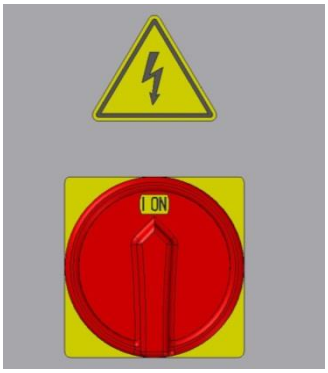
5 Operation

5.1 Button operation

The main switch is on the control box.
The other buttons are positioned on the operating console.

5.1.1 Main switch

Function: To switch the electricity of the entire machine on/off



5.1.2 Operating console

Emergency stop button
Only use the emergency stop button in cases of emergency. (Section 2.3)

Push button/LED START – in operation (green)
Function: To start the machine.

Push button STOP (red)
Function: To stop the machine..

Push button/LED RESET (red)
Function: To reset the machine. This is usually done after a fault.

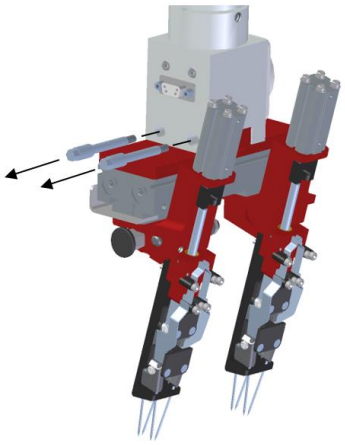
Push button CLEANING SHAKING BELT (black)
Function: Rotate the conveyor in reverse (1x press and hold).
Cleaning the belt (2x press in rapid succession, the conveyor continues to rotate slowly in reverse. To get the belt to stop, press once more)

Switch LIGHTNING (black)
Function: To switch the lightning of the machine on/off.

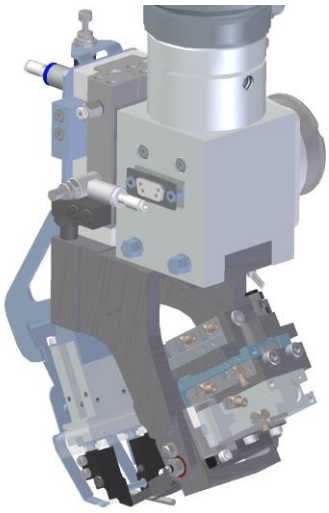
5.2 Alternating between cutting planting and transplanting

The machine is suitable for the automatic planting of cuttings and the transplanting of plants. To switch between these functions, a number of steps must be taken:

- Close the program on the PC.
- Remove the used gripper from the robot and replace it with the gripper to be used. To do this, carry out the following steps:
    - Disconnect all cables and air hoses from the used gripper.
    - Remove the used gripper by loosening the two bolts.



    - Position the new gripper and tighten the two bolts again.

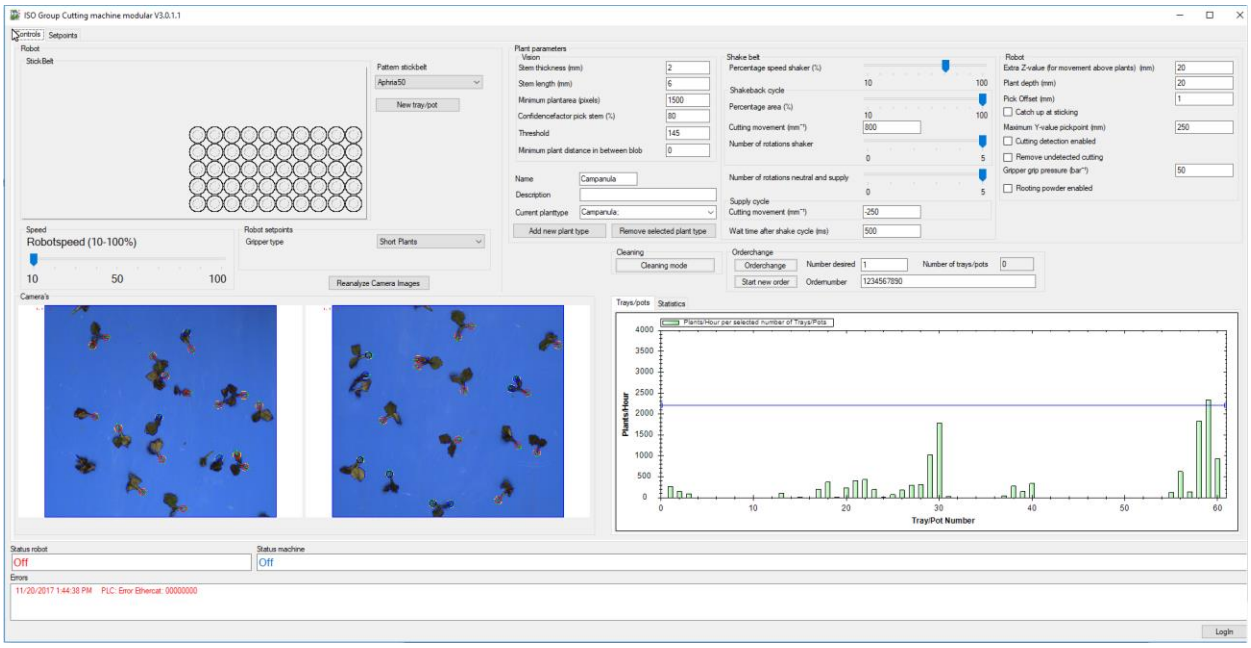


    - Attach the cables and air hoses of the new gripper.
- Adjust the side guides of the planting conveyor to the new tray or pot in which the cutting or plant will be placed.
- Start the program for the selected function from the PC's desktop.

6 Display controls

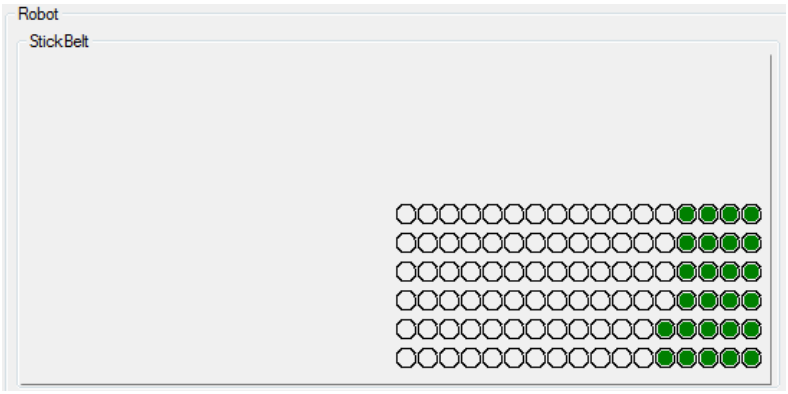
6.1 Display control cutting planting

The display is divided into various parts and is described in more detail in the following pages.



6.1.1 Stick belt

The tray or pot in which the robot is going to plant can be seen on the stick belt. The pattern is dependent on the set tray or pot pattern.



During operation, information will be given herein as to whether a hole has/has not been pricked or is going to be pricked:

Hole colour:

- Grey: No cutting planted
- Light green: Next cutting planting position
- Dark green: a cutting is planted or the robot is under way to plant.

6.1.2 Planting belt operation

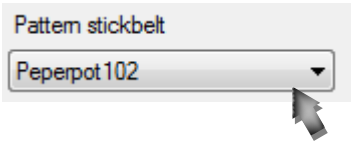
The desired planting belt pattern may be configured. A number of patterns are set at the factory.

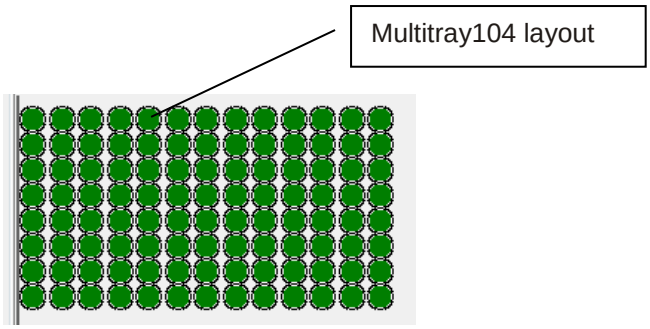
Making another type of tray or pot with different external dimensions and hole pattern is protected by a password, because the machine hardware also has to be adapted for this.

When switching a stickbelt pattern, the current tray is discharged and a new tray or pot is started on. It is advisable to only switch pattern when the old tray or pot has been discharged and before the new tray or pot is started on.

6.1.3 Pattern stickbelt

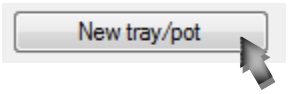
- Select the desired pattern





6.1.4 New tray/pot

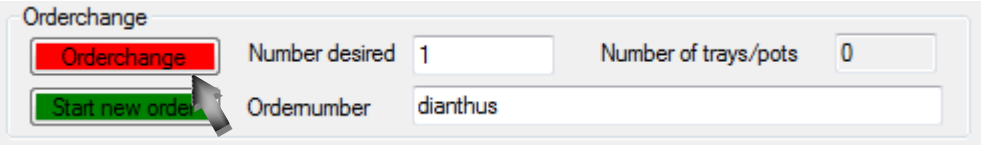
For safety reasons, this button can only be used when the machine is stopped. When the button 'new tray/pot' is activated, the current tray or pot will be discharged. The current cycle will not be completed! The robot is then reset, goes to the home position and drops any cutting there. After that, the tray or pot is discharged. It is therefore recommended to press the stop button at the end of the cycle then use the “new tray/pot” button.



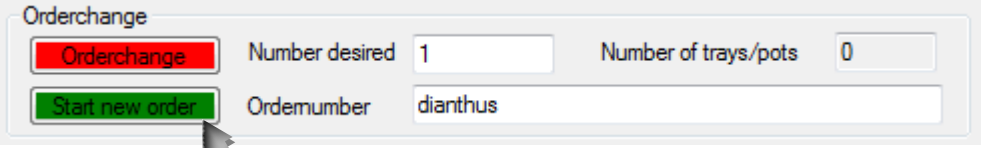
End of a cycle means when the robot has put a plant in the tray or pot and has not yet taken hold of a new plant.

6.1.5 Order change

1. Select ‘Order change’
    - When the desired number is reached, the current tray or pot is finished then the tray or pot is discharged and the belt rolls empty.



2. Position the first tray or pot of the new batch on the planting belt.
3. Enter the desired new quantity of trays or pots
4. Enter a new order number and press ‘start new order’
    - The conveyor belt will now try to feed cuttings and if a tray or pot is present, the robot will plant.

