User manual

AMACS-Manure drying tunnel-

Code No. 99-97-6071

Edition: 04/2014 GB (Version: 2.0.6)

These instructions are a translation of the original instructions!

Program version

The product described in this manual is computer-based, and most functions are realised by software. This manual corresponds to:

Software version: V2.0.6

Product- and Documentation changes:

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IMPORTANT

Notes concerning the alarm system

Where climatic control is used in livestock buildings, break-downs, malfunctions or faulty settings may cause substantial damage and financial losses. It is therefore **most important to install a separate, independent alarm system**, which monitors the house concurrently with climatic control. Please note that the product liability clause of **BIG DUTCHMAN**'s general terms and conditions of sale and delivery specifies that an alarm system **must be installed**.

We want to draw your attention to EU-directive No. 998 of 14/12-1993 concerning minimum requirements for domestic animals, which specifies that an alarm system must be installed in any house, which is mechanically ventilated. In addition to this, there must be a suitable emergency system.

1 Main screen

With the **Big Dutchman** manure drying runnel, fresh or pre-dried manure from cage systems and aviaries for laying hens can be dried in an optimum way, thus achieving a dry matter content as high as possible. The software is available for a manure drying tunnel as belt drying system with distributing auger (OptiSec) or as plate drying system with slewing unit (OptiPlate). A maximum of 20 manure removal groups can be configured independent of the maximum 20 manure cross belts and ensure a flexible and automatic filling of the manure drying tunnel.

	The presentation of the screenshots in this manual may differ from those depicted on your FarmController, depending on which equipment exists in your company. Which areas are visible depends on the system configuration. Menus having no function are faded out to enable a better overview.

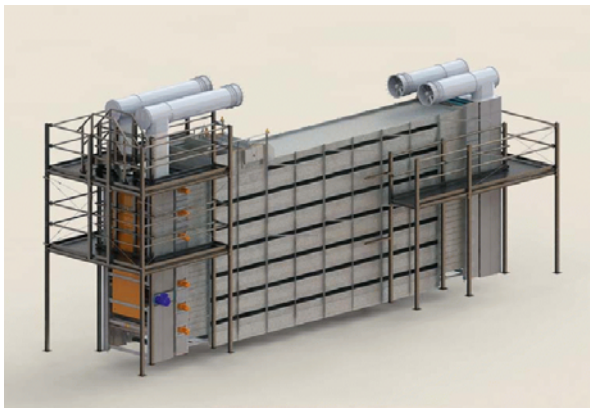


Figure 1-1: Belt drying system

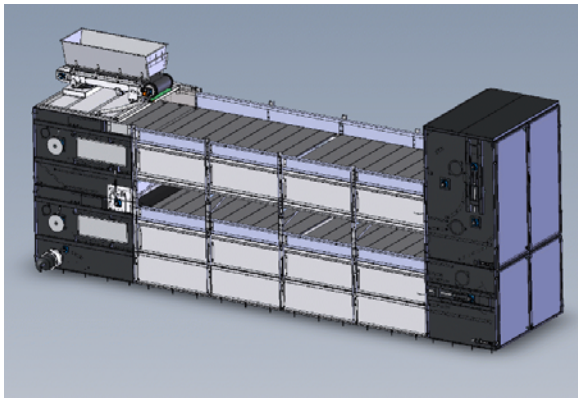
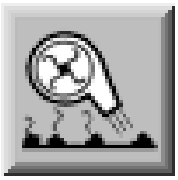


Figure 1-2: Plate drying system



To access the manure drying overview screen, open the area selection by clicking on the shaded lower right corner in each house view. Click on the manure drying tunnel symbol. The manure drying tunnel overview screen only opens if you have the required rights.

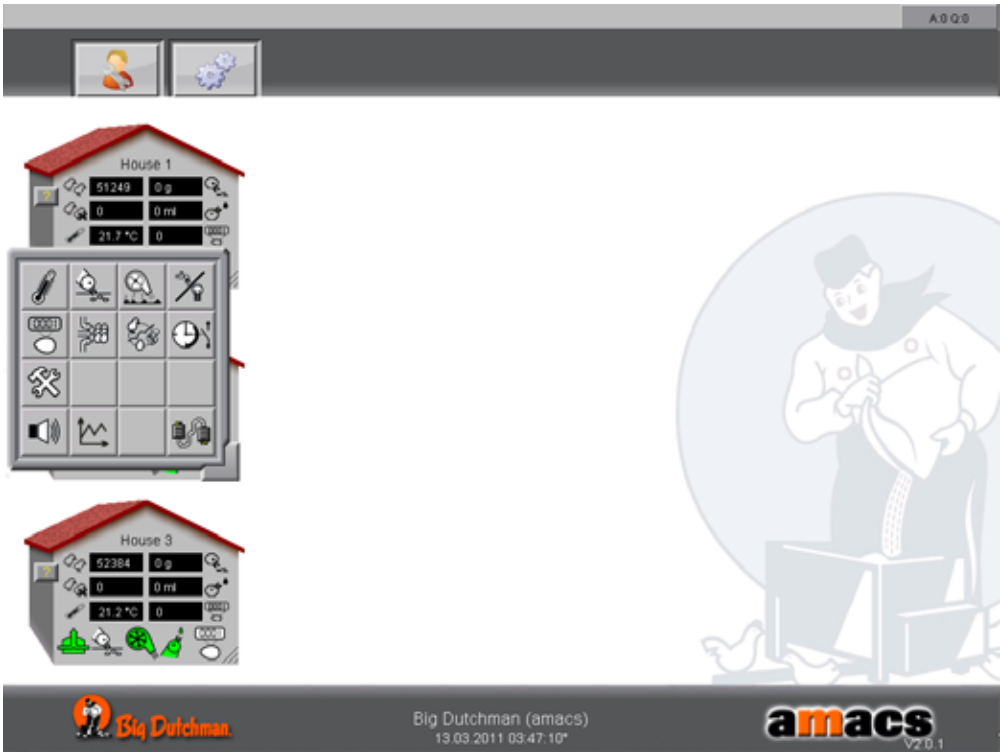


Figure 1-3: Opening the manure drying tunnel

1.1 Manure drying tunnel

The fresh manure is transported by the houses' manure cross belts or the transfer stations into the manure drying tunnel by means of the conveyor belts. It is then spread evenly on the top level by means of a distributing auger or a slewing unit. At the end of each level, the manure is dropped onto the manure belt below and is thus transported through all levels. The warm exhaust air, which is drawn from the house and blown into the pressure corridor with the aid of ventilators, can flow through the manure thanks to the perforations in the manure belts, thus drying the manure.

Additional conveyor belts transport the dried manure out of the manure drying tunnel.

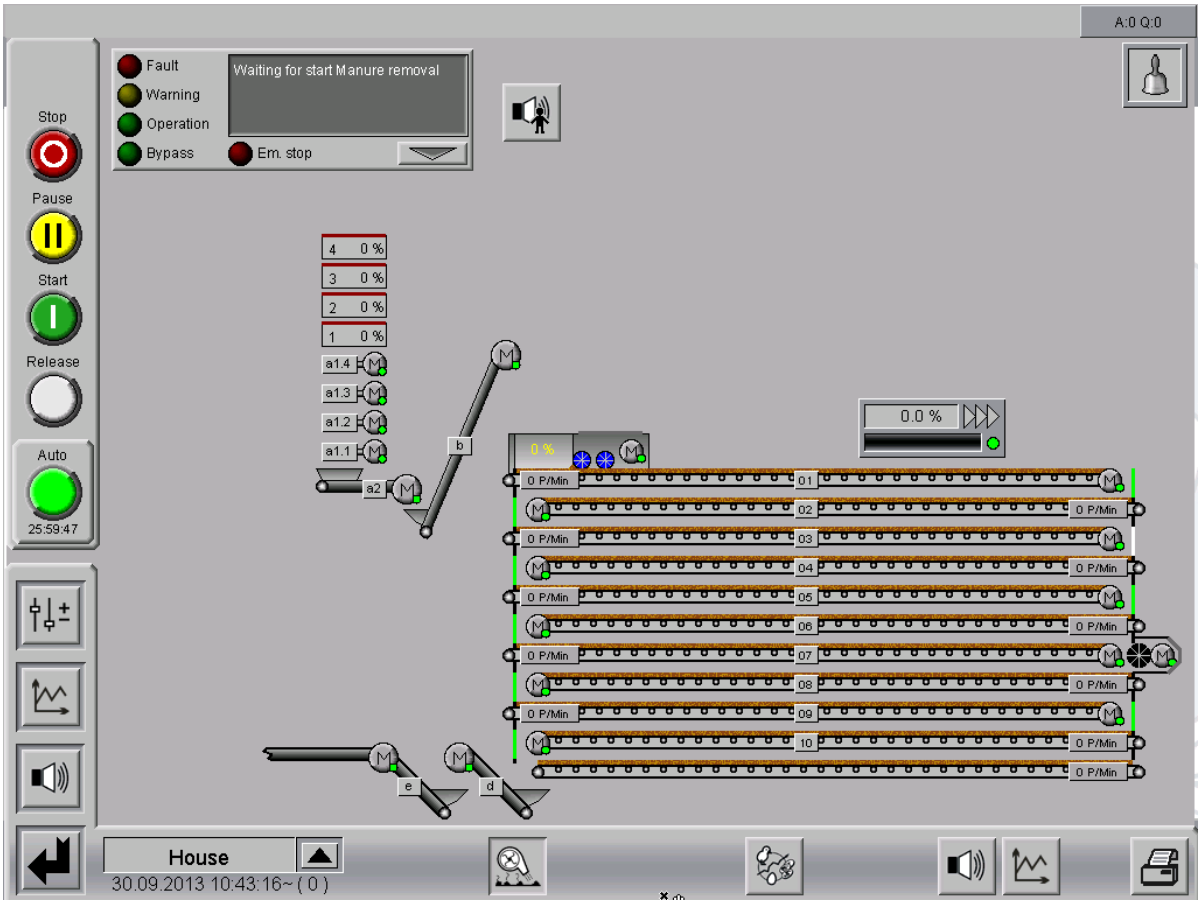
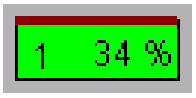


Figure 1-4: Manure drying tunnel in Amacs

1.1.1 Manure removal groups

The up to 20 manure removal groups are displayed in a simplified manner by showing their number and current progress. They are assigned to the manure cross belts (**a1**) in a table in the settings (chapter 2.3.3 ”Assignment”).

The manure removal group is not active.



The manure removal group is active.

The emergency stop of the manure removal group has been triggered.

Clicking on the manure removal group opens a menu with further information.The description entered in the settings is displayed. Additionally, a possible release for this manure removal and a possible actuation of the emergency stop are indicated. The current belt progress is visualised in percent and as a bar graph. Clicking on the area with the rhombuses displays which manure cross belts are required for the manure removal in this group. Manure cross belts which are not required are disabled.

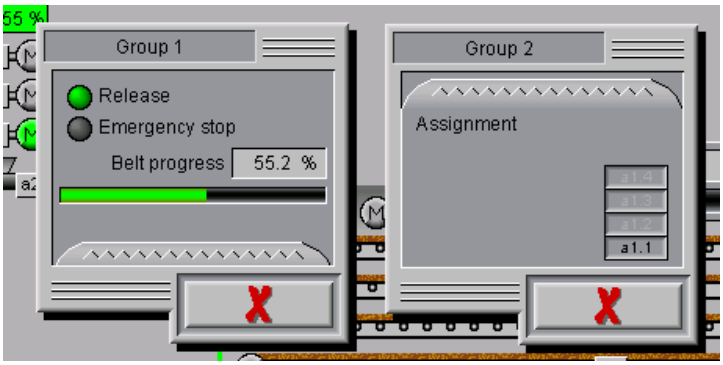


Figure 1-5: Manure removal groups

1.1.2 Feed belts

	The status messages of the motors are described in **Section 1.4 ”Drives”**

- **Manure cross belts [a1.1 - a1.20] see figure1-6**

  The manure drying tunnel is charged by the manure cross belts. The manure cross belts may be situated in one house (in several groups) or in different houses (clients). These may also be simple transfer stations (e.g. supply by trailer).

  The manure cross belts are assigned to the manure removal groups in the settings (chapter 2.3.3 ”Assignment”).

- **Transfer belt [a2] see figure 1-6**

  A transfer belt may optionally exist. This belt collects the manure from the manure cross belts and conveys it to the vertical conveyor belt.

- **Vertical conveyor belt [b] see figure 1-6**

  The vertical conveyor belt supplies the manure drying tunnel with the manure.

1.1.3 Belt drying system

The belt drying system is a manure drying tunnel from Big Dutchman developed for optimum drying of fresh or pre-dried manure from cage systems and aviaries. This system can be configured with four to 20 levels.

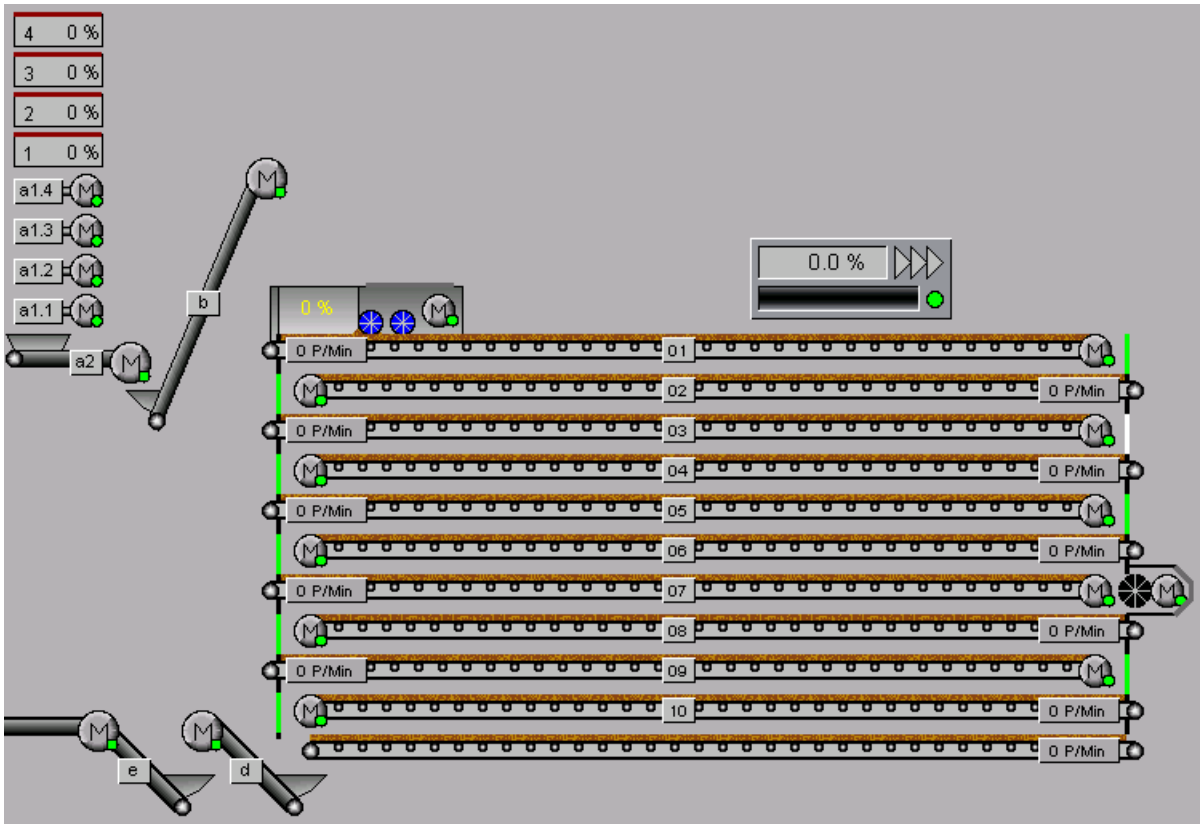


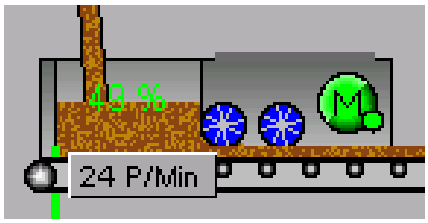
Figure 1-6: Belt drying system main screen

1.1.3.1 Dosing with distributing augers

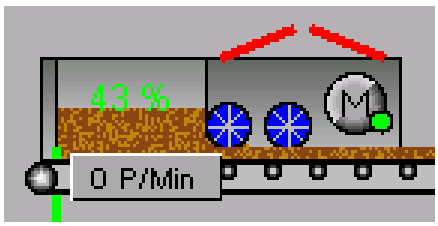
The dosing unit is integrated into the top level of the manure drying tunnel. Up to four load cells measure the incoming amount of manure. Two counter-rotating augers inside the dosing unit distribute the manure to be dried over the entire width of the tunnel belts.

	The status messages of the motors are described in **Section 1.4 ”Drives”**

The current filling level is displayed graphically and as a percentage in the dosing unit next to the distributing augers and the service opening.



If the service opening above the dosing unit is depicted in green, then it is closed.



If the service opening above the dosing unit is depicted in red, then it is open. The safety switch has triggered and the belts are switched off.

1.1.3.2 Tunnel belts

The tunnel belts on which the manure is dried can be optionally operated by means of a frequency converter.

When controlled in this way, the tunnel belts are controlled steplessly according to the filling level of the dosing unit (if the filling level in the dosing unit increases the speed of the tunnel belts increases, and if the filling level decreases, the speed is also reduced).

The filling level of the dosing unit is calculated via load cells. The set value of the frequency converter is displayed above the tunnel belts (in % of the maximum speed).

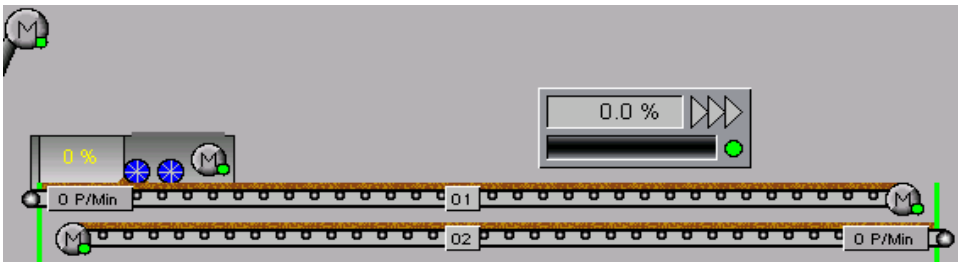


Figure 1-7: Tunnel belts

	The status messages of the motors are described in **Section 1.4 ”Drives”**

- **RPM monitor**

  There are rpm monitors on the manure belt idler. They register the revolutions in pulses per minute. In the event of a slippage between the drive roller and the tunnel manure belt, the speed is not passed on to the idler at all, or only partially. The same applies in the event of a belt breakage. The detection of too low a speed of the deflection pulley leads to the tunnel being switched off.

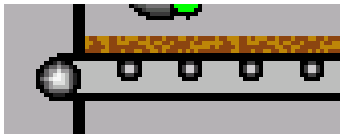
Drive switched off

Drive switched on

Drive switched on, maintenance

Drive switched off, alarm

Speed monitor deactivated



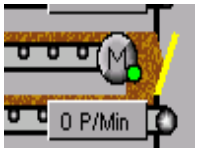
Speed monitor not existing

1.1.3.3 Limit switches (optional)

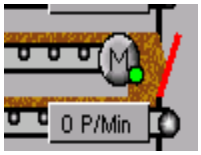
The manure is conveyed on the tunnel belt in the direction of the drive. Here it falls through the deflection area past a spring-loaded flap and onto the next lower belt. If larger manure plates have formed, which do not fit through the deflection area and press against these flaps, the limit switch is triggered and the belts are stopped. The area can then be inspected and the manure plates removed, if necessary.

The same applies in the event of a belt breakage. If a tunnel belt should break, then the material conveyed from above accumulates in front of the flap. If this material presses against the flap, the limit switch is triggered and the tunnel is switched off.

Limit switch in position



Warning limit switch



Alarm limit switch

Limit switch deactivated

Limit switch not available

1.1.4 Plate drying system

The plate drying system has a very compact design. It can be configured with **two to ten** double levels. Each double level consists of two plate rows which can be loaded up to a layer height of 20 cm each.

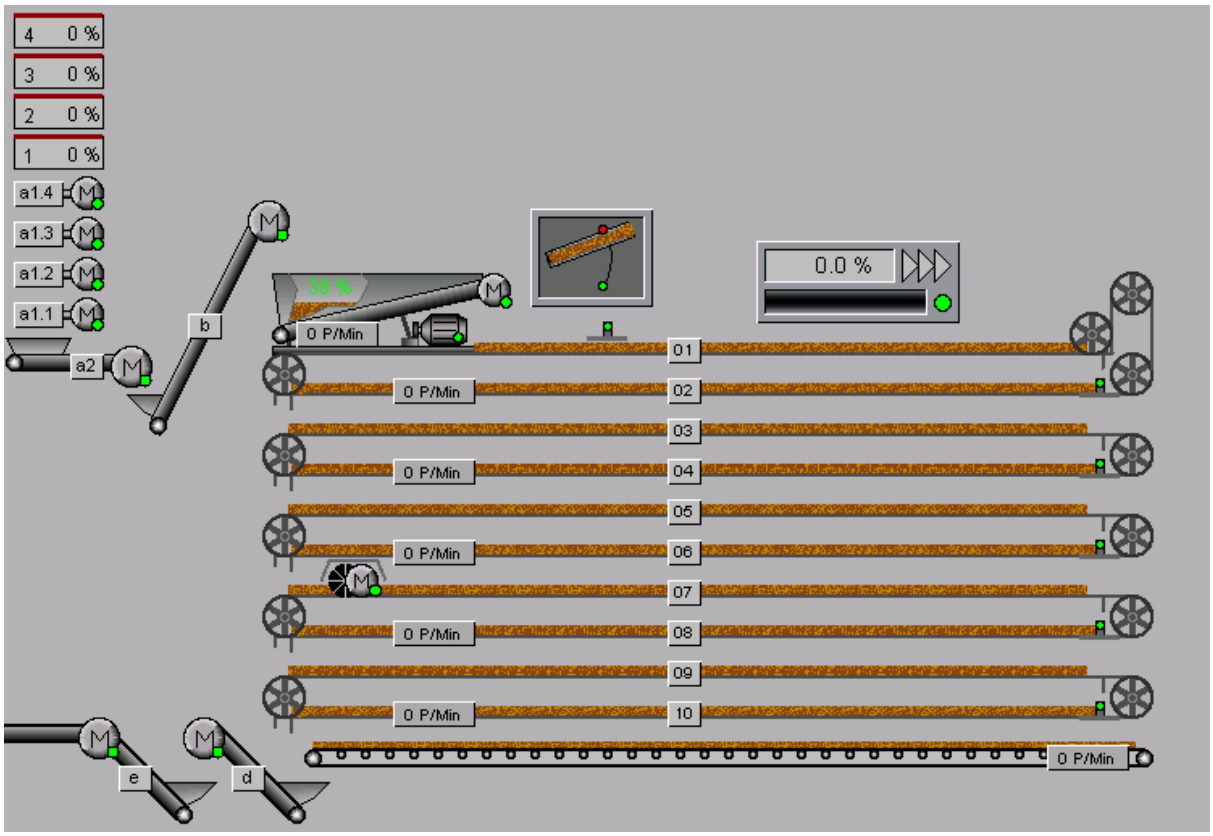
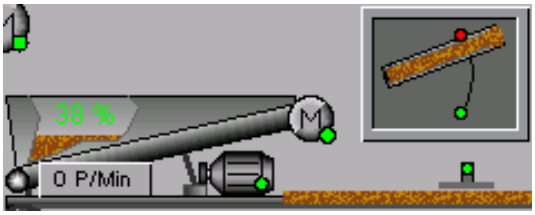


Figure 1-8: Plate drying system main screen

1.1.4.1 Dosing with slewing unit

The dosing unit is integrated into the top level of the manure drying tunnel. Up to four load cells measure the incoming amount of manure.The slewing unit moves one conveyor belt evenly along the entire width of the plates and thus distributes the manure. The speed of the belts and the slewing unit are synchronised.



