

TECH NOTE :: DSE_Filler

Version: 2022-04-26

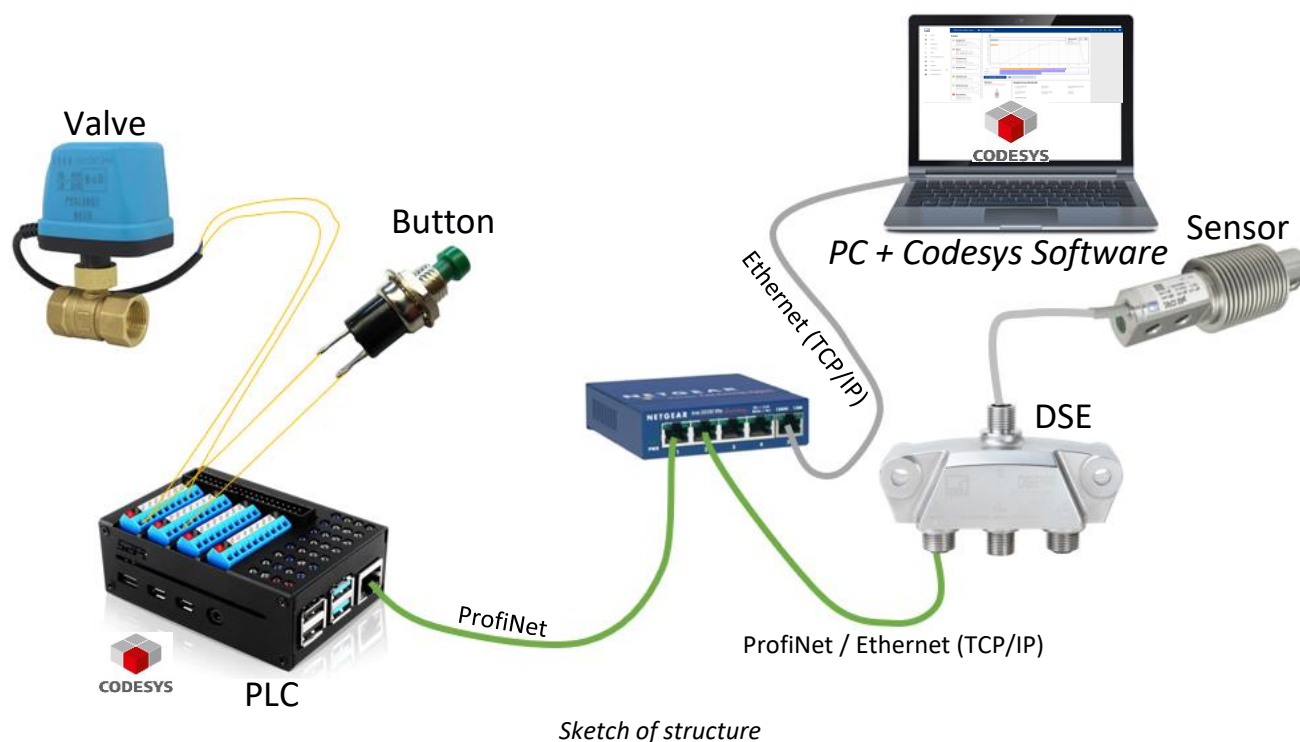
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Status: HBM: Public

Brief description

This is a quick start guide for using the filler function of a DSE. This function serves the optimization and monitoring of processes. By means of a user-friendly interface, complicated control technology is available for every user. For initial commissioning, all you need is a computer, sensor and a DSE. This can be extended by a PLC, which takes over the values set in the DSE for fast and accurate control. In this example, a Raspberry PI Model 4B is used with a PROFINET or EtherCAT interface. The functionality of the filler is available in DSE from the FW V2. 0.

