SIEMENS

Weighing Technology

QUICK GUIDE SIWAREX FTC_L

Commissioning with Siwatool V4

V3.3, 08.27.2013

Contents

Introduction

SIWAREX FTC (Flexible Technology for Continuous Weighing) is a versatile and flexible weighing module for conveyor scales, loss-in-weigh scales and bulk flow meters. It can also be used to record weights and measure force. The SIWAREX FTC function module is integrated in SIMATIC S7/PCS7, and uses the features of this modern automation system, such as integral communication, diagnostics and configuration tools.

Purpose of this document for functional safety

This programming manual contains all information that you will require to commission and use the device.
It is aimed at persons who install the device mechanically, connect it electrically, parameterize and commission it, as well as at service and maintenance engineers.

Notes on warranty

The contents of this programming manual shall not become part of or modify any prior or existing agreement, commitment or legal relationship. All obligations on the part of Siemens AG are contained in the respective sales contract, which also contains the complete and solely applicable warranty conditions. Any statements on the device versions described in the programming manual do not create new warranties or modify the existing warranty.
The content reflects the technical status at the time of printing. We reserve the right to make technical changes in the course of further development.

Validation of this document

This documentation is only valid in conjunction with the manual SIWAREX FTC. This manual is available on the Siemens homepage.
http://support.automation.siemens.com/WW/view/en/20072536/133300

1 Hardware and software requirements

The following hardware parts and software are required to integrate a scale in SIMATIC: 24V Power supply, S7-300 CPU or ET200M Station, memory card for CPU, SIWAREX FTC front connector for SIWAREX FTC, shield contact element, shield connection terminal, SIWATOOL FTC software, RS232 cable, computer with Windows XP or higher and a calibration weight bigger than 5% of the sum of the nominal value of all load cells.

Requested parts:

24V PS

S7-3xx PLC

or

ET 200M

SIWAREX FTC
7MH4900-3AA01

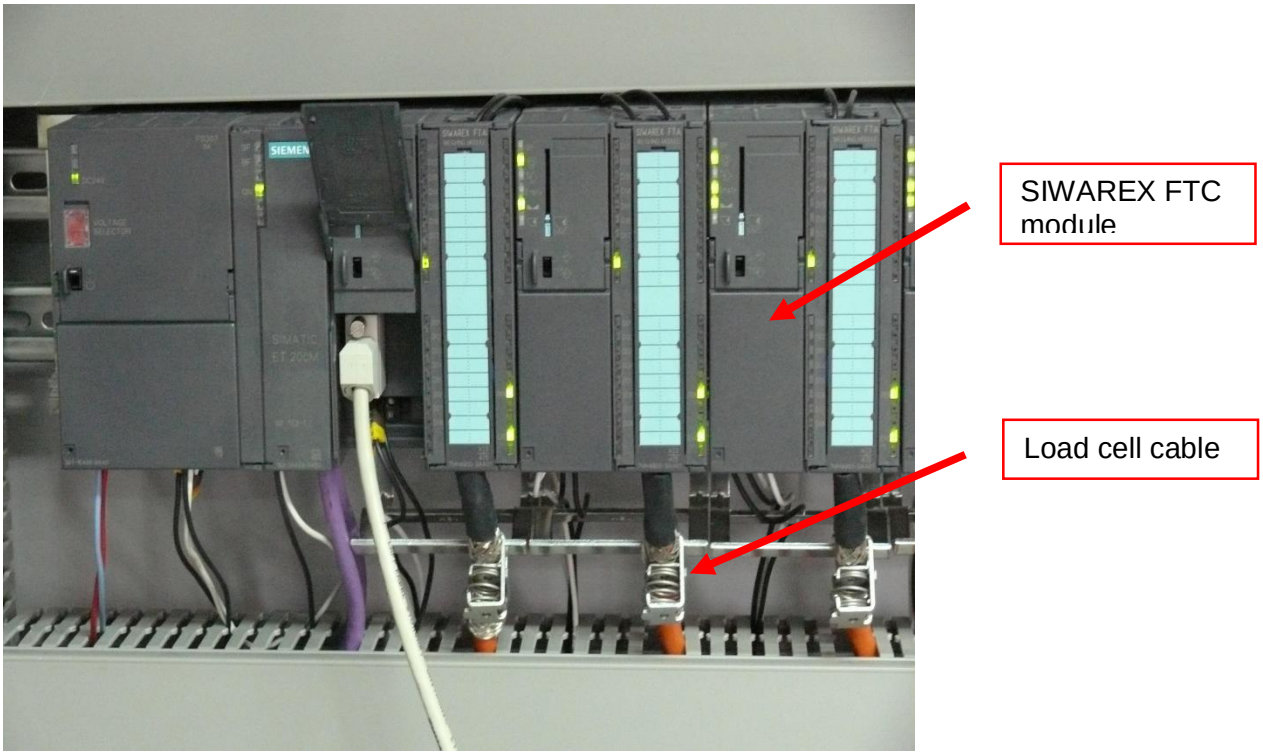
SIWATOOL RS232 Cable
7MH4702-8CA

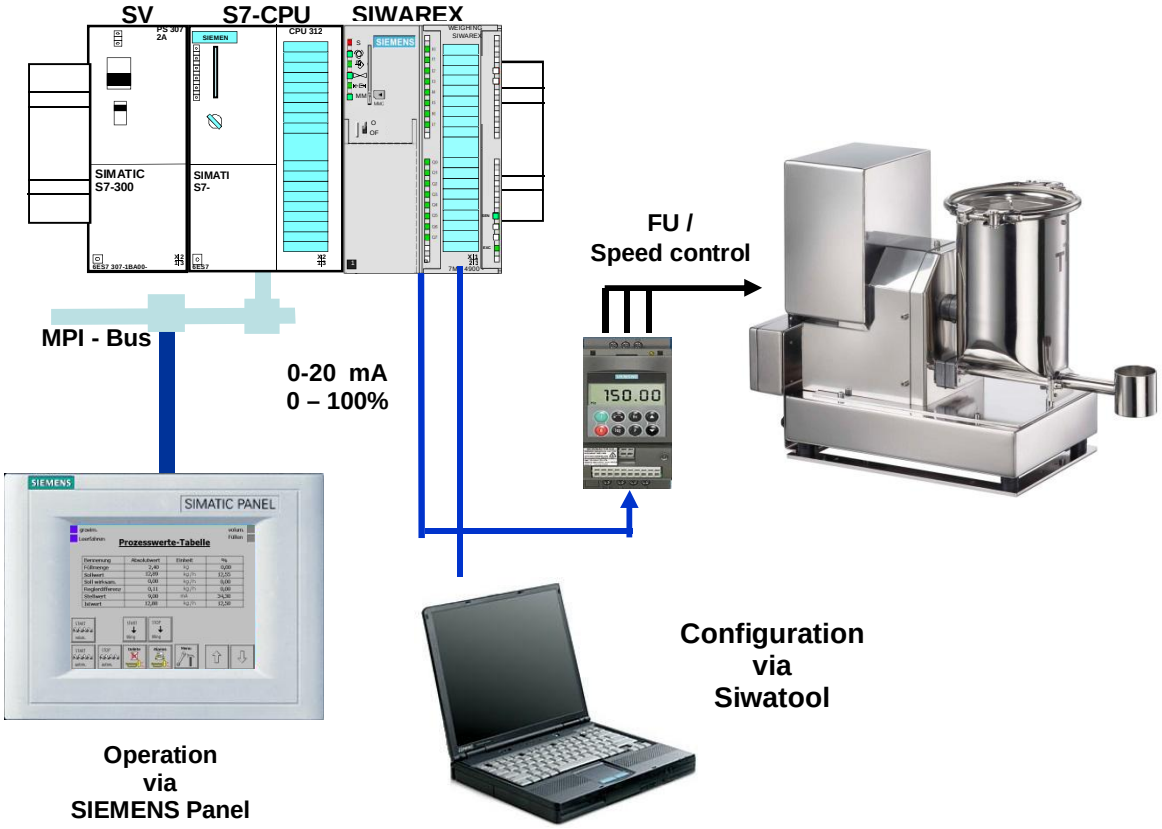
Configuration Package for SIWAREX FTC
Loss in weight dosing system
7MH4900-3AK04

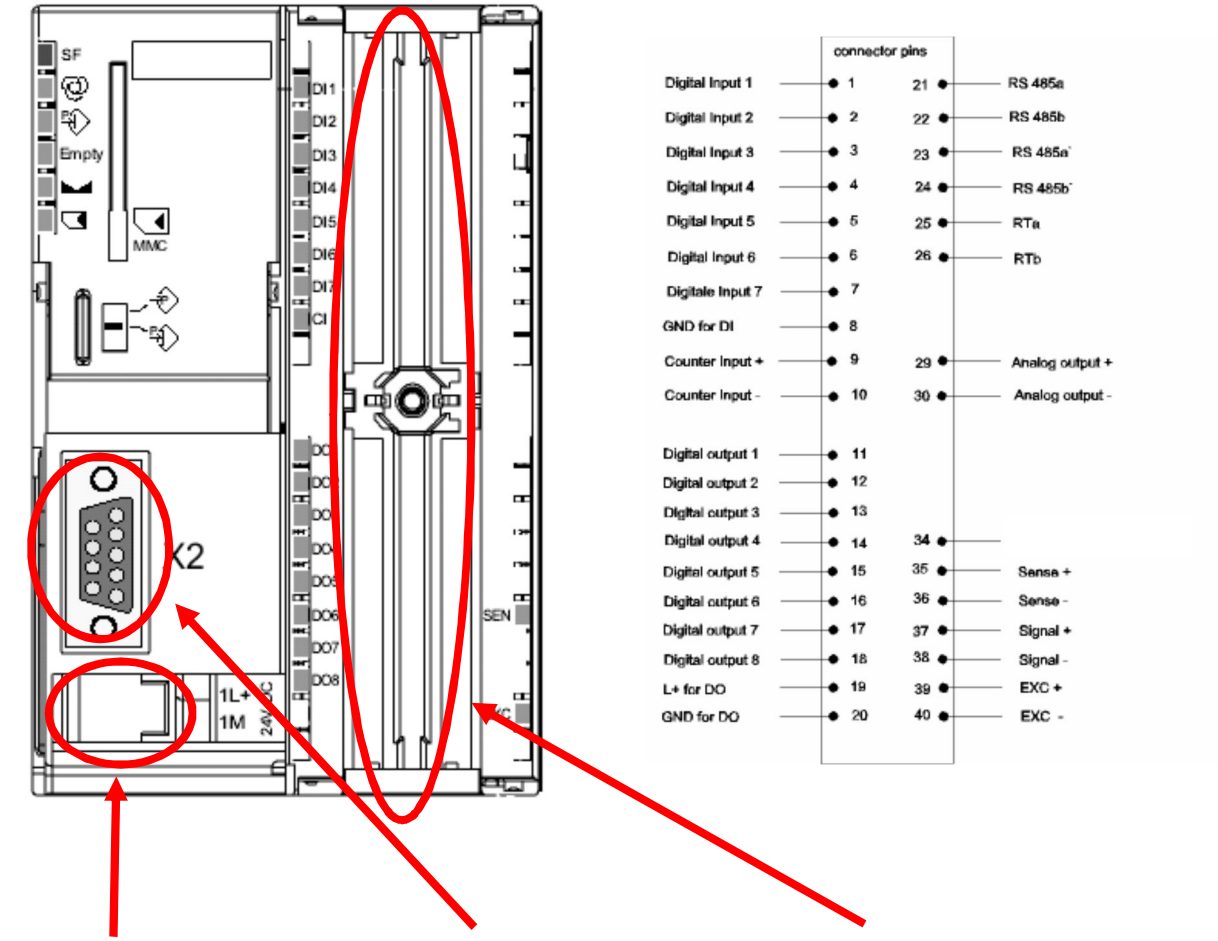
Loss in weight, continuous dosing system

Adjustment weight

The operating environment shown below includes the following:
PS207 2A power supply, ET200M Station or CPU3xx, SIWAREX FTC weighing module, SIWATOOL cable




SV
S7-CPU
SIWAREX
SIMATIC
S7-300
SIMATI
S7-
CPU 312
MPI - Bus
0-20 mA
0 – 100%
FU /
Speed control
150.00
SIMATIC PANEL
Prozesswerte-Tabelle
Operation
via
SIEMENS Panel
Configuration
via
Siwatool

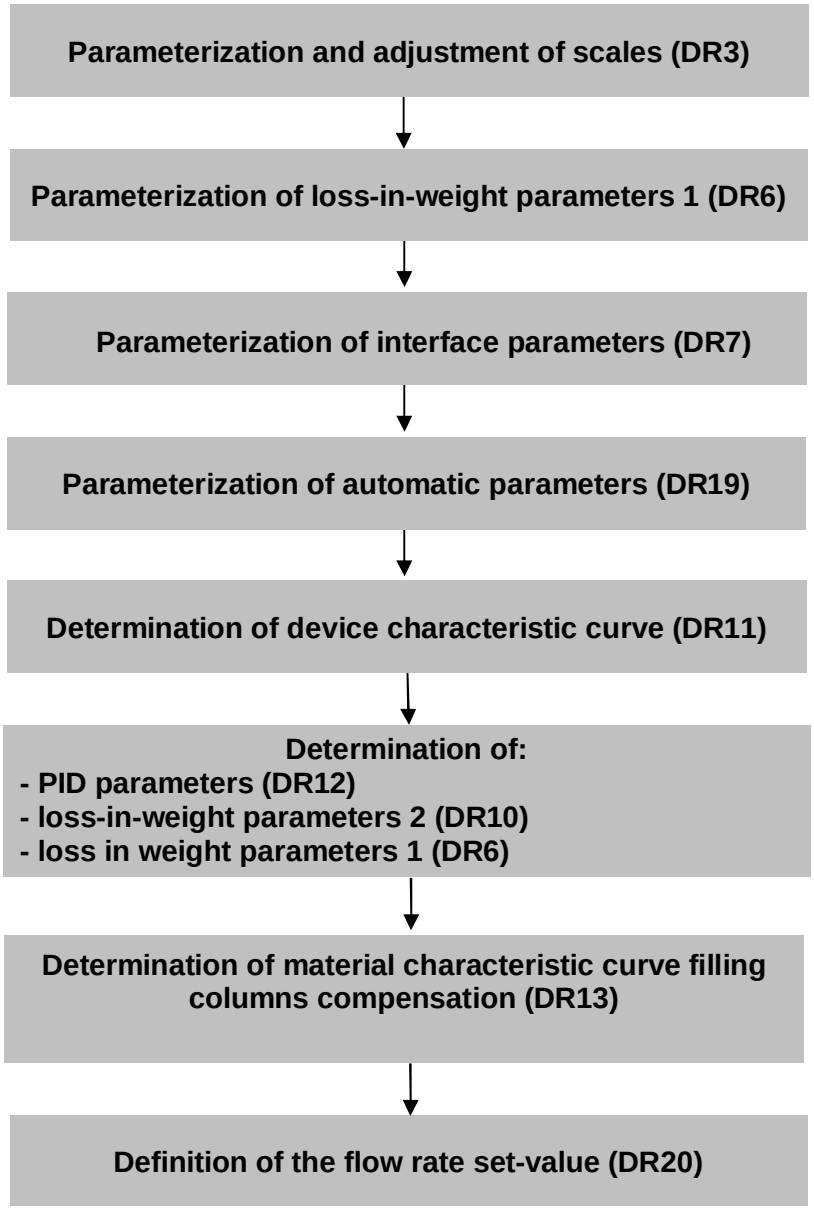


Load Cell Connection:

Connection in terminal block	Signal	Comment
29	IOUT+	Analogue line +
30	IOUT -	Analogue line -
35	SEN+	Sensor line +
36	SEN-	Sensor line –
37	SIG+	Measurement line +
38	SIG-	Measurement line –
39	EXC+	Load cell supply +
40	EXC-	Load cell supply –

2 Commissioning

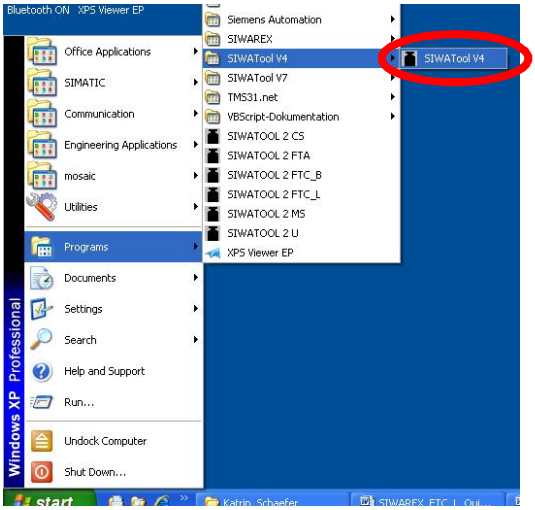
2.1 Steps of Commissioning



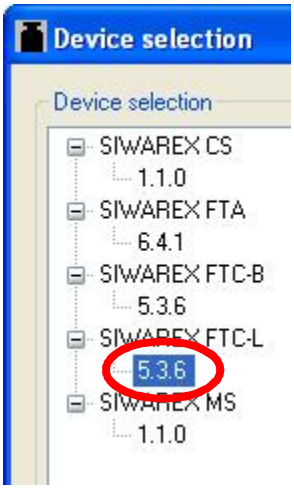
A set-up of various parameters has been installed in the factory. Not all parameters have to be defined during the first commissioning. Only those parameters which have to be defined are mentioned below:

Parameters in DR3 can only be changed when service mode is activated.
The Send button is used to transfer parameters that have been changed in Siwatool to Siwarex.
The Send and Receive buttons refer to the entire data record and not to a single parameter.

