

Weighing Technology

# QUICK GUIDE SIWAREX FTC\_L

Commissioning with Siwatool V4

V3.3, 08.27.2013

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## **Introduction**

SIWAREX FTC (Flexible Technology for Continuous Weighing) is a versatile and flexible weighing module for conveyor scales, loss-in-weight 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

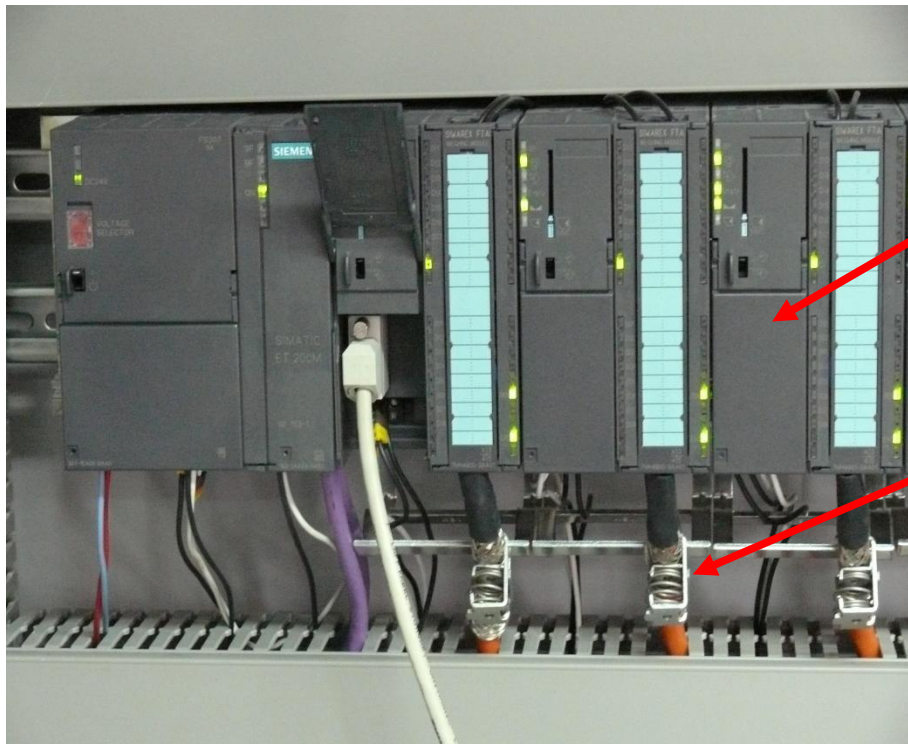


Loss in weight, continuous dosing system



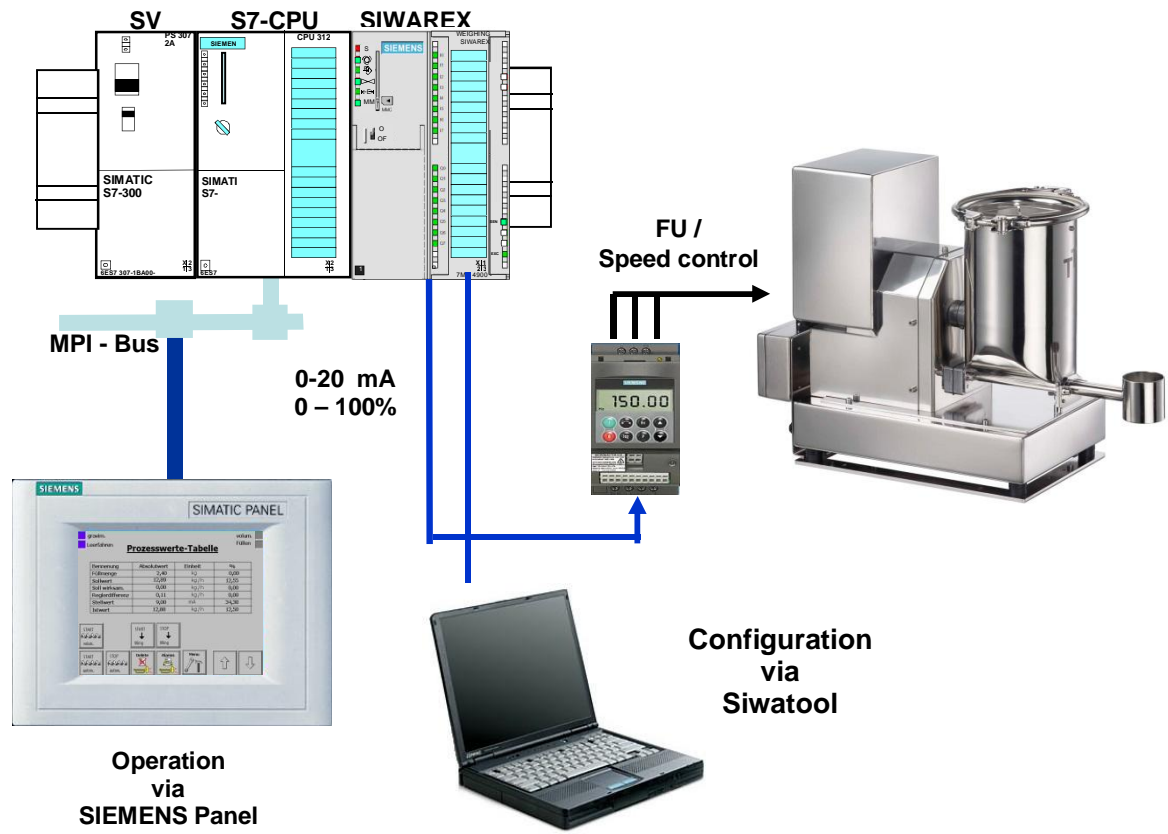
Adjustment weight

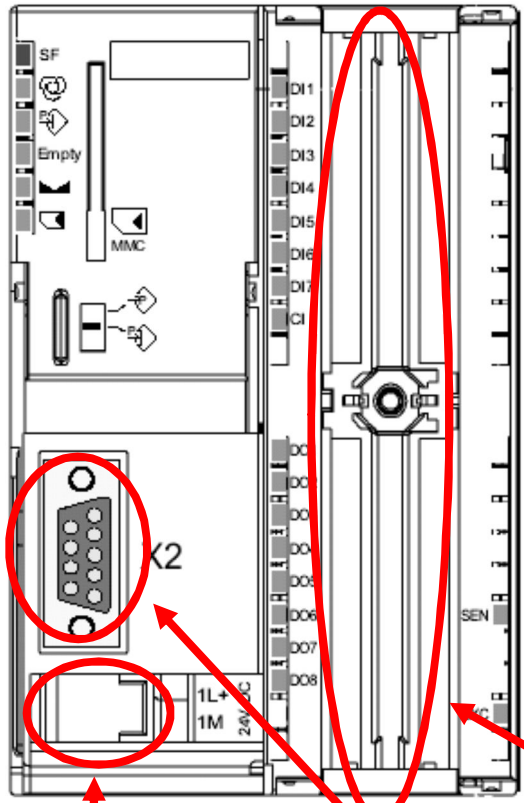
The operating environment shown below includes the following:  
PS207 2A power supply, ET200M Station or CPU3xx, SIWAREX FTC weighing module,  
SIWATOOL cable



