



User manual

FerlinBridge

Revision: 1.10

Release date: 28-03-2024

Document history

Version 1.0 – All information up to FerlinBridge version 2.19.16

Version 1.3 – Added Appendix 6 and changed ConPro explanation

Version 1.4 – Change of address and contact data

Version 1.5 – Removed old omron electrical drawings

Version 1.6 – Added description to allow access to FerlinSQL

Version 1.7 – Added information about connecting IP/TCP and expl. Software update

Version 1.8 – Revision on the compatible operational systems

Version 1.9 – Added module Coextruder and option Accumulate component totals

Version 1.10 – Added information about the SQL direct module

References

FerlinBridge_Manual.PDF
API FGBClient interface v2.7.PDF
NL Handheld control 12.3.X.X
Movac (Omron Manual)
ConPro Manual KWX.22_CP1684,CPS60,FerlinMono_AB7272DS

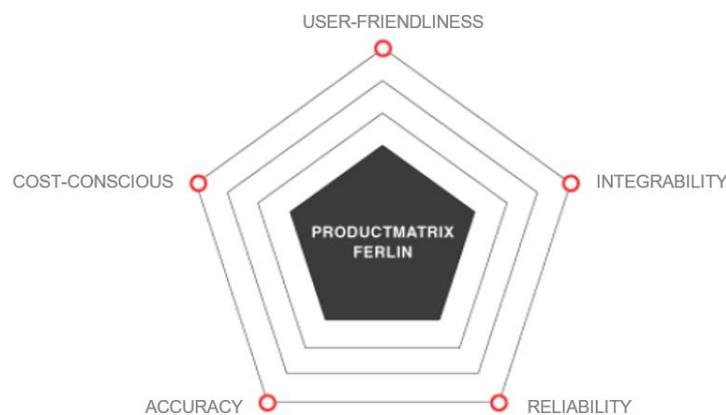
Introduction

Smart process solutions from silo to feed throat.

Ferlin delivers smart solutions from silo to feed throat. Smart solutions are solutions that offer reliability and accuracy as an absolute basis. In addition, the solutions must be very easy to integrate, extremely user-friendly and lastly, all those key priorities must be developed in a cost-conscious manner. To get grips on those points, the FerlinBridge has been developed.

The modern plastics processing industry, with an ever-increasing demand for quality and cost savings, requires easy control and good traceability of materials.

The Web-based application that takes this to the next level is the FerlinBridge. A Web-based application means that it can be accessed by all devices with an internet browser within one network. The FerlinBridge is only for visualization of the data in the machines and works independently of the devices.



For example, dosing devices, the conveying system, extruder controllers and dryers can be controlled via the FerlinBridge. Simple operation guarantees a sharp overview of your production process, with low staffing levels. By saving all process data at component level, an accurate calculation of production costs is possible. All this process data can be fully processed within your company via various common protocols, for example OPC-UA. The FerlinBridge software is successfully used for: extrusion, injection moulding and blow moulding processes

Unique features of the FerlinBridge;

- Status of all devices in one overview
- A database for the components and recipes
- Direct input of recipes, and the possibility to adjust those during production
- All production data can be saved in a database
- Reachable from all devices -with an internet browser- at the same network

Due to the simple and modular construction, adjustments and expansions can be realized quickly. The desired modules can be switched on and the corresponding functions set as required. All functions and operating options can be protected by an username and password.

Table of contents

Document history.....	2
References.....	3
Introduction.....	4
Safety Guidelines.....	8
Qualified personnel.....	8
Warnings of hazards.....	9
Disclaimer.....	9
Technical specification.....	10
Operational system.....	10
Hardware requirements.....	10
Network Overview.....	10
Service.....	11
Controls in general.....	12
Connecting to the FerlinBridge.....	12
Dashboard.....	13
Production screen.....	13
Conveying.....	14
Drying.....	14
Configuration.....	15
Settings.....	16
Users.....	17
Roles per user.....	17
Gravimix.....	17
Recipes.....	18
Dryer.....	18
ConPro.....	18
Transport.....	18
Heartbeat.....	20
Logs.....	20
Modules.....	21
Module Gravimix.....	21
Options Module Gravimix.....	24
Thru counter.....	24
Recipe selector.....	24
Module recipe.....	25

Components	25
Recipe	25
Use of recipe.....	26
Back-up.....	27
Settings module Recipe	27
Options Module Recipe	27
Use Hopper selector.....	27
Module Omron.....	28
Stations (Hopper loaders)	28
Pumps.....	29
Settings module Omron	30
Options module Omron.....	30
Use hopper selector	30
Use usage reporting	30
I/O expansion board.....	30
Module Usage	31
Database.....	31
Database.....	31
FerlinSQL tool	32
Dashboard SQL	32
Gravimixen FerlinSQL tool.....	33
CSV-file	33
Dryers SQL	33
Installation FerlinSQL.....	34
Module Dryer	36
Settings Dryer	37
Module Conpro	38
Extrusion controller.....	38
Module Reporting	39
Module Siemens PLC.....	40
Address hopper loaders	41
Module SQL.....	42
Status.....	42
Sending recipes	44
Optional: naming components.....	45
Saving usage	45

Components	45
Status.....	45
Current recipe.....	46
Commands.....	47
Configuration.....	48
Optional configuration	48
Database.....	48
Module Coextruder	49
Installation FerlinBridge	50
Installation package FerlinBridge	50
Installation Gravimix	51
Set node-ID.....	52
Software update.....	53
Error description.....	54
Appendices	55
Appendix 1: TCW 241 (I/o module).....	55
Appendix 2: Recipe selector	56
Appendix 3: Thru counter.....	58
Appendix 4: Use hopper selector (Module Omron).....	59
Appendix 5: Use hopper selector (Module Recipe)	60
Appendix 6: Connecting ConPro extrusion regulation system.....	61
Physical setup.....	61
Network setup.....	62
FerlinBridge settings ConPro	64
Appendix 7.1: Ferlin Direct SQL default tables.....	65
Query for creating tables	65
Appendix 7.2: Ferlin Direct SQL extra tables.....	70
Query for creating tables	70
Appendix 7.3: Updating .dbo.FerlinBatch for 2.12.47 or newer.....	72
Query for changing tables.....	72
List of Gravimix alarms	73

Safety Guidelines

General

This document provides the information required for the intended use of the specific product. The documentation is written for technically qualified personnel such as engineers, programmers or maintenance specialists who have required specialist knowledge in the field of instrumentation and control.

Knowledge of the safety instructions and warnings in this document and their application are prerequisites for safe installation and commissioning. Only qualified personnel as defined in this chapter having the specialist knowledge are required to correctly interpret the general guidelines relating to the safety instructions and warnings. For the sake of clarity, not all details of all versions of the product are described in this document, nor can all conceivable cases relating to installation, operation and maintenance be covered.

In case any more information is needed, or problems are encountered which are not described sufficiently in this document, please contact Ferlin Plastics Automation B.V. or your local dealer.

We draw your attention to the fact that the contents of this product documentation will not form part of any existing agreements or commitments. The purchase agreement contains the full and exclusive obligations of Ferlin Plastic Automation B.V.. Statements in this document do not provide any new warranties or create any modifications to existing warranties.

Qualified personnel

Persons not qualified should not handle this equipment/system. Failure to comply with the warnings in this document or on the equipment itself could result in serious personal injury or property damage. Only qualified personnel should work on this equipment/system. Qualified persons as referred to in the safety guidelines in this document and on the product itself are defined as follows: System planners and designers who are familiar with the safety components of automation equipment; Operating personnel who are trained to work with automation equipment and who are familiar with the contents of the document as it relates to the actual operation of the system; Commissioning and maintenance personnel who are trained to repair such automation equipment and who are authorized to energize, de-energize, ground and mark circuits, equipment and systems

Qualified personnel know and observe all applicable safety standards and regulations.

Warnings of hazards

The notices and guidelines that follow are intended to ensure personal safety, as well as to protect the product and connected equipment from damage.

The safety instructions and warnings for protection against loss of life (of the users or maintenance personnel) or for protection against material damage are emphasized in this document by the terms and pictograms defined here. The terms used in this document and marked on the equipment itself have the following meanings:

Symbol



This symbol warns for the risk of serious injury or death. Warnings regarding this symbol must be observed to avoid personal injury and material damage.



This symbol warns for the risk of injury or death from electric shock. Warnings related to this icon should be heeded to avoid personal injury and property damage



For specific hazards or malfunctions, an associated pictogram is used, and the hazard is named according to type and source. Precautions regarding this symbol must be followed to avoid personal injury and material damage.



This symbol indicates a risk of damage to the device if these instructions are not followed.



This symbol provides information or a recommendation. Information has no direct relevance to safety but may relate to better functioning or behavior.

Disclaimer

We expressly draw your attention to the fact that the company Ferlin Plastics Automation B.V. is not liable for damage caused by incorrect or careless operation, maintenance or repair or caused by improper use. This also applies to changes to the system, use of non-original spare parts or software, as well as any kind of attachments and conversions to the system that may affect its safety or functionality.

If parts or components are replaced during maintenance, only original spare parts are allowed. Otherwise, all warranty claims become null and void. If original spare parts or non standard components are built in or additions are made, Ferlin Plastics Automation B.V. no guarantee will be honored whatsoever for the correct functioning of the system. Ferlin Plastic Automation B.V. accepts for personal or material damage as a result of the use of deviating parts or components or own additions. no liability whatsoever.

Technical specification

The intended use of the FerlinBridge is on a device assigned to the FerlinBridge or in a virtual environment, both 32bit and 64bit are supported.

Operational system

OS	Service pack version	Comments
Windows 7	SP1	
Windows 8		
Windows 10		
Windows 2008 R2	SP1	
Windows 2012		
Windows 2012 R2		
Windows 2016		
Ubuntu 18.04 LTS		OPC-UA client is not supported
Windows server 2012 R2 (Oct)		
Windows server 2016 (Oct)		
Windows server 2019 (Oct)		
Windows server 2022 (Aug)		

Hardware requirements

	Requisite	Recommended
Network gravimix/omron	100 Mbps, IPv4, Class C	1 Gbps, IPv4, Class C
Network controller/database	100 Mbps	1 Gbps
RAM	1 Gib	2 Gib
Disk space	500 Mib	1 Gib
Cores	2	4

Network Overview

Connected to the network is one or more devices, optional an OPC server and/or a database server and a Windows/Linux server running the FerlinBridge service.



Service

The manufacturer offers after sales support through our local dealers or directly by phone and email, should you need assistance please contact:

Ferlin Plastics Automation B.V.

Rudolf Dieselstraat 15A

Nijverdal, 7442 DR

The Netherlands

Tel.: +31 548 745 370

E-mail: Info@ferlin.nl

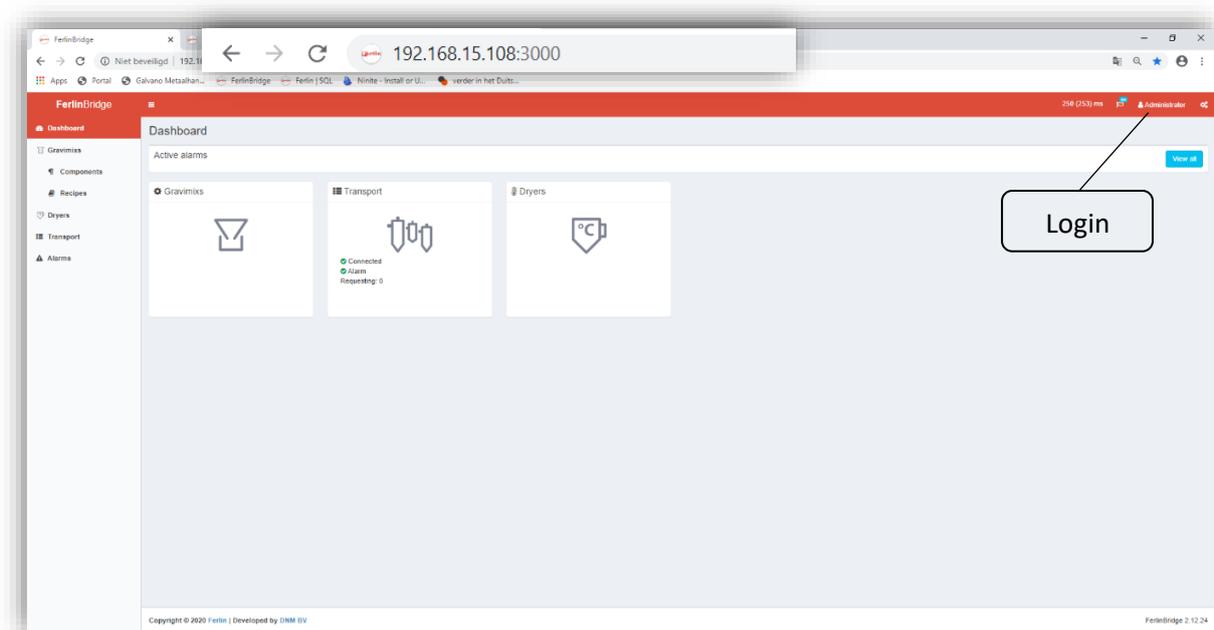
Controls in general

In this chapter a global explanation of the operation of the FerlinBridge follows. Several optional modules are mentioned.

Connecting to the FerlinBridge

This section briefly describes how the FerlinBridge is used in production environment. Details of the system are described in the following chapters.

To access the FerlinBridge, enter the IP address of the computer on which the FerlinBridge is installed in the input field of the web browser (preferably Chrome or Firefox), followed by the port number **:3000**. Press the ***Enter*** button to set up the connection. See an example in the figure below;



The first step is to log in. In the upper right corner is the word "Guest". If this is clicked the login screen appears. Here you can log in with the username and corresponding password.

The shipped username and password for the system is set to:

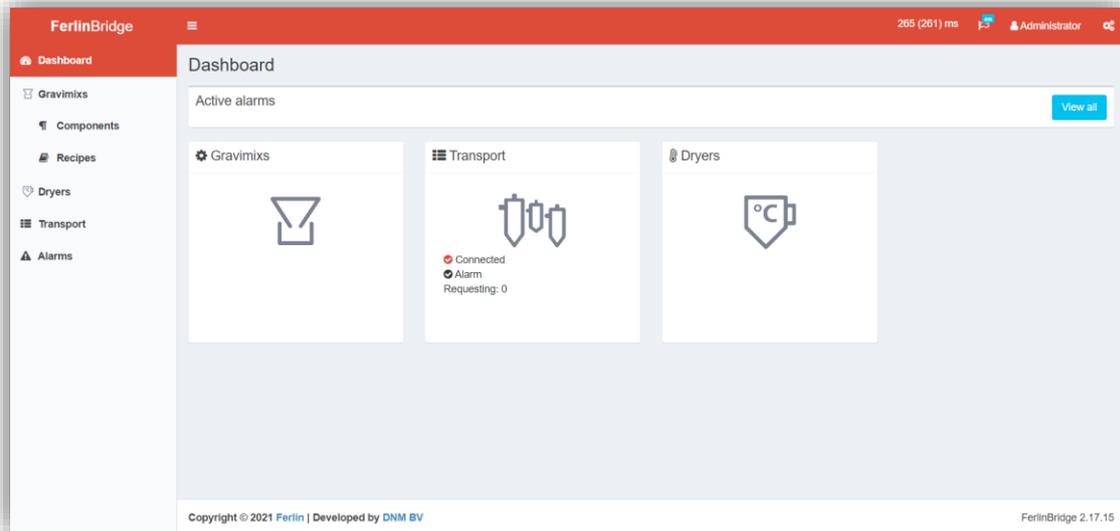
Username = Admin

Password = Ferlin

Passwords are case sensitive.

Dashboard

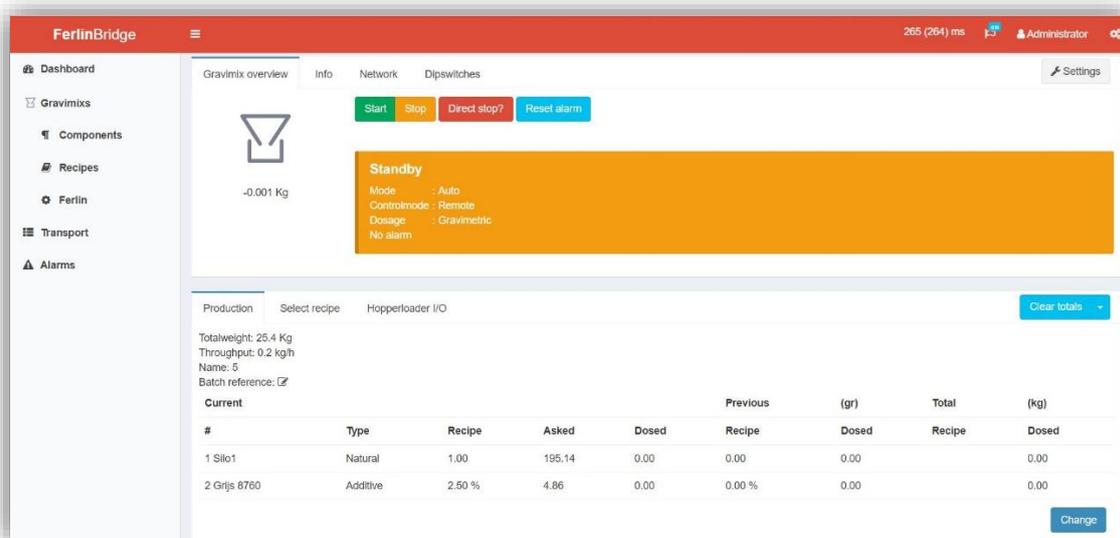
Operating the FerlinBridge is done via the dashboard. Via this dashboard the connected equipment can be accessed, or its settings adjusted. In addition, in the red bar the language and user can be changed, the connection speed displayed, and via the "settings" icon the selectable settings and available modules can be reached.