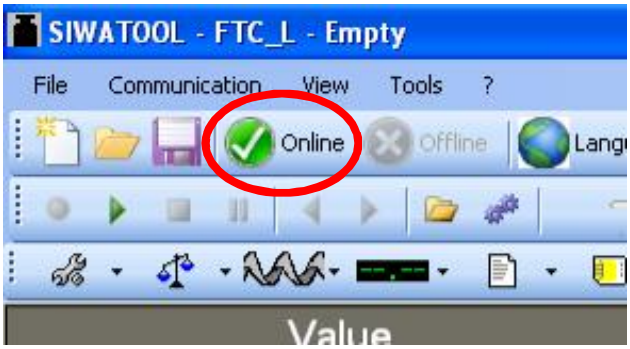
2.2 Start SIWATOOL FTC_L



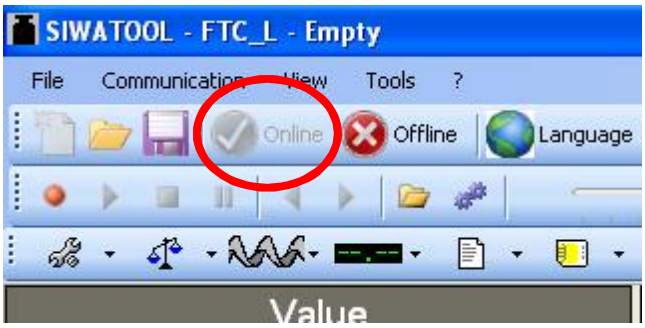
On the SIWATOOL FTC_L interface, select the desired interface, which should be the COM used on your computer.



Click **Online**.

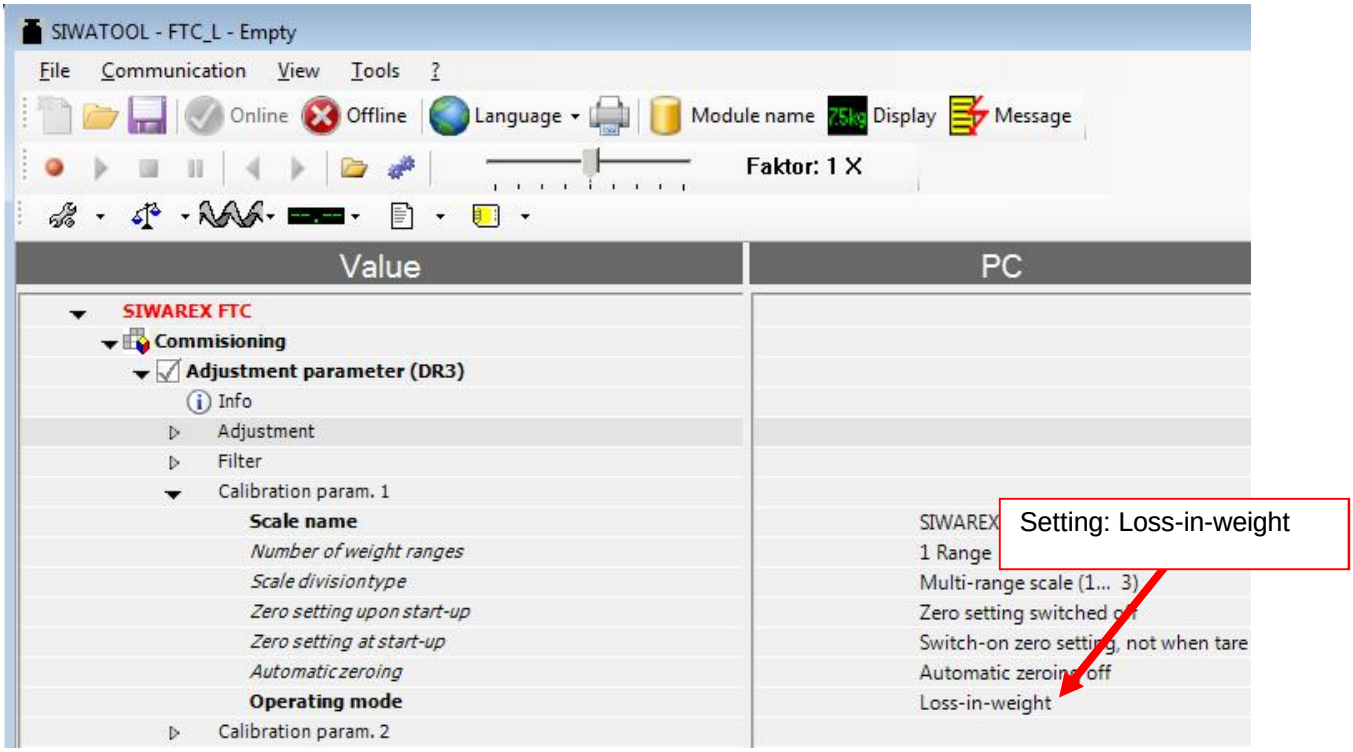


When the communication is established, **Online** turns grey.

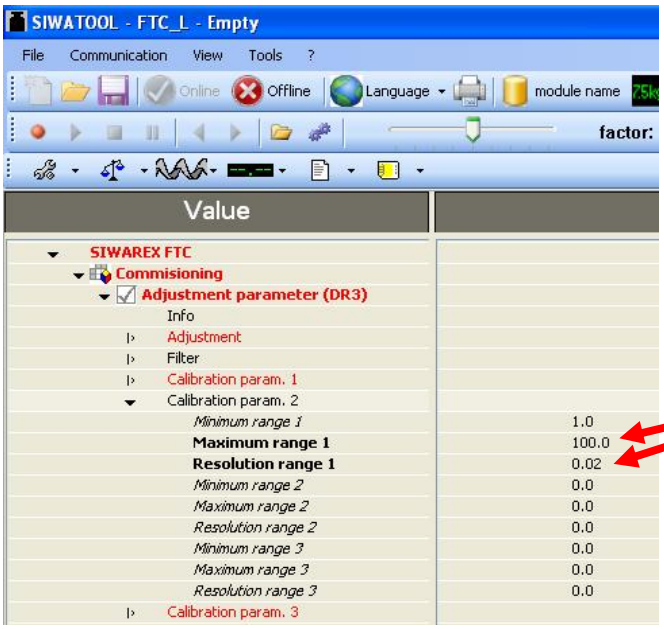


2.3 Parameterization and adjustment of scales (DS3)

Siwarex FTC has to be calibrated to show the right weight value and to calculate the actual flow value. The corresponding parameters are part of DR3.



All other settings of this register are not relevant!



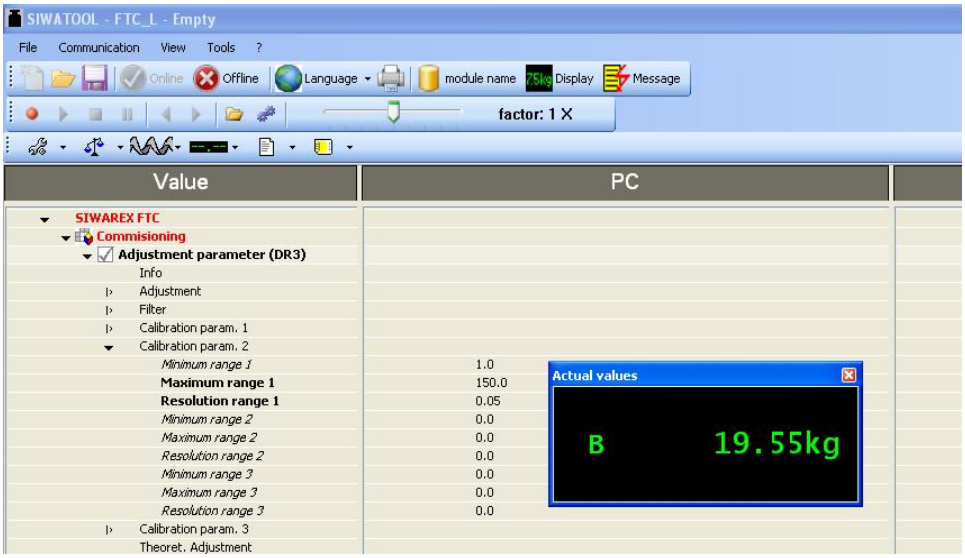
Maximum range 1:
max. weighing range or mass of filling, e.g. 100kg

Setting the resolution range of the scales' display:
e.g. 0.02 kg = 20 g

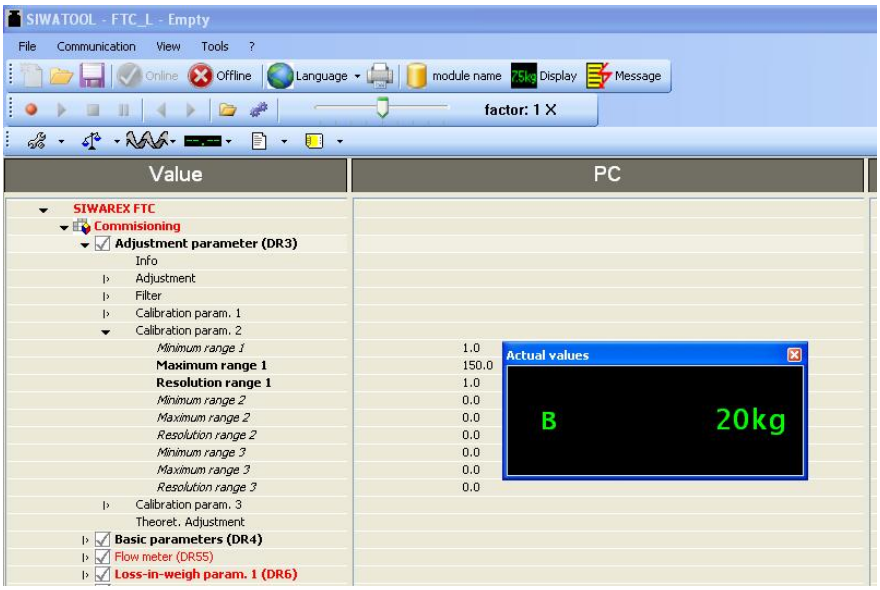
All other settings of this register are not relevant!

"Resolution range 1": It is the minimum change of the displayed weight. The unit is the same as the “Weight unit” selected under the "Calibration param. 3" tab.

Example:

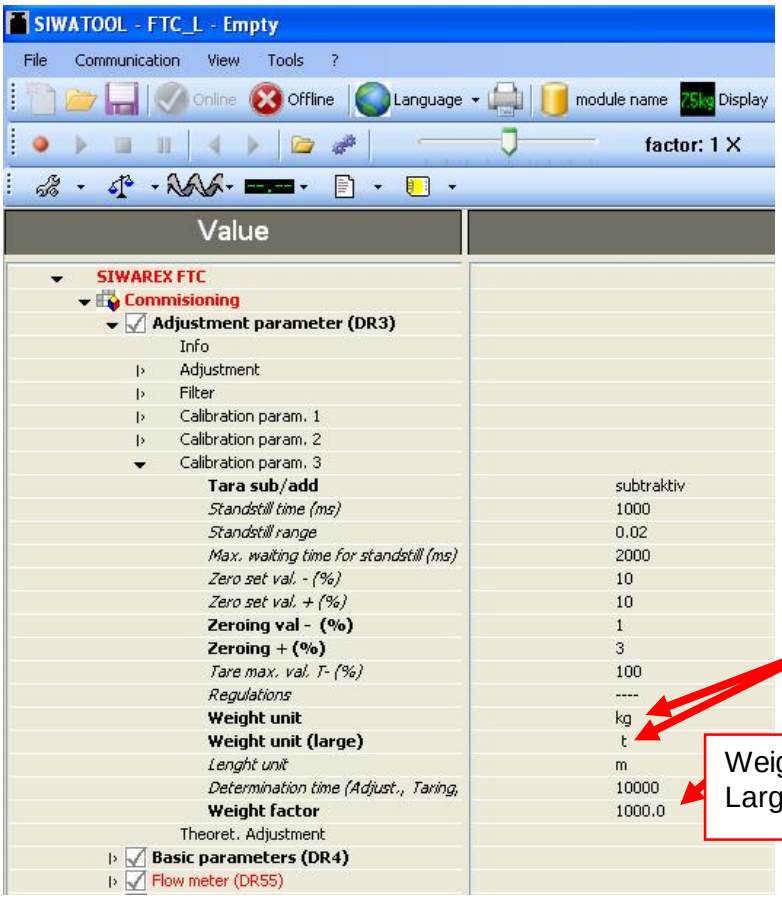


"Resolution range 1" is set to 0.05 kg, so the minimum change is 0.05 kg.



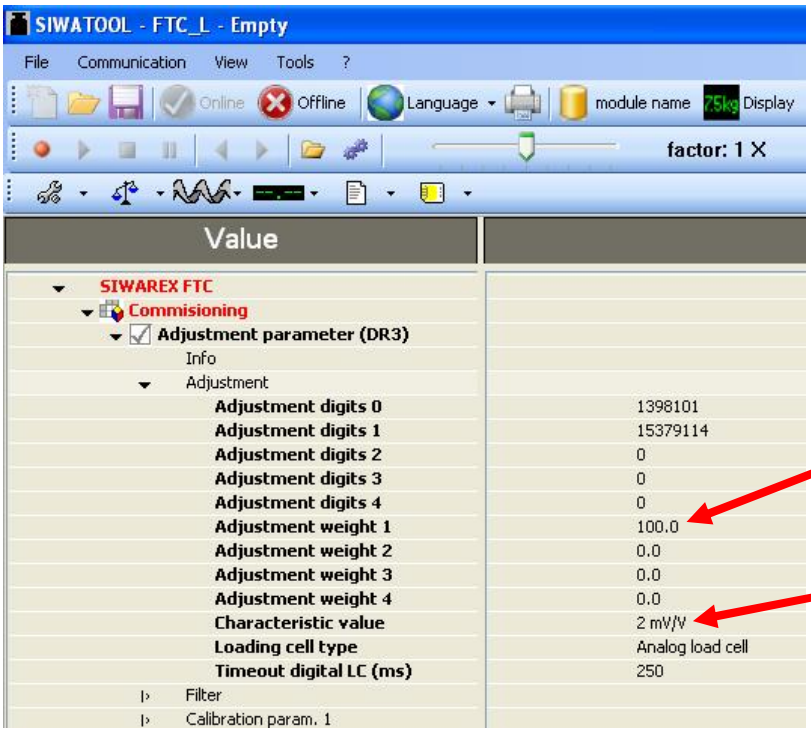
"Resolution range 1" is set to 1.0 kg, so the minimum change is 1 kg.

Note that resolution is related to weight display and is different from precision.



Weight unit and large weight unit are usually “kg and t” or “lbs and t”

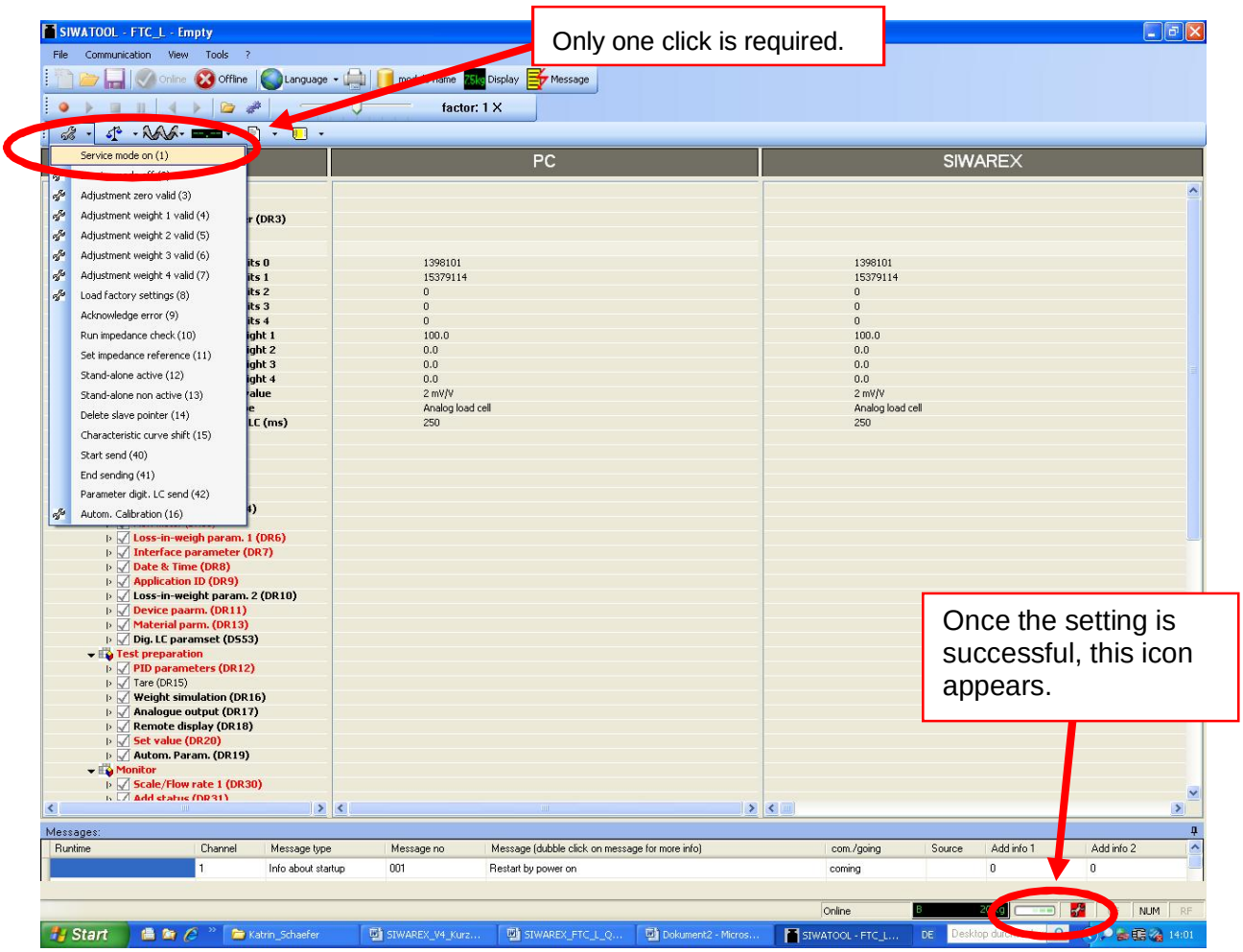
Weight factor:
Large weight unit= weight unit x weight factor



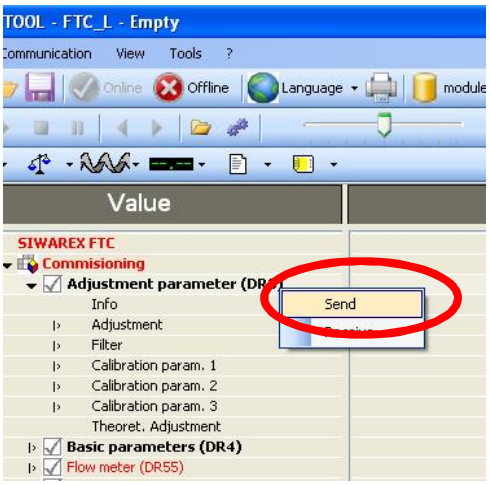
Enter the adjustment weight (e.g. "100.0") as “Reference 1”

Set the Characteristic value range.
Indicated on sensor.
Default value is 2mV/V

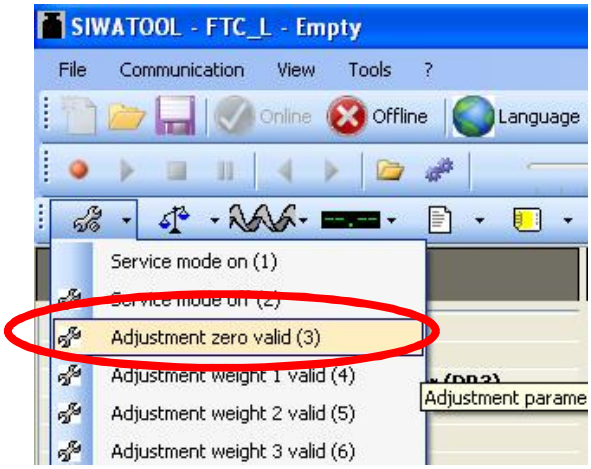
After setting the parameters of the DR3, the Service mode has to be switched on.