Hardware configuration

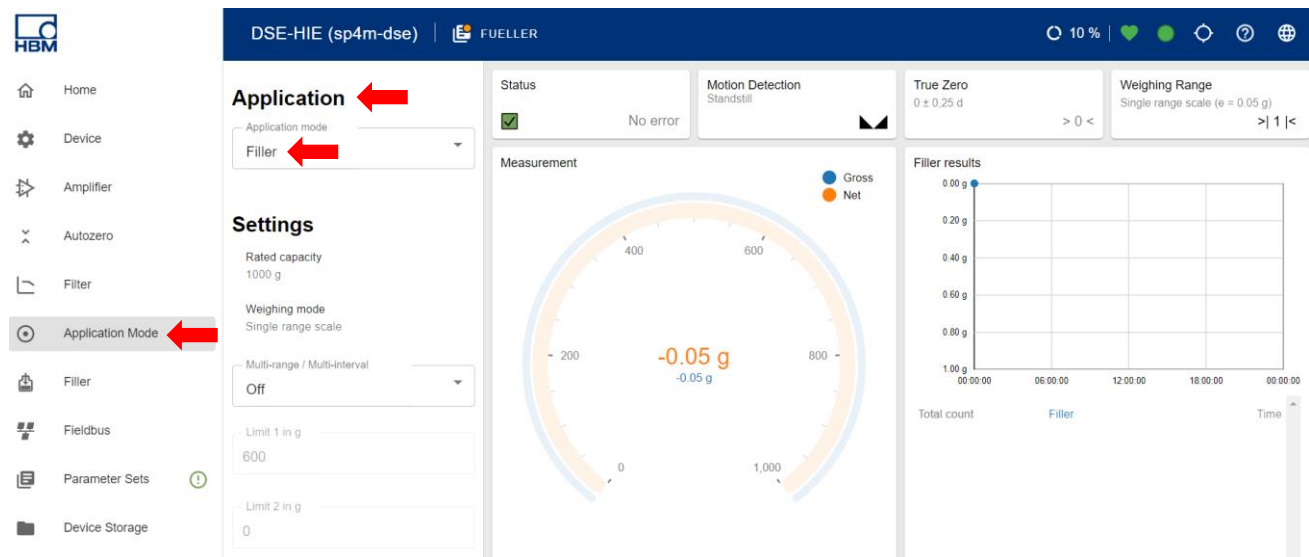


Components required

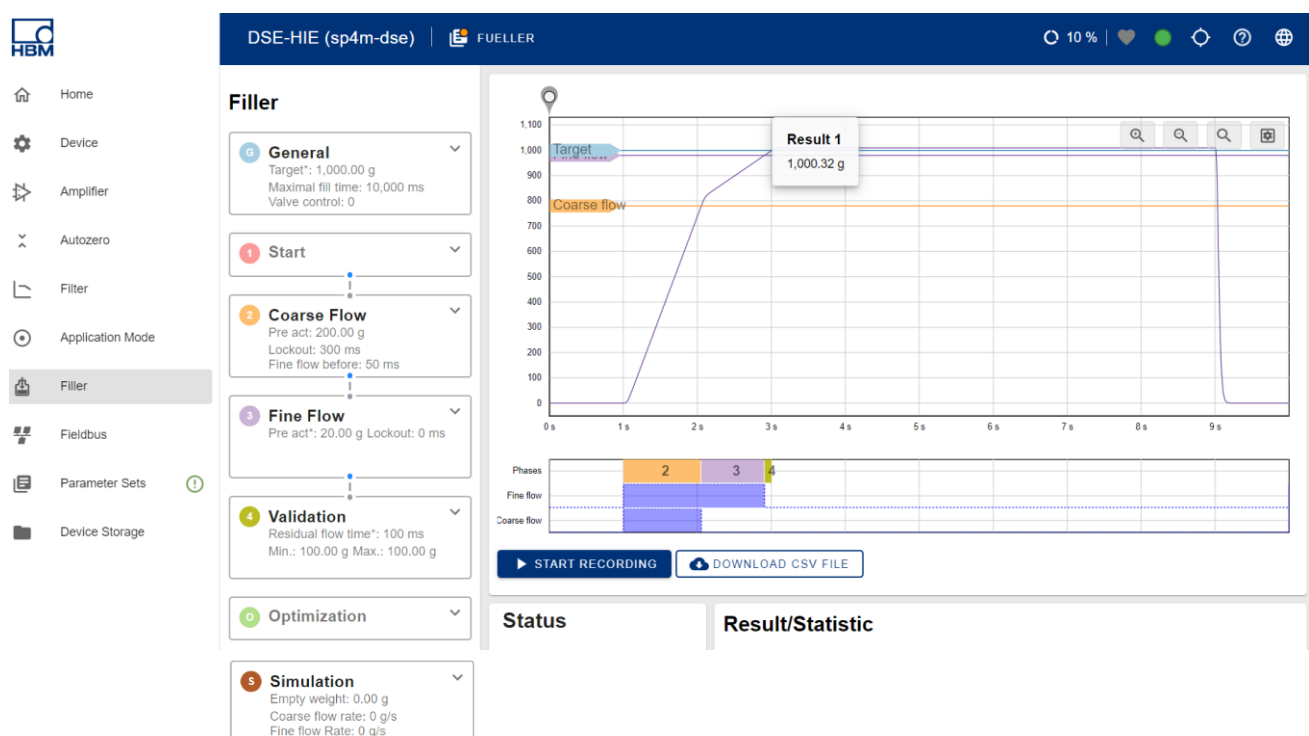
- 1 x DSE system (incl. power supply and Ethernet cable)
 - 1 x Ethernet Switch
 - 1 x Load cell
 - 1 x free software Codesys
 - 1 x PLC, R-PI Model 4B (Codesys Controre for Raspberry Pi V 4.4.0.0)
- Optional:
- 3 x Button
 - 2 x Valve

Level control web interface

With the help of the DSE, different parameters of a level can be recorded and processed.

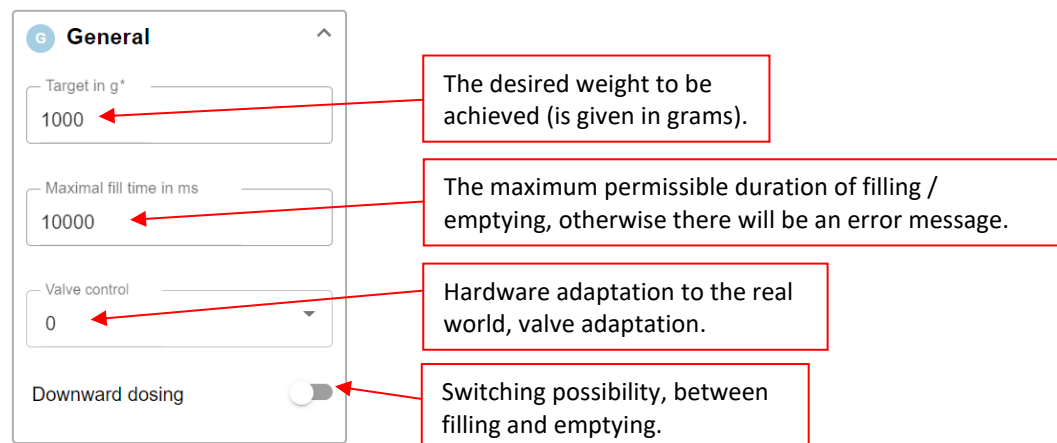


Now switch to the pen. This has various adjustment options in order to capture the different applications of a filling system as well as possible. Many settings are optional, but 3 parameters must be given to the DSE for it to work. Namely **(G) target weight**, **(3) reserve**, **(4) post-flow time**. These and all other settings are discussed in the following chapters.



For all settings, 0 = function inactive.