SIWAREX FTC module

Load cell cable





	connector pins	
Digital Input 1	1	21 RS 485a
Digital Input 2	2	22 RS 485b
Digital Input 3	3	23 RS 485a'
Digital Input 4	4	24 RS 485b'
Digital Input 5	5	25 RTa
Digital Input 6	6	26 RTb
Digital Input 7	7	
GND for DI	8	
Counter Input +	9	29 Analog output +
Counter Input -	10	30 Analog output -
Digital output 1	11	
Digital output 2	12	
Digital output 3	13	
Digital output 4	14	34
Digital output 5	15	35 Sense +
Digital output 6	16	36 Sense -
Digital output 7	17	37 Signal +
Digital output 8	18	38 Signal -
L+ for DO	19	39 EXC +
GND for DO	20	40 EXC -

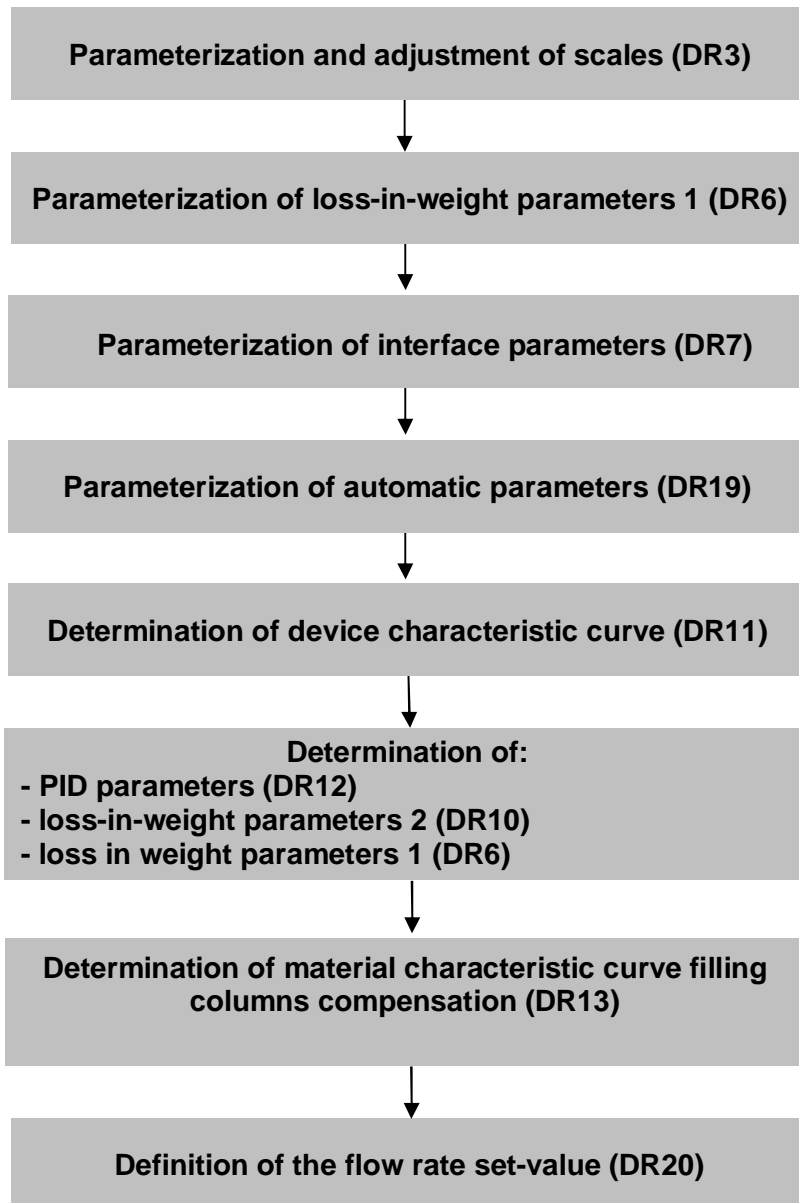
24V Power supply      RS232 interface      Connection terminal of the load cells

