
MILL-ASSIST SOFTWARE INSTRUCTION MANUAL V2.10.1



ROBOJOB

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1. INTRODUCTION

This document describes the use of the Mill-Assist interface developed by RoboJob. Step by step it will be explained how the program should be used. It is therefore advisable to read this manual before using the system. The interactions with the system take place by means of the *IPC* (Industrial PC) and the *Fanuc Teach Pendant*.

This manual will focus primarily on working with the software on the IPC. When the *Fanuc Teach Pendant* is to be used, this will be explicitly stated.



Picture 1 - IPC

1.1 IPC

The majority of interactions with the system occur via the IPC (Industrial Personal Computer, picture). This is equipped with a touch screen so that the user can enter the necessary data with their finger.



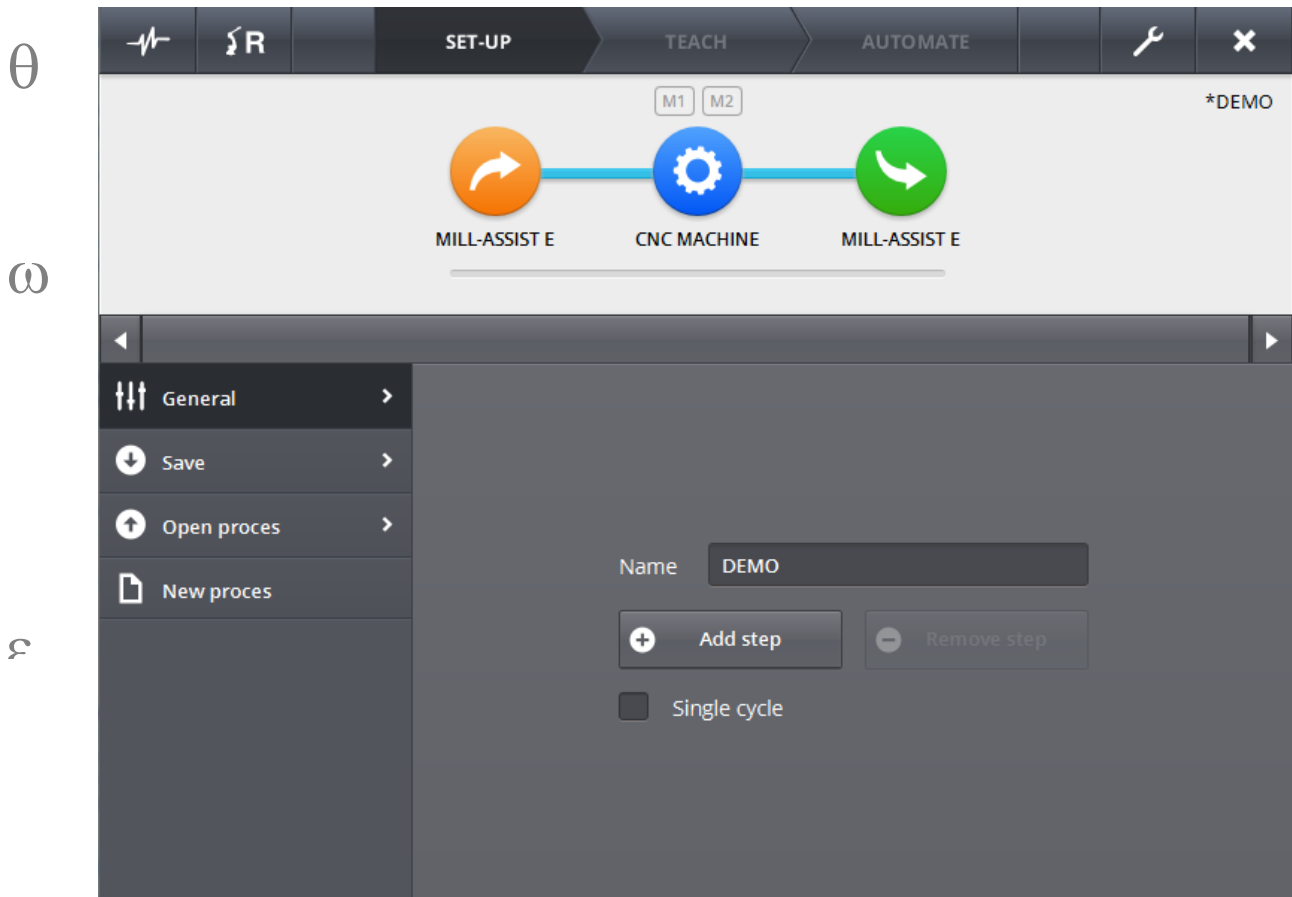
Picture 2 - Fanuc Teach Pendant

1.2 FANUC TEACH PENDANT

The user will only make sporadic use of this operator console. It is used to control and guide the robot manually to an exact final position.

2. SCREEN LAYOUT

After the start-up of the Mill-Assist program, the following screen appears¹:



Picture 3 - Start screen

The screen is composed of three parts:

- A The menu bar; this always remains visible.
- Ω The process; this always remains visible.
- ε A third, specific part, the content of which is adjusted.

¹ The process shown and its name may differ from what is shown in the illustration.

2.1 THE MENU BAR

The menu bar is used for global navigation in the system. The various components are discussed step by step.



Picture 5 - Menu bar

ALARMS POP-UP



A pop-up is shown with the current alarms (if present). A possible alarm for example, is the lack of connection to a particular device.



A reset signal may also be sent via this menu to the connected devices in order to reset the alarms present. If particular alarms are active, the key flashes red.

A list of the possible alarms per device and a description can be found in the List of .

ROBOT MENU



A pop-up is shown with a number of controls for operating the robot. The controls are the following:

- Send a reset signal to the robot.
- Restart the robot software.
- Direct the robot to its home position.
- Direct the robot to a position for switching the gripper fingers.
- Opening/closing the grippers.
- Adjustments to the robot speed.

Note that if the robot is not connected, these controls are inactive. In addition, during an automation process certain controls are blocked (to home, to change position, restart).

For example it is not possible to direct the robot to home while it is busy with another task. When the automation process is stopped (aborted), this is then possible.

NAVIGATION



The setting up of an automation process is done in three successive steps: configuring, guiding and automating. These steps are discussed at length in a later chapter. Navigating between these steps is done via this navigation. If the previous steps were not completed, then it is possible that GUIDE or AUTOMATE are not active.

ADMIN

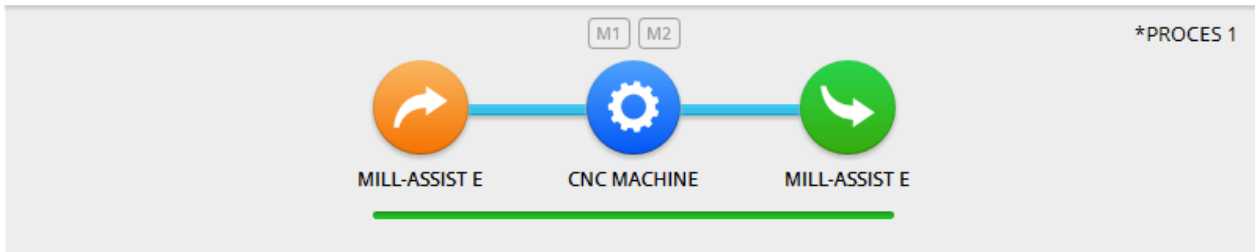
The admin screen is opened. A large number of system properties may be set here. When the admin part of the Software is opened, this button becomes active and the rest of the menu bar inactive. To exit this part of the software one should click again on this button.

EXIT

With this, the software is exited.

2.2 THE PROCESS

The automation process is visualised here. Devices are represented by circles and transport movements by blue links. By reading the visualisation from left to right, the automation process may be traced back.



Picture 6 - The Process

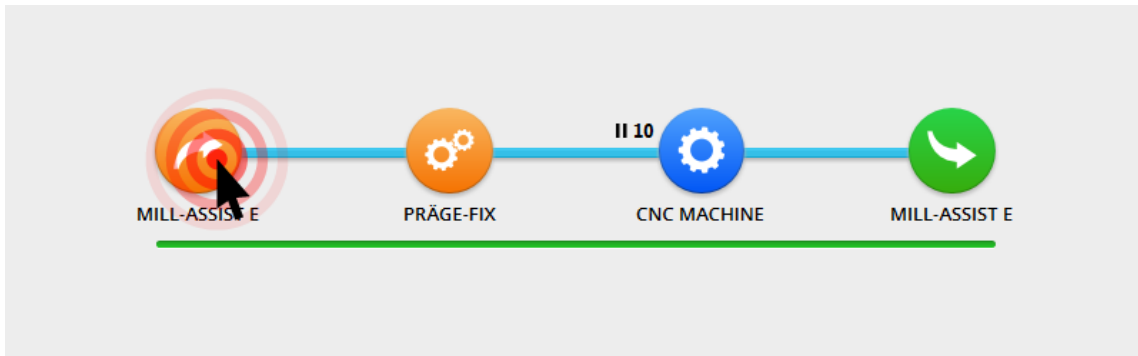
DEVICES

The colour of a device corresponds to the place in the process; orange if the device is before the CNC machine (the component is currently unfinished), green if it is afterwards (the component is finished here). The following device icons are possible:

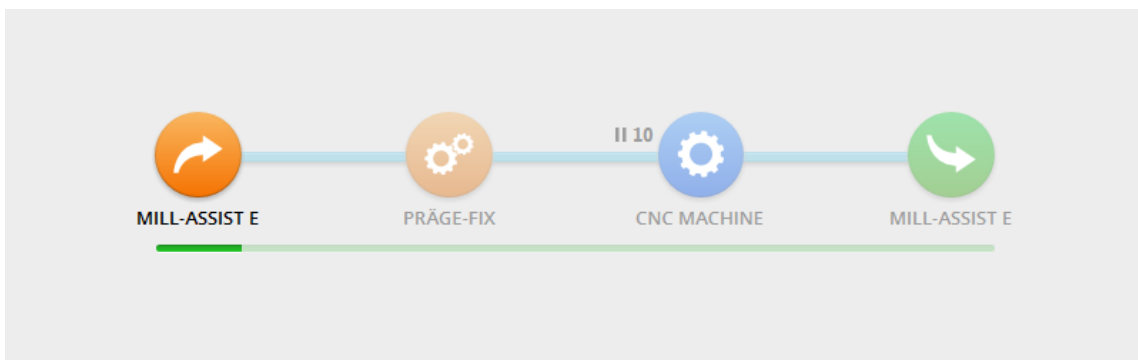
		Mill-Assist Essential as starting device
		Conveyor as starting device
		Pre-treatment
		CNC Machine
		Post-treatment
		Mill Assist Essential as endpoint
		Conveyor as endpoint
		Conveyor as set aside tray

It is often possible to click on these icons. In the bottommost part of the interface, a screen appears that belongs to the selected device. When selecting a particular device is not possible, this is shown in grey (the right-hand pictures).

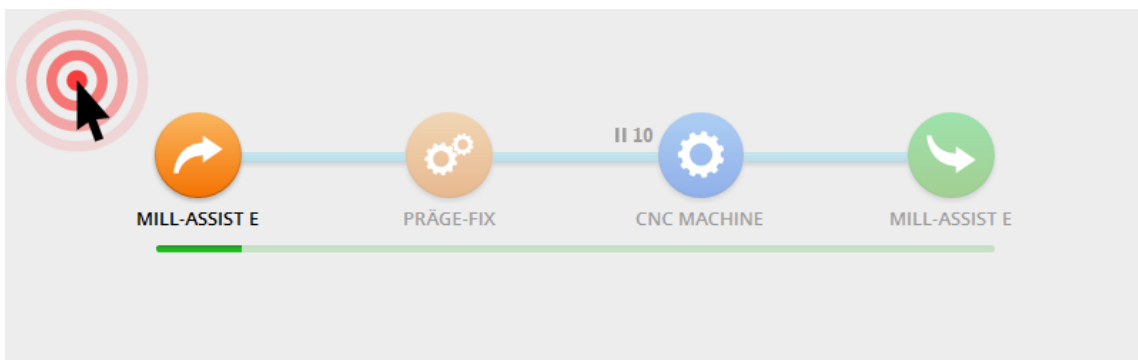
If a device is selected, the rest of the icons in the process screen become transparent. Deselecting a device may be done by clicking on the background (anywhere). The following pictures show this.



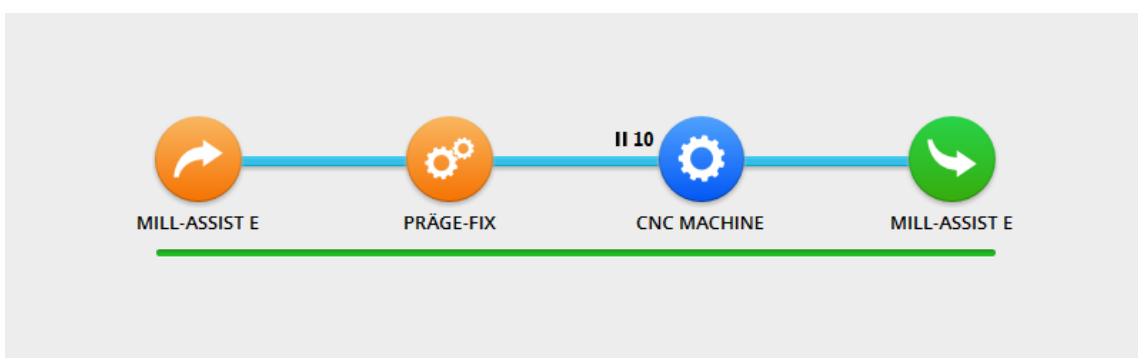
Picture 7 - Select device (a)



Picture 8 - Select device (b)



Picture 9 - Deselect device (a)

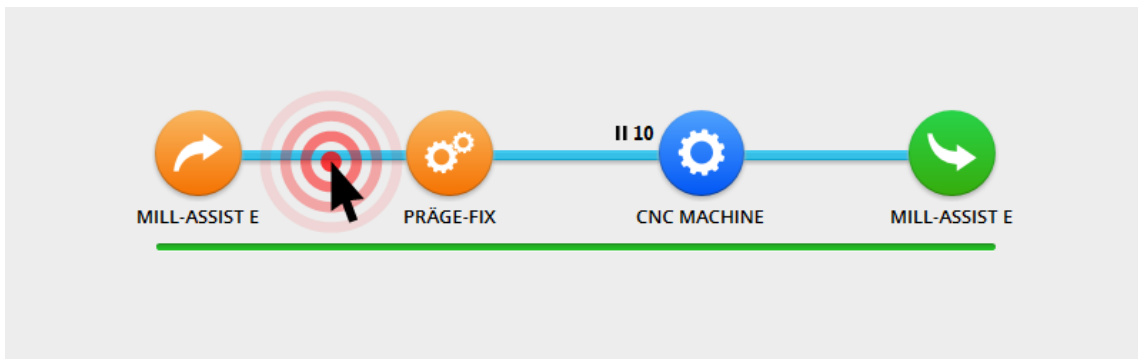


Picture 10 - Deselect device (b)

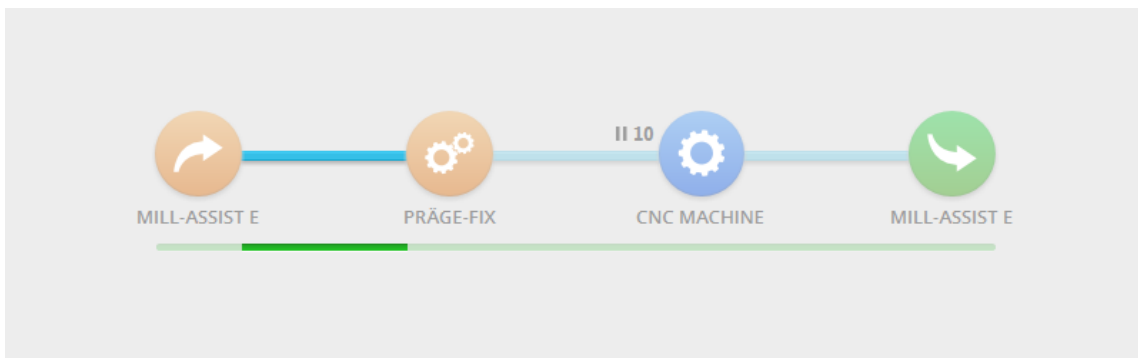
TRANSPORT

The blue arrows always indicate a transport movement of the device on the left-hand side to the device on the right-hand side.

Also here, there is the option to select a specific transport action. The lower part of the interface will then display information associated with this transport action. Also here, the other icons become transparent (the same principle as in Picture 7 and following).



Picture 111 - Select transport (a)



Picture 122 - Select Transport (b)

It is also possible that a number is displayed next to the transport link (such as 10 in the previous examples). This number indicates the time and the interval of an intervention by the operator (for example, a manual measurement). This point will be elaborated later on.

2.3 THE SPECIFIC COMPONENT

The contents of the lower part of the interface change throughout the use of the software. This specific component is often composed of a sub-menu and a contents section.

If no device or transport action has been selected, information is shown in this part relating to the entire process. When a device or transport action is selected, information is displayed that is associated with this device or transport action. In a later chapter the specific content of this part will be discussed step by step for different scenarios.

3. GENERAL PRINCIPLE

Setting up an automation consists of three important steps:

- *Configure*
- *Guide*
- *Automate*

In the first *Configure* step, the process will be defined. The structure of the process and the devices that are part of it (start-stack device, CNC machine, end-stack device and any pre- or post-treatments) are indicated. The user will then will be able to enter the necessary data for each of these devices (for example, the dimensions of the workpieces, the clamping in the machine, etc.). The necessary data will also be able to be entered for the transport actions that link these devices (for example, the choice of gripper, etc.) In short, the entire process is configured. The *Configure* step will be discussed at length in the following chapter.

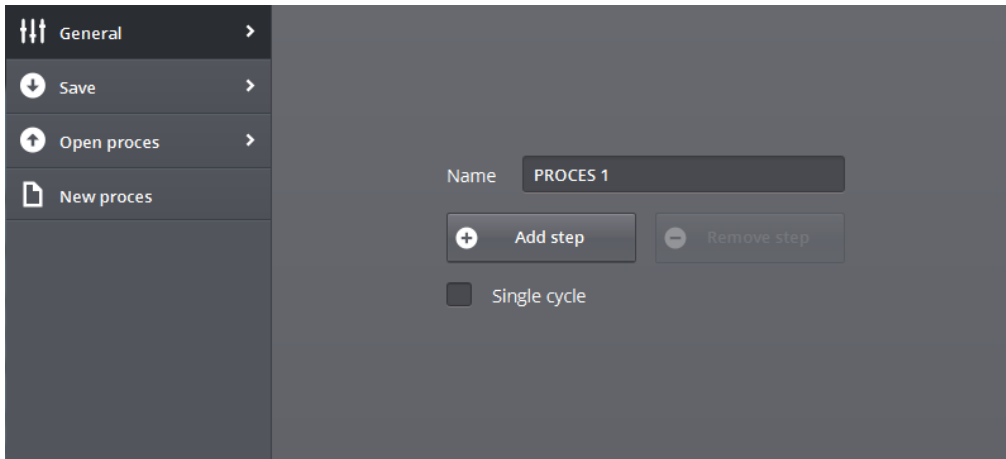
If the process has been configured correctly, one may proceed further with the 2nd *Guide* step. The diversity of workpiece shapes and gripper configurations make it impossible for the system to know exactly how the robot has to take up the workpieces and lay them aside. In this step, the user will therefore guide the robot with this one time. The guided values may also be manually adjusted later. The Mill-Assist itself calculates the locations of the workpieces and makes the movements to and from the workpieces. With the aid of the Fanuc Teach Pendant the user then teaches the system how it should precisely take hold of the workpieces with the selected grippers and precisely where the workpieces must be clamped. The *Guide* step will be discussed at length in a subsequent chapter.

In the final *Automate* step, the user needs only to start the automation process. All necessary information was already provided in the previous steps. The user will see an overview of the progress (for example, the number of pieces that have already been processed) and an estimate is given of the time remaining. In addition, the user may replace finished workpieces by rough workpieces and vice versa at any time. The *Automate* step will be discussed at length in a subsequent chapter.

4. CONFIGURE

4.1 GENERAL PROCESS CONFIGURATION

Initially no device or transport action is selected and it contains the specific part of the interface general settings w.r.t. the entire process. The left-hand menu shows the possible actions:



Picture 13 - General process configuration

CONFIGURE

The name of the process may be set here. By clicking on a text field, a keyboard appears.

Tip: when the text of a text field is clicked on, this will be completely selected automatically.

In addition, pre- and post-treatment steps may be added or removed. The ability to add depends on which devices are configured into the system during installation. As a result, it is sometimes not possible to add steps. Removal may only be done if the process contains pre- or post-treatment steps.

To add a pre- or post-treatment, the user must select the transport action between the devices where the new treatment should come. After clicking on 'Remove step', the user must click on the device to be removed.