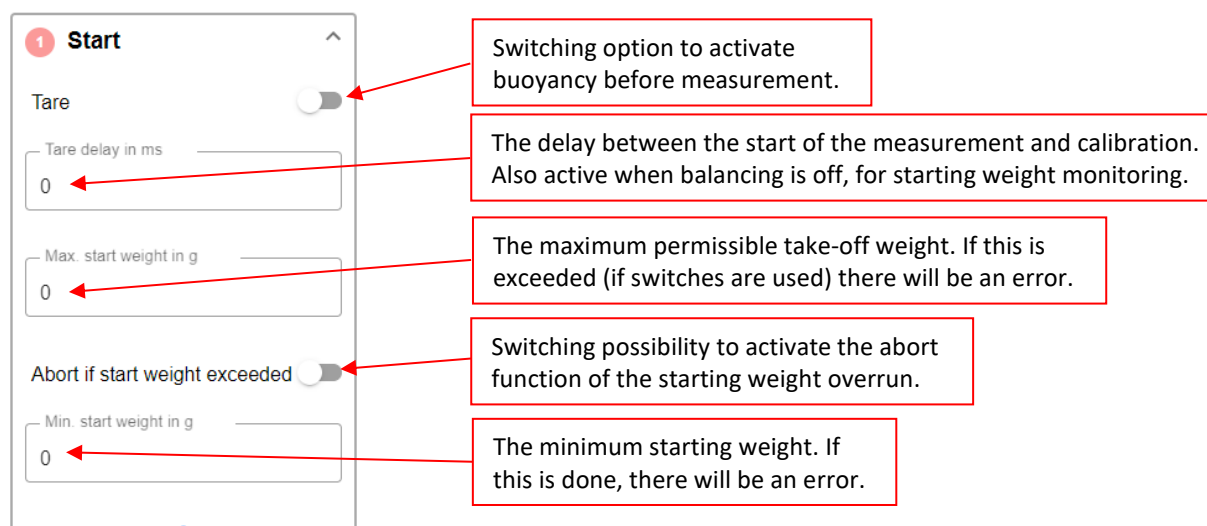
G General



G General

- Target in g***: 1000. The desired weight to be achieved (is given in grams).
- Maximal fill time in ms**: 10000. The maximum permissible duration of filling / emptying, otherwise there will be an error message.
- Valve control**: 0. Hardware adaptation to the real world, valve adaptation.
- Downward dosing**: ☐. Switching possibility, between filling and emptying.

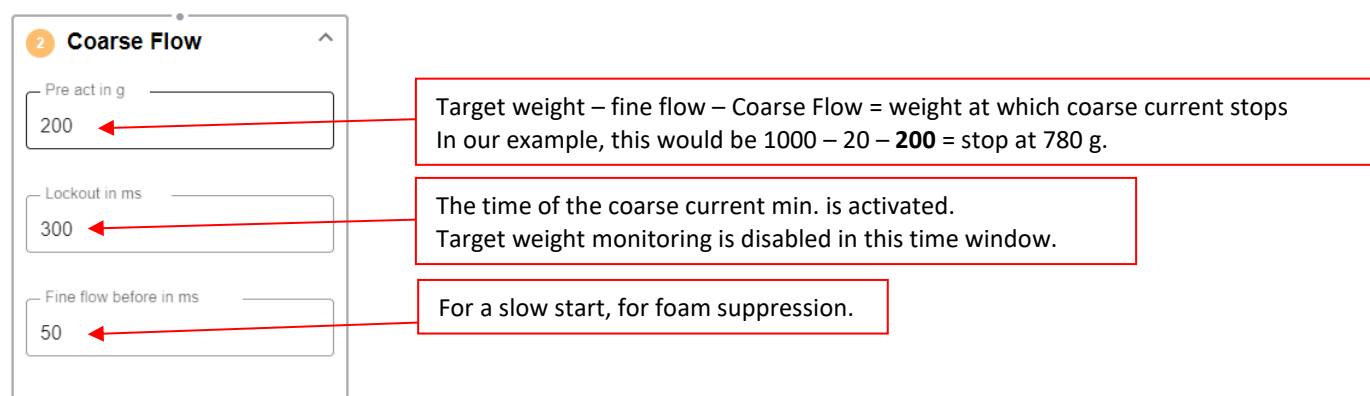
1 Start



1 Start

- Tare**: ☐. Switching option to activate buoyancy before measurement.
- Tare delay in ms**: 0. The delay between the start of the measurement and calibration. Also active when balancing is off, for starting weight monitoring.
- Max. start weight in g**: 0. The maximum permissible take-off weight. If this is exceeded (if switches are used) there will be an error.
- Abort if start weight exceeded**: ☐. Switching possibility to activate the abort function of the starting weight overrun.
- Min. start weight in g**: 0. The minimum starting weight. If this is done, there will be an error.

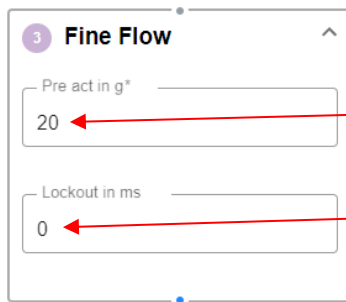
2 Coarse Flow



2 Coarse Flow

- Pre act in g**: 200. Target weight – fine flow – Coarse Flow = weight at which coarse current stops. In our example, this would be 1000 – 20 – **200** = stop at 780 g.
- Lockout in ms**: 300. The time of the coarse current min. is activated. Target weight monitoring is disabled in this time window.
- Fine flow before in ms**: 50. For a slow start, for foam suppression.

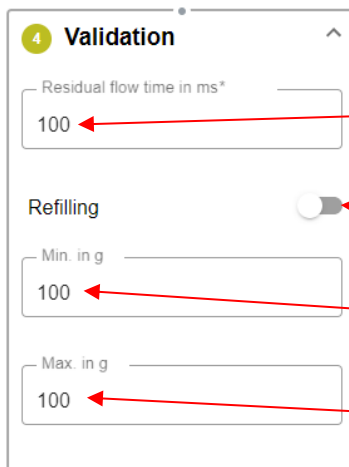
3 Fine Flow



Target weight – reserve = weight at which the fine current stops.
In our example, this would be: $1000 - 20 = \text{Stop at } 980 \text{ g}$.

The time of the fine current min. is activated. Target weight monitoring is disabled in this time.

4 Validation



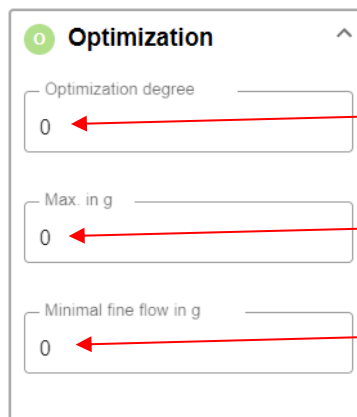
The time that the residual flow still needs before the measured value comes to a standstill.