The movement of the slewing unit is indicated by means of the limit switch's state. The final movement of the previous dosing is completed whenever the slewing unit starts. If the slewing unit is switched on automatically, the slewing moves are also carried out. The pause times in reverse position are also adhered to.

There are additional options for the slewing unit. These include the possibility for pulse monitoring of the conveyor belt in the slewing unit (see chapter 1.1.4.3 ”Tunnel plates”).

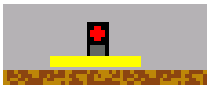
An additional output for the piloting of a separate frequency converter can also be configured for the speed of the conveyor belt. The set value of the slewing belt can then be adjusted depending on the set value of the tunnel belts.

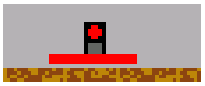
1.1.4.2 Monitoring of filling level

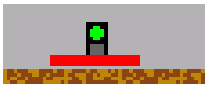
The filling level monitoring is displayed above the top level. This measures the filling level of the top level and issues an alarm in case of overfilling.

A delay time may be set for the filling level monitoring.The monitoring first warns when the sensor has been triggered. After the delay time has expired, an alarm message is issued and the manure drying tunnel is stopped.

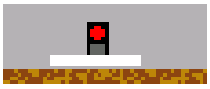

Filling level OK


Filling level exceeded


Filling level exceeded, delay time expired


Filling level OK after exceeding


Monitoring deactivated, filling level OK


Monitoring deactivated, filling level exceeded

This delay time considers the piloting of the level drives, i.e. the delay time does not elapse while the drives are not piloted.

1.1.4.3 Tunnel plates

The tunnel plates on which the manure is dried can optionally be piloted by a frequency transformer. With this control, the tunnel plates are controlled steplessly depending on the filling level of the dosing unit (if the filling level in the dosing unit increases, the tunnel plates' speed increases; if the filling level decreases, the speed does so as well). Load cells measure the filling level of the dosing unit. Above the tunnel plates, the set value of the frequency transformer is displayed in percent depending on the maximum speed.

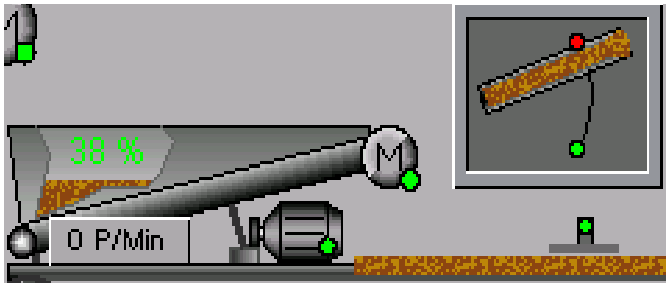


Figure 1-9: Tunnel plates

The status messages of the motors are described in **Section 1.4 ”Drives”**

- **Speed monitor**

  A pulse monitoring of the plate drying system depending on the system's speed can be configured per double level. The rotations are registered in pulses per minute. In the case of a slip between the drive roller and the tunnel plate, the number of rotations is not passed on, or only passed on partially, to the idler unit. The same applies if the plates jam. Recognition of too low a number of rotations of the idler roller leads to the tunnel being switched off.

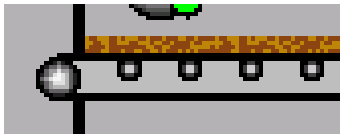
Drive switched off

Drive switched on

Drive switched on, maintenance

Drive switched off, alarm

Speed monitor deactivated



Speed monitor not existing

The messages generated for the speed monitor of the dirt belt are identical to the messages of the tunnel belt speed monitor (see above).

- **Plate monitoring**

  A plate monitoring is also planned for each double level. This monitoring system checks whether the plates are positioned correctly behind the idler unit. If the plate monitoring is triggered, the tunnel immediately stops if it is operated automatically. The manure removal is not interrupted during bypass operation. A manual piloting is still possible as long as no electromechanical lock is installed.

Plate position OK

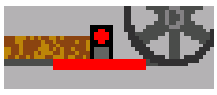


Plate position triggered

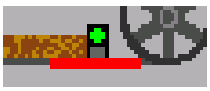


Plate position OK again after having been triggered

Monitoring deactivated, plate position OK

Monitoring deactivated, plate position triggered

1.1.5 Chopper

The chopper consists of a quickly rotating shaft, at which several chain sections and beaters are fastened. They chop up the manure chunks before they are fully dried. The chopper can be installed on any level; however, it should only be used on a level where a good drying degree of the manure has already been reached.

The chopper is equipped with overcurrent monitoring so the tunnel drives are stopped in case of an overload and an alarm message is generated if the overload is not eliminated even though the tunnel drives have been stopped.

Optionally, a digital input can be utilised as an analogue value to register and evaluate the chopper's limit values. Clicking on the chopper opens a menu for manual operation. Clicking on the area with the rhombuses displays the state of the current monitoring as well as the operating hours. Where an analogue current monitoring has been installed, the current load is indicated by a percentage and a bar.

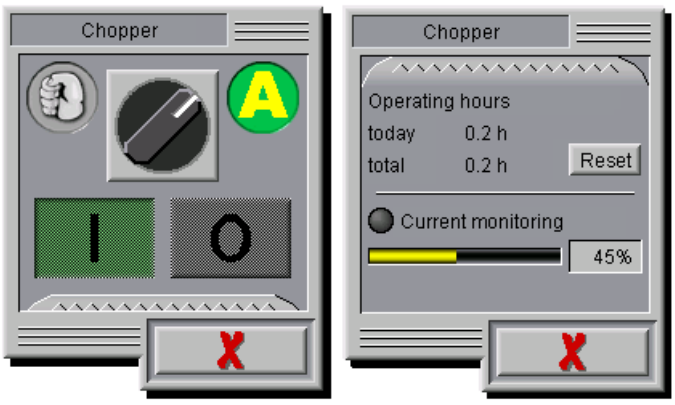
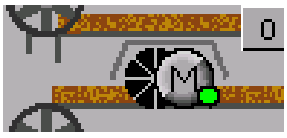
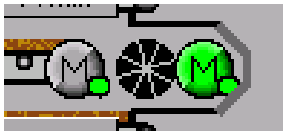


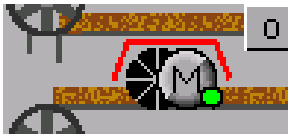
Figure 1-10: Chopper



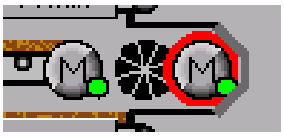
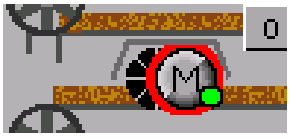
Chopper switched off



Chopper switched on

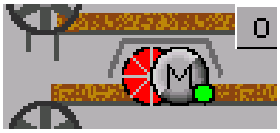


Service openings open

Protective motor protection switch triggered


Overcurrent warning

Overcurrent fault

	The status messages of the motors are described in **Section 1.4 ”Drives”**

1.1.6 Dirt belt

- **Dirt belt**

  Beneath the bottom level, an additional manure belt without perforations is installed, collecting small particles and dust from all levels. When the dry manure is removed, this solid belt is also cleaned, so that the floor beneath the tunnel remains clean.

  If the lowest level (dirt belt) has its own drive, it can also be equipped with a speed monitor.

	The messages generated for the speed monitor of the dirt belt are identical to the messages of the tunnel belt speed monitor (see above).

1.1.7 Discharge belts

The discharge belts are switched on first for every start of the manure drying tunnel to ensure a secure removal of the dried manure.

	The status messages of the motors are described in **Section 1.4 ”Drives”**

- **Conveyor belt [d] see figure 1-4**

  The conveyor belt [d] is a discharge belt which transfers the manure from the tunnel onto the conveyor belt [e].

- **Conveyor belt [e] see figure 1-4**

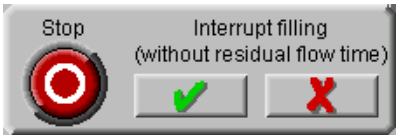
  The conveyor belt [e] is an externally controlled belt. A release contact is required by belt [e] (operating message) for the operation of the tunnel so that the manure drying tunnel can start.

1.2 Operating buttons

The following shown keys correspond to those which also exist at the control cabinet. Thus they have also the same function.

- **Stop**

  Stop manure drying tunnel filling (observance of the preset residual flow time of the individual conveyor belts, see **section**)



The button for direct stop without residual flow time only exists on the user interface (farm computer and operation on-site).

It appears if a filling is not finished and the stop button was pressed for more than 5 seconds. If the button is not activated within another 10 seconds, it is hidden again.

This may be necessary if e.g. the filling must be stopped due to a defect or fault without having to restart the belts and augers in order to observe the residual flow times.

- **Pause**

  Interruption of filling

  (Pause is lifted again by pressing the start button)

- **Start**

  Start the filling of the manure drying tunnel

- **Enable**

  Acknowledgment of alarms for the manure drying tunnel. After a fault (limit position switch, pulse monitoring, emergency stop, etc.) the tunnel filling will only recommence after actuation of the release button.

- **Auto (optional)**

  In order to release an automatic start of the manure removal, the system must be checked at least once a day. This check can be acknowledged by means of a push button. The check is always valid for 26 hours; the remaining time is shown below the button.

  For the first 24 hours after actuation, the button is lit continually, for the last two hours in a slow rhythm and after the time has expired, the light is turned off.

  After the time has expired, no more manure removals are entered into the to-do list. Started removals and the list are completed. A manual start is possible irrespective of an autostart release.

	Since Big Dutchman cannot assume liability for such an operation, this optional function is only released after written risk assumption by the operator! A safety briefing must have taken place before. **Please also observe the notes in the manual "Safety instructions for the operation of AMACS"!**

1.3 Status messages

In the field "Status messages", information about the current status of the manure drying tunnel is displayed during manure removal.

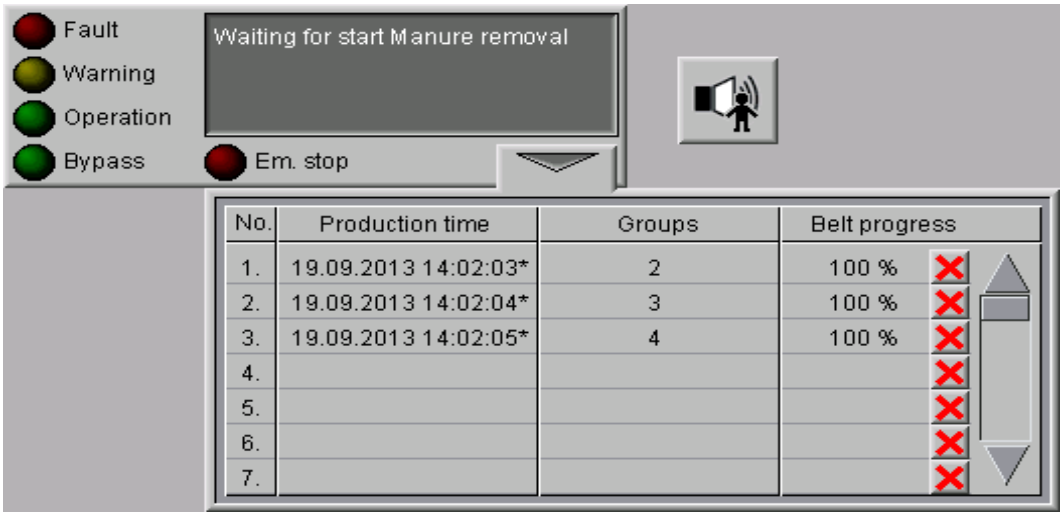


Figure 1-11: Status messages

- **Fault**

  A fault is present that has led to the drives being stopped (e.g. emergency stop, limit switch, motor protection).

- **Warning**

  A warning has been issued that has not (yet) led to the drives being stopped (e.g. weight in the dosing unit undercut or exceeded, limit switch, pulse monitoring, chopper overcurrent).

- **Operation**

  Filling of the manure drying tunnel has started or is active. Some messages only lead to an alarm message (e.g. safety switch on the service openings of the chopper and the dosing unit) when the manure drying tunnel is active.

- **Bypass**

  Visualisation of the input status bypass.

- **Emergency stop**

  Visualisation of the emergency stop input.

- **Information window**

  The information window displays the currently requested manure removal groups and the desired belt progress.

- **Manure removal list**

  Pending manure removals triggered by the automatic start are be saved in a list by means of the manure removal groups. Up to 40 pending manure removals may be displayed. If the automatic start triggers further manure removals, the oldest entries on the list are deleted and the new ones added.

  The list displays the time of the entry, the group number and the desired belt progress. It is also possible to delete individual entries from the list.

- **Start warning signal**

  The warning signal for the start can be triggered manually at any time by clicking on the button in the upper centre of the screen.

	**Caution!** A warning signal is generated before each start of the manure drying tunnel, whether in manual, automatic or bypass mode. This signal is activated three times for one second, with one second pause in-between. Afterwards, there is a pause of five seconds before the request for the belt is released.

1.4 Drives

1.4.1 Manual operation without the control

A control panel opens up by clicking on a drive. Depending on whether the element is set digitally (ON/OFF) or is an analogue element, either a switch or a slide bar appears. The drive can be switched on or off via this element, and/or the operating mode can be switched over from manual to automatic.

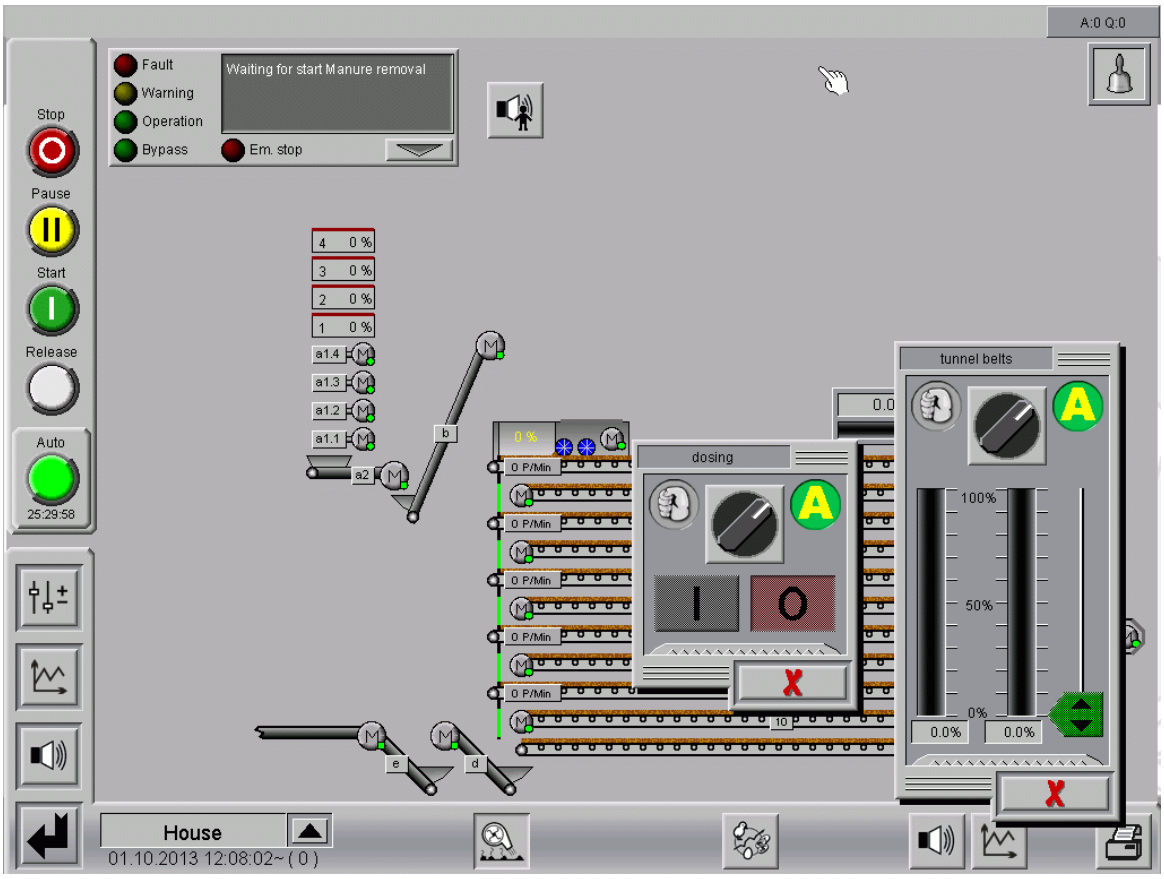


Figure 1-12: Hand-automatic switch

⚠	**Warning** Work on drives or fans may only be carried out when the protection switch is switched off. The drives are enabled without warning, e.g., by the timers. Observe local safety instructions and regulations!

1.4.2 Operating hours

It is helpful to be able to read off the motors' running times, in order to be able to determine service intervals. With a click on the serrated area, the respective operating hours counter of a component opens.

Here the completed hours are displayed under "today" and "total". The reset button resets the values to 0.

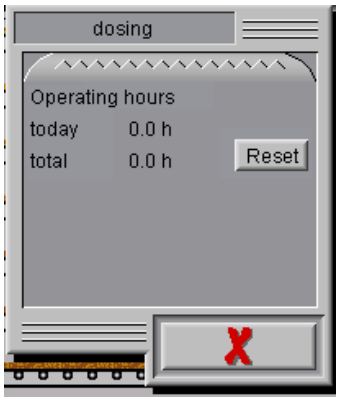


Figure 1-13: Operating hours

1.4.3 Status

You can recognise the status of the respective drive by means of the display:

Drive Off

(Auto)

Drive Off

(Manual)

Drive active

Drive fault

(Protective motor switch)

Drive requested

(only external belt [e], see figure figure 1-4)

Drive active

(with feedback, only external belt [e], see figure 1-4)

1.5 On-site visualization (control cabinet)

	The presentation of the on-site visualization is mainly the same as that of the FarmController. The symbols are, however, slightly closer together, in order to be able to present all information on the display. The functions of the individual elements are explained in this section.

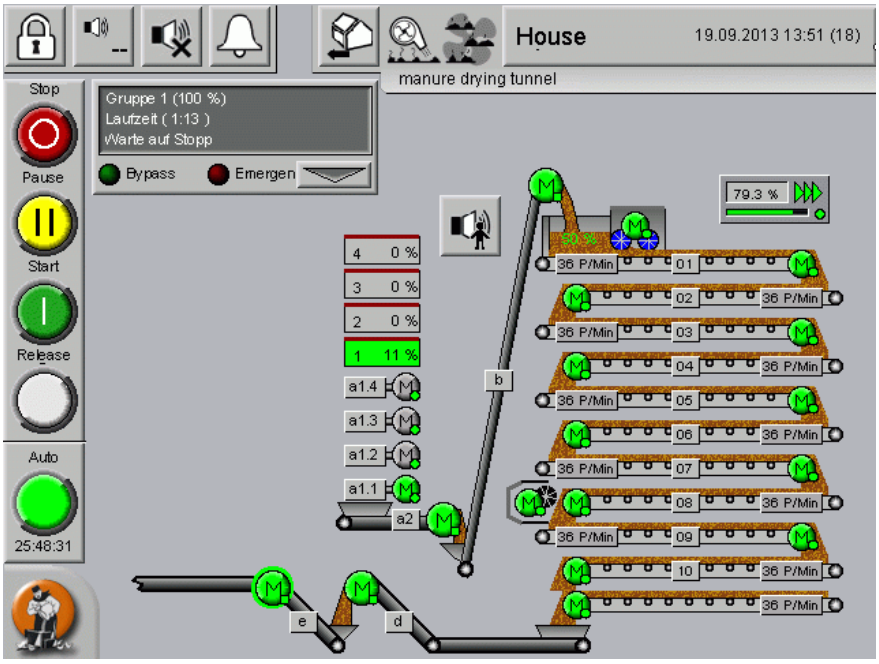


Figure 1-14: On-site visualization - belt drying system

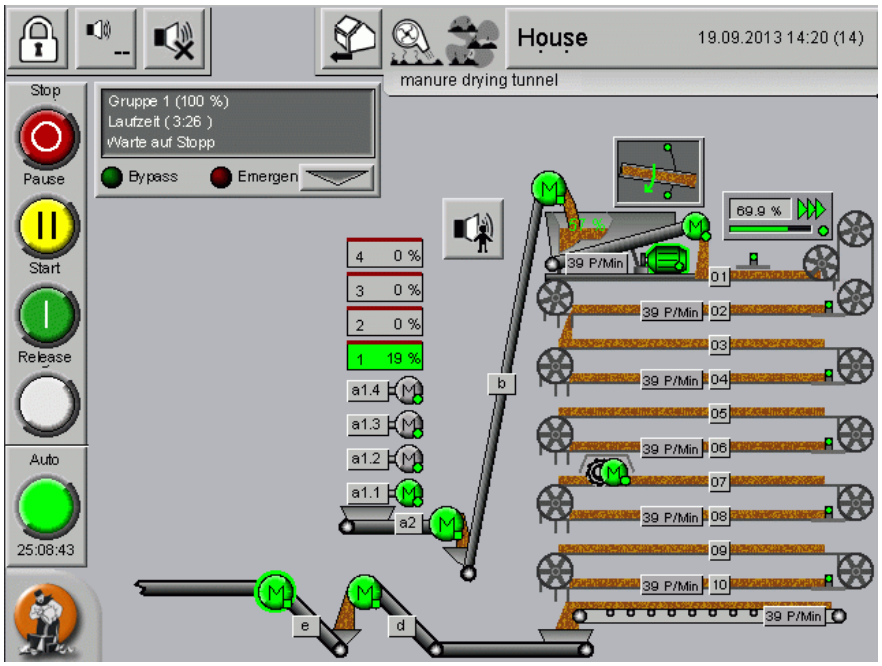
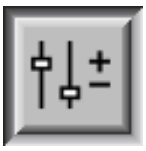


Figure 1-15: On-site visualization - plate drying system

2 Manure drying tunnel settings



Clicking on the settings icon opens the overview of the "Manure drying tunnel" parameter input.

Not only the status messages of the drives are displayed, but the dosing, parameters and belt controls can be adjusted as well.