The possible pre-treatment devices are:

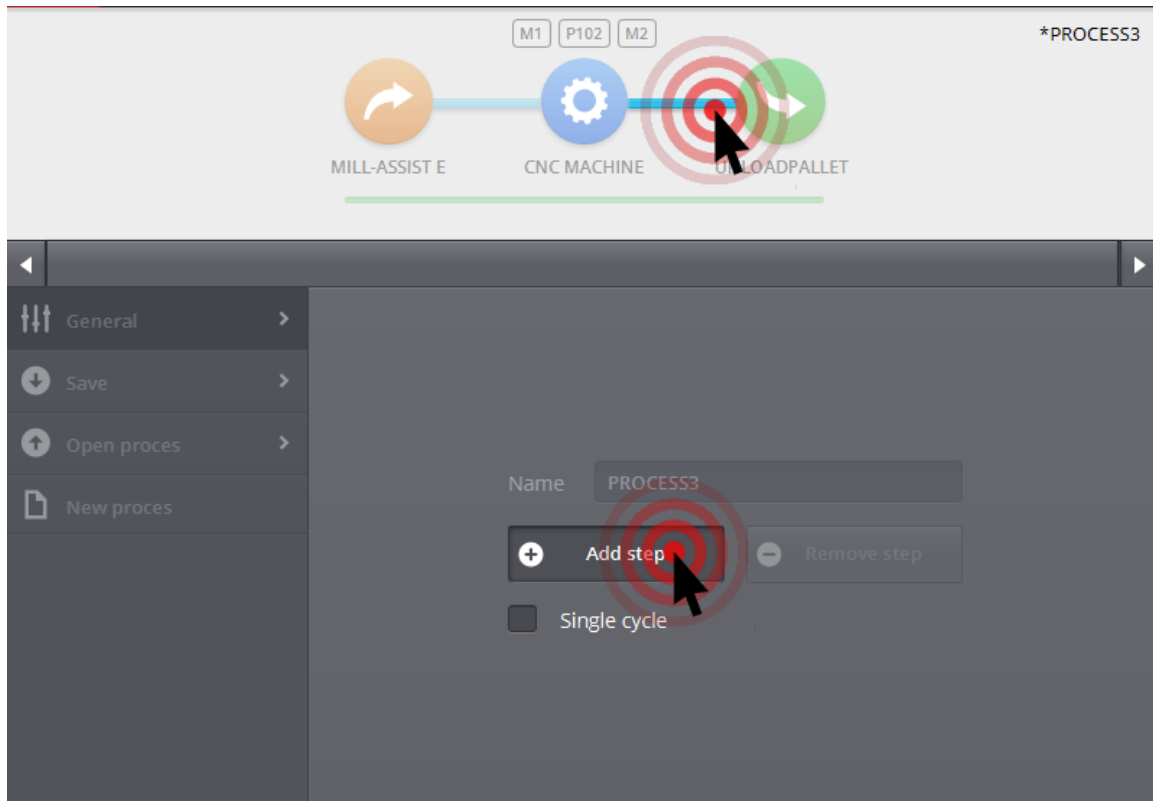
- Präge-Fix stations

The possible post-treatment devices are:

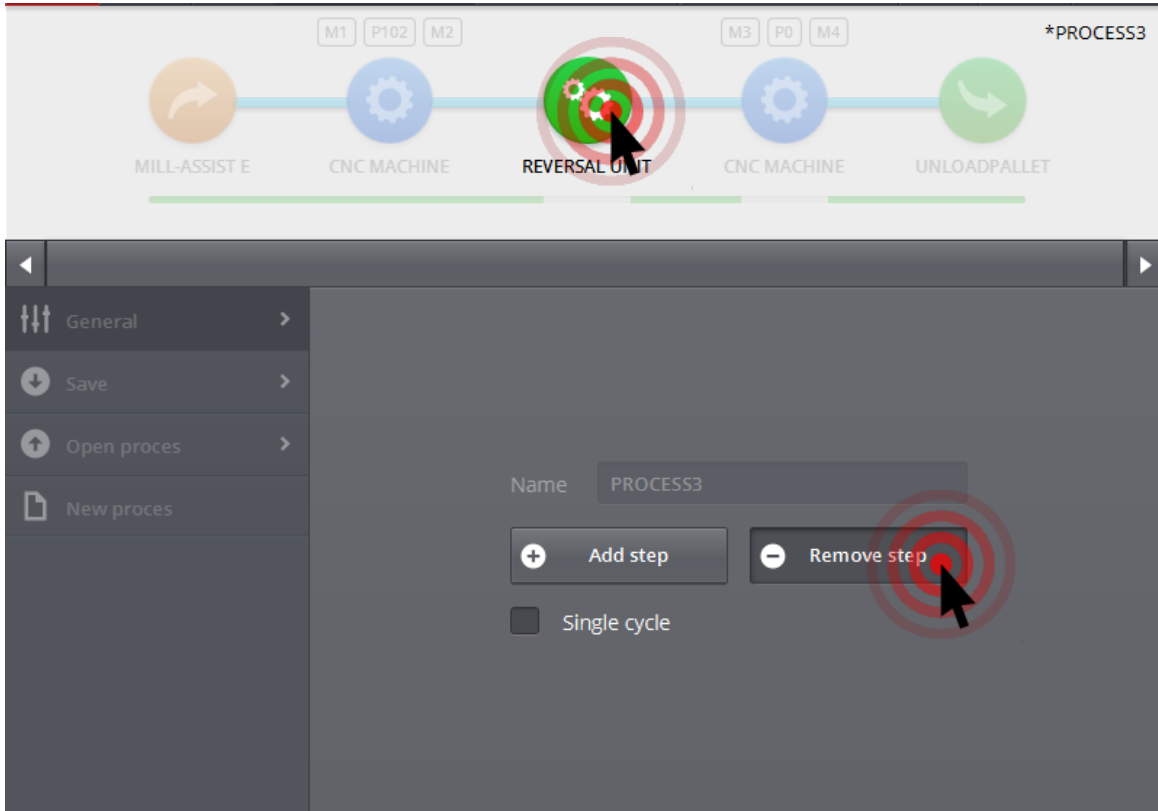
- Revolving unit

Likewise, it is possible to select a 'Single cycle' in the configure screen. If this option is checked, the robot will only be able to take one piece at a time in its grippers. The robot will first completely finish a piece (take rough

piece, have it processed and then place it back it as a finished piece) before picking up a new rough piece. This option can be useful where one does not have enough room in the machine for two pieces simultaneously in the grippers.



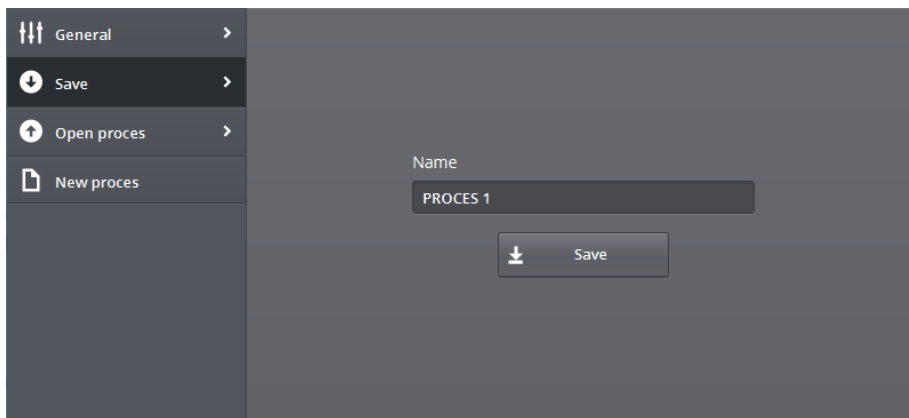
Picture 14 - Add step



Picture 15 - Remove step

SAVE

The name of the process may also be changed in this screen. In addition, the process can be stored in two ways:



Picture 16 - Save

Saves the data for the current process. If the name of the process is not changed, the changes will be incorporated into the existing process. The following message is displayed.

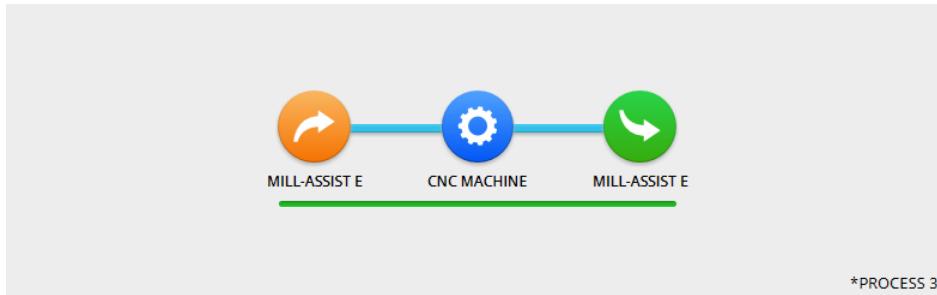


If the selected name is unique, a copy of the existing process is stored (save as).



Do not forget to regularly save parameters and processes learned.

Note that there are unsaved changes if the name of the process is preceded by an *.

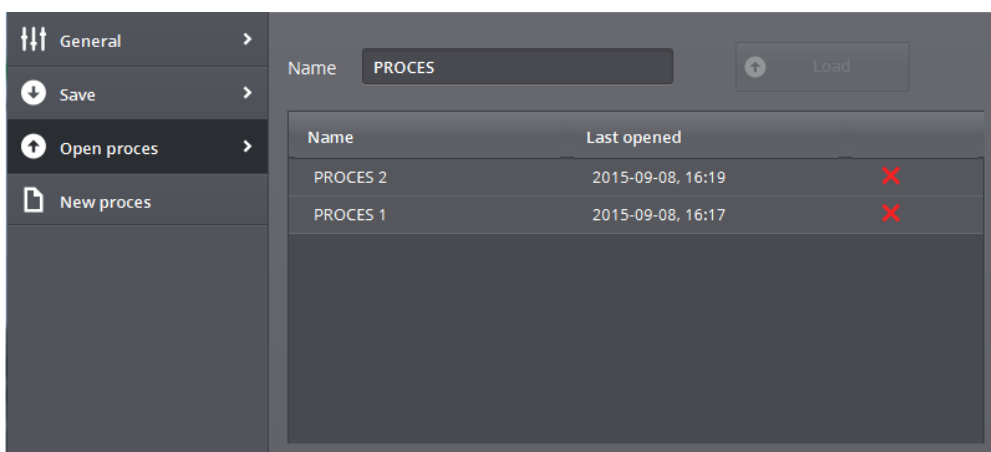


Picture 17 - Unsaved changes in current process

OPEN PROCESS

In this screen you can search for previously saved processes. To this end, the user may enter part of the name of process in the search field. Note that the results are adjusted with any change in the search field and the search term may appear anywhere in the process name.

In addition, the sorting of the search results may also be adjusted by clicking on 'Name' or 'Last opened'. The arrow indicates the sequence. To remove a process from the database, the user may click on the red cross.



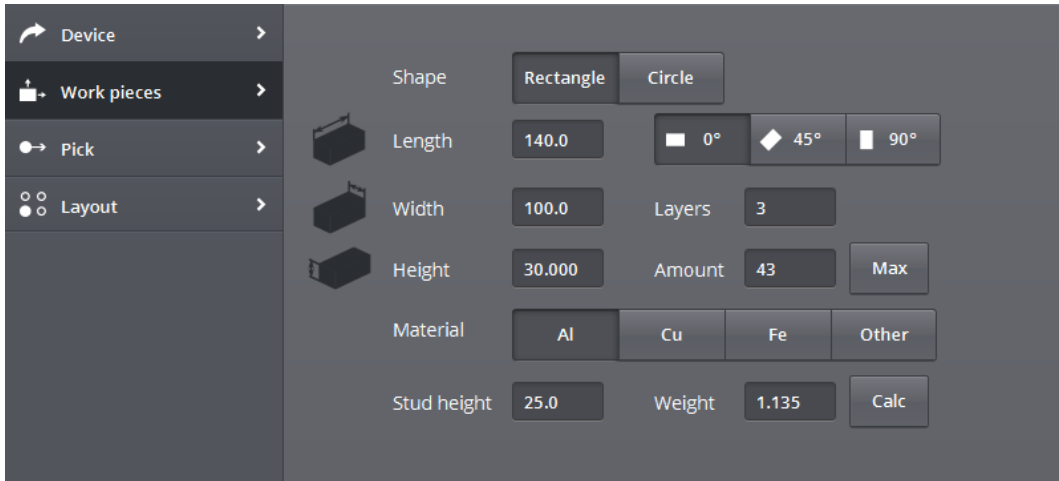
Picture 18 - Searching for a process

NEW PROCESS

Opens a new, standard process.

4.2. DEVICE: MILL-ASSIST E AS START POINT

After selection of the *Mill-Assist E* as starting device, the following screen appears in the specific section:




Picture 19 - Configure IRS M Basic (workpieces)

The menu contains 4 items: *Device*, *Workpieces*, *Incorporate* and *Layout*. The device may be changed from where the automation starts via the *Device* item. This is possible only when multiple load devices are defined; if they are not, then this item is inactive.


WORKPIECES

The **rough** workpieces may be set up in this screen. The majority of settings speak for themselves. The angle that may be chosen is the angle with which pieces are placed on the stacking table (exactly how this is done is discussed in the discussion about the '*Layout*' item).

When setting these data, some error messages may be displayed.

 The length should be larger than the width..

The workpiece length must always be greater or equal to the workpiece width.

 The weight should be greater than 0.

The workpiece weight must always be filled in and greater than 0.

Layers indicates the number of layers that can be stacked one above the other. **It is the responsibility of the operator to select this amount so that the robot always can pick up / put down workpieces on to the bottommost layer, taking into account the presence of the uprights.**

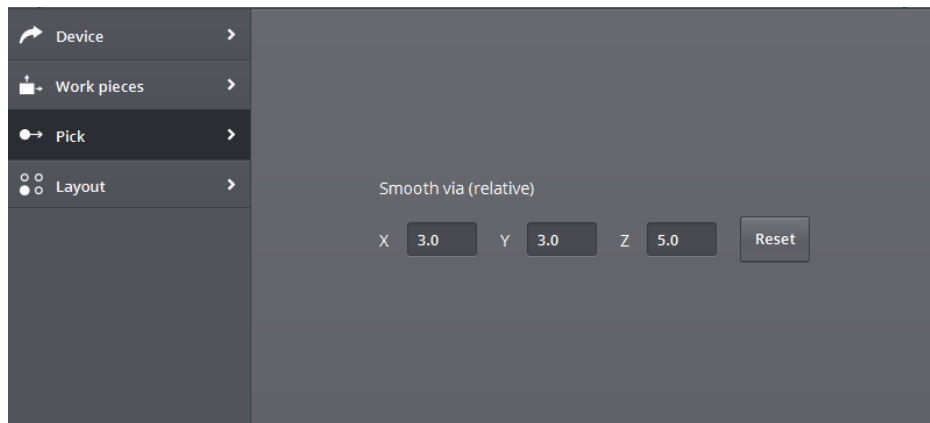
Number indicates the number of workpieces; by clicking on *Max* the maximum number is calculated, taking into account the number of selected layers. The weight may

also be calculated with the *Calc* button, taking account of the selected material.

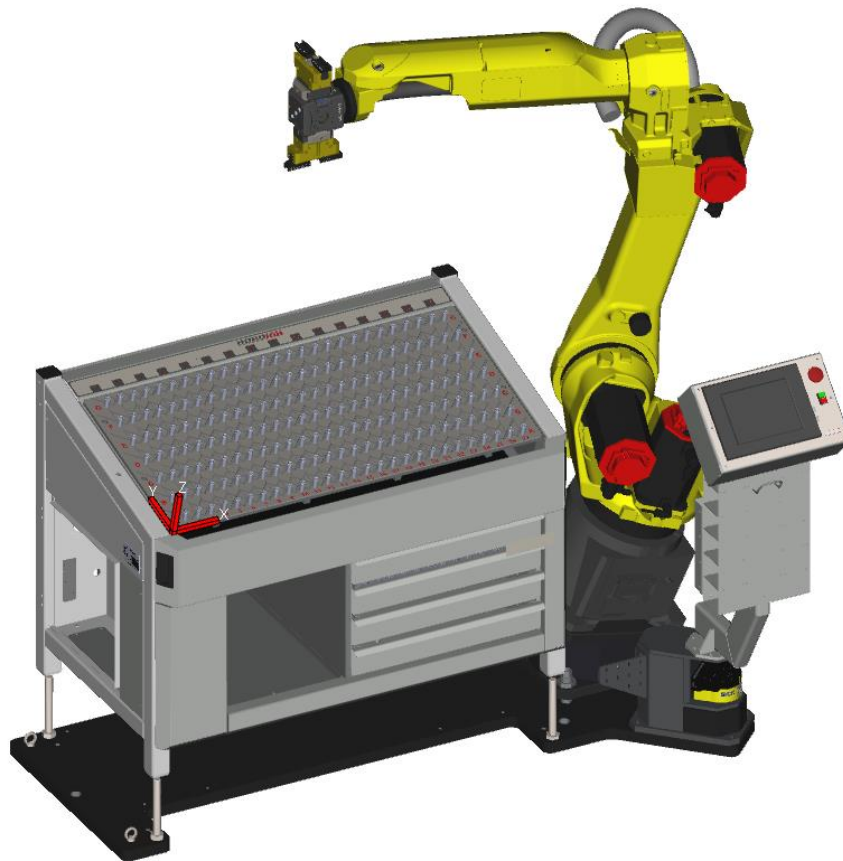
Note that it is also possible to choose to have round pieces processed if this option is activated. In order to configure these round pieces, *Circle* should be clicked on instead of *Rectangle*.

PICKING UP

This screen is used to enter how the robot moves away from the table after having picked up a workpiece. The X, Y and Z-coordinates entered are relative in relation to the end position where a piece is removed. If these values are for example, X=5, Y=5, Z=5, then after grasping the workpiece, the robot will first move 5mm in the positive X-, Y- and Z- direction before rising in Z above all workpieces. As standard these values will comprise a correct value, but may be able to be adjusted here per process.



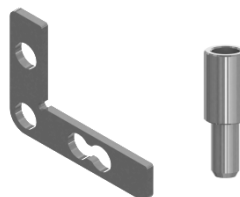
Picture 20 - Lifting



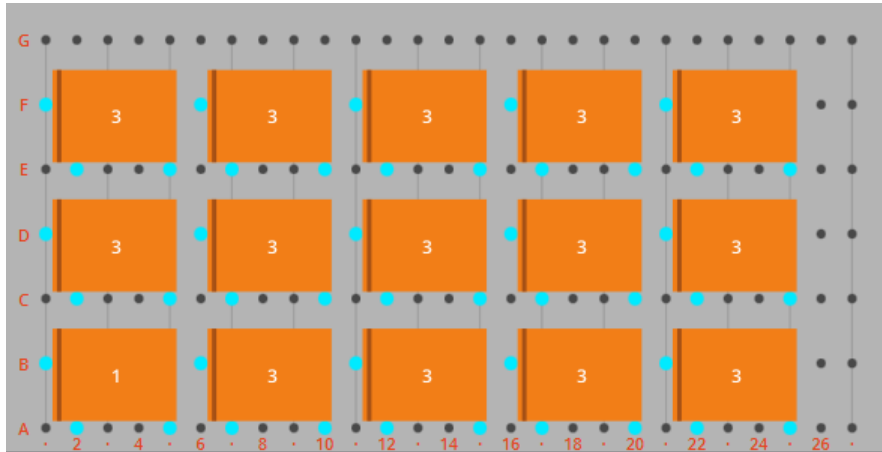
Picture 21 - Mill-Assist E coordinate system

LAYOUT

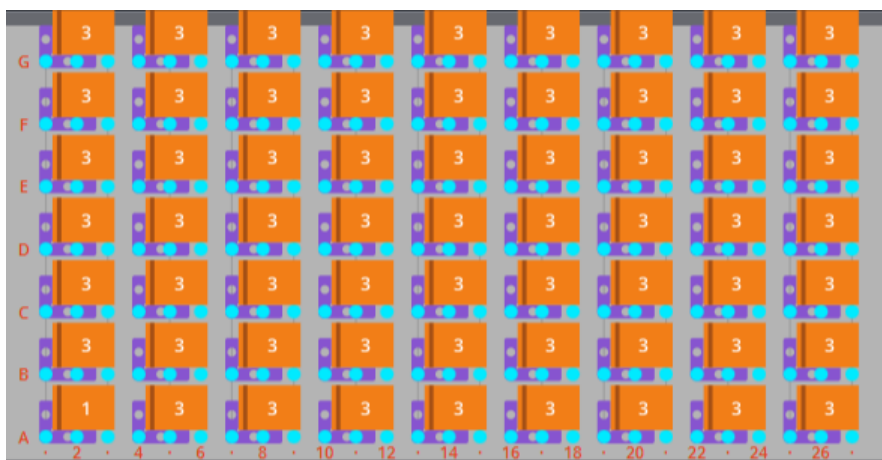
This screen provides an overview of the configuration of the stacking table for the selected workpieces. The required *studs* are shown as light blue circles. For small workpieces, it is also necessary for *construction corners* to be positioned. These are shown as purple shapes. The rough workpieces are shown as orange rectangles. Note that a dark orange stripe is always shown with the workpieces. This is used later to show how the workpieces will correctly be positioned in the machine clamping.