Activate refilling to limit residual fluid.

Min. Residual flow. Meaning: $1000 - 100 = 900$
If this value is lower there is an error.

Min. Residual flow. Meaning: $1000 + 100 = 1100$
If this value is exceeded there is an error.

0 Optimization



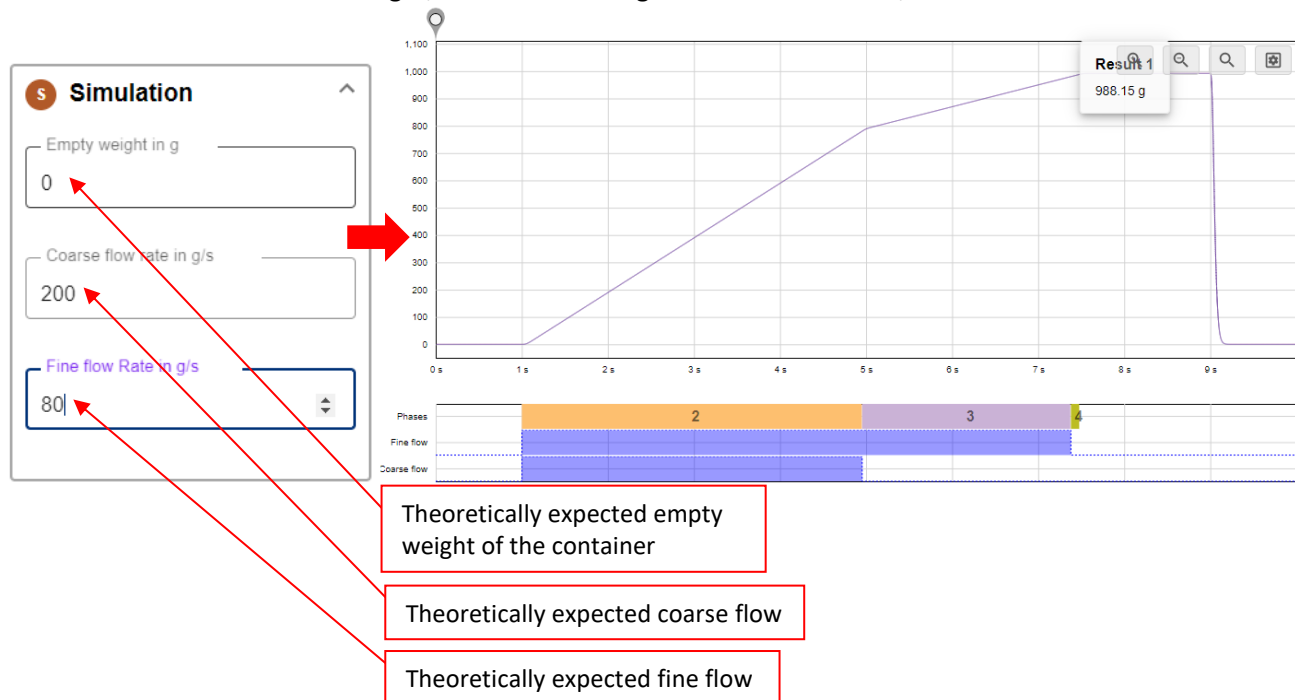
Adjustment possibility for tracking, in 3 speed levels.

Maximum change of the cut-off points by the correction.

The divergence between coarse current and fine current.

Simulation

The Simulation setting is used for the theoretical testing of the previously entered parameters. These are checked to see if the desired target, in our case 1000g and 10 sec. duration, can be reached.

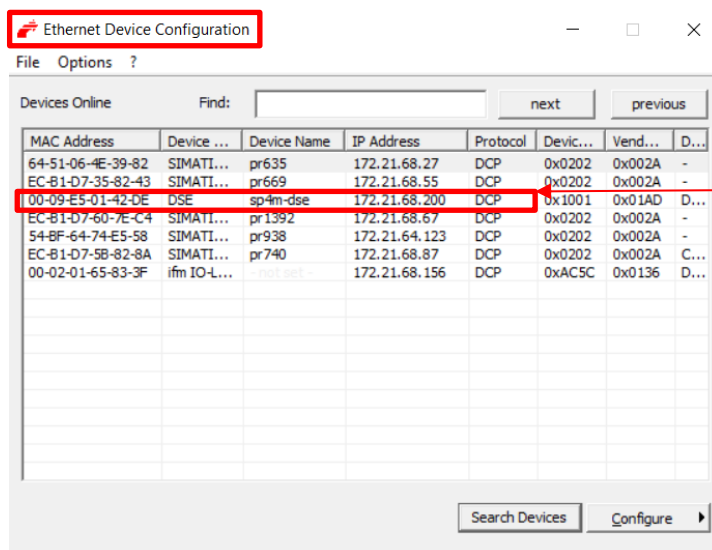


Level control Codesys

How to prepare Codesys to capture the values of the DSE is explained in the TechNote "TECH-NOTE_DSE_Checkweigher_with_PLC (R-PI) _en". All essential steps are explained there.

Network configurations

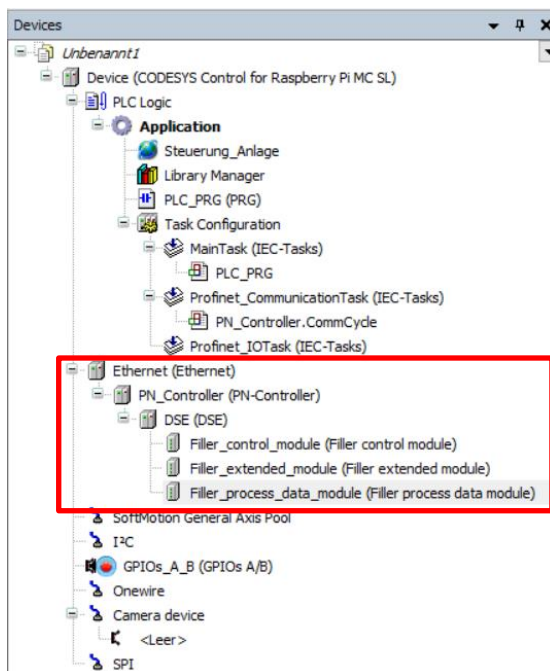
Note: The IP address as well as the device name of the DSE can be configured using "Ethernet Device Setup".