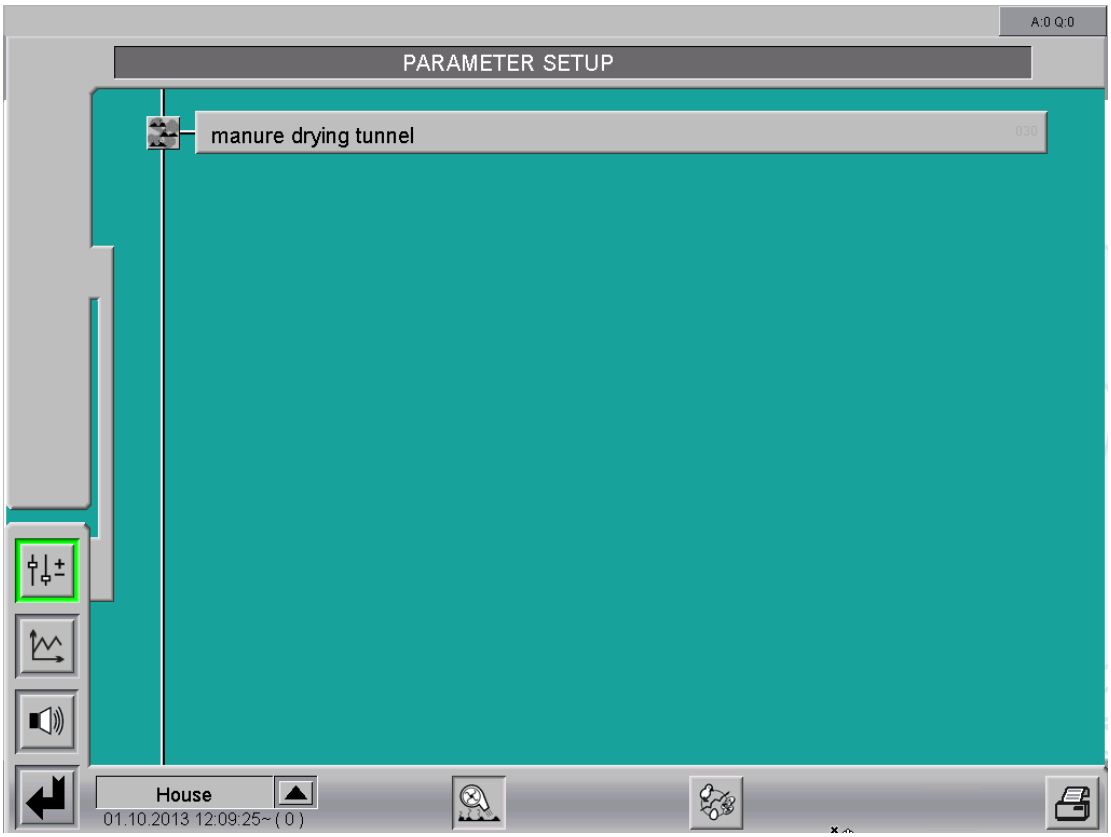


Figure 2-1: Setup

The settings for the OptiSec and OptiPlate manure drying tunnels are virtually identical. Where settings or displays only apply to one of the manure drying tunnels, this will be stated explicitly.

2.1 Start settings

On the first page you will find the settings for the start of the manure drying tunnel.

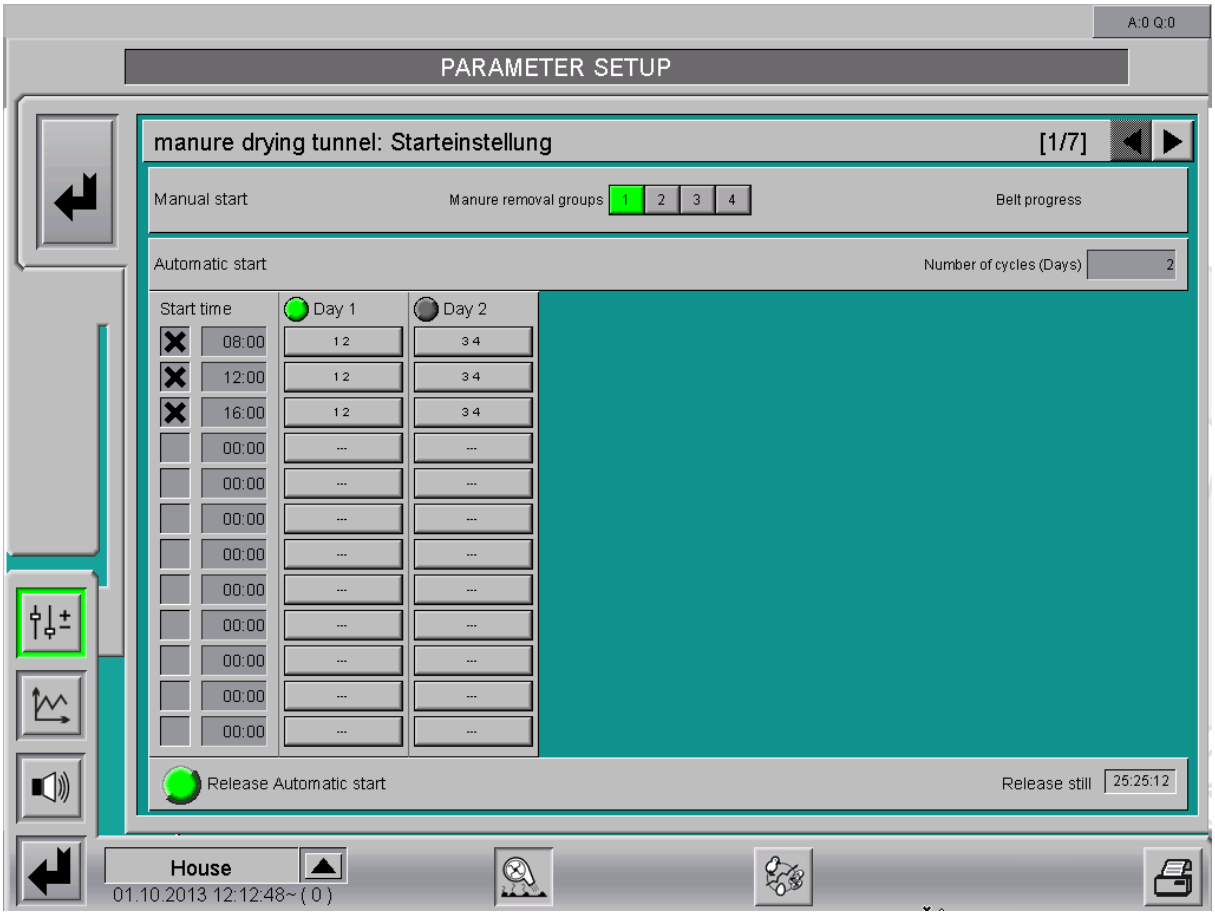


Figure 2-2: Start settings

	If only one manure removal group is available, there are no further selection options. This one group is always started. Only the settings for the belt progress appear.

	If the selection or the desired progress are changed during an active manure removal, this does not influence the currently active removal. The changes are only considered for the next start. If there is still a manure removal active, no additional removal can be started manually. The start button is instead used for a restart after a pause or fault.

	If no manure removal has been selected or the belt progress has been set to 0 percent, the filling of the manure drying tunnel does not start with the start button.

2.1.1 Manual start

Selecting the manure removal groups at the user interface

- If more than one feed belt (manure removal) exists and "**Select delivery at user interface**" was selected in the settings (see 2.5.4 ”Delivery”), it is possible to choose here the manure removal to be activated in case of a manual start.

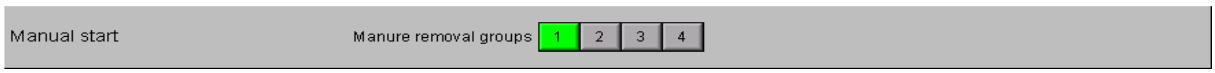


Figure 2-3: Manual start

The overview screen indicates the selected groups whose belt progress has been set to a figure higher than zero in green. The settings for the manual start of individual groups can be adjusted in a submenu. The menu can be accessed by clicking on the respective manure removal group.

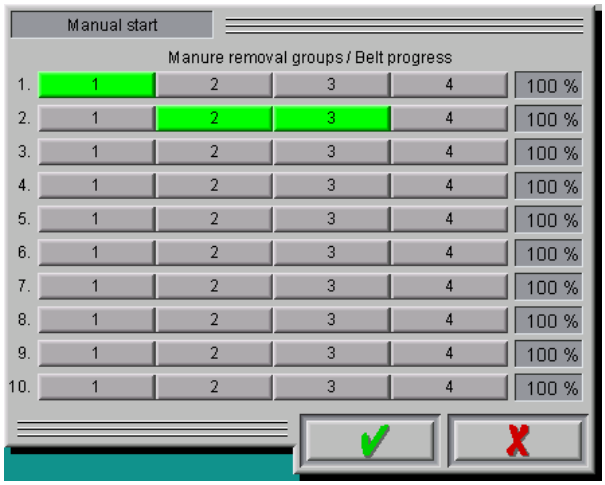


Figure 2-4: Selection manual start

Up to ten manure removal groups can be entered for the start by using the menu. These starts are then automatically carried out successively. For each of these ten manure removal groups, the desired belt progress can be set. It is also possible to activate several groups for one manure removal. The removal for these groups is then carried out simultaneously. The set belt progress applies to all groups in which the manure is removed simultaneously.

	All changes are only accepted upon clicking on the button with the green checkmark. Clicking on the button with the red cross abandons all changes.

Selecting the manure removal groups via digital inputs

- If the setting "**Select delivery via digital inputs**" was chosen (see 2.5.4 ”Delivery”), there is no selection possible here. Only the manure removal group selected with the switch starts. The status of the inputs is displayed as information. For the manure removal in the group, the setting for the desired belt progress is displayed as well. The group is released until it has made the set progress.

Figure 2-5: Manual start

	The presentation of the on-site visualization is mainly the same as that of the FarmController. The symbols are, however, slightly closer together, in order to be able to present all information on the display. The functions of the individual elements are explained in this section.

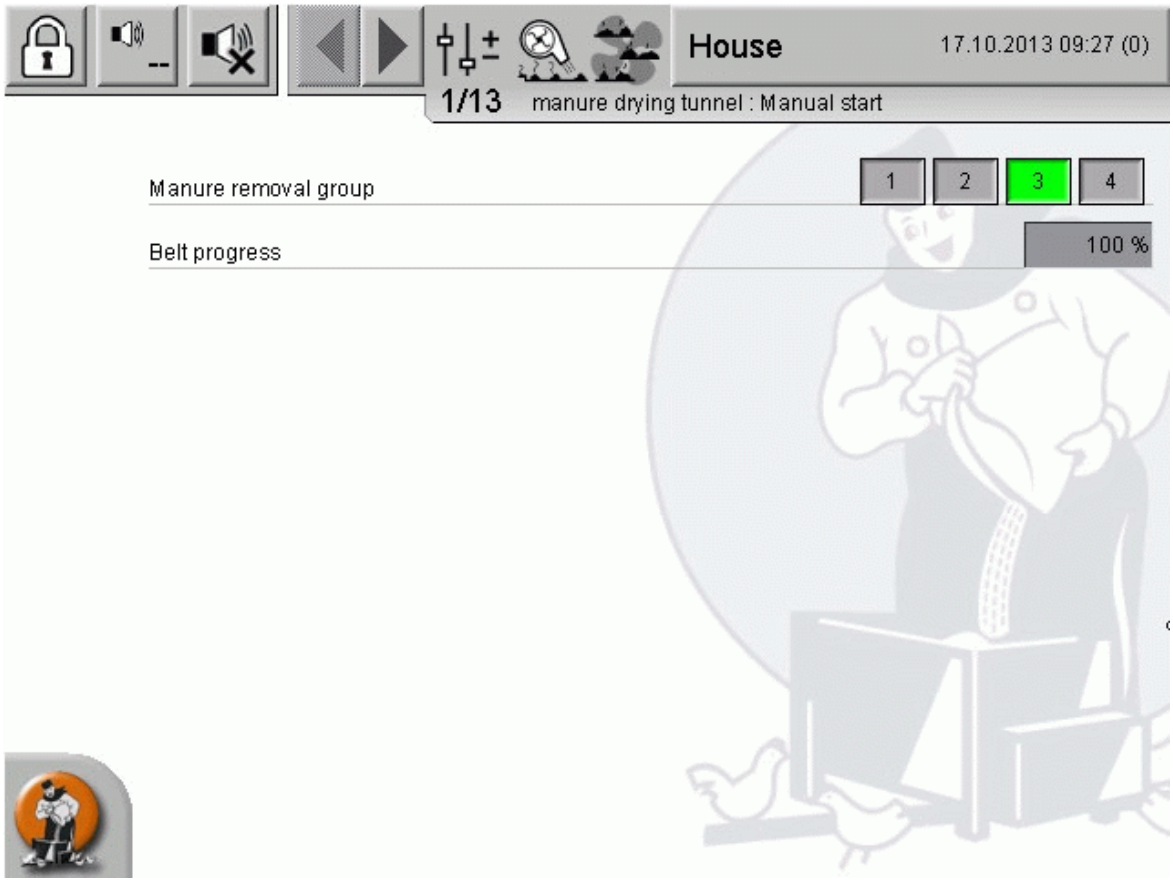


Figure 2-6: Manual start

2.1.2 Automatic start (optional)

⚠	Since Big Dutchman cannot assume liability for such an operation, this optional function is only released after written risk assumption by the operator! A safety briefing must have taken place before. **Please also observe the notes in the manual "Safety instructions for the operation of AMACS"!**

In order to achieve a high flexibility, an interval of several days can be set via the setting **"Number of cycles (days)"** . A setting of up to seven days is possible.

The interval does not depend on weekdays. The current **day** is displayed by the green round button in the day settings. Clicking the button switches to the setting for the respective day.

If a 1-day interval was selected, the display of the current day does not appear.

⚠	**Caution!** A warning signal is generated before each start of the manure drying tunnel, whether in manual, automatic or bypass mode. This signal is activated three times for one second, with one second pause in-between. Afterwards, there is a pause of five seconds before the request for the belt is released.

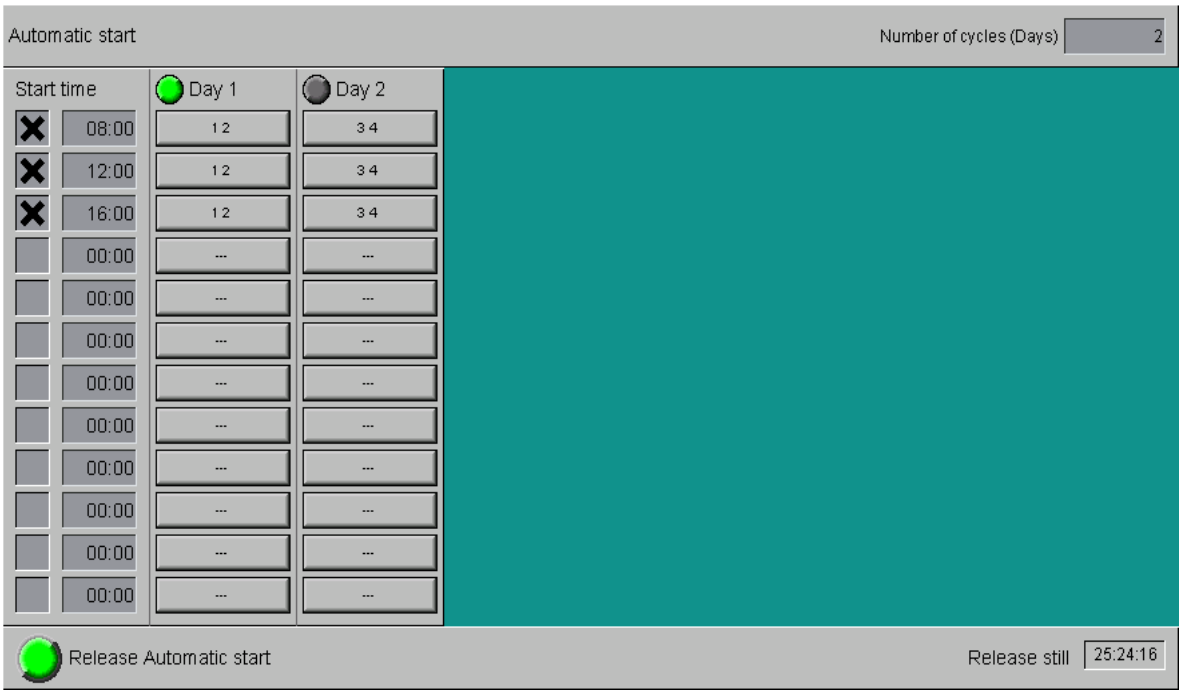


Figure 2-7: Automatic start

Twelve **start times** can be set and activated. The groups for which the manure is to be removed are displayed on the **groups** button on the respective day and time. The group sequence on the button is not the actual starting sequence. The corresponding menu is accessed by clicking on the respective buttons.

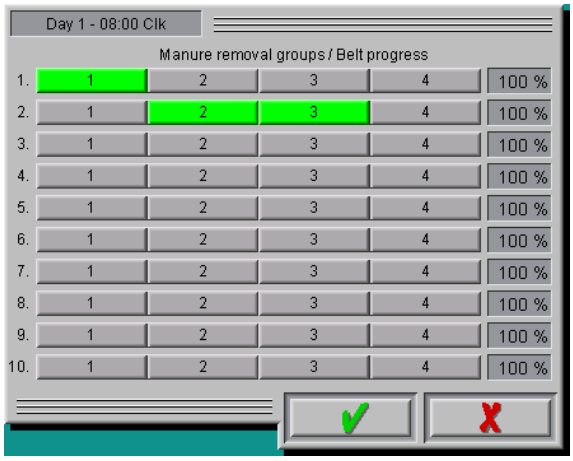


Figure 2-8: Selection automatic start

Up to ten **manure removals** can be defined for the start by using the menu. These starts are then automatically carried out successively. For each of these ten manure removals, the desired **belt progress** and the **manure removal group** can be set. It is also possible to activate several groups for one manure removal. The removal for these groups is then carried out simultaneously. The set belt progress applies to all groups in which the manure is removed simultaneously.

	If on one day no delivery is selected for the starting time or the belt progress has been set to 0 %, the manure drying tunnel does not start automatically at this time. If a filling is still active at the starting time, it is listed for manure removal.

Moreover, the button **Release automatic start** is displayed. It has the same meaning and function as in the main screen.

	The presentation of the on-site visualization is mainly the same as that of the FarmController. The symbols are, however, slightly closer together, in order to be able to present all information on the display. The functions of the individual elements are explained in this section.

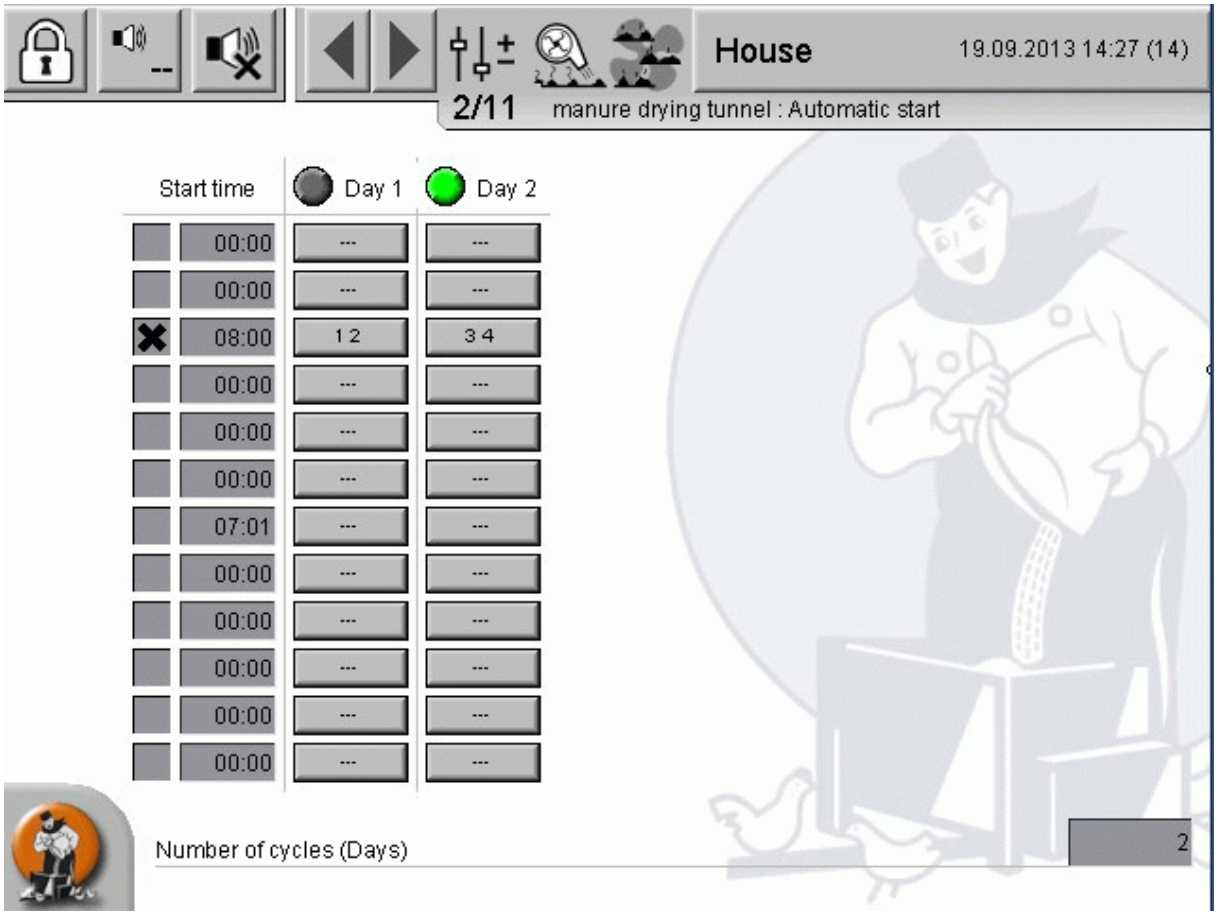


Figure 2-9: Start

2.2 Dosing

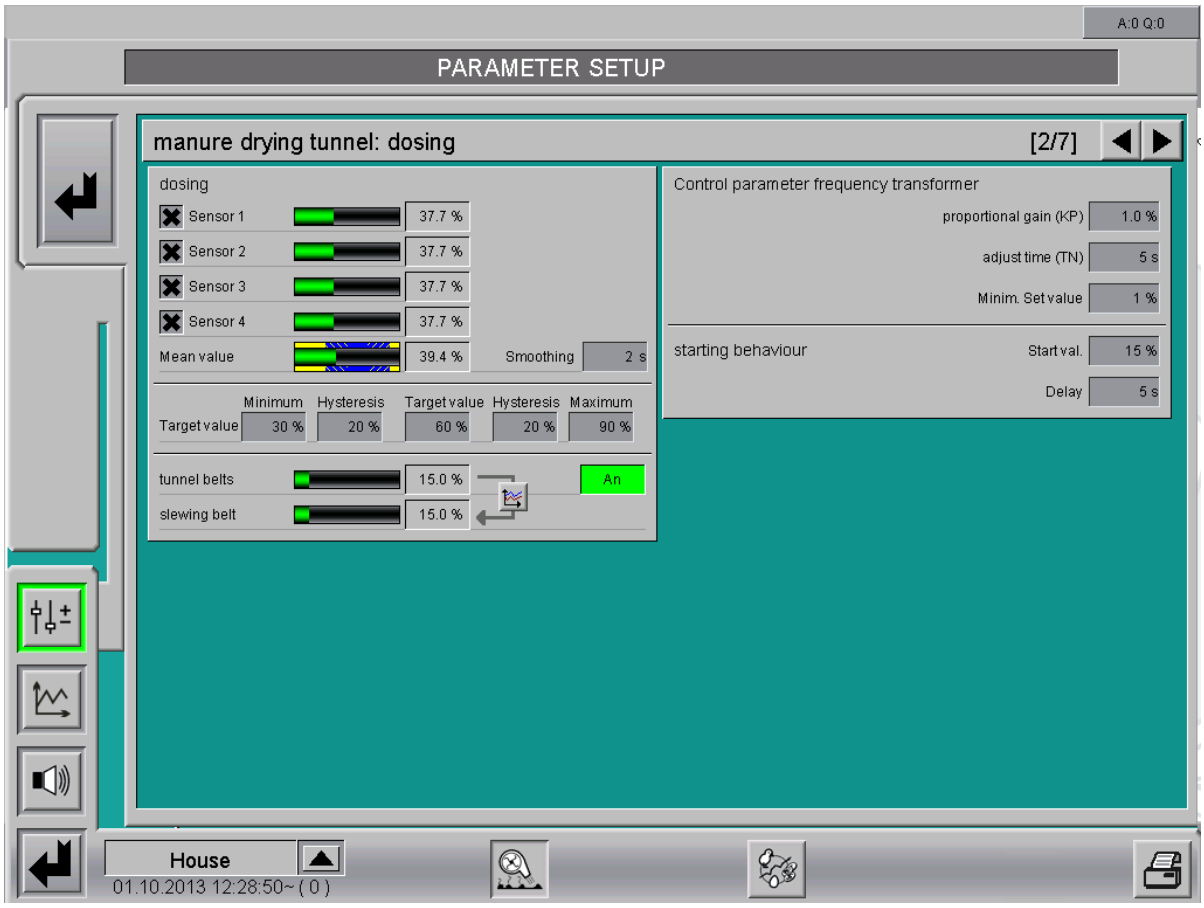


Figure 2-10: Overview

The weight of the material filled into the dosing unit is determined by up to four electronic load cells (sensors 1 to 4) and required to calculate the speed of the manure drying tunnel.