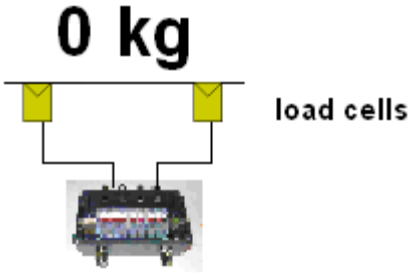


Afterwards click **Send** (mouse right-click to “Adjustment parameter (DR3)”) so that the DR3 is sent to the FTC module.

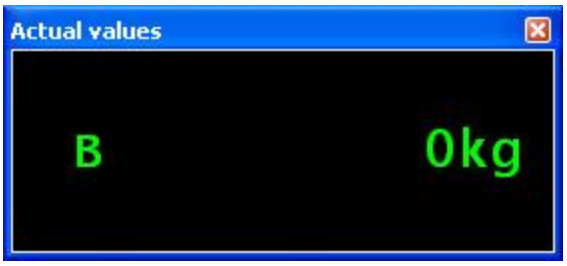


Ensure that the scale is empty (not loaded) and click **Adjustment zero valid (3)**.

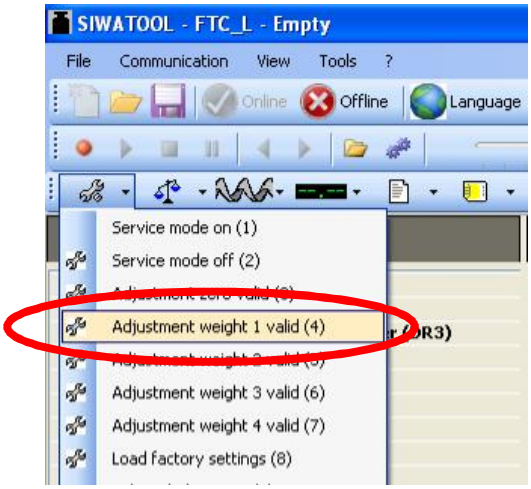


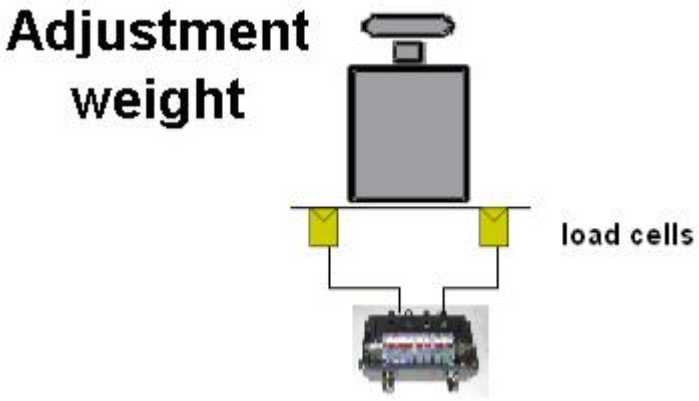


After that the displayed value is as follows:



Add the adjustment weight on the scale and then click **Adjustment weight 1 valid (4)**.

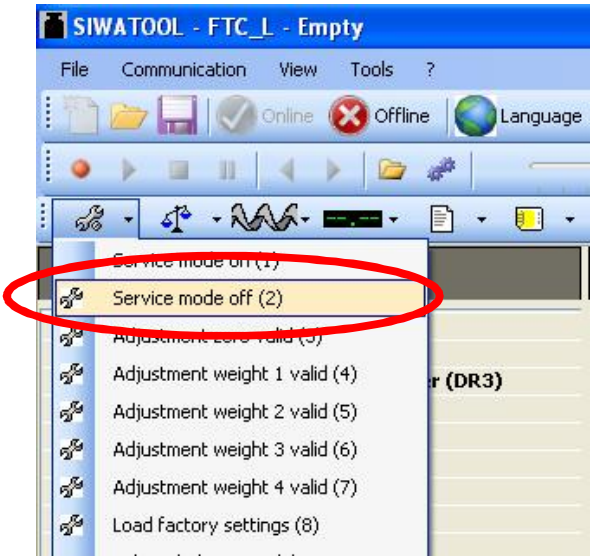




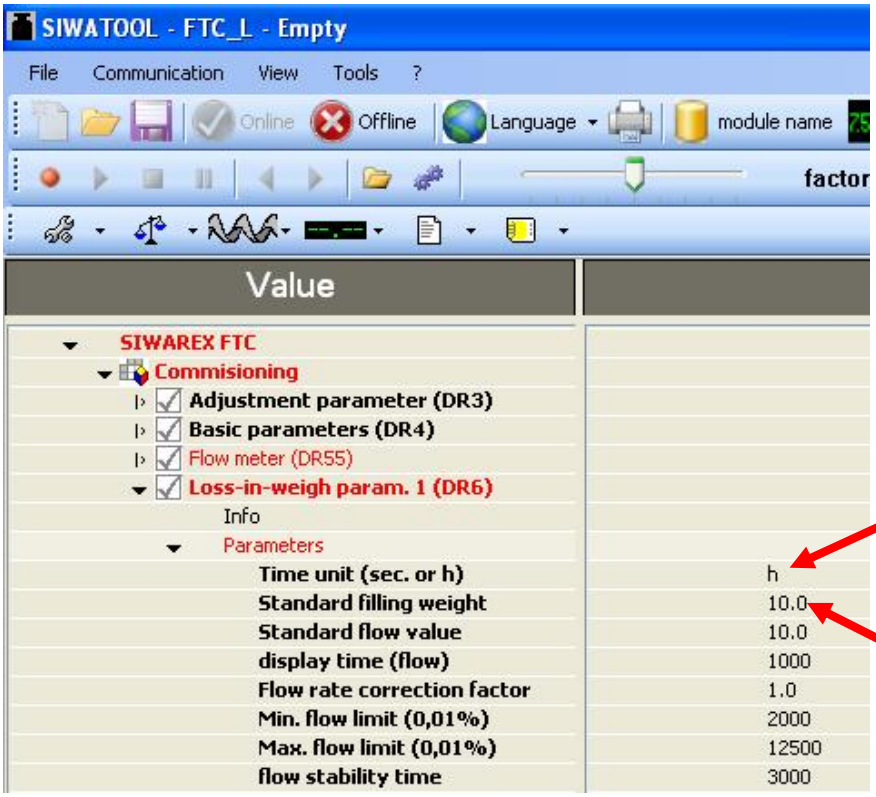
The weight becomes the adjustment weight (e.g. 150kg) and the adjustment is complete.

If the corresponding weight is now changed it will be equal to the actual weight and exact accuracy will be achieved.

The Service mode can be switched off.



2.4 Parameterization of loss-in-weight parameters 1 (DR6)

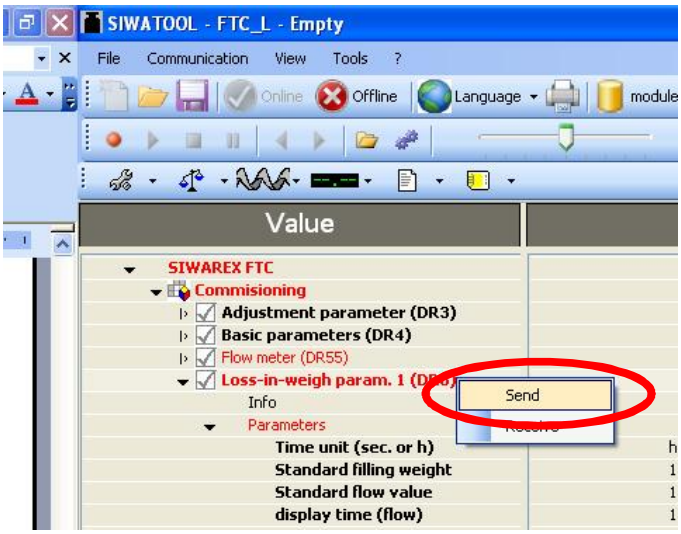


The time unit for the flow calculation normally is set to „h“ like hour.
It is also possible to type in „s“ like second.

The standard filling weight has to be adapted to the actual net weight of the hopper.

All other settings of this register are not relevant!

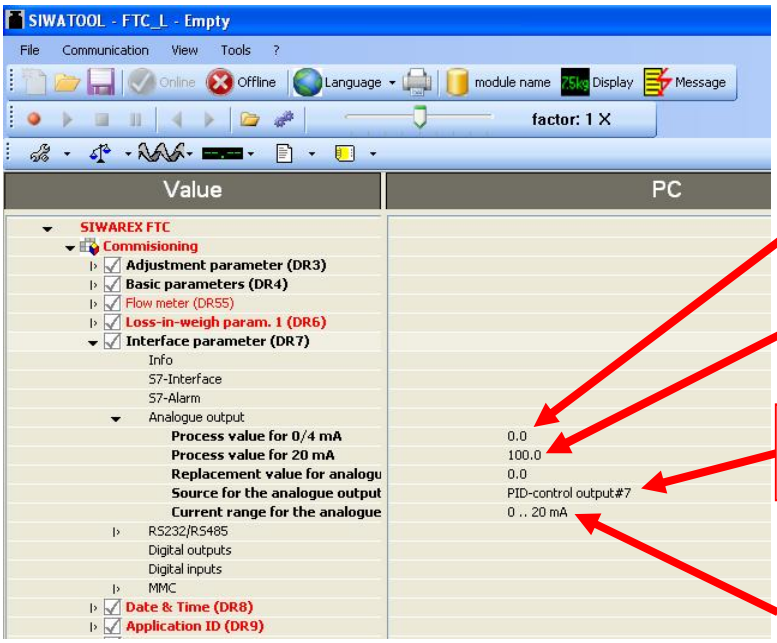
Click Send (mouse right-click to “Loss-in-weigh param. 1 (DR6)”) so that the DR6 is sent to the FTC module.



2.5 Parameterization of interface parameters (DR7)

This set of parameters defines various interfaces of Siwarex FTC. The analogue output e.g. for the frequency converter or the digital outputs (dosing active; filling active) has to be defined.

<u>The parameters for the analogue output have to be defined as defined in the following picture.</u>
This set up has to be done in the same way, if the set point for the frequency converter will be sent via Profibus



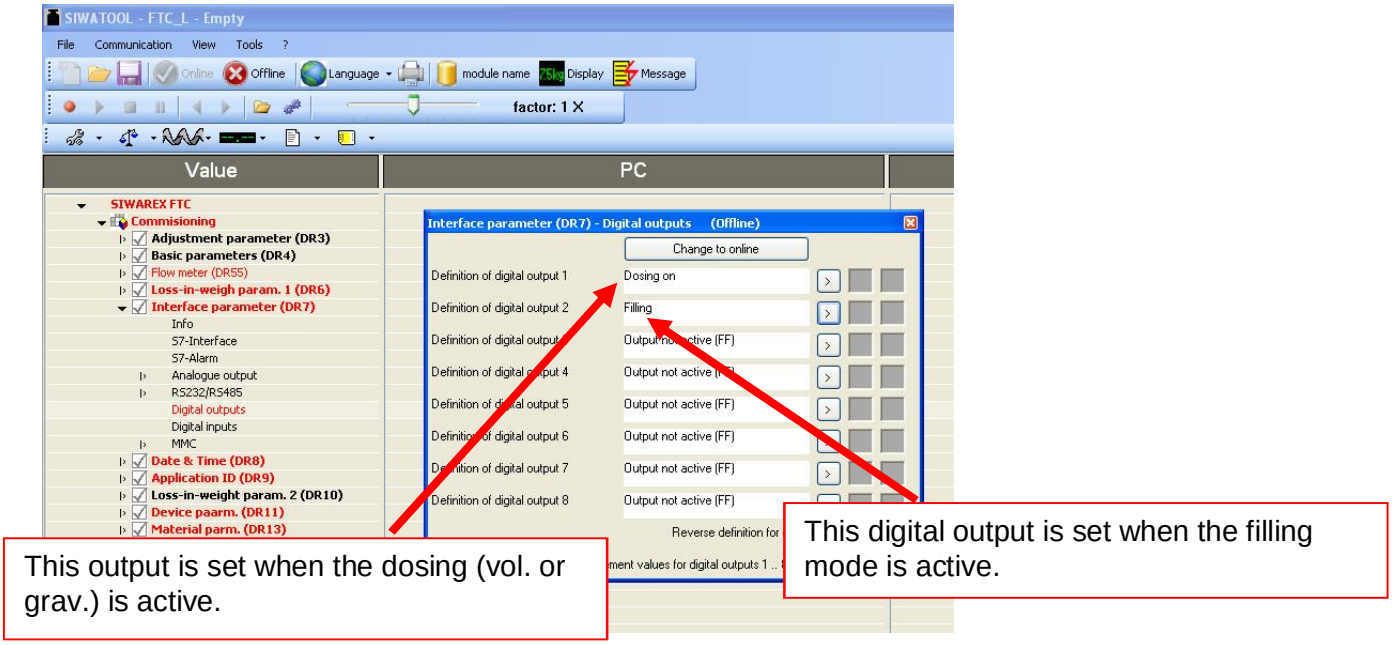
Parameter has to be „0.0“
(= 0.0% of the flow rate)

Parameter has to be „100.0“
(= 100% flow rate)

The source for the analogue output has to be selected like „PID-control output“

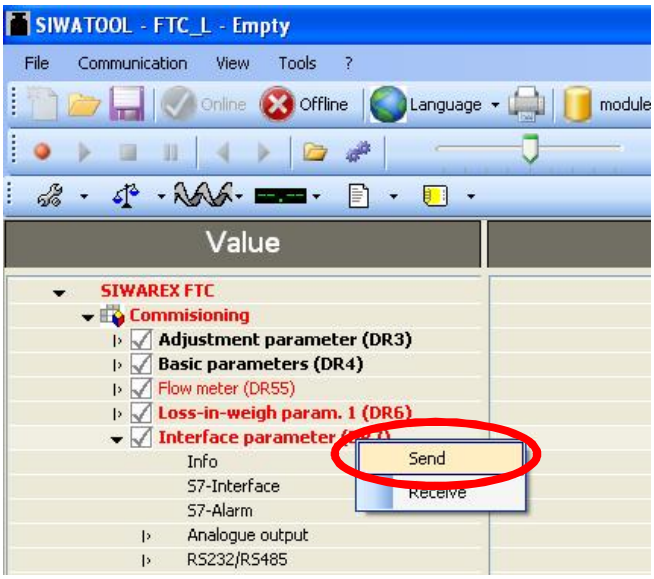
The current range for the frequency converter has to be selected.
- „0 .. 20mA“ or
- „4 .. 20mA“

This digital output can be defined as **„Dosing on“**



All other settings of this register are not relevant!

Click Send (mouse right-click to “Interface parameter (DR7)”), so that the DR7 is sent to the FTC module.



2.6 Parameterization of automatic parameters (DR19)

This set of parameters defines autostart parameters for the execution of the automatic set-up procedure like calculation of the device characteristic curve or the determination of the PID parameters. Both parameters will be explained in a separate chapter.

1. Definition of operating points:

Four operating points (control values) can be used in DR19 to define four different set points for the analogue output of the Siwarex weighing module.