Right click -> Set IP/Device Name to configure.

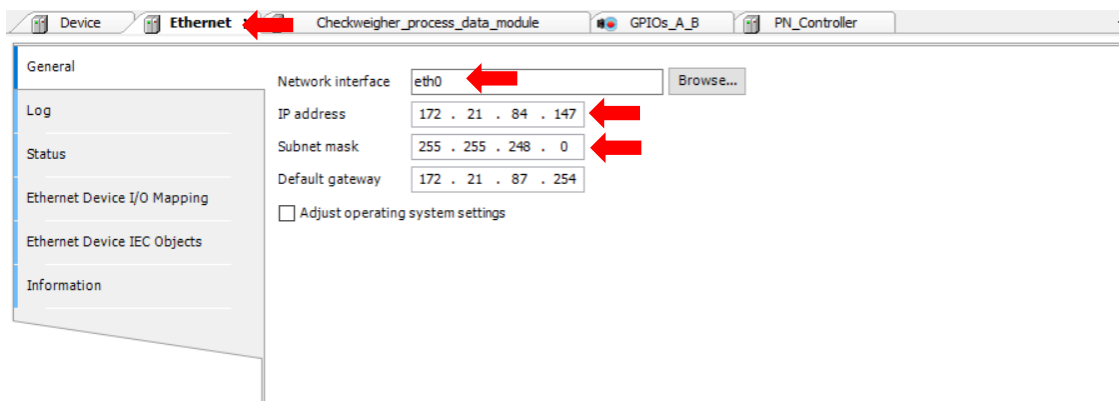
Note: The IP must match the IP address of the R-Pis, i.e. the first 3 blocks must be the same, the last different.

Here you can see the different adapters to connect the DSE with the Codesys Control. These must now be configured for the network.

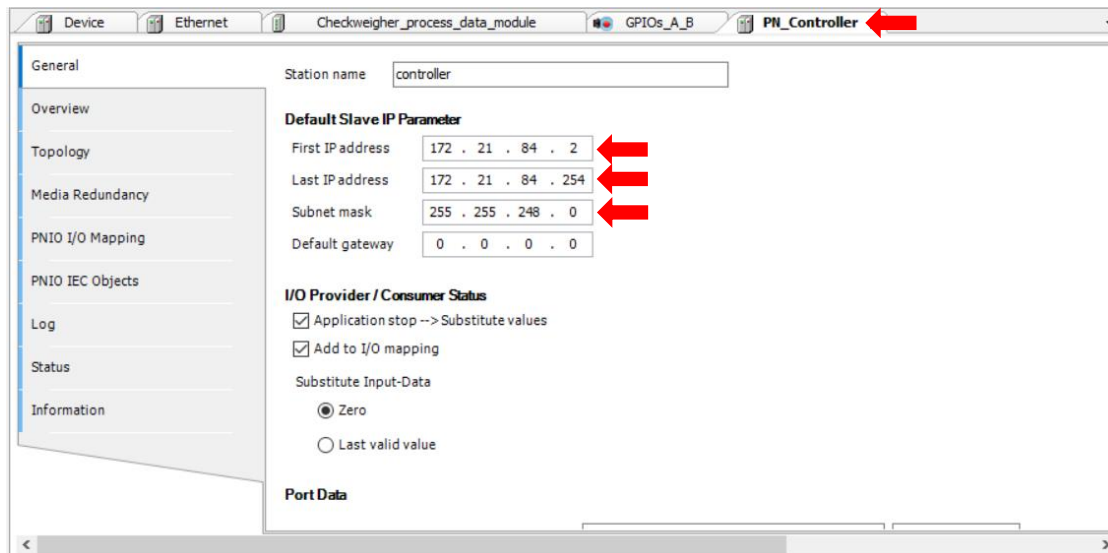


Since the Codesys main programme must communicate with the application on the Raspberry, they must be connected to each other using PROFINET. This is explained below:

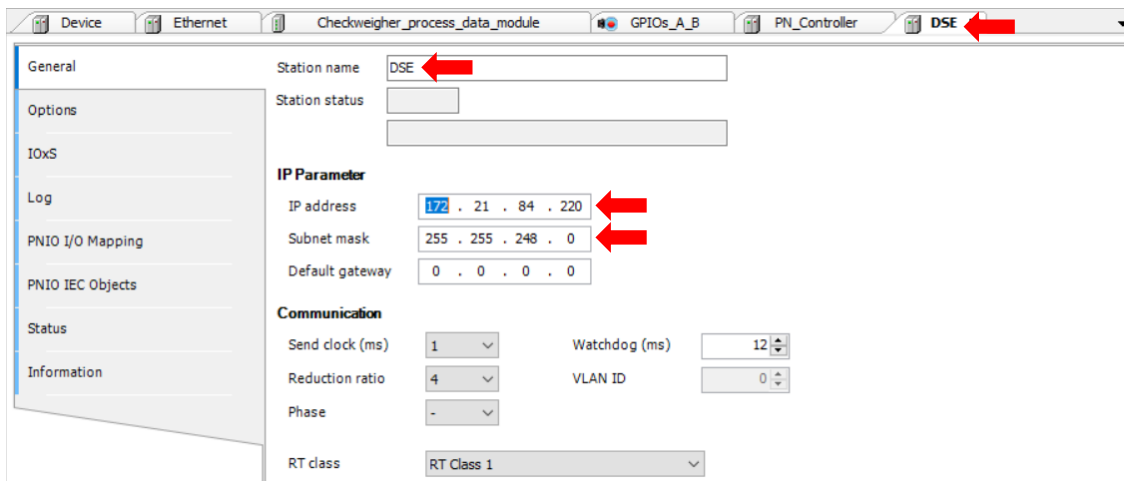
First, the network must be adapted by the Ethernet adapter. To do this, click on "Browse..." and select "eth0" so that you are in the network of the network cable.



Now the "PN_controller" must also be adapted. It is important that the first 3 columns are identical to the first 3 columns of "eth0". The subnet mask must also match that of "eth0".