	Tunnel belts and manure feed belts from the house to the tunnel are started and stopped according to the values determined by the load cells!

	The presentation of the on-site visualization is mainly the same as that of the FarmController. The symbols are, however, slightly closer together, in order to be able to present all information on the display. The functions of the individual elements are explained in this section.

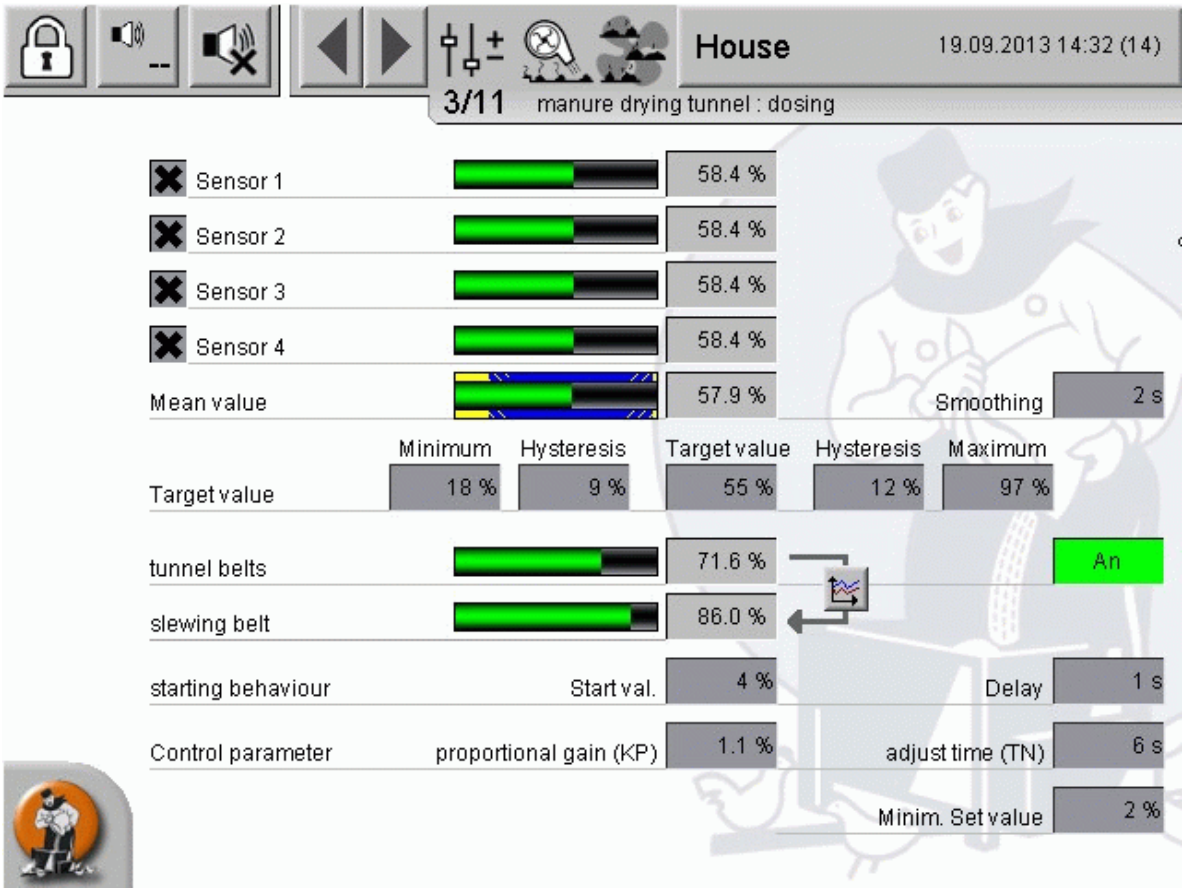


Figure 2-11: Dosing

2.2.1 Sensors

The currently measured values of the **sensors** and the smoothed **mean value** for the control are shown numerically and as bar graphs. For a better overview, the settings regarding the minimum and maximum values are shown together with the corresponding hysteresis at the bar graph displaying the mean value. The minimum and maximum areas are displayed in yellow, the respective hysteresis is shaded in blue/yellow.

The minimum and maximum values of the measuring range are defined when putting the system into operation (e.g. minimum = 30 %, maximum = 90 %).

As long as the load cells determine a weight between these values, the tunnel drives as well as the manure conveyor belts will continue to run from the house to the tunnel.

Defective sensors can be deactivated temporarily by removing the "**X**" in front of the sensor. A maximum number of one sensor has to remain active.

Important!

To ensure smooth operation, defective sensors should be replaced immediately.

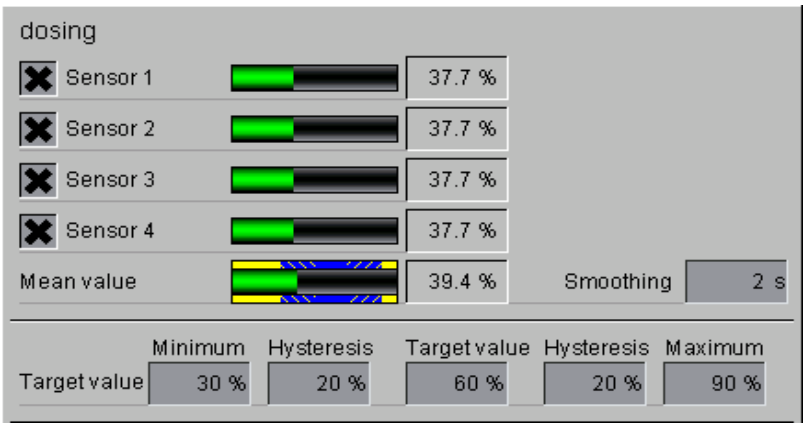


Figure 2-12: Dosing

- **Smoothing**

  To ensure that the tunnel drives do not react too sensitively, it is possible to define a time for the smoothing of the sensor value.

- **Target value**

  The desired target value for the filling level of the dosing unit is set here.

- **Maximum and hysteresis**

  Settings regarding the maximum filling level of the dosing unit can be carried out here. If the maximum value is exceeded, the manure feed stops (belt [b], [a2], [a1]), see). The tunnel drives continue to run so that manure continues to be transported away from the load cells. The value to be measured by the load cells decreases and the manure feed is resumed as soon as it falls below the set hysteresis (maximum minus (-) hysteresis).

- **Minimum and hysteresis**

  Settings regarding the minimum filling level of the dosing unit can be carried out here. If the filling level falls below the minimum value, the tunnel drives stop. The manure feed (belt [b], [a2], [a1], see) continues to run from the house to the tunnel so that manure continues to be conveyed to the tunnel. The value to be measured by the load cells increases and the tunnel belts begin to run again as soon as the set hysteresis value (minimum plus (+) hysteresis) is exceeded.

2.2.2 Control parameters frequency transformer (optional if FT available)

A PI controller (proportional-integral controller) is used for the frequency-controlled tunnel drives. The corresponding parameters can be set here.

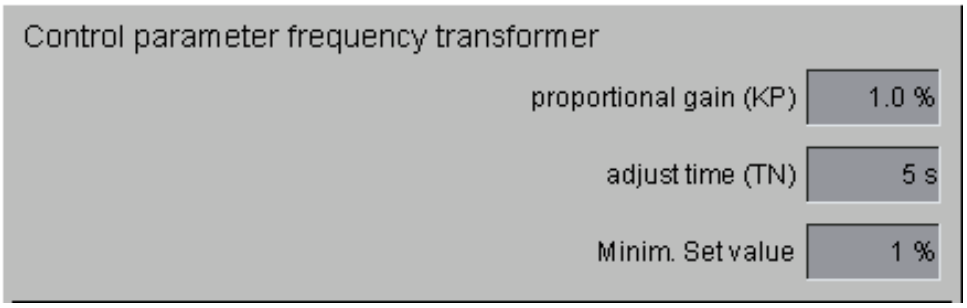


Figure 2-13: Control parameter

- **Proportional gain (KP)**

  P part of the PI controller. The more the mean value deviates from the target value, the larger the change to the set value. The closer the mean value approximates the target value, the smaller the change to the set value of the tunnel drives.

- **Adjust time (TN)**

  Time factor for the I part of the PI controller. The longer the time period is, the slower the control signal is changed at identical deviation.

- **Minimum set value**

  The minimum set value for the frequency transformer ensures that the tunnel drives do not stop if the filling level of the dosing unit is below the target value but above the minimum for an extended period of time.

2.2.3 Starting behaviour

The starting behaviour settings ensure that the tunnel drives are piloted with the desired start value for the set delay time at every start. After the delay time has elapsed, the speed control of the drives is released via the sensor values.

Figure 2-14: Starting behaviour

2.2.4 Tunnel drives

The tunnel speed is calculated based on the control parameters and the starting behaviour and is displayed here numerically and as a bar graph. In addition, the piloting of the slewing belt depending on the tunnel drives can be entered here by means of a curve if a plate drying system is used.

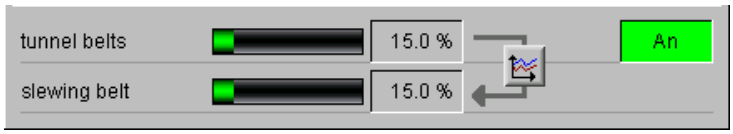


Figure 2-15: Tunnel belts

- **Status**

  The status display indicates whether the tunnel drives are piloted (An = on / Aus = off).

- **Tunnel belts**

  The current set value of the frequency transformer for the speed of the tunnel drives is displayed numerically and graphically here.

- **Slewing belt**

  The set value can be influenced when using a plate drying system in case an individual set value output is available for the piloting of the slewing belt, depending on the piloting of the tunnel drives.

Clicking on the button with the curve symbol opens a menu in which the ratio can be entered into a curve.

	The values in this curve are changed or saved as described in more detail in the "**Amacs Operating Manual, section Target curves**".

	Even if a slewing belt speed is already set for the tunnel belt control of 0 % in the curve settings, the slewing belt is not piloted.

2.3 Setting parameters

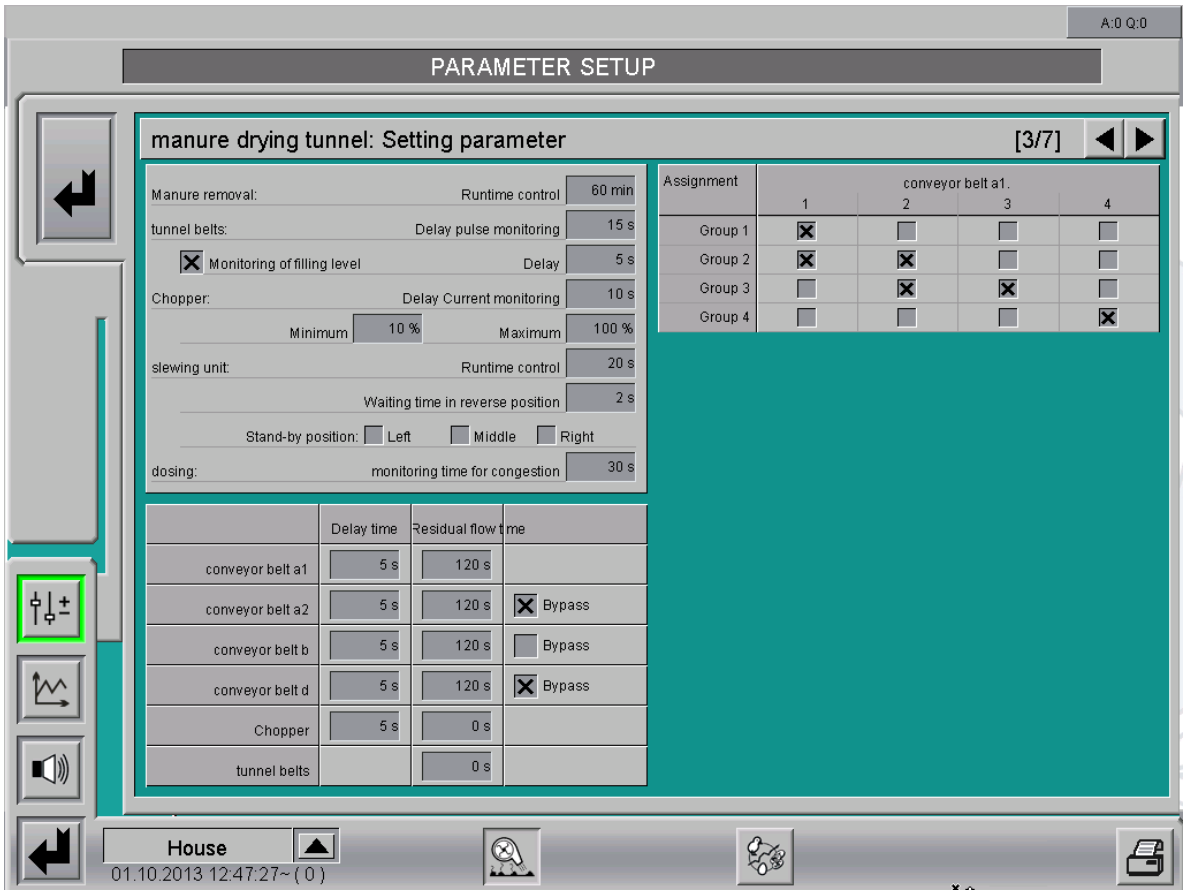


Figure 2-16: Setting parameters

2.3.1 Monitoring times

During the monitoring times, the system is checked for problems between the drives and the sensors. If the monitoring times are not observed, the manure drying tunnel switches off and an alarm is generated.

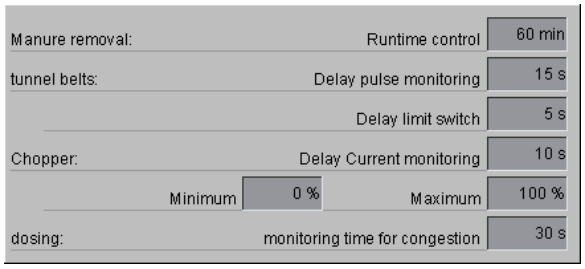


Figure 2-17: Monitoring times - belt drying system

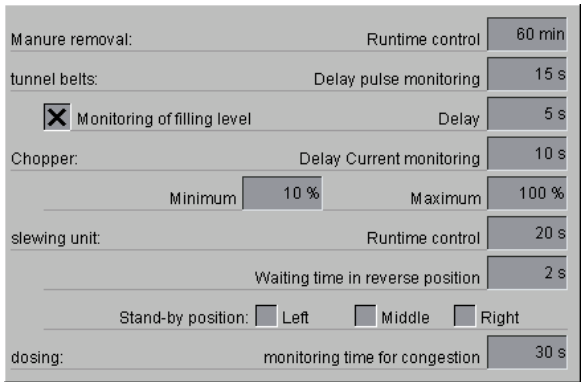


Figure 2-18: Monitoring times - plate drying system

	For the monitoring times settings, there are differences between the plate and belt drying systems. These are described in the next three sections (general settings, belt drying system and plate drying system).

	The presentation of the on-site visualization is mainly the same as that of the FarmController. The symbols are, however, slightly closer together, in order to be able to present all information on the display. The functions of the individual elements are explained in this section.

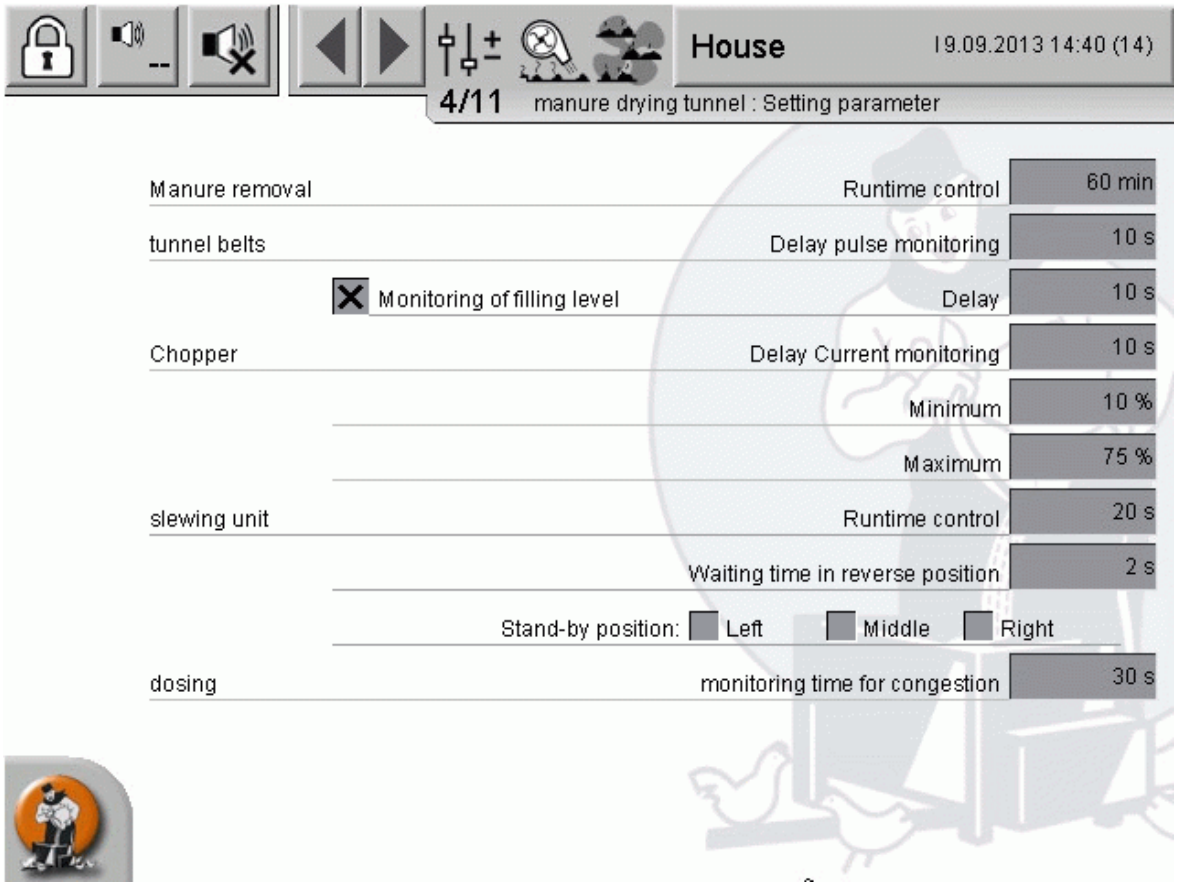


Figure 2-19: General settings

2.3.1.1 General settings

The general settings are available for the belt as well as the plate drying system.

- **Runtime control manure removal**

  The runtime of the current manure removal is controlled by means of these settings. The manure removal runtime control always applies per manure removal. If the manure removal group is changed without emptying the manure drying tunnel, the runtime is evaluated again. If the manure removal takes longer than the monitoring time, an alarm message "runtime error" is generated. The conveyor belts stop.

  This setting is especially useful for the measuring of the belt progress via pulse.

	Clicking on the Stop button stops the manure removal even before the desired progress has been reached. The delay times of the drives are considered.

- **Delay pulse monitoring (tunnel drives)**

  The pulse monitoring controls the actual speed of the tunnel drives. It is triggered when the expected "pulses per minute" are not met.

  If the number of expected pulses is below the set value for a longer time than set as monitoring time here (e.g. due to belt slippage), the warning becomes a fault and the manure removal is interrupted.

- **Delay overcurrent monitoring (chopper)**

  The overcurrent monitoring checks the load on the chopper. If an overcurrent is detected, a warning is displayed. If the duration of the overcurrent exceeds the monitoring time set here, the tunnel drives and the feed belts are stopped in order to reduce the load on the chopper.

  If an analogue signal can be analysed for the current monitoring of the chopper, it is possible to set a minimum and maximum value for the generation of an alarm in addition to the delay time.

- **Monitoring time for congestion (dosing)**

  This monitoring time serves for recognizing a bridging problem in the dosing unit. If the weight in the dosing unit is so large that the supply stops (congestion) and the weight is not reduced within the pre-set time despite switched-on tunnel belts so that the supply can be started again, the manure drying tunnel is stopped and an alarm is generated (see chapter).

  This shall prevent that the tunnel belts run dry in case the material cannot be transported out of the dosing unit.

2.3.1.2 Belt drying system

- **Delay limit switch (tunnel drives)**

  The flaps' limit switches of the idler unit can be monitored on every level as an option. A warning indicates if a flap has been displaced.

  If the time of the displacement is exceeded by the monitoring time set here, the warning is turned into a fault and the manure removal is interrupted.

2.3.1.3 Plate drying system

- **Monitoring of filling level (tunnel drives)**

  The monitoring of the filling level is an optional feature only available for the plate drying system. It monitors the filling level of the manure on the top level and can be activated or deactivated. In addition, a delay time can be set. This delay time considers the piloting of the level drives.

- **Runtime control (slewing unit)**

  A runtime control for the OptiPlate slewing unit is possible as well. If the slewing unit does not reach its final position within this time, an alarm is generated to stop the manure drying tunnel.

- **Waiting time in reverse position (slewing unit)**

  A waiting time can be set for the direction change of the slewing unit. When the slewing unit reaches a final position, it waits in the reverse position for the set waiting time before moving into the reverse direction.

- **Stand-by position (slewing unit)**

  It is possible to set a stand-by position for the slewing unit. If the filling level of the dosing unit is not sufficient to start the tunnel belts, the unit moves into this position. The slewing unit also moves into this position at the end of the manure removal. Several position can be activated. The slewing unit then stops at the next set position.

2.3.2 Delay time / Residual flow time

Here a delay time and a run-on time can be set for each of the conveyor belts shown. The delay time is also observed after an interruption (fault, pause, overfilling of dosing unit, chopper overcurrent). The run-on times are intended to ensure that the conveyor belts are completely emptied after completion of the manure removal process.

	Delay time	Residual flow time	
conveyor belt a1	5 s	120 s	
conveyor belt a2	5 s	120 s	☒ Bypass
conveyor belt b	5 s	120 s	☐ Bypass
conveyor belt d	5 s	120 s	☒ Bypass
Chopper	5 s	0 s	
tunnel belts		0 s	

Figure 2-20: Conveyor belts

- **Conveyor belt**

  The set delay and residual flow times of the conveyor belts (belt [a1], [a2], [b] and [d]) serve for the ideal starting and stopping of the system. The times set for the conveyor belt [a1] apply to all manure cross belts a1 [1 to 20].