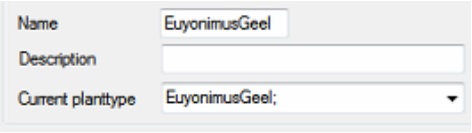


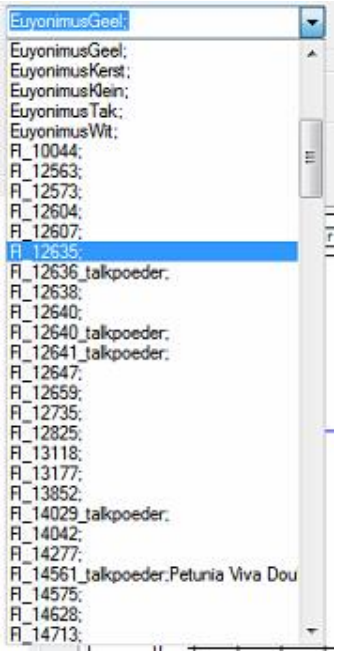
5. Deselect ‘Order change’
    - The first tray or pot of the new order will now be completed, and then be discharged.

☞ The order number is entered before the batch is started.

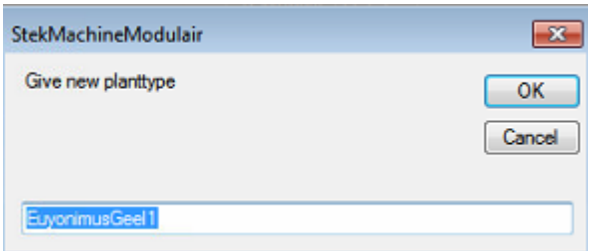
6.1.6 Plant type selection

By selecting a plant type, the manner in which a plant needs to be looked at is determined by the vision system. Furthermore, a number of shaking parameters per plant type can be set. Finally you can set how the cutting will be planted.





If a particular type of plant is not available as selection, although it is available in the system (the web server), it should be added first. For this, first a plant type must be added by clicking on the *'Add new plant type'* button. A new plant type is then created with the same parameters as the selected plant type, after which the name of this new plant type can be changed to the desired plant type (in the *'plant type name'* text box).

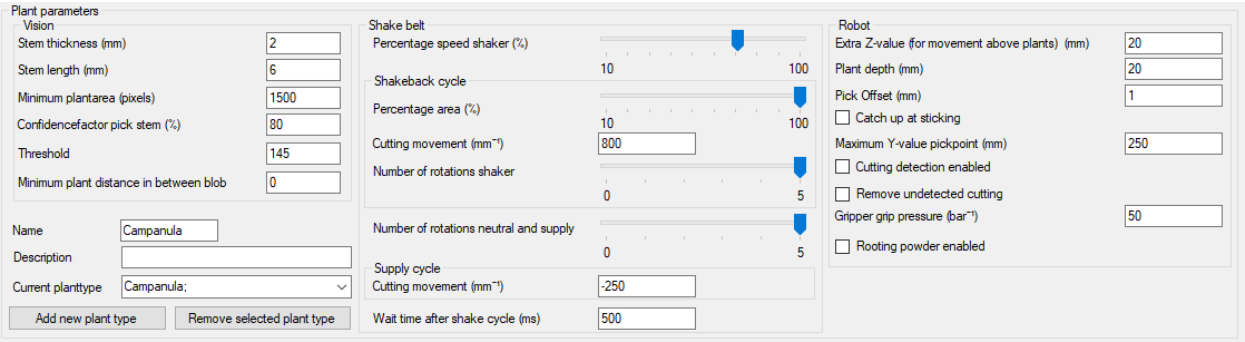


The name must be typed exactly the same as it is in the web server. It is best to copy the plant type in the web server and then paste it here

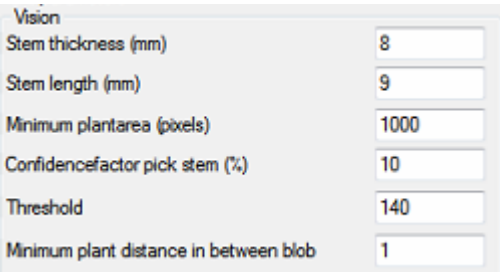
A new type of plant can best be created on the basis of a similar plant type. The majority of parameters are already correct.

By clicking the *'Delete current plant type'* button, the current plant type is deleted from the selection list.

6.1.6.1 Plant parameters



6.1.6.1.1 Vision



Stem thickness (mm):
This is the mean stem thickness of the selected plant type. (if this is greater than 7, then different pick points per stem will be reduced to one).

Stem length (mm):
This is the mean stem length of the selected plant type, measure from the stem end up to the first leaf. This stem length must always exceed the stem thickness.

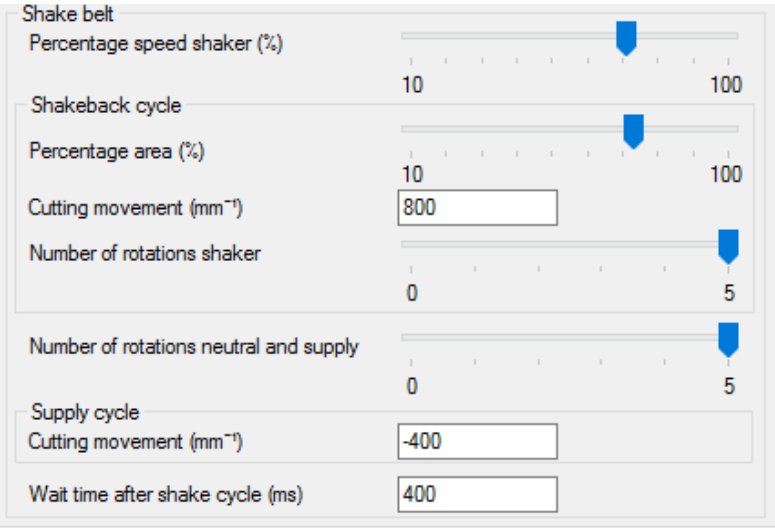
Minimum plantarea (pixels):
The area of the cutting must be at least this number of pixels. Otherwise that cutting will be generated.

Confidencefactor pick stem (%):
This is a factor between 0 – 100% about how dependable the grip point is. If this set to 100%, the vision will only create grip points at points where it is 100% certain that it involves a stem. If this is set at 10% for example, there is a chance that the leaf will also be seen a stem.

Threshold:
With this threshold the contrast value between belt and cuttings can be adjusted.

Minimum plant distance in between blob (mm):
If the grabbing points from the 2 plants that are lying on each other are closer to each other than the set value, the robot will not pick both plants.

6.1.6.1.2 Shaking belt



Percentage speed shaker (%):
Here the speed of the shaking can be set in a percentage from 10-100%, this then applies for the return, supply and neutral shaking.

Percentage area shakeback cycle:
Here, the number of pixels for the shaking back cycle can be set in a percentage from 10-100% (of the total, set in the 'settings'->'Number of pixels shake back cycle'). In general this will be lower for small plants and larger for large plants. The higher this percentage, the less there will be shaken back.

Cutting movement (mm^{-1}) (schakeback cycle)
Here the distance of the schakeback cycle movement can be set for the shaking belt.

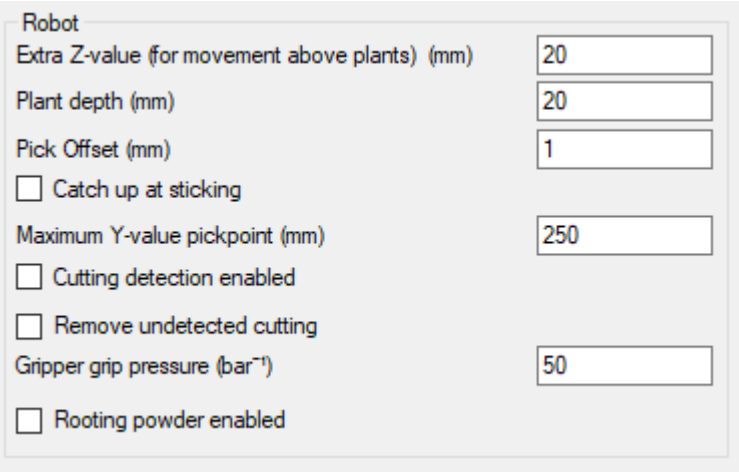
Shakeback cycle: Number of rotations shaker:
Here the number of rotations that the shaker makes during shakeback cycle can be set.

Number of rotations neutral and supply cycle:
Here the number of rotations that the shaker makes during shaking can be set. This is only applicable for the supply and neutral cycle.

Cutting movement (mm^{-1}) (supply cycle)
Here the distance of the supply cycle movement can be set for the shaking belt.

Wait time after shake cycle (ms)
The time between the end of the shaking of the belt and the first grab movement of the robot gripper.

6.1.6.1.3 Robot



Extra Z-value (for movement above plants) (mm):
For large plants, this is an additional height, in order to be able to move over the plants. This value should be set to the cutting height.

Plant depth (mm):
This is the extent of the depth that the cutting must be inserted into the growth medium for plants.

Pick offset (mm):
This is the offset from the end of the stalk on which the robot grips the cutting

Catching up at sticking:
If this is on, the robot will not go cutting straight from above the plants, but will first catch up low over the tray or pot (from the 1st row before the row to be cut), and will then cut.

Maximum Y-value pickpoint (mm):
This is the maximum Y-position (seen from the centre of the robot base) at which the robot can pick cuttings from the conveyor. All cuttings that are farther away are ignored. This allows you to limit the distance the robot must be away.

Cutting detection enabled:
With this checkbox the cutting detection can be switched on or off.

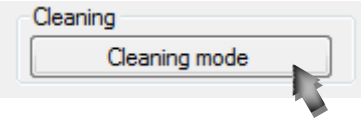
Remove undetected cutting:
If this checkbox is checked, a plant which is taken and not detected, will be put in the recycle bin. When it is not checked, the robot lets the plant fall and will retake the plant.

Gripper grip pressure:
With this parameter you can adjust the grip pressure.

Rooting powder enabled:
This is only present when the option is checked at the setpoints page. The robot will then dipp the cutting in the rooting powder before putting the cutting in the tray.

6.1.7 Cleaning

The ‘cleaning mode’ button can be used to put the machine into a certain position so that you can clean the machine properly (e.g. with steam).
If this is pressed while the machine is active, the current tray will be completed. After ejecting this tray, the machine will go into the cleaning position and not supply any new trays or pots (until the button has been pressed again).