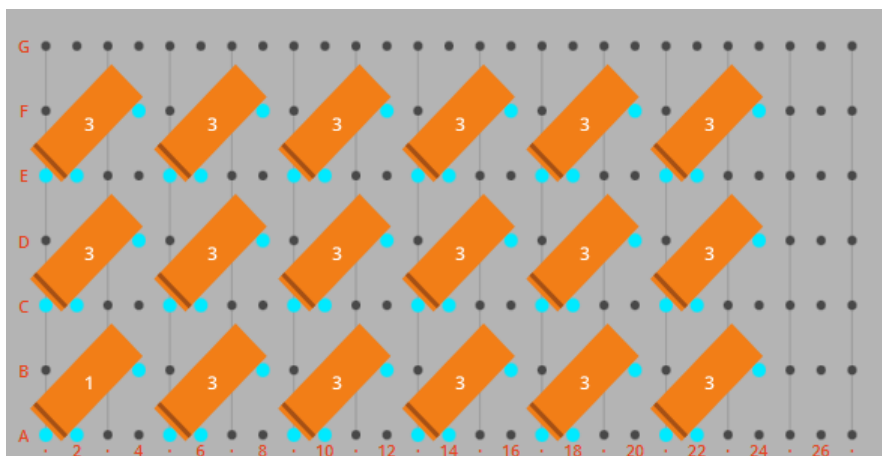
Picture 22 - Construction corner and stud



Picture 23 - Layout (a)



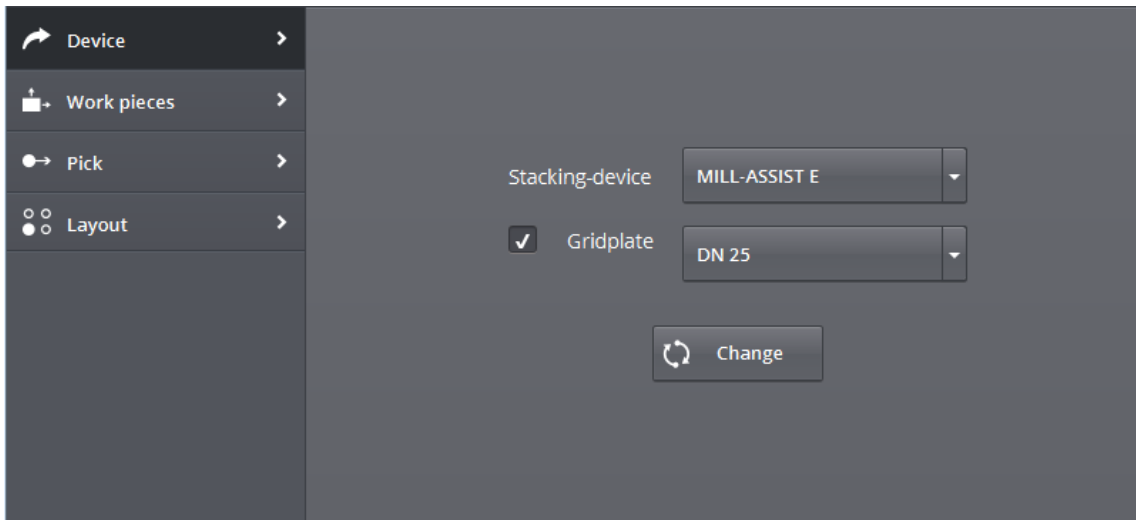
Picture 24 - Layout (b)



Picture 25 - Layout (c)

DEVICE

Working with grid plates may be selected in the first MILL-ASSIST E menu. In this case a grid plate is a plate that may be positioned on the stacker. This may be defined in the admin menu. We will come back to this in more detail later. If one chooses to use the grid plate, the layout will also be adjusted. This can be seen in picture 27.



Picture 26 - Mill-Assist E (Device)



Picture 27 - Layout (d)

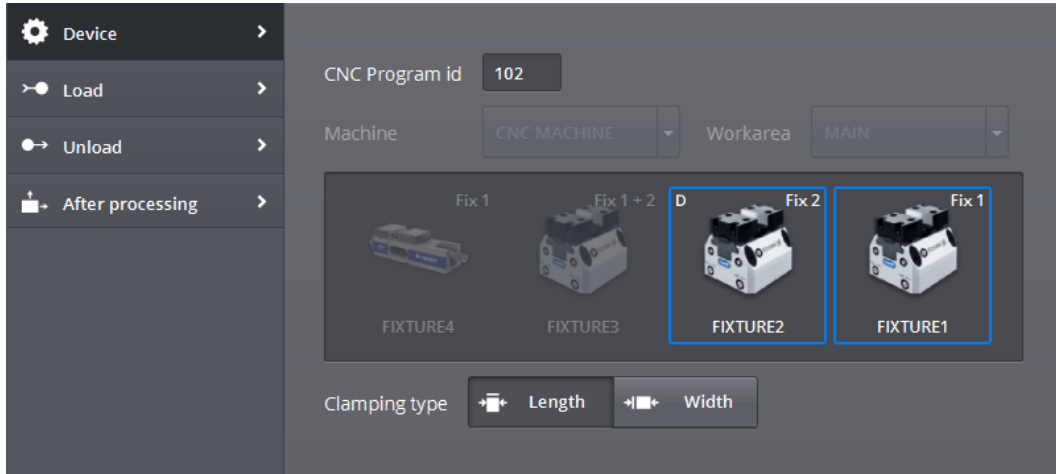
4.3. DEVICE: PRÄGE-FIX

This device-step may or may not be present. Nothing needs to be configured for this device. If present, the rough workpiece will first be pre-treated with the Präge-Fix device, before being loaded into the machine.

4.4. DEVICE: CNC MACHINE

After selection of *CNC MACHINE*² the following screen appears in the specific section. The menu contains 4 items: *Apparatus*, *Load*, *Unload* and *Layout*.

² The name of this device will be the name of your CNC Machine.

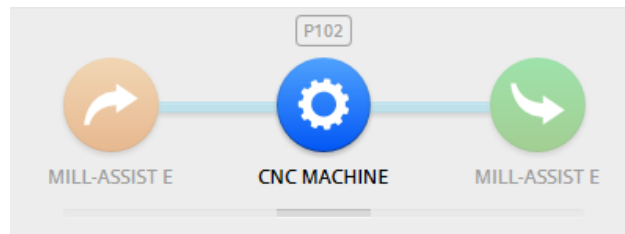


Picture 28 - Configure CNC Machine (Apparatus)

APPARATUS

If there are multiple CNC Machines defined in the database, the Machine may be selected in this screen. By default, there is one machine present and no selection is possible. The same applies for the operating range.


The CNC program may be set in this screen if the machine has 'worknumber search'. This is the program that is run during this processing step. Note that with a turning unit, one has two different processing steps and thus can also set two different programs. In order see a quick overview of the programs set, the CNC program ID is also shown in the flow.




Picture 29 - CNC program ID in the flow

In addition, the clamping may be selected and it can be indicated as to how the piece is to be clamped. If multiple clampings are possible within one operating range, it is possible to simultaneously select multiple clamping. The type is displayed in each case in the upper right corner of the icon of the clamping. Thus in the example we see a type 'Fix 1', 'Fix 2' and 'Fix 1+2'. This means that we can control clamps 1 and 2 separately. With type 1+2 we control both clamps simultaneously.


There are a number of limitations that have to be taken into account. For example it is not possible to select two 'Fix 1' types simultaneously. The following warning is then displayed.

 It is not possible to have fixtures of the same type

It is also not possible to choose two different sorts of types. For example a type wherein we only control one clamp (Fix 1) and a type wherein we control two clamps (Fix 1 + 2). In that case, the following warning will be shown:

 The different clampings need to be from the same family (e.g. fix 1 / fix 2)

If one has a revolving unit in the current process, two instances of CNC machine will have to be configured. It is therefore important that both instances use the same number of clampings. If that is not the case, the following warning will be shown:

 All CNC machines need to have the same amount of clampings selected

Note that there is a small 'D' in the top left-hand corner of the icon. This indicates the default clamping. This will also be used in the teaching of the process.

Note that the indication strip, also shown in the *layout* screen of the *IRS M BASIC* is also used here, so that it may be seen how the pieces will be positioned.

LOADING

In this screen, a position can be entered, relative w.r.t. the end point for loading, along which the robot will move. This may be useful, for example, to allow the robot to first move above and behind a stop block on the clamping, before going to the end position. In this way the piece may be brought against the stop block.

It may be also selected for the robot to release the workpiece before or after the machine clamps it.


With some machines it is possible to connect an airblow on to the clamp. In this case, it is possible to activate this option by checking 'Machine airblow'. The airblow that is going to be done here will be executed by the machine. Thus, no movement of the robot is required.

If there is sufficient space to rotate in the machine, then the option '*Turn in machine*' is also available. If at the same time a piece in the machine is ready and a rough piece is ready to be slotted into the machine, an exchange of the pieces must be made. Using the option '*Turn in machine*' it is thus possible to choose for carrying out this rotational movement oneself instead of moving outside of the machine in order to exchange. Note that this option has the same value in both the load as well as the unload screen. Thus one cannot choose to


deactivate 'Turn in machine' when loading and to activate when unloading (or vice versa).

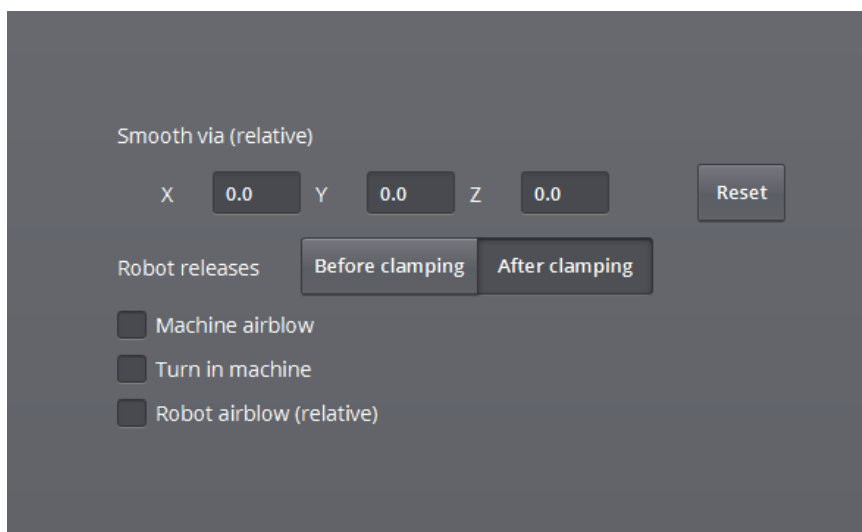
Additionally, it may be indicated here as to whether the robot, when loading into the machine, has to execute an airflow routine. If you select this option, a selection box and 2 coordinate boxes will appear. All the selected clampings are in the selection box (selected with 'Apparatus'). To obtain a correct configuration, one must set a correct airflow rectangle for all selected clampings. The airflow routine may be set manually by selecting 2 coordinates. These coordinates designate a rectangle whose centre is the selected clamping. The first coordinate indicates the lower left-hand corner of the rectangle, with which the second indicates the top right-hand corner. Note that these two coordinates are relative with respect to the clamping. This means that if we take $X = 5$, we are going to move 5 mm to the right of the clamping. One may also choose to use the default values. These may be set by clicking on 'Reset'. The values that appear are the values defined in the Admin section when creating the clamping.

If you enter the wrong coordinate whereby the lower left-hand corner is not at the lower left compared in relation to the completed upper right-hand coordinate, a warning will be displayed.

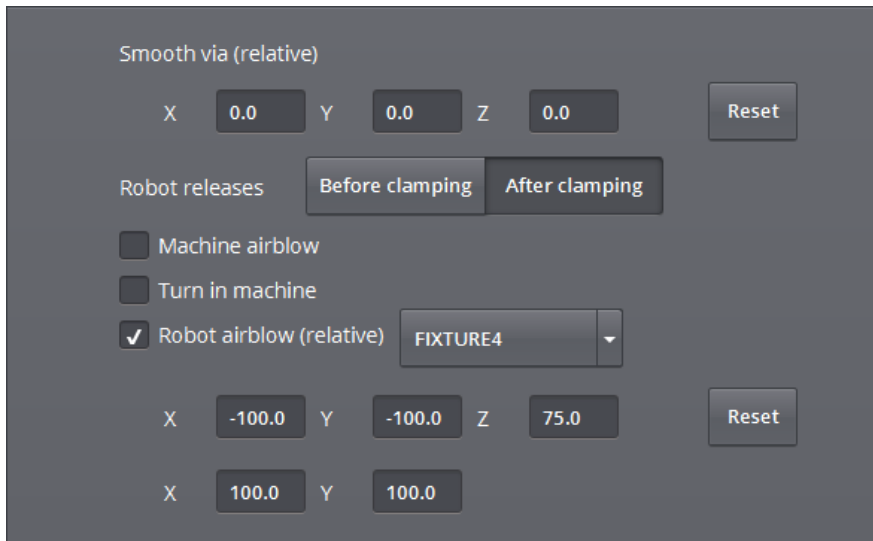
 The 1st coordinate (lower left corner wrt clamping) must be lower than the 2nd (upper right corner).

With the installation, a maximum limit will be determined for the airflow area. If one goes outside this area when setting the airflow, a warning will likewise be displayed.

 Defined airflow area exceeds boundaries.



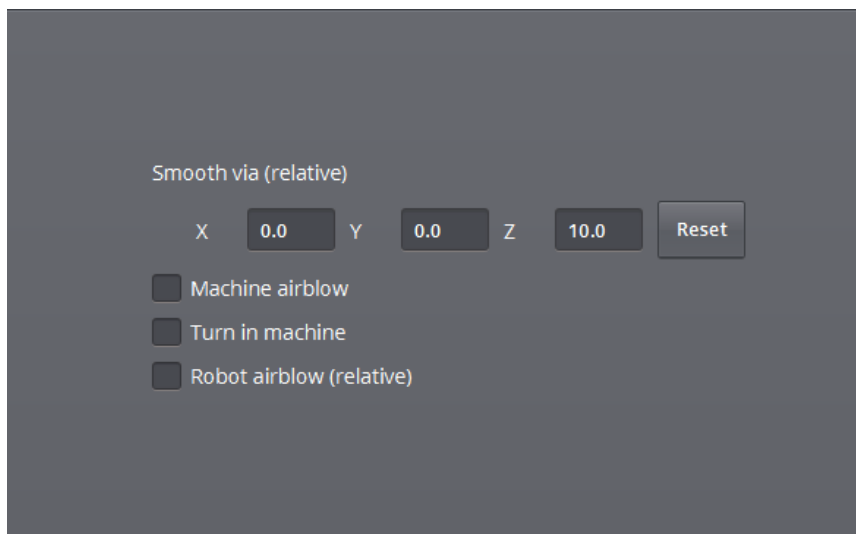
Picture 30 - Configure CNC Machine (Load)



Picture 31 - Configure airblow (Load)

UNLOADING

The principle of this screen is the same as that of the 'Load' screen.



Picture 32 - Configure CNC Machine (Unload)

AFTER PROCESSING

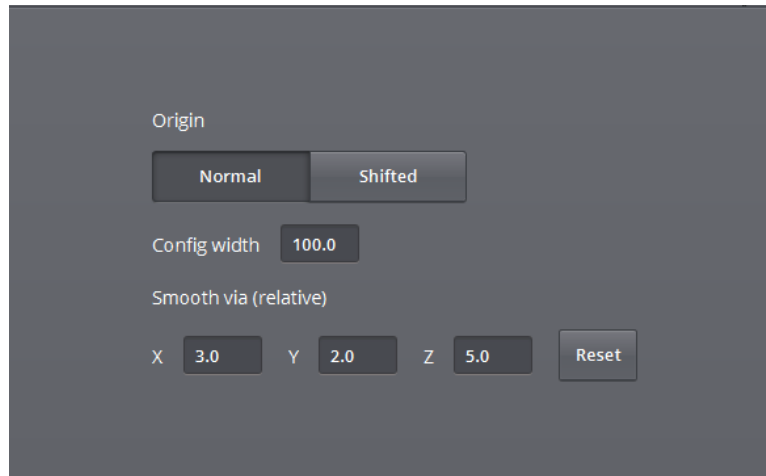
Using this screen, the finished workpiece can be set up. The dimensions and the weight may be entered. Using the *Reset* button, the size (or the weight) of the rough workpiece may be copied and using *Calc*; the weight is then calculated on the basis of the stated dimensions and the material that is entered for the rough workpiece. Note that this button is unavailable if *Other* is selected as material of the rough workpiece.



Picture 33 - Configure CNC Machine (After processing)

4.5. DEVICE: REVOLVING UNIT

LOADING



Picture 34 - Loading from revolving unit

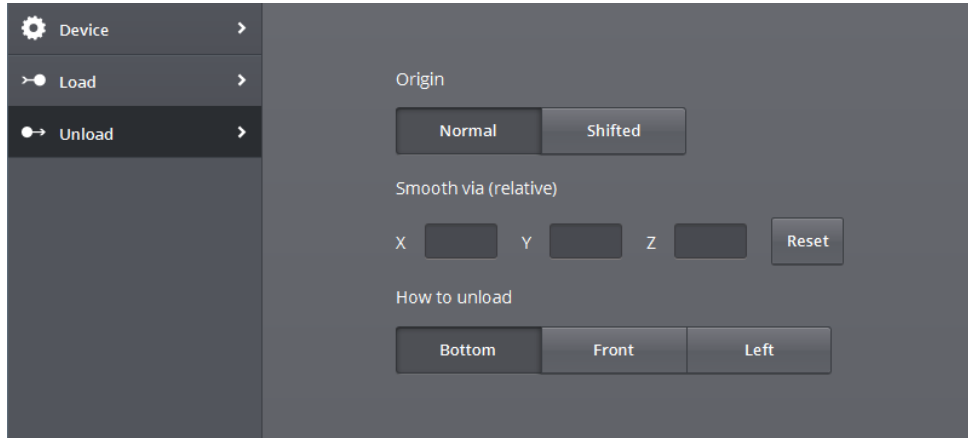
Three settings can be seen in the loading screen of the revolving unit. First of all we have the origin. If one has a special revolving unit, with the possibility to shift the source further forward (by manually unscrewing a pin in one of the legs of the revolving unit), then shifted or normal may be selected here. In most cases one will have to select 'Normal' here.

We then have the 'Set width'. This is the distance to which the unit is set or also the distance between the two legs of the unit. This value is purely for information and is thus only a memoria technica for the operator.

Then we have the relative position that has to be taken into account when loading.

UNLOADING

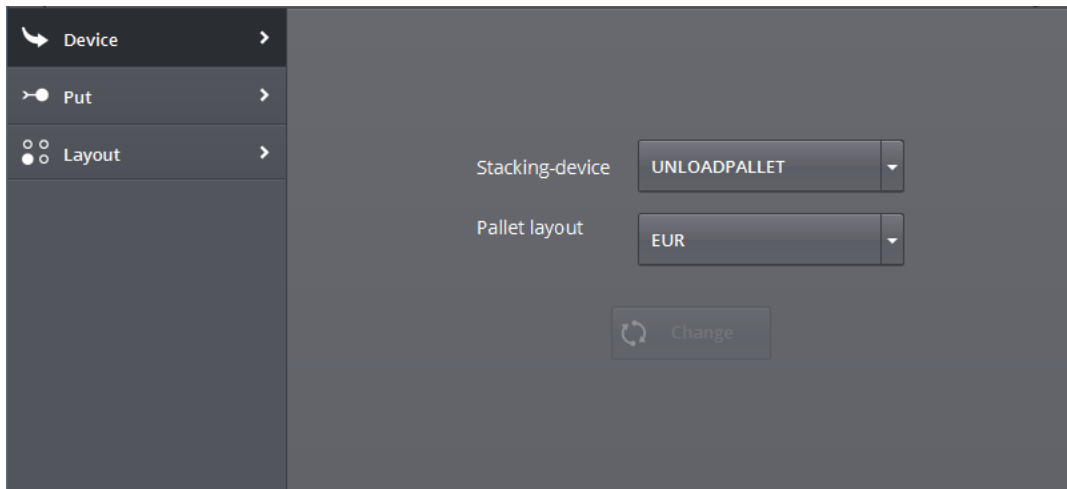
Unloading is similar to loading. If, on installation, the possibility has been given to unload the revolving unit along different sides (below, at the front or to the left). If the robot still has to come and get the piece from below, this option will not be visible. Note by the way that the robot will always load the revolving unit at the top.