- **Bypass**

  For conveyor belts [a2], [b] and [d] (see figure 2-20) an activation field for "bypass" is displayed. When you click on this field, an "X" appears and the control is informed that this belt is necessary for the bypass mode of the manure removal.

- **Chopper**

  The delay time for the chopper is used if the chopper requires a delay time to achieve the operating speed. The tunnel drives will only be switched on after the delay time.

  The residual flow time for the chopper ensures that the manure can be removed from it without new manure being fed in. This guarantees that no manure remains in the chopper.

- **Tunnel drives**

  The tunnel drives move towards their minimum weighing value at the end of the manure removal and are then piloted independent of the weight value for the set residual flow time. This is to ensure that the dosing unit / the slewing belt are completely empty so that no manure remains in the tunnel.

	The presentation of the on-site visualization is mainly the same as that of the FarmController. The symbols are, however, slightly closer together, in order to be able to present all information on the display. The functions of the individual elements are explained in this section.

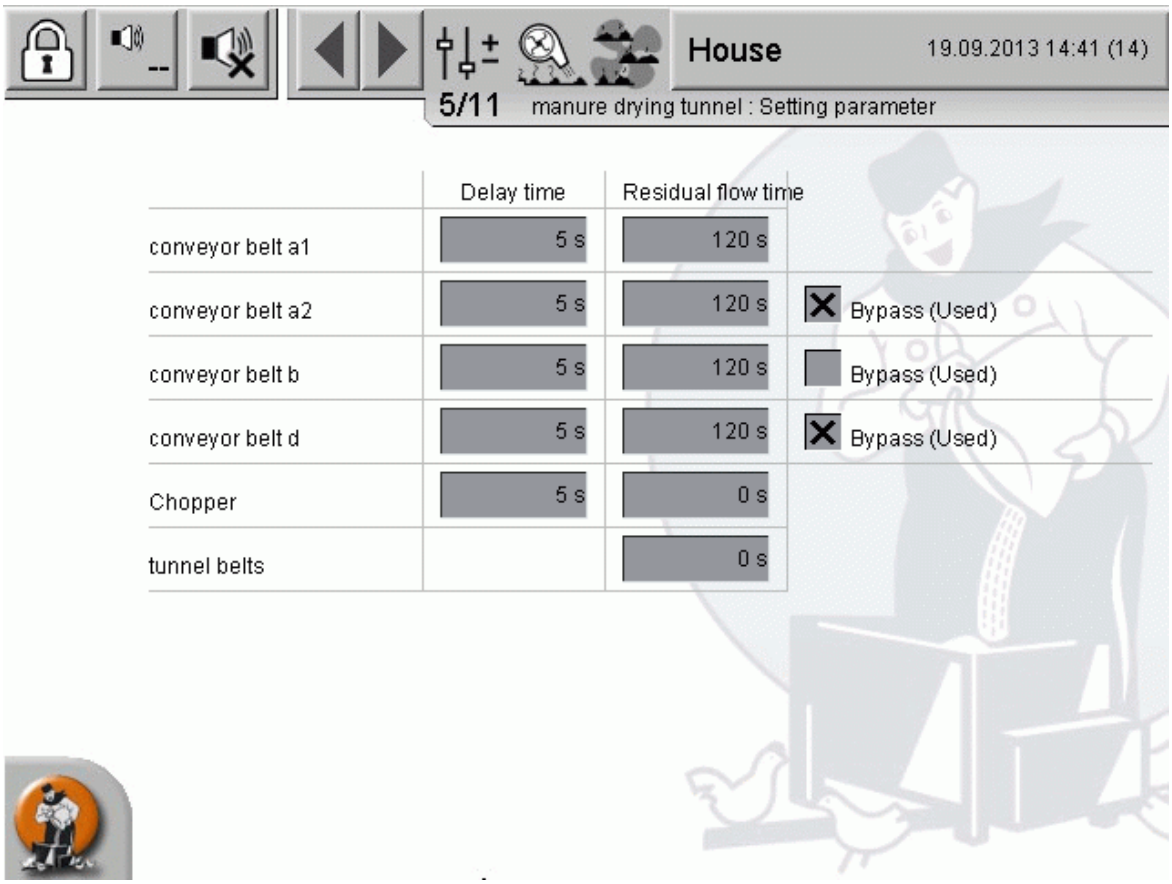


Figure 2-21: Conveyor belts

2.3.3 Assignment

With this assignment table, it is possible to freely select the a1 conveyor belts [1 to 20] required for the manure removal in one group. The a1 belts can thus be used individually by several groups. It may also be the case that some groups do not need a1 belts. Changes to these assignments influence active manure removals, as well. If several manure removal groups are active simultaneously, all required a1 belts are piloted for this group.

Assignment	conveyor belt a1.			
	1	2	3	4
Group 1	☒	☐	☐	☐
Group 2	☒	☒	☐	☐
Group 3	☐	☒	☒	☐
Group 4	☐	☐	☐	☒

Figure 2-22: Assignment

	The presentation of the on-site visualization is mainly the same as that of the FarmController. The symbols are, however, slightly closer together, in order to be able to present all information on the display. The functions of the individual elements are explained in this section.

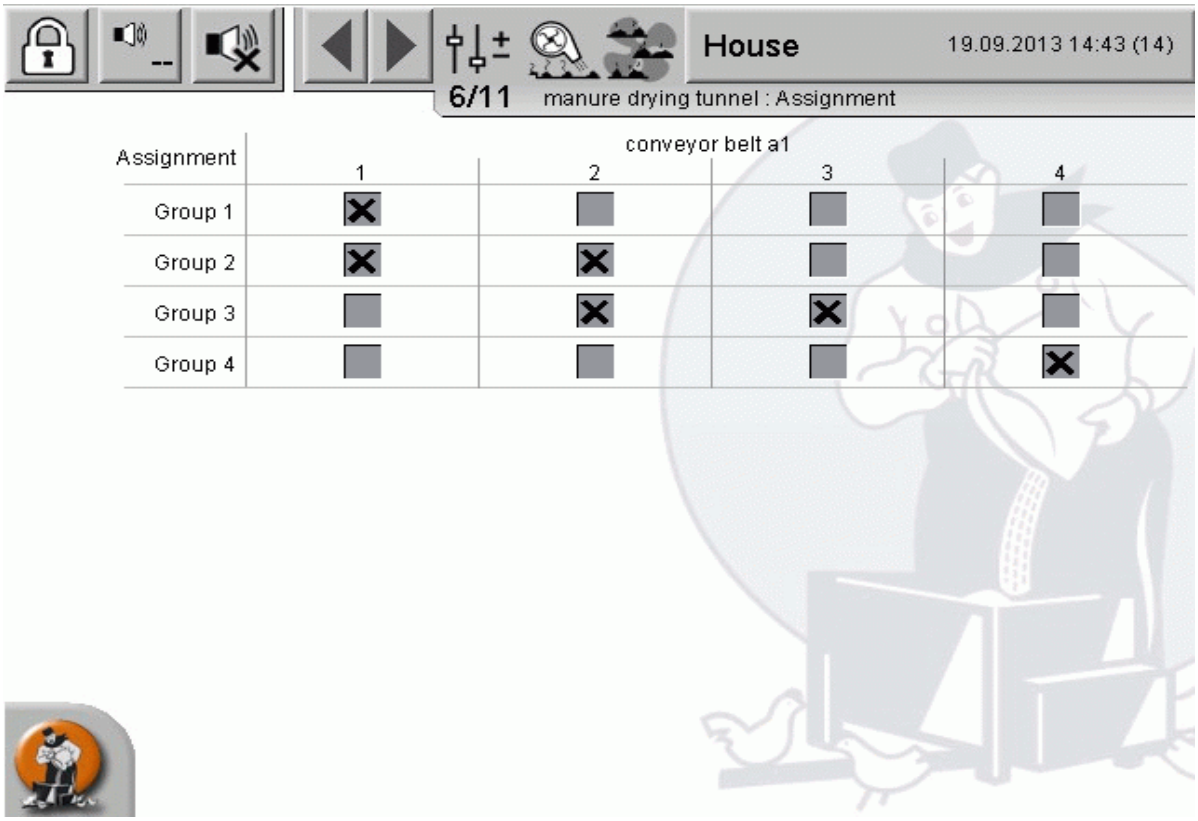


Figure 2-23: Assignment

2.4 Manure removal groups

The manure removal groups (groups 1 to 20) are assigned manure cross belts for an automatic manure removal. The name of the manure removal group can be entered in this display. Additionally, the current progress is displayed numerically and graphically. The manure removal groups must be calibrated beforehand so their progress can be registered. By default, the belt progress of the feed belts is measured on a time basis. If a pulse sensor has been installed for progress determination, a selection between **"time-controlled"** and **"pulse-controlled"** determination is possible.

- In case of a time-controlled procedure, the **Time for 100% progress** is to be set for the respective feed belt.
- In case of a pulse-controlled procedure, the **Pulses for 100% progress** are to be set.

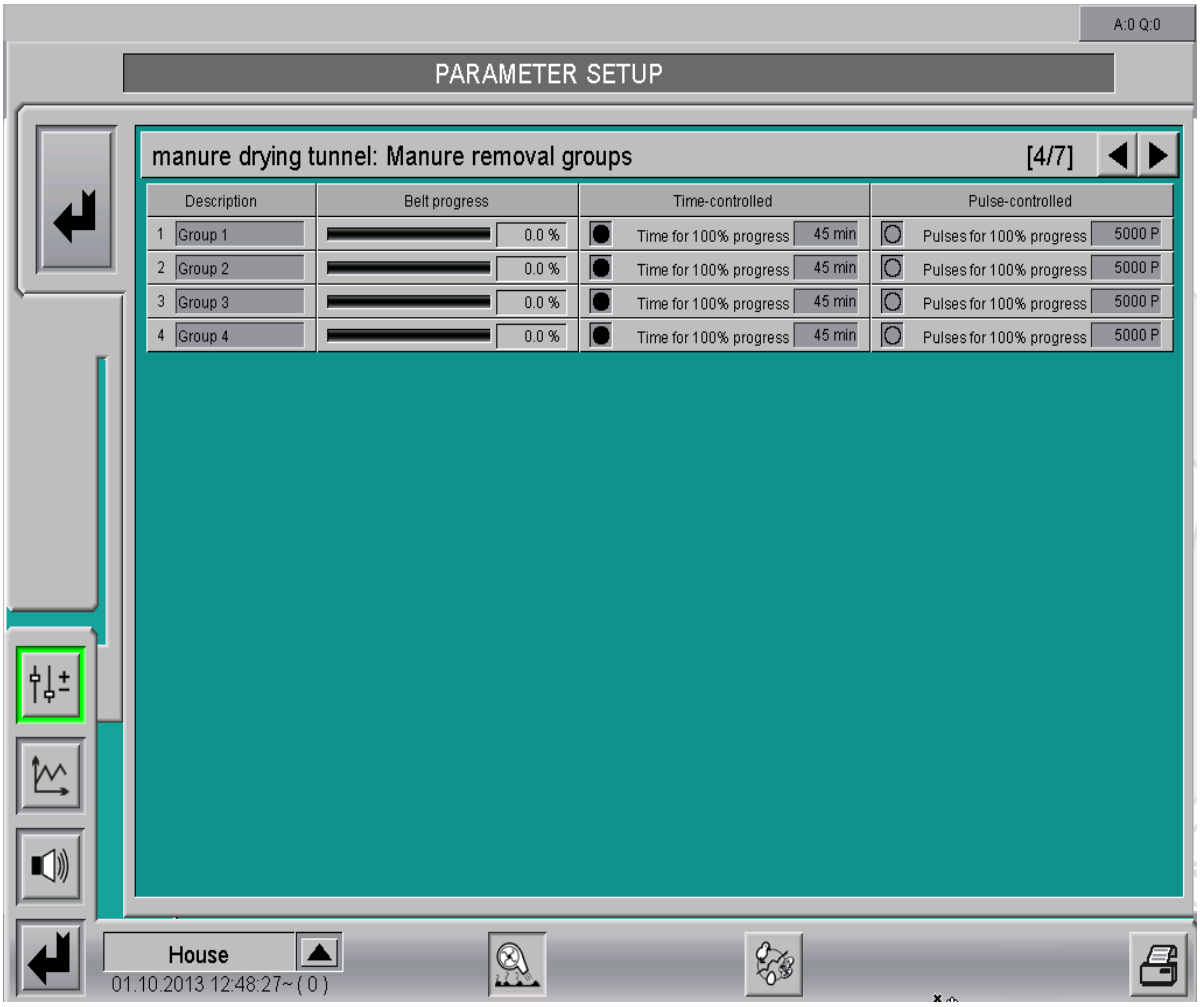


Figure 2-24: Belt progress

	The progress is reset every day at midnight (00:00). If a filling is still active at that point, the progress is reset after the filling has been completed. The procedure can be changed and the values can be modified at any time. The progress will then be measured from the current position.

	The presentation of the on-site visualization is mainly the same as that of the FarmController. The symbols are, however, slightly closer together, in order to be able to present all information on the display. The functions of the individual elements are explained in this section.

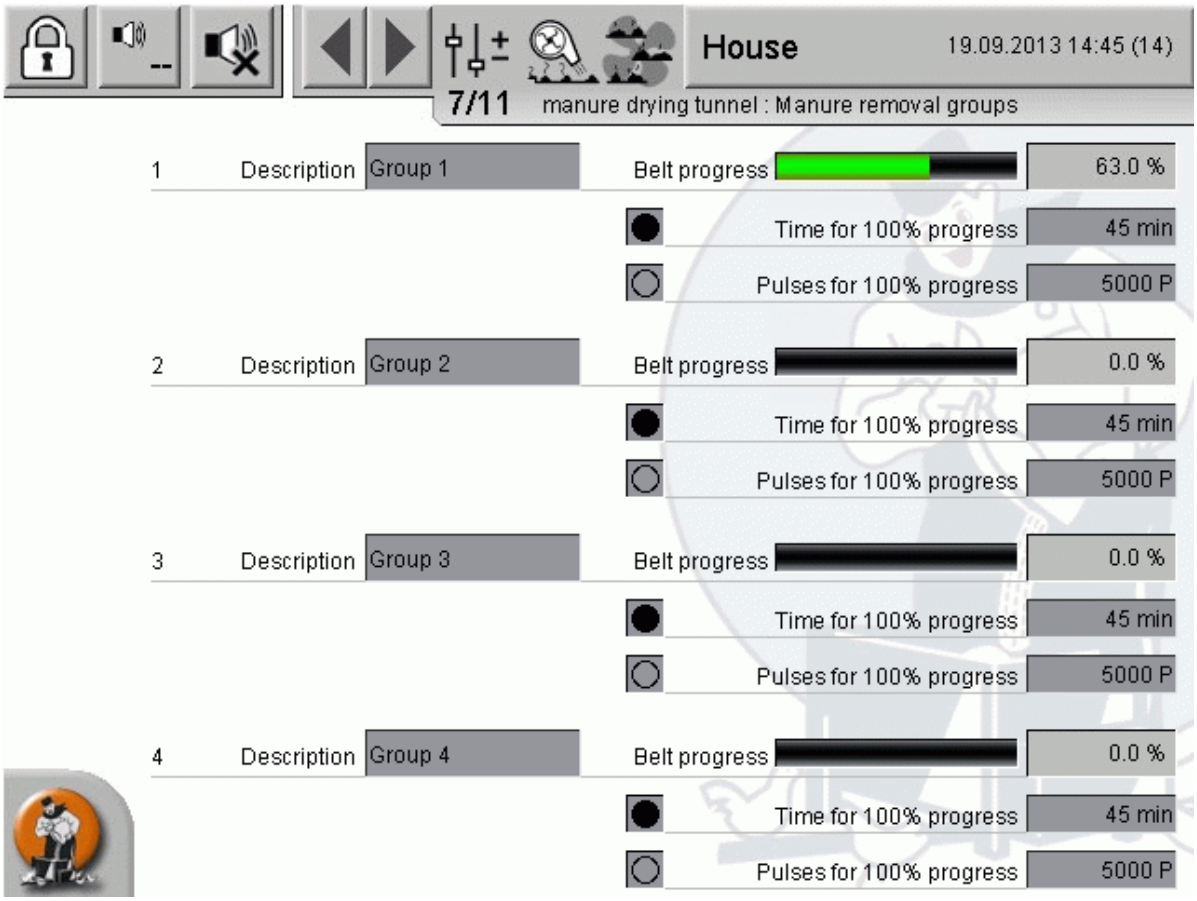


Figure 2-25: Belt progress

2.5 Status of conveyor belts

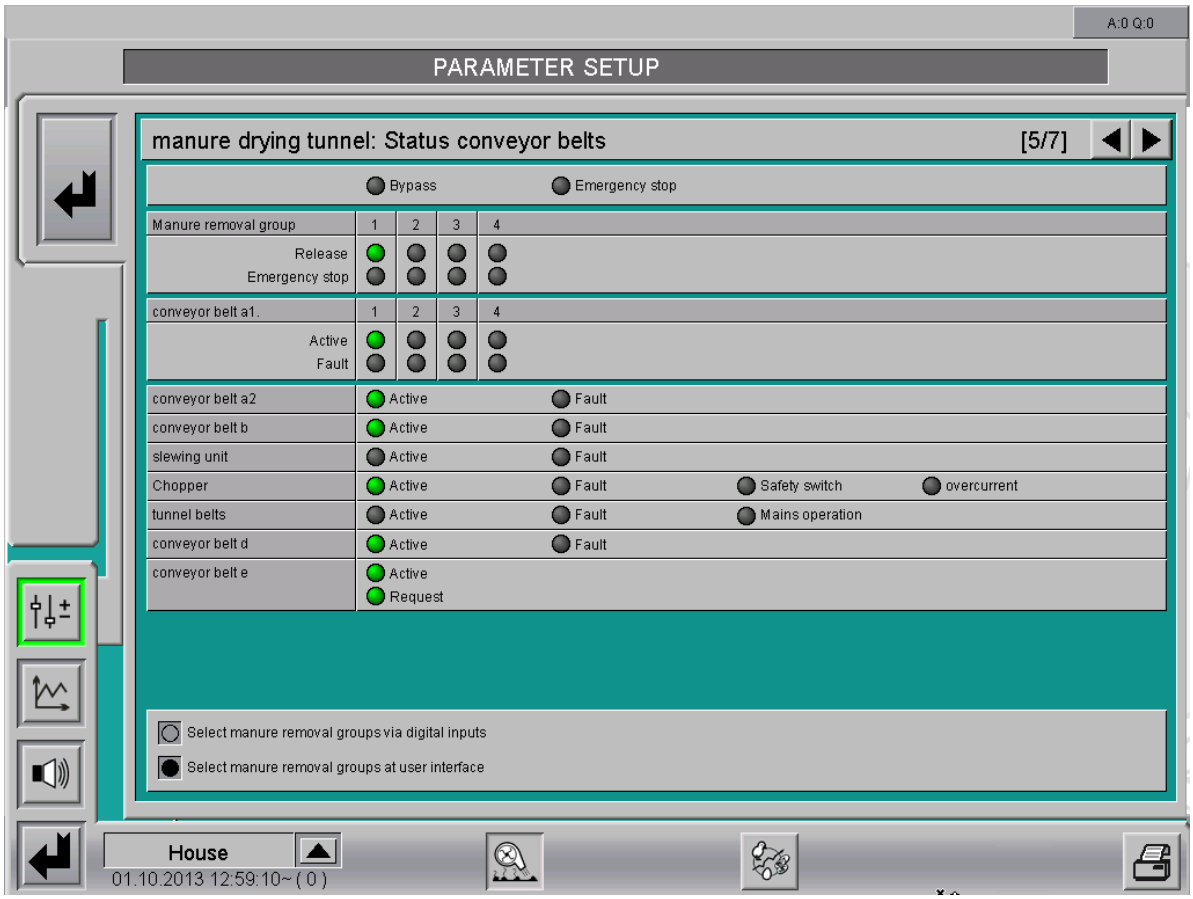


Figure 2-26: Status conveyor belts

- **Bypass**

  Here it is indicated whether a tunnel- or bypass operation is activated (selection key at the control cabinet).

> **Caution**
>
> If the operation mode is set to bypass while a manure removal is active, the manure drying tunnel pauses.

- **Emergency stop**

  The current status of the emergency stop circuit is displayed (grey = OK; red = triggered)

2.5.1 Manure removal group

Figure 2-27: Manure removal group

	Description	Status
Release	Release manure removal group	grey = off green = on
Emergency stop	Status emergency stop circuit manure removal	grey = OK red = triggered

Table 2-1: Conveyor belt

2.5.2 Conveyor belt [a1]

Figure 2-28: Supply

	Description	Status
Active	Status output / drive	grey = off green = on
Fault	Status protective motor switch	grey = OK red = fault

Table 2-2: Conveyor belt [a1]

2.5.3 Tunnel drives

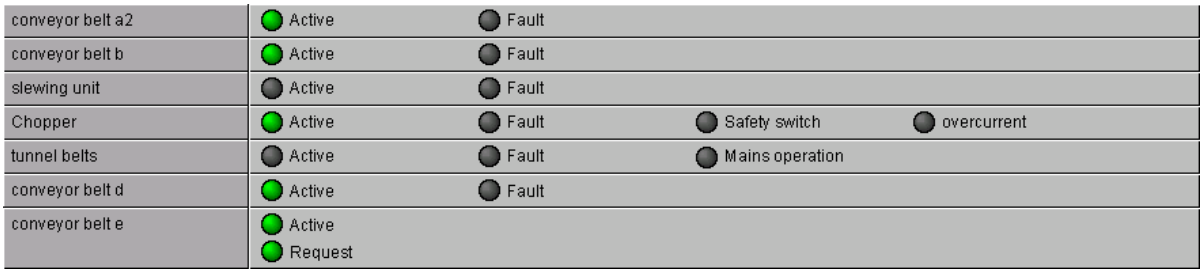


Figure 2-29: Tunnel drives

- **Conveyor belt [a2] (optional)**

	Description	**Status**
Active	Status output / drive	grey = off green = on
Fault	Status protective motor switch	grey = OK red = fault

Table 2-3: Conveyor belt [a2]

- **Conveyor belt [b]**

	Description	**Status**
Active	Status output / drive	grey = off green = on
Fault	Status protective motor switch	grey = OK red = fault

Table 2-4: Conveyor belt [b]

- **Dosing / slewing unit**

	Description	**Status**
Active	Status output / drive	grey = off green = on
Fault	Status protective motor switch	grey = OK red = fault
Safety switch	Status safety switch Dosing unit	grey = OK red = triggered

Table 2-5: Dosing

- **Chopper**

	Description	**Status**
Active	Status output / drive	grey = off green = on
Fault	Status protective motor switch	grey = OK red = fault
Overcurrent	Status overcurrent monitoring	grey = OK red = fault
Safety switch	Status safety switch	grey = OK red = triggered

Table 2-6: Chopper

- **Tunnel drives**

	Description	**Status**
Active	Status output / drive	grey = off green = on
Fault	Status protective motor switch	grey = OK red = fault

Table 2-7: Tunnel drives

- **Conveyor belt [d]**

	Description	**Status**
Active	Status output / drive	grey = off green = on
Fault	Status protective motor switch	grey = OK red = fault

Table 2-8: Conveyor belt [d]

- **Conveyor belt [e]**

	Description	**Status**
Demand	Status demand ext. belt	grey = off green = on
Active	Status switched on	grey = off green = active

Table 2-9: Conveyor belt [e]

2.5.4 Delivery

Here it can be selected whether the selection of the deliveries to be activated shall be effected at the user interface **(Select delivery at user interface)** or via digital inputs **(Select delivery via digital inputs)**.