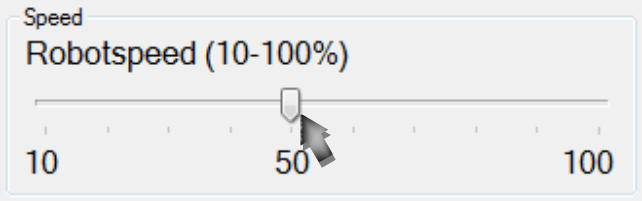


If this button is pressed after the machine has been stopped, the machine will immediately go into the cleaning position when it is started up again.

If the machine is not used for a long time, it is recommended to switch the machine to cleaning mode. (see section **Error! Reference source not found.**)

6.1.8 Robot speed

A slider is used to set the desired speed for the robot. 10% is the minimum speed.



This does not, however, set the machine speed. All the other movements of the machine will continue at the same speed.

6.1.9 Robot settings

The gripper type is chosen using the selector knob.

If the cuttings have “weak” stems, the gripper type suited to these stems must be selected. If, on the other hand, the stems are “sturdy”, the gripper type for these stems must be selected.

The settings for each gripper type are chosen under the Settings tab.

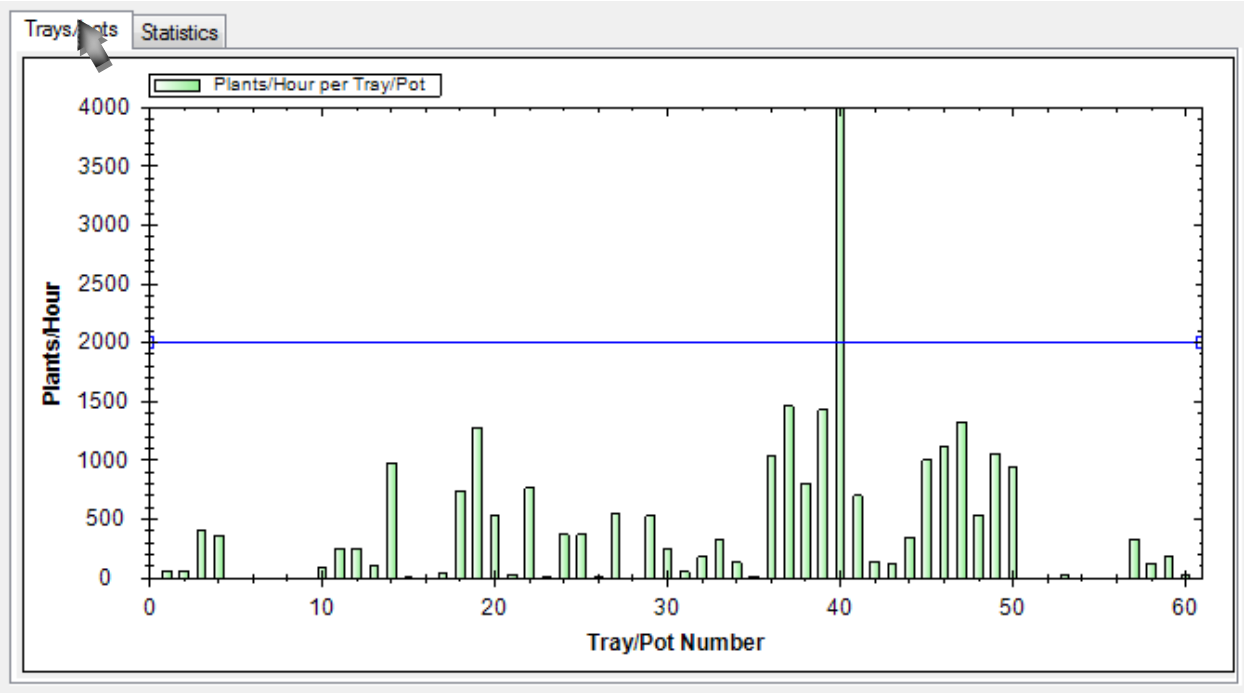
The gripper fitted to the robot must be changed at the same time so the set type always matches the type currently in the robot.

6.1.10 Statistical information

This section consists of 2 tabs

6.1.10.1 Trays/pots tab:

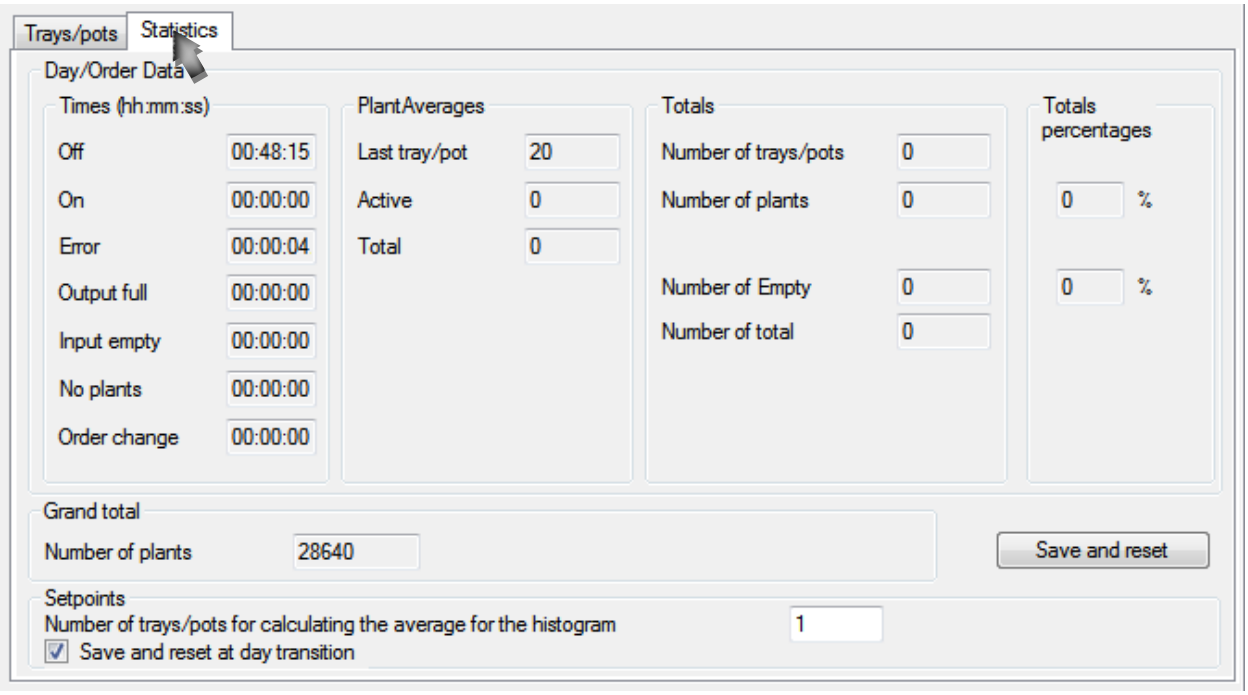
This uses a bar chart to show the speed for the last 60 trays.
A blue line shows the target value, giving a clear overview of how the machine is running at a glance.



6.1.10.2 Statistic tab:

The daily production data are reset from one day to the next.
This occurs at midnight if the program is on. If the program is off at night, this is done when the program is started. This also happens when the button ' save & reset ' is pushed.
The following data are displayed on this tab (these data are saved every day in the log directory under the name statistics<date>>_<sequence number>..xls). Statistieken20140210_12.xls
Each time the button is pressed, the sequence number is increased. So there can be made a report per shift.

The production data per order or per day are also stored in a file. StatistiekenTotaal.xls
This allows you to see statistical information for a particular period.
A new file is created immediately if this file is deleted.
The old data are no longer available.



On this tab, the following data is displayed:

6.1.10.2.1 Times

Off:
This is the time that the machine is stopped without a fault (of course the program must be started). This time is not included in the plant averages.

On:
This time runs when the machine has the status ‘in operation’. That is when the green button on the machine burns, and there is no output full, no input empty and no order change active.

Error:
This time runs when the machine has the status ‘fault’.

Output full:
This time runs when the machine has the status ‘output full’. The current tray must be moved and can not be moved because output is full.

Input empty:
This time runs when the machine has the status ‘supply empty’. This occurs when a new tray is asked at the robot and there is no new tray at the input.

No plants:
This time runs when the machine has the status ‘no plants’. This occurs when time on is active, but there are no ore not enough plants at the shaking belt.

Order change:
This time runs when the machine has the status ‘order change’. This time is active when the order change button is active **and** the current order is ready. The time stays active until the new order is started.

6.1.10.2.2 PlantAverages

Last tray/pot
Number of plants last tray/pot / (time in operation (during the processing of the last tray/pot)+ - fault time (during the processing of the last tray/pot). Attention: Times output full, input empty and order change are here not included!

Active:
Total number of plants / (time On – time no plants)

Total:
Total number of plants / (time operating + fault time + output full time + input empty time + order change time)

6.1.10.2.3 Totals

Number of trays/pots:
The number of trays or pots that have come through the machine. A tray or pot is also counted if it is only partially done but has not been completed.

Number of plants:
This counter is incremented when the robot receives a command to grip a plant.

Number empty:
The number of times that no plant is detected in the gripper after gripping.

Total number of plants:
This is the sum of the number of plants + number empty.

Time total (only displayed on remote application):
time operating + fault time + output full time + input empty time + order change time

6.1.10.2.4 Totals percentages

Number of plants:
Percentage plants of “Number of plants” w.r.t. “Total number of plants”.

Number of empty:
Percentage of “Number empty” w.r.t. “Total number of plants”.

6.1.10.2.5 Grand total

Number of total:
Total of all inserted plants. This figure always increments and cannot be reset.

6.1.10.2.6 Set points

Number of trays/pots for calculating the average for the histogram:
Each bar in the histogram is made from a measurement of the average of this number of trays/pots.