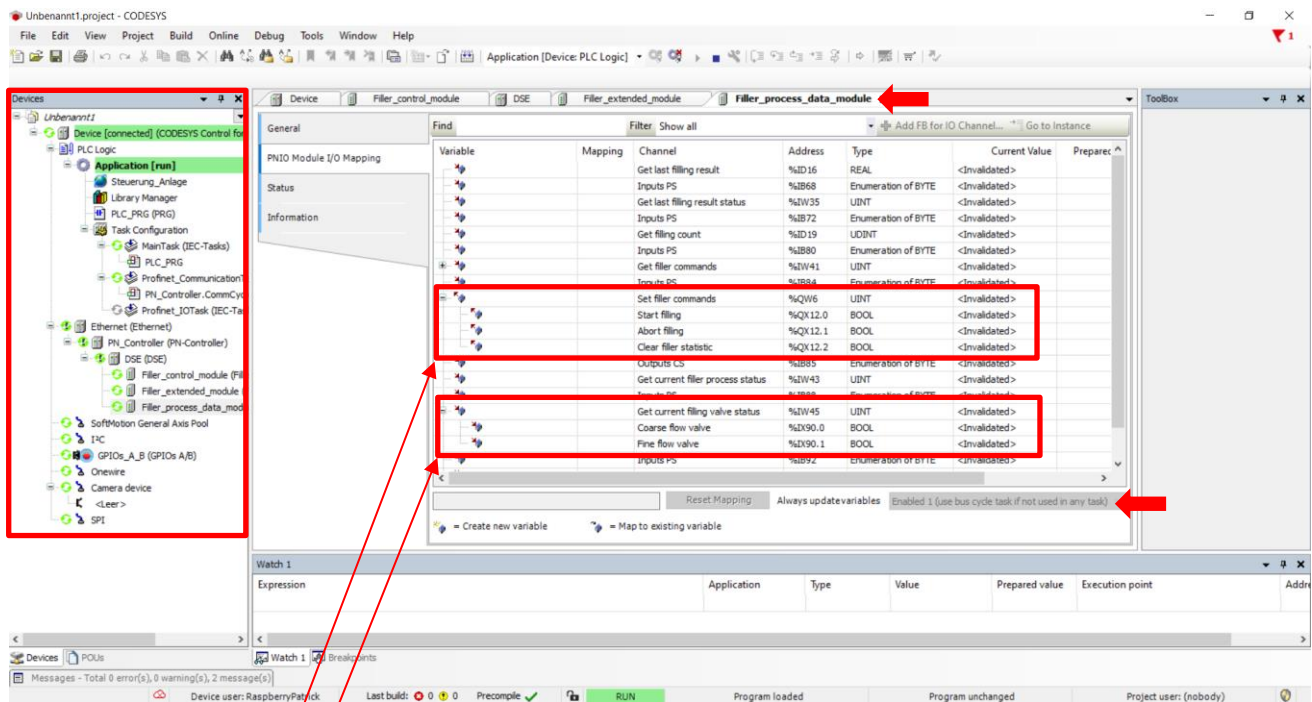
The subnet mask must again match that of "eth0", and the IP address of the DSE must also be entered. The device name must also be entered correctly.



Now the programme only has to be started.



You can see that the programme works when there are green circles next to the inserted devices. See picture:



The variables of the DSE to be controlled with the PLC.

Example valve control

The Codesys control system takes over the parameters entered in the DSE and uses them to control the filling process. Due to the intelligent software of the DSE, only a few steps have to be programmed independently.

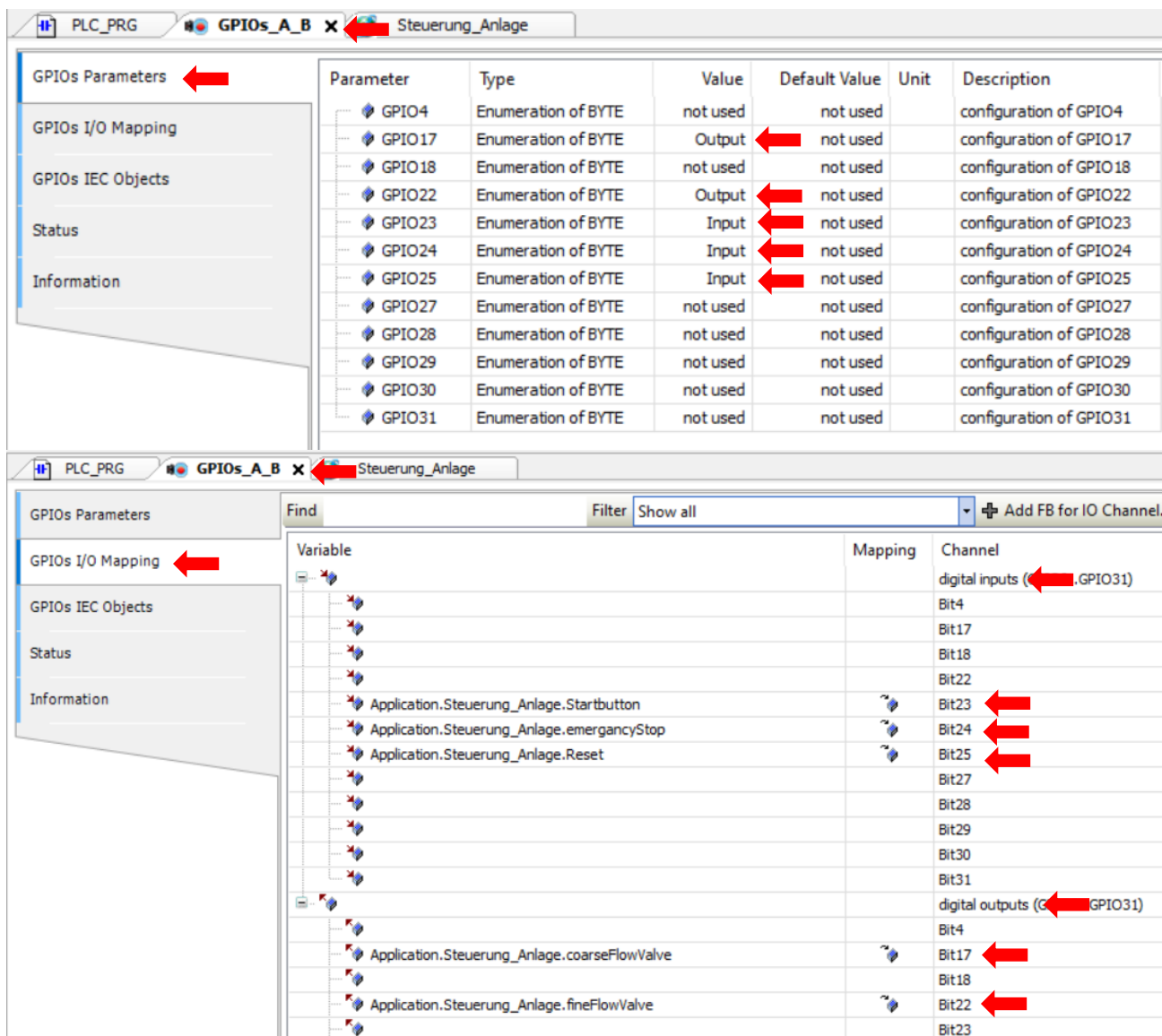
First, variables must be created:

```

1  | attribute 'qualified_only'
2  | VAR_GLOBAL
3  | //Input
4  | Startbutton : BOOL;
5  | Reset : BOOL;
6  | emergencyStop : BOOL;
7  |
8  | //Output
9  | coarseFlowValve : BOOL;
10 | fineFlowValve : BOOL;
11 |
12 | END_VAR