Figure 2-30: Delivery

	The settings for the selection are only available if more than one delivery is possible. They are usually carried out by the service technician during initial operation.

	The presentation of the on-site visualization is mainly the same as that of the FarmController. The symbols are, however, slightly closer together, in order to be able to present all information on the display. The functions of the individual elements are explained in this section.

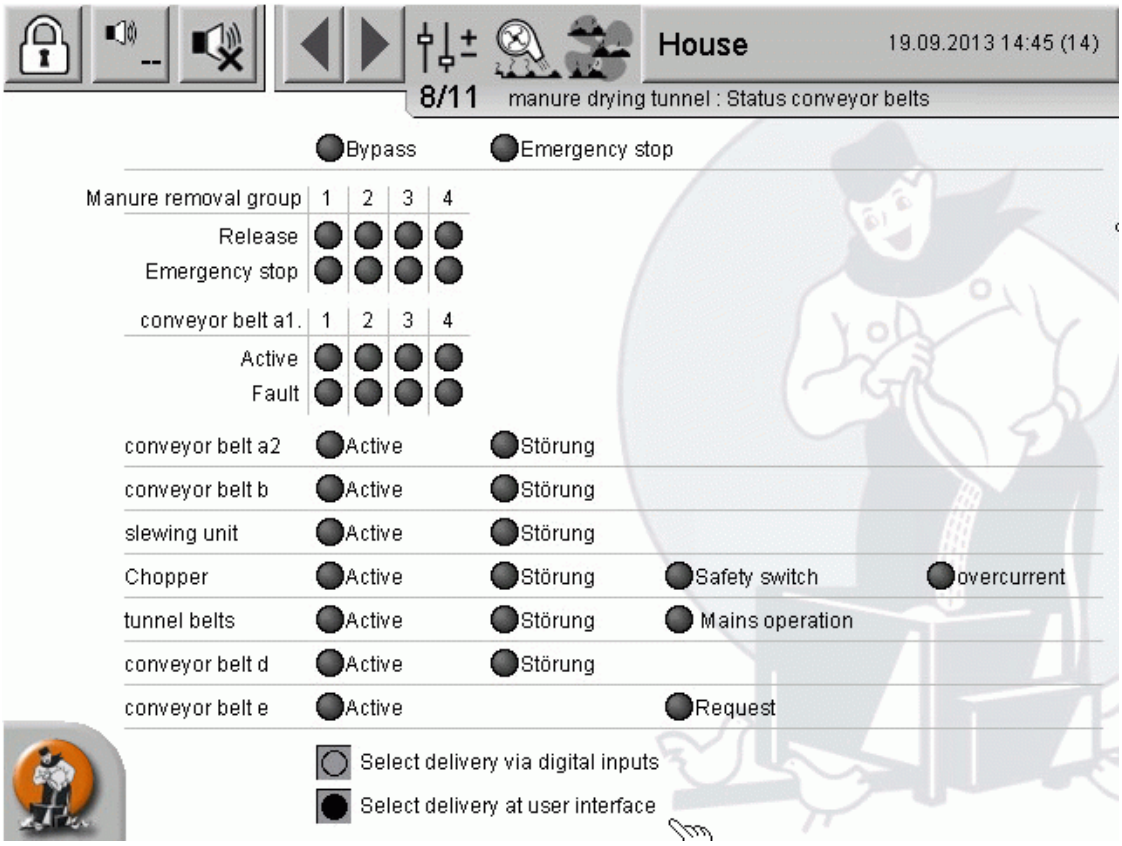


Figure 2-31: Conveyor belts

2.6 Belt controls

The belt controls of the slewing belt, levels and dirt belt can be set and calibrated individually here. In addition, the current sensor values (limit switch / plate monitoring) and the resulting states are displayed.

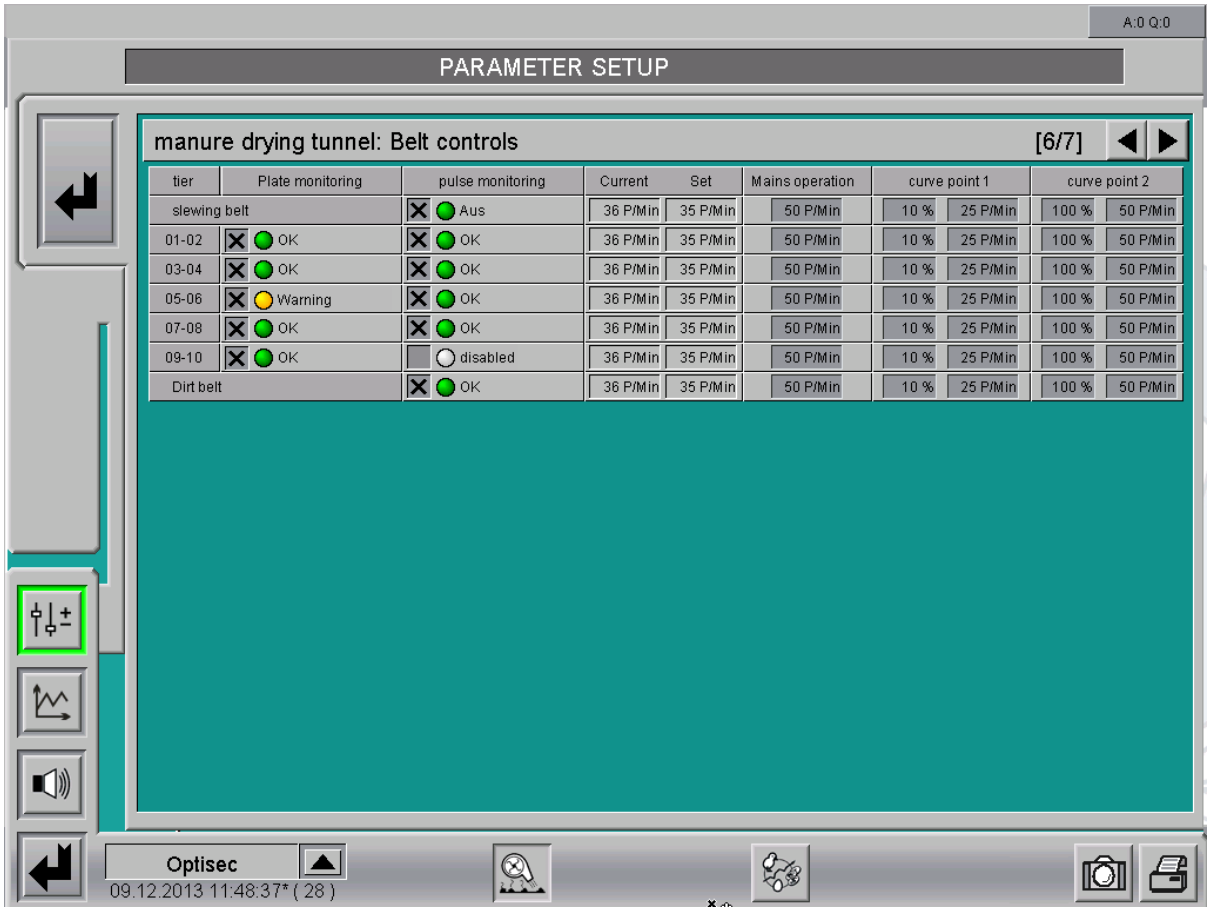


Figure 2-32: Belt controls

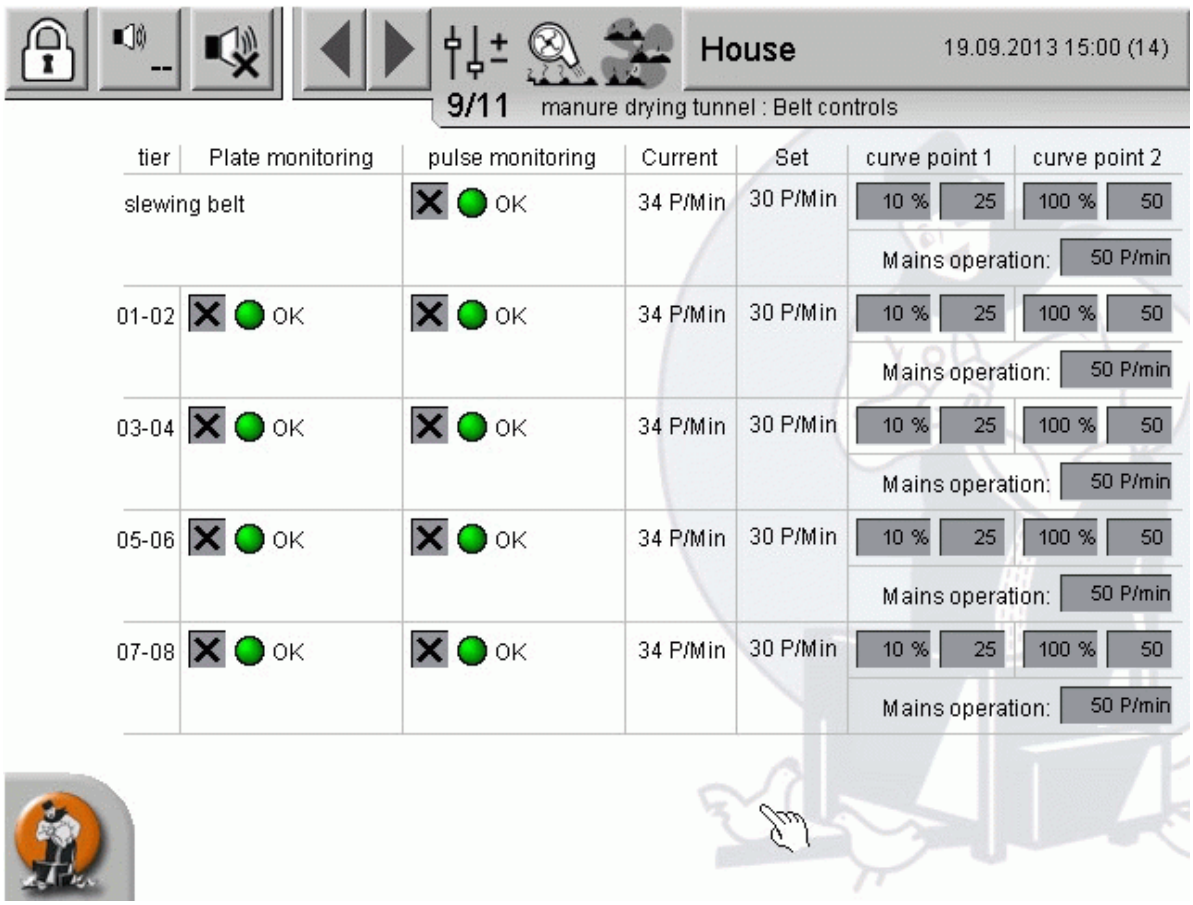


Figure 2-33: Belt controls at the on-site visualisation

2.6.1 Limit switch

Limit switch deactivated

Limit switch in position

Warning limit switch

The limit switch has triggered, the delay time has not yet been exceeded.

Alarm limit switch

The limit switch has triggered and the delay time has been exceeded.

2.6.2 Plate monitoring

Plate monitoring deactivated

Plate monitoring activated

Alarm plate monitoring

The plate monitoring has been triggered.

2.6.3 Pulse monitoring

Speed monitor deactivated

Drive switched off

Drive switched on

Warning pulse monitor

The speed is below the target value but the delay time has not yet been exceeded.

Alarm pulse monitor

The speed is below the target value and the delay time has been exceeded.

2.6.4 Characteristic points of the pulse monitor

In order to be able to monitor the speed of the tunnel belts, the expected pulses per minute (target) are calculated and compared with the current pulses per minute (actual).

The expected pulses per minute result from the current speed, which interpolates with the two characteristic points and summed with the time.

In the settings for the pulse monitoring, a value for the **mains operation** can now be set for single and double levels. This setting also appears if the tunnel drives are not equipped with a frequency transformer. In case of only one speed, the frequency transformer is used to simplify the settings for pulse monitoring.

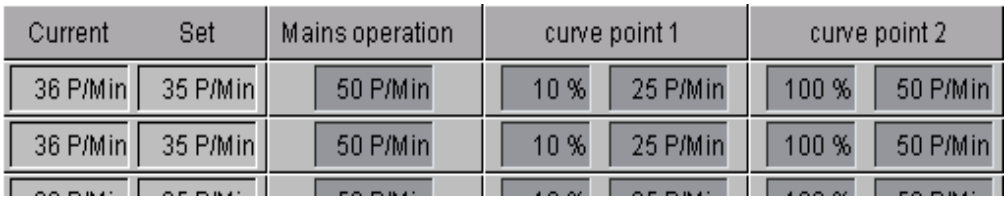


Figure 2-34: Characteristic points of the pulse monitor

	Perform the following cycle for characteristic points 1 and 2 as well as for each tier with a pulse monitor.

1. When calibrating the characteristic points you must manually specify a fixed set value for the tunnel belts (e.g. 10% for characteristic point 1 and 100% for characteristic point 2).
2. The set value must be entered in the field % for the respective characteristic point/ tier.
3. When the pulses per minute have stabilised, you can read them off here or on the main screen and enter them in the field P/min.

2.7 Influence by free alarms

Free manure drying alarms can now optionally stop manure drying tunnels in automatic mode. A manual operation is also possible. For each free alarm, it is possible to select whether the manure removal in tunnel mode or bypass mode is stopped in case of an alarm. The current state of the free alarm is also displayed as information. Up to ten free alarms are possible to include additional alarms and to allow for a flexible alarm configuration.

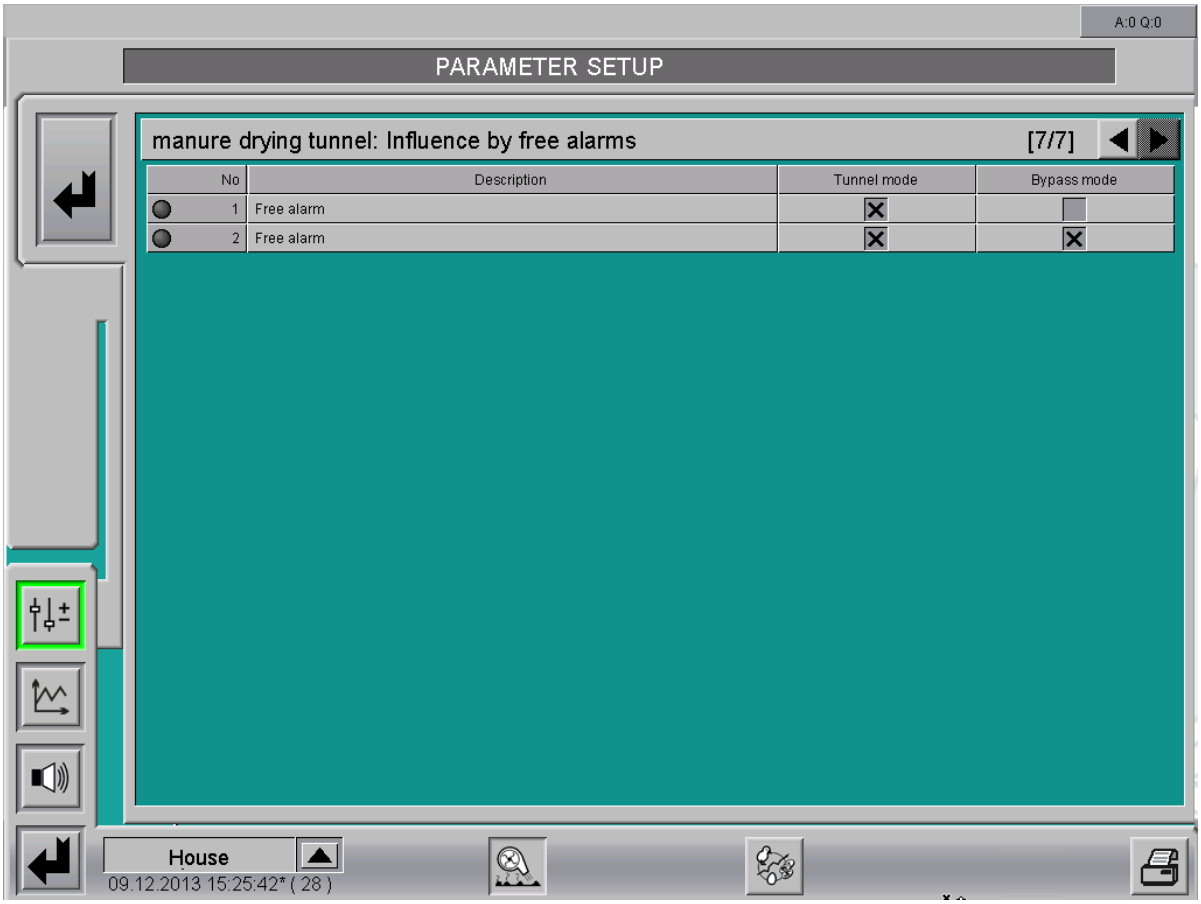


Figure 2-35: Influence by free alarms

	The presentation of the on-site visualization is mainly the same as that of the FarmController. The symbols are, however, slightly closer together, in order to be able to present all information on the display. The functions of the individual elements are explained in this section.

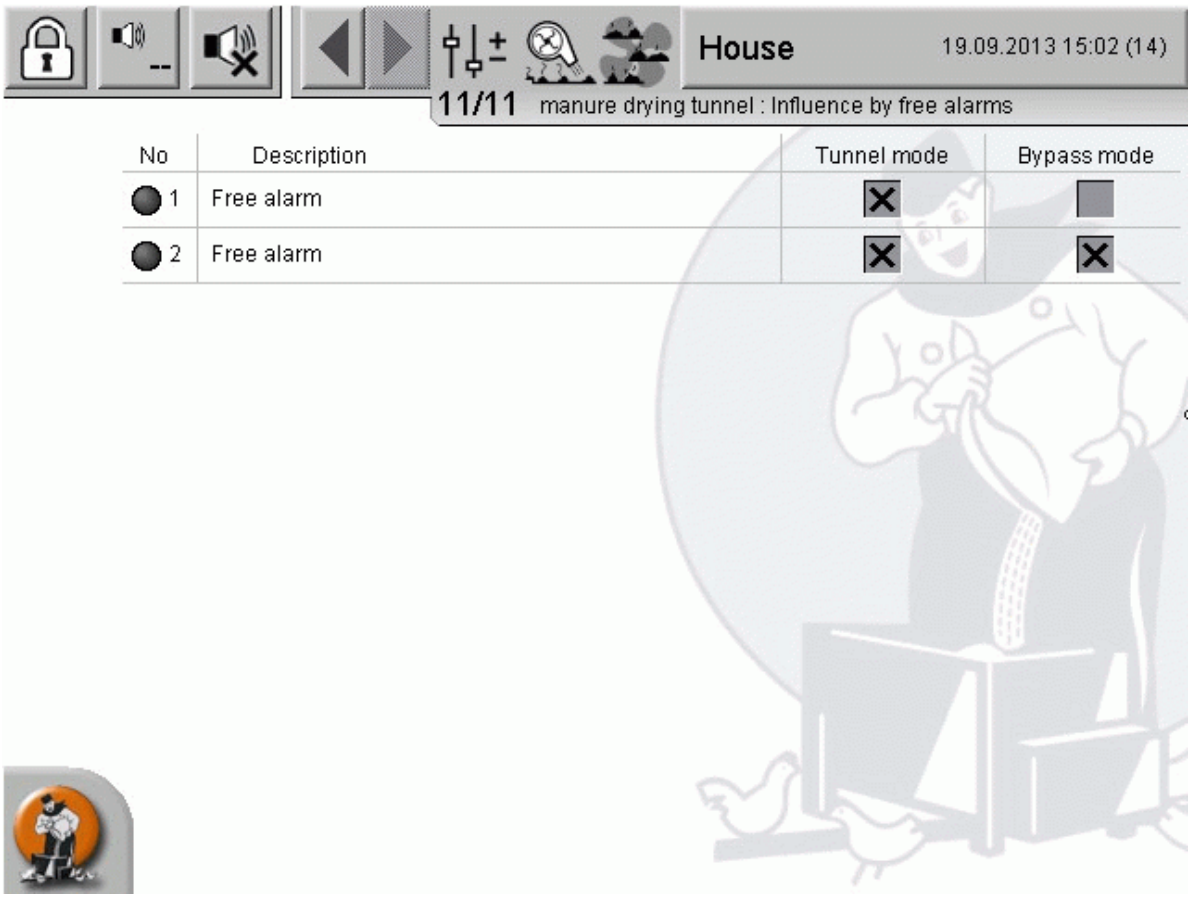


Figure 2-36: Influence by free alarms

3 Functional principle

The cycle of a regular manure removal process is presented below.

The times in the cycle during which you as the person executing the manure removal process need to act are marked "Employee".

The items regulated by the control unit are marked "Control unit".

If faults occur, the manure drying tunnel is switched off. In this case, the alarm has to be investigated and acknowledged via the Release control button (see **chapter 3.2**).

	**Caution!** A warning signal is generated before each start of the manure drying tunnel, whether in manual, automatic or bypass mode. This signal is activated three times for one second, with one second pause in-between. Afterwards, there is a pause of five seconds before the request for the belt is released.

3.1 Automatic tunnel filling

	Before the auto start is released every 24 hours, the maintenance instructions section 6 ”Maintenance instructions” must be observed.

	Since Big Dutchman cannot assume liability for such an operation, this optional function is only released after written risk assumption by the operator! A safety briefing must have taken place before. **Please also observe the notes in the manual "Safety instructions for the operation of AMACS"!**

3.2 Manual tunnel filling

1. Employee: performs a visual inspection of the system

2. Employee: chooses which manure removal is to be used (if more than one are available)

3. Employee: sets the selector switch tunnel/bypass to tunnel

4. Employee: presses the start button

Control unit: generates three warning signals of one second to indicate that belt [e] is running

Control unit: sets request for ext. belt [e] and waits until belt [e] is running

5. Employee: switches on the external belt

Control unit: waits until the delay time has expired and starts belt [d]

Control unit: starts the chopper, dosing unit and tunnel drives if the dosing unit does not indicate an error

Control unit: waits until the delay time has expired and starts belt [b]

Control unit: waits until the delay time has expired and starts belt [a2]

Control unit: waits until the delay time has expired and starts belt (e.g. [a1.1])

Control unit: sets release for manure belts in the house

6. Employee: monitors the tunnel filling

Control unit: resets release for house

Control unit: waits until the residual flow time has expired and switches off belt (e.g. [a1.1])

Control unit: waits until the residual flow time has expired and switches off belt [a2]

Control unit: waits until the residual flow time has expired and switches off belt [b]

Control unit: switches off tunnel belts, dosing screw and chopper

Control unit: waits until the run-on time has expired and switches off belt [d]

Control unit: resets request for ext. belt [e]

7. Employee: switches off the external belt [e]

An overview of all belt names can be found in figure 1-2.

3.3 Bypass operation

In the control, you can select for the manure belts [a2], [b], [d] (see figure 1-3) whether they are required for the bypass function. A possible directional reversal of individual belts owing to the system is realised electro-mechanically.