Picture 35 - Unloading from revolving unit

4.6 DEVICE: PALLET FOR SETTING ASIDE

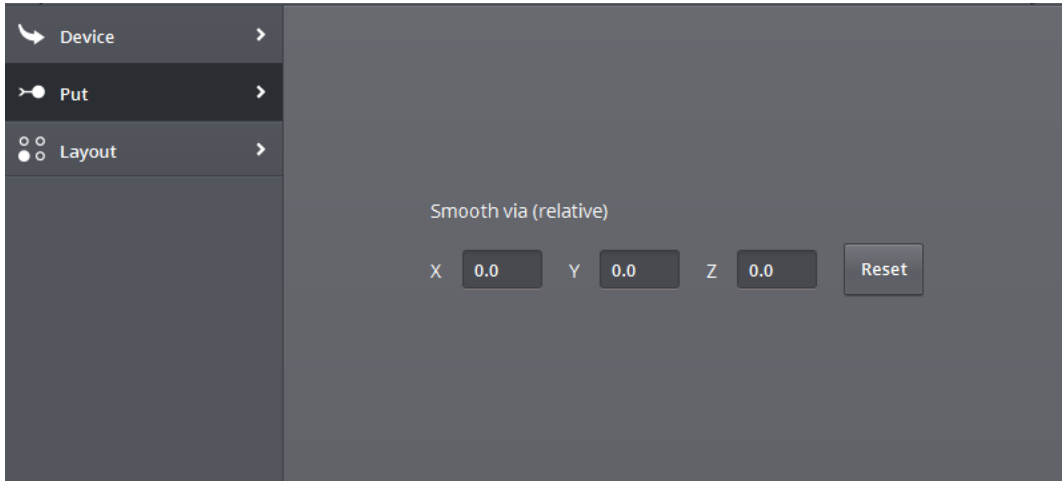
If a pallet is selected for the setting aside of finished pieces, you have the option of selecting a layout for the device. The layout determines the dimensions of the pallet (width, height, length, minimum distance to the edge, etc.). A series of predefined layouts may be selected; these can be created in the admin (see 7. Admin).



Picture 36 - Pallet for setting aside

SETTING ASIDE

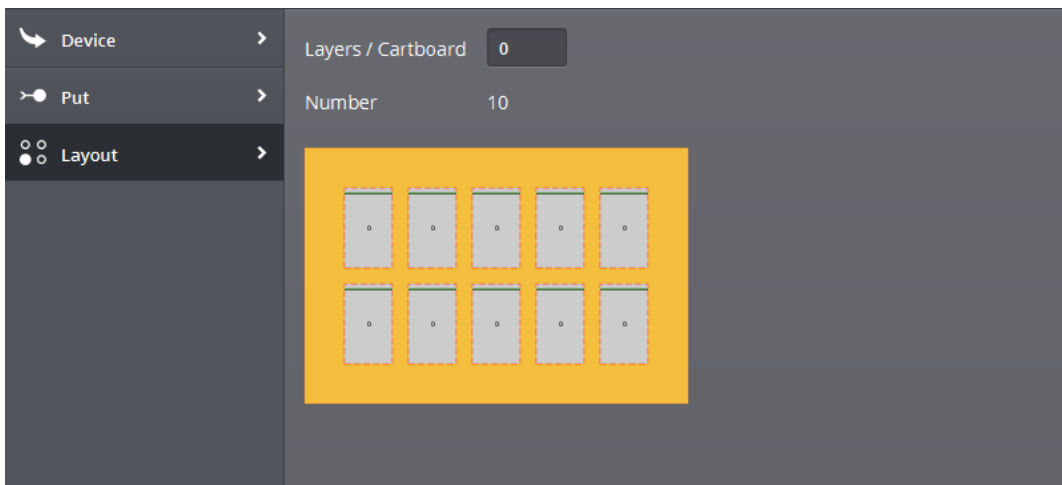
An X, Y and Z coordinate may be entered in the *Set aside* screen, along which the robot will move before setting the workpiece aside on the table.



Picture 37 - Setting aside for pallet

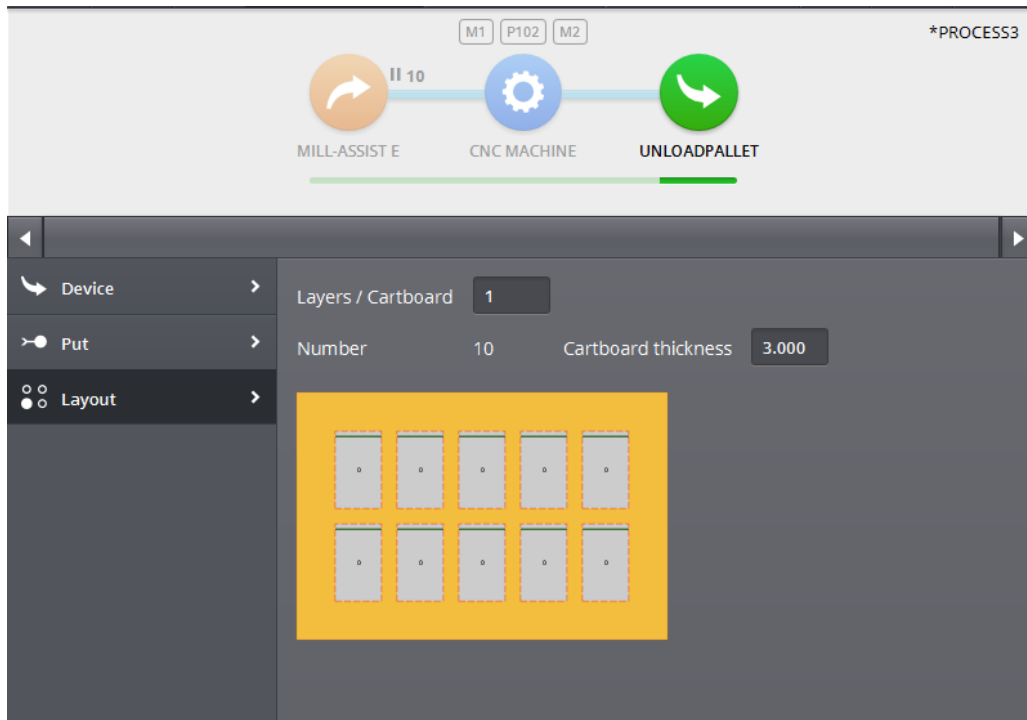
LAYOUT

This screen provides an overview of the configuration of the pallet for the selected workpieces. The configuration shows the positions where a workpiece can be placed and is automatically calculated by the system. Note that a dark green stripe is always shown with the workpieces. This is used to show how the workpieces will correctly be taken from the machine clamping.



Picture 38 - Layout for pallet

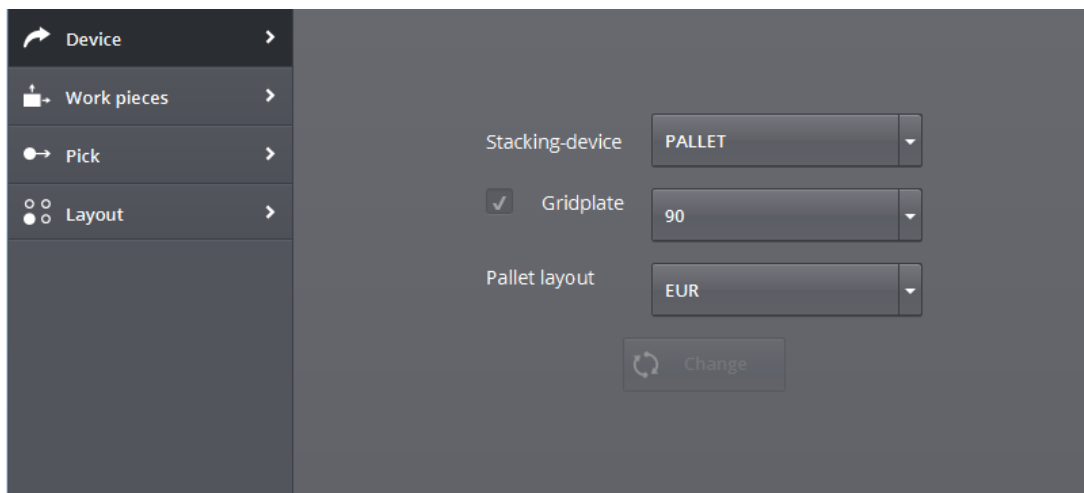
The number of layers of a cardboard separator that have to be positioned may be entered on this screen. If for example one enters 1 then an intervention will be created after 10 pieces (in this example, 1 layer comprises of 10 pieces). Note that the thickness of a cardboard separator may also be entered. This is necessary so that the difference in height of the cardboard may be taken into account for the subsequent layers.



Picture 39 - Layout for pallet: #layers/cartboard

4.7. DEVICE: CALIBRATION PALLET

A calibration pallet may be used for the picking up and setting aside of workpieces. A calibration pallet consists of a pallet with determined layout and a grid plate that is fastened on to the pallet. When a calibration pallet is selected as device for picking up and/or setting aside then a grid plate and a pallet layout must be selected.



Picture 40 - Configuring calibration pallet

WORKPIECES

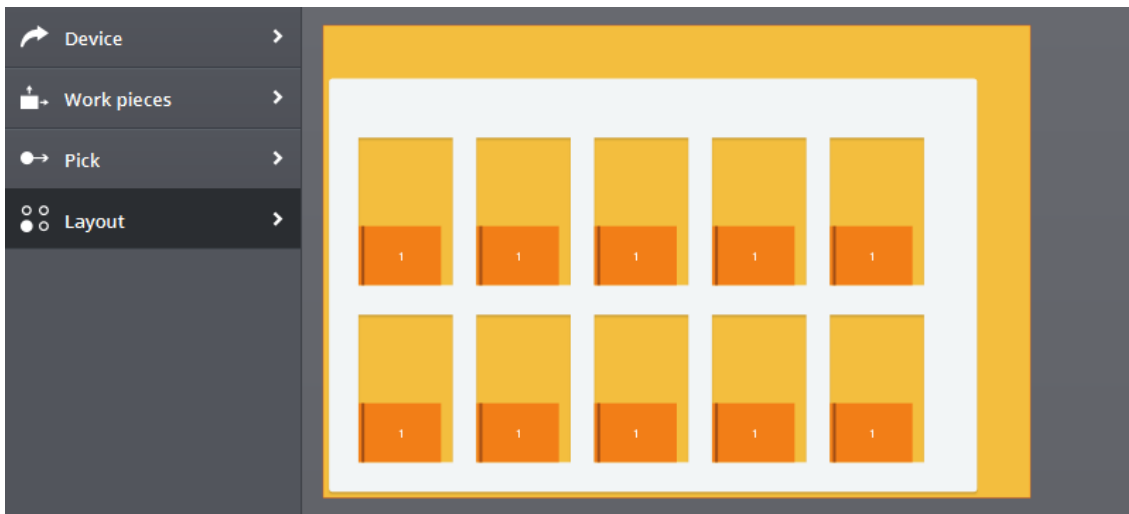
The *Workpieces* screen comprises the same content as for a Mill-Assist E. For more information see "4.2. Device: Mill-assist E as start point".

PICKING UP

The *Pickup* screen comprises the same content as for a Mill-Assist E. For more information see "4.2. Device: Mill-assist E as start point".

LAYOUT

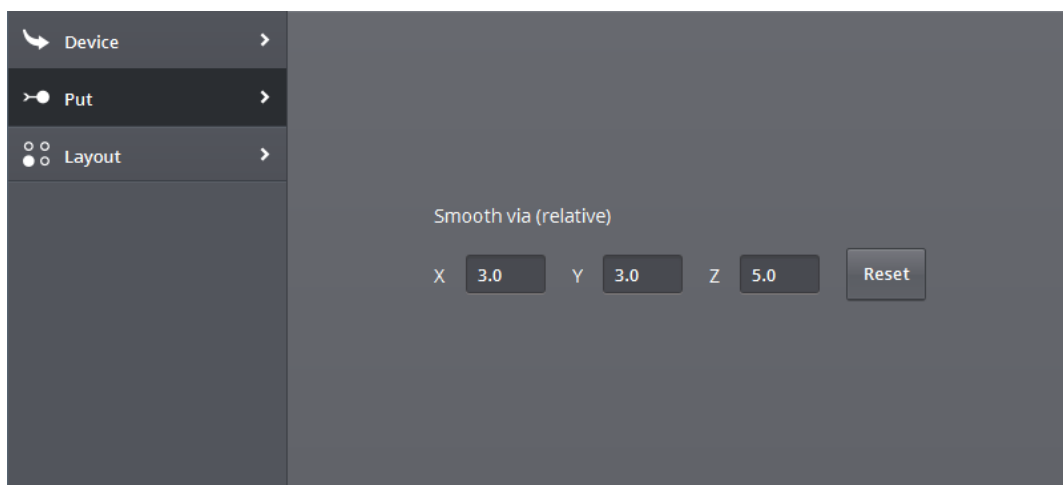
This screen provides an overview of the configuration of the calibration pallet for the selected workpieces. The configuration shows the positions where a workpiece may be placed. These positions are determined by the selected grid plate.



Picture 41 - Calibration pallet layout

4.8. DEVICE: IRS M BASIC AS END POINT.

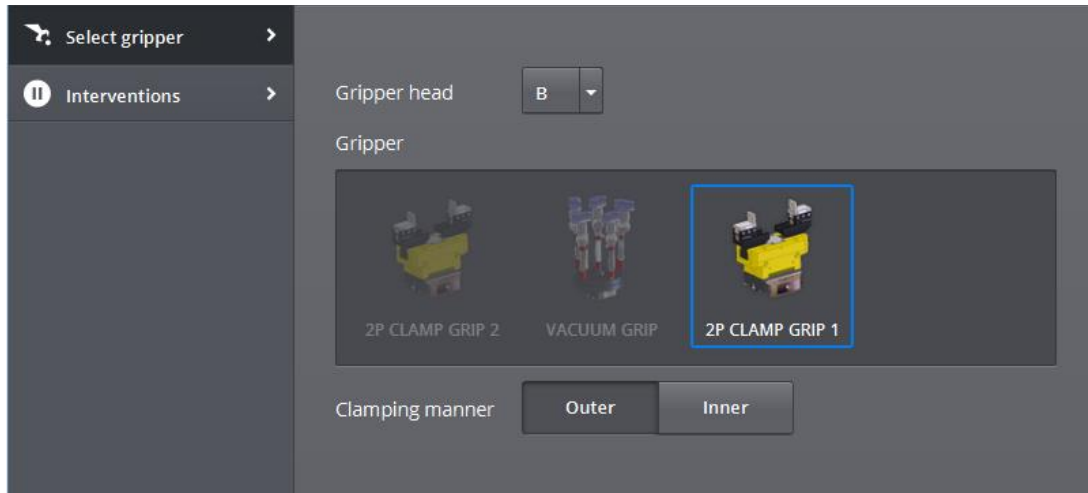
The *Workpieces* screen is not active here; the *Layout* screen has already been discussed. The *Set aside* screen has the same content as the *Pick up* screen. An X-, Y- and Z- coordinate may also be entered here along which the robot will move before setting the workpiece aside on the table.



Picture 42 - Setting aside on Mill-Assist E

4.9 TRANSPORT ACTIONS

After the selection of each transport action, the following screen is displayed:



Picture 43 - Configure transport action (Gripper)

SELECT GRIPPER

This screen indicates with which gripper-head the transport movement should be done and which gripper will be used with this. The gripper that is present in the database will be displayed.

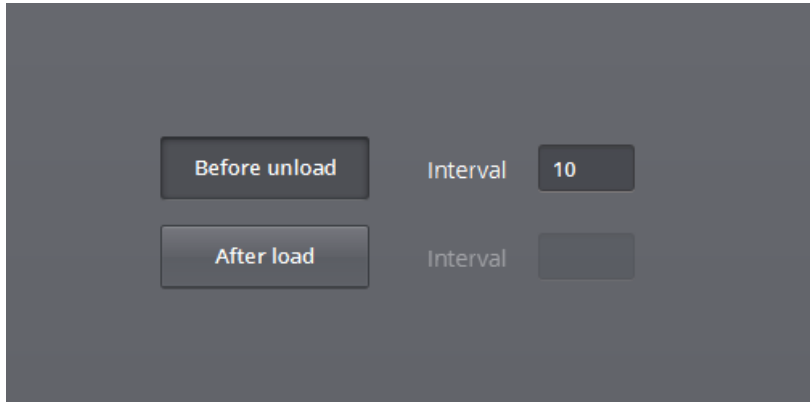
Conventionally, gripper-head A is used for the rough workpiece and gripper-head B for the finished workpiece!

Note also that if a particular gripper is selected for a gripper-head, this gripper will be used in all the steps in which the same gripper-head has been selected, and this gripper may not be selected on a different gripper-head.

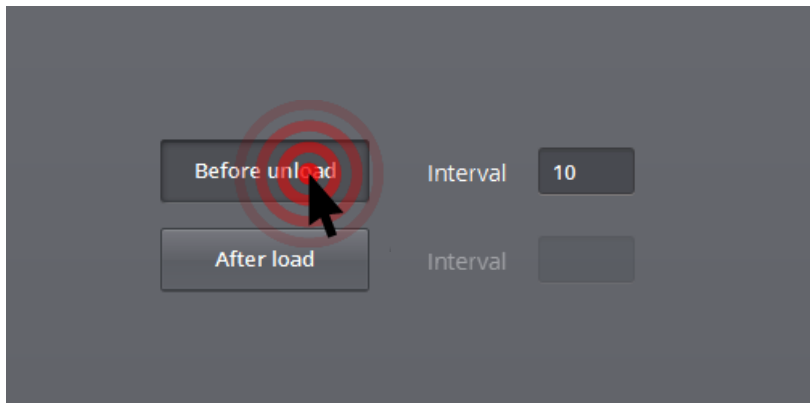
Additionally you may select whether the workpiece will be internally or externally gripped.

MANAGE INTERVENTIONS

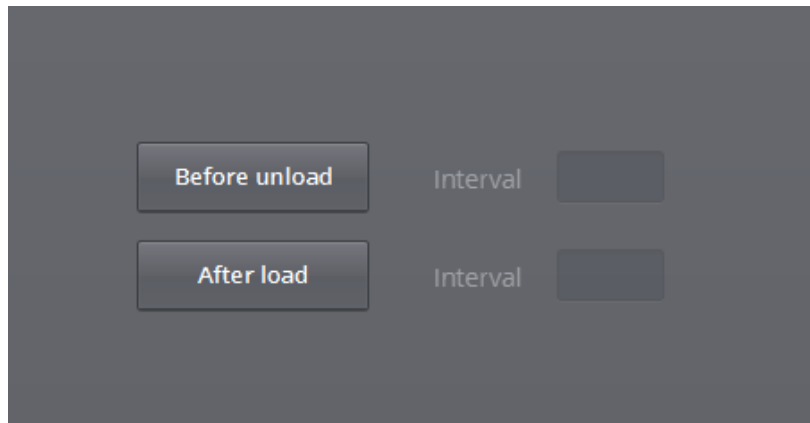
The interventions may be set using this screen. In an intervention, the robot will return to its home position and the process will be interrupted. For example, this may be used in order to make a measurement. Interventions may be stopped by pressing the button again.



Picture 44 - Interventions



Picture 45 - Stop intervention (a)



Picture 46 - Stop intervention (b)

5. GUIDE

If all the data of the process are configured correctly, you may proceed with the second step: *Guide*. The following screen is displayed. Note that all device buttons of the process are shown in grey. In this screen it is not possible to click on one of these. However, transport actions may be clicked on; we will come back to this later.