```


After that, these variables must be assigned to GPIOs:



The screenshot displays the DSE software interface for configuring GPIOs. The top window shows the 'GPIOs Parameters' table, and the bottom window shows the 'GPIOs I/O Mapping' table.

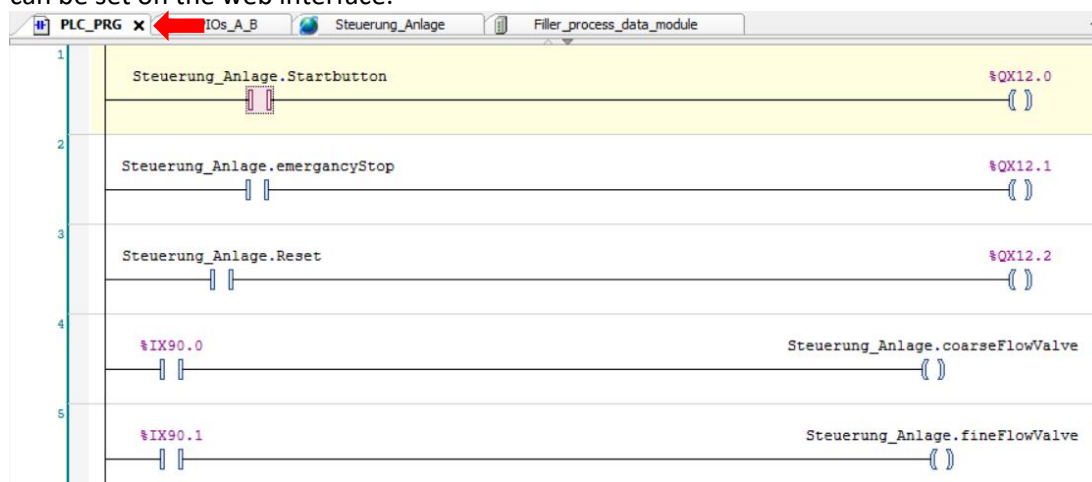
GPIOs Parameters Table:

Parameter	Type	Value	Default Value	Unit	Description
GPIO4	Enumeration of BYTE	not used	not used		configuration of GPIO4
GPIO17	Enumeration of BYTE	Output	not used		configuration of GPIO17
GPIO18	Enumeration of BYTE	not used	not used		configuration of GPIO18
GPIO22	Enumeration of BYTE	Output	not used		configuration of GPIO22
GPIO23	Enumeration of BYTE	Input	not used		configuration of GPIO23
GPIO24	Enumeration of BYTE	Input	not used		configuration of GPIO24
GPIO25	Enumeration of BYTE	Input	not used		configuration of GPIO25
GPIO27	Enumeration of BYTE	not used	not used		configuration of GPIO27
GPIO28	Enumeration of BYTE	not used	not used		configuration of GPIO28
GPIO29	Enumeration of BYTE	not used	not used		configuration of GPIO29
GPIO30	Enumeration of BYTE	not used	not used		configuration of GPIO30
GPIO31	Enumeration of BYTE	not used	not used		configuration of GPIO31

GPIOs I/O Mapping Table:

Variable	Mapping	Channel
		digital inputs (GPIO31)
		Bit4
		Bit17
		Bit18
		Bit22
Application.Steuerung_Anlage.Startbutton		Bit23
Application.Steuerung_Anlage.emergencyStop		Bit24
Application.Steuerung_Anlage.Reset		Bit25
		Bit27
		Bit28
		Bit29
		Bit30
		Bit31
		digital outputs (GPIO31)
		Bit4
Application.Steuerung_Anlage.coarseFlowValve		Bit17
		Bit18
Application.Steuerung_Anlage.fineFlowValve		Bit22
		Bit23

For illustration purposes, a simple programme in which all inputs and outputs are used once. In most cases, forwarding the signals is sufficient, as the DSE internally processes the desired settings that can be set on the web interface.



Example Optimization

In this concrete example, a filler model was used that only executes Fine Flow. Nevertheless, it is recommended to enter a small value for Course Flow. Otherwise, Course Flow can lead to negative values and thus to strong deviations.