- **Output 1 for automat. set up (0.01%)**
- **Output 2 for automat. set up (0.01%)**
- **Output 3 for automat. set up (0.01%)**
- **Output 4 for automat. set up (0.01%)**

Note:
- The values of the operating points have to increase
- The values should be as close as possible to the nominal values the system will later have to operate with.
- The first value has to be at least 3%. (= 300)
- The interval between the values has to be at least 1%

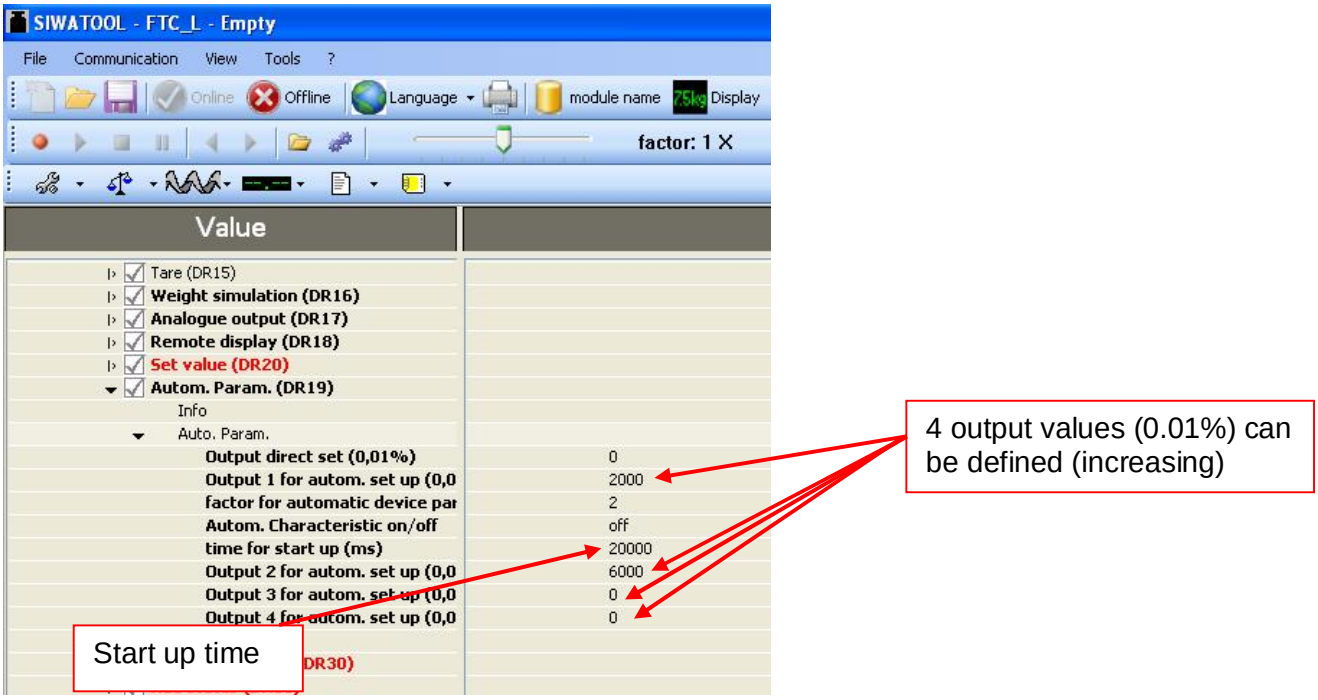
2. Start up time for an analogue output value:

The parameter **time for start-up (ms)** defines the time period for a definite analogue output value during the automatic start-up phase.

In the following the parameters of data DR19 will be explained.

In DR19 some default parameters are pre-defined (refer to illustration):

time for start-up (ms) = 20000
Output 1 for automat. set up (0.01%) = 2000
Output 2 for automat. set up (0.01%) = 6000
Output 3 for automat. set up (0.01%) = 0
Output 4 for automat. set up (0.01%) = 0



In case of command **Automat. Startup1 (165)** or **Autoparameter start (164)** the following control values will be set at the analogue output:

1. The first value **Output 1 for autom. set up (0,01%)** will be set for 20 sec:

Parameter DS7: „current range for the analogue output“	current range	Output value in %, Parameter DR19: „Output 1 for autom. set up (0,01%)“	Act. current (Range x output value in %)	Start-up current for the current range	**Current at analogue output**
0 .. 20 mA	20 mA	20%	4 mA	0 mA	**4 mA**
4 .. 20 mA	16 mA	20%	3.2 mA	4 mA	**7.2 mA**

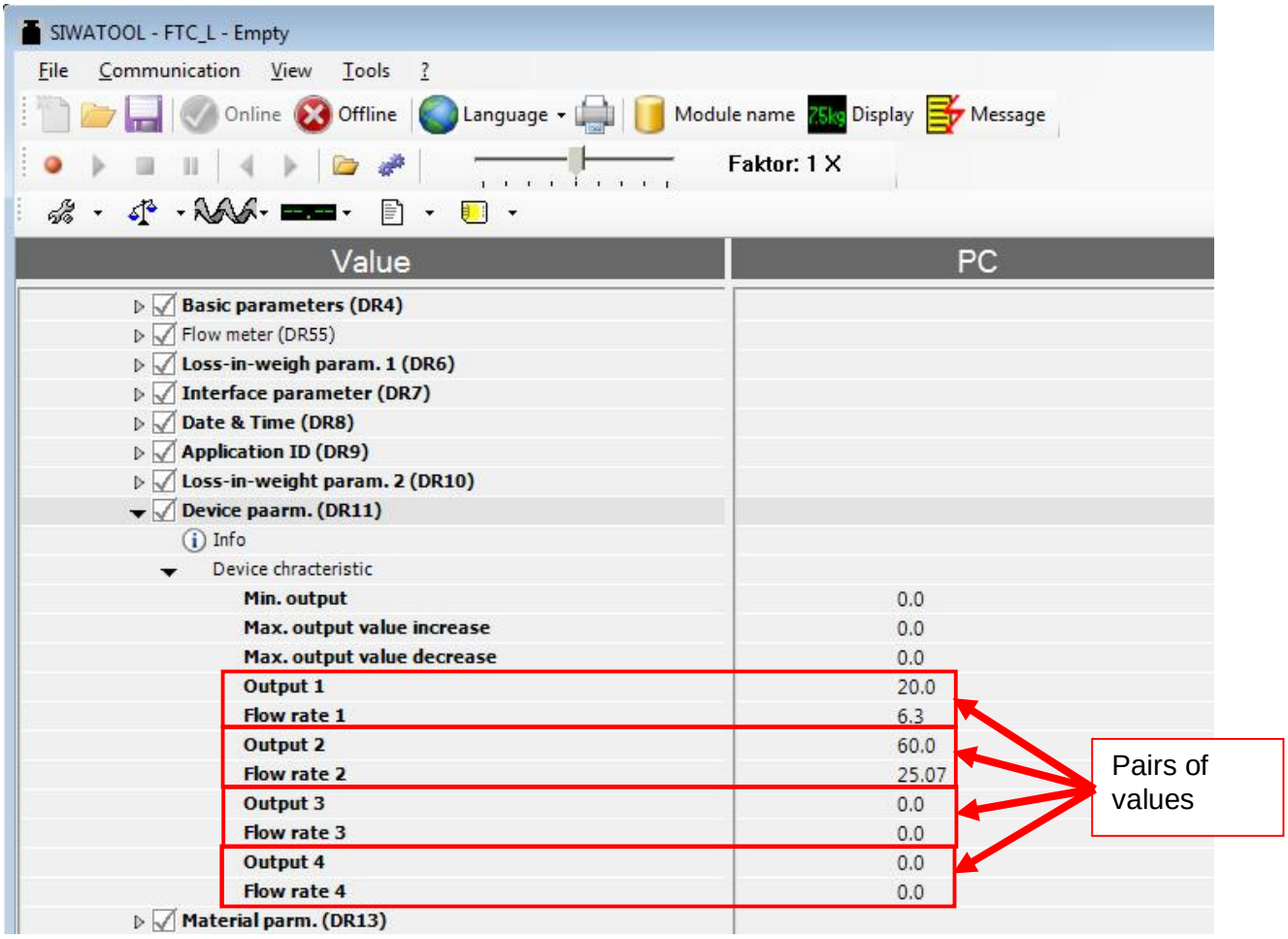
2. The second value **Output 2 for automat. set up (0,01%)** will be set for 20 sec:

Parameter DS7: „current range for the analogue output“	current range	Output value in %, Parameter DR19: „Output 1 for autom. set up (0,01%)“	Act. current (range x output value in %)	Start-up current for the current range	**Current at analogue output**
0 .. 20 mA	20 mA	60%	12 mA	0 mA	**12 mA**
4 .. 20 mA	16 mA	60%	9.6 mA	4 mA	**13.6 mA**

3. The output values **Output 3 for automat. set up (0,01%)** and **Output 4 for autom. set up (0,01%)** will not be used: Both parameters are equal zero.

2.7 Determination of device characteristic curve (DR11)

The characteristic curve of the dosing device defines the relation between a **certain material flow** and an **analogue control value** (current value).
The general purpose of the device characteristic curve is the following: In case of switching from the gravimetric to the volumetric dosing mode the system selects those analogue control values from the characteristic curve that correspond to the flow rate set-value.
Those pairs of values (max. 4) are stored in a DR 11.

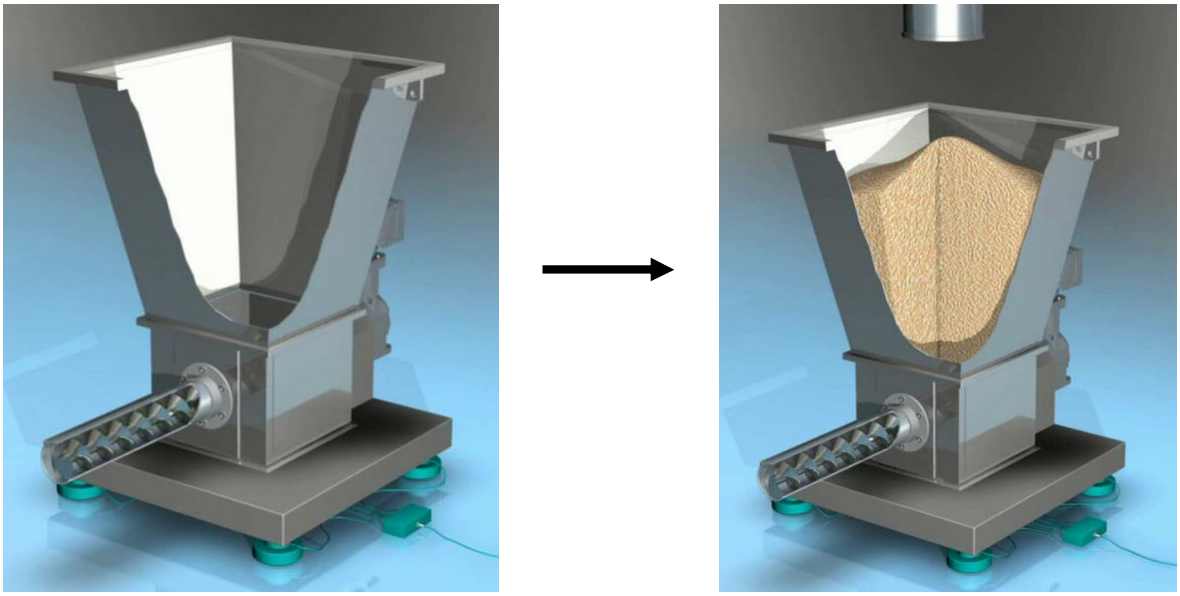


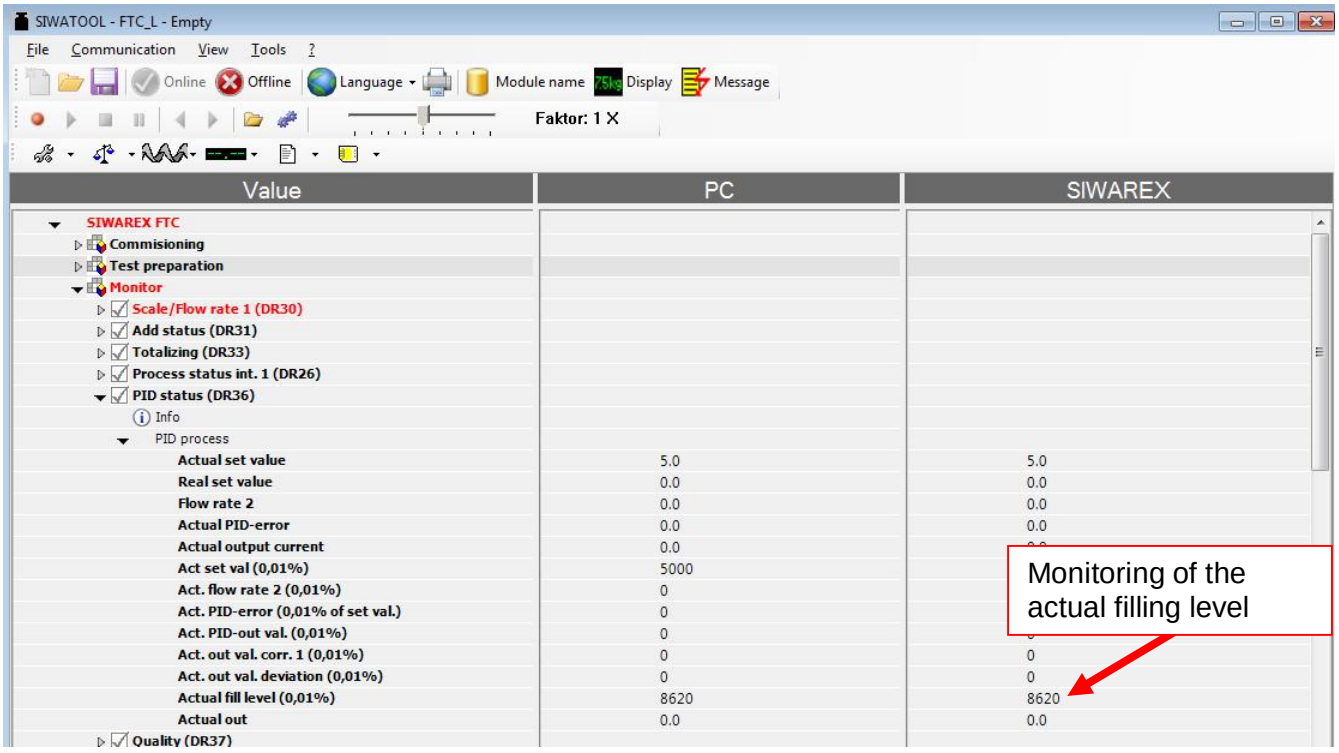
Using the command **Autom. Startup 1 (165)** the device characteristic curve will be automatically calculated. During the execution of that command the analogue control values will be set like they have been defined in DR 19 (eg.20% und 60%).

For calculating the device characteristic curve it is only necessary to execute the **Autom. Startup 1 (165)**. The commands **Autom. Startup 2 (166)** (= calculating the device characteristic curve and afterwards starting the dosing in volumetric mode) and **Autom. Startup 3 (167)** (calculating the device characteristic curve and afterwards starting the dosing in gravimetric mode) **needn't** executed.

In the following the device characteristic curve will be defined using command **Automat. Startup1 (165)**:

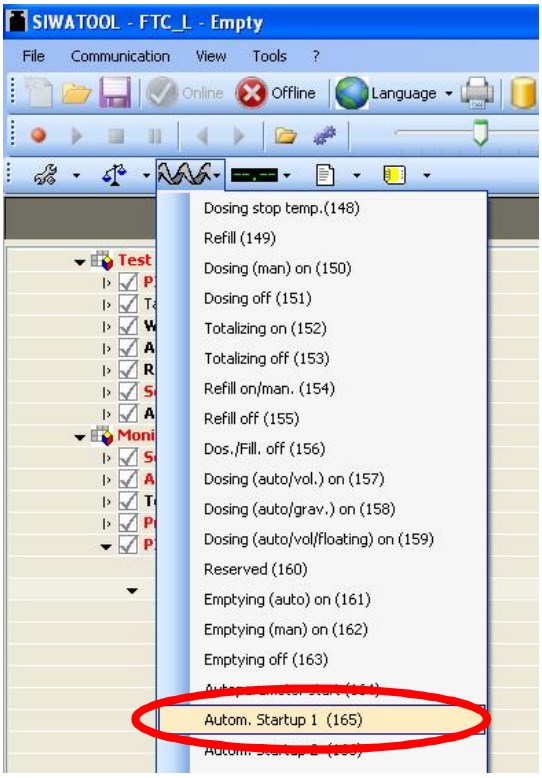
The hopper should be filled to more than 90%.
The filling level has to be above the limit value for refill (start refiiling in DR 6)