Production screen

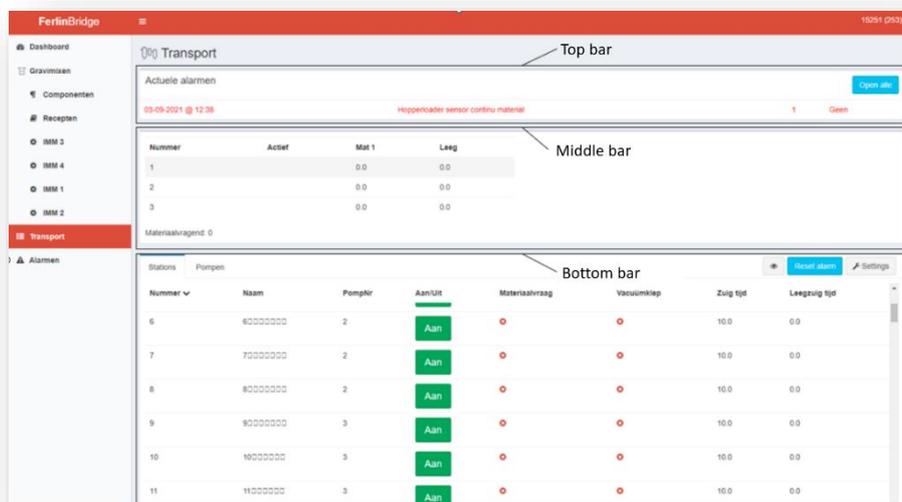
If the "Gravimix" area is selected the connected GRAVIMIX dosing devices will be displayed in one overview. All devices are surrounded with green, orange or red. Green indicates that the respective dosing device is in production. Orange indicates that the respective dosing device is in standby mode. Red indicates that the respective dosing device is in alarm.

The desired dosing device can be selected, and the following production menu of the respective dosing device appears. In this menu, the machine can be operated, e.g. started or stopped. In addition, a recipe can be selected, settings changed, or production totals viewed.



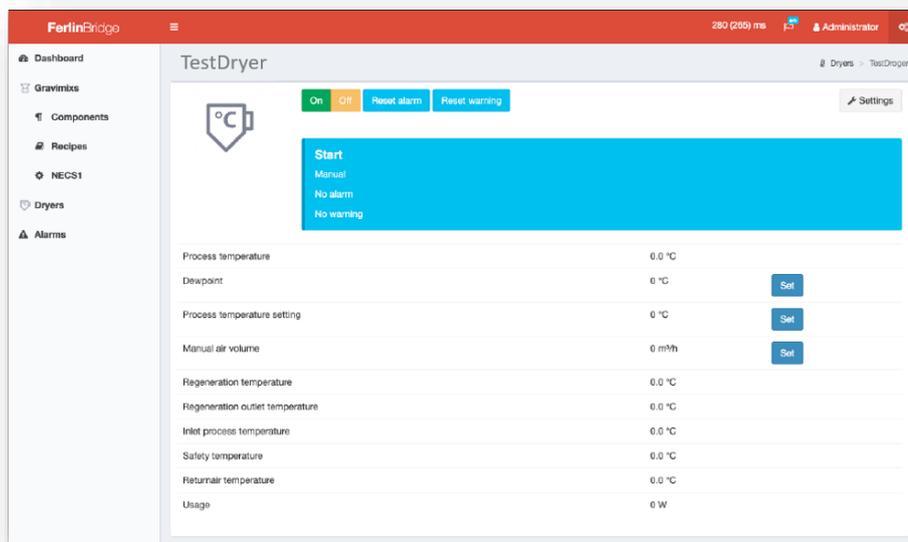
Conveying

The second read panel is "Transport". This module is used in combination with a PLC system belonging to the Movac conveying system. This overview is divided into three parts. The top bar is an overview of all the alarms that are active. The middle bar shows the queue and the current activity. In the lower bar all stations and pumps can be selected, and the parameters adjusted. The maximum number of pumps and stations depends on the PLC.



Drying

The last read panel is "Dryer." This module is used in combination with the Drywell dryer series. The dryers are connected to the FerlinBridge via a serial module. The process parameters of each dryer can be monitored and changed. In addition, the dryer can be switched on and off and its settings can be changed.

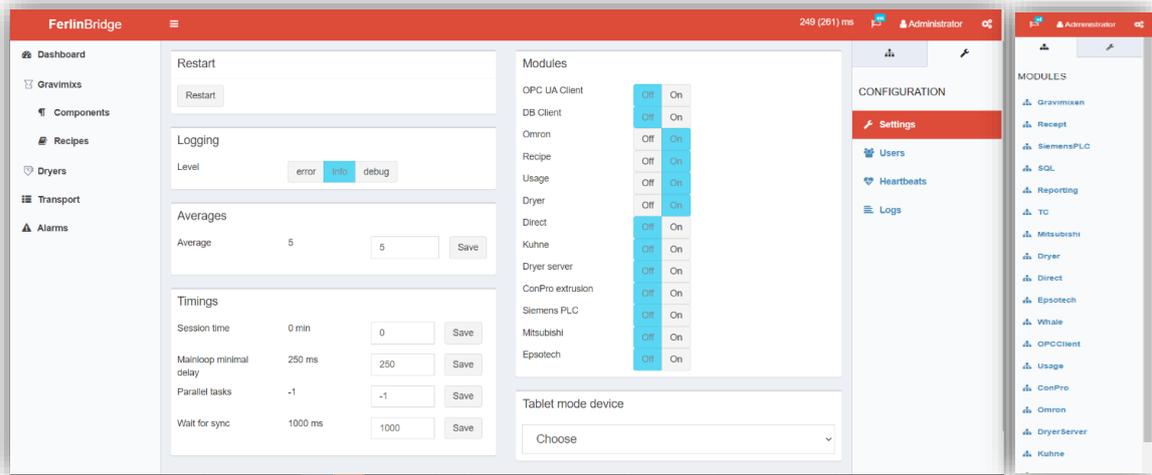


After this introduction with the absolute basics of the FerlinBridge, a range of in-depth functions will be explained further in this manual. The next chapter will look further into the configuration of the FerlinBridge.

Configuration

This chapter describes how to set up the FerlinBridge, how to enable modules, and how to test communications between the FerlinBridge and connected devices.

To reach the control panel of the FerlinBridge you need to click the gears icon found in the upper right corner. The "gears" icon stands for settings. Select this icon and a wrench and an Ethernet icon will appear. The "wrench" icon represents configuration. The "network" icon represents modules. This section explains the configuration settings.



If some of the functions described in this chapter are not visible. Check if there is logged in as Administrator, or as a user with the correct roles.

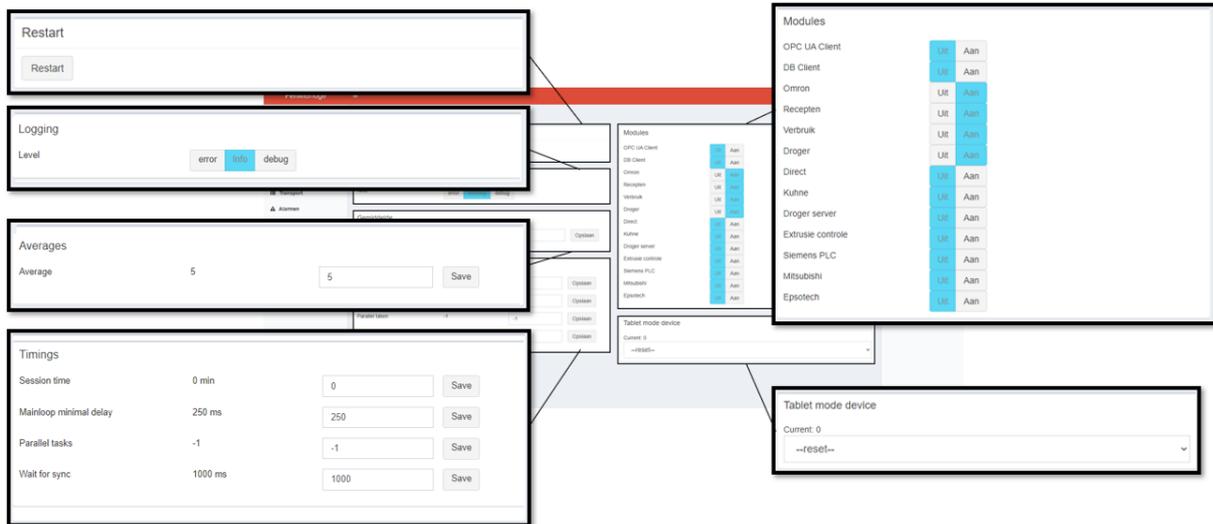
The configuration screen consists of four parts;

- **Settings**
- **Users**
- **Heartbeats**
- **Logs**

The following sections further describes these four parts.

Settings

In the settings, for example modules can be turned on or off and log in time can be limited. In this section all settings are explained.



Restart

The restart button restarts the FerlinBridge service.



If the FerlinBridge does not immediately take over the configurations entered in a module, it may help to restart using this button.

Logging

When using the FerlinBridge, data is continuously exchanged and processed. Up to which level this data is stored can be set. You can choose to keep either the errors info or debug. This form of data is only for the operation of the FerlinBridge program and is irrelevant to the business process. The recommended choice is "info".

Average

Throughput Gravimix in kg/hr is calculated as a moving average over several batches. With this function the number of batches that is taken into account in the calculation is set. This function is only used in combination with OPC-UA.

Time

Through the session time the possibility is given to either log off the user or not. If zero is entered, the user is not logged out. Minimum cycle determines the minimum time before the program refreshes. This is used to reduce network load. It is recommended to keep the 250 ms. Parallel tasks is a function to limit the number of cores used by the FerlinBridge. -1 is default, then no restriction takes place. Wait for synchronization is a setting to allow several tasks to be completed

Modules

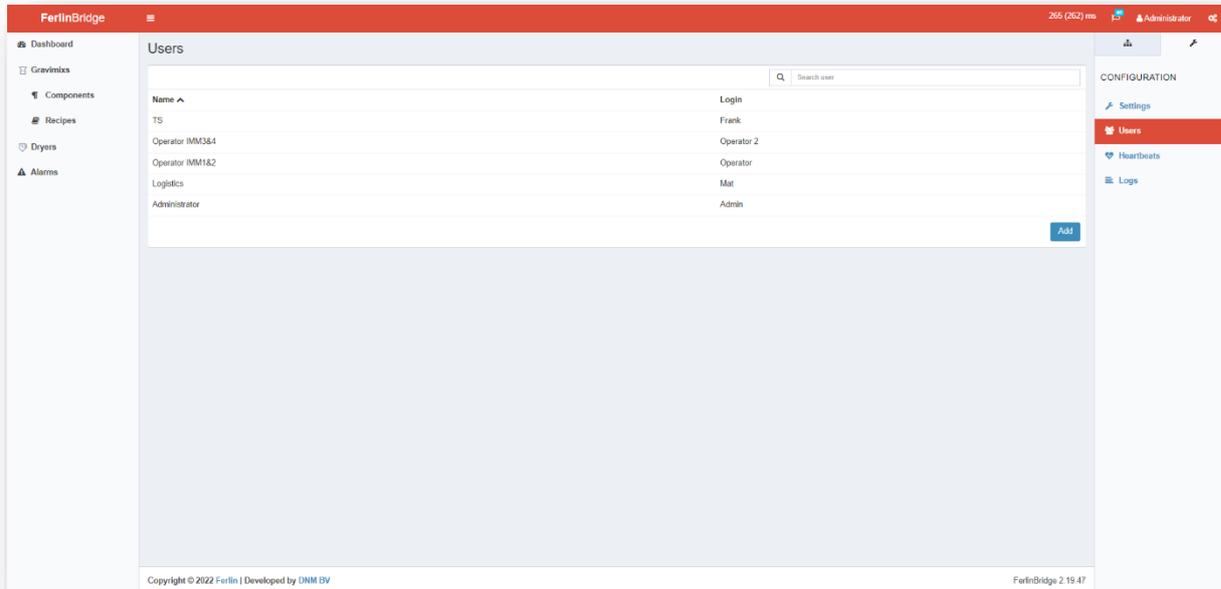
The FerlinBridge can be set up according to the customer's wishes. Here the modules that are used can be switched on and the modules that are not used can be switched off. By only switching on the modules that are used, the control screen remains clear and the process speed high. The setting of the modules, which can be done before the modules are enabled, is further explained in chapter Modules.

Allowed gravimix node ID(s)

Here you can enter the node ID(s) of the Gravimix dosing devices that should be visible on the device. If nothing is entered here, all Node ID(s) are visible.

Users

The FerlinBridge uses a user profile. Per user roles can be assigned. Each user logs in with a created login name and password and all roles assigned are visible, all other functions are hidden.



A user can be created by an administrator, or a user with an administrator role. When creating the user, roles can be assigned. It is possible to modify the assigned roles at another time. The roles are briefly explained;

- **Login:** This is the username for login.
- **Name:** This is name visible after login.
- **Password:** The login combined with this password is used to log in when the user is created.
- **Start in tablet mode:** In the FerlinBridge a tablet mode is built in, where for example buttons are resized for a smaller touch screen. If this function is enabled, the system will automatically switch to tablet mode after logging in.

Roles per user

- **General:** This function allows you to switch the different modules, on or off.
- **Admin:** With this button, the user has all rights, and all possible settings are enabled.

Gravimix

Below are all the roles summarized and explained which can be assigned per user. The following roles are important when using Gravimix module;

- **DeviceBatchRef:** This button provides the user with the role to modify or enter a batch reference during a production run.
- **DeviceStartStop:** This button gives the user the role to start and stop the Gravimix dosing unit using the FerlinBridge.

- **DeviceRecipeSelect:** This button gives the user the role to choose a recipe which the Gravimix will produce. This role is used in combination with the Recipes module.
- **DeviceRecipeChange:** This button gives the user the role of modifying an existing recipe, during production
- **DeviceClearTotals:** This button provides the user with the role to reset the production totals.
- **DeviceSettingsMain:** This button gives the user the role to adjust the settings of the Gravimix. For example, date, time or IP address.
- **DeviceSettingsCleaning:** This button provides the user with the role to manually open the valves of the Gravimix. This is used to empty hoppers between production runs for cleaning.
- **DeviceSettingsParams:** This button gives the user the role of adjusting the parameters of the Gravimix. For example, production mode, dosing mode or a weighing time.
- **DeviceSettingsSystem:** This button gives the user the role of adjusting system settings. For example, local and remote clients for the HMI.
- **DeviceSettingsSpecial:** This button provides the user with the role to enable special options of the Gravimix.

Recipes

These roles are important when using a recipes and components database. The recipes and components database is explained in chapter "Recipes";

- **ComponentEdit:** This button gives the user the role to modify already created components in the component database. For example, name or type of component.
- **ComponentNew:** This button gives the user the role to create new components in the component database.
- **RecipeEdit:** This button gives the user the role to modify already created recipes in the recipe database. For example, a different component or ratio of the recipe.
- **RecipeNew:** This button gives the user the role to create a new recipe in the recipe database.
- **Hopper1 t/m 10:** This button provides the user with the role to modify the component or ratio from this hopper. This can be used in combination with RecipeEdit or RecipeNew.

Dryer

These rolls are important when using a Drywell dryer.

- **DryerOnOff:** This button provides the user with the role to start or stop the dryer, via the FerlinBridge.
- **DryerSettings:** This button provides the user with the role to adjust the settings and process parameters of the dryer.

ConPro

These roles are important when using the ConPro extruder control system.

- **ConProSet:** This button provides the user with the role to adjust the settings of the Conpro extruder control.

Transport

These roles are important when using a Movac conveying system.