**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





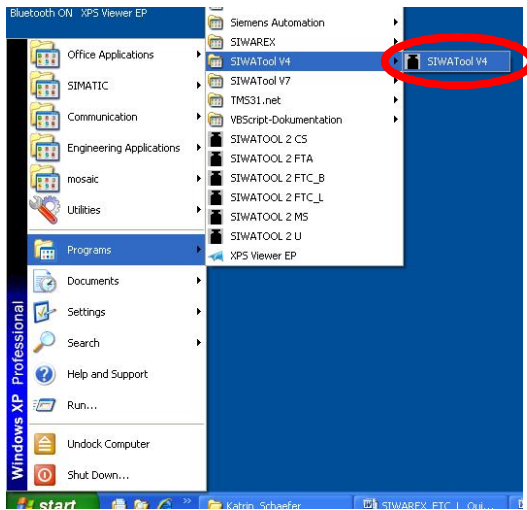
A set-up of various parameters has been installed in the factory. Not all parameters have to be defined during the first commissioning. Only those parameters which have to be defined are mentioned below:

Parameters in DR3 can only be changed when service mode is activated.

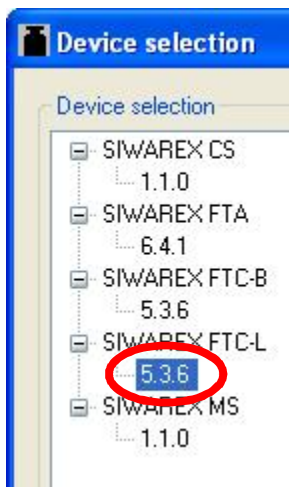
The Send button is used to transfer parameters that have been changed in Siwatool to Siwarex.

The Send and Receive buttons refer to the entire data record and not to a single parameter.

## 2.2 Start SIWATOOL FTC\_L



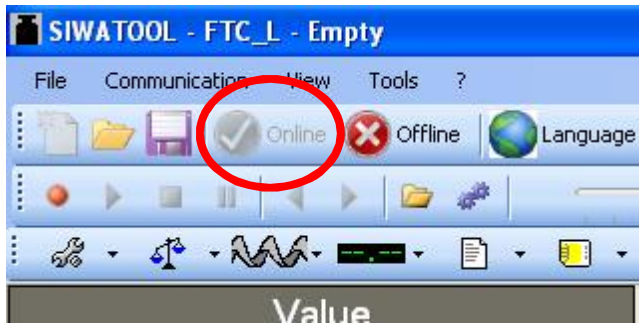
On the SIWATOOL FTC\_L interface, select the desired interface, which should be the COM used on your computer.



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.

The screenshot shows the SIWATOOL - FTC\_L - Empty software interface. The main window is divided into two columns: 'Value' and 'PC'. The 'Value' column contains a tree view of parameters for 'SIWAREX FTC'. The 'PC' column shows the corresponding parameter values. A red box highlights the 'Setting: Loss-in-weight' value in the 'PC' column, with a red arrow pointing to it from the text 'Setting: Loss-in-weight'.

Value	PC
<b>SIWAREX FTC</b>	
<b>Commisioning</b>	
<input checked="" type="checkbox"/> <b>Adjustment parameter (DR3)</b>	
Info	
▶ Adjustment	
▶ Filter	
▶ Calibration param. 1	
<b>Scale name</b>	SIWAREX
<i>Number of weight ranges</i>	1 Range
<i>Scale divisiontype</i>	Multi-range scale (1... 3)
<i>Zero setting upon start-up</i>	Zero setting switched on
<i>Zero setting at start-up</i>	Switch-on zero setting, not when tare
<i>Automatic zeroing</i>	Automatic zeroing off
<b>Operating mode</b>	Loss-in-weight
▶ Calibration param. 2	

All other settings of this register are not relevant!

Value	
SIWAREX FTC	
Commsioning	
<input checked="" type="checkbox"/> Adjustment parameter (DR3)	
Info	
> Adjustment	
> Filter	
> Calibration param. 1	
▼ Calibration param. 2	
<i>Minimum range 1</i>	1.0
<b>Maximum range 1</b>	100.0
<b>Resolution range 1</b>	0.02
<i>Minimum range 2</i>	0.0
<i>Maximum range 2</i>	0.0
<i>Resolution range 2</i>	0.0
<i>Minimum range 3</i>	0.0
<i>Maximum range 3</i>	0.0
<i>Resolution range 3</i>	0.0
> Calibration param. 3	