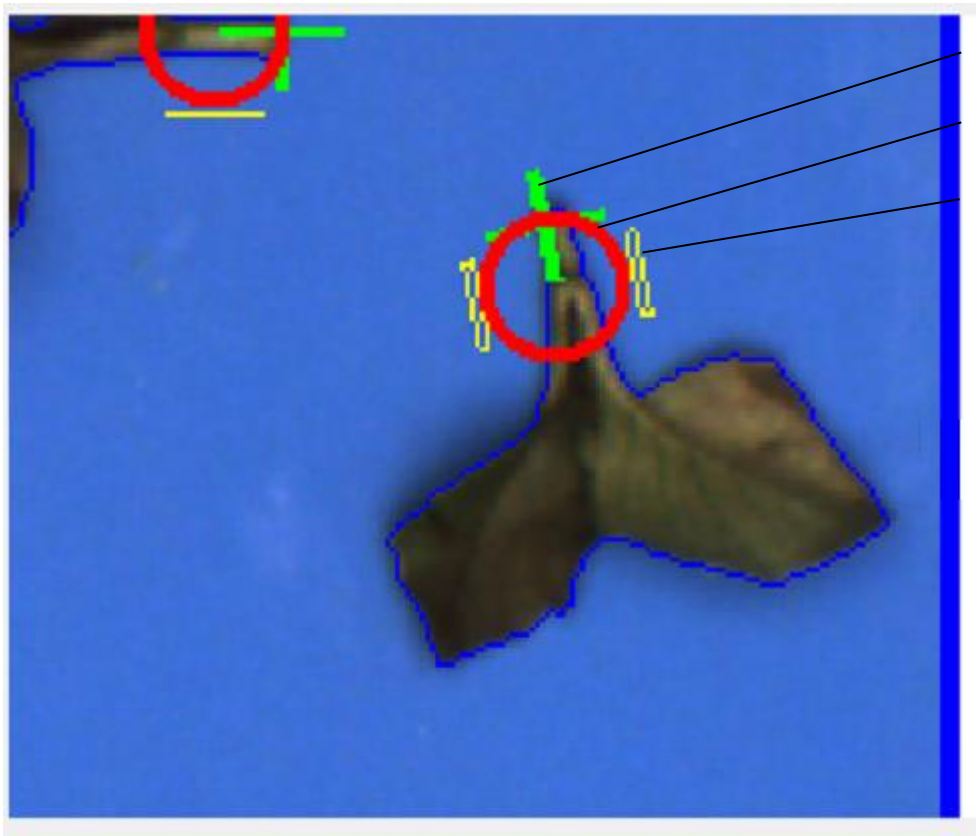
Save and reset at day transition:
When this checkbox is on, the counters and timers (except the ‘number of total’ from grand total’ will be reset at day transition (24.00u).

6.1.11 Cameras

This section shows the images of both cameras.
When the button “Reanalyse camera’s” is pushed, the information of the camera’s on the screen will be renewed.

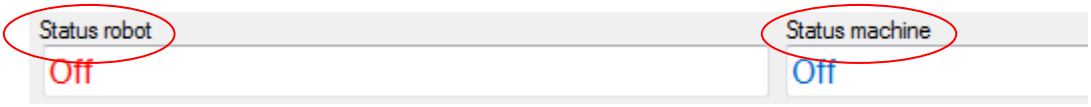
The belt runs in a vertical direction on the images of the cameras.

Vision information can also be seen in these images:



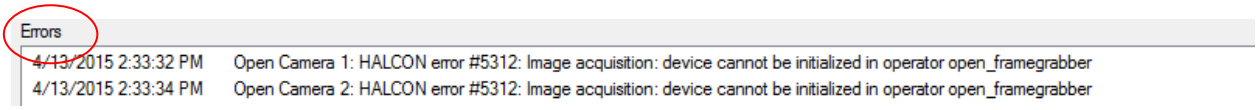
6.1.12 Operational status

This section states the status of the machine and the status of the robot. For the machine's status, see Section 8.1.
The status of the robot can be 'out of operation' when the robot motor is off, or 'in operation' when the robot motor is on.



6.1.13 Error information

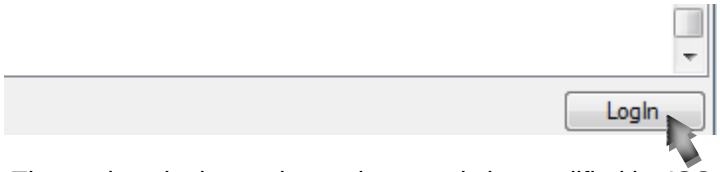
This section shows the last 20 faults, along with the time of occurrence. The last 3 faults are shown by default, while the other 17 faults can be accessed with a scroll bar.



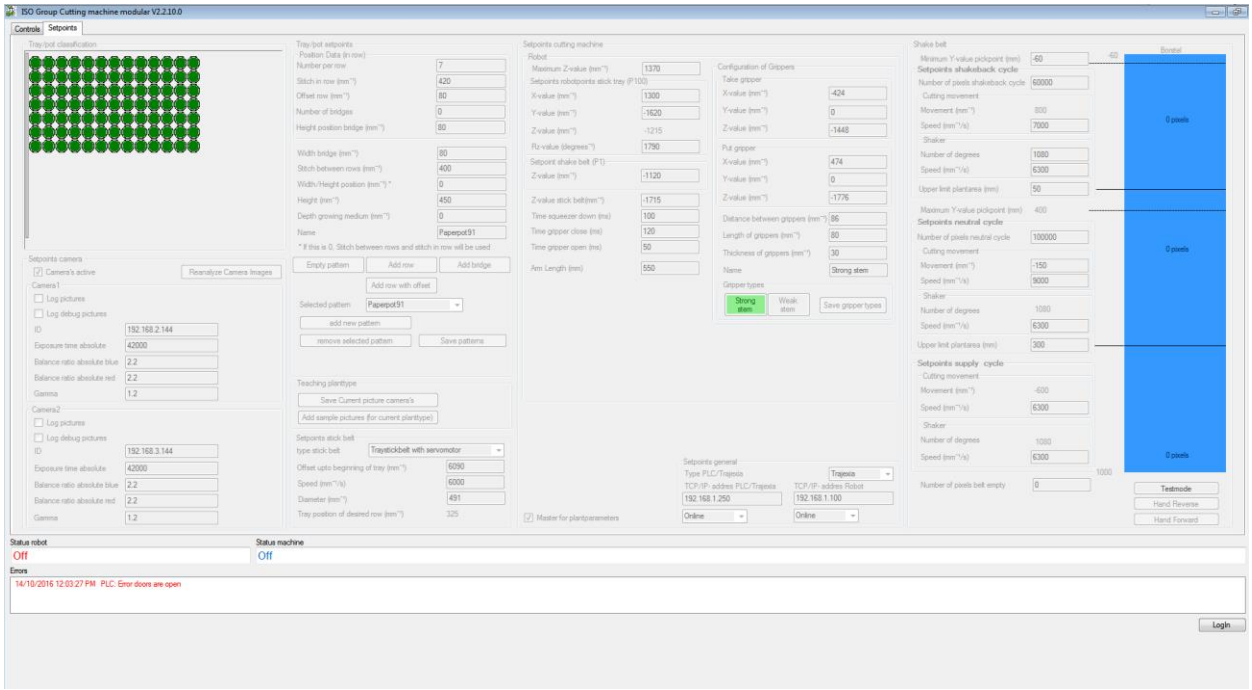
☞ The fault information is not saved, as a result of which only active faults, if any, are displayed after the program is restarted. The faults are all logged in the log directory in the file Faults<date>.log.
If a fault is present while the machine has the status 'fault', then the fault will light up red so that the fault that caused the machine to stop can be seen immediately.

6.1.14 Logging in/logging out

Here can be used to log in and log out, so that more or fewer functions will become available.

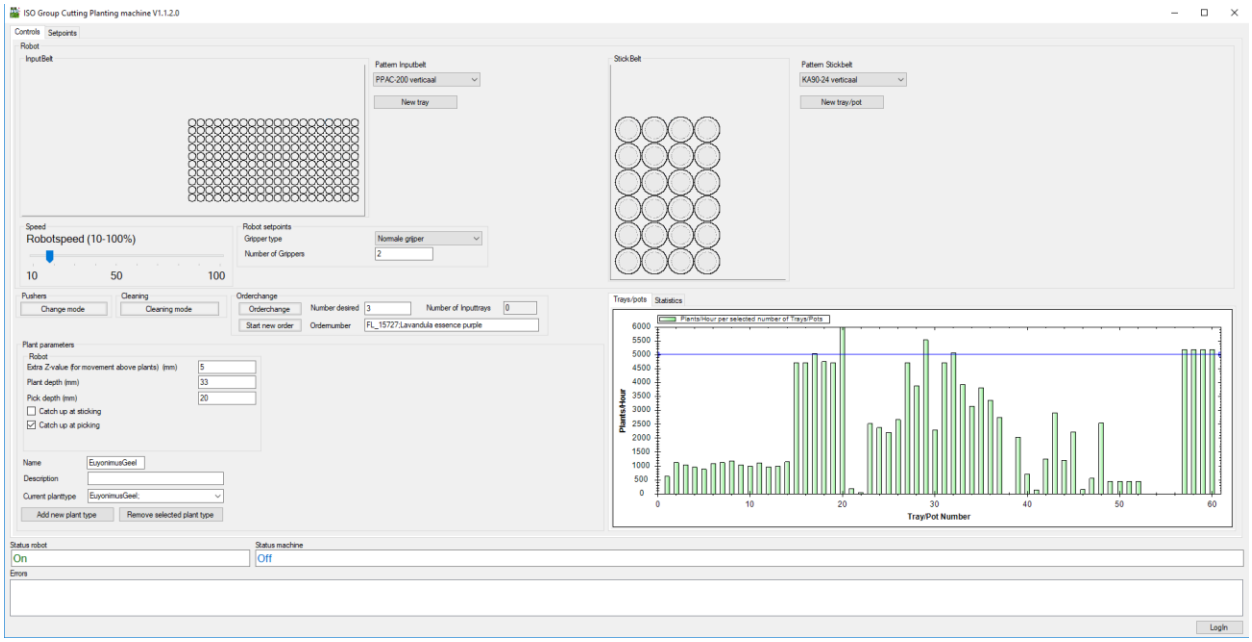


☞ The settings in the settings tab can only be modified by ISO Group.



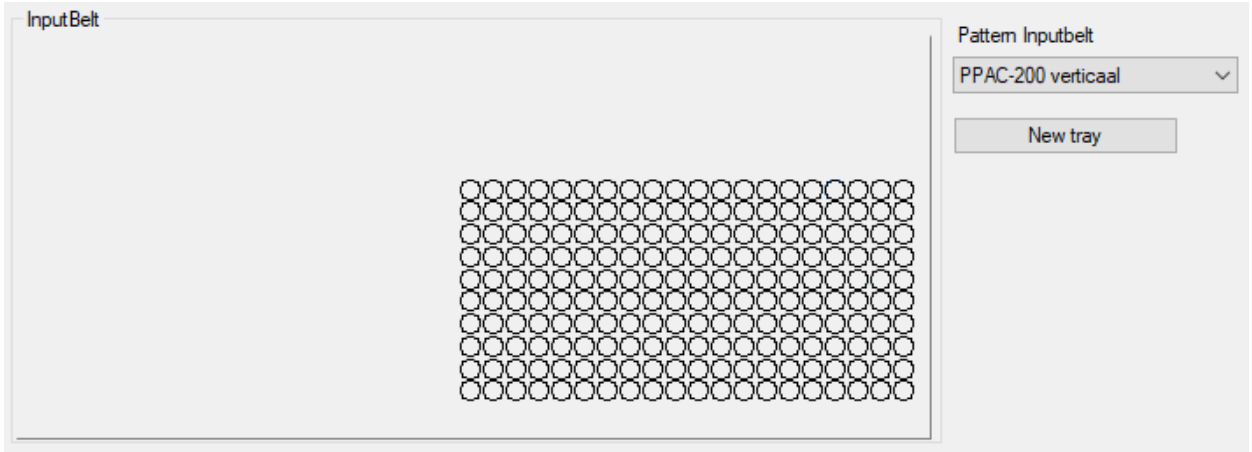
6.2 Display control transplanting

The display is divided into various parts and is described in more detail in the following pages.