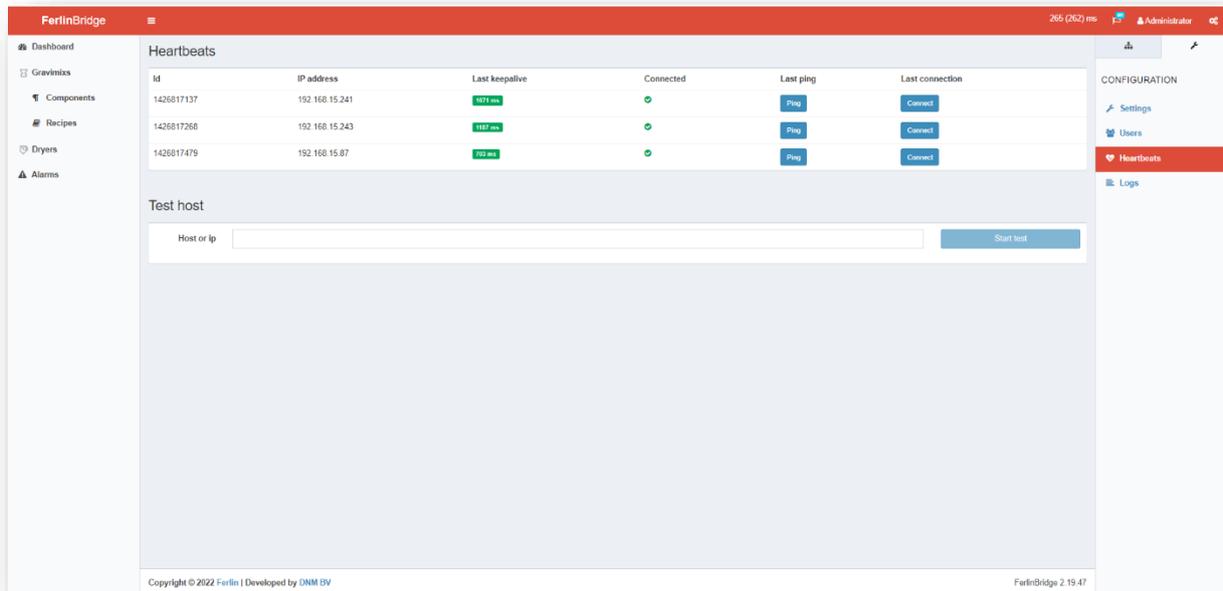
- **TransportOnOff:** This button provides the user with the role to enable or disable hopper loaders.
- **HopperloaderChange:** This button provides the user with the role to adjust suction time, empty suction time, and pump number.

- **HopperloaderSettings:** With this button the user has the role to use the extensive settings of the hopper loader, such as regulating MES signals, regulating material layers with a proportional valve or putting a sensor into operation.
- **PumpstationChange:** This button provides the user with the role to set Filter cleaning.
- **PumpstationSettings:** This button provides the user with the role to adjust pump and filter settings.
- **AKSName:** This button gives the user the role to define the name of the stock.
- **AKSHLSupply:** This button provides the user with the role to modify the supply number.
- **AKSMaterial:** This button provides the user with the role to define the material in the inventory.
- **AKSBatch:** This button gives the user the role of assigning a batch ID to the material batch.

If all roles are correctly assigned, the new user can be created using the "Save" button in the bottom right-hand corner. It is possible to modify roles at a later stage.

Heartbeat

A proper connection and proper connection speed with the connected devices is imperative for proper operation of the FerlinBridge. Testing and checking the connection with each device can be done using the "Heartbeat" configuration. The set IP address of each device can be entered here after which the connection will be checked. The connection speed of each device can be checked as well.



Logs

In settings, the log level can be set. All saved data is displayed in "Logs". This data is stored in the default directory. Here the folder "Logs" is available. All data is written there and will be saved for a limited time.

The log files in the folder will show more detailed information than the logging in the FerlinBridge interface.

Modules

In addition to the configuration, the modules -the network icon- is also accessible through settings. In the FerlinBridge several modules are built in. With each of these modules it is possible to further integrate the FerlinBridge within the business process. In this chapter all general modules and their possibilities are explained. The other modules are client specific, and will not apply within your plant.

Module Gravimix

The Gravimix module enables you to control and set up the gravimetric dosing devices. The Gravimix dosing units can be controlled via two different production screens;

- **Production screen:** for a comprehensive overview.
- **Gravimix overview:** in which the status of all devices is simpler displayed.

Production screen

The production screen is accessible from the dashboard. If the "Gravimix" area is selected, all connected Gravimix dosing devices are displayed. The color around the Gravimix indicates whether it is in operation (Green), in alarm (Red) or on stand-by (Orange). The desired Gravimix can be selected, and the production screen of the respective device will appear.

In the production screen all information, of the respective Gravimix, is displayed. The name is at the top. Below the name are two blocks, the first block contains several buttons;

- **Gravimix overview:** Here the current production status is displayed, and the dosing unit can be operated. The machine can be started, stopped and alarms can be reset. The direct stop is also available in this overview.
- **Info:** This view contains all the basic information of the machine, Name, Node ID, number of hoppers and the software version.
- **Network:** Here you can find the set network data.
- **Settings:** Here you can find the settings, the cleaning settings and the calibration settings.



By using the cleaning settings, and the Gravimix overview, sliding and rotating components can be turned on without visual inspection. If working on components, parts or electrics, care should be taken to ensure that there is no voltage.

If covers are removed, the machine should not be left unattended, and the Ethernet cable should be disconnected.



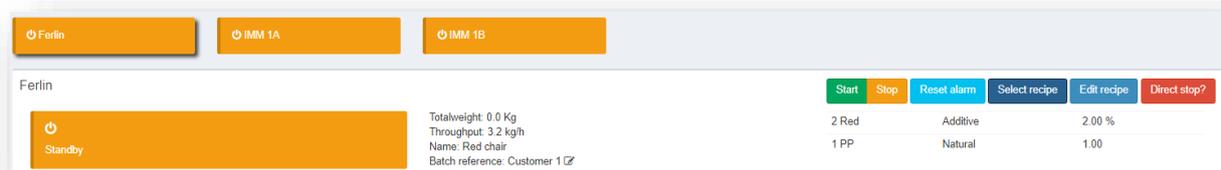
After an direct stop, the material in the mixing chamber may not be in a correct ratio, because some of the material may have been dosed and some may not yet be. After an direct stop, it may be necessary to empty the mixing chamber before resuming production.

The second block provides information about the current production run, and the ability to make adjustments to it;

- **Production:** The total weight from the last reset, current throughput, possibly recipe name and batch reference is visible here. The **batch reference** is customizable, to provide additional information with the current run. For example, a customer name, order number etc. Below the batch reference, the current recipe is displayed including dosage values from the last batch.
- **Select recipe:** If the module "Recipe" has been turned on, the list of created recipes is displayed here. This is further explained at the recipe module.
- **Clear totals:** here the totals (material consumption) can be reset
- **Change:** In change, the current recipe can be adjusted for the current run. If the recipe is to be changed permanently, the recipe in the database must be changed.

Gravimix overview

This overview is particularly suitable for large numbers of machines. The Gravimix overview can be reached in the menu on the left side of the screen by selecting the text "Gravimix". All connected Gravimix dosing units are displayed as blocks in which the color of the block indicates the status -in operation is green, in alarm is red or standby is orange-. The desired Gravimix can be selected, and the overview of the respective machine is displayed as a small bar with the basic information such as;



- **Production status:** The color and text indicate whether the machine is in operation, standby or in alarm.
- **Total weight:** Total weight produced by the Gravimix, after the last reset.
- **Throughput:** A calculated value of the number of kilograms dosed by the machine per hour in kg/Hr
- **Batch reference:** Additional information for the current production run, for example, an order number.
- **Start/stop button:** Buttons for starting or stopping the machine, stopping is done after the batch is completed to ensure proper ratio of materials.
- **Reset alarm:** When the alarm is resolved, the button can be used to reset the status.
- **Choose recipe (if module recipe is enabled):** The desired recipe can be selected from the database.
- **Change recipe:** In change, the current recipe can be adjusted for the current run. If the recipe is to be changed permanently, the recipe in the database must be changed.

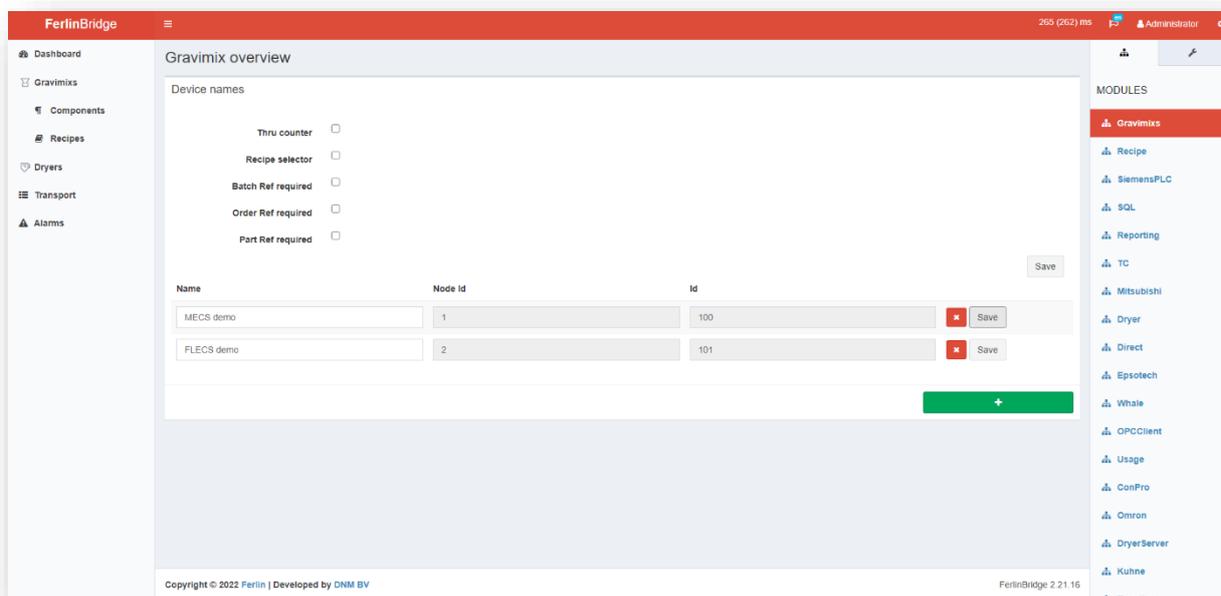
- **Direct stop:** Machine immediately stop everything, hereby the batch will not be finished.
- **Current recipe:** Information on current prescription, as percentages and possibly materials.



After a direct stop, the material in the mixing chamber may not be in a correct ratio, because some of the material may have been dosed and some may not yet be. After a direct stop, it may be necessary to empty the mixing chamber before resuming production.

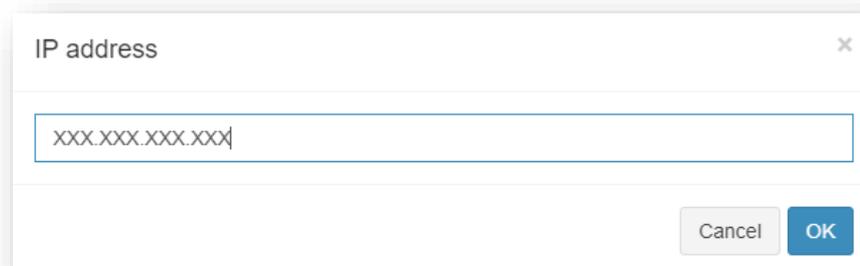
Settings module Gravimix

In the settings of the module "Gravimix" it is possible to give each connected device a name. For distinction, all node ID(s), which need to be set on the board, are shown after the name. For an explanation of how to set the Node ID, please refer to chapter "Setting Gravimix". After entering the name, the change can be confirmed with "save".



In the FerlinBridge an autodiscovery function is made. This means the Gravimix dosing units with the correct network settings are found automatically when FerlinBridge is turned on. In some cases the dosing units cannot be found automatically. Therefore a manual function is built in to connect by IP.

In this case the green "+" symbol should be used. In the appearing input field the IP address of the dosing unit should be put in. Confirm with "ok" and the Gravimix dosing unit will be added to the list.



Options Module Gravimix

Two options are built in that can take the integration of the Gravimix dosing unit into the next level. These are Thru counter and Recipe selector.

Thru counter

Thru counter is an option that makes it possible to count through the material consumption when a Gravimix is exchanged for a material hopper, for example between two production runs. When an external signal* comes in, the material consumption counts through for a set component, with the throughput taken from the Gravimix. set up the FerlinBridge for this module is further explained in Appendix 3.

Recipe selector

Recipe selector is an option that allows one of fifteen recipes to be selected for each Gravimix using external signals*. When the external signals come in, the corresponding recipe is set in the Gravimix. A detailed explanation can be found in Appendix 2.

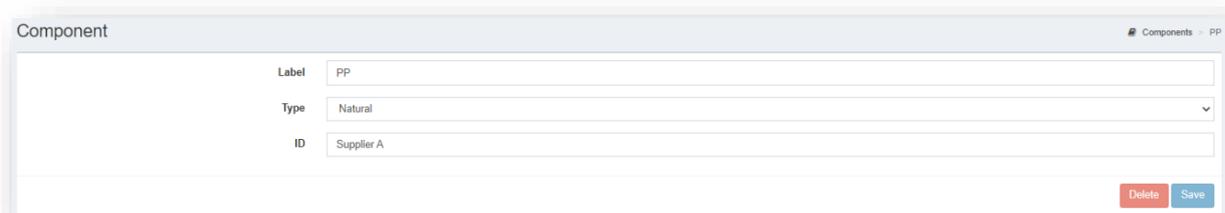
*) For receiving an external signal an I/o module is used. Further information and setting up the I/o module can be found in Appendix 1.

Module recipe

When using the "Recipe" module, a database of components and recipes is created. Each recipe is created with defined components from the database. For each Gravimix dosing device, a recipe can be selected from the database. This reduces the chance of production waste due to incorrect entry of ratios, and allows traceability of each component. If the "recipes" module is enabled, two additional bars appear in the left side of the screen, these are the "Components" and "Recipes".

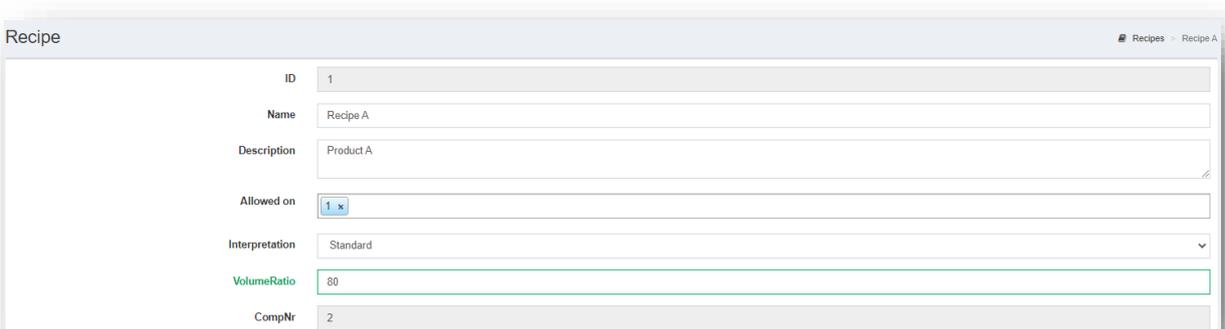
Components

If the component bar is selected, a list of all created components appears. It is possible to add new components by clicking on the "New" button. Here you can enter the name, the type of material and any additional information.



Recipe

In the recipe bar you will find a list of all the recipes you have created. It is possible to add new recipes by using the button "new".



The information to be entered per prescription is;

- **Name:** Name of the recipe.
- **Description:** Any additional information. (This input field can be enlarged in the bottom right corner).
- **Allow On:** Here you can enter on which machines the recipe can be used. If nothing is entered, the recipe can be used on any machine. The node ID(s) of the respective machines must be entered. This is entered by typing in the node number then pressing enter.
- **Volume ratio:** Here the batch weight can be reduced. This may be necessary if one or more components is bulky (low bulk density) and overfills the weigh pan.

The recipe itself can be set below;

Hopper	Component	Type	Receipt	Alarm	Dispenserate
1	PP	Natural	1	Error	100
2	Regrind product A	Regrind	20	Error	100
3	Red	Additive	2.6	Error	100
4	Light stabiliser	Additive	1	Error	100

Buttons: Add component, Copy, Delete, Save

- **Add components:** The blue button in the lower left corner can be used to increase the number of components to be entered.
- **Components:** For each hopper number, the component can be selected by entering the first letters of the created component name in the input field. The components beginning with these letters appear and the desired component can be selected.
- **Ratio:** In "recipe" mode, the ratio of the components entered can be set. In percentage mode, the color around the box indicates whether the total comes to one hundred percent. If it is red, it is not possible to save the recipe.
- **Alarm:** The choice can be made what to do if the component in question is not dosed.
- **Sequence:** The arrows at the end of the row can be used to determine the order in which the components are dosed. The machine starts with the top component and ends with the bottom component.

Finish the correctly filled out recipe by saving.



Recommended regrind first, then Additive and last the natural components for optimal ratio.

Use of recipe

Per Gravimix, the created recipes assigned to the corresponding Node ID can be selected. This can be done both in the "Gravimix Overview" and in the "Production Screen". The "select Recipe" button leads you to a listing of all recipes. Here the correct recipe can be selected with a search bar, or by scrolling.

ID	Naam	Omschrijving	CompNr	Volume ratio	Gemaakt	Aangepast	Door
10	test 10		2	100	17-11-2021 @ 13:59	01-12-2021 @ 14:34	



If a recipe is modified via the production screen or Gravimix overview, a copy of the recipe in which the modification was made is created, to leave the created recipe intact. It is recommended that the actual recipe will be modified. Or a copy be created manually with its own name, if the recipe modification is for long term use.

Back-up

The recipe database is stored in the default directory on the server. The file is called recipe.database. The file can be found at the following path; C:\Program Files\Ferlin



It is strongly recommended that this file is being backed up regularly.

Settings module Recipe

A number of settings are possible for the Recipe module.

Module Recipe

Instellingen

Regrind

Interpretatie

Use Hopper Selector

Hopper Selector IP

Set

- **Regrind:** This activates the regrind (grinding material) control, this offers the possibility to have one component add as much as it is supplied with the help of a sensor. For further details, please refer to the Gravimix dosing unit manual "NL Handheld control 12.3.X.X".
- **Interpretation:** The interpretation selected here is adopted by default when creating a new recipe. For further details please refer to the manual of the Gravimix dosing machine "NL Handheld control 12.3.X.X".