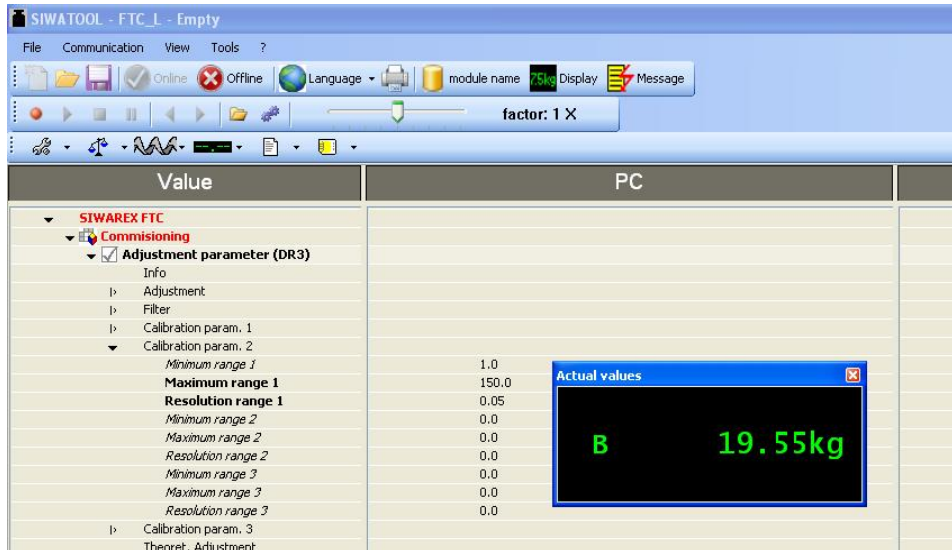
Maximum range 1:  
max. weighing range or  
mass of filling, e.g. 100kg

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

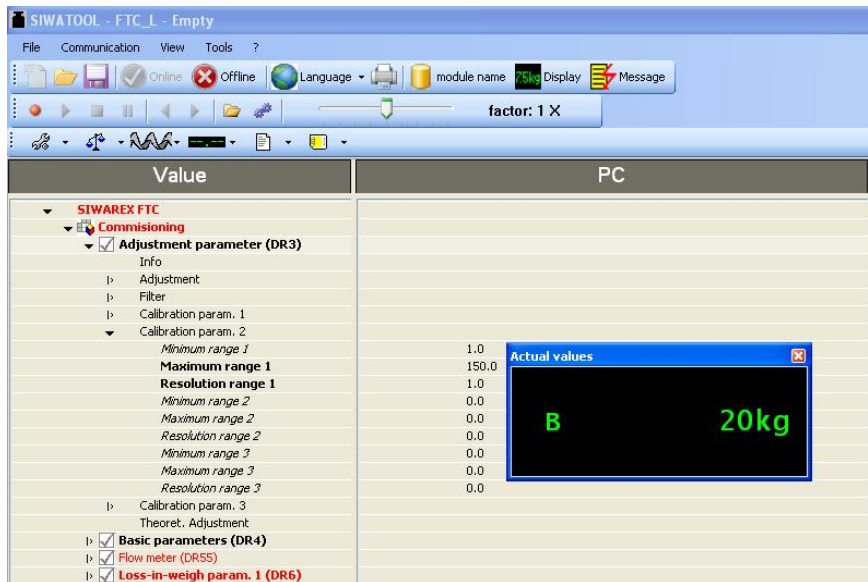
**All other settings of this register are not relevant!**

"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:

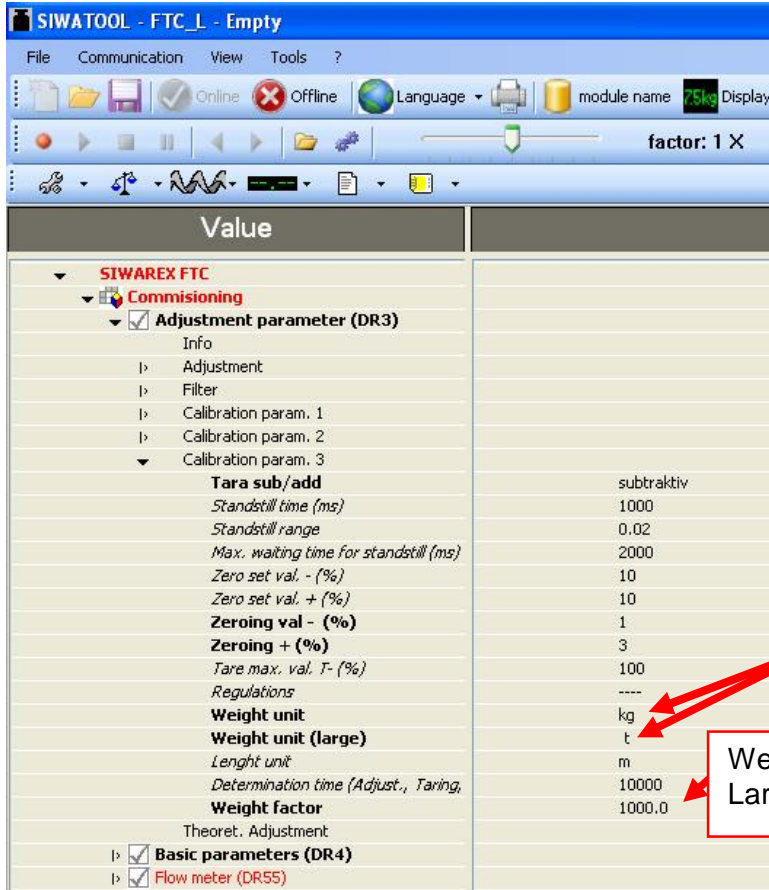


"Resolution range 1" is set to 0.05 kg, so the minimum change is 0.05 kg.