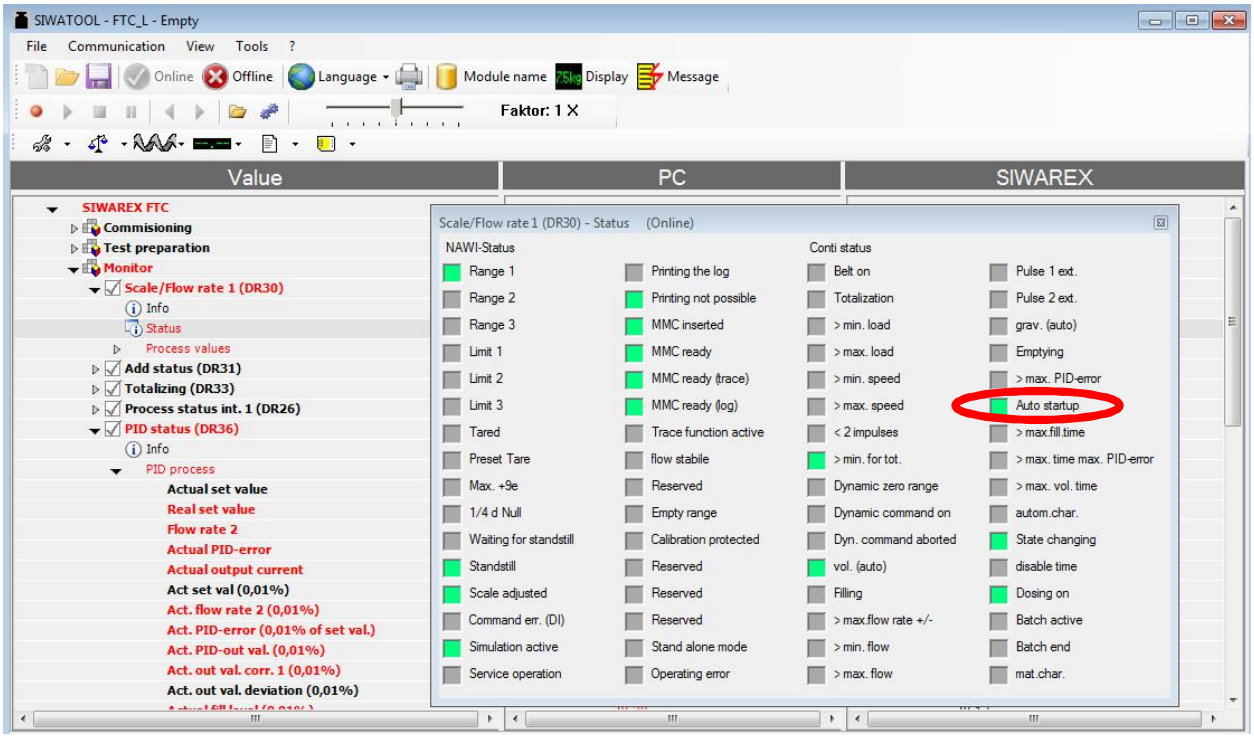


2. The screw device is filled with material.

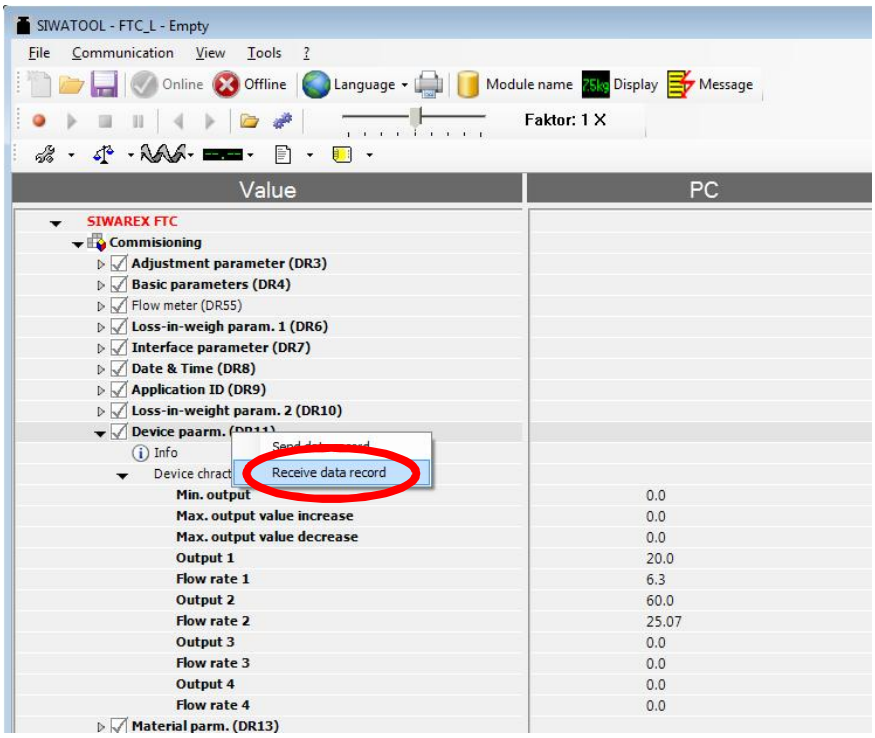
3. The command **Automat. Startup1 (165)** will be executed:

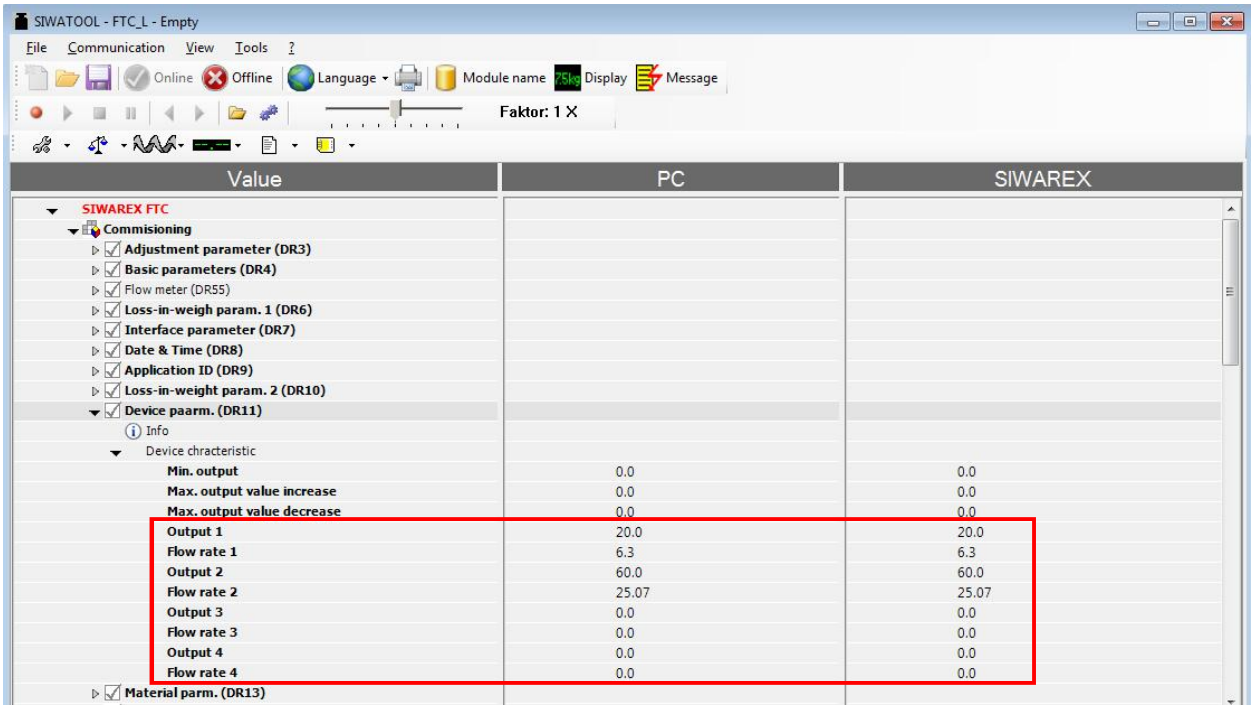


4. While running the batch the bit **Auto startup** in DR32 is actice.



After 20 sec. of **startup time,** the first pair of values (output value/flow rate) is added to the device characteristic curve and can be monitored by SIWATOOL after pushing the **Receive** button (mouse right-click to “Device param. (DR11)”).

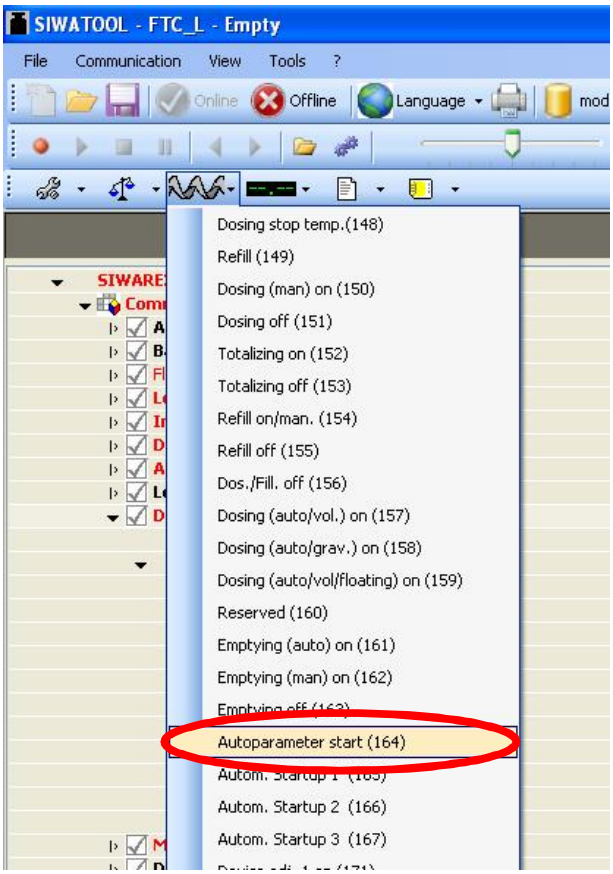

SIWATOOL - FTC_L - Empty
File Communication View Tools ?
Online Offline Language Module name Display Message
Faktor: 1 X
Value
PC
SIWAREX FTC
Commisioning
Adjustment parameter (DR3)
Basic parameters (DR4)
Flow meter (DR55)
Loss-in-weigh param. 1 (DR6)
Interface parameter (DR7)
Date & Time (DR8)
Application ID (DR9)
Loss-in-weight param. 2 (DR10)
Device paarm. (DR11)
Info
Device chract
Receive data record
Min. output 0.0
Max. output value increase 0.0
Max. output value decrease 0.0
Output 1 20.0
Flow rate 1 6.3
Output 2 60.0
Flow rate 2 25.07
Output 3 0.0
Flow rate 3 0.0
Output 4 0.0
Flow rate 4 0.0
Material parm. (DR13)


SIWATOOL - FTC_L - Empty
File Communication View Tools ?
Online Offline Language Module name Display Message
Faktor: 1 X
Value
PC
SIWAREX
SIWAREX FTC
Commisioning
Adjustment parameter (DR3)
Basic parameters (DR4)
Flow meter (DR55)
Loss-in-weigh param. 1 (DR6)
Interface parameter (DR7)
Date & Time (DR8)
Application ID (DR9)
Loss-in-weight param. 2 (DR10)
Device paarm. (DR11)
Info
Device chracteristic
Min. output 0.0 0.0
Max. output value increase 0.0 0.0
Max. output value decrease 0.0 0.0
Output 1 20.0 20.0
Flow rate 1 6.3 6.3
Output 2 60.0 60.0
Flow rate 2 25.07 25.07
Output 3 0.0 0.0
Flow rate 3 0.0 0.0
Output 4 0.0 0.0
Flow rate 4 0.0 0.0
Material parm. (DR13)

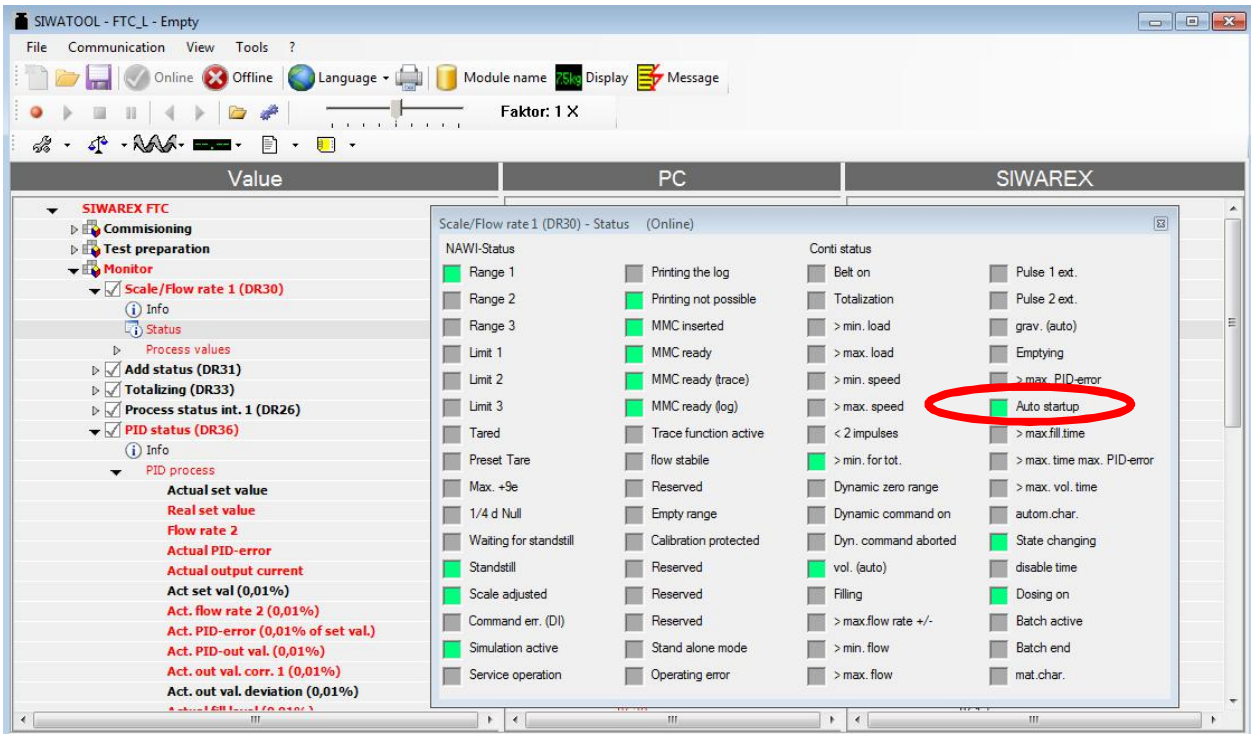
2.8 Determination of PID parameters (DR12)

During the execution of command **Autoparameter start (164)** the following parameters will be automatically calculated:
- PID-parameters (DS12)
- Flow rate parameters (DS10)
- Criteria for stability (DS6)

Using the command **Autoparameter start (164)** the system defines those PID parameters running with various analogue control values defined in the device characteristic curve table DR 19 (eg.20% and 60%).
The duration for each output value is corresponding to the start-up time (e.g. 20sec)

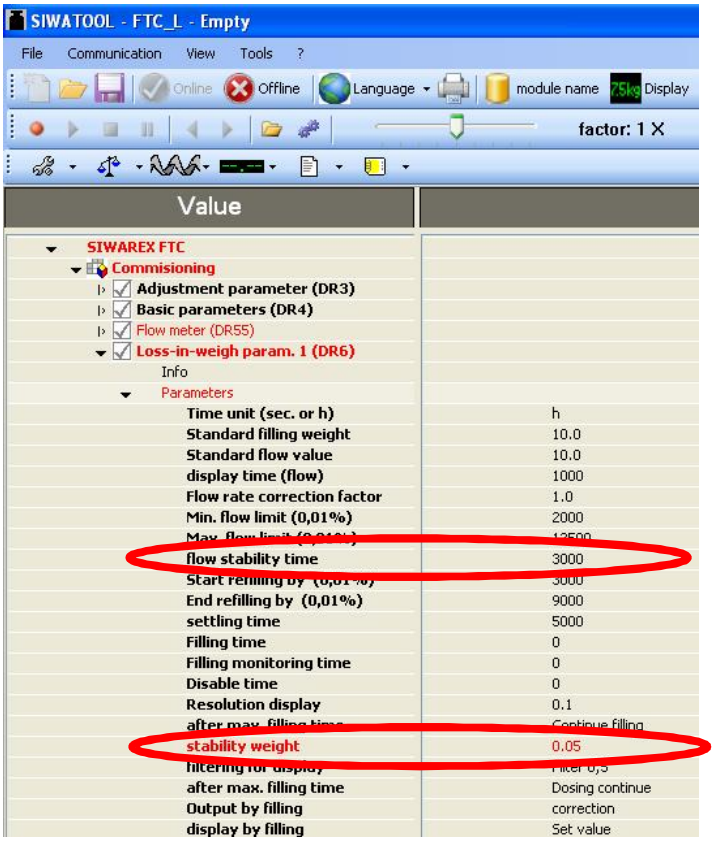


While running the batch the status flag **auto startup** in DR32 is actice.

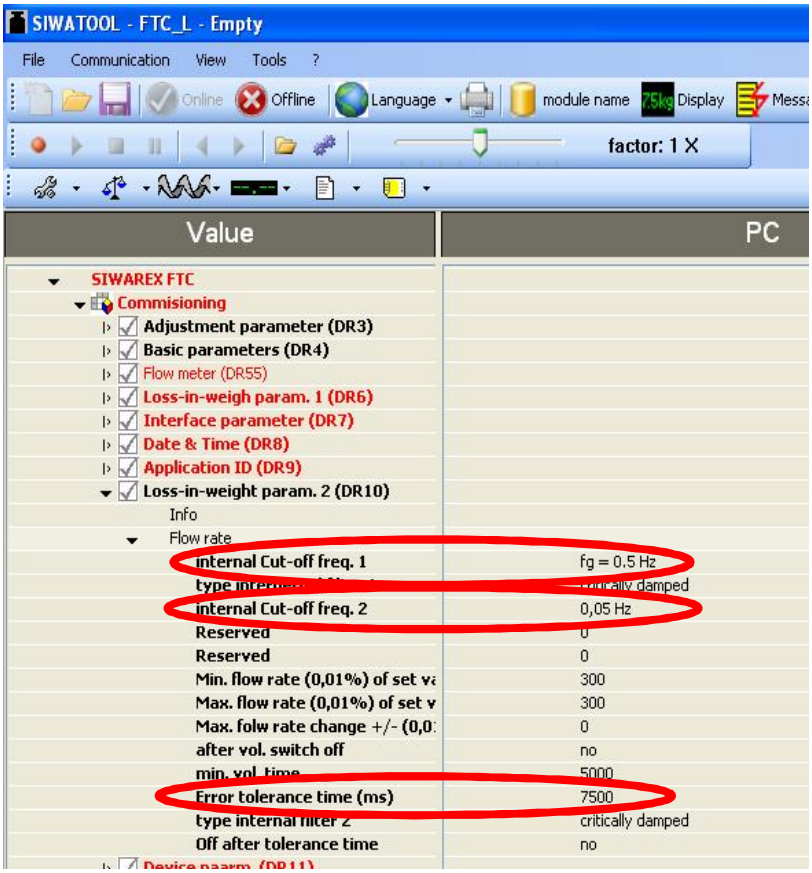


After finishing the autostart procedure all these automatically calculated parameters can be monitored in DR 12, DR10 and DR6 with a mouse right-click to these datarecords:

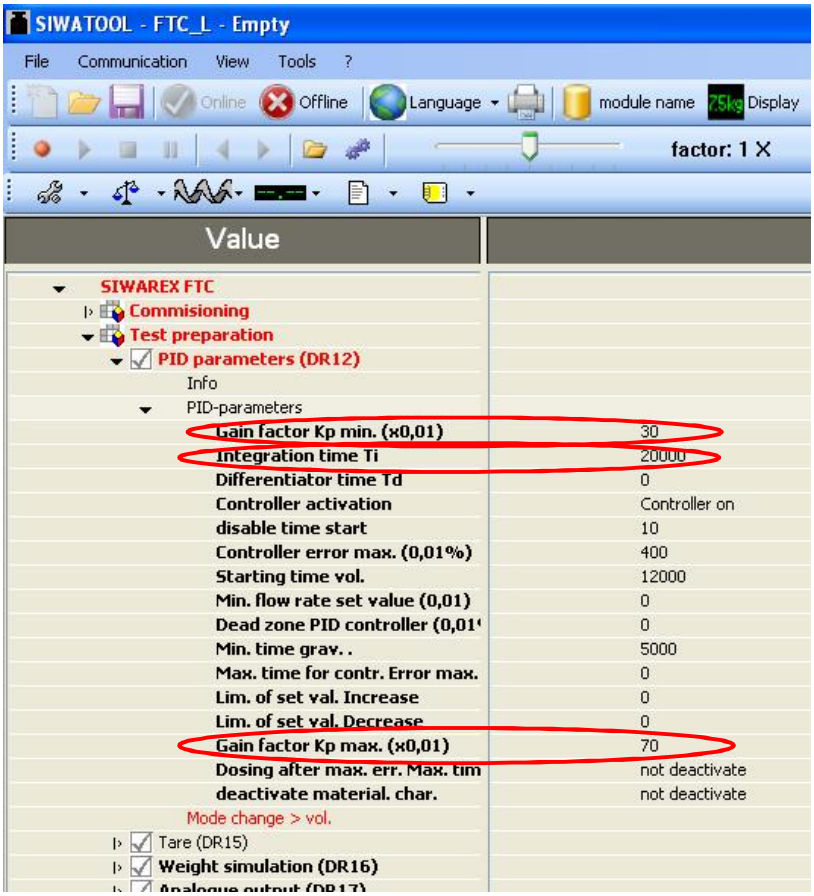
DR6:



DR10:

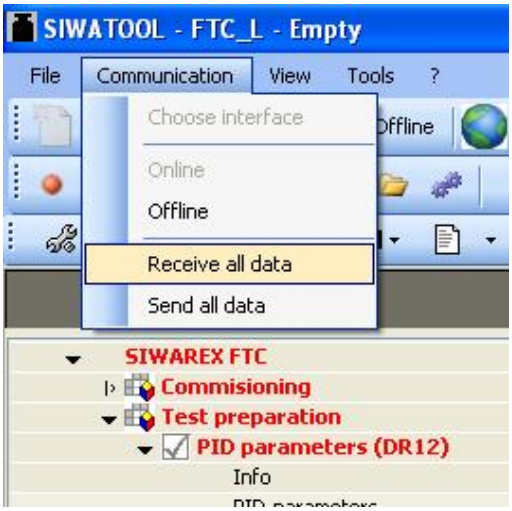

SIWATOOL - FTC_L - Empty
File
Communication
View
Tools
?
Online
Offline
Language
module name
Display
factor: 1 X
Value
PC
SIWAREX FTC
Commisioning
Adjustment parameter (DR3)
Basic parameters (DR4)
Flow meter (DR55)
Loss-in-weigh param. 1 (DR6)
Interface parameter (DR7)
Date & Time (DR8)
Application ID (DR9)
Loss-in-weight param. 2 (DR10)
Info
Flow rate
internal Cut-off freq. 1
fg = 0,5 Hz
internal Cut-off freq. 2
0,05 Hz
Reserved
0
Reserved
0
Min. flow rate (0,01%) of set v
300
Max. flow rate (0,01%) of set v
300
Max. folw rate change +/- (0,0
0
after vol. switch off
no
Error tolerance time (ms)
7500
type internal filter 2
critically damped
Off after tolerance time
no

DR12:


SIWATOOL - FTC_L - Empty
File
Communication
View
Tools
?
Online
Offline
Language
module name
Display
factor: 1 X
Value
SIWAREX FTC
Commisioning
Test preparation
PID parameters (DR12)
Info
PID-parameters
Gain factor Kp min. (x0,01) 30
Integration time Ti 20000
Differentiator time Td 0
Controller activation Controller on
disable time start 10
Controller error max. (0,01%) 400
Starting time vol. 12000
Min. flow rate set value (0,01) 0
Dead zone PID controller (0,01 0
Min. time grav. . 5000
Max. time for contr. Error max. 0
Lim. of set val. Increase 0
Lim. of set val. Decrease 0
Gain factor Kp max. (x0,01) 70
Dosing after max. err. Max. tim not deactivate
deactivate material. char. not deactivate
Mode change > vol.
Tare (DR15)
Weight simulation (DR16)

PLEASE NOTE:

If the datarecords, which are changed through the Auto-parameterisation, aren't still received to the Siwatool software, it is recommend to execute the command **Receive all data.**



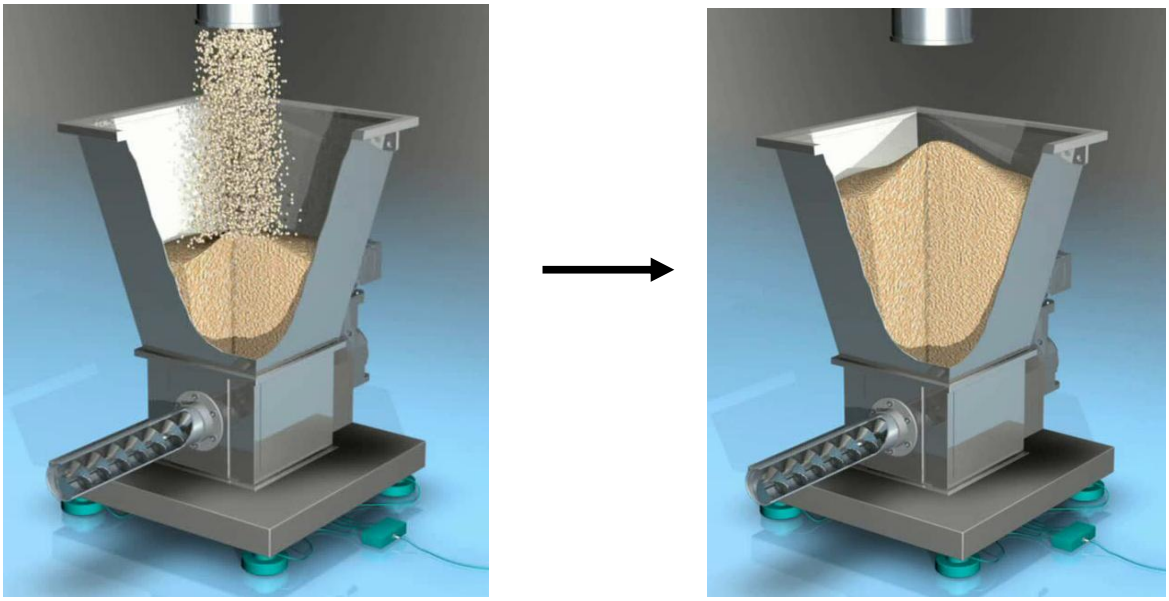
After receiving all data to the Siwatool software, the parameter settings into Siwatool are conform again to the parameter settings into the Siwarex FTC module.

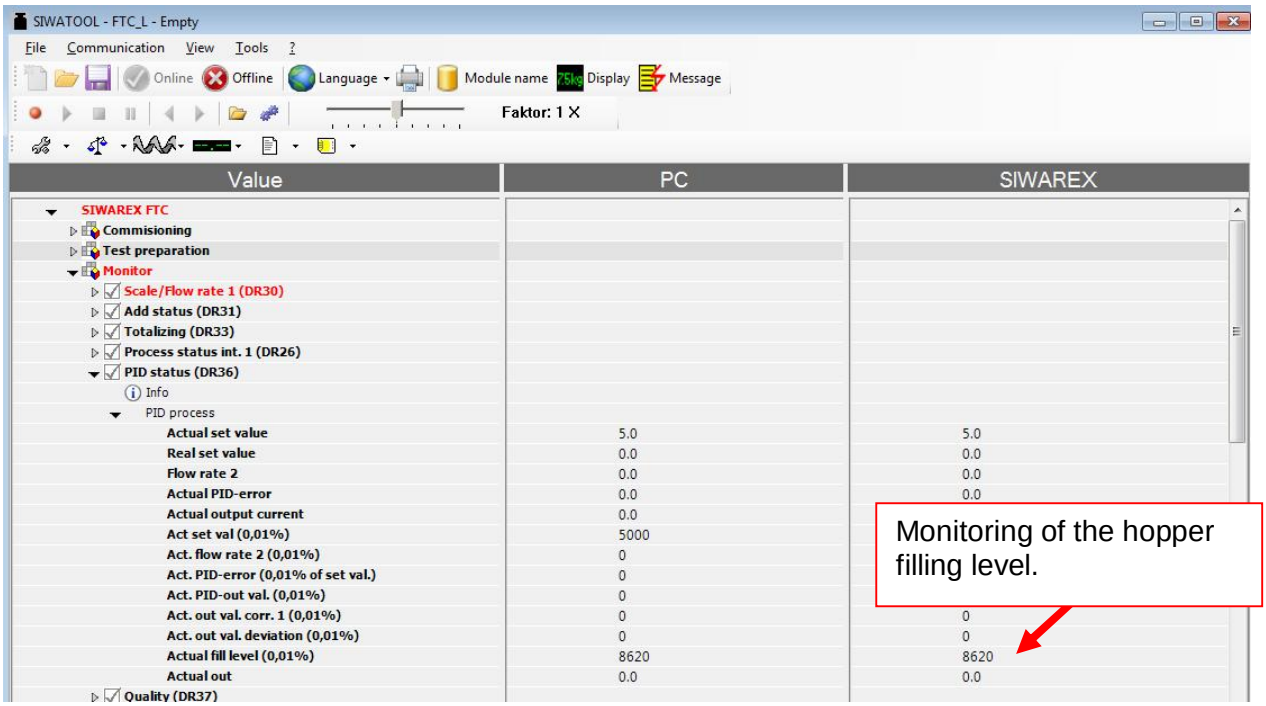
2.9 Determination of material characteristic curve (DR13)

The material characteristic curve DR 13 defines a set of correction factors for the analogue control value. The idea is to compensate for the material pressure on top of the screw device because of the filling level in the hopper. The determination of the material characteristic curve can be done in the volumetric or gravimetric dosing mode.
At different heights of the filling level (90%, 70%, 50%, 30% und 10%) a correction factor can be calculated by using a certain command. The material characteristic curve should be calculated based on a typical flow rate set-value. (Chap. 2.10).

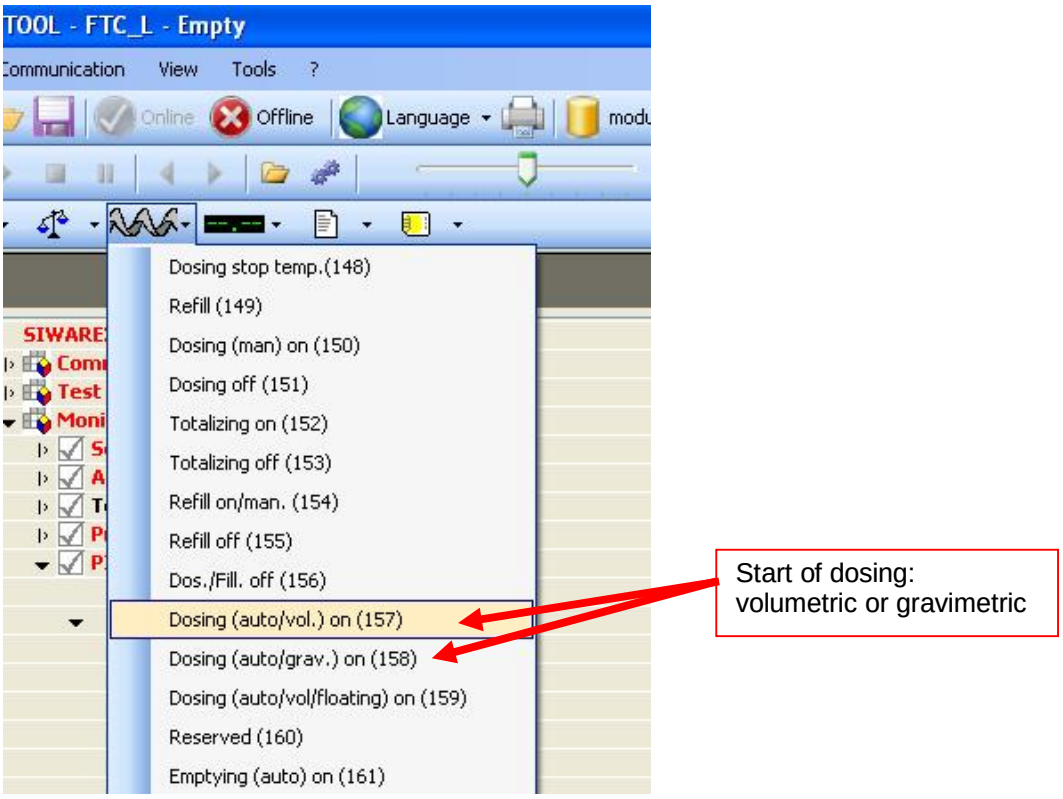
In the following the material characteristic curve will be calculated:

1. The hopper will be filled to at least to 90% of the standard filling weight:

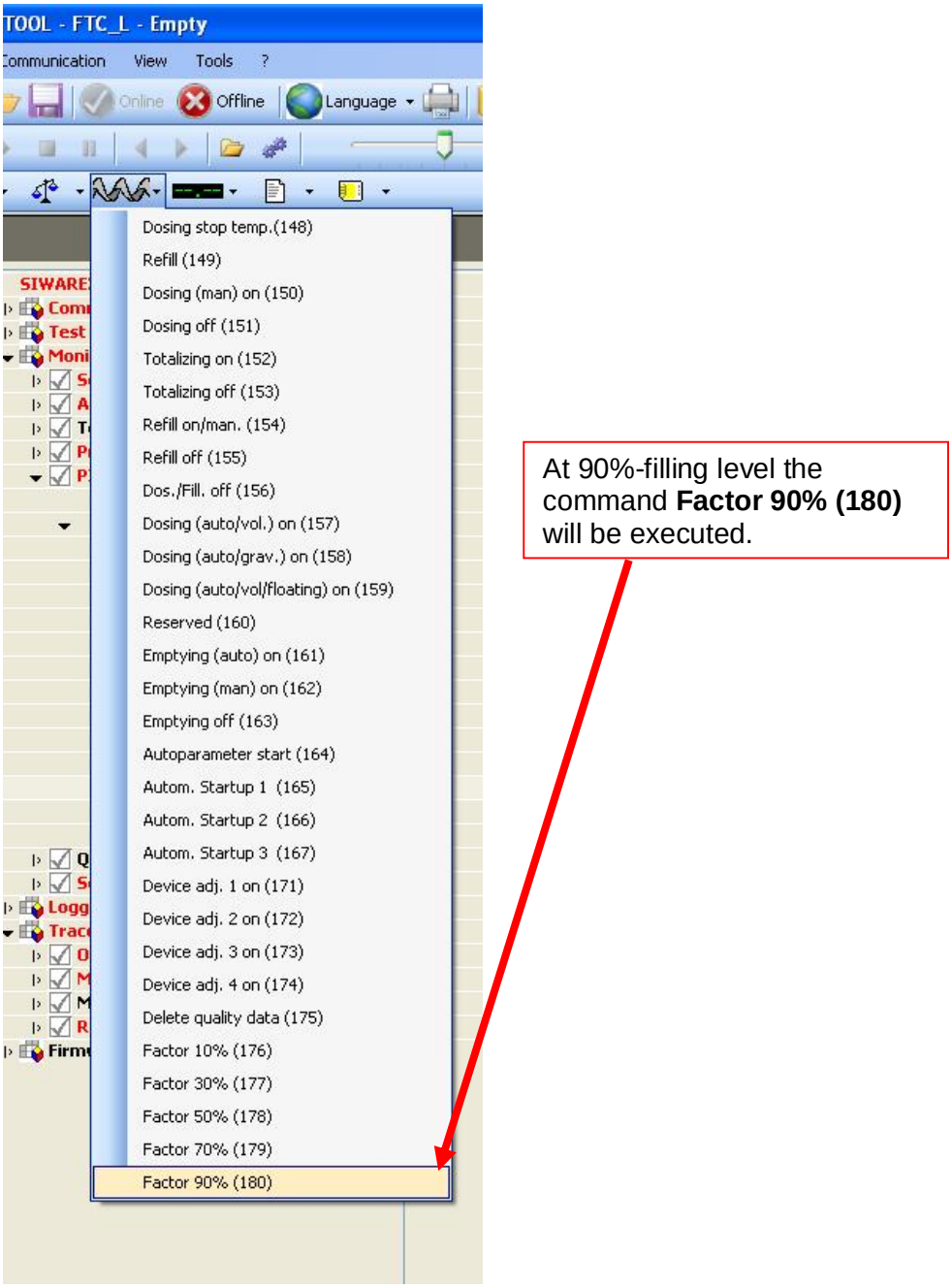




2. Start dosing **Dosing (auto/vol.) on (157)** or **Dosing (auto/grav.) on (158)**:



3. Reaching the 90%-filling level the command **Factor 90% (180)** will be executed.



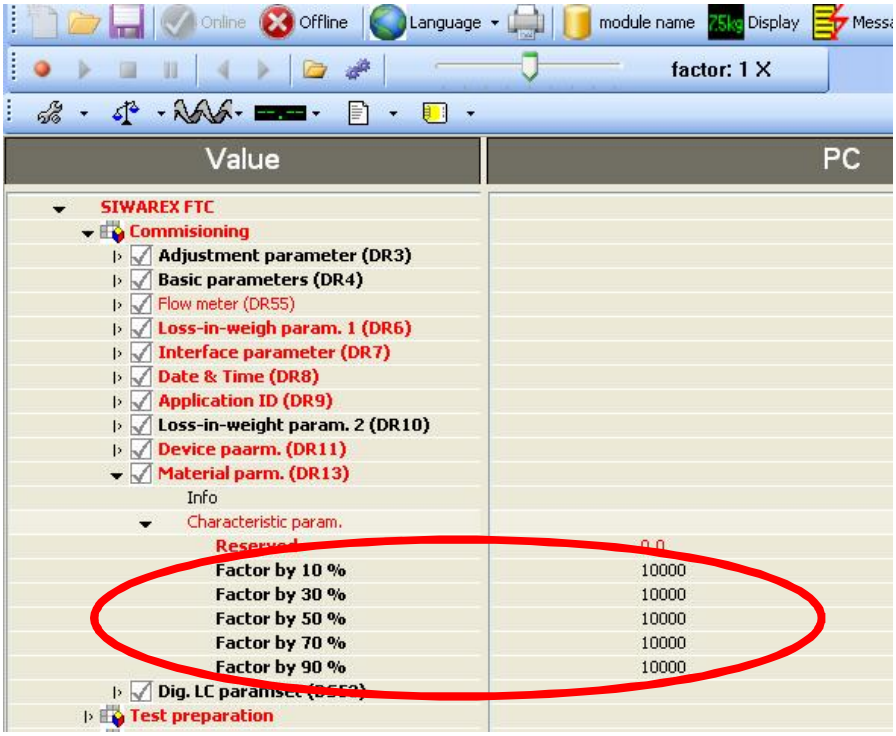
4. Reaching the 70%-filling level the command **Factor 70% (179)** will be executed.