Options Module Recipe

There is an option built in that can take recipe integration into production to the next level. This is "use hopper selector".

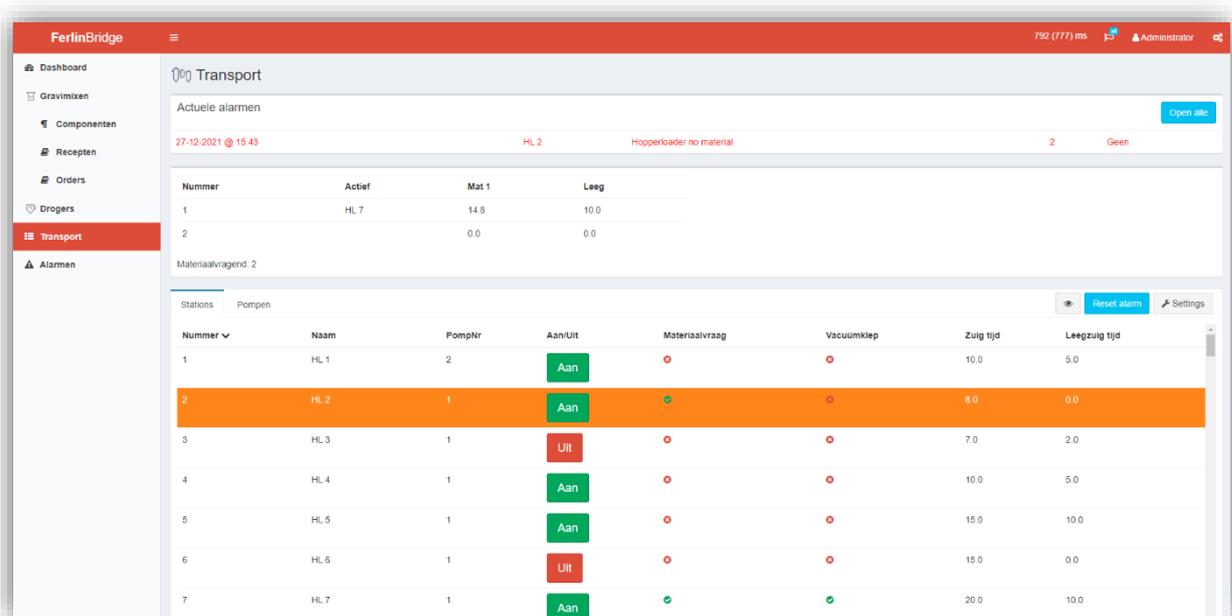
Use Hopper selector

Use hopper selector can be used in combination with a proportional valve. Using this function, the proportional valve can be switched when changing a recipe. If this function is enabled, it must be selected per component whether this is an A or a B component. For a further explanation please refer to appendix 5.

Module Omron

The Omron module makes it possible to control and set the material conveying equipment. The Movac conveying system, which may consist of hopper loaders, pumps, filters and automatic coupling stations, is controlled by an Omron PLC. When the Omron module is switched on, the transport system appears in the menu and consists of three parts;

- **Current alarms;** Here is an overview of all the alarms that are present, with "open all" an overview with alarms history appears.
- **Activity;** This lists all the current activity of the stations, and the number that are in the queue to be supplied with material.
- **Devices:** All stations and pumps are listed here.



Stations (Hopper loaders)

All stations are displayed below each other. Per station the name, pump number, material demand, vacuum valve, suction time is displayed. In addition, the on and off button is used to turn the station on or off. When a station turns orange, no material has been received for two suction cycles, and this station gives an alarm.

The settings of each station can be adjusted, by selecting the desired station, the following settings are visible.

Standard settings station

- **Name:** Here you can define the name of the station.
- **Suction time:** Here you can define the suction time required to fill the station to the correct level.
- **Empty suction time:** When using a empty suction valve, a suction time can be defined here to empty the piping.

Protective settings

- **PumpNr:** When using multiple pumps, the pump number to which this station is connected must be entered here.
- **On/Off:** Here the status of the station can be changed manually.
- **Material demand:** Here you can manually change the status of material demand.
- **Vacuum valve:** Here the status of the vacuum valve can be manually adjusted.
- **Block from MES:** Allow to block material request via an MES system.
- **Empty signal MES:** Allow to generate an empty signal through an MES system.
- **Level sensor:** Here the level sensor, if present, can be switched on. The hopper loader determines the suction time with the sensor.
- **Proportional valve:** If a changeover valve is present, it can be enabled.
- **Empty suction valve no.:** If an empty suction valve is present, the empty suction time can be defined here.
- **Delay time:** A delay time can be set, to give the station time to set the under vacuum.
- **Switches:** Number of switch valve operations during suction cycle.
- **Suction time 2:** The suction time of material two when using a changeover valve.
- **Minimum dump time:** Minimum time that empty signal should be interrupted after a suction cycle.

Pumps

All pumps are displayed below each other. Per pump the standby time, Filter cleaning frequency, Pulses, Time per Pulse and the Filter cleaning method is shown. The settings of each pump can be adjusted, by selecting the desired pump, see figure;

Default setting pump;

- **Standby time:** This is the time the pump remains in operation, with no station material demand, until the pump stops.
- **Filter cleaning frequency:** This parameter determines the number of stations operated until the next filter cleaning cycle.
- **Pulses:** This parameter determines the number of pulses that make up 1 filter cleaning cycle.
- **Time per pulse:** The time per pulse. For a standard system, the time to bring the filter under vacuum.
- **Filter cleaning method:** Depending on the type of filter, you can choose to clean the filters with compressed air or vacuum, Ferlin standard is using vacuum.

Protected settings

- **Filter blockage detection:** With an additional sensor in the filter, an alarm can be generated when the filter sleeves are full to a certain degree.
- **Hopper to hopper delay:** The time required to change between stations.
- **Start-up time:** The time it takes for the pump, from standstill, to reach speed.



The standby time reduces the number of times the pump is started. This extends the life time of the pump, and reduces power consumption.

Settings module Omron

In the settings of the module "Omron" the input fields are available to establish the connection between the FerlinBridge and the Omron PLC. In addition, there are a number of settings that allow the use of an automatic coupling station.

Options module Omron

Two options are built in that can take the integration of the Omron PLC in production to the next level. These are Use hopper selector and Use usage reporting. Both options can only be used in combination with a special PLC program.

Use hopper selector

Use hopper selector can be used in combination with a proportional valve. Using this function, the proportional valve can be switched using the FerlinBridge. If this function is enabled, an extra option will appear in the transport under "devices" where 8 proportional valves can be switched. For a further explanation, please refer to appendix 4.

Use usage reporting

The "use usage reporting" tool was developed to gain insight into the amount of material which is transported or processed with a MOVAC conveying system. The number of kG content of the respective hopper loaders can be set via the PLC system or via the FerlinBridge. Every complete suction cycle this number is added to the total consumption.



The use usage reporting tool is suitable for gaining insight but does not provide an exact value because it is volume-based. A system with a load cell is required for an exact insight.

I/O expansion board

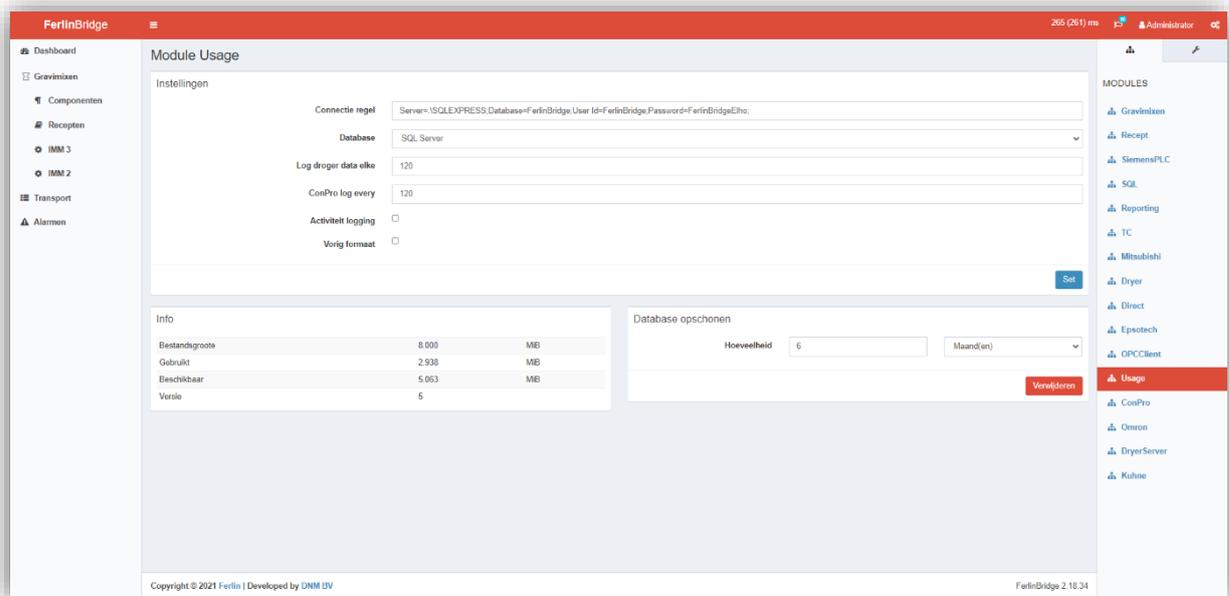
It is possible to connect the cables of up to six hopper loaders to one Gravimix dosing unit. The communication between the Omron PLC is then done via the network. Therefore an circuit board (PCB) is required in the control cabinet of the dosing unit.

Module Usage

The usage module offers the possibility to store all usage data in a database, for example SQL or MariaDB. In these databases all usage data is stored per component on batch level. In addition, the possibility exists to store alarms and user actions.

Database

All production data generated by the connected equipment can be stored in a database. Setting up the FerlinBridge so that the data is stored in the database is set in this module;



- **Connection string:** The connection string determines which database is used and has the data to access the database. End the connection string with *;*
- **Database:** Here you need to choose which type of database to use.
- **Log Dryer data every:** The set refresh time of the dryer's data in milliseconds.
- **Log Conpro every:** The set refresh time of the throughput measurement data in milliseconds.
- **Activity logging:** If desired, the actions of users can be saved, this function should be turned on for this purpose.
- **Accumulate component totals:** This backup option is made to save the dosed data per hopper in the database, table dbo.componenttotals. Those totals are a value calculated by the Gravimix. The value will be saved every hour and is used as a backup in case of a network issue.

Database

If the connection string is correct, and the database is set-upped correctly. At info the filesize, used memory, available memory and database version is shown.

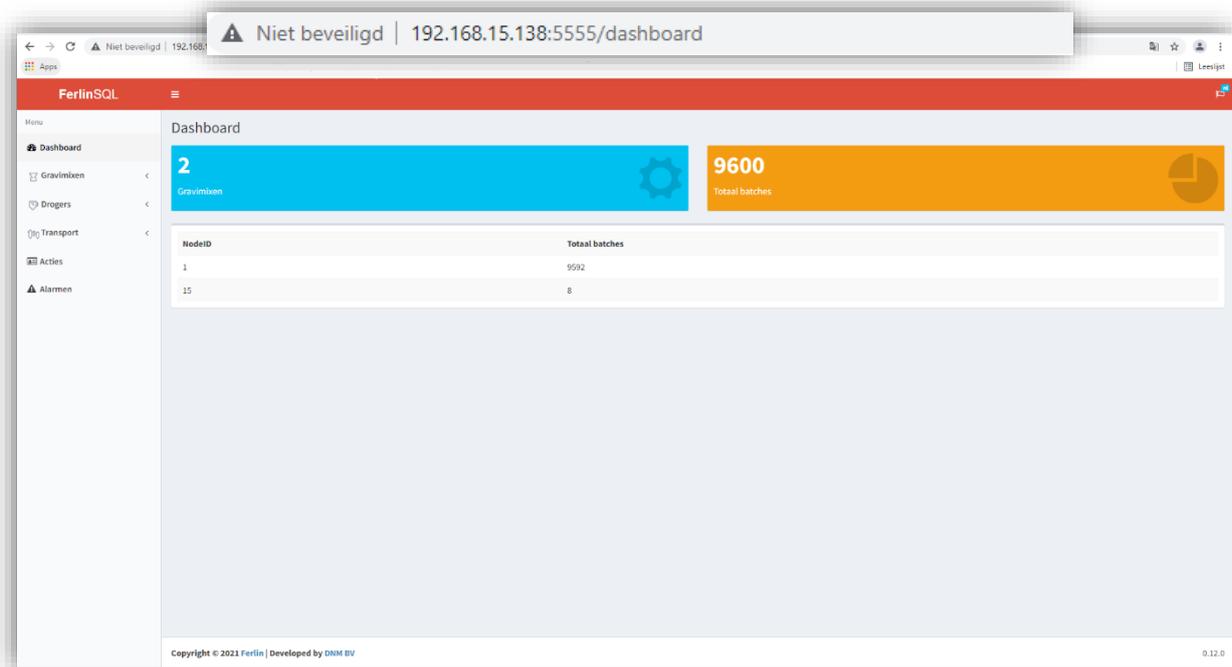
A function is available to cleanup the database. The amount of time, which should not be removed can be selected, and by pressing delete all date older then the selected amount of time will be deleted.

The FerlinBridge creates its own tables when the module is enabled in the database.

FerlinSQL tool

To gain insight into the data generated by the equipment in an SQL database, the FerlinSQL tool was developed. This software forms a bridge between the FerlinBridge and the Microsoft SQL database. From the dosing weight of one component in one batch to the total processed material of one or more machines, this tool provides insight. In addition, the drying process, the actions of users or alarms can be seen. All these data can be sorted and exported to a CSV file.

To access the FerlinSQL, enter the IP address of the server running the FerlinBridge in the input field of the web browser (preferably Chrome or Firefox), followed by the port number :5555. Press the *Enter* button to set up the connection. See an example in the figure below.



The FerlinSQL menu consists of six components;

- Dashboard
- Gravimixen
- Dryers
- Transport
- Actions
- Alarms

Dashboard SQL

The Dashboard shows a listing of the storage totals.

Gravimixen FerlinSQL tool

The consumption data of the Gravimixes can be sorted by levels;

- Batches
- components
- Material usage
- Material per recipe
- Trendline

Material consumption can be analyzed at all these levels. The data can be filtered by time, node ID, recipe or reference. In addition, the ratio can be analyzed using trend lines.

One or more filters can be added. The filters component or reference should be written out completely. The Node ID or recipe ID should be the number of the Gravimix or recipe in question. Below these input fields, a "from" and "to" time and date can be selected.

The screenshot shows a web-based filter interface titled "Batches". It features a search bar labeled "Zoeken" with a download icon to its right. Below the search bar are four filter sections: "Referentie" (Filter op referentie), "Component" (Filter op component label), "Node" (Filter op node ID), and "Recept" (Filter op recipe ID). At the bottom, there are two date and time selection fields. The first field is labeled "Van" and shows "00 : 00 : 00" with a date of "2021-10-19". The second field is labeled "Tot" and shows "23 : 59 : 59" with a date of "2021-10-20".

The list below the filter will contain all data that fits within the applied filter. Next to list is the button "summary". In which the relevant results are listed.

CSV-file

The filtered data can be saved to a CSV file. This button is in the upper right corner.

Dryers SQL

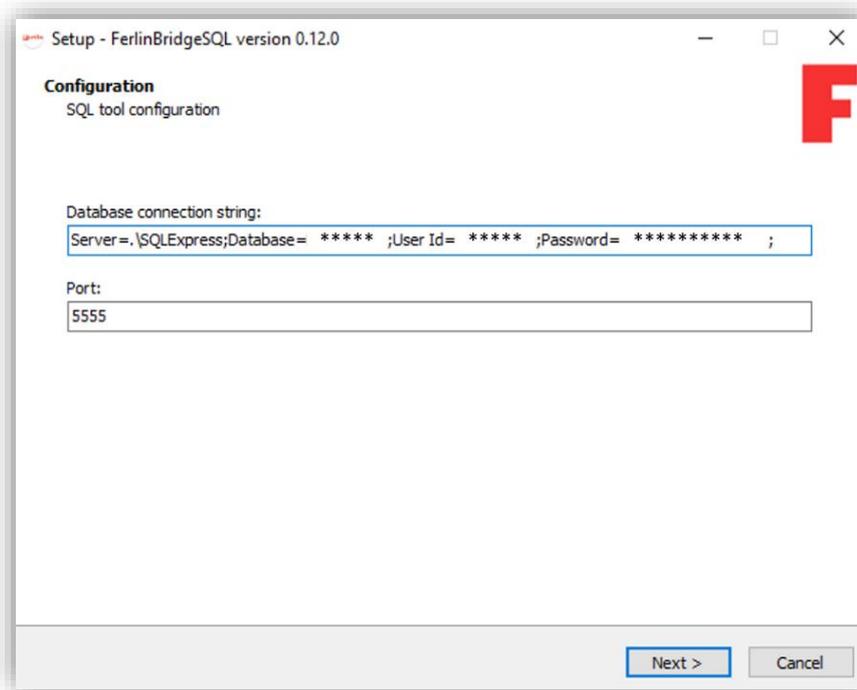
The consumption and process data of the dryer are stored. For example temperature of the incoming and outgoing air, energy consumption or volume flow rate can be analyzed.