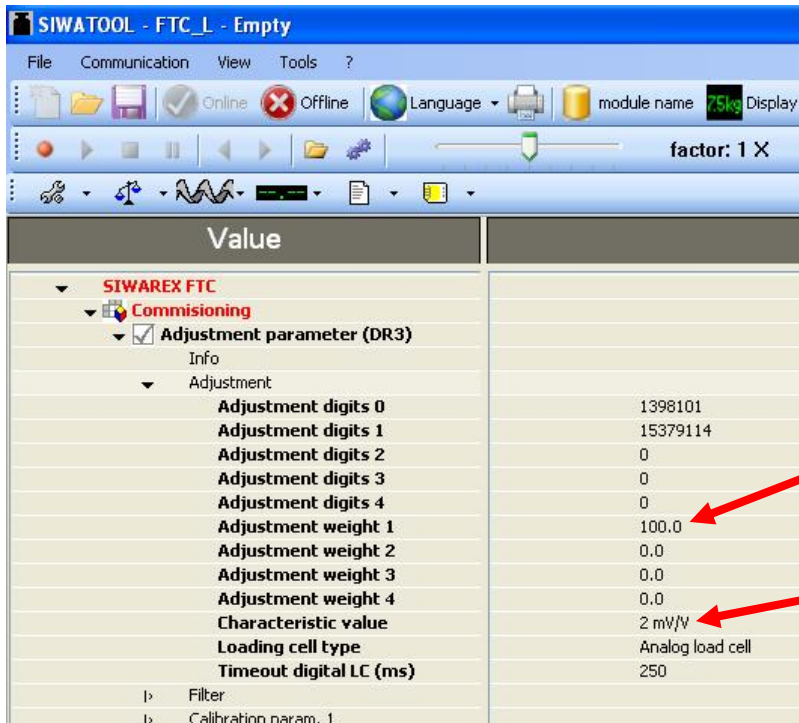
"Resolution range 1" is set to 1.0 kg, so the minimum change is 1 kg.

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"

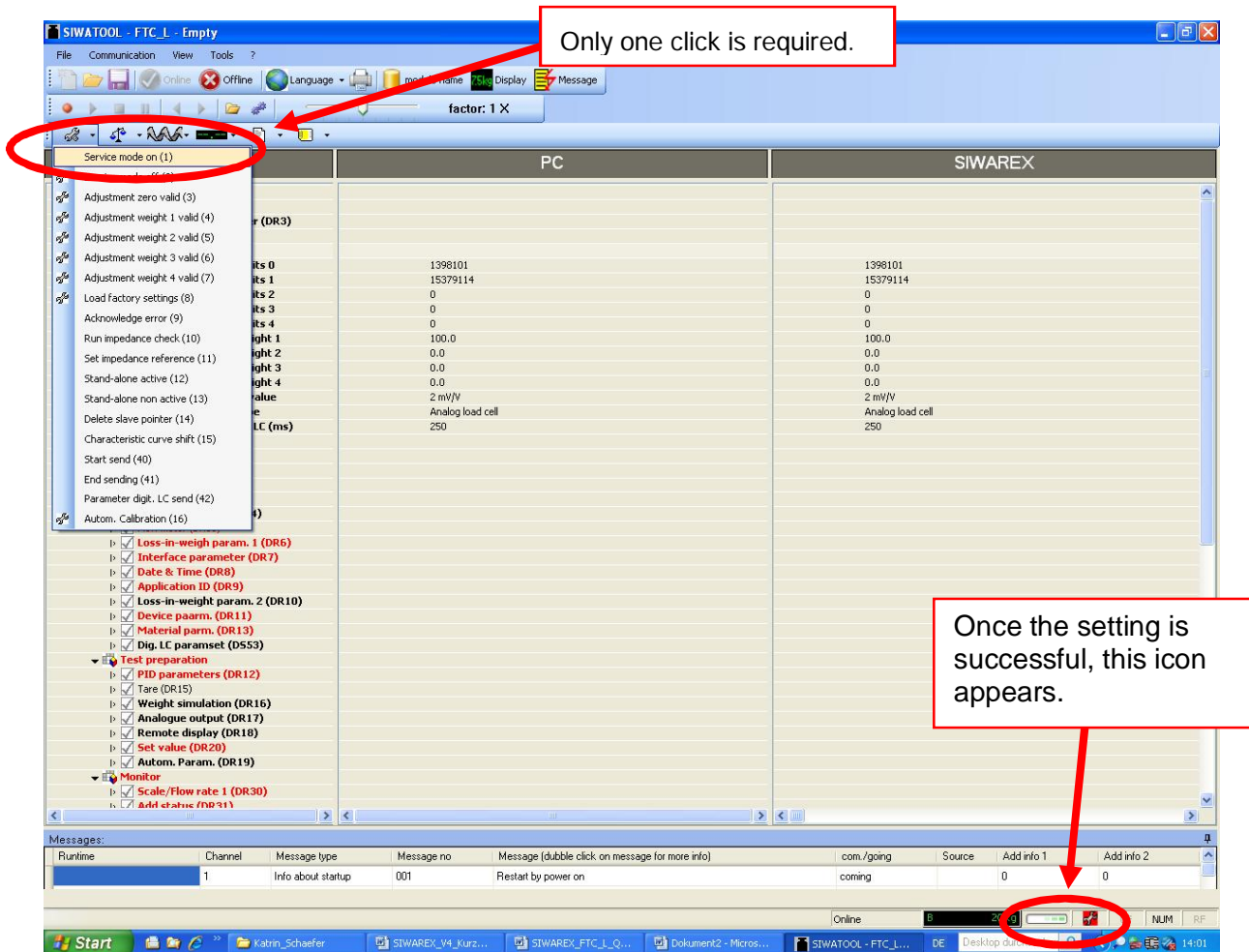
Weight factor:  
Large weight unit= weight unit x weight factor



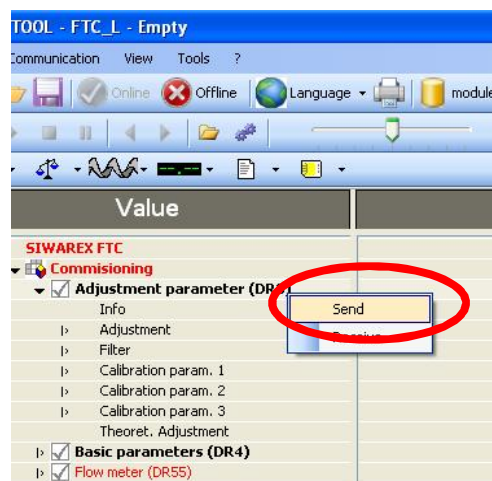
Enter the adjustment weight (e.g. "100.0") as "Reference 1"

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.