5. Reaching the 50%-filling level the command **Factor 50% (178)** will be executed.

6. Reaching the 30%-filling level the command **Factor 30% (177)** will be executed.

7. Reaching the 10%-filling level the command **Factor 10% (176)** will be executed.

By pushing the **Receive** button in DR 13 (mouse right-click to “Material param. (DR13)”) the calculated correction parameters can be monitored.



2.10 Flow rate set-value (DR20)

In DR 20 the Flow rate set-value for the Loss-in-weight scale has to be defined.
The set-value can be defined in two ways:

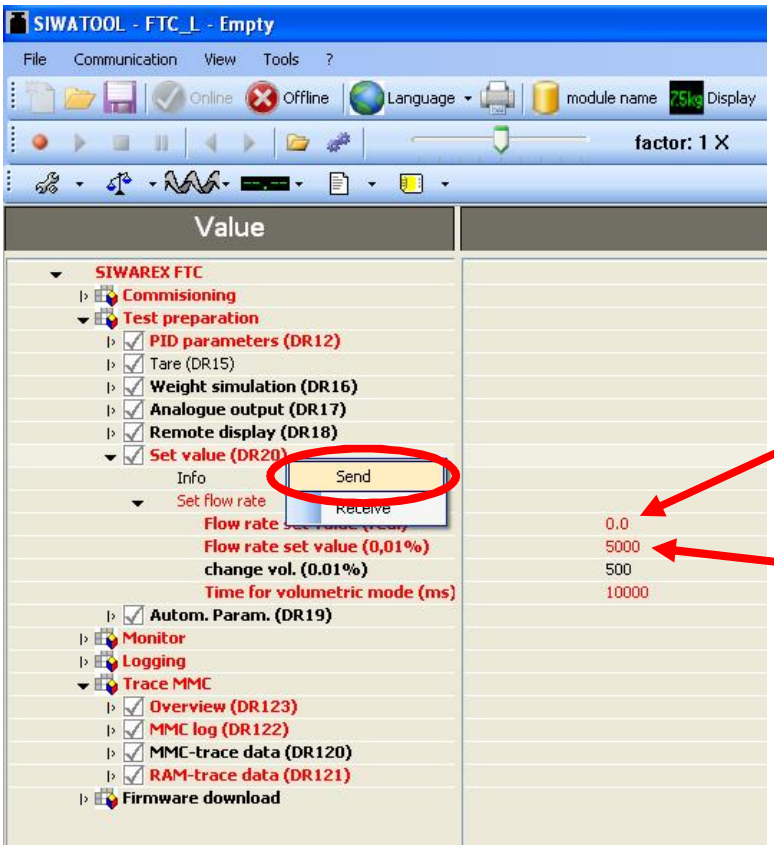
Quantity per time unit *or:*
%- value of the nominal flow rate

One of the two parameters always has to be set to “0“.

If the change of the flow rate set-value is more than the **set-value treshold (0.01%)** the system switches to the volumetric mode for a certain time period **Time for volm. mode (ms).** If the set-value threshold is equal „0“ there will be no change of the operating mode.

DR20: Definition of the flow rate set-value:

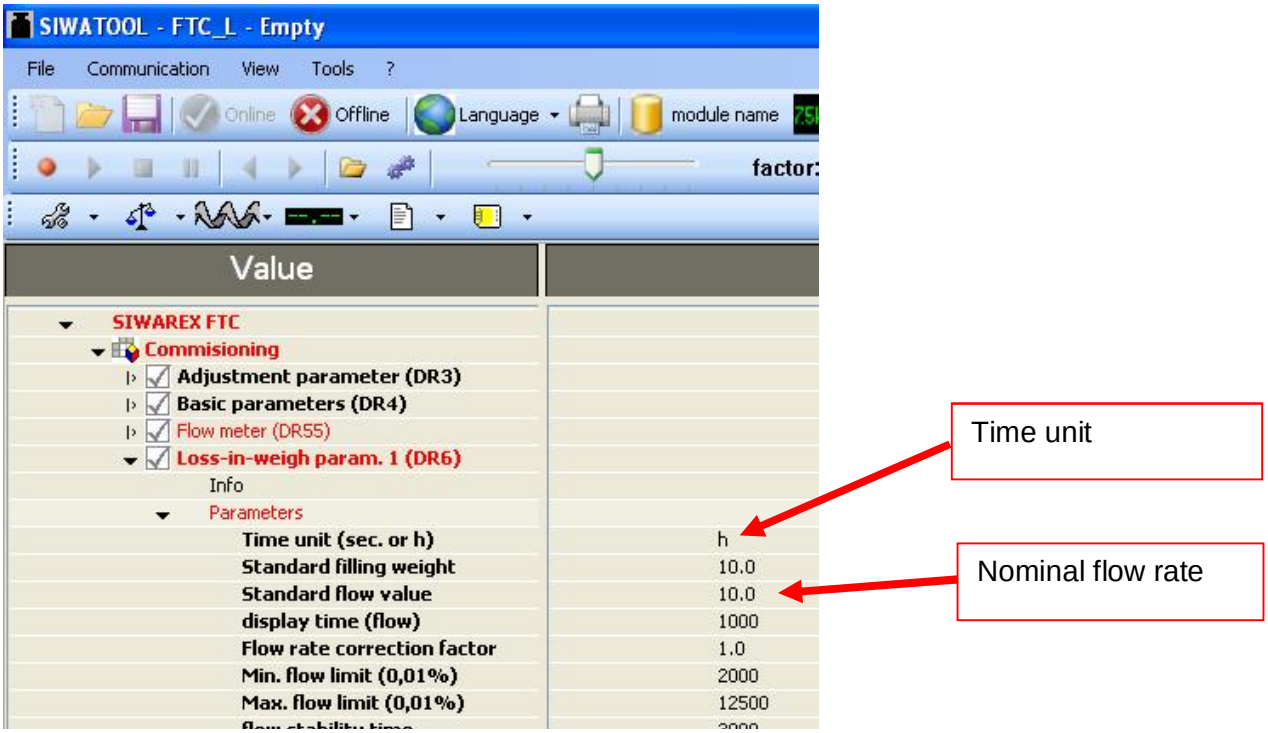
Push the button **Send** (mouse right-click to “Set value (DR20)”) to send the parameters of DR20 to the SIWAREX FTC weighing module.



Setpoint: Quantity / time unit

Setpoint as a %- value of the nominal flow rate
(Nominal flow rate: Def. im DR6)

DR6: Definition of time unit and nominal flow rate:

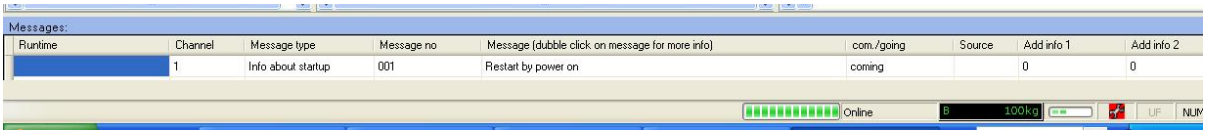


2.11 Save the calibration data's into a file

Transfer all data from the SIWAREX FTC to the PC.

Confirm with Yes

The transmission from the Siwarex FTC module to the PC can be monitored with the bar:



Save the data as a SIWATOOL FTC File:

3 Switching to volumetric operation mode upon flow rate fault

After the detection of a disturbance (like a vibration) during the gravimetric dosing the Siwarex FTC module switches to the volumetric mode.

A disturbance might be detected because of:

1) Instability of weight *(violation of the stability criteria) or:*
2) Actual flow rate *(violation of the Min/Max- Limit-value or max. change of the flow rate)*

3.1 Volumetric mode of operation due to violation of stability criteria

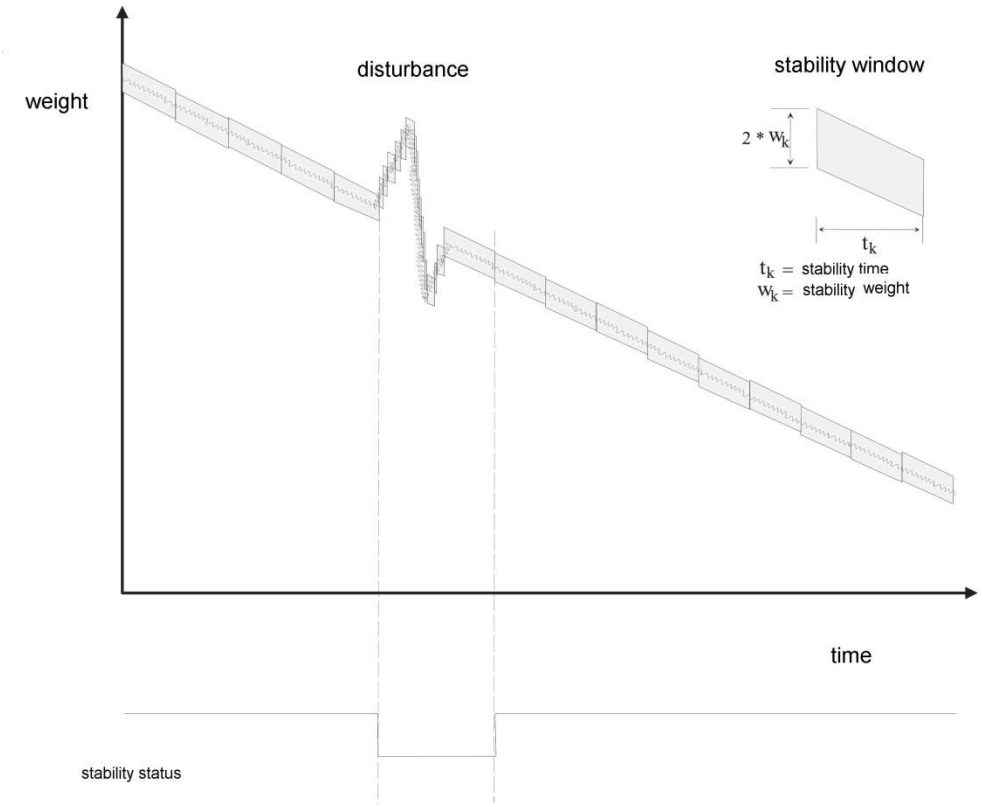
In case of violation of the stability criteria over a certain time period the Siwarex FTC module switches to the volumetric mode. The monitoring of the stability criteria is done as described below:

The decreasing weight value is monitored by a „stability window".

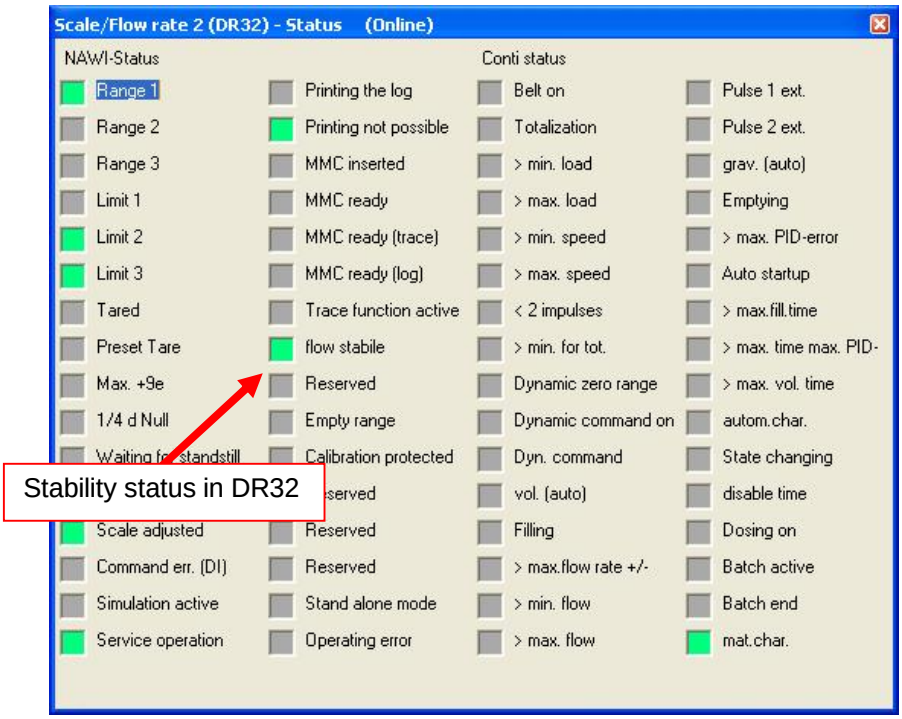
The weight value (filtered according to parameters in DR6) is checked for a certain time period (time of stability flow in DR 6) against a maximum change of weight (**Stability weight** in DR 6)**.** This means the systems monitors if the weight stays within the stability window.

If the maximum weight related to the stability window is exceeded for a certain time period the actual analogue output value will be frozen and the status bit (**Flow stable, DR 32)** will be reset.

The following diagram illustrates the principle:



In case of violation of the stability criteria over a certain time period the status flag **flow stable** switches back to DR32.



If the status bit **Flow stable** stays in status " not true " for a longer period than the pre-defined tolerance limit **Fault tolerance time** DR10 the system will switch to the volumetric operation mode leaving the actual analogue output value unchanged.
The monitoring of the stability criteria is always active.

The relevant parameters for the monitoring of the stability criteria are the following ones:

- Stability time flow rate DR6
- Stability weight DR6
- Fault tolerance time DR10

These parameters will automatically be calculated with the command: "Autoparameter start (164)"

3.2 Cross-check of the actual flow rate

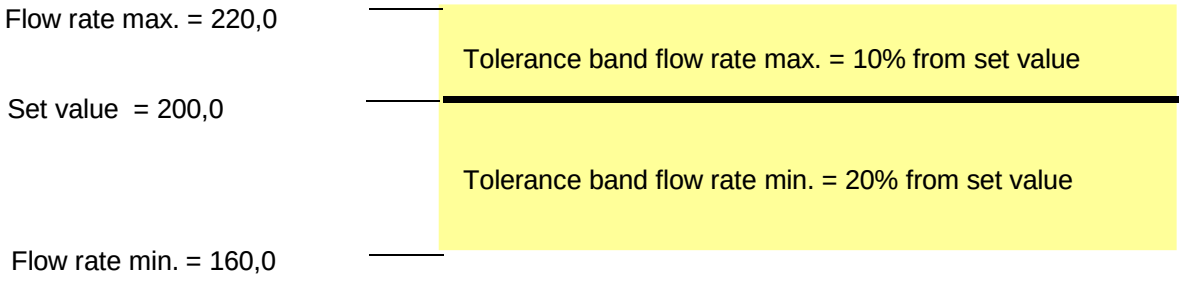
Beside the monitoring of the stability criteria there is also the option to switch to the volumetric mode of operation by cross-checking the actual flow rate with Min/Max flow rate limits. The conditions for these cross checks can be defined by the operator in DR 12.

If the actual flow rate falls below the limit **flow rate min. (0.01% in** DR6) or exceeds the limit **flow rate max. (0.01%** in DR6) related to the **nominal** flow rate **nominal flow rate (GE/s o. GE/h** in DR6), the operator can specify that the system will switch to the volumetric operation mode.
If the actual flow rate falls below the limit **flow rate min. (0.01% in** DR10) or exceeds the limit **flow rate max. (0,01%** in DR10) related to the **actual** flow rate set point defined in DR 10 **flow rate set point (GE/s o. GE/h)** the operator can specify that the system will switch to the volumetric operation mode.
If the flow rate change exceeds the **Max. flow rate change +/- (0,01%/s** in DR10) related to the nominal flow rate **nominal flow rate (GE/s o. GE/h** in DR6), the operator can specify that the system will switch to the volumetric operation mode.

The limits are related to the nominal flow rate or to the actual set value. They define a tolerance band around the nominal flow rate or the actual set value.