Transport SQL

As there are no measuring systems in the conveyor system, an accurate material consumption cannot be measured. The "use usage reporting" tool was developed to gain insight into the amount of material transported or processed with a MOVAC conveyor system.

Installation FerlinSQL

This installation package is called the "FerlinBridgeSQL.Setup". During the installation, a pop-up appears with two input fields, the connection string and the port.



Connection string:

The upper input field can be used to enter the connection string. The connection string must match the connection string entered at usage. The connection line determines which database is used and has the data to access the database. End the connection string with *;*

Allow remote access to your database

To allow all devices to the FerlinSQL tool, a file should be changed at the FerlinBridge server. To be able to change this file the windows application "notepad" should be opened as administrator.

Go to the following file location C:\Program Files (x86)\FerlinBridgeSQL

Open the file "appsettings" and change the first "localhost" to "**"

```
"Kestrel": {
  "Endpoints": {
    "Http": {
      "Url": "http://*:5555"
```

Port:

The network port defaults to 5555, this can be changed if necessary.

The FerlinSQL tool, unlike the FerlinBridge, is a program that must be started;

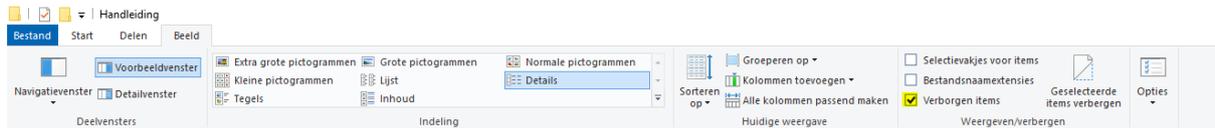
- It is possible to have the FerlinSQL tool start up directly, this is described in Appendix...
- It is possible to install the FerlinSQL tool on another device than the server, and start it from there.

FerlinBridgeSQL does not start-up

In many cases this is caused by abrupt stop/power interruption of the ipc/server. A **.net** file is corrupt and needs to be deleted in order to resolve this issue. This file will automatically be created again after that.

The **.net** stores files in C:\Users\<>Username>\AppData\Local\Temp\.net\FerlinSQL, the files in this folder needs to be deleted, in most cases these are two folders.

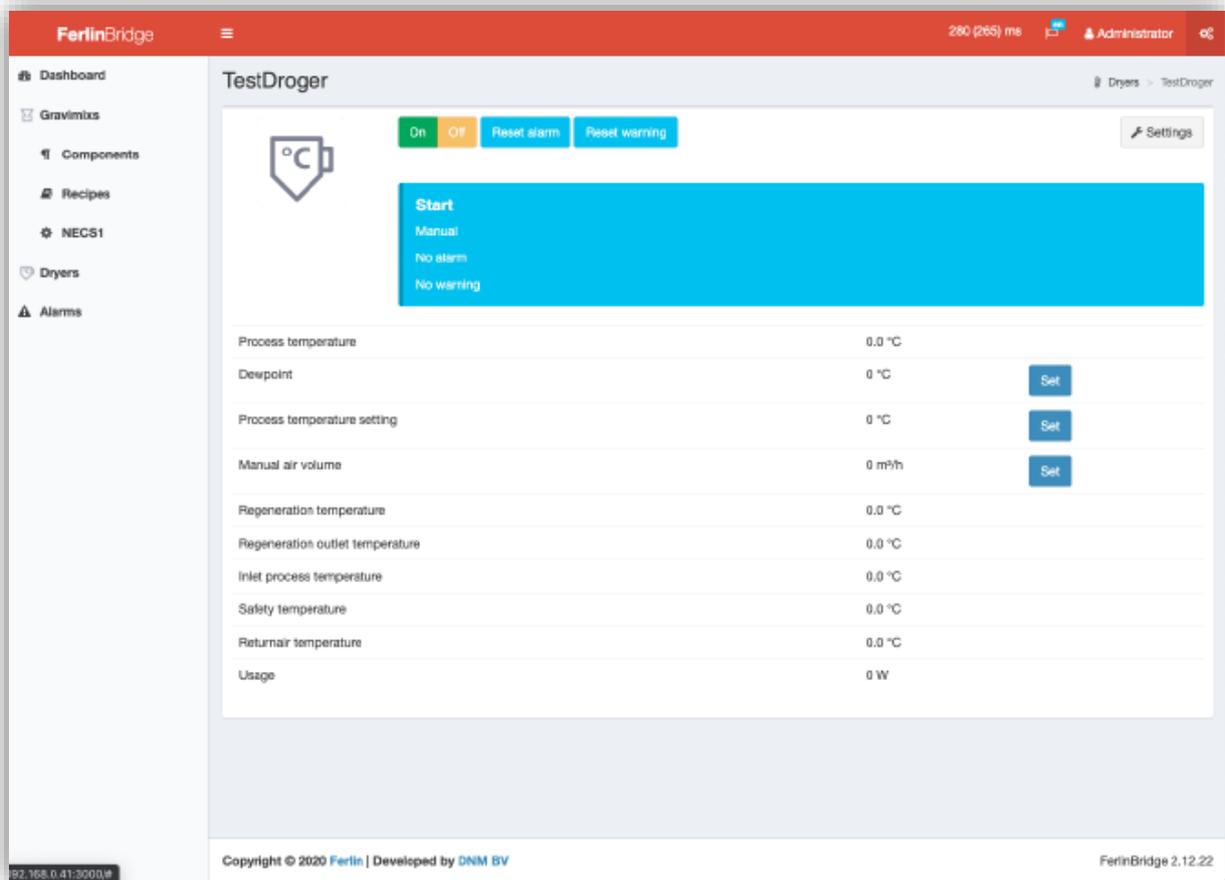
In order to be able to do this you need to set "show hidden files" to on. See the picture below.



Module Dryer

The Dryer module enables the control and adjustment of material drying equipment. The Drywell drying system, which consists of energy-efficient, flexible dryer systems with a hopper capacity of 10 to 150 liters. When the Dryer module is switched on the drying system appears in the menu;

If a dryer is selected, the following screen will appear



At the top is the name of the particular dryer. The dryer can be turned on, or off. Alarms and warning that have occurred during the process can also be reset here. In addition, a number of process parameters can be adjusted for optimal drying results. The adjustable process parameters are;

- The dew point
- The process temperature
- The volumetric flow rate



The material manufacturer's recommendations for the plastic granules to be dried must be observed!

Settings Dryer

The dryer needs to be set up to establish a connection via TCP/IP or via a COM port. For this purpose, the following settings have to be set correctly;

- **Min polling:** limits how often data is retrieved.
- **Timeout:** If it is detected that connection is lost longer than set value, an alarm is generated.
- **Name:** the name of the dryer can be set in this input field.
- **Port of host:** IP of the TCP/IP module.
- **Slave ID:** Value allowing the FerlinBridge to distinguish between different dryers.
- **Server offset:** number of addresses reserved per dryer.
- **Enabled:** enable or disable communication with related device.

After the name and settings are set, the module can be enabled at "settings".

Module Conpro

The ConPro extrusion module makes it possible to control and setup an extruder controller. The ConPro system, which consists of a weighing system and possibly a screw conveyor below. This system is capable of determining the throughput and adjusting the screw conveyor even as the extruder. How to setup the system can be found in appendix 6.

	Actual	Set	
Meter weight	0.000	196.610	g / m
Velocity control	0.00	0.01	%
Velocity actual	0.000		m / min
Total production	0		m

#	Name	Throughput set kg/h	Throughput actual kg/h	Manual	Rev %-1min	Weight kg
1	Door	0.00	(0.00 %) 0.00	(0.0 %)	0.00	7.429
		0.00		0.00		

Haul-off

If the ConPro Extrusion module is on, an extra read panel appears. The first four parameters, meter weight, velocity control, velocity actual and total production visualize and control the haul-off of the system.

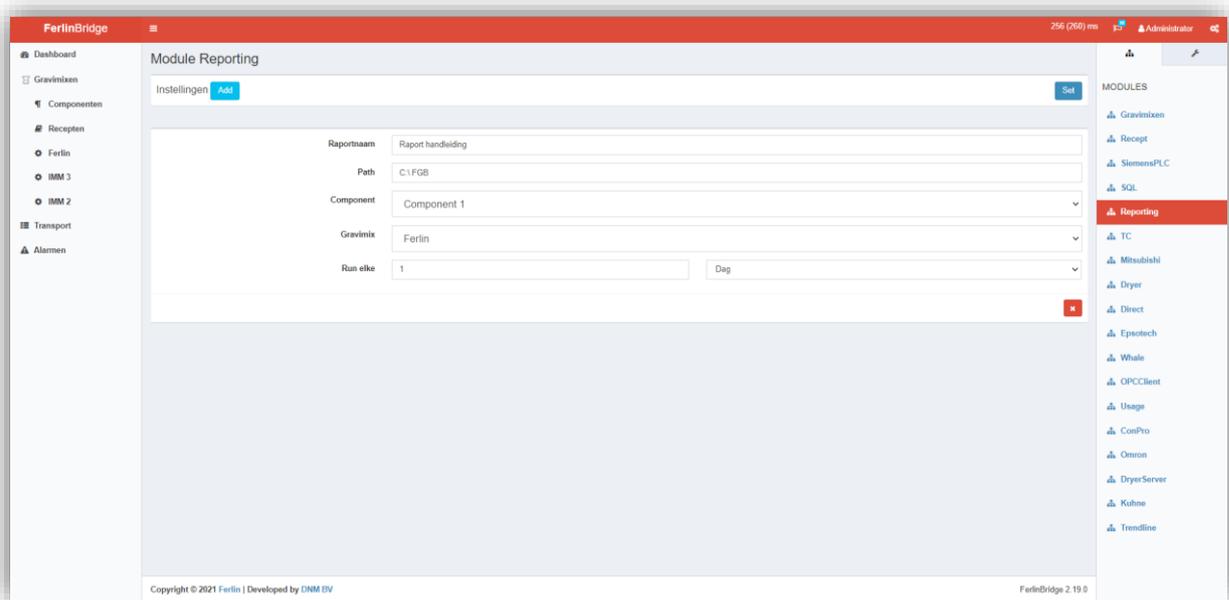
Extrusion controller

The parameters below are for controlling the weighing system. Some of the parameters can be changed by pressing the numbers, a input mask will appear. Manual or automatic mode is changed by pressing the icon. If the hand is shown, it is in manual mode. If Arrows are shown, it is in automatic mode.

- **#:** Number of weighing systems connected.
- **Name:** Name of the weighing system (can be changed in module settings).
- **Throughput set kg/h:** Targeted throughput.
- **Throughput actual kg/h:** Current throughput.
- **Manual:** Manual mode enables to change the rev %-1min used during startup. Automatic mode will change speeds of conveyor screw during process.
- **Rev %-1min:** Current revolution per minute in percentage. In manual mode this value can be changed.
- **Weigh kg:** Weight measured by the loadcell, in the weighing hopper.

Module Reporting

To automatically export the data, one or more simple queries can be created using the reporting module. These queries can generate totals statements, which are stored in preset locations. Go to the modules settings, and click on "reporting" to create a report query.



By pressing Add button a new query is created. With a newly created query a number of input fields have to be filled in;

- **Report name:** Here a report name can be added, from the FerlinBridge a name is already generated, but this can be changed.
- **Path:** Enter the desired file location to save the report. Tip: open the windows file explorer, find the desired location and copy this file location into the input field.
- **Component:** Select the component whose totals are to be reported. Leave this field empty if all components are to be included in the report.
- **Gravimix:** Choose the Gravimix dosing machine from which the data report is required.
- **Run every:** Choose an interval.

Press Set to create the query



The files are created by the query at the set times. They are in .xlsx format. This means that these files can be opened with newer versions of Excel or similar programs.



In order to use the reporting tool, a SQL database and the usage module are required.

After the query is/are set correctly, the module can be switched on at "Settings".

Module Siemens PLC

The FerlinBridge contains a module that makes it possible to communicate with a Siemens PLC, when it uses a Siemens S7 protocol. The following CPU's are supported in this module: S7-400, 300, 200, 1200, 1500.

Settings module SiemensPLC

To set up the communication between the Siemens PLC and the FerlinBridge, there are some settings that have to be entered correctly.

The screenshot shows a web-based configuration interface for the Siemens PLC module. The title is 'Module SiemensPLC'. Below it is a 'Settings' section with various input fields and checkboxes. The fields are arranged in a grid-like fashion. A 'Set' button is located at the bottom right of the settings area.

- **IP and Port:** The IP and port of the PLC to be connected must be entered in these input fields.
- **CPU:** The CPU of the PLC to be connected must be entered here.
- **Database Gravimix:** Number of cyclones used for Gravimix.
- **Database Hopper loaders:** Number of cyclones used for Hopper loaders.
- **Batch Data:** Production data is sent to siemens.
- **Conpro:** The Conpro must be ticked if a Conpro extruder controller is used.
- **Cyclone:** Number of cyclones.
- **Database cyclone data:** Which location per cyclone.
- **Rack:** Number of rack's
- **Slot:** Number of slot's
- **#Gravimix:** The number to be entered is equal to the highest NodeID of a gravimix. The NodeID(s) can easily be found in the Gravimix module.
- **#Hopperloaders:** The maximum number of hopper loaders which can be connected to a Gravimix is six. (a=1 b=2 c=3..) The highest number of hopper loaders on one Gravimix has to be set in this input field.
- **Timeout:** If it is detected that connection has been lost longer than the set value, an alarm is generated.
- **Min poll:** Limits how often data is retrieved.



The number of modules written to and read from is limited to the number of connected devices using these settings. The limitation is to keep the communication speed as high as possible. Be smart in this by having the NodeID(s) incremented numerically from 1, for example.

Address hopper loaders

In order to address the correct hopper loaders, it is important to follow the same counting system as the FerlinBridge follows. The hopper loaders are defined from 1 to 200. The order of the NodeID, of the Gravimix, is used to define which hopper loader is connected to which Gravimix, starting with 1. The length of the row with hopper loaders belonging to a certain NodeID is defined with #Hopperloaders in the settings. After the first row, the second row starts from NodeID 2.



Example/ Two Gravimixes are connected, with NodeID 1 and 3. The Gravimix with NodeID 1 is connected to two Hopper loaders. Four Hopper loaders are connected to Gravimix, with NodeID 3 (a=1 b=2 c=3 d=4).

Correct settings;

#Gravimix = 3

#Hopperloaders= 4

The numbers of the six hopper loaders are; (1,2,9,10,11,12).

All related addresses can be found in the technical manual, (FerlinBridge_Manual.PDF)

After the settings have been made correctly, the module can be switched on under "Settings".

Module SQL

This module makes it possible to use a SQL database to control a number functions. For example this module allows to read the status and current recipe, send recipes and start or stop the dosing units.



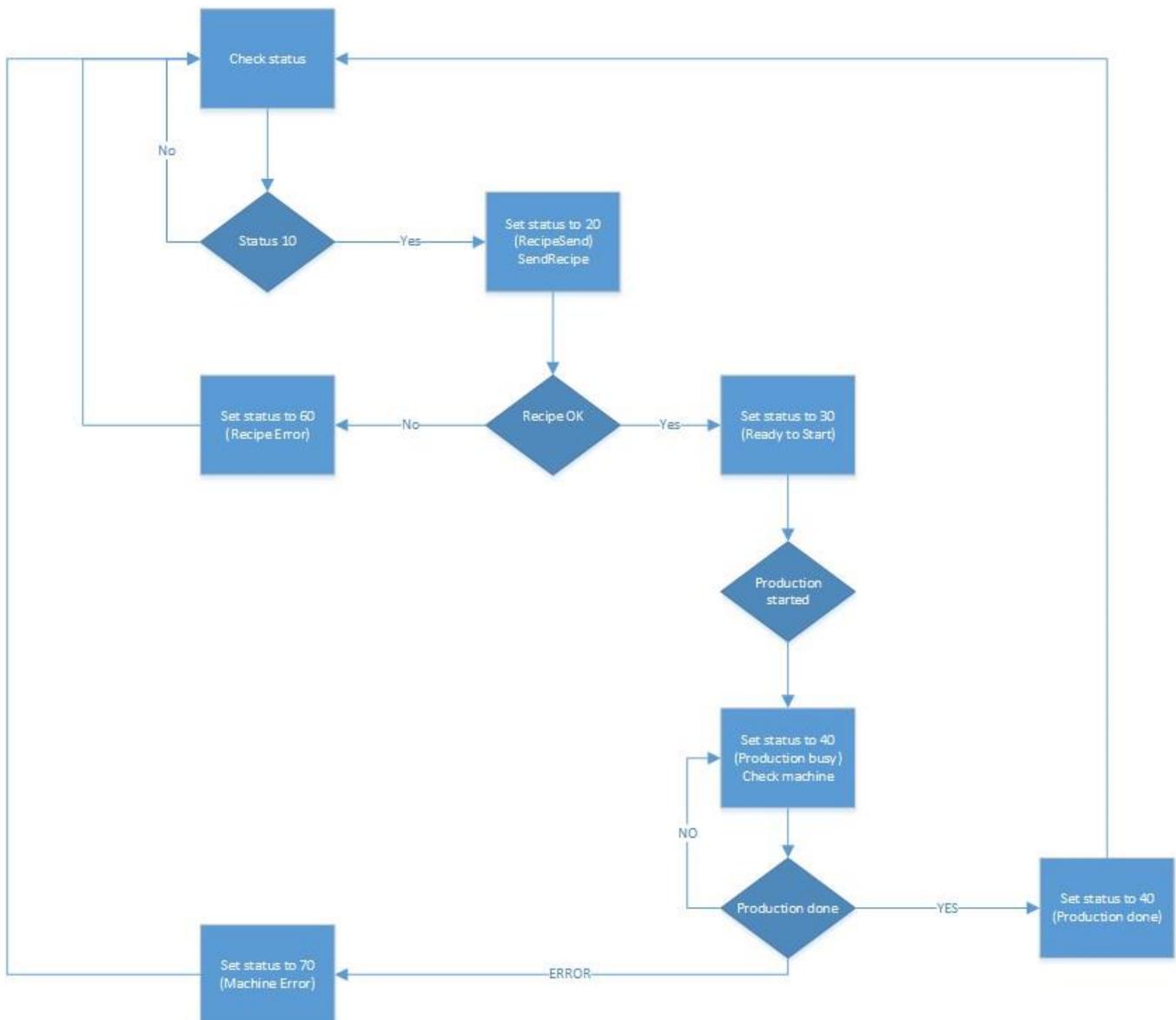
The tables for this module have to be created manually. The query for creating the tables can be found in attachment 7.1 and 7.2.