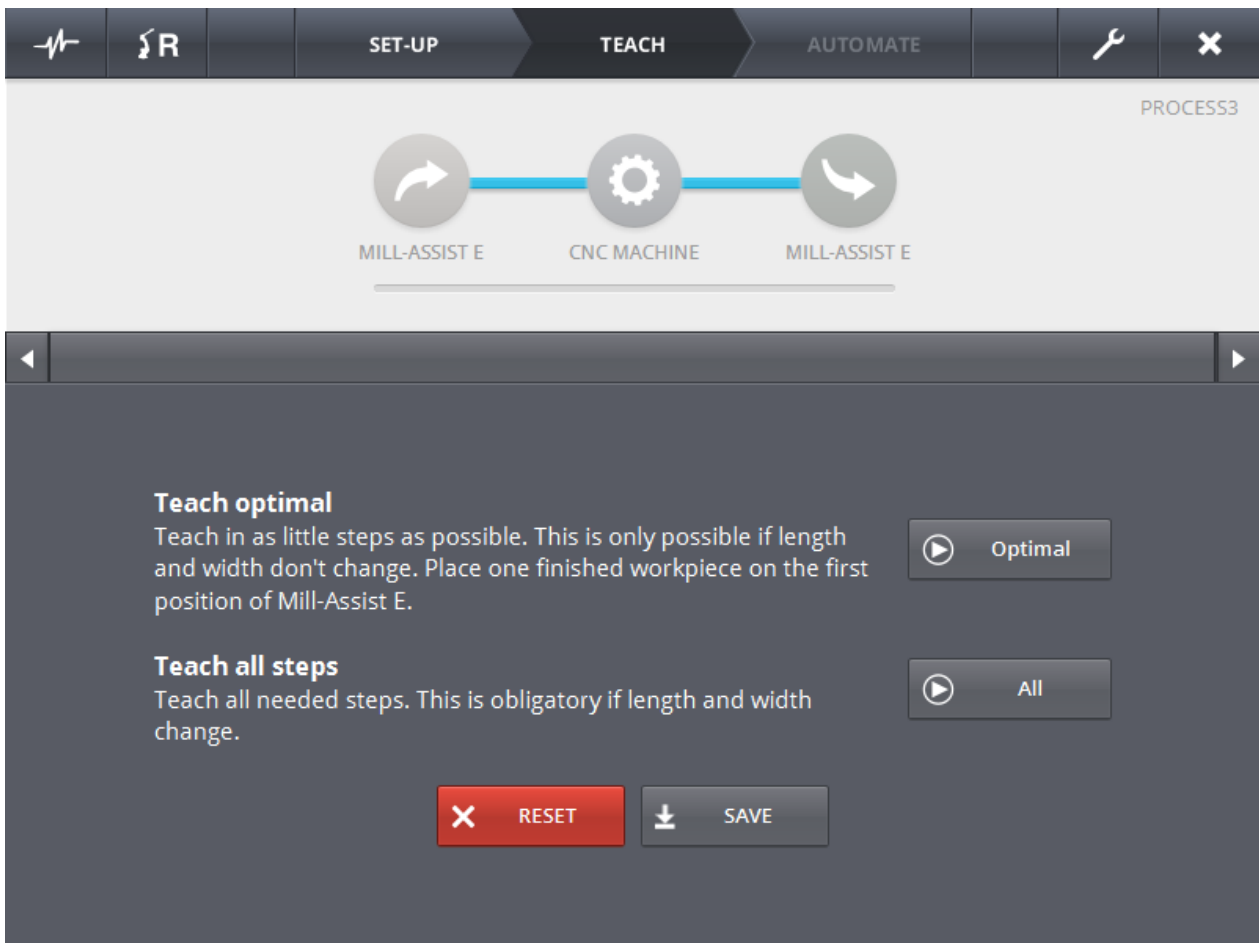
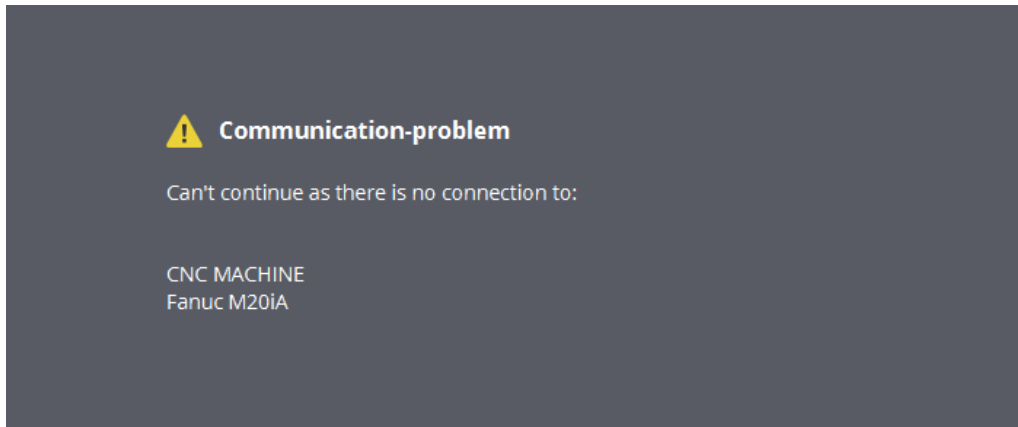


Figure 47 - Guide screen

As indicated there are two possible ways of guiding: *Optimal guiding* and *Guiding all steps*. When guiding, the robot will always be able to perform all movements **itself** between the various devices and to the workpieces. Guiding is only required to specify how workpieces should be taken hold of and how pieces should be positioned in clampings, so that the user has complete freedom in this.

Note that you cannot start if one or more devices from the process are not connected. A message will be displayed indicating which devices are not connected. (Note that this information is also available via the *Alarm* pop-up)

It is extremely important that during the learning process, pieces do not move into the robot grippers. If this happens, it is necessary to break off the learning process and start anew!



Picture 48 - Communication problem

Via the *Reset* button, the existing data learned will be erased. It is indeed so that if in the past, one or more steps have already been guided, the information learned is still stored so that the re-execution of this movement is no longer needed.

All data is saved via *Save*. Note that it is important for the process to have a valid name.

5.1. OPTIMAL GUIDING

With optimal guiding, as few as possible operations have to be learned. It is required that one finished workpiece is at hand.

The user will first teach the robot how finished pieces should be taken hold of. He does this by placing a finished piece on the stacking table and guiding the robot to the exact position in order to grasp this piece.

Next the robot will be taught how a rough piece should be taken hold of. This will also again occur on the stacking table. The robot then grasps this first rough piece (which is located at the second position), and moves to the first clamping.

Next the robot will be taught how the rough piece should be positioned in this clamping. This may happen in the machine or in the Präge device if this is present.

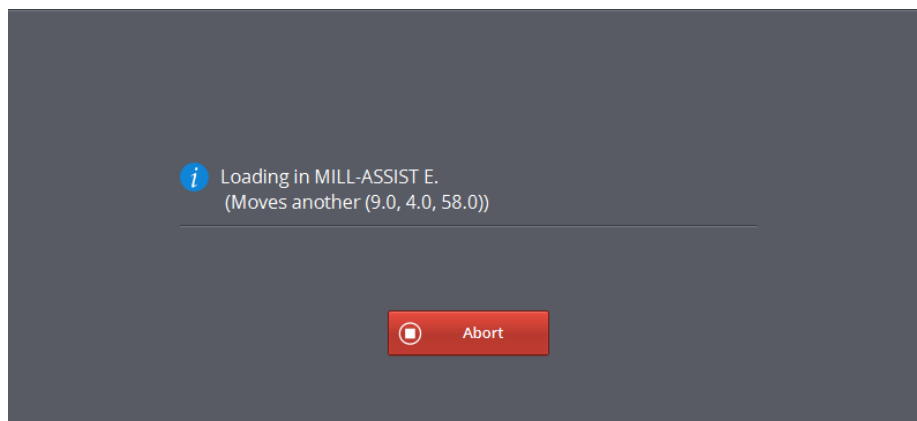
Once this is done, the system has all the necessary data. Because it is known how a rough workpiece is taken hold of and positioned in the clamping, and how a finished piece should be taken hold of, the system also knows how a finished workpiece should be taken out of the clamping. The system now knows the relationship between the rough and finished workpieces (because both workpieces

were taught on the same stacking table), and it knows the position in the clamping (this was also taught).

During the guiding process, an information message will be displayed indicating the current status. In the display of the process you can also follow which step of the process is being carried out. After opening the *Robot pop-up* it is temporarily no longer possible to restart the robot program or to send the robot to *home*. The speed of the robot may however be adjusted at any time.

An *Abort* button is always displayed during the guided implementation of the process. Using this, the process is interrupted and stopped. The robot may then be sent to its start position in a secure manner via the '*To home*' function of the robot pop-up. The guiding will then have to start again from step 1.

In addition, when the robot moves in close proximity to a device, its remaining movement distance is displayed.



Picture 49 - Abort and remaining distance

GUIDING: PRACTICAL

When the system displays the message '*Please guide the robot to the exact position.*' the robot should be guided by means of the Fanuc Teach Pendant. Prior to controlling the robot manually, the robot has to be put into "teach mode". This may be done using the 3 position switch on the control cabinet. For the guiding this switch should be set to T1.



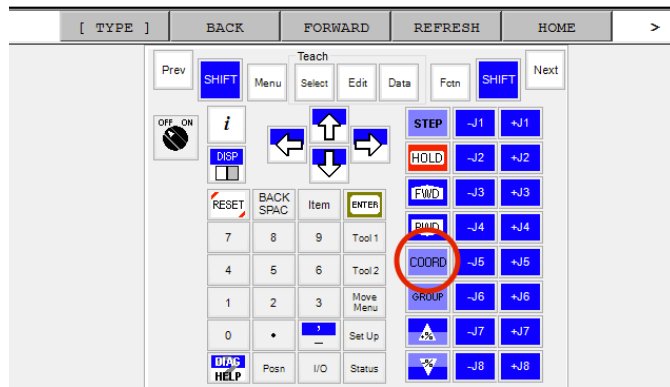
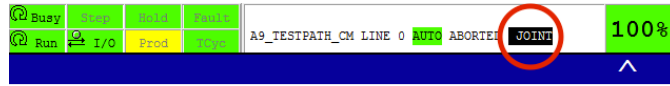
Picture 50 - 3 position switch

When the robot is in this mode, the Teach Pendant of the robot should also be on (switch at top left). In addition, it is important that one of the two dead man's buttons on the rear side of the Teach Pendant is pressed and held. When all these conditions are met, the Reset may be pressed to reset the existing error messages. The 'Fault' indicator field on the Teach Pendant becomes green and the robot continues to work as normal.

When controlling the robot manually, it is important that the robot moves in accordance with known coordinate systems. For this, the movement mode of the robot must be on USER. This movement mode may be read on the Teach Pendant. If the USER mode is not on, it is important that it is changed, by pressing the COORD key, until the indication is correct.



Picture 51 - Switch and dead man's button on de Teach Pendant



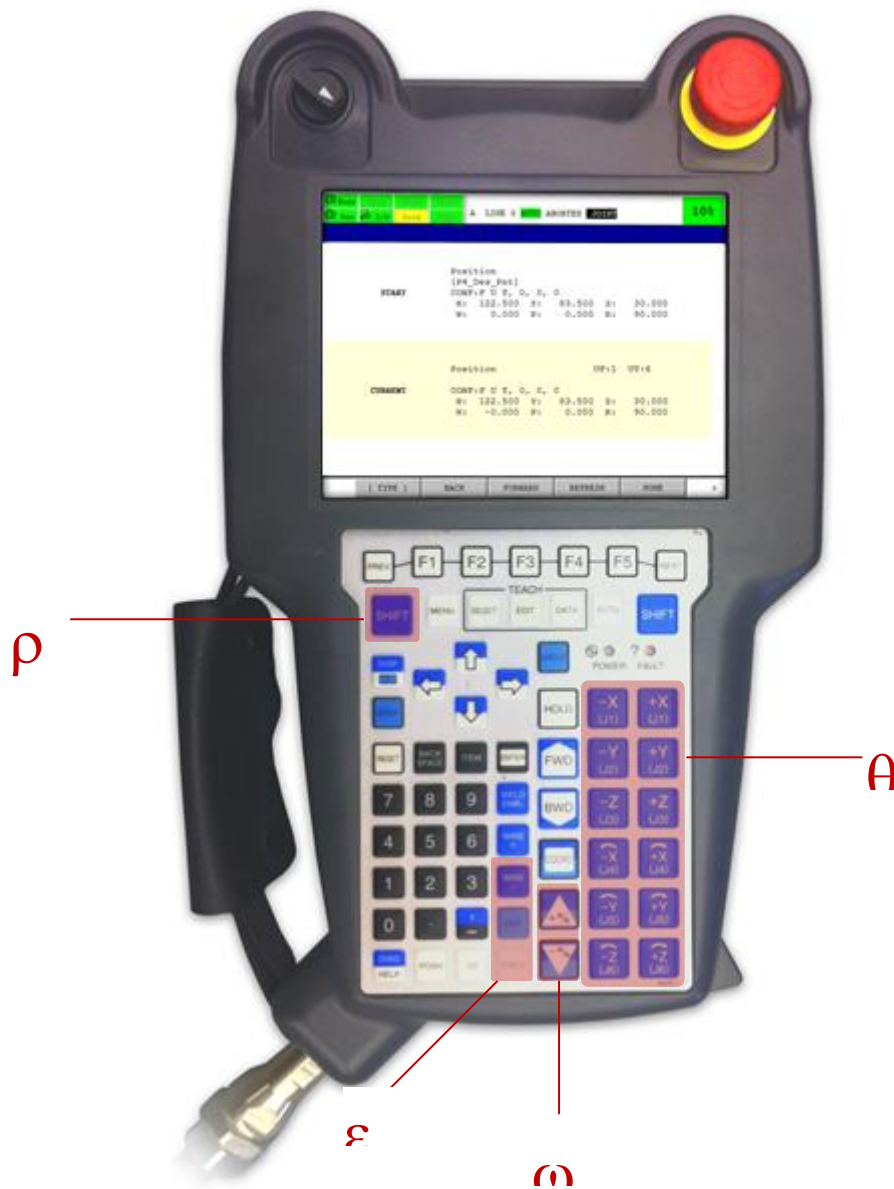
Picture 52 - Teach Pendant screen Joint vs User

The screen shown below appears on the Teach Pendant. What the starting position was (before guiding) can always be read here as well as the current position.

```
Position
[P4_Des_Pnt]
START CONF:F U T, 0, 0, 0
      X: 122.500 Y: 83.500 Z: 30.000
      W: 0.000 P: 0.000 R: 90.000
```

```
Position
UF:1 UT:6
CURRENT CONF:F U T, 0, 0, 0
      X: 123.654 Y: 82.097 Z: 26.104
      W: 0.000 P: 0.000 R: 90.000
```

Picture 53 - Teach Pendant screen



Picture 54 - Fanuc Teach Pendant

A

Movement controls: The movement of the robot may be controlled using these controls. The robot may be moved in the x-, y-, z- and w-, p- and r- direction (rotation around the x-, y- and respectively z- axis).



Speed controls: The speed with which the robot moves may be adjusted using these controls. The possible speeds with teaching are 1%, 5%, 10% and 20%.

Note that when the robot may be guided, the speed automatically goes to 10%. When the guiding is completed, the robot reverts to the speed that was set via the IPC before guiding took place.



General controls: These controls should always be used **in conjunction with the shift key** (4). Using the first two, the gripper may be controlled:

SHIFT+WIRE Closing the grippers

SHIFT + OTF Opening the grippers


It is possible that these last 3 controls do not have any printing.

The last key (*SHIFT + STATUS*) is used to indicate that the robot is at the correct position. Guiding is concluded with this and the robot moves itself further.

Guiding specifically takes place as follows. The interface on the IPC indicates that the robot must be guided to the correct position. With the aid of the movement controls the robot is guided to the correct position. Optionally, the speed controls are used to adjust the speed so that more movement may be more precise. This can be useful if the robot comes close to its destination. The robot may not be guided into a collision.

If necessary, the grippers may be opened and closed in order to verify that the robot can correctly take hold of the piece. **However, it is recommended that the opening and closing of the grippers only be used when the robot does not initially have hold of a piece.** If the robot has hold of a piece and the grippers are opened before the robot is in its correct end position, the accuracy of the learning is compromised, because the relationship between the gripper and the workpiece is lost.

When the robot is at its destination, using *SHIFT + STATUS* indicates that the guiding has ended. If all required steps have been guided, the following message appears. You may now continue further in the *Automate* screen.

 That's all! The process can now be automated. Go to 'AUTOMATE'.

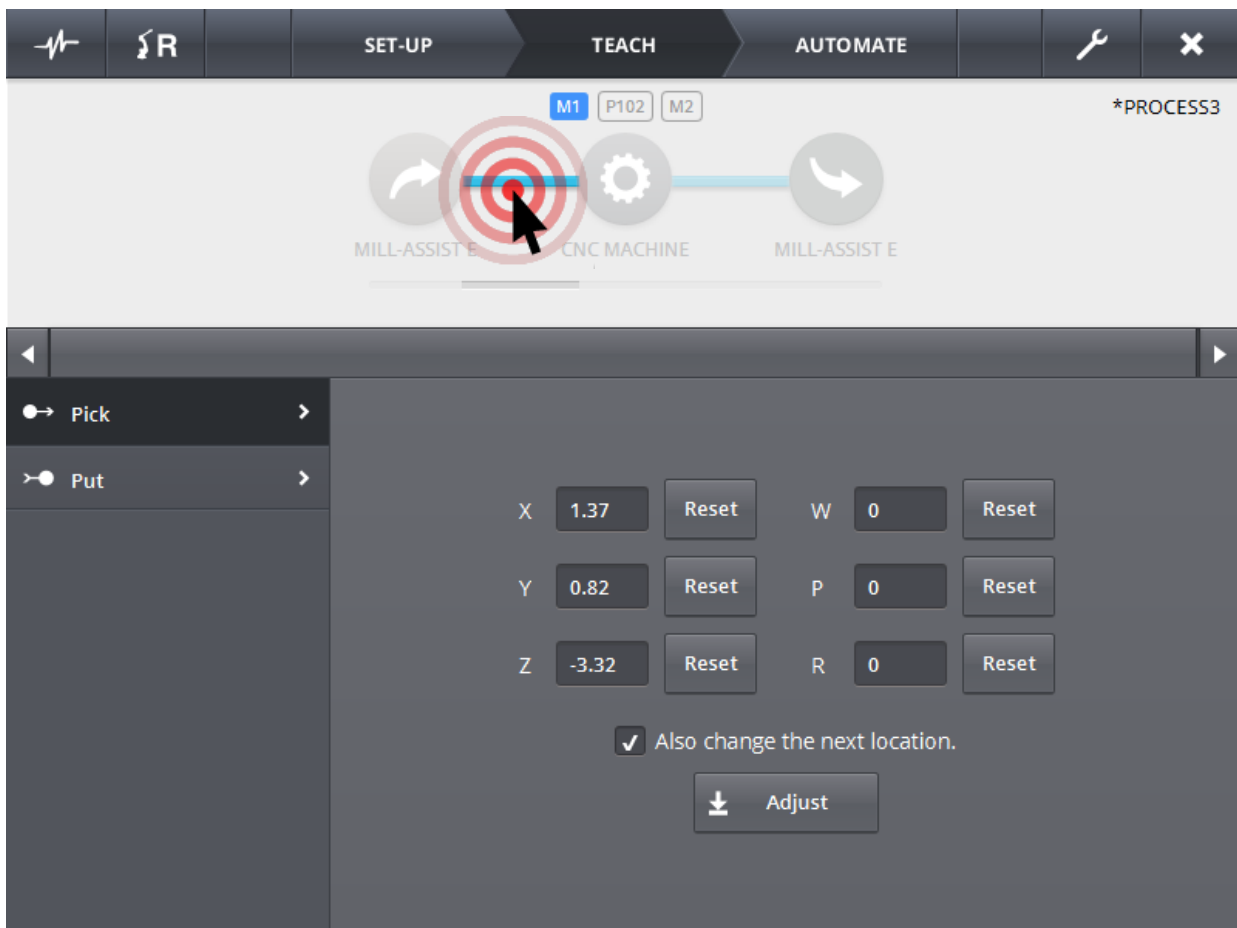
Do not forget to save the data after guiding! This may be done in the *Configure* screen by overwriting the process data, or by clicking on *Save*.

5.2. GUIDING ALL STEPS

If *Guide all steps* is selected, the robot must be guided each time before it takes hold of or sets aside a workpiece. In this way, the user has the most control over how the robot will perform these actions. The principle of guiding is the same as with *Optimal guiding*. This way of guiding takes a little more time than optimal guiding because more steps are learned and because of the need to also wait for the CNC program to finish.