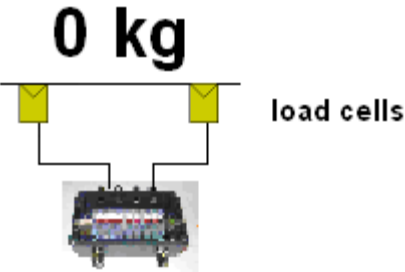
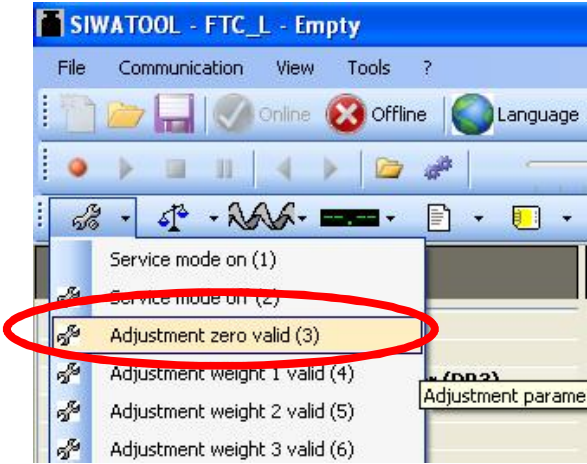


Afterwards click **Send** (mouse right-click to "Adjustment parameter (DR3)") so that the DR3 is sent to the FTC module.

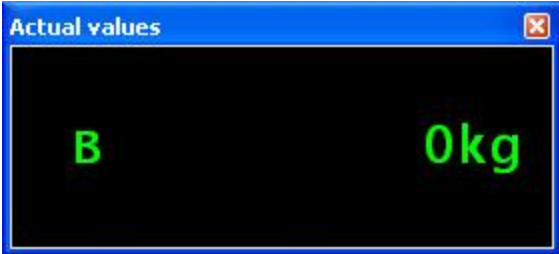




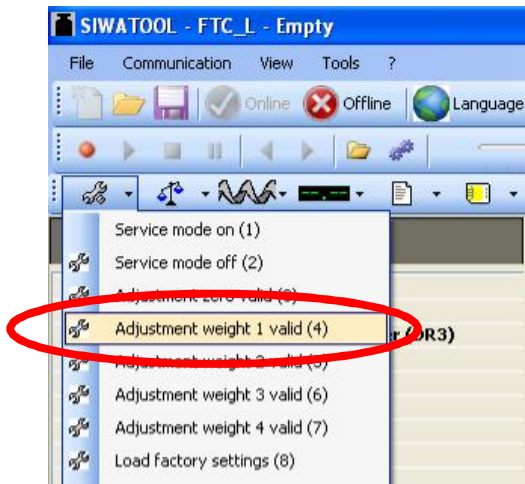
Ensure that the scale is empty (not loaded) and click **Adjustment zero valid (3)**.



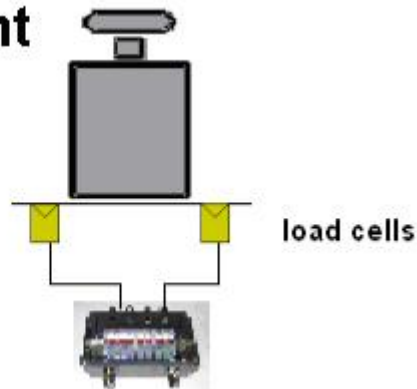
After that the displayed value is as follows:



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



**Adjustment weight**

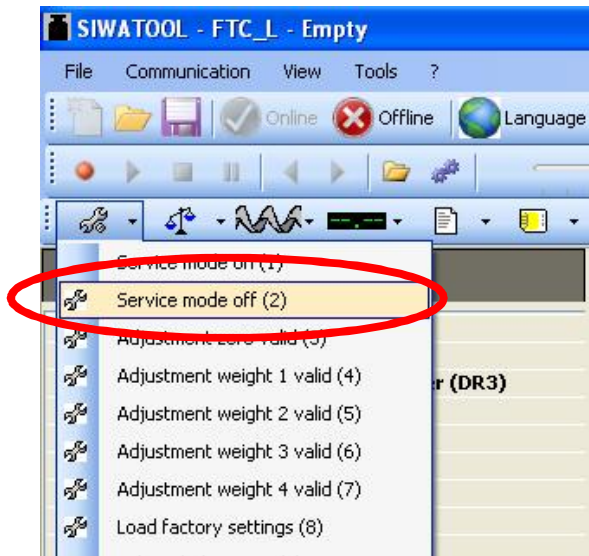


The weight becomes the adjustment weight (e.g. 150kg) and the adjustment is complete.