Status

The Ferlin SQL module is following an order of steps. It is important to keep this in mind when controlling the process via the SQL database.



For example/ the recipes will be taken over when a dosing unit is in status 10 (ready for production). It will wait with changing recipe until the machine is in status 10.



The description of the statuses are;

Status	Description
0	Initial
10	Ready for production
20	Recipe sent to GDI
30	Ready to start
40	Production busy
50	Done (not used)
60	Recipe error
70	Machine error/alarm

Sending recipes

Table dbo.FerlinBatch is used to set recipes. The following interface is used.

FerlinBatch	
Name	Description
Id	Automatically generated identifier
MachineName	Device name as shown in Bridge interface.
Created	Date/time of record creation
Status	<p>0 = Init 10 = ReadyForProduction 20 = RecipeSend 30 = ReadyToStart 40 = ProductionBusy 50 = ProductionDone 60 = RecipeError 70 = MachineError</p> <p>To signal that a batch is ready to be started, set this value to 10. As soon as the Gravimix identified by MachineName is in stand-by, it will send this batch recipe.</p> <p>Depending on whether the AutoStartRecipesSQL configuration flag is set to true, production will commence immediately. Otherwise, the start needs to be triggered manually through the Bridge interface.</p> <p>This value is kept up-to-date by Bridge to show any state changes.</p>
Changed	Date/time of last state change [Read only]
RecipeID	Recipe reference id. Does not need to correspond to id in Bridge interface.
RecipeInt	Recipe interpretation 0 = Standard 1 = Percentage
CompNr	Number of Components
VolumeRatio	VolumeRatio
Comp[1-10]Hopper	Component Hopper number
Comp[1-10]Type	Component type 0 = Regrind 1 = Additive

	2 = Natural
Comp[1-10]AlarmType	Component alarm type 1 = Ignore 2 = Warning 3 = Error
Comp[1-10]Ratio	Component ratio

Optional: naming components

It is optional to name components (component labels). Therefore the combination with the usage module and the recipe module is required. The names of the components will be shown in the FerlinBridge interface and the data can be sorted on the component name to understand the usage per material.



For the option in the configuration the **“Track component names by generating Recipes from SQL data”** should be allowed



If the option **“Track component names by generating Recipes from SQL data”** is used, the table *dbo.FerlinUsage* and *dbo.FerlinComponent* is not appropriate. The data can be found in *dbo.BatchReport*. The recipe module is used for saving the names of the different components, and is therefore required.

Saving usage

The batches are all separately saved. Those are shown in table *dbo.FerlinUsage*.

Components

The components per batch are all separately saved. Those are shown in table *dbo.FerlinComponent*

Status

The status of the dosing units are tracked in the table *dbo.FerlinState*. Also alarmbits and a timestamp for the change of state is shown.

Current recipe

The current recipe is shown in table dbo.FerlinCurrentRecipe. The following interface is used;

FerlinCurrentRecipe	
Name	Description
Id	Unique identifier per device
MachineName	Device name as shown in Bridge interface. Whenever the MachineName of a device is changed, a new recipe row may appear.
RecipeID	Recipe reference id. This corresponds to id in the Bridge interface.
RecipeName	The recipe name, when available.
RecipeInt	Recipe interpretation 0 = standard 1 = Percentage
CompNr	Number of Components
VolumeRatio	VolumeRatio
Comp[1-10]Hopper	Component Hopper number
Comp[1-10]Type	Component type 0 = Re grind 1 = Additive 2 = Natural
Comp[1-10]AlarmType	Component alarm type 1 = Ignore 2 = Warning 3 = Error
Comp[1-10]Ratio	Component ratio

Commands

It is possible to start, stop or reset alarms by using the table dbo.FerlinCmd. This can be useful when the status have to be set back for changing a recipe. The following interface is used;

FerlinCmd	
Name	Description
Id	Automatically generated identifier
MachineName	Device name as shown in Bridge interface.
CmdBit	1 = AlarmClearAll 2 = ProductionStart 4 = ProductionStop
Cmd1Param8	<u>Most not be set.</u> Reserved for future use.
Cmd2Param8	
Cmd3Param8	
Cmd1Param16	
Cmd2Param16	
Cmd3Param16	
Cmd1Param32	
Cmd2Param32	
Cmd3Param32	
CmdParamFloat	
ReturnCode	<p>Indicates the execution status of the command. This field is kept up to date by Bridge and <u>must not be set</u> when inserting a new command.</p> <p>0 = Successfully send to device -1 = Error while parsing command / sending to device -2 = Command is to old to be executed</p> <p>Normal execution, i.e. the command was successfully sent to the Gravimix device will result in a return code of 0.</p> <p>When an error is encountered while parsing or sending the command, the return code is -1.</p> <p>Command entries with a creation time more than one minute in the past that have no return code yet, will be marked as too old (return code -2).</p>

Created	<p>Date/time of record creation.</p> <p>When not set explicitly, this field is automatically set to the current database time. Time should not be in the past!</p>
----------------	--

Configuration

The configuration for the SQL module have to be done in the following overview. The connection string is used for the communication with a database. If the FerlinBridge is installed by Ferlin the connection string of the usage module can be used in this module as well. The tables are all set to default.

The screenshot shows the 'Module SQL' configuration window. It contains the following settings:

- Connection string: Server=:\SQLExpress;Database=MAT1;User Id=MAT1;Password=MAT1;
- Batch table: FerlinBatch
- Usage table: FerlinUsage
- Component table: FerlinComponent
- Status table: FerlinState
- Current recipe table: FerlinCurrentRecipe
- Gravimix Command table: FerlinCmd
- Automatically start production after recipe change:
- Keep track of current Gravimix recipes:
- Track component names by generating Recipes from SQL data:
- Enable sending of Gravimix commands via SQL table:

A 'Set' button is located at the bottom right of the configuration window.

Optional configuration

“Keep track of current recipes” and “enable sending of Gravimix commands via SQL table” are optional. The create those extra tables the queries in attachment 7.2 should be used.

Database

After the Module SQL is configured the module have to be turned on, this can be done like described at the “settings” page. The module is called DB client.

Verions



If the FerlinBridge is updated to a version 2.21.47 or newer, the dbo.FerlinBatch have a number of extra field. Use the query in attachment 7.3 to update the table dbo.FerlinBatch.

After explaining the possible modules that can be used to integrate the FerlinBridge, the next chapter deals with the installation of the FerlinBridge and the devices to be connected.

Module Coextruder

The FerlinBridge contains a module which can be used a production environment with coextrudes. A number of dosing units can be assigned to each other and be seen in one overview.

Installation FerlinBridge

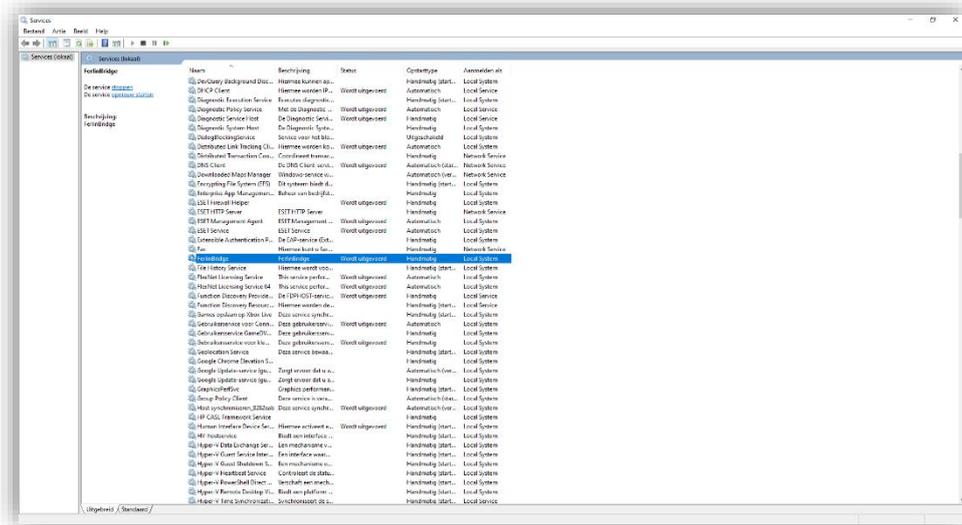
There are two operating systems compatible with FerlinBridge, Windows and Linux. Each of these operating systems has its own installation package. The installation package for windows is FerlinBridge.SetupWithFramework, the one for linux is FerlinBridge.Linux. The package has to be installed on the server. It is important that this server communicates via the same network as the devices to be connected, servers or the PLC.

Installation package FerlinBridge

Windows

The installation package is a so-called Windows service. This means that the program runs in the background and starts when the server is switched on.

On the server the installation of the "FerlinBridge.SetupWithFramework" can be done, go through the questions and within a few minutes in the program installed. The program is installed in the following location (Program Files(x86)-FerlinBridge). After completing the installation, the program starts running. Via the windows application "services" it is possible to see the current status of the FerlinBridge, and to switch it off or on if necessary.



Network

For a constant connection between devices, it is important that the network settings are correct. These include an IP address, gateway and subnet network mask. A gateway is especially important for the Gravimix depositors. If the network is self-managed, the gateway can be the same as the IP address of the server.

Also the ports have to be opened to be able to communicate over the network. The Ports used by the FerlinBridge are; 3000, 3001, 5555, 4321, 64123, 62124.



Check with Windows that the network being used is configured as a private profile. A public or guest network may cause disturbances. *

Installation Gravimix

To be able to connect between the FerlinBridge and the Gravimix series, there are a number of requirements;

- The Gravimix has an H-print including software version 12.1.3.XX or newer.
- The Gravimix is equipped with an Ethernet module connected to the FerlinBridge network.

Requirements

Each of the requirements is easy to check. Whether the Gravimix is equipped with an H-Print, which will be supplied as standard from 2016, can be recognized by the software version. To check the software version, the EB2/3 handheld is required. The version can be found behind the interface in the main menu. If the version starts with 12.X.X.XX the machine has an H-print. If there is a value behind MAC in the same menu, the machine also has an Ethernet board.

If there is no H-print present, please contact Ferlin Plastics Automation, who can advise you on the possibilities of a conversion. If there is an H-print but no Ethernet module present, it can be ordered and easily installed in the correct position.

Network settings Gravimix

The IP address can be set -with an EB2/3- at version, found behind interface. In order to adjust the IP address, the following combination of numbers has to be entered "03011994". If DHCP is set to no, the IP address, the Gateway and the network are free. These must all be entered correctly in order to establish proper communication. Restart the Gravimix after entering the IP address to implement the change.



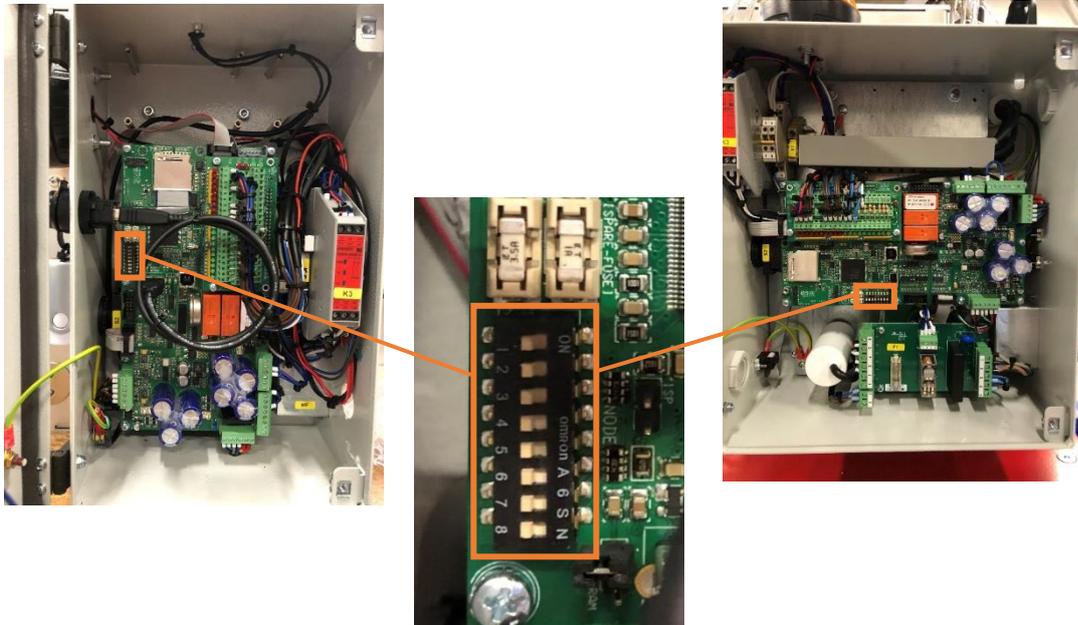
Set node-ID

Each Gravimix should have a separate Node-ID so the FerlinBridge can distinguish between the different machines. It is recommended to build the Node-ID of the different machines in a logical way, because the Node-ID will be used at different places in the FerlinBridge. Setting the Node-ID is done as follows; 8 dipswitches on the circuit board are used to set the Node-ID. A binary counting system is used, which works as follows;

- 1 = 1 of 0
- 2 = 2 of 0
- 3 = 4 of 0
- 4 = 8 of 0
- 5 = 16 of 0

...

For example, to make number six, the second and third switches must be switched (2+4=6).



Software update

Before performing the update, it is recommended to first back up the configuration files, and the local databases.

the default location for the databases is; C:\Program Files\Ferlin. This contains the two databases;

- recipe.database
- Alarm.database

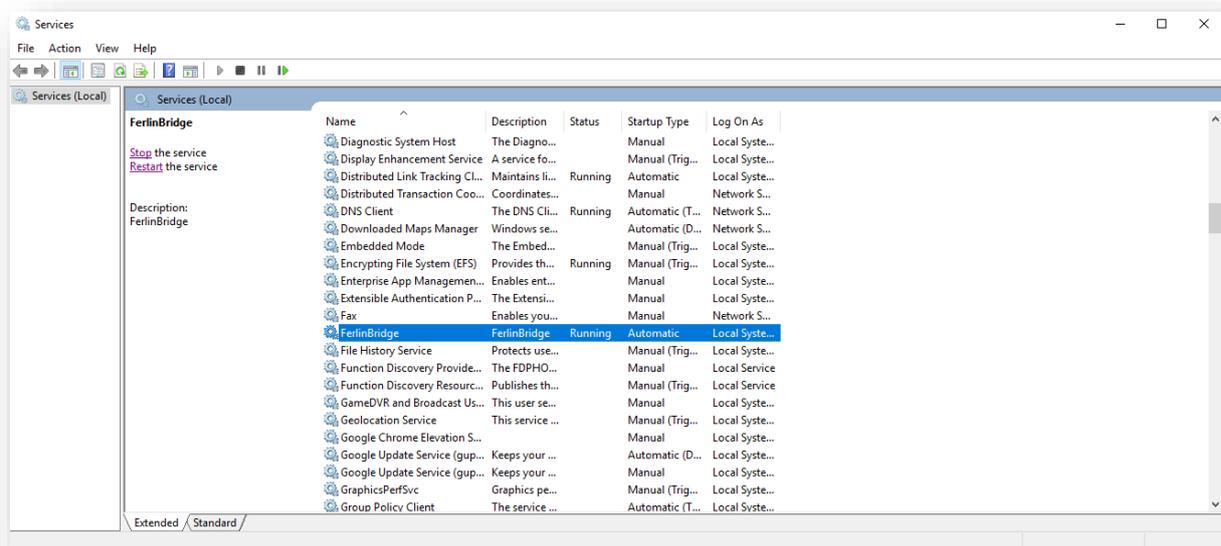
It is recommended to backup these

The configuration files is in the following default location; C:\Program Files\Ferlin\Conf

- FerlinBridge.old
- FerlinBridge.backup
- FerlinBridge.conf

It is recommended to back up these as well.