5.3 CARRYING OUT MANUAL CORRECTIONS

After guiding a process, manual corrections may be carried out on the learned positions. When a transport action is selected in the *Guide* part of the software, the following screen appears:



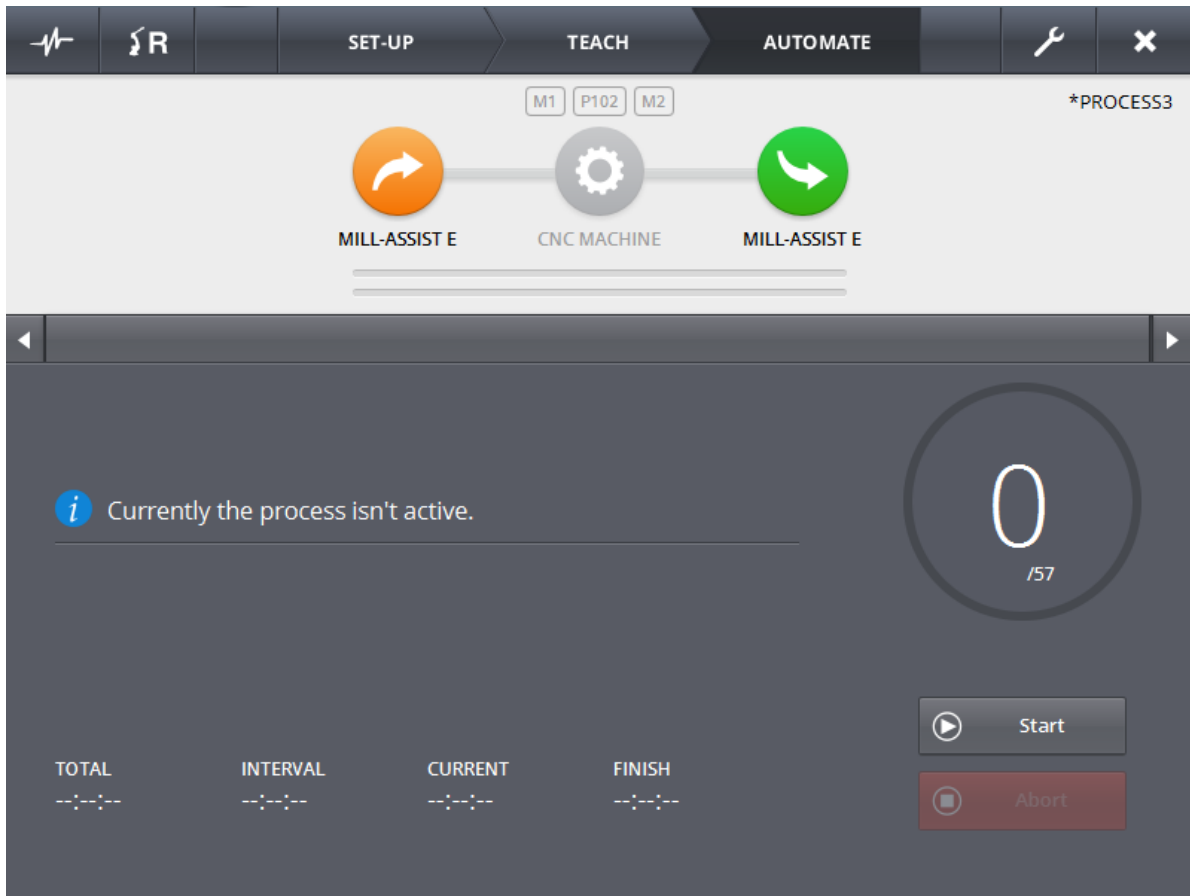
Picture 55 - Adjust guide data

A correction to the position for *Pick up* and *Set down* may be carried out per transport action. Here, the learned position is displayed (the effective displacement of the robot). These data may be modified and by clicking on *Adjust* and they are kept up to date effectively. As long as you do not click on *Adjust*, the position will not be adjusted and this may be restored per coordinate by clicking on *Reset*.

If the check-box *Also adjust following position* is ticked, the correction made will be carried out on the following move. For example, it will often be the case that a piece is taken hold of differently (e.g. extra 20mm in the X-direction), the piece also has to be positioned differently in the clamp (in terms of position of the robot, this 20mm will also have to be compensated by setting aside).

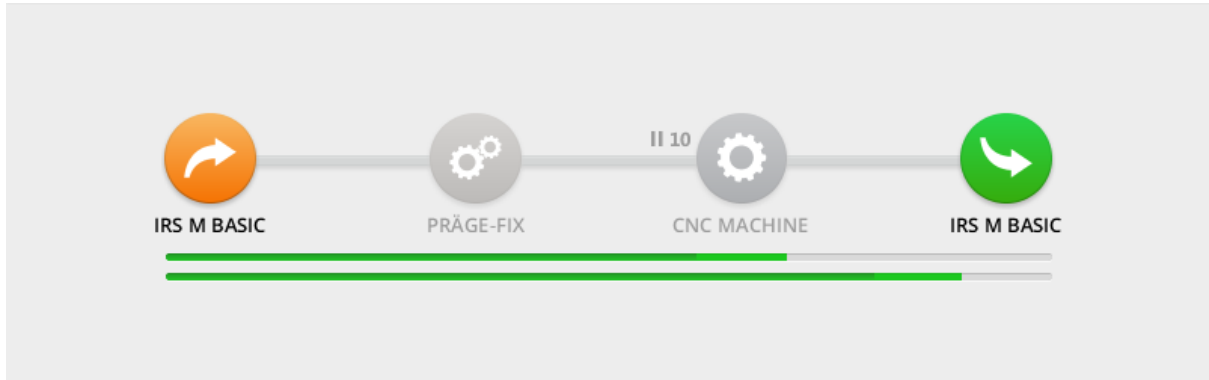
6. AUTOMATE

If all data has been correctly configured, and all necessary steps have been guided, the process may automatically be carried out. The following screen is displayed.



Picture 56 - Automate

The known screen layout is also used here. The specific part contains information about the automation process. Note that during implementation of the process, the steps that are being carried out may be followed at any moment in process representation.



Picture 57 - Automate process representation

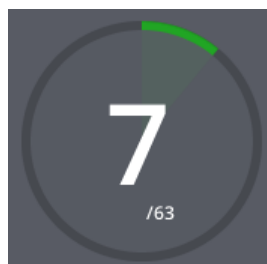
The process may be started by clicking the *Start* button on the right-hand side below. Note that during automatic execution of the process, the robot may not be sent home and may not be restarted. The speed however, may be adjusted.

6.1 SCREEN LAYOUT, SPECIFIC PART

The specific part contains various sorts of information.

A status message is displayed on the top left-hand side. The information that is displayed here is similar to that displayed in the Guide screen. Displayed at any moment are what has correctly taken place and when the robot approaches an end position, how much the remaining distance is (ditto **Fout! Verwijzingsbron niet gevonden.**).

The number of finished pieces is displayed on the right-hand side. It also shows how many pieces will be processed throughout the whole process and the percentage of finished pieces will be displayed graphically. Initially, the number of finished pieces is 1, because with the optimal guidance we have placed 1 finished piece on the stacker.



Picture 58 - Automate (numbers)

At the bottom left, some time estimates are displayed. The total time is displayed, in addition, the interval at which finished workpieces are set aside. The remaining time of the current workpiece and the time before the entire series is ready are displayed.

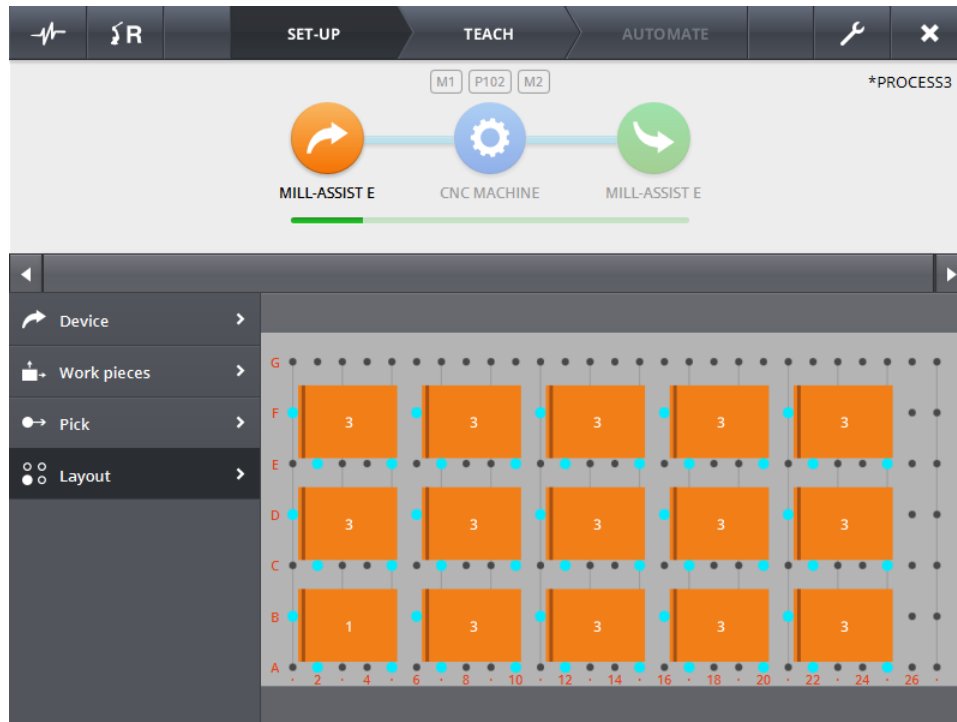
TOTAAL	INTERVAL	HUIDIG	REEKS
00:03:13	00:00:42	00:00:06	00:26:46

Picture 59 - Time estimates

The process may be stopped at any time with the *Abort* button. Note that you will need to start anew, and that the stacking table must be filled with rough workpieces.

6.2. DEVICE: MILL-ASSIST E

In the process representation one is able to see that the Mill-Assist E icons are active. When you click on this icon, the next screen opens in the specific part. There are three menu items available: *Layout*, *Replace* and *Add*.



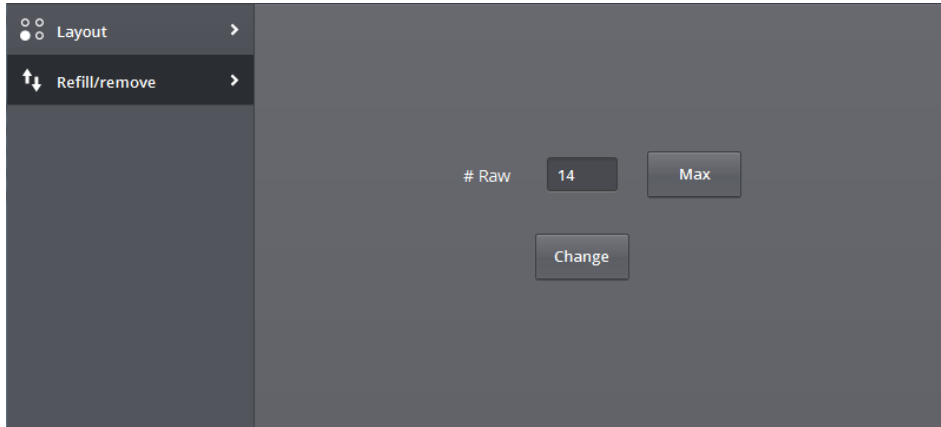
Picture 60 - Automate (IRS M Basic)

LAYOUT

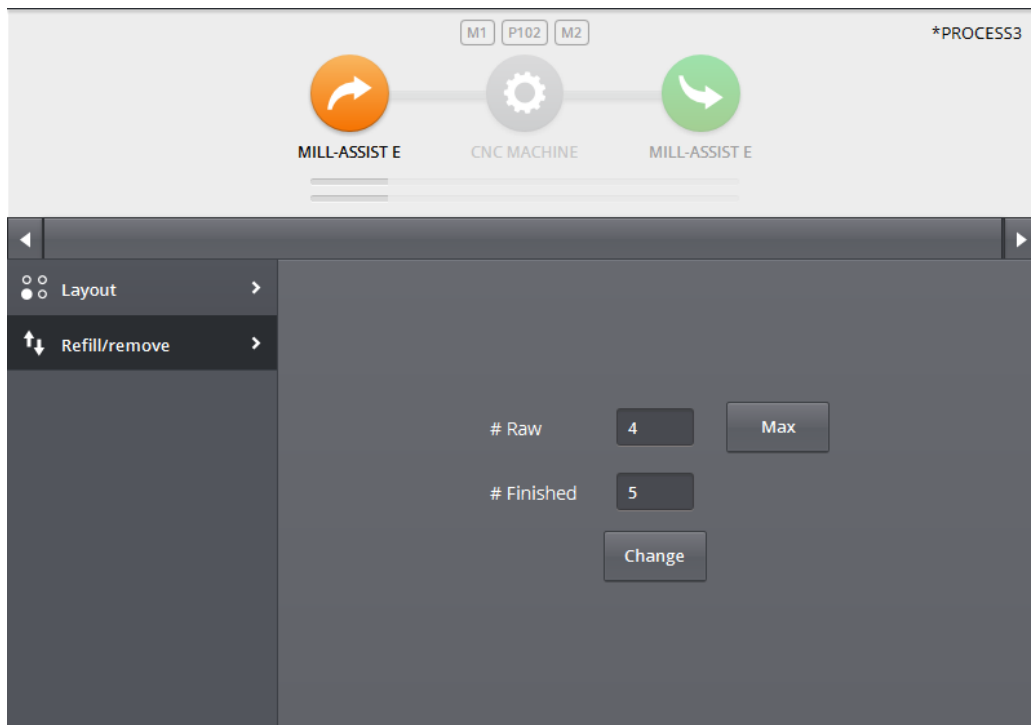
An overview of the stacking table is displayed in the layout screen. The orange workpieces show (just like in the Configure part) the rough workpieces. The green workpieces are those that are finished. This overview is always updated if one of the contents of the table changes.

ADDING/REMOVING

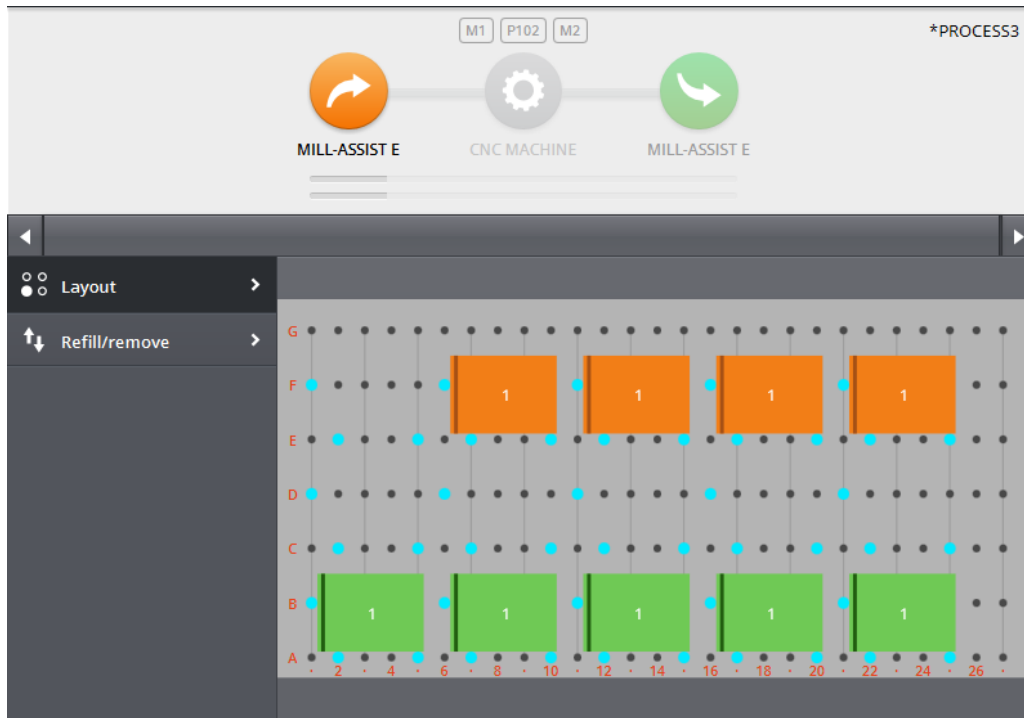
In the adding/removing screen one may select how many pieces are there per device. In the figure below (Picture 611) you can see an example wherein 15 rough pieces may be placed on the device. In this case the device is only used for the rough pieces. When the device is also used for finished pieces, one also has an entry field for '# Finished'. Note that if you supplement the number of rough pieces, one always begins at the top. The finished pieces will be supplemented from position one. This may be clearly seen on Picture 62 - Example adding/removing (1) and Picture 63 - Example adding/removing (2).



Picture 61 - Adding/removing



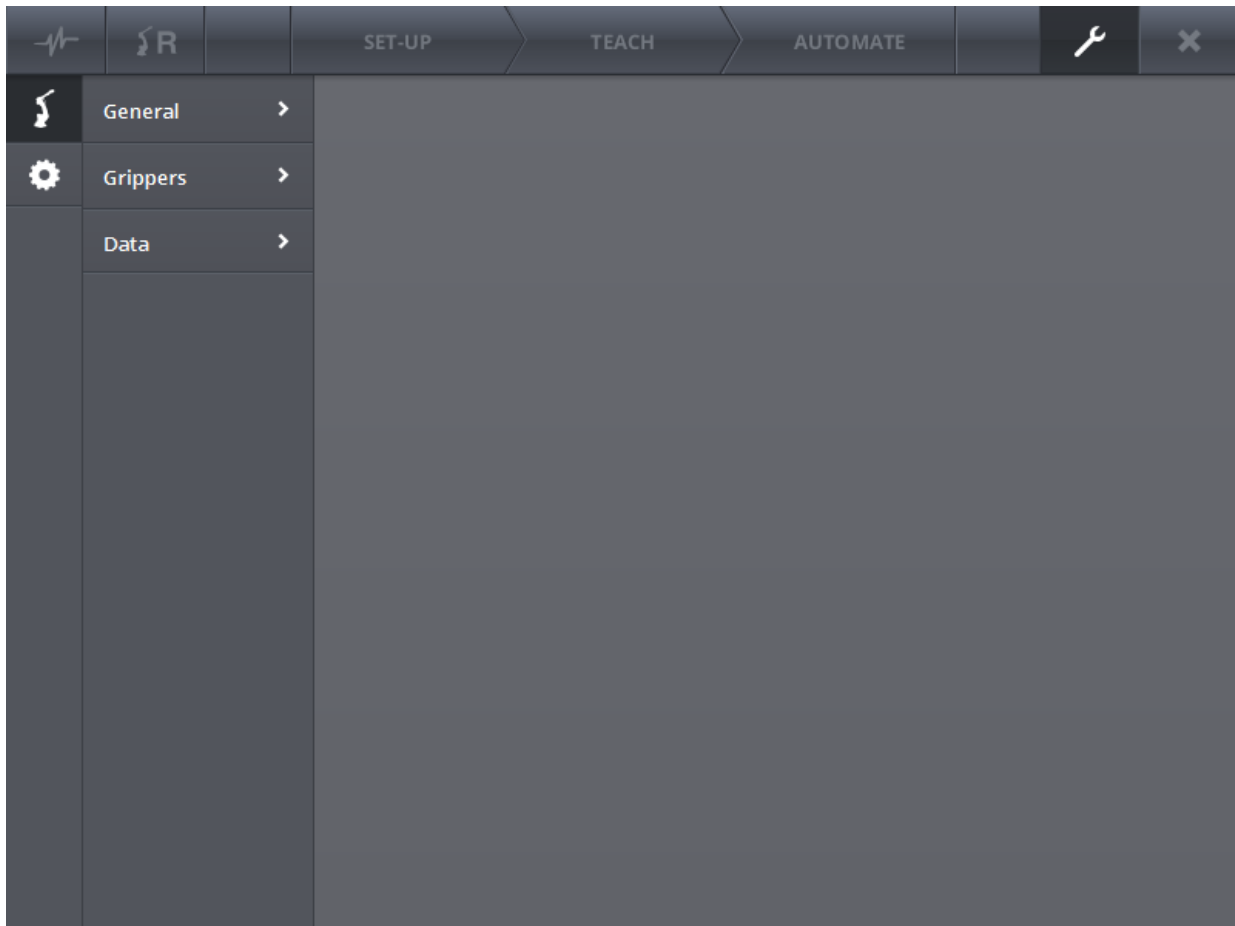
Picture 62 - Example adding/removing (1)



Picture 63 - Example adding/removing (2)

7. ADMIN

Various settings may be adjusted via the *Admin* screens with respect to the robot and its grippers or the different devices. Not all components of this admin will be discussed in detail, since certain screens are for RoboJob employees.