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)

Value	
SIWAREX FTC	
Comissioning	
<input checked="" type="checkbox"/> Adjustment parameter (DR3)	
<input checked="" type="checkbox"/> Basic parameters (DR4)	
<input checked="" type="checkbox"/> Flow meter (DR55)	
<input checked="" type="checkbox"/> Loss-in-weigh param. 1 (DR6)	
Info	
Parameters	
Time unit (sec. or h)	h
Standard filling weight	10.0
Standard flow value	10.0
display time (flow)	1000
Flow rate correction factor	1.0
Min. flow limit (0,01%)	2000
Max. flow limit (0,01%)	12500
flow stability time	3000

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.

Value	
SIWAREX FTC	
Comissioning	
<input checked="" type="checkbox"/> Adjustment parameter (DR3)	
<input checked="" type="checkbox"/> Basic parameters (DR4)	
<input checked="" type="checkbox"/> Flow meter (DR55)	
<input checked="" type="checkbox"/> Loss-in-weigh param. 1 (DR6)	
Info	
Parameters	
Time unit (sec. or h)	h
Standard filling weight	1
Standard flow value	1
display time (flow)	1

## 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.

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

Value	PC
<b>SIWAREX FTC</b>	
<b>Commissioning</b>	
Adjustment parameter (DR3)	
Basic parameters (DR4)	
Flow meter (DR55)	
Loss-in-weigh param. 1 (DR6)	
<b>Interface parameter (DR7)</b>	
Info	
S7-Interface	
S7-Alarm	
Analogue output	
Process value for 0/4 mA	0.0
Process value for 20 mA	100.0
Replacement value for analogue	0.0
Source for the analogue output	PID-control output#7
Current range for the analogue	0 .. 20 mA
RS232/RS485	
Digital outputs	
Digital inputs	
MMC	
Date & Time (DR8)	
Application ID (DR9)	

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“

The screenshot shows the SIWATOOL interface with a tree view on the left and a parameter configuration window on the right. The tree view includes 'SIWAREX FTC' and 'Commissioning' with sub-items like 'Adjustment parameter (DR3)', 'Basic parameters (DR4)', 'Flow meter (DR55)', 'Loss-in-weigh param. 1 (DR6)', and 'Interface parameter (DR7)'. The 'Interface parameter (DR7)' window is open, showing a table of digital outputs. The first row is 'Dosing on' and the second row is 'Filling'. Red arrows point from text boxes to these two entries.

Definition of digital output	Value
Definition of digital output 1	Dosing on
Definition of digital output 2	Filling
Definition of digital output 3	Output not active (FF)
Definition of digital output 4	Output not active (FF)
Definition of digital output 5	Output not active (FF)
Definition of digital output 6	Output not active (FF)
Definition of digital output 7	Output not active (FF)
Definition of digital output 8	Output not active (FF)

This output is set when the dosing (vol. or grav.) is active.

This digital output is set when the filling mode is active.

**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.

The screenshot shows the SIWATOOL interface with the 'Interface parameter (DR7)' selected in the tree view. A context menu is open over the selected item, showing 'Send' and 'Receive' options. The 'Send' option is circled in red.

## 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):

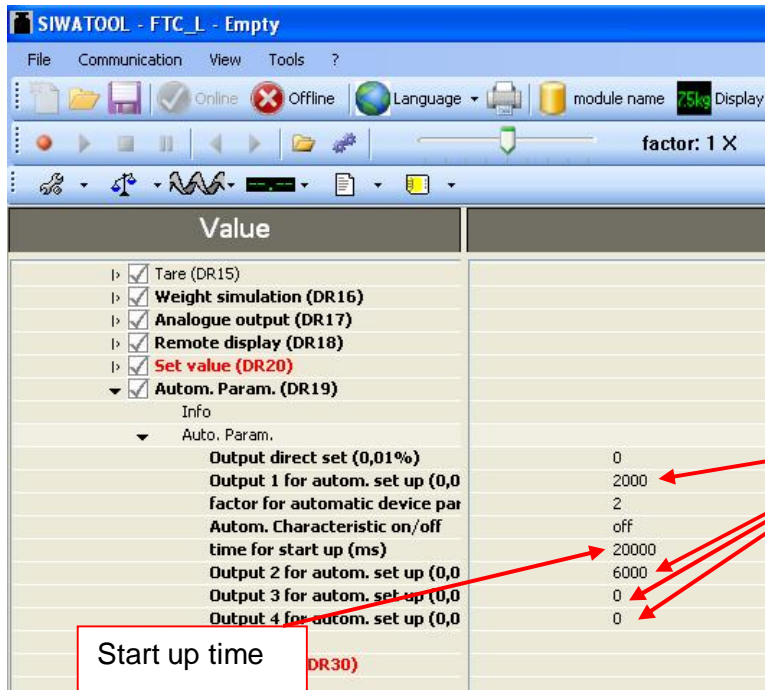
**time for start-up (ms) = 20000**

**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**



Start up time

4 output values (0.01%) can be defined (increasing)



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 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 automat. set up (0,01%)“	Act. current (Range x output value in %)	Start-up current for the current range	<b>Current at analogue output</b>
0 .. 20 mA	20 mA	20%	4 mA	0 mA	<b>4 mA</b>
4 .. 20 mA	16 mA	20%	3.2 mA	4 mA	<b>7.2 mA</b>

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 automat. set up (0,01%)“	Act. current (range x output value in %)	Start-up current for the current range	<b>Current at analogue output</b>
0 .. 20 mA	20 mA	60%	12 mA	0 mA	<b>12 mA</b>
4 .. 20 mA	16 mA	60%	9.6 mA	4 mA	<b>13.6 mA</b>

3. The output values **Output 3 for automat. set up (0,01%)** and **Output 4 for automat. 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.