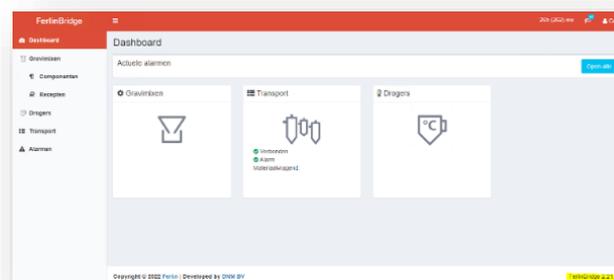
The FerlinBridge should be stopped manually via windows tool "services".



If the FerlinBridge is stopped the installation file "FerlinBridge.setup 2.XX.XX.X" can be run.

Follow the installation wizard and within a minute the update should have ran.

Start FerlinBridge via services. Compare in the FerlinBridge application if the alarm, recipe and modules are still set as before the update. Check that the revision number matches the number of the update file in the bottom right corner.



Error description

1. FerlinBridgeSQL doesn't start-up?

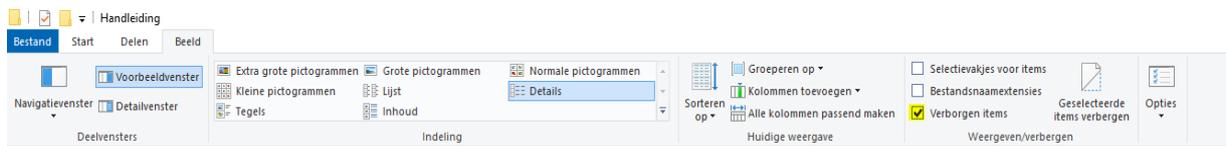
In many cases this is caused by abrupt stop/power interruption of the ipc/server.

A **.net** file is corrupt and needs to be deleted in order to resolve this issue. This file will automatically be created again after that.

Solved

The **.net** stores files in C:\Users\<<Username>\AppData\Local\Temp\.net\FerlinSQL, the files in this folder needs to be deleted, in most cases these are two folders.

In order to be able to do this you need to set "show hidden files" to on. See the picture below.



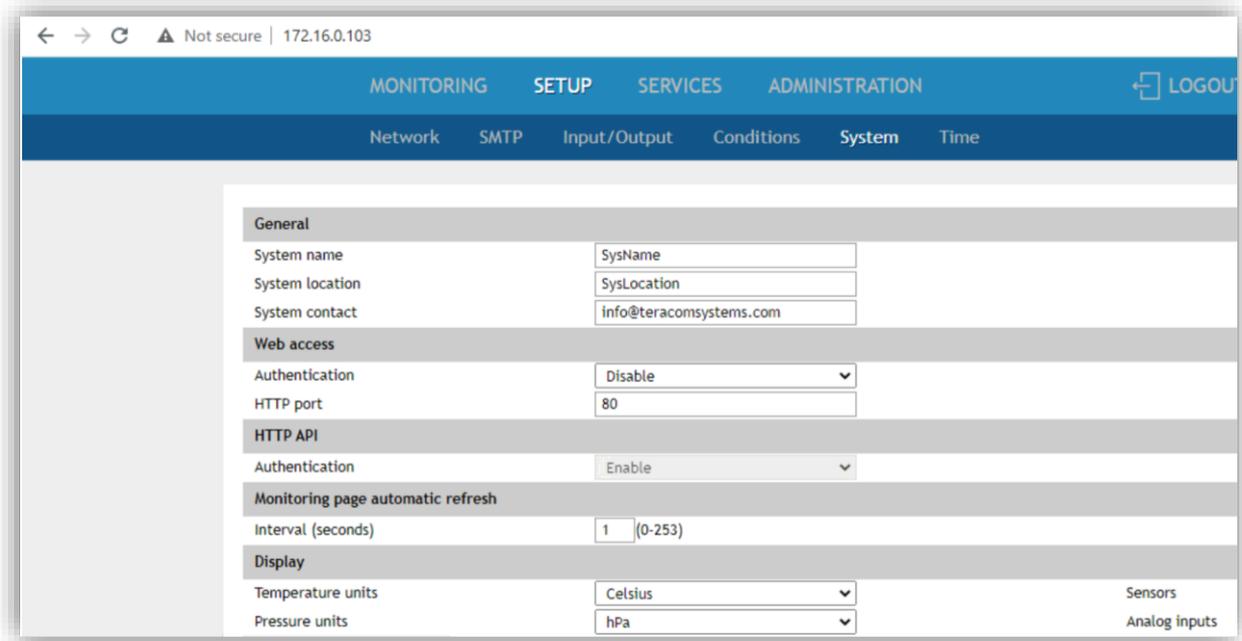
Appendices

Appendix 1: TCW 241 (I/o module)

The I/o module used by Ferlin Plastics Automation for various applications is the TCW 241 from Taracom. This module has four digital inputs, four analog inputs and four relays.

Set IP-adress

To set the correct IP address, please refer to the manual of the TCW 241.



The screenshot shows a web browser window with the URL 172.16.0.103. The page is titled 'SETUP' and has a navigation menu with 'MONITORING', 'SETUP', 'SERVICES', and 'ADMINISTRATION'. Below the navigation menu, there are sub-menus for 'Network', 'SMTP', 'Input/Output', 'Conditions', 'System', and 'Time'. The main content area is divided into sections: 'General', 'Web access', 'HTTP API', 'Monitoring page automatic refresh', and 'Display'. The 'Web access' section is highlighted, showing 'Authentication' set to 'Disable' and 'HTTP port' set to '80'. The 'HTTP API' section shows 'Authentication' set to 'Enable'. The 'Monitoring page automatic refresh' section shows 'Interval (seconds)' set to '1'. The 'Display' section shows 'Temperature units' set to 'Celsius' and 'Pressure units' set to 'hPa'. There are also labels for 'Sensors' and 'Analog inputs' on the right side of the 'Display' section.

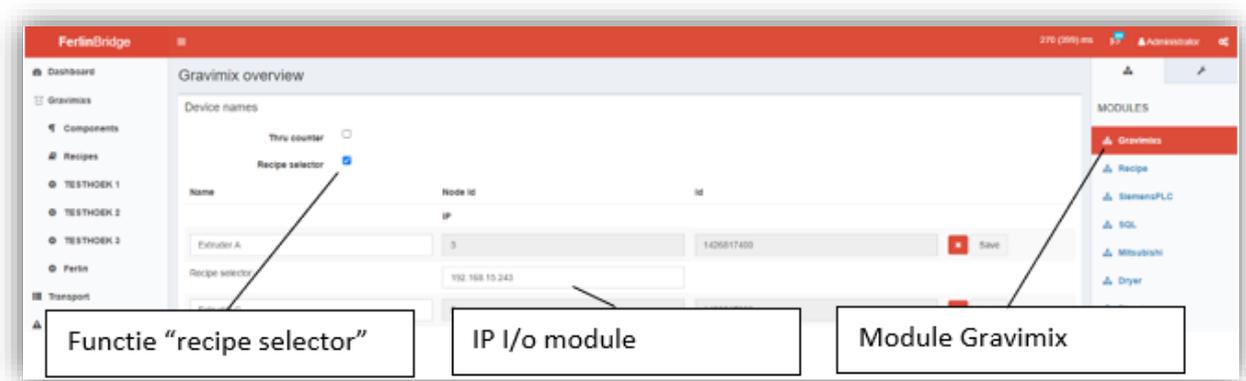
Set the Web access to "Disable" to set up communication between the FerlinBridge and the I/o module.

Appendix 2: Recipe selector

The recipe selector is an option in which one of fifteen recipes can be chosen per Gravimix, by means of external signals. The external signals are received by a separate I/o module, described in appendix 1, after which the recipe corresponding to the signal is set.

Settings recipe selector

To enable this function, the "Recipe selector" function must be enabled in the Gravimix module. When the function is enabled an input field per Gravimix will appear. In this field the IP-address of the matching I/o module has to be set..



The I/o module has four digital inputs. To count from one to fifteen, a binary counting system is used, where 0 is not included. The system works as follows;

- 1 = 1 or 0
- 2 = 2 or 0
- 3 = 4 or 0
- 4 = 8 or 0

For example/ To choose recipe six, the second and third inputs should be high (2+4=6).

Recipe

To select the correct recipe for the correct combination of external signals, the names of the recipes should end with 01 through 15, according to the signal in the I/O module. To match the correct recipe to the correct Gravimix, the NodeID of the Gravimix is also incorporated into the recipe name. The recipe name starts with the NodeID of the particular Gravimix for which the recipe was created, followed by the number of the recipe. The "description" input field can be freely used to describe any recipe.

For example, if you want to define the third recipe for the Gravimix with NodeID six. The name of the recipe should then be 603. Below is a figure with an example.

The screenshot displays the 'Recipes' section of the FerlinBridge software. A table lists several recipes, with a modal window providing a detailed view of the 'Name' and 'Description' fields. The modal window shows the following data:

Name	Description
606	Material description 6
605	Material description 5
604	Material description 4
603	Material description 3
602	Material description 2
601	Material description 1

Callout boxes provide the following information:

- Node ID + Recept nummer
- Beschrijving recept (vrij in te vullen)

Appendix 3: Thru counter

Thru counter is made to keep counting the material consumption when the Gravimix is changed for a material hopper, for example between two production runs. If the signal is high on the I/o module, the material consumption for one set component continues to count with the same throughput (kg/Hr) as the throughput of the Gravimix.

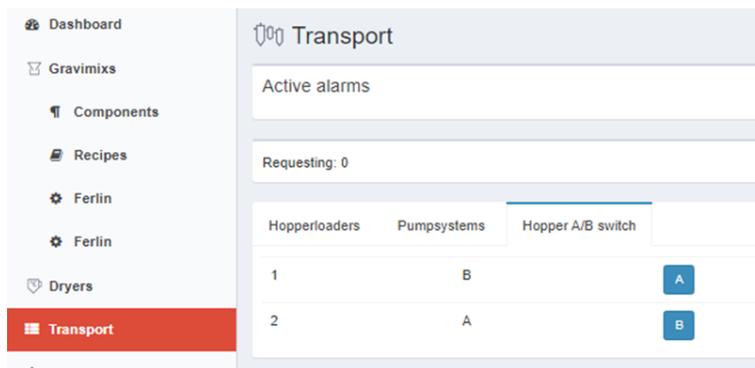
To make this function available, the "Thru counter" function must be checked in the settings of the Gravimix module. After the "Thru counter" function is checked, two additional input fields appear. The first input field has to be used to enter the IP address of the I/o module (see appendix 1). The second input field should be used to select one of the components from the database, this component will be counted through the material consumption of.



Appendix 4: Use hopper selector (Module Omron)

With this function it is made possible to choose between material A and B, when using a changeover valve. The selection is generated by the FerlinBridge and will offer an output on the I/o module, to which the diverter or hopper loader is connected.

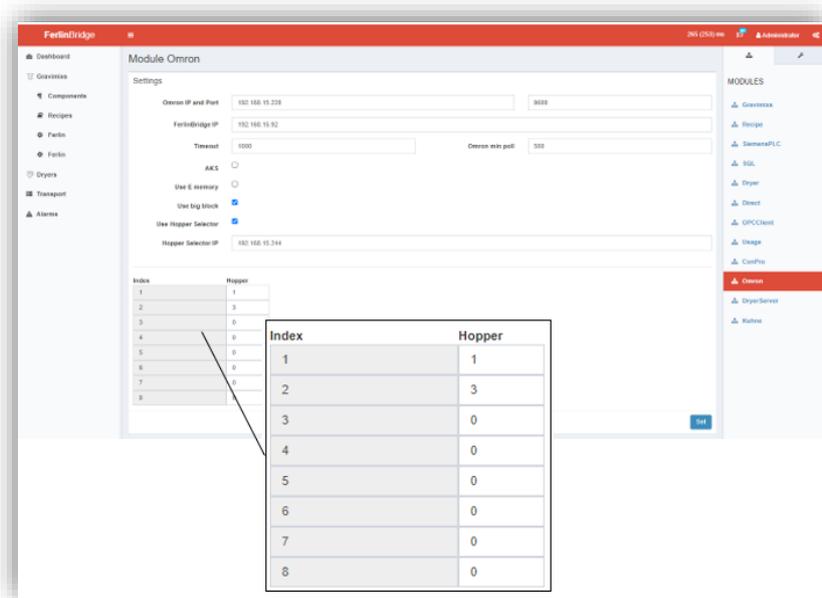
If no Gravimix is used, but an Omron PLC is, it is possible to switch the valves via the "Transport" screen. Via the tap "Hopper A/B switch", which can be found in the settings of the Omron module after switching on the Use hopper selector, you can easily select material A (no power on output) or B (power on output) by tapping the button, the button shows the current setting, by clicking you can change it.



To make the option available, you must check "Use Hopper Selector" in the Omron Module* settings (Figure 2). Now you can enter the IP address of the I/O module. Set the module to the correct IP address as described in the I/O Module manual.

Now you can select which output (Index) can be set to which hopper loader (Hopper).

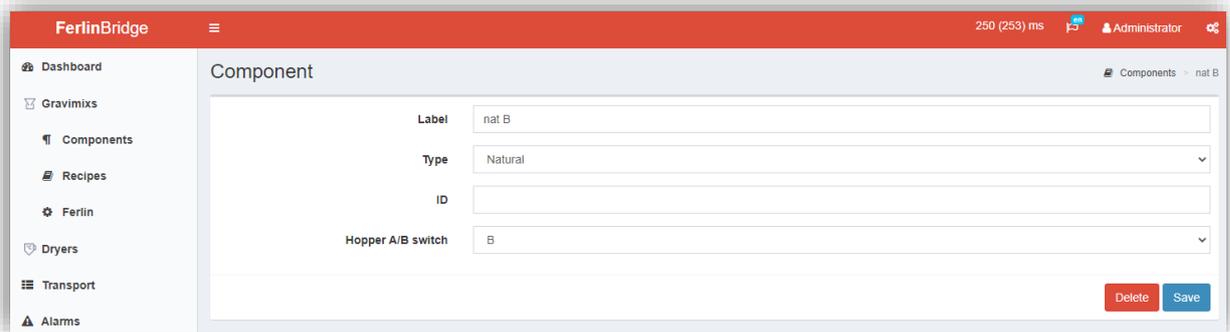
The setting in the figure below means that at hopper loader 1 you can activate or deactivate output No. 1 of the I/O Module. For hopper loader 3, you can activate or deactivate output No. 2 of the I/O module.



Appendix 5: Use hopper selector (Module Recipe)

With this function it is made possible to choose between material A and B, when a changeover valve is used. The selection is generated by the FerlinBridge and will give an output on the I/O module, to which the diverter valve is connected.

If a Gravimix is used, the diverter valve can be switched automatically, depending on which recipe is selected. Per component it has to be set whether it comes from stock A or B. This can be set at "hopper A/B switch". Setting A means that no output is given, setting B means that an output is given.



If this component is used in a recipe with the correct mixer with the correct hopper number, the corresponding output is activated (B) or deactivated (A).

To make this selection available, you must check "Hopper Selector IP" in the Recipe Module* settings (Figure 4). Now you can enter the IP address for the I/O module. Set the module to the correct IP address as described in the I/O Module manual.

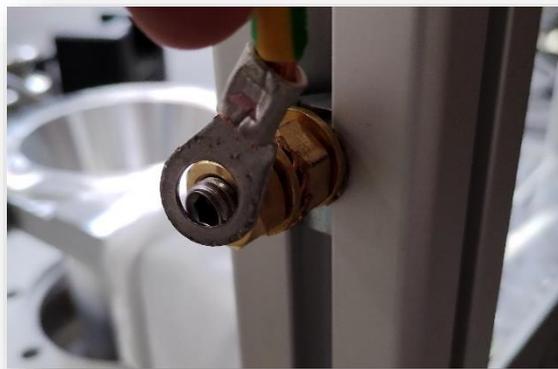
Now you can select which output (Index) can be set at which mixer (NodeId=Node Id of the specific mixer) which hopper can activate or deactivate the output on the I/O module.

*The Recipe module can be found by pressing the settings symbol in the upper right corner.

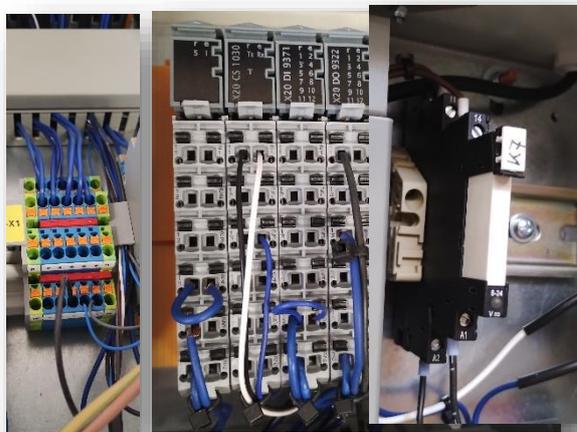
Appendix 6: Connecting ConPro extrusion regulation system

Physical setup

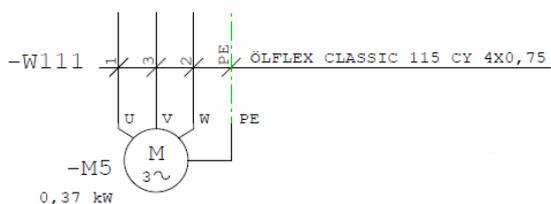
Connect the green connector (from -W100) to "in" at the loadcell module (K10). Connect the protective earth cable to the side of the stand as well: Connect signal bottom valve of the dosing unit with PLC conpro.