6.2.1 Input belt

Bij de invoerband is de tray te zien waar de robot de planten uit zal afhalen. Het patroon is afhankelijk van het ingestelde tray patroon. Dit patroon kan worden ingesteld met het menu ‘Patroon invoerband’.



6.2.2 Input belt operation

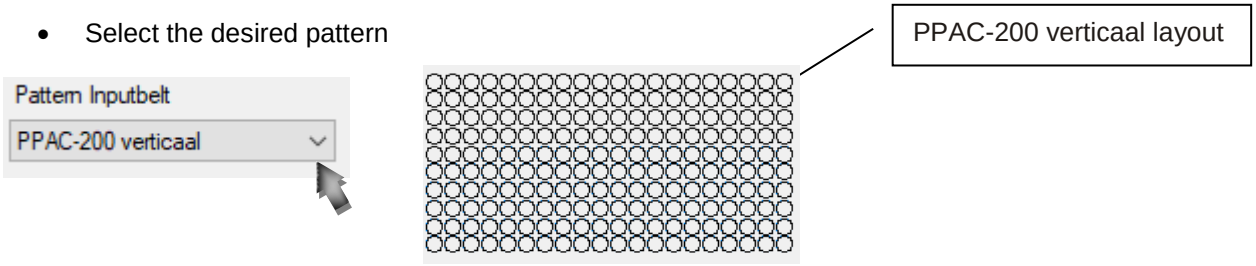
The desired input belt pattern may be configured. A number of patterns are set at the factory.

Making another type of tray or pot with different external dimensions and hole pattern is protected by a password, because the machine hardware also has to be adapted for this.

When switching a stickbelt pattern, the current tray is discharged and a new tray or pot is started on. It is advisable to only switch pattern when the old tray or pot has been discharged and before the new tray or pot is started on.

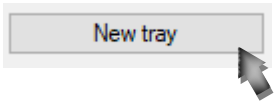
6.2.2.1 Patroon input belt

- Select the desired pattern



6.2.2.2 New tray

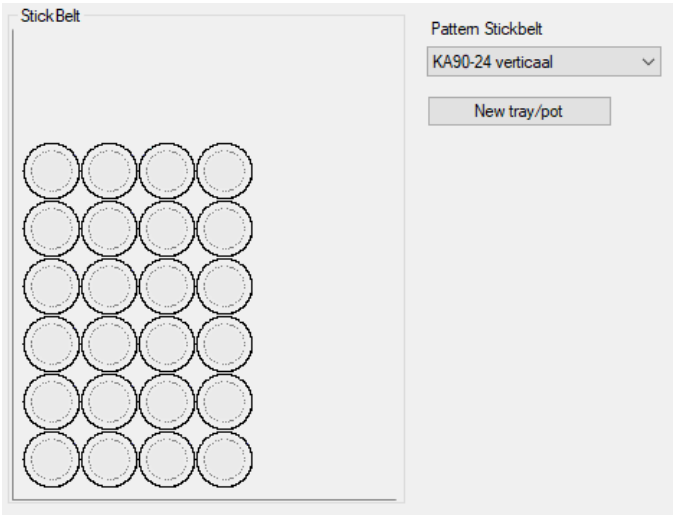
For safety reasons, this button can only be used when the machine is stopped and when the pushers are not in change mode. When the button 'new tray' is activated, the current tray will be discharged. The current cycle will not be completed! The robot is then reset, goes to the home position and drops any plant there. After that, the tray is discharged. It is therefore recommended to press the stop button at the end of the cycle then use the “new tray” button.



End of a cycle means when the robot has put a plant in the tray or pot and has not yet taken hold of a new plant.

6.2.3 Stick belt

The tray or pot in which the robot is going to plant can be seen on the stick belt. The pattern is dependent on the set tray or pot pattern.



The transplanting always starts at the bottom right and then goes first to the left. If there are 2 grippers, the plants in row 1 and 2 are simultaneously placed at the furthest right-hand side.

During operation, information will be given herein as to whether a hole has/has not been pricked or is going to be pricked:

Hole colour:

- Grey: No cutting planted
- Light green: Next cutting planting position
- Dark green: a cutting is planted or the robot is under way to plant.

6.2.4 Planting belt operation

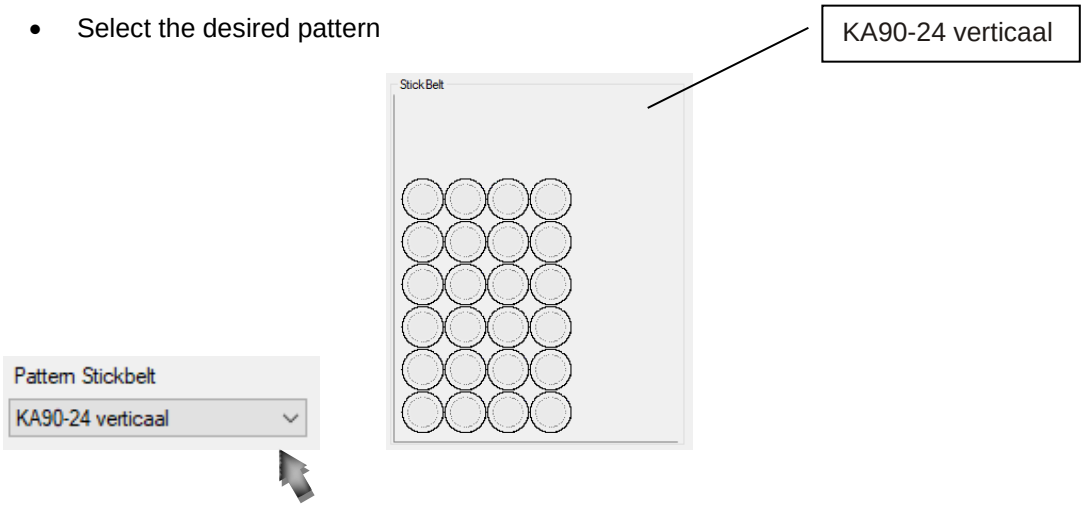
The desired planting belt pattern may be configured. A number of patterns are set at the factory.

Making another type of tray or pot with different external dimensions and hole pattern is protected by a password, because the machine hardware also has to be adapted for this.

When switching a stickbelt pattern, the current tray is discharged and a new tray or pot is started on. It is advisable to only switch pattern when the old tray or pot has been discharged and before the new tray or pot is started on.

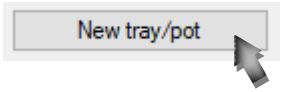
6.2.4.1 Pattern stickbelt

- Select the desired pattern



6.2.4.2 New tray/pot

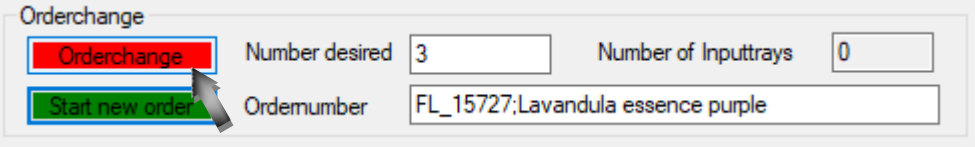
For safety reasons, this button can only be used when the machine is stopped. When the button 'new tray/pot' is activated, the current tray or pot will be discharged. The current cycle will not be completed! The robot is then reset, goes to the home position and drops any cutting there. After that, the tray or pot is discharged. It is therefore recommended to press the stop button at the end of the cycle then use the “new tray/pot” button.



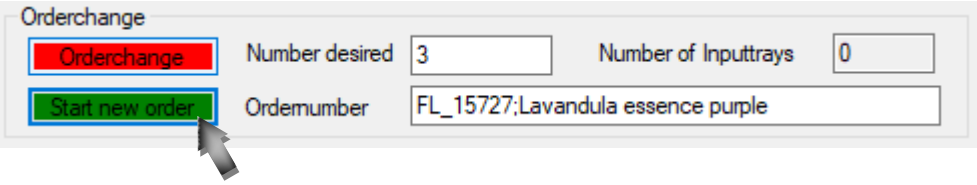
End of a cycle means when the robot has put a plant in the tray or pot and has not yet taken hold of a new plant.

6.2.4.3 Order change

1. Select ‘Order change’.
    a. When the desired number is reached, the current tray or pot is finished then the tray or pot is discharged and the belt rolls empty.



2. Position the first tray or pot of the new batch on the planting belt.
3. Enter the desired new quantity of trays or pots
4. Enter a new order number and press ‘start new order’.
    a. The conveyor belt will now try to feed trays and if a tray or pot is present, the robot will plant.

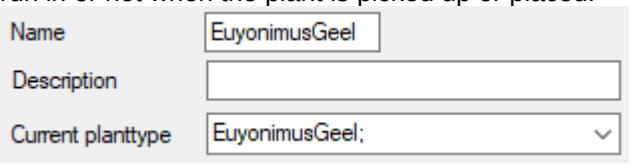


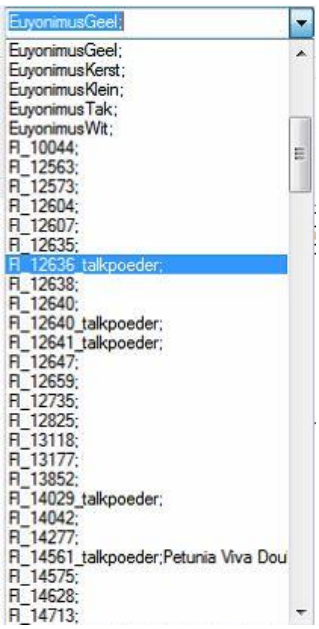
5. Deselect ‘Order change’.
    a. The first tray or pot of the new order will now be completed, and then be discharged.

☞ The order number is entered before the batch is started.