The settings before the first run:

Filler

6

General

Target*: 0.20 kg

Maximal fill time: 0 ms

Valve control: 0

1

Start

2

Coarse Flow

Pre act: 0.01 kg Lockout: 0 ms

Fine Flow Time Startup: 0 ms

3

Fine Flow

Pre act*: 0.02 kg Lockout: 0 ms

4

Validation

Residual Flow Time*: 1,000 ms

Min.: 0.00 kg Max.: 0.00 kg

0

Optimization

Optimization Grade: 1

Max.: 0.25 kg

Minimal fine flow: 0.00 kg

Result first run:

Result/Statistic

Filler result

0.18 kg

Standard deviation

0.00 kg

Coarse time

0 ms

Total count

1

Mean value

0.18 kg

Fine time

9,743 ms

Total time

10,744 ms

The settings after the first optimisation:

Filler

6

General

Target*: 0.20 kg

Maximal fill time: 0 ms

Valve control: 0

1

Start

2

Coarse Flow

Pre act: 0.02 kg Lockout: 0 ms

Fine Flow Time Startup: 0 ms

3

Fine Flow

Pre act*: 0.00 kg Lockout: 0 ms

4

Validation

Residual Flow Time*: 1,000 ms

Min.: 0.00 kg Max.: 0.00 kg

0

Optimization

Optimization Grade: 1

Max.: 0.25 kg

Minimal fine flow: 0.00 kg

3

Fine Flow

Pre act in kg*

0,002731

closest possible values: 0.00 and 0.01

Lockout in ms

0

Internally, the DSE calculates with this optimised value, as input it would be inadmissible.

Result second run:

Result/Statistic

Filler result

0.20 kg

Standard deviation

0.01 kg

Coarse time

0 ms

Total count

2

Mean value

0.19 kg

Fine time

9,587 ms

Total time

10,588 ms

The DSE optimises itself further with each subsequent run. This can also be seen in the results. For speed optimisation in this concrete example, the value for coarse and fine flow becomes smaller and smaller. After the second optimisation:

Filler

G General

Target*: 0.20 kg

Maximal fill time: 0 ms

Valve control: 0

1 Start

2 Coarse Flow

Pre act: 0.00 kg Lockout: 0 ms

Fine Flow Time Startup: 0 ms

3 Fine Flow

Pre act*: 0.00 kg Lockout: 0 ms

4 Validation

Residual Flow Time*: 1,000 ms

Min.: 0.00 kg Max.: 0.00 kg

o Optimization

Optimization Grade: 1

Max.: 0.25 kg

Minimal fine flow: 0.00 kg

2 Coarse Flow

Pre act in kg

0,0008

closest possible values: 0.00 and 0.01

Lockout in ms

0

Fine Flow Time Startup in ms

0

3 Fine Flow

Pre act in kg*

0,004225

closest possible values: 0.00 and 0.01

Lockout in ms

0

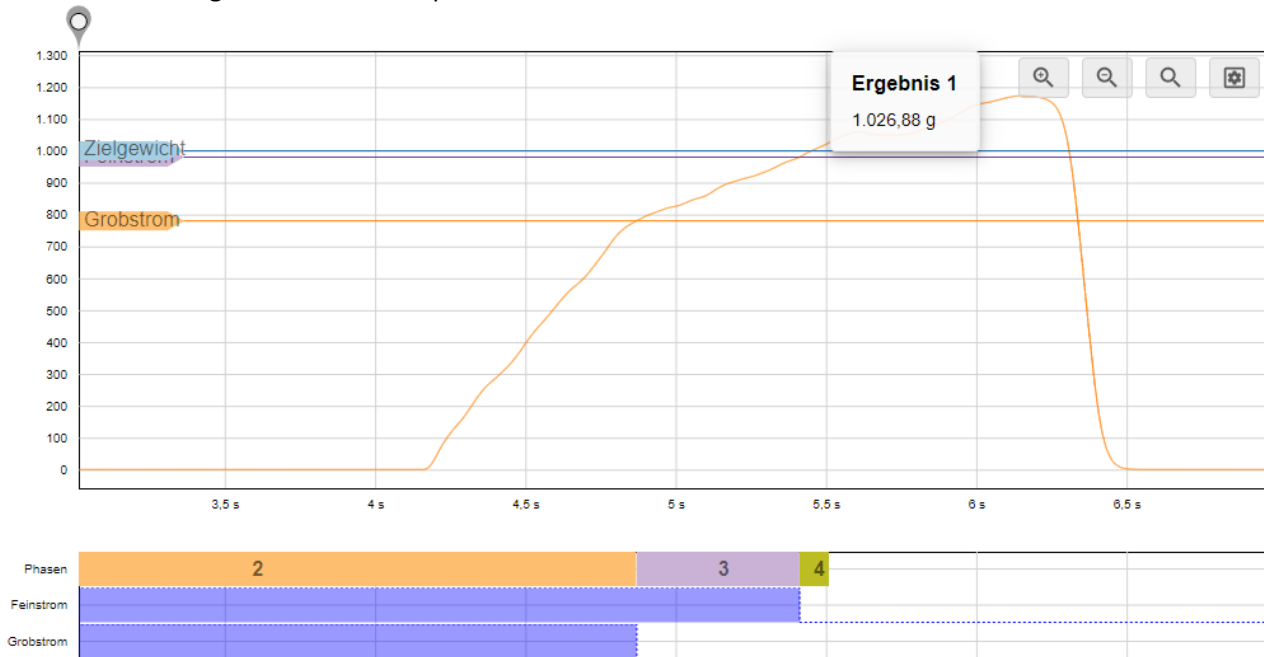
Result third run:

Result/Statistic

Filler result	Mean value
0.20 kg	0.19 kg
Standard deviation	Fine time
0.01 kg	9,095 ms
Coarse time	Total time
0 ms	10,096 ms
Total count	
3	

Result

This orange trace is a real measurement. Now you can see if everything is set correctly. In this example, the coarse flow is set well, but the fine flow is still filling beyond the desired 1000g. Result 1 records the weight after the remaining flow time has elapsed.



Status

[CSV-DATEI HERUNTERLADEN](#)



Ready

Leerlauf

Ergebnisse/Statistik

Füller-Ergebnis 1.035,28 g	Mittelwert 632,05 g	Standardabweichung 351,49 g
Feinstromzeit 284 ms	Grobstromzeit 2.644 ms	Füllzeit 3.029 ms
Gesamtanzahl 12		

Legal notice

This example is for illustrative purposes only. It is not subject to any warranties or liability claims.