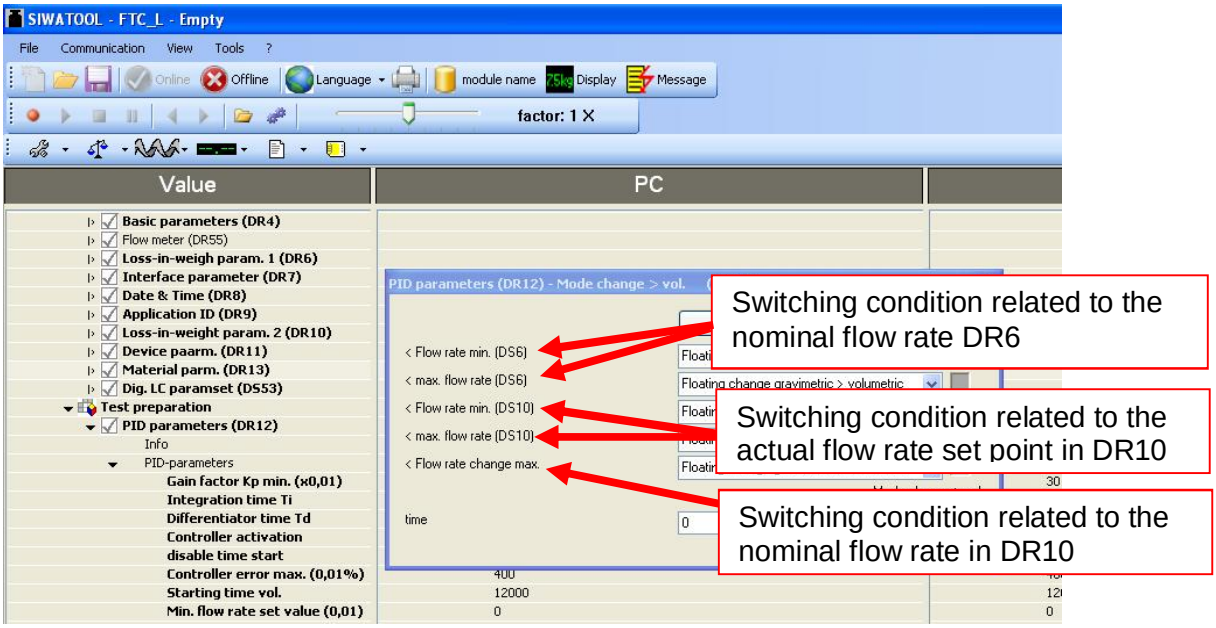
Flow rate min. (0,01%) related the nominal flow rate
Flow rate max. (0,01%) related the nominal flow rate
Flow rate min. (0,01%) related to the actual set point
Flow rate max. (0,01%) related to the actual set point
Max. change of flow rate +/- (0,01%/s)

Example: flow rate set value = 200,0
Flow limit max. (0,01%) of the set value = 1000
Flow limit min. (0,01%) ort he set value = 2000



Switching to the volumetric operation mode can be done in two ways:

1. Freezing the actual analogue output (continuing operation with the actual analogue output value).
2. Picking up the analogue output value related the flow rate set point derived from a combination of the device - and the material characteristic curve table.

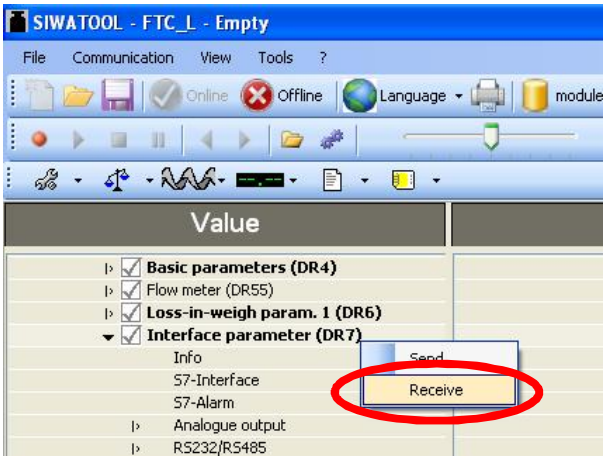


4 Optimizing the system parameters using the trace function

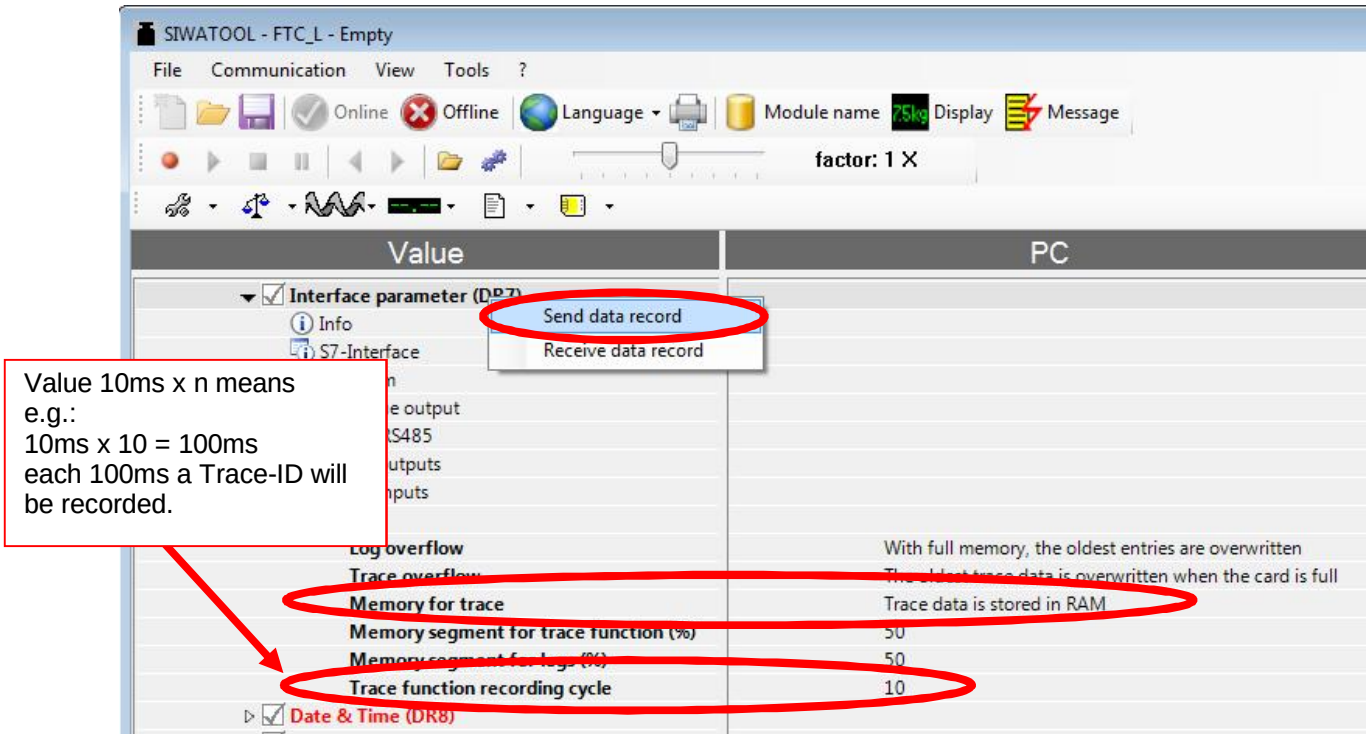
To optimize the parameter set up of the loss-in-weight system, the operator can use the trace–function. In a pre-defined recording cycle this recording function stores the most important weighing and process data inside the internal RAM of the Siwarex module.
In a second step, these data can be exported to Excel.

Preparation of a trace:

Using the Button **Receive** (mouse right-click to “Interface parameter (DR7)”) data (DR7) will be read from the weighing module.



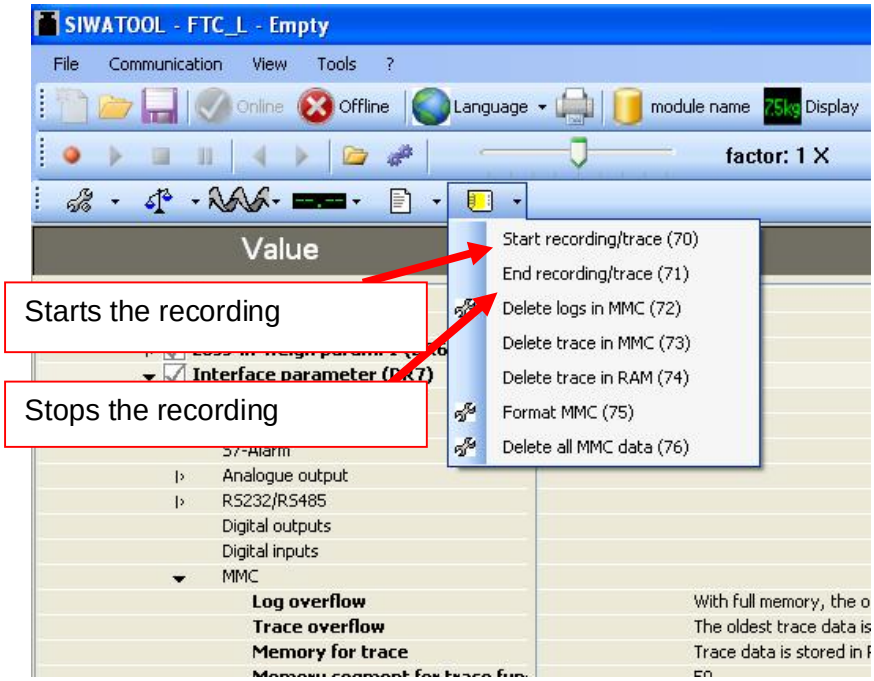
The following parameter settings shall be used:



Using the button **Send** (mouse right-click to “Interface parameter (DR7)”) the data can be sent to the Siwarex module

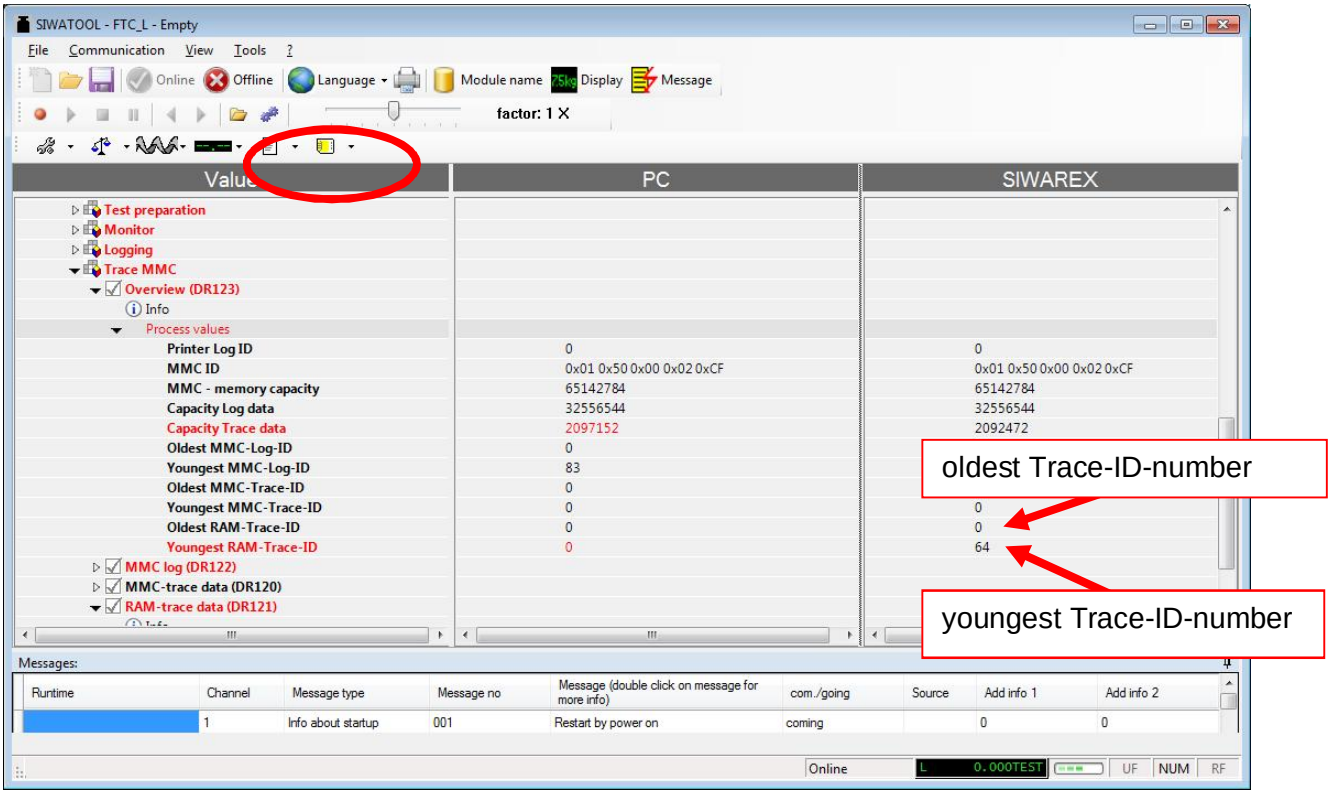
Running the trace:

The Command **Start recording/trace (70)** starts the recording of data .
The command **End recording/trace (71)** stops the recording of data.

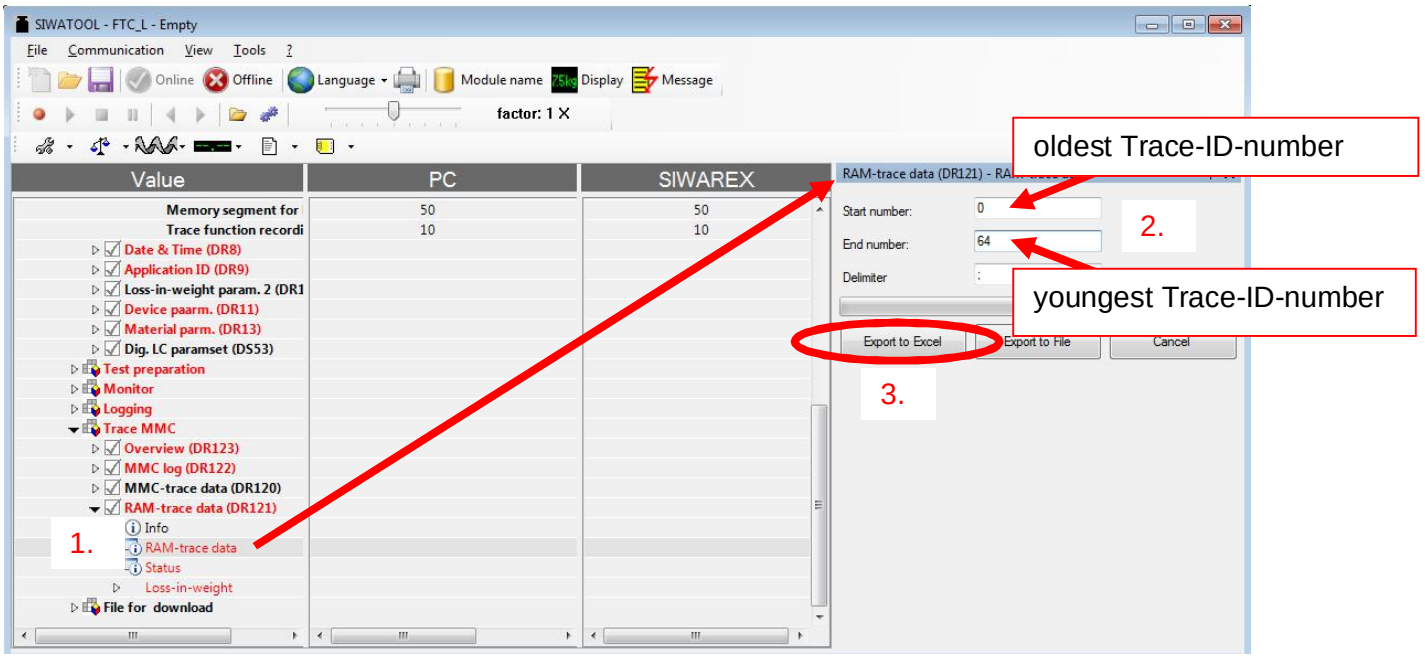


Export of data to Excel (or *.csv-file) :

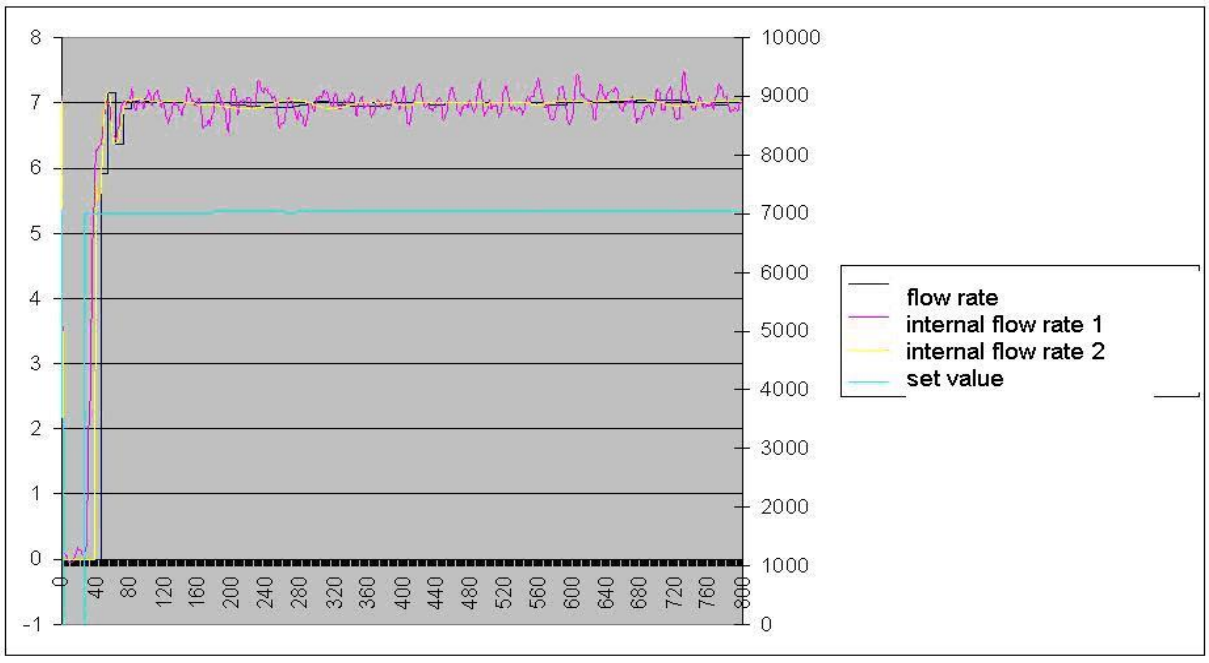
In DR123 the recorded Trace-ID-numbers can be seen.
In the following example there are traces with the ID-numbers „0“ to „64“:



Via DR121 the recorded Trace-data can be exported into Excel (or in a *.csv-file).
Therefore the recorded Trace-ID numbers have to be entered (in the example „0“ and „64“).
Afterwards the button **Export to Excel** has to be pushed.



Then all data can be analyzed with Excel:



If you have any issues or suggestions regarding the related products or documents, please feel free to contact:

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