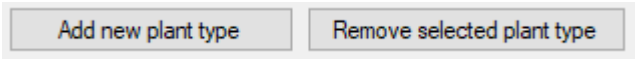
6.2.5 Plant type selection

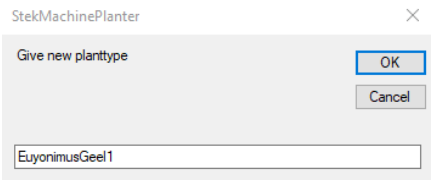
Selecting a plant type also sets the picking and planting depth. It is also possible to set an additional Z movement for the movement above the plants. There is also the option to set whether the gripper should run in or not when the plant is picked up or placed.





To add a new plant type, proceed as follows: Press the *'new plant type'* button. A window pops up where you can input the name of the new plant type. Click on *'OK'* afterwards and a new plant type is created that has the same parameters as the selected plant type.

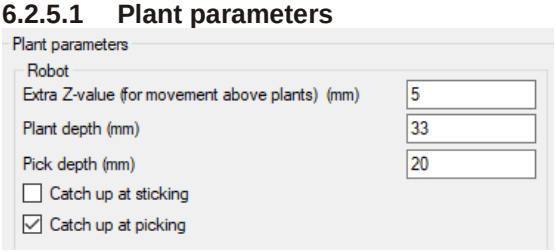




A new type of plant can best be created on the basis of a similar plant type. The majority of parameters are already correct.

By clicking the *'Delete current plant type'* button, the current plant type is deleted from the selection list.

6.2.5.1 Plant parameters



Extra Z-value (for movement above plants) (mm):
For large plants, this is an additional height, in order to be able to move over the plants. This value should be set to the cutting height.

Plant depth (mm):
This is the extent of the depth that the plant must be inserted into the growth medium for plants.

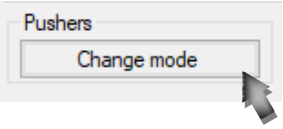
Picking depth (mm):
This is the depth level to which the gripper enters the tray when picking up the plants (without the needle depth).

Catching up at planting:
If this is on, the robot will not go planting straight from above the plants, but will first catch up low over the tray or pot (from the 1st row before the row to be plant), and will then plant.

Run-in during pick-up:
If this option is selected, the robot will not pick up directly from above the plants, but will first run low over the tray (from 1 row ahead of the row to be picked up in the case of several grippers. Where there is 1 gripper, the robot will run from the right 1 position ahead of the position to be picked up) and will then pick up.

It is possible to set the run-in height in the settings page (if 1 gripper is being used, the 1st run-in height is to be adjusted separately, because it runs above the guide).

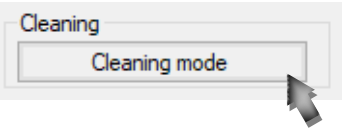
6.2.6 Lifters



Selecting this button will switch the machine to alternate mode. The lifters move to a position where they are easily accessible. This makes it easy to switch between one or more lifters. If there is a tray at the feed, it is pushed out.

6.2.7 Cleaning

The ‘cleaning mode’ button can be used to put the machine into a certain position so that you can clean the machine properly.
If this is pressed while the machine is active, the current tray will be completed. After ejecting this tray, the machine will go into the cleaning position and not supply any new trays or pots (until the button has been pressed again).

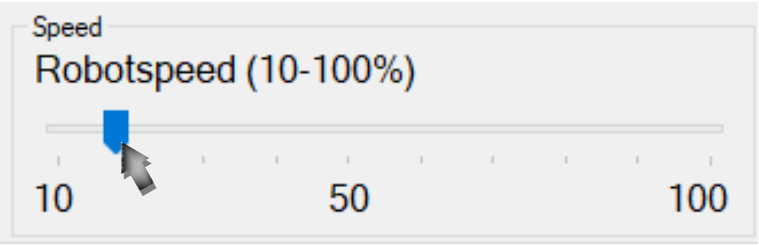


If this button is pressed after the machine has been stopped, the machine will immediately go into the cleaning position when it is started up again.

If the machine is not used for a long time, it is recommended to switch the machine to cleaning mode. (see section **Error! Reference source not found.**)

6.2.8 Robot speed

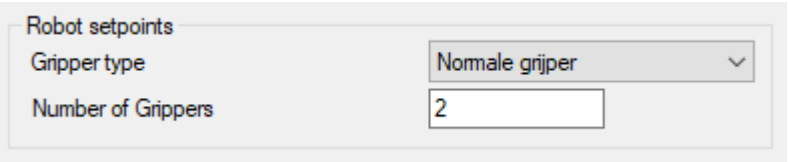
A slider is used to set the desired speed for the robot. 10% is the minimum speed.



This does not, however, set the machine speed. All the other movements of the machine will continue at the same speed.

6.2.9 Robot settings

The gripper type is chosen using the selector knob. Also, the number of grippers can be set.



The settings for each gripper type are chosen under the Settings tab.

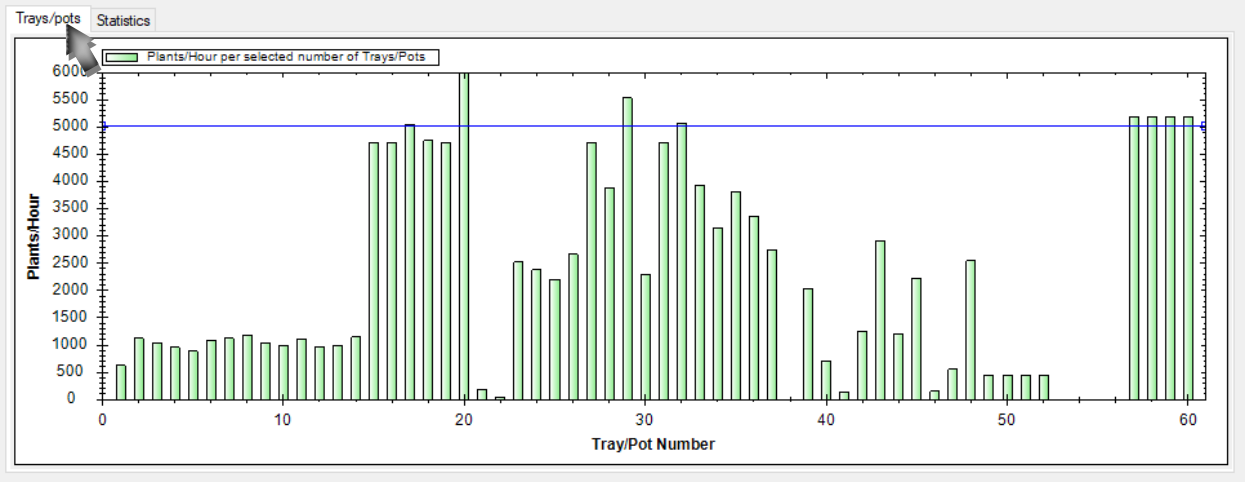
The gripper fitted to the robot must be changed at the same time so the set type always matches the type currently in the robot.

6.2.10 Statistical information

This section consists of 2 tabs.

6.2.10.1 Trays/pots tab:

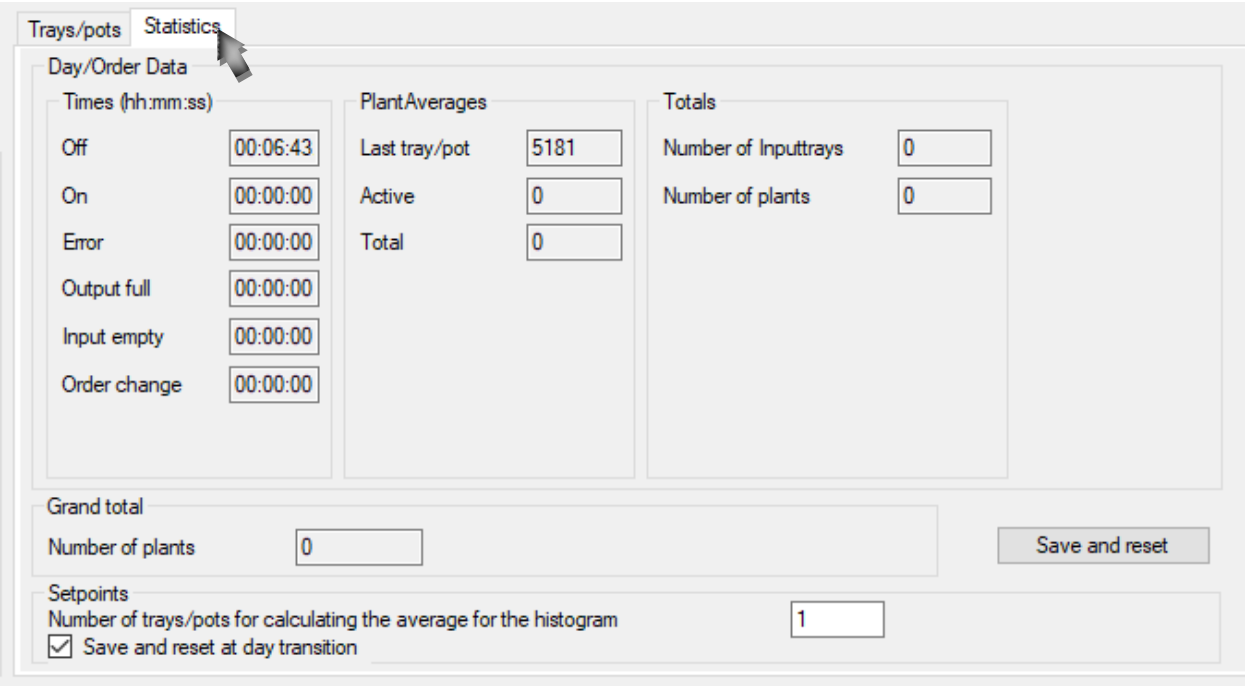
This uses a bar chart to show the speed for the last 60 trays.
A blue line shows the target value, giving a clear overview of how the machine is running at a glance.



6.2.10.2 Statistic tab:

The daily production data are reset from one day to the next.
This occurs at midnight if the program is on. If the program is off at night, this is done when the program is started. This also happens when the button ' save & reset ' is pushed.
The following data are displayed on this tab (these data are saved every day in the log directory under the name statistics<date>>_<sequence number>..xls). Statistieken20140210_12.xls
Each time the button is pressed, the sequence number is increased. So there can be made a report per shift.

The production data per order or per day are also stored in a file. StatistiekenTotaal.xls
This allows you to see statistical information for a particular period.
A new file is created immediately if this file is deleted.
The old data are no longer available.