Picture 64 - Admin screen

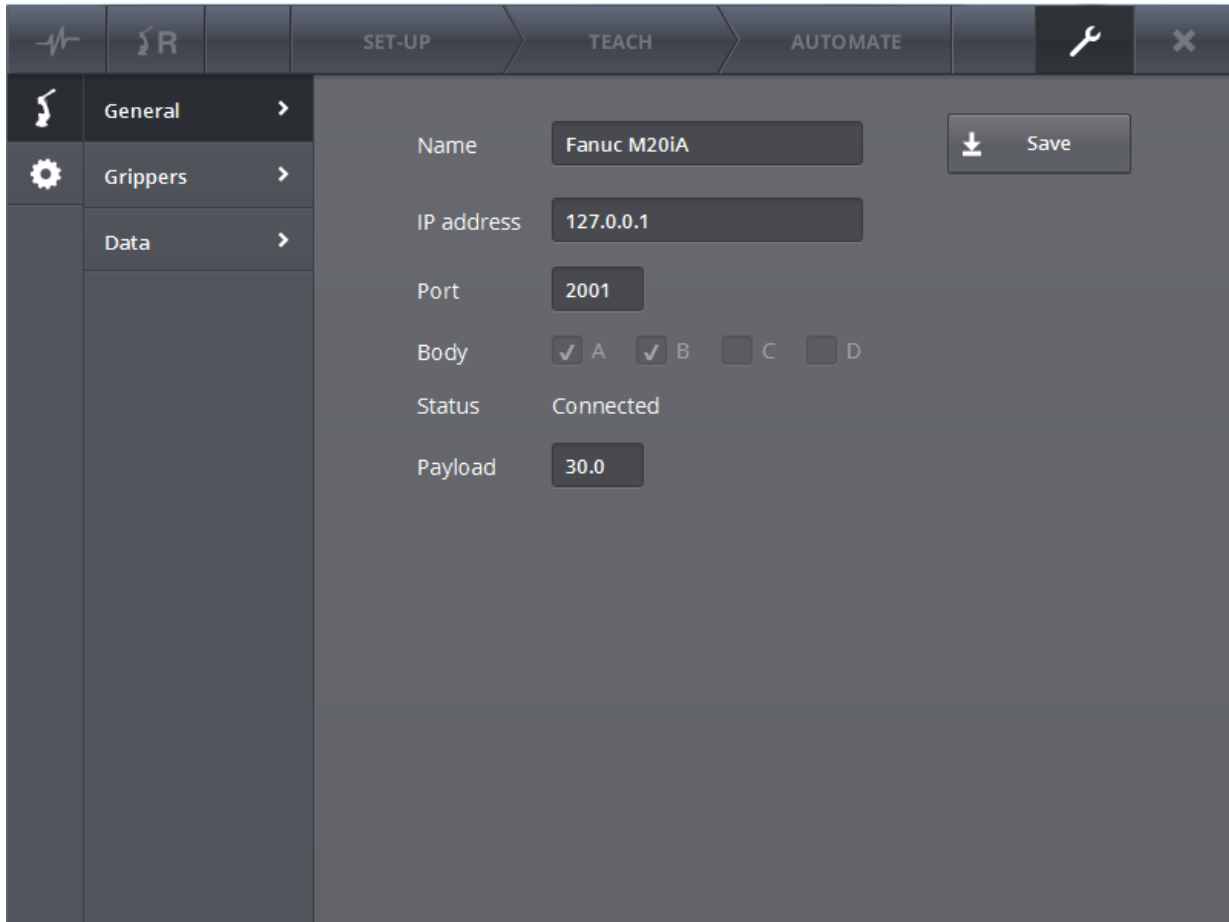
The admin screen is built up from one main menu, a sub-menu (which depends on the selected menu item) and a remaining content area. The main menu consists of two items: A robot item and a device item.

ADMIN: ROBOT

The robot part of the admin contains two sub-menu items: *General*, *Grippers* and *Data*.

GENERAL

The name of the robot may be modified in this part (free text field). In addition, the IP address and the port to which the robot is waiting to be connected may be set. The status shows whether the robot is connected or not.



Picture 65 - Admin robot (general)

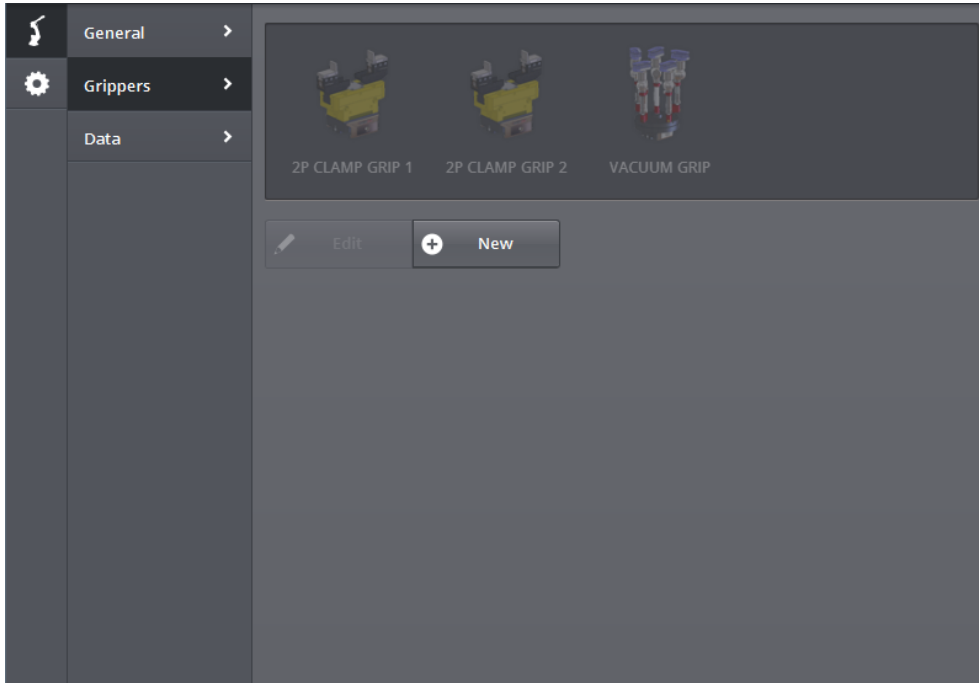
GRIPPERS

The grippers may be controlled in the *Grippers* screen. Existing grippers may be adjusted by selecting a gripper and clicking on *Adapt*. New grippers may be added via *New*. The following items may be adjusted:

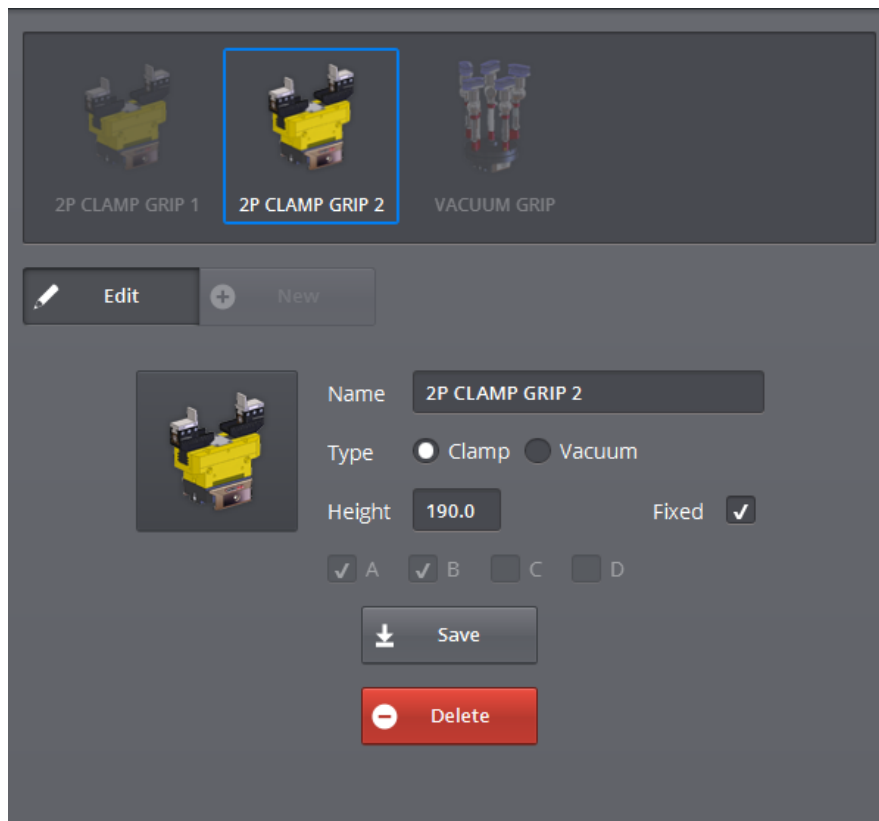
- the name of the gripper.
- the image of the gripper.
- the height.
- the height is fixed.

Additionally, existing grippers may be removed. Adjusting the gripper image may be done by clicking on the image. A dialogue window appears with which an image may be searched for on the hard disk.

The best image size is 100px wide by 90px high and the best type is *.png. For the best results please provide images of this size with a transparent background.



Picture 66 - Admin robot (grippers)

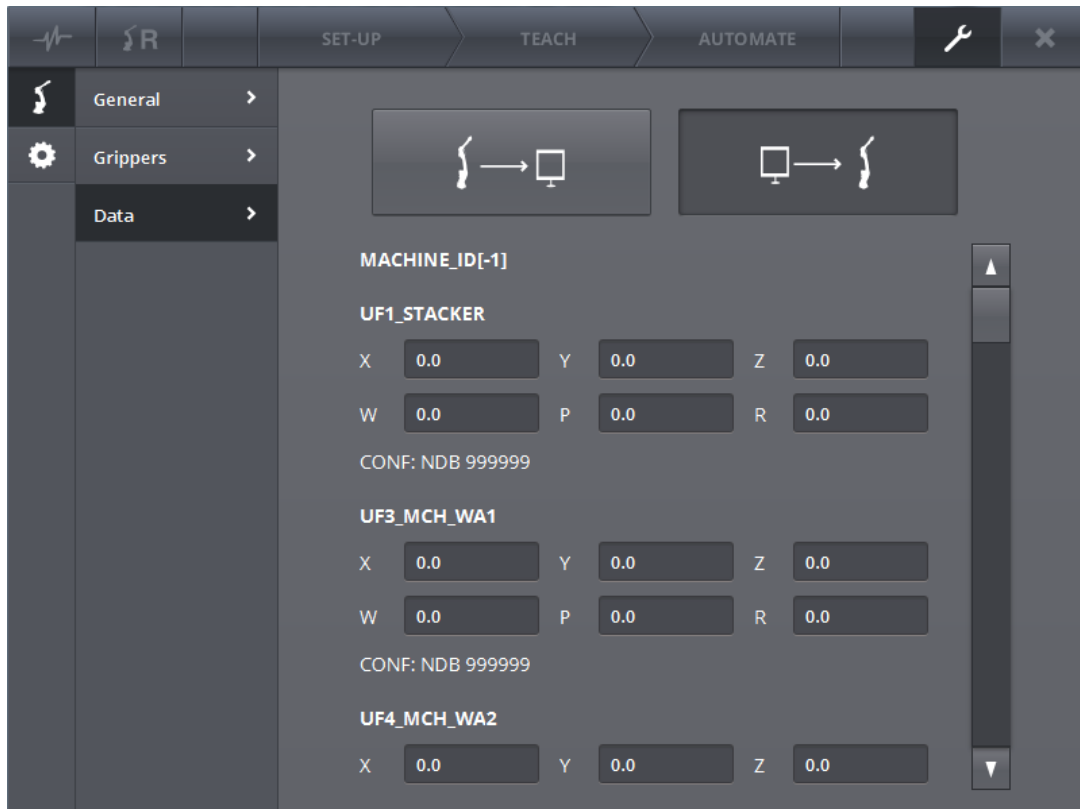


Picture 67 - Adapt grippers - select image

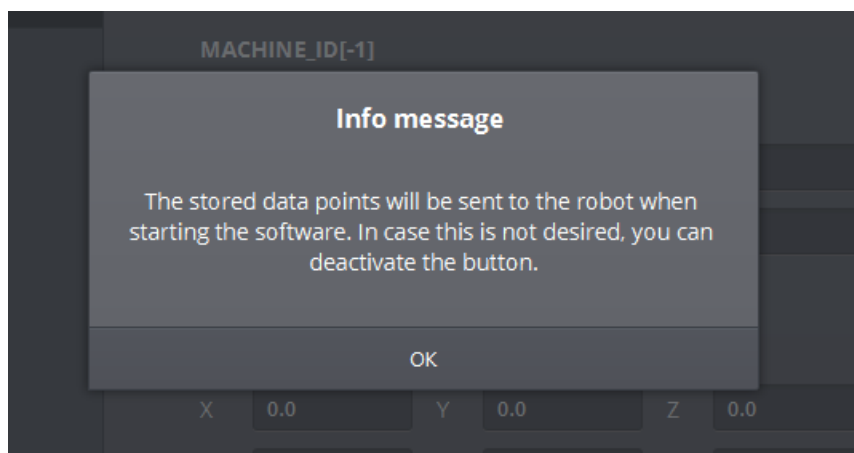
DATA

The *Data* sub-menu is used for installations with the movability option. This menu should only and solely be used for installation by authorized persons. One has two buttons in this menu: one for sending data from the robot to the IPC and

one for sending data from the IPC to the robot. The first button loads the data from the robot with regard to IP points, user frames, tool frames and reference points. The second button has two positions: active or inactive. The first time this button is activated, an information message will be displayed with additional explanation about this feature. In the event that this button is active, the stored data will be sent to the robot each time the IPC software is started up. This way one is assured that the robot always uses the same information after moving.



Picture 68 - Data sub-menu

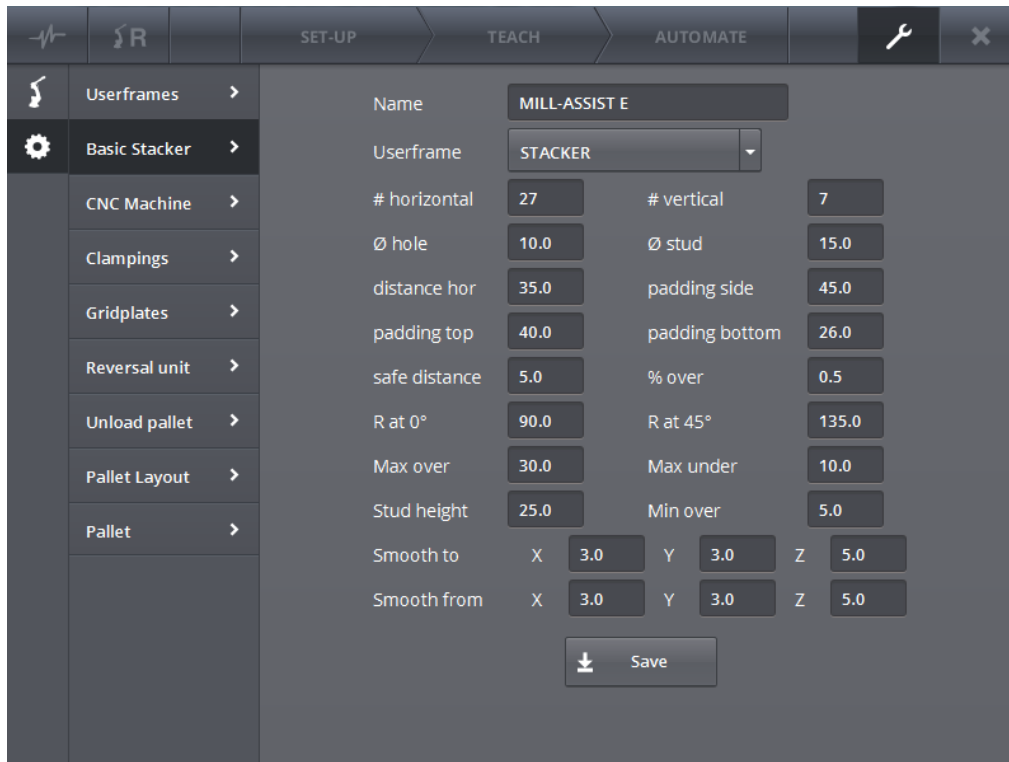


Picture 69 - Info message data menu

ADMIN: DEVICE

The sub-menu items of the device admin are *User frames*, *Basic Stacker*, *CNC Machine*, *Clamping*, *Präge-Fix*, *Set Aside Tray*, *Grid Plates* and *Revolving unit*. It is possible however that some menu items are unavailable. This also depends on the installation. The *User Frames* item will not be discussed since it is not relevant for a standard user.

BASIC STACKER

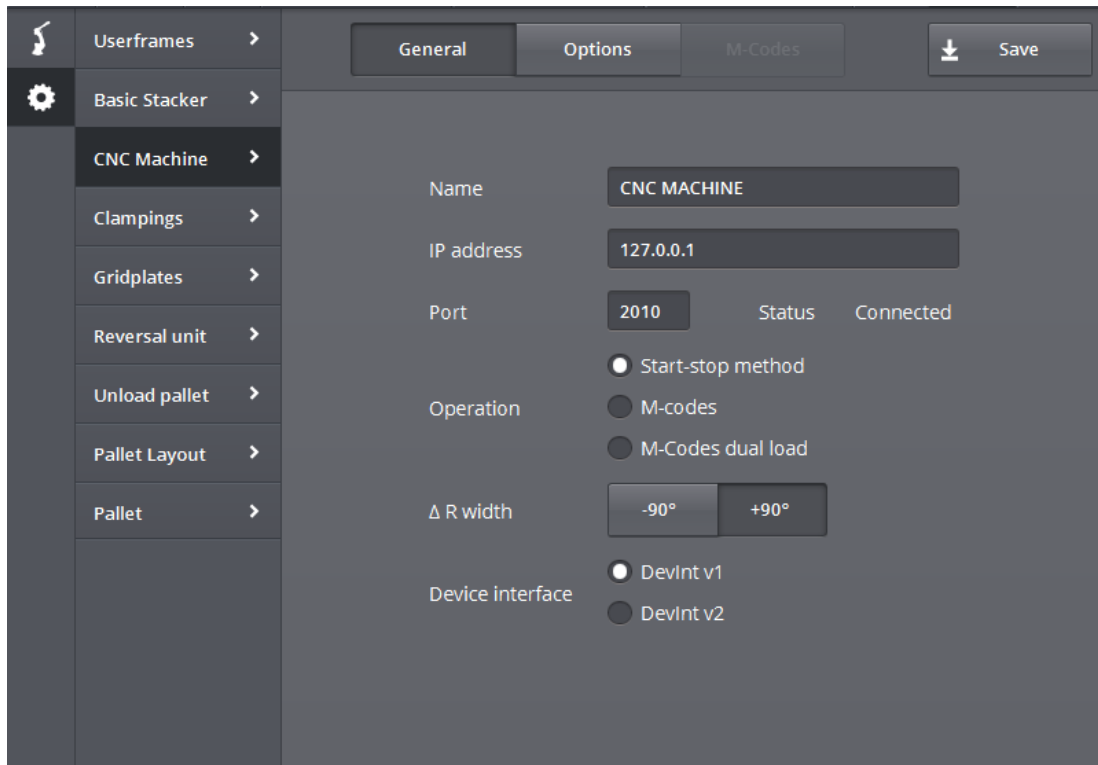


Picture 70 - Admin device (Basic Stacker)

In this screen, all kinds of parameters may be set w.r.t. the IRS M Basic. Important for the user are the lower two (smooth to and smooth from). With this it can be checked which smooth pieces of the IRS M Basic are being loaded and unloaded (this principle is similar to the setting of load and unload in the configure part of the CNC Machine).

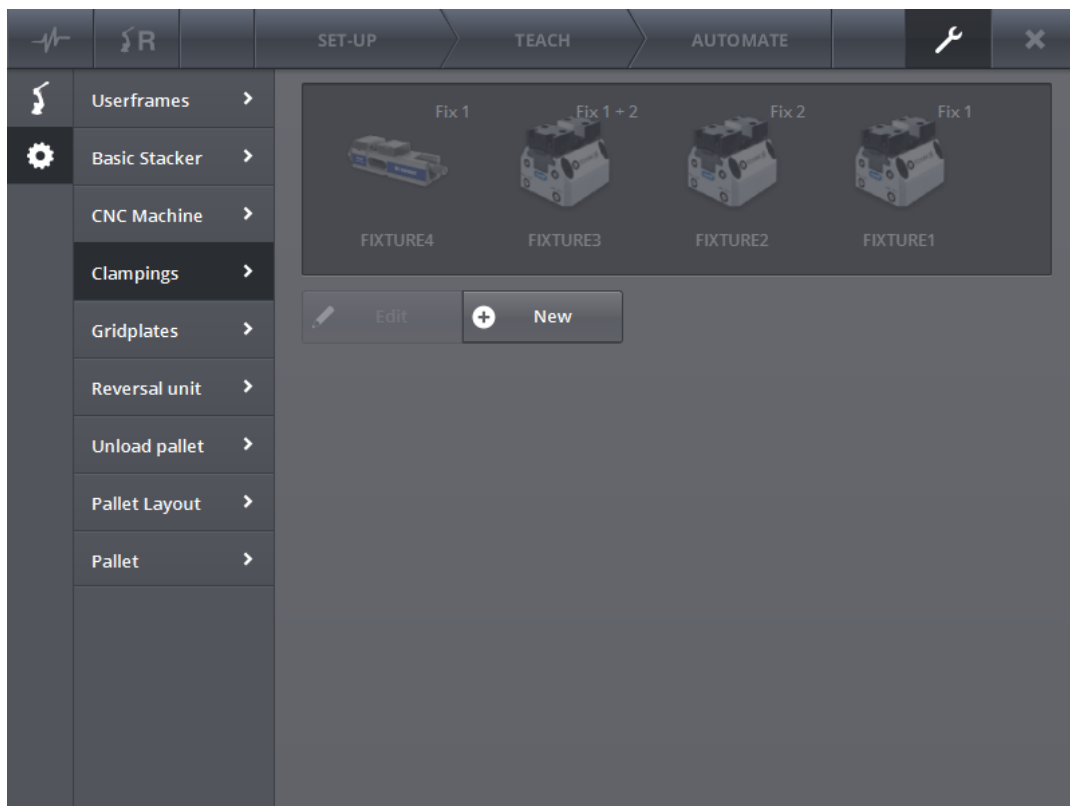
CNC MACHINE

Information w.r.t. the CNC Machine may be configured in this screen. This screen is basically unimportant for the user.