1 Employee: performs a visual inspection of the system

2. Employee: chooses which manure removal is to be used (if more than one are available)

3. Employee: sets the selector switch tunnel/bypass to bypass

4. Employee: presses the start button

Control unit: generates three warning signals of one second to indicate that belt [e] is running

Control unit: sets request for ext. belt [e] and waits until belt [e] is running

5. Employee: switches on the external belt [e]

Control unit: waits until the time delay has expired and starts belt [d] (if active for bypass)

Control unit: waits until the time delay has expired and starts belt [b] (if active for bypass)

Control unit: waits until the time delay has expired and starts belt [a2] (if active for bypass)

Control unit: waits until the delay time has expired and starts belt (e.g. [a1.1])

Control unit: sets release for manure belts in the house

6. Employee: starts the release belts in the house

7. Employee: supervises manure removal

8. Employee: presses the stop button when the manure removal process has ended

Control unit: resets release for house

Control unit: waits until the delay time has expired and switches the manure removal off

Control unit: waits until the residual flow time has expired and switches off belt (e.g. [a1.1])

Control unit: waits until the residual flow time has expired and switches off belt [a2] (if active for bypass)

Control unit: waits until the residual flow time has expired and switches off belt [b] (if active for bypass)

Control unit: waits until the residual flow time has expired and switches off belt [d] (if active for bypass)

Control unit: resets request for ext. belt [e]

9. Employee: switches off the external belt [e]

An overview of all belt names can be found in figure 1-2.

4 Alarm description

In the alarm settings you can choose which alarms you require and when they should appear. In addition you can state whether the alarm is to be issued by the alarm device or sent to the users by e-mail.

Attention

All alarms are activated as standard!

Before deactivating an alarm you should make sure to check whether it is really not required. Alarms help to prematurely recognise problems they may potentially endanger the animals' health. Alarms should not be viewed as disturbing but as a chance to be able to keep the productivity of the house at a consistently high level.

How to operate the **Alarm settings** can be found in the "Amacs Operation" manual.

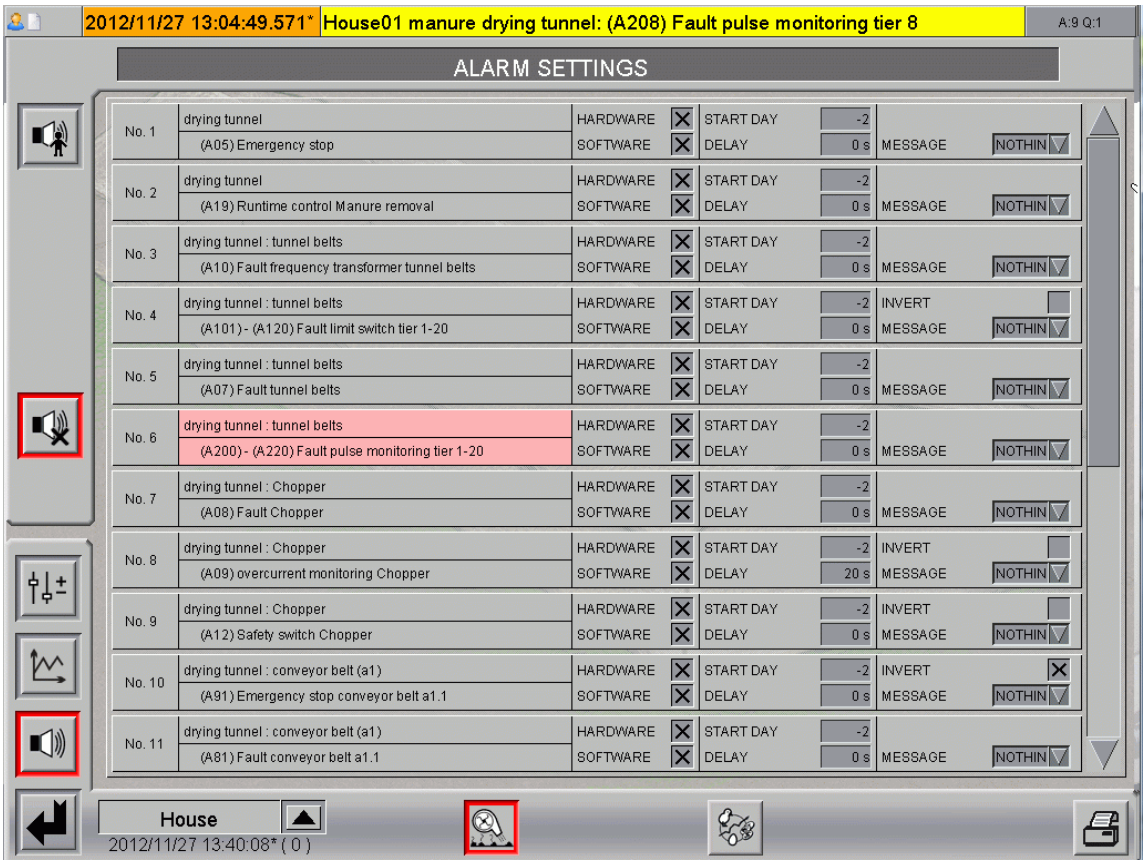


Figure 4-1: Alarm setting

This section describes the various alarms shown in the message line and their cause.

You will find information regarding how to operate the message line in the manual **Amacs Operation**.

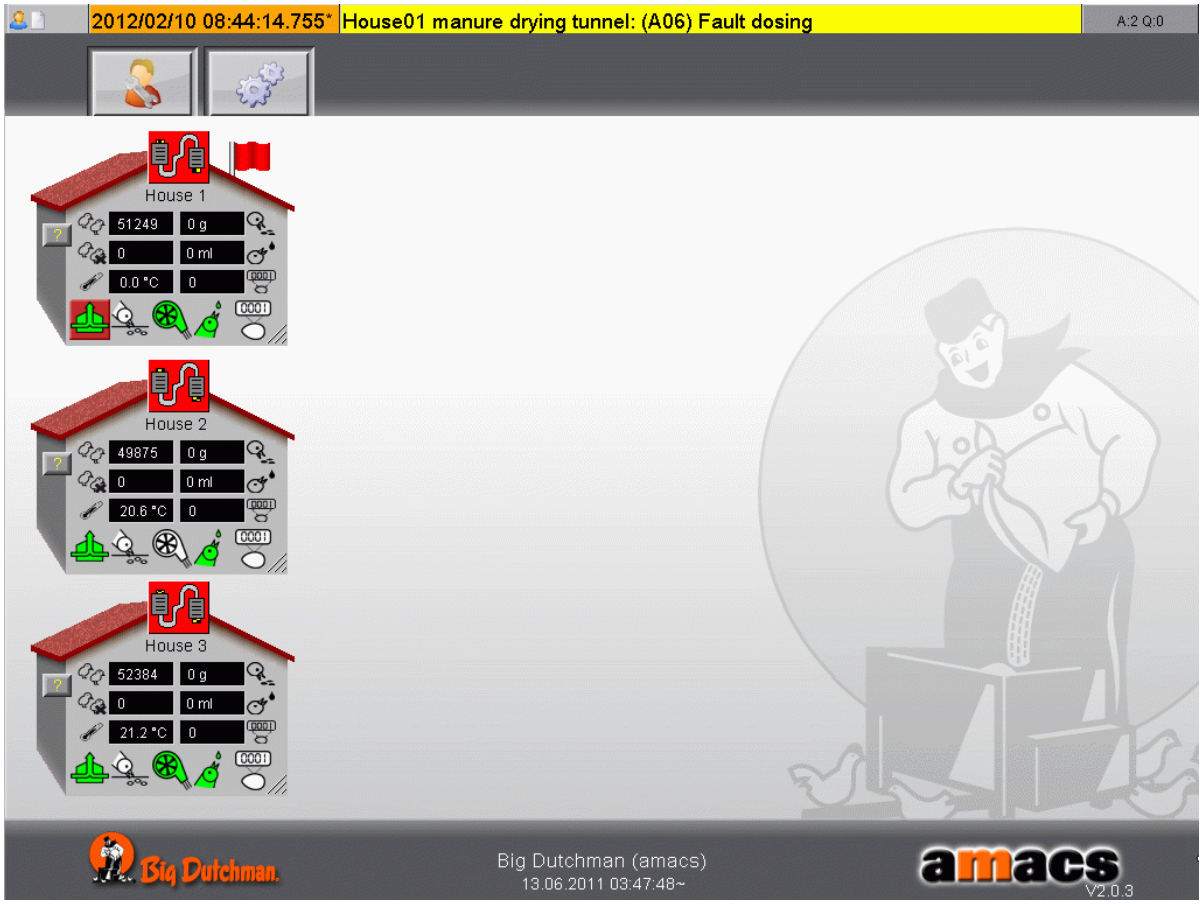


Figure 4-2: Alarm line

	An overview of all belt names can be found in figure 1-2.

Fault no.	Description
A05	Manure drying tunnel: (A05) Emergency stop
=> An Emergency stop switch at the manure drying tunnel has been triggered.	
A19	Manure drying tunnel: (A19) Runtime monitor manure removal
=> Time limit for manure removal exceeded. Duration of manure removal too long, important in case of progress measuring via pulse counter.	

Table 4-1: General alarms

Fault no.	Description
A8 [1-20]	Manure drying tunnel: (A8 [1-20]) Fault conveyor belt (e.g. [a1.01-20])
=> The protective motor switch of the conveyor belt [a1.01-20] was triggered (control cabinet).	
A9 [1-20]	Manure drying tunnel: (A9 [1-20]) Emergency stop conveyor belt [a1.01-20]
=> Emergency stop at the manure removal [a1.01-20] was triggered.	
A02	Manure drying tunnel: (A02) Fault conveyor belt [a2]
=> The protective motor switch of the conveyor belt [a2] was triggered (control cabinet).	
A03	Manure drying tunnel: (A03) Fault conveyor belt [b]
=> The protective motor switch of the conveyor belt [b] was triggered (control cabinet).	

Table 4-2: Feed belt alarms

Fault no.	Description
A06	Manure drying tunnel: (A06) Fault dosing unit
Belt drying system => The protective motor switch of the dosing unit was triggered (control cabinet).	
A13	Manure drying tunnel: (A13) Safety switch dosing unit
Belt drying system => The service opening of the dosing unit is open.	
A14	Manure drying tunnel: (A14) Fault emptying dosing unit
=> Bridging in the dosing unit. Weight is not decreasing despite piloted tunnel belts and interruption of delivery.	
A15	Manure drying tunnel: (A15) Monitoring of filling level
Plate drying system => The maximum filling level of the plate drying system was exceeded. The manure drying tunnel is switching off.	
A17	(A17) Underfilling dosing unit
Warning message: Dosing unit is underfilled. The tunnel drives stop, the manure feed (belts [b], [a2], [a1]) continue running (status message).	
A18	A18 Congestion dosing unit
Warning message: Dosing unit is congested. The manure feed (belts [b], [a2], [a1]) stops, the tunnel drives continue running (status message).	
A23	(A23) Fault slewing unit
Plate drying system: The protective motor switch of the plate drying system's slewing unit was triggered (control cabinet).	
A24	(A24) Runtime control slewing unit
Plate drying system: Time limit slewing unit was exceeded. The position sensor of the slewing unit does not indicate that the position was reached.	
A221	(A221) Fault pulse monitoring of slewing unit
Plate drying system: The speed of the dosing unit's slewing belt is too slow. The manure drying tunnel is switched off.	

Table 4-3: Dosing unit alarms

Fault no.	Description
A07	Manure drying tunnel: (A07) Fault tunnel drives
The protective motor switch of the dosing unit was triggered (control cabinet).	
A10	Manure drying tunnel: A10 Fault frequency transformer tunnel drives
=> The frequency transformer triggers an alarm in event of a mains, motor or device malfunction (control cabinet).	
A1 [01-20]	Manure drying tunnel: (A1 [01-20]) Fault limit switch level [01-20]
Belt drying system => Too much manure is in the idler unit. The transfer is blocked. The manure drying tunnel is switching off.	
A200	Manure drying tunnel: (A200) Fault pulse monitoring of dirt belt
=> The speed of the idler roller at the dirt belt is too slow. The manure drying tunnel is switching off.	
A2 [01-20]	Manure drying tunnel: (A2 [01-20]) Fault pulse monitoring of levels [01-20]
Belt drying system => The speed of the idler rollers at the tunnel belts is too slow. The manure drying tunnel is switching off.	
A3 [01-10]	Manure drying tunnel: (A3[01-10]) Plate monitoring levels [01-10]
Plate drying system => A displaced plate was detected during the reversing of the plates. The tunnel is being stopped automatically.	
A4 [01-10]	Manure drying tunnel: (A4 [01-10]) Fault pulse monitoring of levels [01-20]
Plate drying system => The speed of the tunnel plates is too slow. The manure drying tunnel is switching off.	

Table 4-4: Tunnel drive alarms

Fault no.	Description
A08	Manure drying tunnel: (A08) Fault chopper
=> The protective motor switch of the chopper was triggered (control cabinet).	
A09	Manure drying tunnel: (A09) Overcurrent monitoring of chopper
=> The overcurrent monitoring of the chopper was triggered because the load is too high. The tunnel drives are being stopped.	
A12	Manure drying tunnel: (A12) Safety switch chopper
=> The service opening of the chopper is open.	
A20	Manure drying tunnel: (A20) Overcurrent chopper
Warning message => The analogue current monitor of the chopper indicates excessive power consumption (status message).	
A21	Manure drying tunnel: (A21) Current monitoring of chopper (maximum)
=> The analogue current monitor of the chopper indicates excessive power consumption (status message).	
A22	Manure drying tunnel: (A22) Current monitoring of chopper
=> The analogue current monitor of the chopper indicates a power consumption which is too low (status message).	

Table 4-5: Chopper alarms

Fault no.	Description
A04	Manure drying tunnel: (A04) Fault conveyor belt [d]
=> The protective motor switch of conveyor belt [d] has triggered (control cabinet).	
A70	Manure drying tunnel: (A70) No feedback conveyor belt [e]
=> The discharge belt [e] is not switched on. The manure drying belt has no release signal.	

Table 4-6: Alarms discharge belts

5 Summary of sensor positions

5.1 Belt drying system

5.1.1 Discharge side end set

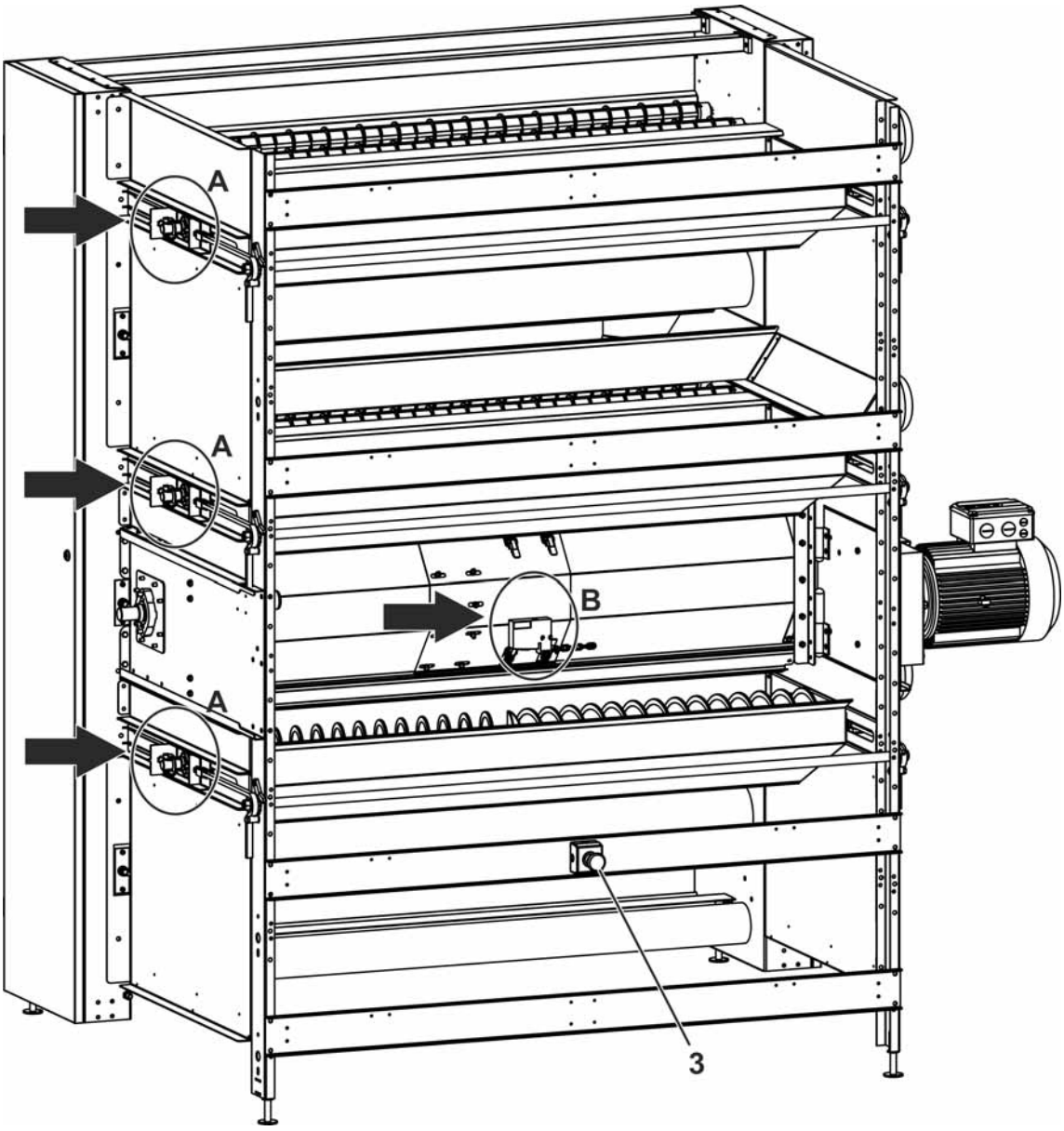
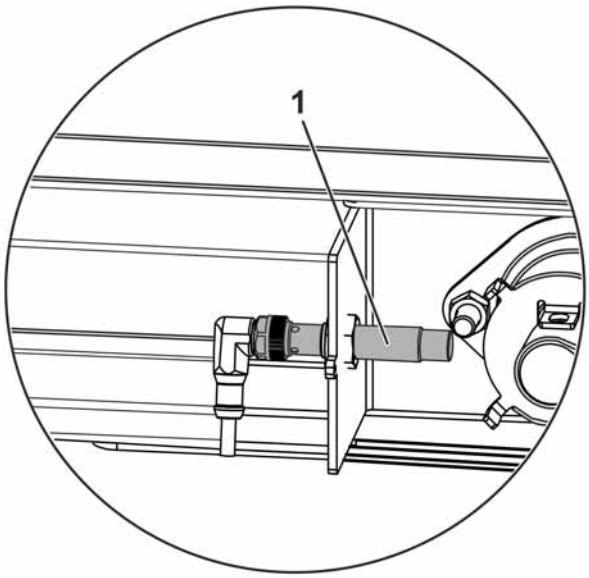
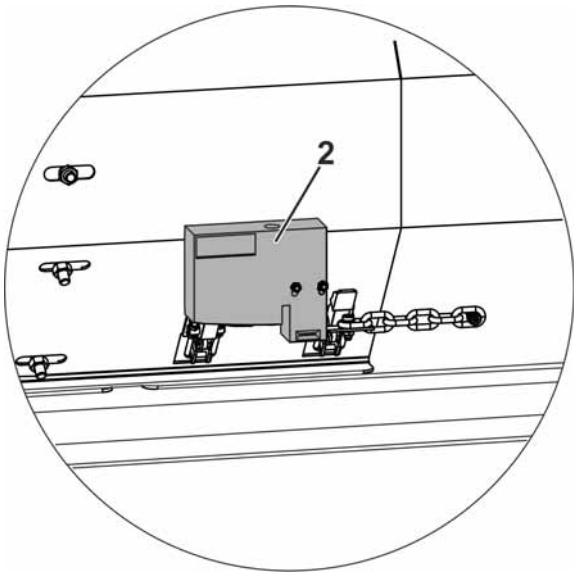


Figure 5-1: Discharge side end set

Position numbers see the following page

Details sensor of speed monitor	Details safety switch of chopper
	

Pos.	Code no.	Description
1	91-04-0049	Sensor inductive 10-30 V DC NO plug connection IFC246
2	20-52-3114	Safety switch electro-magnetic 24 V 50 Hz
3	91-00-2332	Switch for emergency shutdown cpl. with housing M22-PV/KC02/IY

5.1.2 Filling side end set

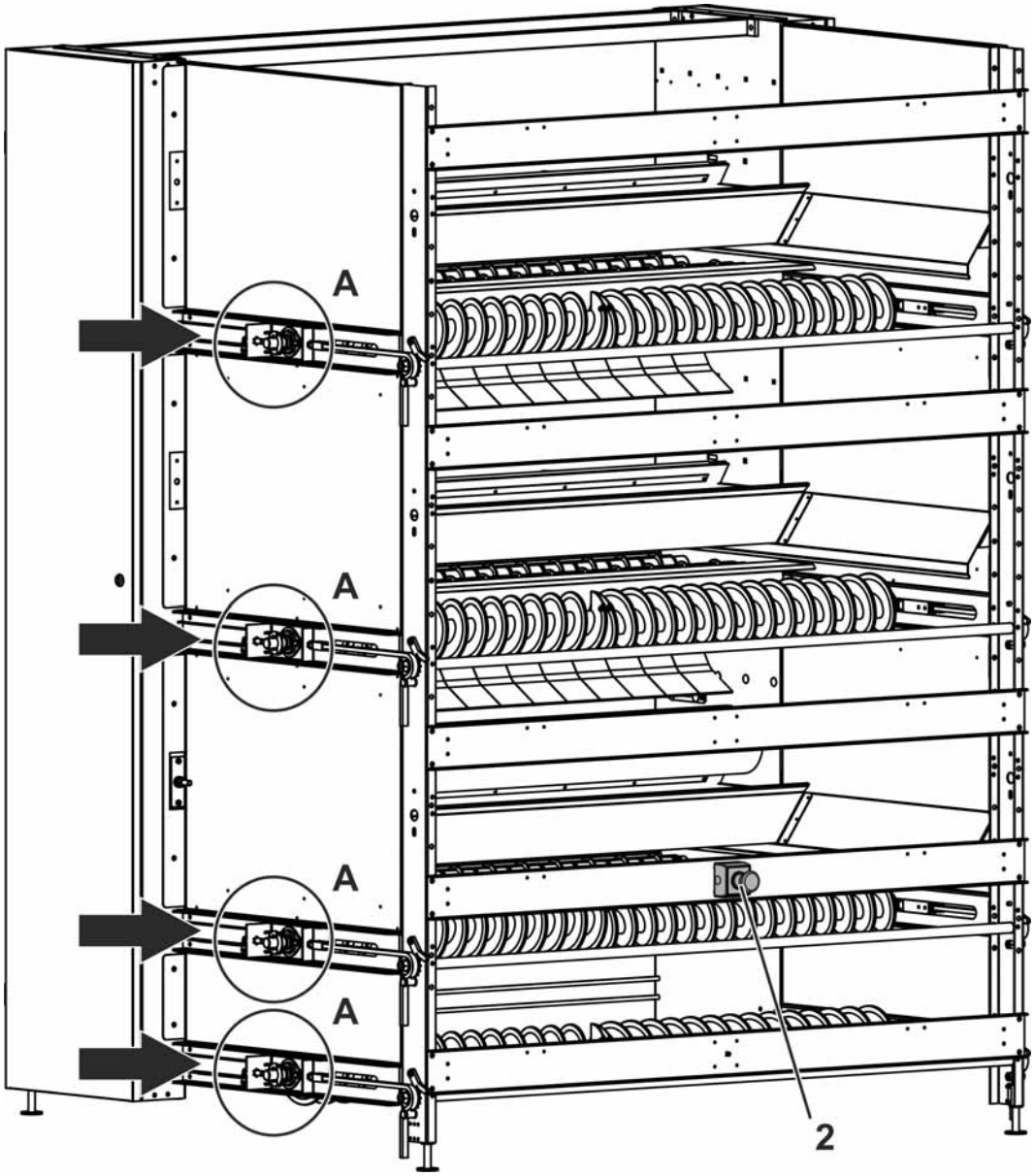
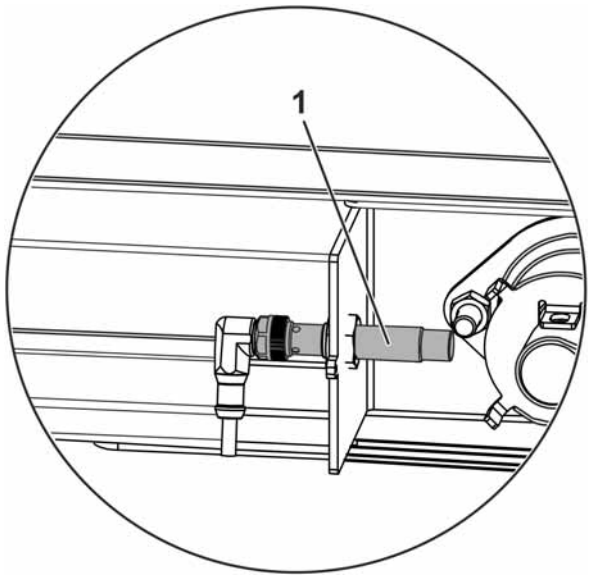


Figure 5-2: Filling side end set

Position numbers see the following page

Details sensor of speed monitor



Pos.	Code no.	Description
1	91-04-0049	Sensor inductive 10-30 V DC NO plug connection IFC246
2	91-00-2332	Switch for emergency shutdown cpl. with housing M22-PV/KC02/IY

5.1.3 Filling station

	Emergency stop switches are fitted on the railing on both sides of the filling station.