On this tab, the following data is displayed:

6.2.10.2.1 Times

Off:
This is the time that the machine is stopped without a fault (of course the program must be started). This time is not included in the plant averages.

On:
This time runs when the machine has the status ‘in operation’. That is when the green button on the machine burns, and there is no output full, no input empty and no order change active.

Error:
This time runs when the machine has the status ‘fault’.

Output full:
This time runs when the machine has the status ‘output full’. The current tray or pot must be moved and cannot be moved because output is full.

Input empty:
This time runs when the machine has the status ‘supply empty’. This occurs when a new tray or pot is asked at the robot and there is no new tray at the input or sticking belt.

Order change:
This time runs when the machine has the status ‘order change’. This time is active when the order change button is active **and** the current order is ready. The time stays active until the new order is started.

6.2.10.2.2 Plant/Averages

Last tray/pot
Number of plants last tray/pot / (time in operation (during the processing of the last tray/pot)+ - fault time (during the processing of the last tray/pot). Attention: Times output full, input empty and order change are here not included!

Active:
Total number of plants / (time On – time no plants)

Total:
Total number of plants / (time operating + fault time + output full time + input empty time + order change time)

6.2.10.2.3 Totals

Number of input trays:
The number of input trays that have come through the machine. A tray is also counted if it is only partially done but has not been completed.

Number of plants:
This counter is incremented when the robot receives a command to grip a plant.

6.2.10.2.4 Grand total

Number of total:
Total of all inserted plants. This figure always increments and cannot be reset.

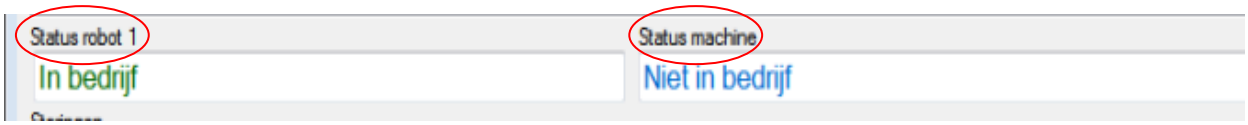
6.2.10.2.5 Set points

Number of trays/pots for calculating the average for the histogram:
Each bar in the histogram is made from a measurement of the average of this number of trays/pots.

Save and reset at day transition:
When this checkbox is on, the counters and timers (except the 'number of total' from grand total' will be reset at day transition (24.00u).

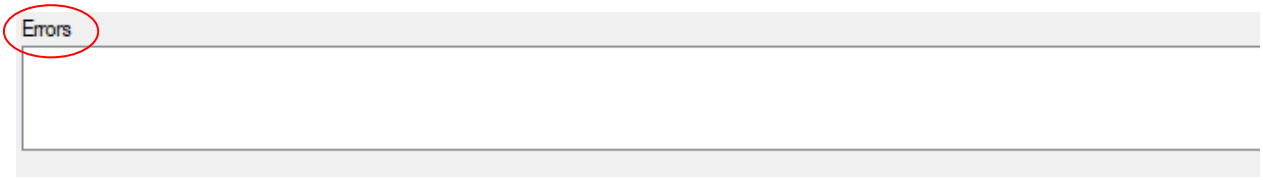
6.2.11 Operational status

This section states the status of the machine and the status of the robot. For the machine's status, see Section 8.1.
The status of the robot can be 'out of operation' when the robot motor is off, or 'in operation' when the robot motor is on.



6.2.12 Error information

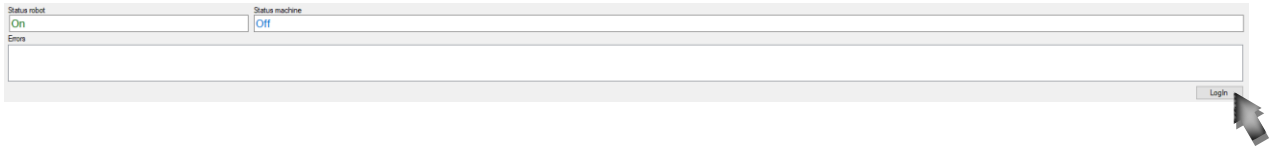
This section shows the last 20 faults, along with the time of occurrence. The last 3 faults are shown by default, while the other 17 faults can be accessed with a scroll bar.



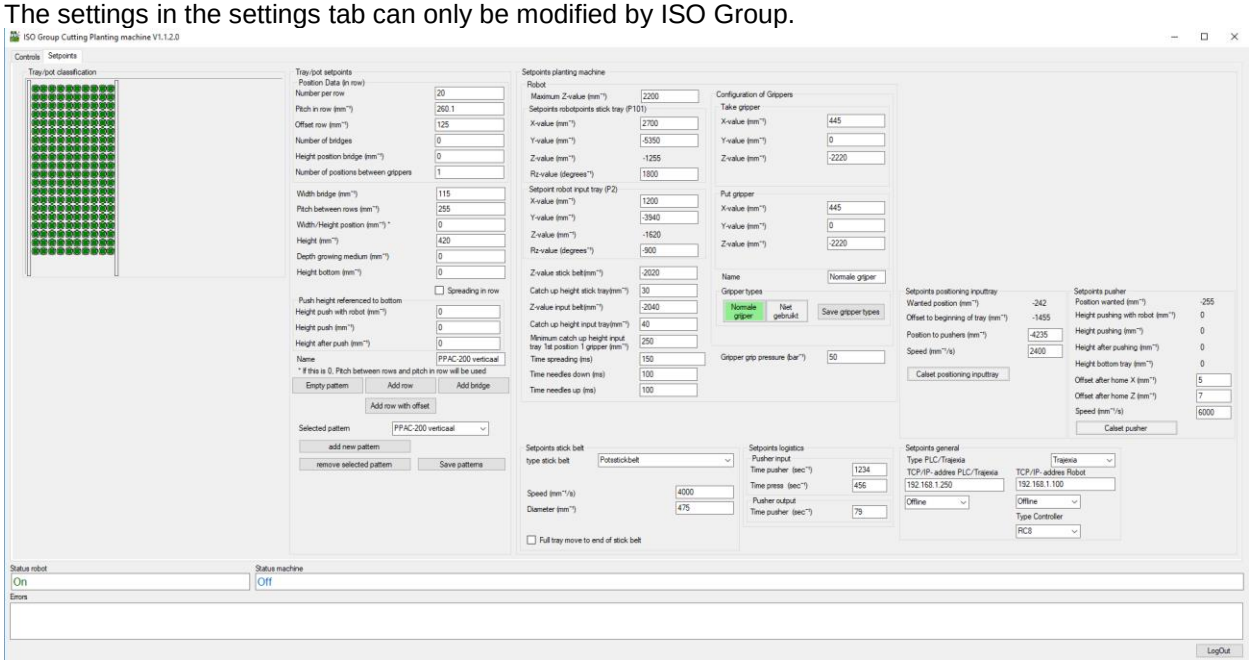
☞ The fault information is not saved, as a result of which only active faults, if any, are displayed after the program is restarted. The faults are all logged in the log directory in the file Faults<date>.log.
If a fault is present while the machine has the status 'fault', then the fault will light up red so that the fault that caused the machine to stop can be seen immediately.

6.2.13 Logging in/logging out

Here can be used to log in and log out, so that more or fewer functions will become available.



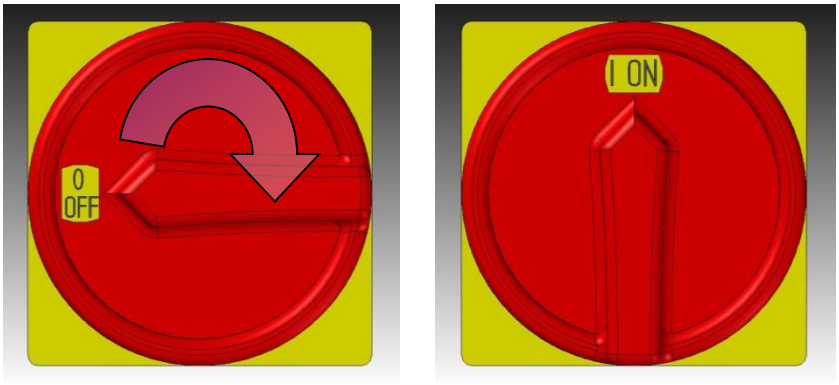
The settings in the settings tab can only be modified by ISO Group.



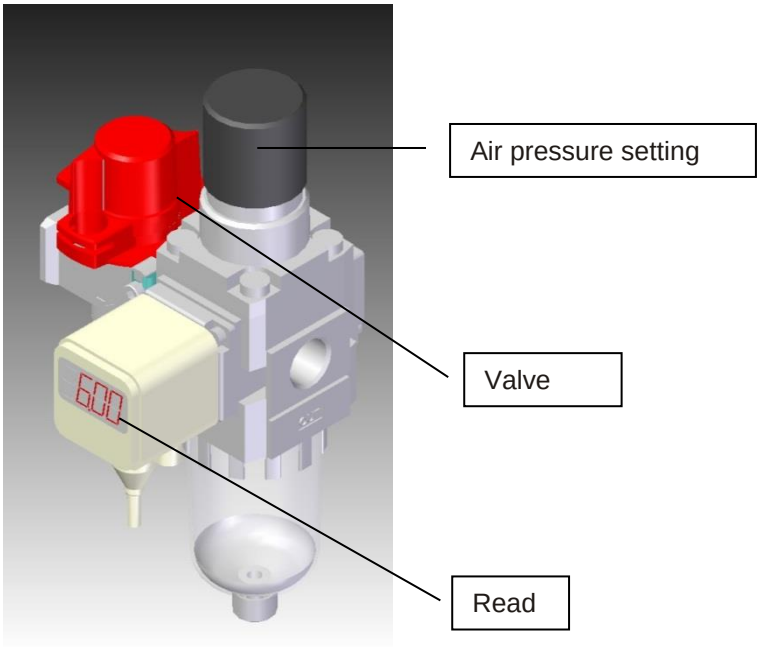
7 Start up

To start up the machine, follow the procedure below:

1. Set the main switch to “ON”.



2. The compressed air pressure at the air supply unit must range between 5.5 and 6.5 bar.
It can be read on the small digital display next to the supply unit. Adjust the pressure if necessary by turning the knob (air pressure setting).



3. Press "RESET" (if the red light is on).
4. Start the program via the display
5. Press "Start".

8 Messages and faults

8.1 Messages and faults cutting planting

8.1.1 Status messages cutting planting

Message	Explanation
Not in operation:	Machine is switched off.
In service:	Machine is started.
Order change:	The cutting belt will be emptyed, a new order can be imported.
Supply empty:	No crates are delivered from the long supplier conveyor.
Output full:	The current tray or pot must be moved and cannot be moved because output is full.
Fault:	There is an active fault.