Picture 71 - Admin device (CNC Machine)

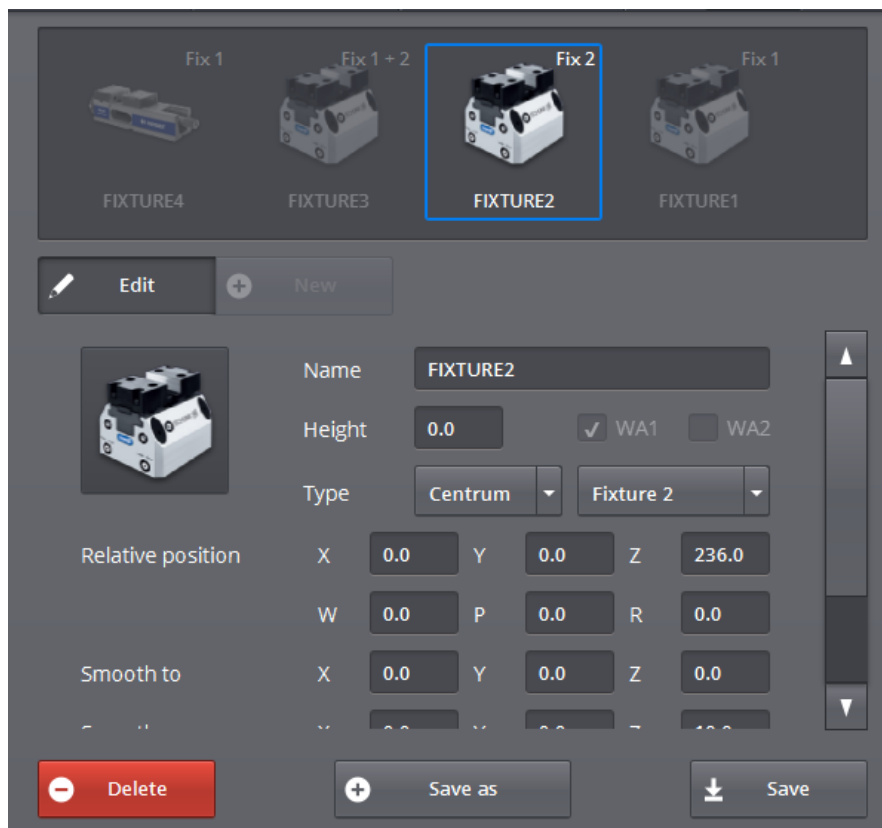
CLAMPING



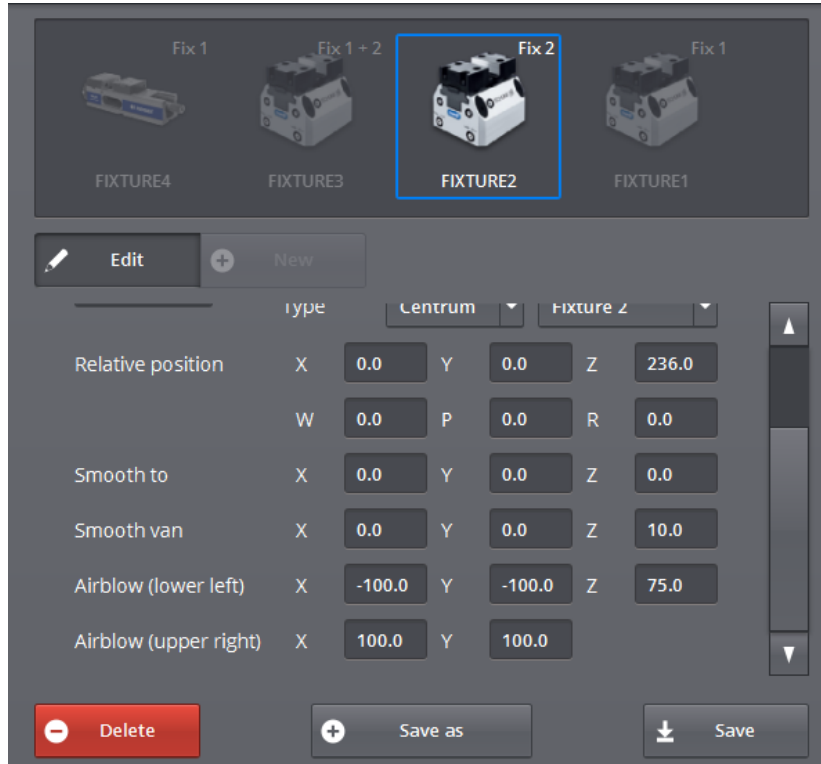
Picture 72 - Admin device (Clampings)

The clampings that are positioned in the machine may be configured in this screen. Here too, both existing clampings may be adjusted (and removed) as well as new clampings added.

In addition to the name, image and height, the relative position may be entered (with respect to the zero point on the machine) and the standard smooth from and to may be entered. Likewise it is possible to define a default airflow rectangle (see Picture 74 - Adapting clampings (2)). To be able to define a rectangle, we make use of 2 coordinates. The first coordinate indicates the lower left-hand corner of the rectangle, with which the second indicates the top right-hand corner. One must therefore imagine that the clamping has been centrally positioned and a rectangle is defined around it. Note that these two coordinates are relative with respect to the clamping. This means that if we take $X = 5$, we are going to move 5mm to the right of the clamping.



Picture 73 - Adapting clampings (1)



Picture 74 - Adapting clampings (2)

PRÄGE-FIX

This screen is unimportant for the user and will therefore not be discussed.

SETTING ASIDE TRAY

This screen is unimportant for the user and will therefore not be discussed.

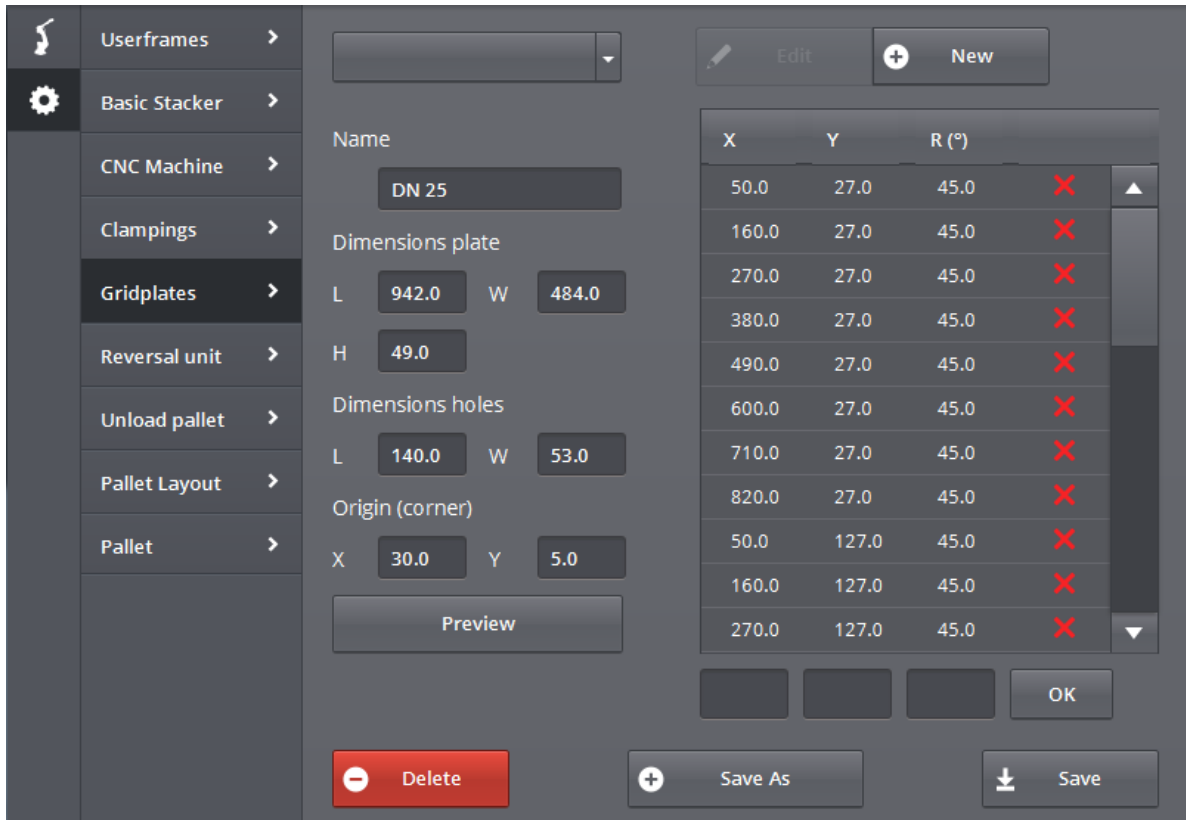
GRID PLATES

It is possible to enter a proprietary grid plate. This is done via the grid plates menu. We discuss the most important and necessary settings below:

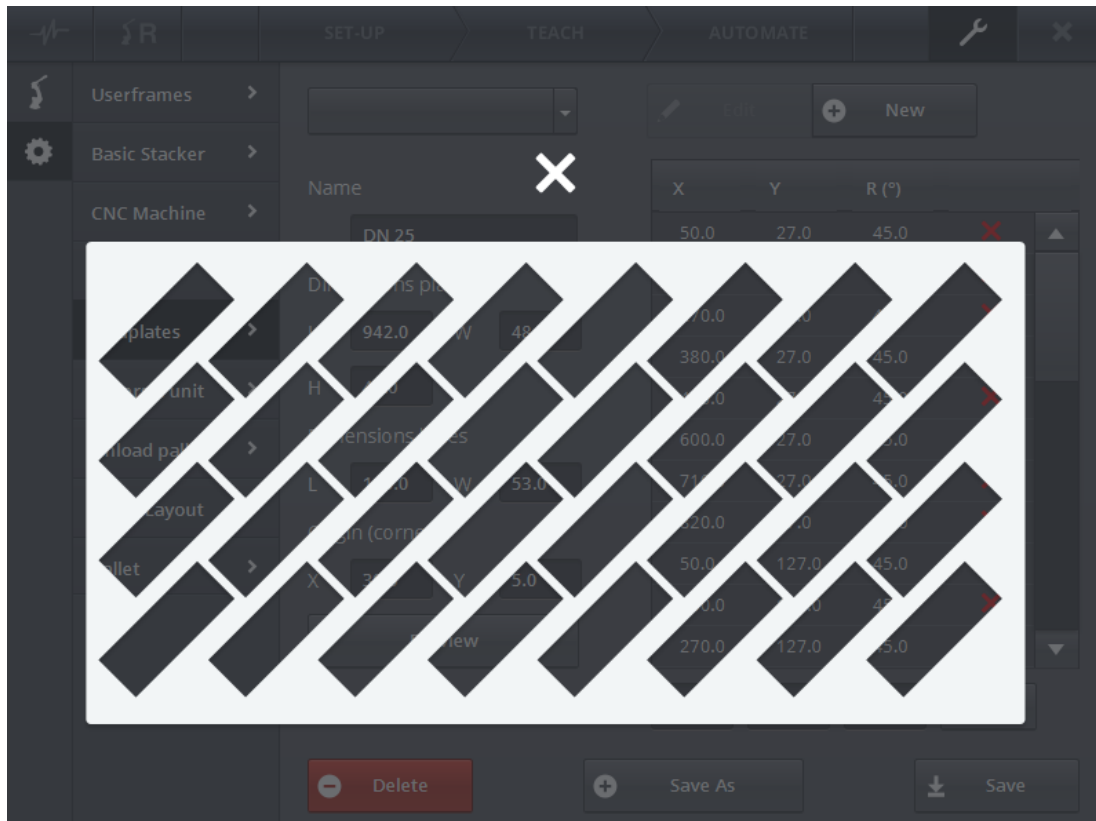
- Name: the unique name of the grid plate
- Plate dimensions: the total size of the plate in length (L), width (W) and height (H)
- Plate position: the relative position of the lower left-hand corner in relation to the zero point of the stacker
- Hole dimensions: the length and the width of 1 hole in the plate (hole into which the workpiece must come)
- Zero point: the zero point of the grid plate in relation to the bottom corner of the stacker/pallet
- Hole positions: In the table (right-hand side of the screen) you can see a list with the positions of each hole. The point that is defined here, is the bottom left-hand corner of the hole.

The angle (R°) is also the rotation of the hole around this same hole. Note that it is therefore possible to define each hole separately.

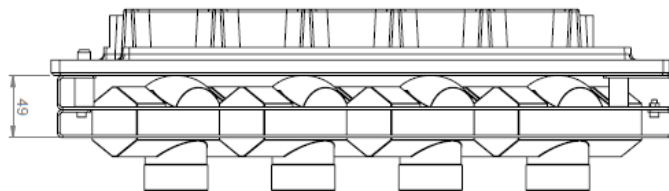
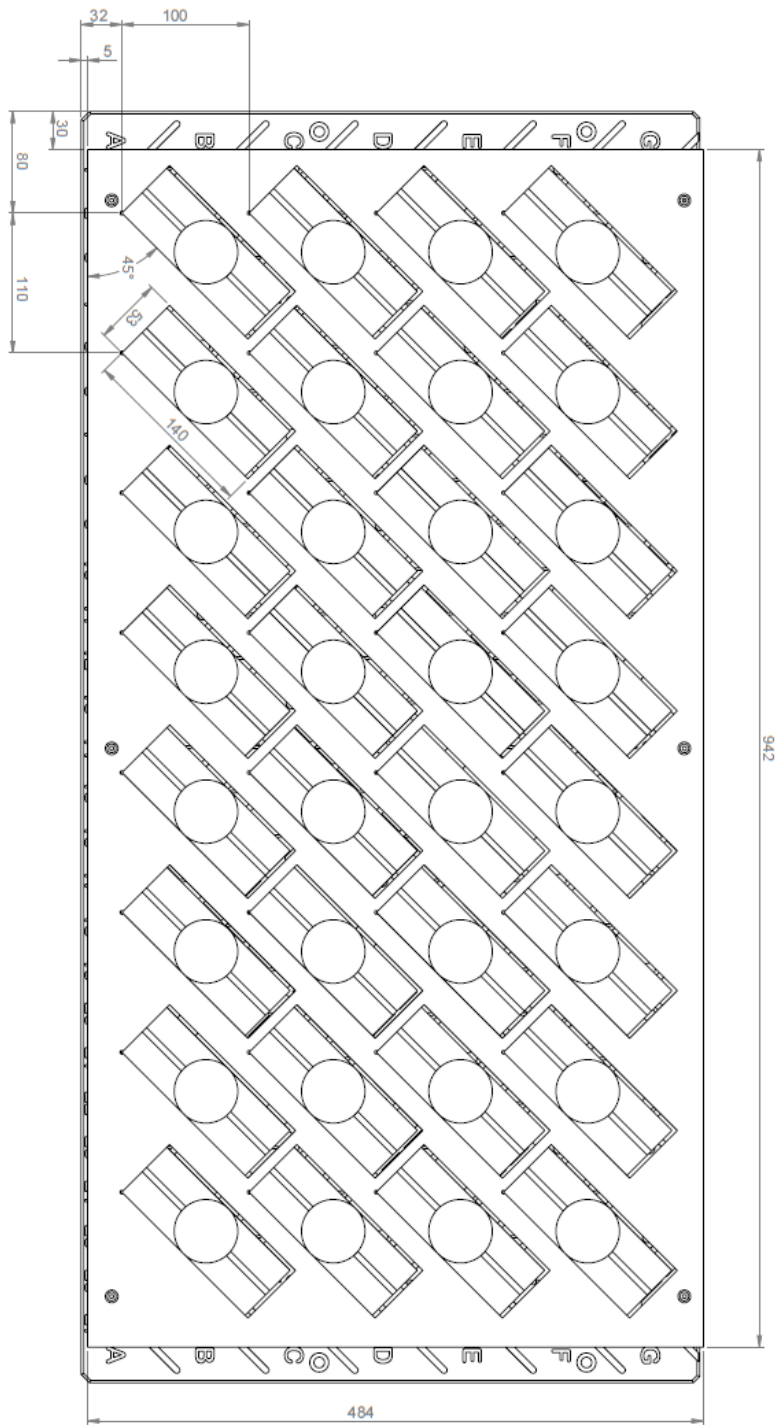
- Example: It is possible to retrieve an example of the plate at any time. This can be done by clicking on the preview button.



Picture 75 - Admin device (Grid plates)



Picture 76 - Example of grid plate



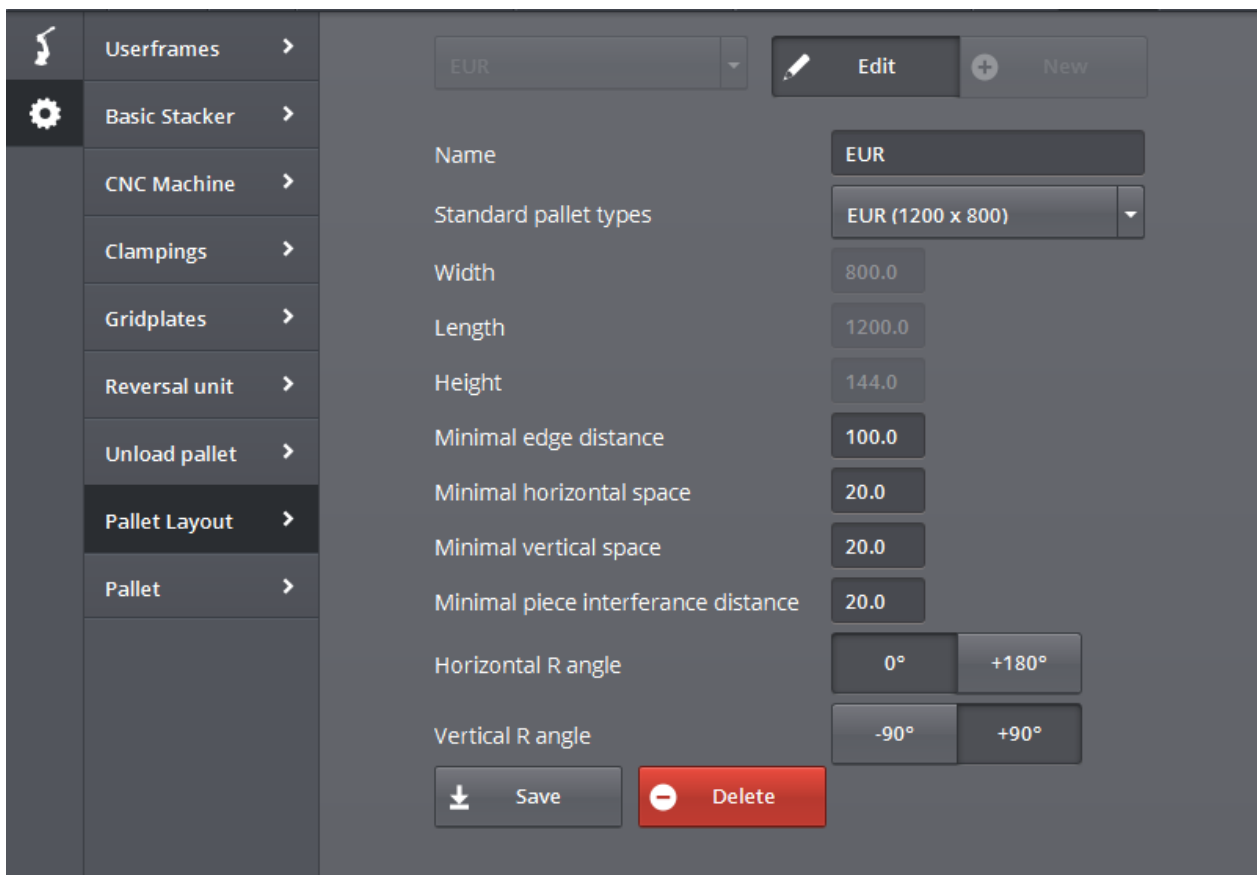
REVOLVING UNIT

This screen is unimportant for the user and will therefore not be discussed.

PALLET LAYOUT

It is possible to create a pallet layout yourself. We discuss the most important and necessary settings below:

- Standard pallet type: pallets occur in predefined dimensions (EUR, EUR2, EUR6, etc.) By selecting a determined standard type, the length, height and width of the pallet layout is filled in with the ISO values of the type. If CUSTOM is selected, the dimensions of the pallet layout may be determined by yourself.
- Minimum distance from edge: minimum margin between the outside pieces and the edge of the pallet.
- Minimum horizontal space: minimum distance between adjacent pieces in the horizontal direction.
- Minimum vertical space: minimum distance between adjacent pieces in the vertical direction.
- Minimum distance between the pieces: minimum distance between adjacent pieces in both the horizontal and vertical direction.



Picture 77 - Pallet layout

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