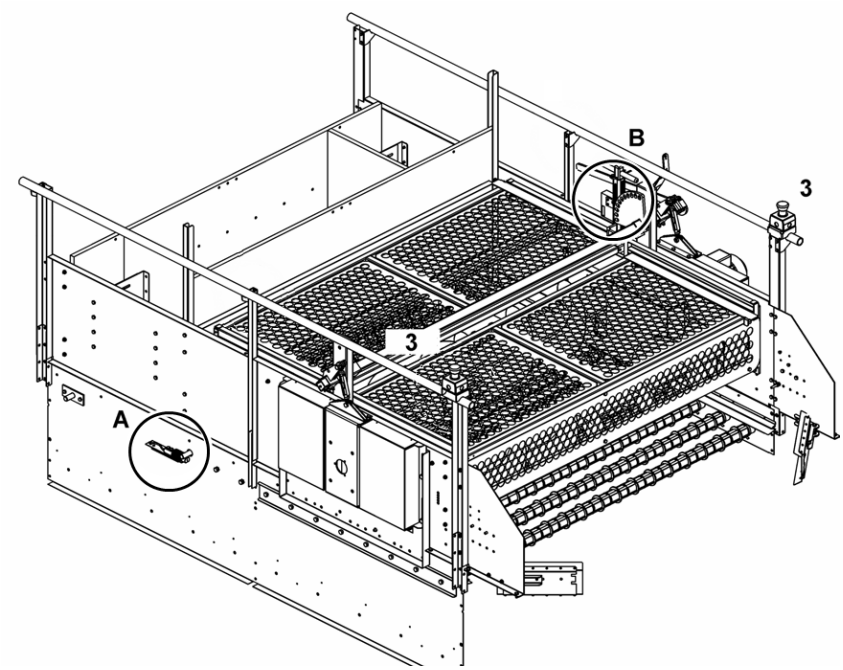
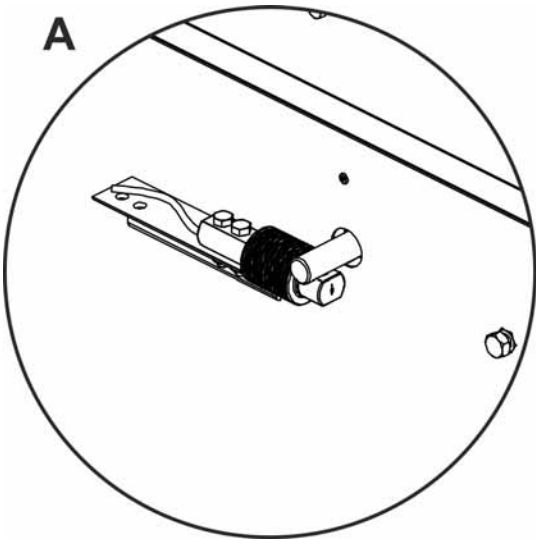
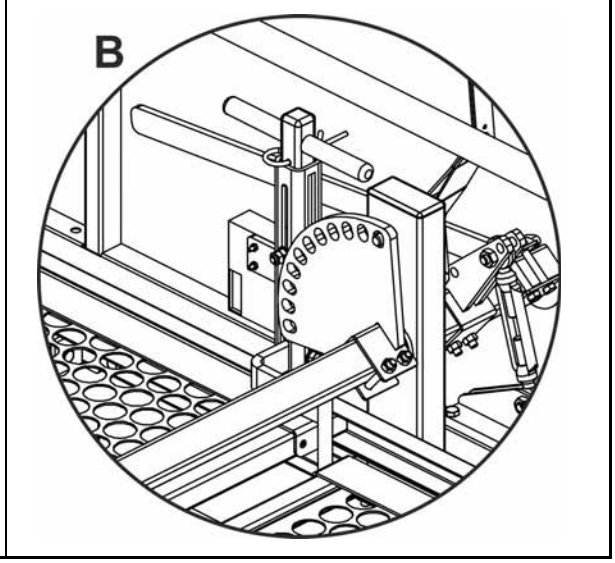


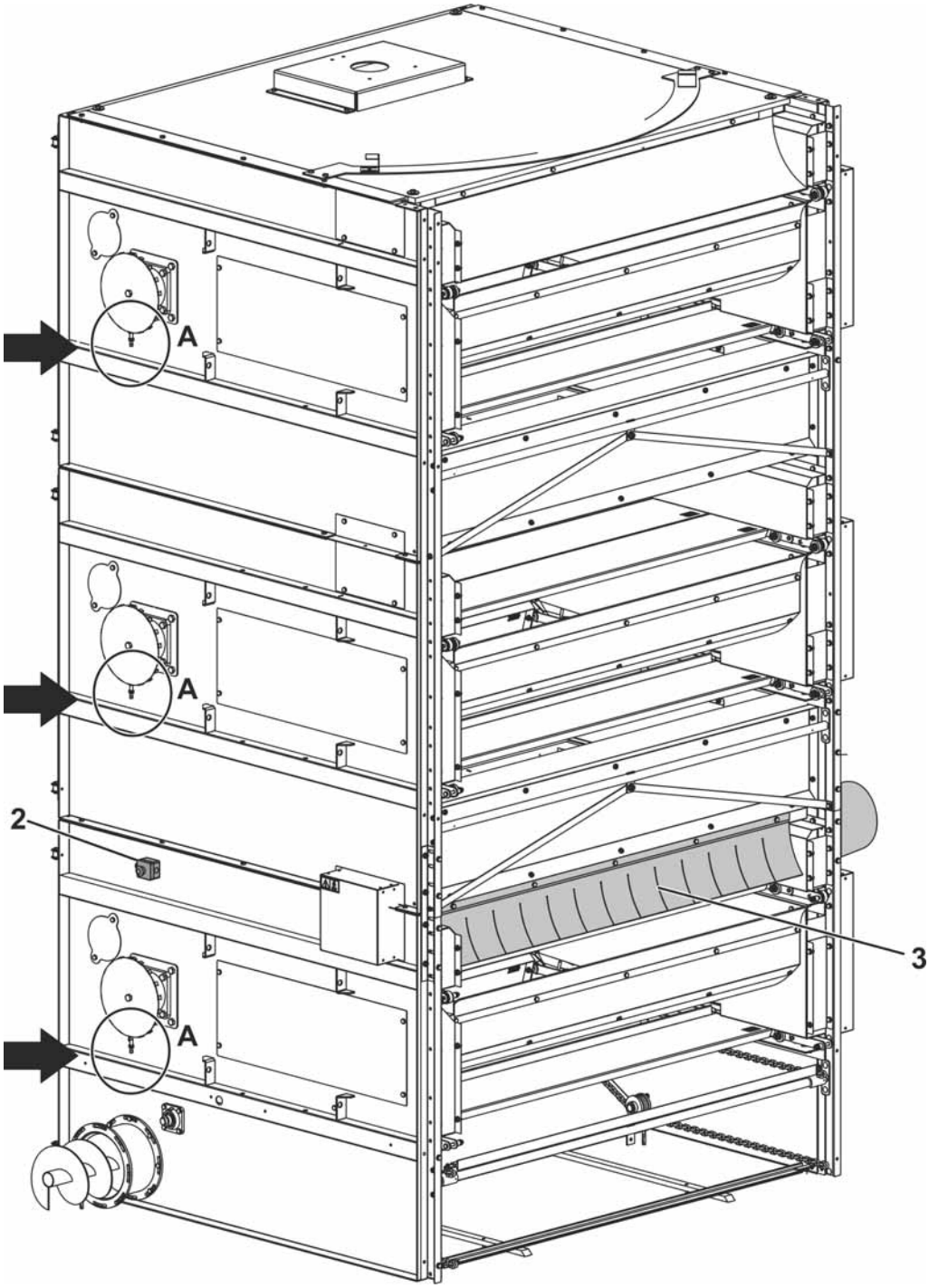
Figure 5-3: Filling station

Detail sensor weighing unit	Detail safety switch dosing unit
	

Pos.	Code no.	Description
A	83-00-7789	Load cell Z6FD1/100 kg stainless steel
B	71-51-0101	Safety position switch, complete, for Optisec OS 175
3	91-00-2332	Emergency Stop switch complete with M22-PV/KC02/IY housing

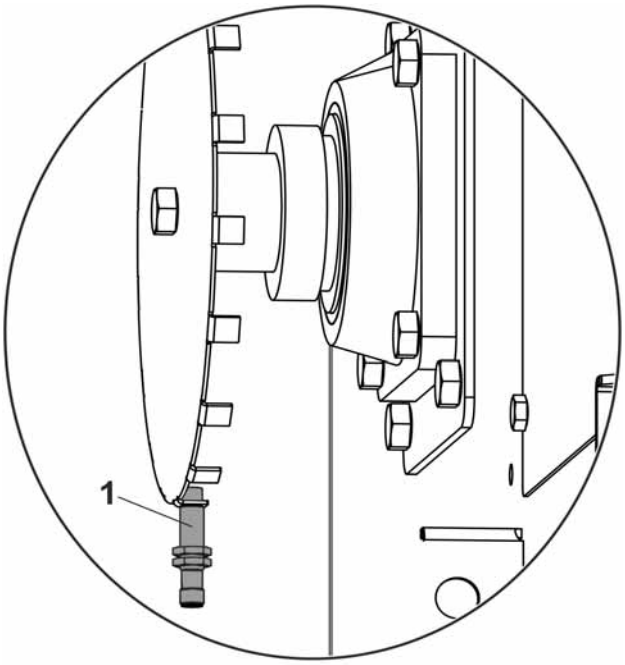
5.2 Plate drying system

5.2.1 Drive unit



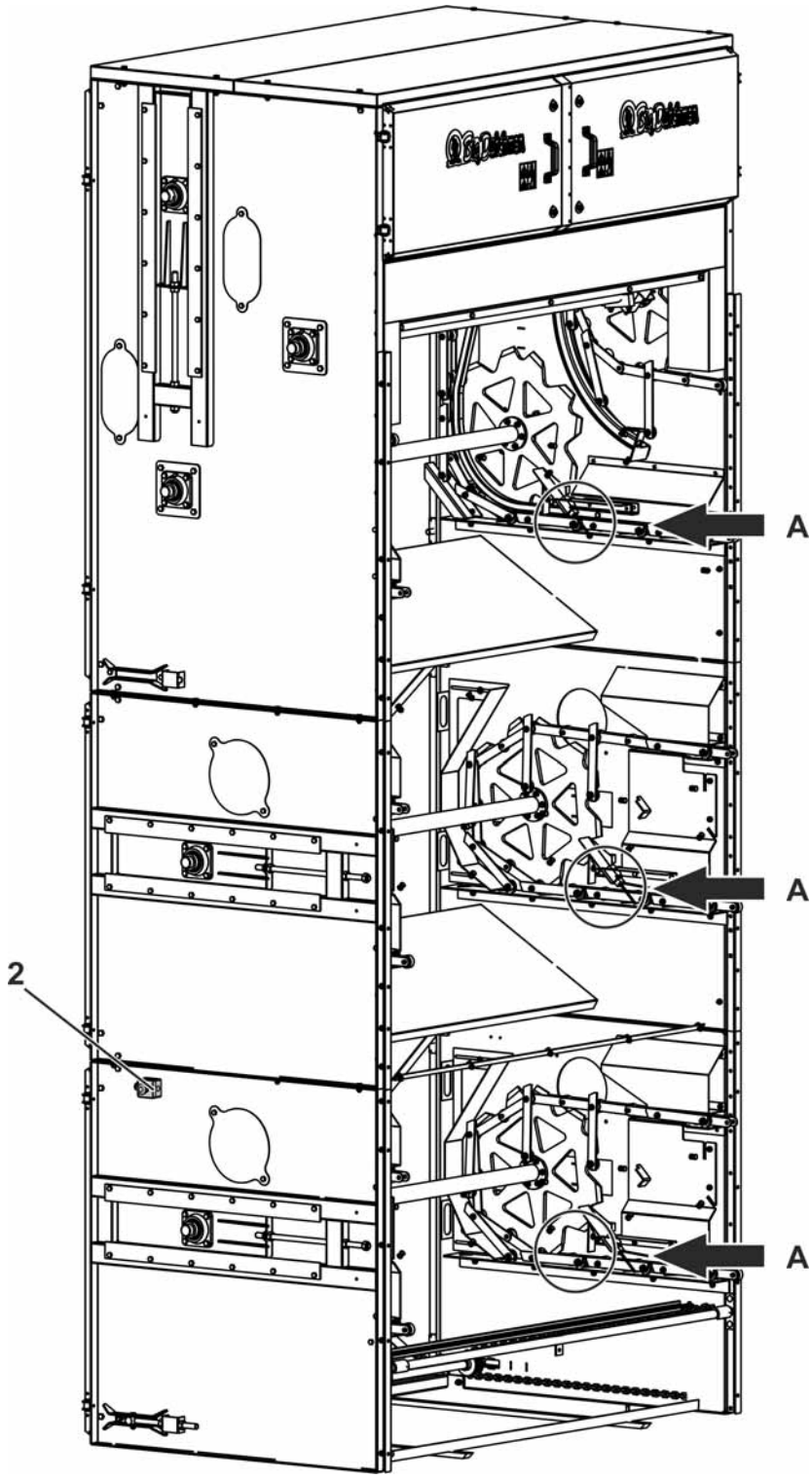
Position numbers see the following page

Details sensor of speed monitor



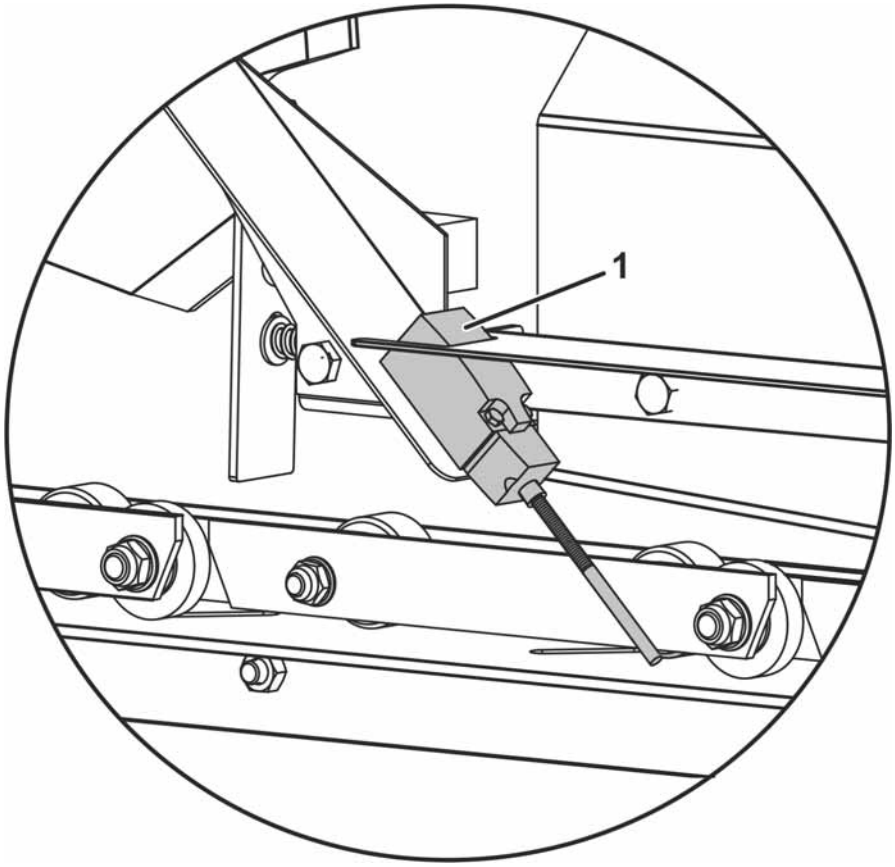
Pos.	Code no.	Description
1	91-04-0049	Sensor inductive 10-30 V DC NO plug connection IFC246
2	91-00-2332	Switch for emergency shutdown cpl. with housing M22-PV/KC02/IY
3	71-52-5402	Chopper OptiPlate V14 cpl.

5.2.2 Idler unit



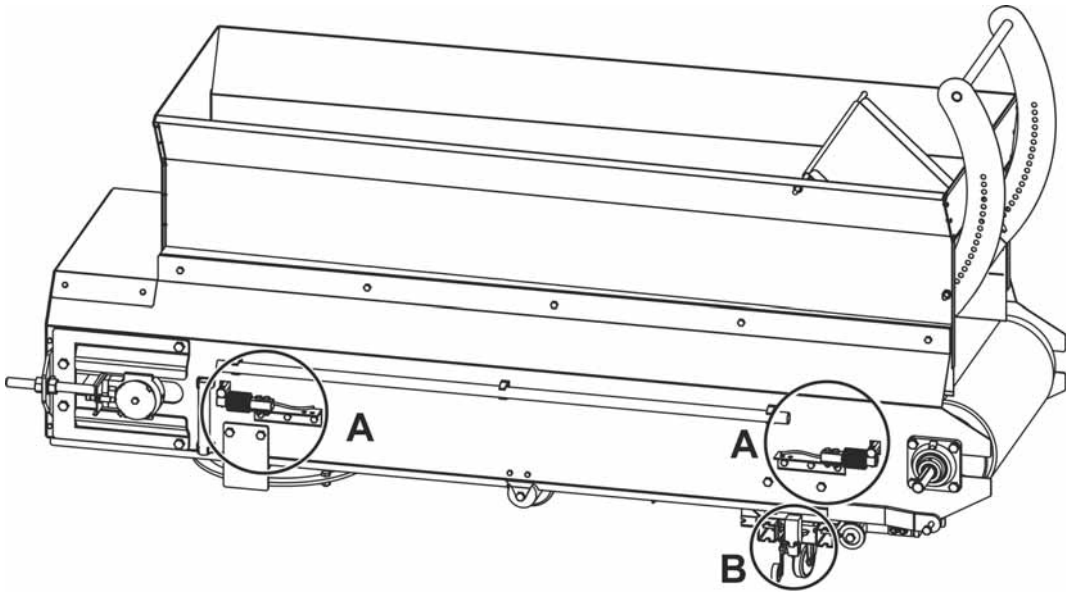
Position numbers see the following page

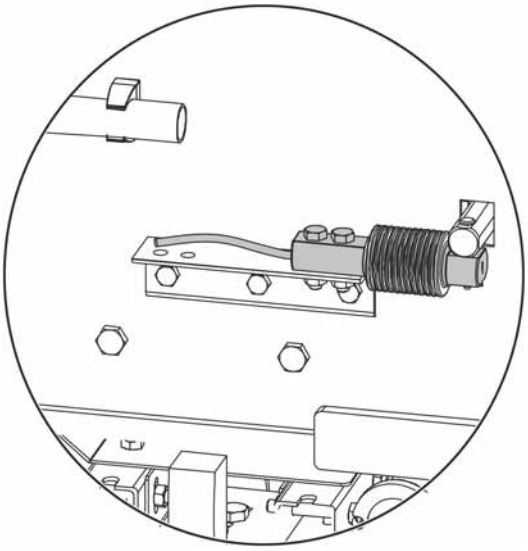
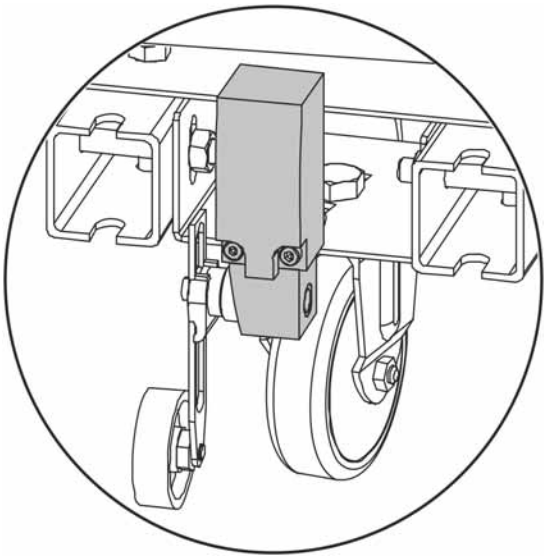
Details plate monitoring



Pos.	Code no.	Description
1	91-00-1179	Limit switch LS-S11S plate monitoring
2	91-00-2332	Switch for emergency shutdown cpl. with housing M22-PV/KC02/IY

5.2.3 Feeding station



Detail A - Sensor weighing unit	Detail B - Position switch
	

Pos.	Code no.	Description
A	83-00-7789	Load cell Z6FD1/100 kg SST
B	91-00-1179	Limit switch LS-S11S position switch

6 Maintenance instructions

It is essential to maintain the manure drying tunnel at regular intervals!

Carry out the following points adhering to the specified intervals!

6.1 Belt drying system

During operation:

- Check the drive motors of the belts
- Ensure the straight running of the belts, readjust if necessary
- Check function of idlers
- Check the operational readiness of all sensors

After each use:

- Perform a visual inspection of the filling station
- Open the chopper doors and perform a visual inspection
- Clean the motor from dust deposits.

Weekly:

- Check the welded seams of the belts

Monthly:

- Check the chain tensioner and oil the chain
- Remove the dirt in the end set area and in the space underneath the manure drying belt
- Lubricate the bearings

6.2 Plate drying system

Caution!

The system has an autostart function. Put the mains switch to off when carrying out maintenance or repair works!

During operation:

- Check the functioning of the idlers
- Check the operational readiness of all sensors

Daily:

- Check the functioning of all parts and replace defective parts immediately
- Check all safety devices
- Check the emergency stop system
- Clean the motor from dust deposits.

Weekly:

- Check possible manure deposits at the manure separator rods and clean them if necessary
- Check possible bridging at the funnel
- Check the cleanliness of the weighing table and clean it, if necessary
- Check possible manure deposits at the idler unit's scraper and clean it, if necessary
- Check mechanical and electrical parts

Monthly:

- Lubricate the bearings of the idler unit, drive unit, filling station and chopper
- Lubricate the chain of the drive unit
- Check the chain tension of the drive unit, scraper floor and the plates