8.1.2 Fault messages cutting planting

Message	Explanation
Emergency stop:	The emergency stop button has been pressed. Resolve the problem. Turn the knob back.
Doors are open:	Close the door or doors.
Air pressure:	Set the air pressure to between 5.5 and 6.5 bar.
Phase watch:	One of the voltage phases is not correct. Resolve the problem. Press the reset button for 10 seconds
Error robotgripper not up:	Robot is steering gripper high (long plants gripper only), but the concerning endswitch is not present. Either the valve is not working properly or the end switch is broken.
Error robotgripper not down:	Robot is steering gripper high (long plants gripper only), but the concerning endswitch is not present. Either the valve is not working properly or the end switch is broken.
Error robotgripper not in plant position:	The limit switch concerned is not operating. Either the rotating is not working properly or the end swicht is broken.
Error robotgripper not in take position:	The robot moves the rotation cylinder on the gripper to the gripping position, but the limit switch concerned is not operating. Either the rotating is not working properly or the end swicht is broken.
Robot motor not on	The motor for the robot is not on. Set the robot switch to auto. Check that the doors are closed. Restart the robot controller if necessary.

Servo <motorname>	The relevant motor has a fault Check that the motor cannot run into anything Use the emergency stop and restart the machine. The motors will then return to their home positions.
Error robot grapple not up:	Even though the gripper's grapple is moved upwards, the high sensor is not activated. Either the valve is defective, or the high sensor is broken.
Error robot grapple not down:	Even though the gripper's grapple is moved upwards, the low sensor is not activated. Either the valve is defective, or the low sensor is broken.
Error thermal (input belt)	The feed belt is drawing too much current. Defective motor?
Error blocker not high:	The stopper for the feed belt is sent upwards but the height sensor is not operated. Either the valve of the stopper is not right or the height sensor is defective.
Error blocker not low:	The stopper for the feed belt is sent downwards but the low sensor is not operated. Either the valve of the stopper is not right or the low sensor is defective.
Error frequency-controller input:	The frequency converter of the feed belt is faulty Check the malfunction on the frequency converter and try to repair the fault.
Error frequency-controller output:	The frequency converter of the discharge belt is faulty Check the malfunction on the frequency converter and try to repair the fault.
Error flap transferunit Input stick trays:	The flap of the transferunit input is sent downwards, but the sensor flap down is not coming or flap transferunit is sent upwards and sensor flap down is still coming. Either the flap or the sensor is defective.
Error transferunit Input stick trays:	The transferunit input is sent back, but the rest position sensor is not operating or transferunit is sent away and rest position is still coming. Either the valve or the sensor is defective (or something is in between so that the rest position is not reached.
Eror transferunit Output stick trays:	The transferunit output is sent back, but the rest position sensor is not operating or transferunit is sent away and rest position is still coming. Either the valve or the sensor is defective (or something is in between so that the rest position is not reached.
Error PLC <nr>:	The Sysmac PLC has an error. This error is showed as a number. This number can be searched in: "NJ_NX-series Troubleshooting Manual" Location laptop: C:\ProgramData\Omron\Sysmac Studio\StartMenu\Sysmac Studio\Manual\NJ_NX Series
Error Motion control <nr>:	The Servo control has an error. This error is showed as a number. This number can be searched in: "NJ_NX-series Troubleshooting Manual" Location laptop: C:\ProgramData\Omron\Sysmac Studio\StartMenu\Sysmac Studio\Manual\NJ_NX Series
Error Ethercat <nr>:	The Ethercat communication has an error. This error is showed as a number. This number can be searched in: "NJ_NX-series Troubleshooting Manual" Location laptop:

	C:\ProgramData\Omron\Sysmac Studio\StartMenu\Sysmac Studio\Manual\NJ_NX Series
Error Ethernet <nr>:	The Ethernet communication has an error. This error is showed as a number. This number can be searched in: “NJ_NX-series Troubleshooting Manual” Location laptop: C:\ProgramData\Omron\Sysmac Studio\StartMenu\Sysmac Studio\Manual\NJ_NX Series
Error stopper not descended:	This malfunction only occurs when the ‘tray planting conveyor with servomotor’ is selected. The stopper for the feed belt is sent downwards but the low sensor is not operated. Either the valve of the stopper is not right or the low sensor is defective.
Error transfer unit not in rest position:	This malfunction only occurs when the ‘pot planting belt’ is selected. The pot transfer unit is sent back, but the rest position sensor is not operating. Either the valve or the sensor is defective (or something is in between so that the rest position is not reached).
Error transfer unit not in end position:	This malfunction only occurs when the ‘pot planting belt’ is selected. The pot transfer unit is sent back, but the rest position sensor is not operating. Either the valve or the sensor is defective (or something is in between so that the end position is not reached)
Malfunction pot jammed in planting position:	This malfunction only occurs when the ‘pot planting belt’ is selected. The planted pot is fed through, but the sensor concerned remains covered. Either the valve or the sensor is defective (or something is in between so that the clamps do not open properly)
Malfunction pot jammed in buffer:	This malfunction only occurs when the ‘pot planting belt’ is selected. The pot planted is fed through but the new pot does not arrive at the planting position, while the buffer is indeed full. Either the valve or the sensor is defective (or something is in between so that the pots are unable to move up)

8.2 Messages and faults transplanting

8.2.1 Status messages transplanting

Message	Explanation
Not in operation:	Machine is switched off.
In service:	Machine is started.
Order change:	The cutting belt will be emptyed, a new order can be imported.
Seed trays feeder runs empty:	There are no seed trays
Cutting trays feeder runs empty:	There are no cutting trays present.
Seed trays discharger runs full:	The seed tray cannot be removed of moved up.
Cutting trays discharger runs full:	The cutting tray cannot be removed or moved up.

Fault:	There is an active fault.

8.2.2 Fault messages transplanting

Fault	Explanation
Emergency stop:	The emergency stop button has been pressed. Resolve the problem. Turn the knob back.
Doors are open:	Close the door or doors.
Air pressure:	Set the air pressure to between 5.5 and 6.5 bar.
Phase watch:	One of the voltage phases is not correct. Resolve the problem. Press the reset button for 10 seconds.
Expand gripper:	The robot allows the gripper to expand, but the corresponding limit switch does not snap back in. Either the valve is not responsive, or the limit switch is broken
Robot motor not on:	The motor for the robot is not on. Set the robot switch to auto. Check that the doors are closed. Restart the robot controller if necessary.
Servo <motorname>	The relevant motor has a fault Check that the motor cannot run into anything Use the emergency stop and restart the machine. The motors will then return to their home positions.
Pot supply planting Conveyor sensor dirty or broken:	The sensor is dirty or broken Clean the sensor or replace it if it's broken.
Lifter does not move to position:	The lifter does not reach its position. The lifter may be jammed. Check that the lifter can move freely both horizontally and vertically.
Error seed tray positioning:	The pusher for the seed tray positioning does not move to position. The pusher may be jammed. Check that the pusher can move freely horizontally.
Error thermal (input belt)	The feed belt is drawing too much current. Defective motor?
Error blocker not high:	The stopper for the feed belt is sent upwards but the height sensor is not operated. Either the valve of the stopper is not right or the height sensor is defective.
Error blocker not low:	The stopper for the feed belt is sent downwards but the low sensor is not operated. Either the valve of the stopper is not right or the low sensor is defective.
Error frequency-controller input:	The frequency converter of the feed belt is faulty Check the malfunction on the frequency converter and try to repair the fault.
Error frequency-	The frequency converter of the discharge belt is faulty

controller output:	Check the malfunction on the frequency converter and try to repair the fault.
Error motor feed tray feed belt:	The motor driving the feed belt has a malfunction. Disconnect the motor temporarily from the power supply or use the reset function.
Error motor feed tray discharge belt:	The motor driving the discharge belt has a malfunction. Disconnect the motor temporarily from the power supply or use the reset function.
Error flap transferunit input trays:	The flap of the transferunit input is sent downwards, but the sensor flap down is not coming or flap transferunit is sent upwards and sensor flap down is still coming. Either the flap or the sensor is defective.
Error transferunit input trays:	The transferunit input is sent back, but the rest position sensor is not operating or transferunit is sent away and rest position is still coming. Either the valve or the sensor is defective (or something is in between so that the rest position is not reached
Error transferunit output trays:	The transferunit output is sent back, but the rest position sensor is not operating or transferunit is sent away and rest position is still coming. Either the valve or the sensor is defective (or something is in between so that the rest position is not reached.
Error PLC <nr>:	The Sysmac PLC has an error. This error is showed as a number. This number can be searched in: “NJ_NX-series Troubleshooting Manual” Location laptop: C:\ProgramData\Omron\Sysmac Studio\StartMenu\Sysmac Studio\Manual\NJ_NX Series
Error Motion control <nr>:	The Servo control has an error. This error is showed as a number. This number can be searched in: “NJ_NX-series Troubleshooting Manual” Location laptop: C:\ProgramData\Omron\Sysmac Studio\StartMenu\Sysmac Studio\Manual\NJ_NX Series
Error Ethercat <nr>:	The Ethercat communication has an error. This error is showed as a number. This number can be searched in: “NJ_NX-series Troubleshooting Manual” Location laptop: C:\ProgramData\Omron\Sysmac Studio\StartMenu\Sysmac Studio\Manual\NJ_NX Series
Error Ethernet <nr>:	The Ethernet communication has an error. This error is showed as a number. This number can be searched in: “NJ_NX-series Troubleshooting Manual” Location laptop: C:\ProgramData\Omron\Sysmac Studio\StartMenu\Sysmac Studio\Manual\NJ_NX Series

9 Shutting down

9.1 Shutting down

Before the machine is shut down for a longer period of time, the following actions must be taken:

1. Disconnect the machine from all energy sources;
    a. Activate the button “cleaning stand”
    b. Disconnect the air press
    c. Turn the power off (don’t shutdown the PC first, the UPS will do that. When you first shutdown the PC, then the UPS will not go off and will not start automatically next time)
2. Perform the cleaning work as described in section 3 ;
3. Close the control box.

9.2 Dismantling and scrapping

When it is time to dispose of the machine, the requirements for waste processing that apply at the time and place of disposal must be followed. The machine is made entirely of commonly used construction materials. Proper waste processing methods were available and no special risks for the persons charged with the dismantling work were known at the time of the design and construction of the machine.

9.3 Disposal and the environment

There are no specific hazards to the environment associated with the use, maintenance and scrapping of this machine.