Conpro		Ferlin	
Ventil Komp.1	"DO9322" K4 DO1 1.1	24VDC potential-free relay	K7, A1
	"X1" -	24VDC potential-free relay	K7, A2

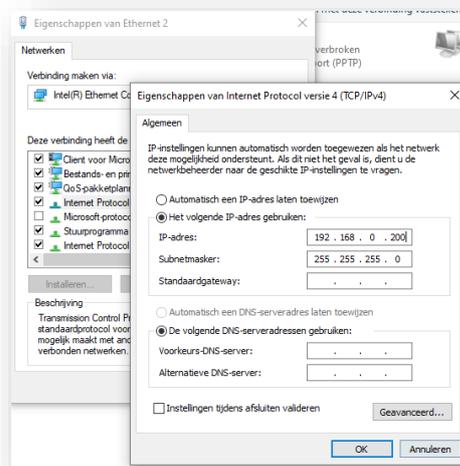


Connect the motor of the screw conveyor to -W111 connected with the escodrive frequency converter, 1=u, 3=v, 2w

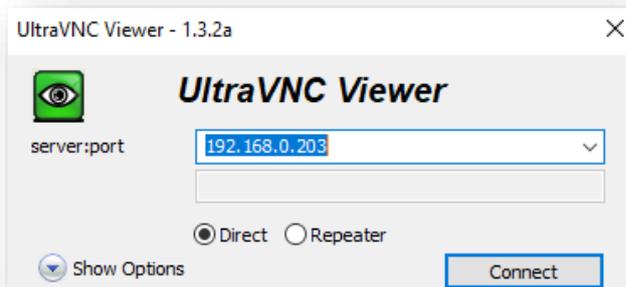


Network setup

- Connect PLC of the ConPro to a PC using ethernet communication cable and Ethernet switch.
- Download UltraVNC viewer
<https://uvnc.com/downloads/ultravnc.html>
- Setup a network port. Default IP of PLC is 192.168.0.203, Subnet 255.255.255.0.



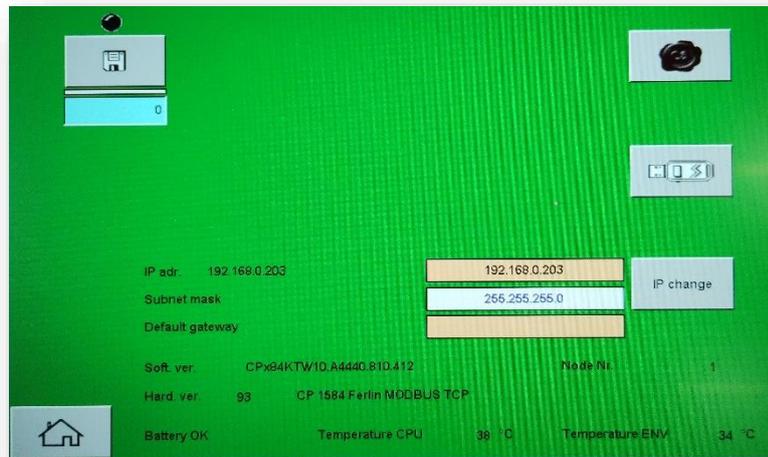
- Open UltraVNC viewer and enter IP of PLC.



- Check if the following settings at setup are corresponding;

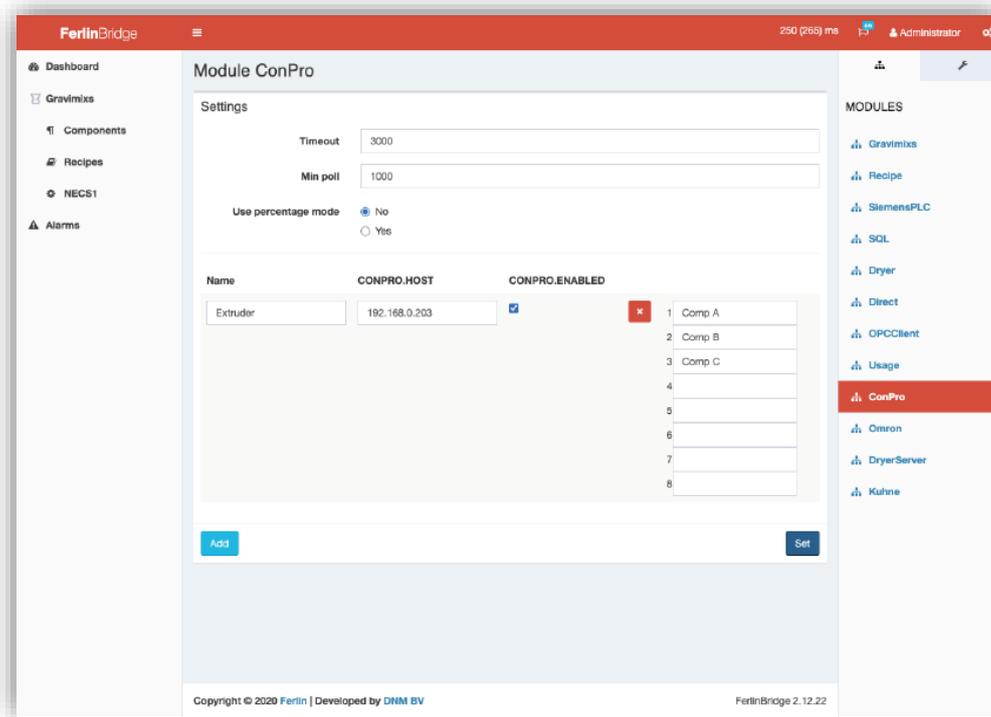


- Use diskette icon to be able to change IP-address and save settings if changed at setup.
Password to enter is "2112"



- If the settings are changed, press the diskette to save those settings.
- By pressing at IP-address an input mask will appear, change the IP-address.
Do not use backspace, start typing when input mask appears
- Check IP-address, if it is correct press at "IP Change". The connection will be lost and the new IP-address is set.
- Connect the Ethernet cable to the same network as the FerlinBridge is connected to.

FerlinBridge settings ConPro



- **Timeout:** If it is detected that connection is lost longer than set value, an alarm is generated. Default 3000 ms.
- **Minpoll:** limits how often data is retrieved. Default 1000 ms.
- **Use percentage mode:** Option percentage mode of Conpro system.
- **Name:** Enter name of Conpro module.
- **Conpro.Host:** IP-adress of Conpro, which is set at UltraVNC viewer.
- **Conpro.Eneabled:** enable or disable communication with related device.
- **Conponents:** number of attached components.

After the name, settings and IP-address is set, the module can be enabled at "settings".

Appendix 7.1: Ferlin Direct SQL default tables

Query for creating tables

```
IF OBJECT_ID('dbo.FerlinBatch', 'U') IS NOT NULL
    DROP TABLE FerlinBatch;
IF OBJECT_ID('dbo.FerlinState', 'U') IS NOT NULL
    DROP TABLE FerlinState;
IF OBJECT_ID('dbo.FerlinUsage', 'U') IS NOT NULL
    DROP TABLE FerlinUsage;
IF OBJECT_ID('dbo.FerlinComponent', 'U') IS NOT NULL
    DROP TABLE FerlinComponent;
```

```
CREATE TABLE FerlinState
```

```
(
    Id                nvarchar(50) NOT NULL,
    MachineName       nvarchar(50),
    State             int,
    StateDesc         nvarchar(100),
    Mode              int,
    ModeDesc          nvarchar(100),
    Alarm             int,
    AlarmDesc         nvarchar(500),
    AlarmState        int,
    AlarmStateDesc    nvarchar(200),
    AlarmCount        int,
    Connected         bit NOT NULL,
    Changed           datetime,
    PRIMARY KEY (Id)
);
```

```
CREATE TABLE FerlinBatch
(
  Id                int IDENTITY (1,1),
  MachineName       nvarchar(50) NOT NULL,
  Created           datetime NOT NULL
  CONSTRAINT CreateTS_Batch DEFAULT
    CURRENT_TIMESTAMP,
  Status            int,
  Changed           datetime,
  RecipeID         int NOT NULL,
  RecipeInt        int NOT NULL,
  CompNr           int NOT NULL,
  VolumeRatio      int NOT NULL,
  Comp1Hopper      int,
  Comp1Type        int,
  Comp1AlarmType   int,
  Comp1Ratio       float,
  Comp2Hopper      int,
  Comp2Type        int,
  Comp2AlarmType   int,
  Comp2Ratio       float,
  Comp3Hopper      int,
  Comp3Type        int,
  Comp3AlarmType   int,
  Comp3Ratio       float,
  Comp4Hopper      int,
  Comp4Type        int,
  Comp4AlarmType   int,
  Comp4Ratio       float,
  Comp5Hopper      int,
  Comp5Type        int,
  Comp5AlarmType   int,
  Comp5Ratio       float,
  Comp6Hopper      int,
  Comp6Type        int,
  Comp6AlarmType   int,
  Comp6Ratio       float,
  Comp7Hopper      int,
  Comp7Type        int,
  Comp7AlarmType   int,
  Comp7Ratio       float,
  Comp8Hopper      int,
  Comp8Type        int,
  Comp8AlarmType   int,
  Comp8Ratio       float,
  Comp9Hopper      int,
  Comp9Type        int,
```

```
Comp9AlarmType    int,  
Comp9Ratio        float,  
Comp10Hopper      int,  
Comp10Type        int,  
Comp10AlarmType   int,  
Comp10Ratio       float,  
PRIMARY KEY (Id, MachineName)
```

```
);
```

```
CREATE TABLE FerlinComponent
```

```
(
```

```
  Id                nvarchar(50) NOT NULL,  
  MachineName      nvarchar(50) NOT NULL,  
  BID              int    NOT NULL,  
  [Time]          int,  
  Hopper          int    NOT NULL,  
  CID             int,  
  Ratio           float,  
  [Weight]       float,  
  TR              int,  
  PR              int,  
  PRIMARY KEY (Id, MachineName, BID, Hopper)
```

```
);
```

```
CREATE TABLE FerlinUsage
```

```
(
```

```
  Id                NVARCHAR(50) NOT NULL,  
  MachineName      nvarchar(50) NOT NULL,  
  RecipeID        int    NOT NULL,  
  RecipeInt       int    NOT NULL,  
  CompNr          int    NOT NULL,  
  VolumeRatio     int    NOT NULL,  
  RecipeChanged   bit    NOT NULL,  
  Comp1Hopper     int,  
  Comp1Type       int,  
  Comp1AlarmType  int,  
  Comp1Ratio      float,  
  Comp1Weight     float,  
  Comp2Hopper     int,  
  Comp2Type       int,  
  Comp2AlarmType  int,  
  Comp2Ratio      float,  
  Comp2Weight     float,  
  Comp3Hopper     int,  
  Comp3Type       int,
```

Comp3AlarmType	int,	
Comp3Ratio	float,	
Comp3Weight	float,	
Comp4Hopper	int,	
Comp4Type	int,	
Comp4AlarmType	int,	
Comp4Ratio	float,	
Comp4Weight	float,	
Comp5Hopper	int,	
Comp5Type	int,	
Comp5AlarmType	int,	
Comp5Ratio	float,	
Comp5Weight	float,	
Comp6Hopper	int,	
Comp6Type	int,	
Comp6AlarmType	int,	
Comp6Ratio	float,	
Comp6Weight	float,	
Comp7Hopper	int,	
Comp7Type	int,	
Comp7AlarmType	int,	
Comp7Ratio	float,	
Comp7Weight	float,	
Comp8Hopper	int,	
Comp8Type	int,	
Comp8AlarmType	int,	
Comp8Ratio	float,	
Comp8Weight	float,	
Comp9Hopper	int,	
Comp9Type	int,	
Comp9AlarmType	int,	
Comp9Ratio	float,	
Comp9Weight	float,	
Comp10Hopper	int,	
Comp10Type	int,	
Comp10AlarmType	int,	
Comp10Ratio	float,	
Comp10Weight	FLOAT,	
BID	int	NOT NULL,
[Time]	int,	
Method	int,	
[Weight]	float,	
Ratio1	float,	
Ratio2	float,	
Ratio3	float,	
Ratio4	float,	
Ratio5	float,	
Ratio6	float,	

```
Ratio7          float,  
Ratio8          float,  
Ratio9          float,  
Ratio10         float,  
PRIMARY KEY (Id, MachineName, BID)  
  
);
```

Appendix 7.2: Ferlin Direct SQL extra tables

Query for creating tables

```
IF OBJECT_ID('dbo.FerlinCurrentRecipe', 'U') IS NOT NULL
    DROP TABLE FerlinBatch;
IF OBJECT_ID('dbo.FerlinCmd', 'U') IS NOT NULL
    DROP TABLE FerlinState;
```

```
create table FerlinCurrentRecipe (
```

```
    Id                nvarchar(50) NOT NULL,
    MachineName       nvarchar(50) NOT NULL,
    RecipeID          int not null,
    RecipeName        nvarchar(255) null,
    RecipeInt         int not null,
    CompNr            int not null,
    VolumeRatio       int not null,
    Comp1Hopper       int,
    Comp1Type         int,
    Comp1AlarmType    int,
    Comp1Ratio        float,
    Comp2Hopper       int,
    Comp2Type         int,
    Comp2AlarmType    int,
    Comp2Ratio        float,
    Comp3Hopper       int,
    Comp3Type         int,
    Comp3AlarmType    int,
    Comp3Ratio        float,
    Comp4Hopper       int,
    Comp4Type         int,
    Comp4AlarmType    int,
    Comp4Ratio        float,
    Comp5Hopper       int,
    Comp5Type         int,
    Comp5AlarmType    int,
    Comp5Ratio        float,
    Comp6Hopper       int,
    Comp6Type         int,
    Comp6AlarmType    int,
    Comp6Ratio        float,
    Comp7Hopper       int,
    Comp7Type         int,
    Comp7AlarmType    int,
    Comp7Ratio        float,
    Comp8Hopper       int,
    Comp8Type         int,
```

```
Comp8AlarmType    int,  
Comp8Ratio        float,  
Comp9Hopper       int,  
Comp9Type         int,  
Comp9AlarmType    int,  
Comp9Ratio        float,  
Comp10Hopper      int,  
Comp10Type        int,  
Comp10AlarmType   int,  
Comp10Ratio       float,  
Updated           DateTime,  
Primary key(Id,MachineName)  
  
);
```

```
create table FerlinCmd (  
  
Id                INT NOT NULL IDENTITY(1,1),  
MachineName      nvarchar(50) NOT NULL,  
CmdBit           INT NOT NULL,  
Cmd1Param8       SMALLINT NULL,  
Cmd2Param8       SMALLINT NULL,  
Cmd3Param8       SMALLINT NULL,  
Cmd1Param16      INT NULL,  
Cmd2Param16      INT NULL,  
Cmd3Param16      INT NULL,  
Cmd1Param32      BIGINT NULL,  
Cmd2Param32      BIGINT NULL,  
Cmd3Param32      BIGINT NULL,  
CmdParamFloat    FLOAT NULL,  
ReturnCode       INT NULL,  
Created datetime NOT NULL DEFAULT CURRENT_TIMESTAMP,  
  
Primary key(Id,MachineName)  
  
);
```

Appendix 7.3: Updating .dbo.FerlinBatch for 2.12.47 or newer.

Query for changing tables

```
alter table FerlinBatch add Comp1Label nvarchar(100);  
alter table FerlinBatch add Comp2Label nvarchar(100);  
alter table FerlinBatch add Comp3Label nvarchar(100);  
alter table FerlinBatch add Comp4Label nvarchar(100);  
alter table FerlinBatch add Comp5Label nvarchar(100);  
alter table FerlinBatch add Comp6Label nvarchar(100);  
alter table FerlinBatch add Comp7Label nvarchar(100);  
alter table FerlinBatch add Comp8Label nvarchar(100);  
alter table FerlinBatch add Comp9Label nvarchar(100);  
alter table FerlinBatch add Comp10Label nvarchar(100);
```

List of Gravimix alarms

NO_CONTROL_VOLTAGE	0	Control voltage
COVERS_OPEN	1	Panels are open
PRODUCTION_WEIGHT_REACHED	2	Production weight reached
NO_WEIGHBIN_OR_CALIBRATE	3	Weighbin out of tara-band
PARAMETERS_CORRUPTED	4	Parameters are corrupted
DATA_CORRUPTED	5	Production data corrupted
HOPPER_EMPTY	6	Hopper is empty
LOADCELL_NOT_CALIBRATED	7	Loadcell is not calibrated
LOADCELL_OVERLOAD	8	Loadcell overload
LOADCELL_NOT_STABLE	9	Loadcell not stable
SILO_HIGH	12	Silo full error
SILO_LOW	13	Silo empty error
REGRIND_PROCESS_PAR_CONFLICT	14	Regrind control, selected hopper no regrind
ADDITIVE_REGRIND_PAR_CONFLICT	15	Regrind control, selected hopper no additive
HOPPER_NO_MATERIAL	16	Low level in hopper
EMERGENCY_STOP	18	Emergency stop executed
THERMAL_OVERLOAD	19	Mixer thermal overload
OVERDOSE	20	Loadcell overload
TO_MANY_COMPONENTS	22	More components in recipe then present hoppers
NO_RECIPE_SET	23	No recipe loaded
AUTOSTART_WAITING_FOR_START	24	Autostart, waiting for startsignal
FGBM_STATE_IDLE	25	Gravimix Idle