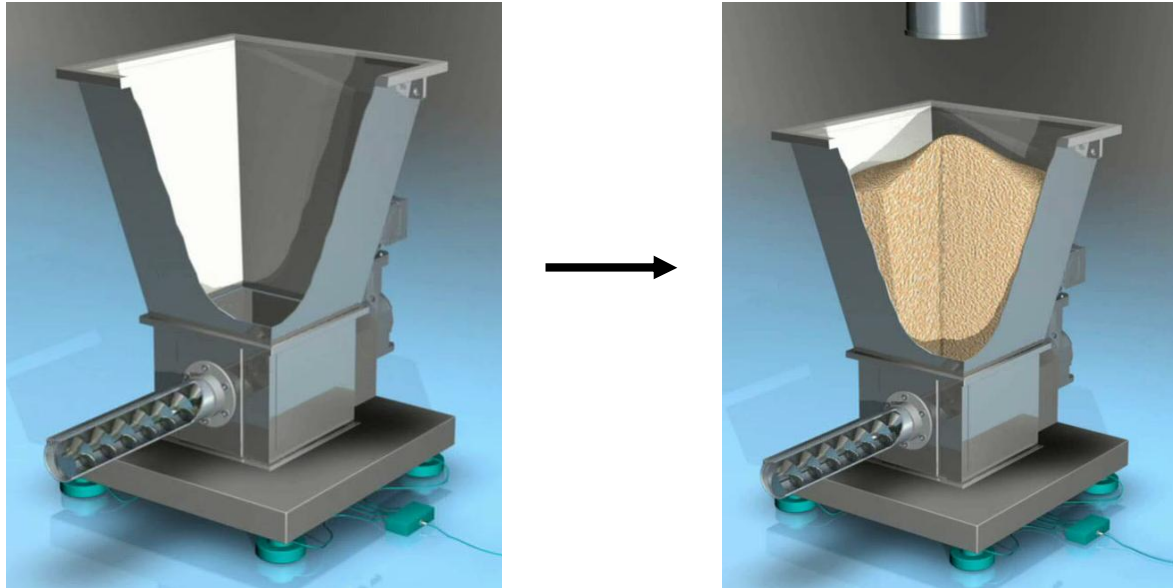
Value	PC
▶ <input checked="" type="checkbox"/> Basic parameters (DR4)	
▶ <input checked="" type="checkbox"/> Flow meter (DR55)	
▶ <input checked="" type="checkbox"/> Loss-in-weigh param. 1 (DR6)	
▶ <input checked="" type="checkbox"/> Interface parameter (DR7)	
▶ <input checked="" type="checkbox"/> Date & Time (DR8)	
▶ <input checked="" type="checkbox"/> Application ID (DR9)	
▶ <input checked="" type="checkbox"/> Loss-in-weight param. 2 (DR10)	
▼ <input checked="" type="checkbox"/> Device paarm. (DR11)	
Info	
▼ Device characteristic	
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
▶ <input checked="" type="checkbox"/> Material parm. (DR13)	

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 refilling in DR 6)



SIWATOOL - FTC\_L - Empty

File Communication View Tools ?

Language Module name 75kg Display Message

Faktor: 1 X

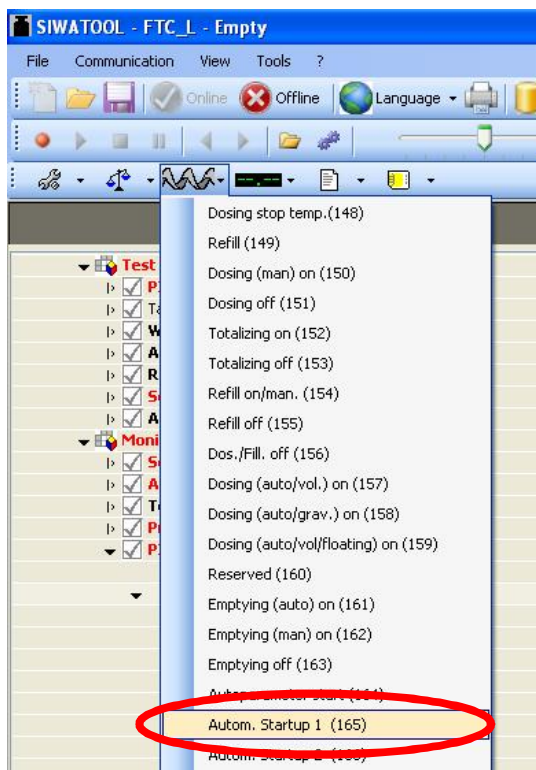
Value	PC	SIWAREX
SIWAREX FTC		
Comissioning		
Test preparation		
Monitor		
Scale/Flow rate 1 (DR30)		
Add status (DR31)		
Totalizing (DR33)		
Process status int. 1 (DR26)		
PID status (DR36)		
Info		
PID process		
Actual set value	5.0	5.0
Real set value	0.0	0.0
Flow rate 2	0.0	0.0
Actual PID-error	0.0	0.0
Actual output current	0.0	0.0
Act set val (0,01%)	5000	
Act. flow rate 2 (0,01%)	0	
Act. PID-error (0,01% of set val.)	0	
Act. PID-out val. (0,01%)	0	
Act. out val. corr. 1 (0,01%)	0	
Act. out val. deviation (0,01%)	0	
Actual fill level (0,01%)	8620	8620
Actual out	0.0	0.0
Quality (DR37)		

Monitoring of the actual filling level

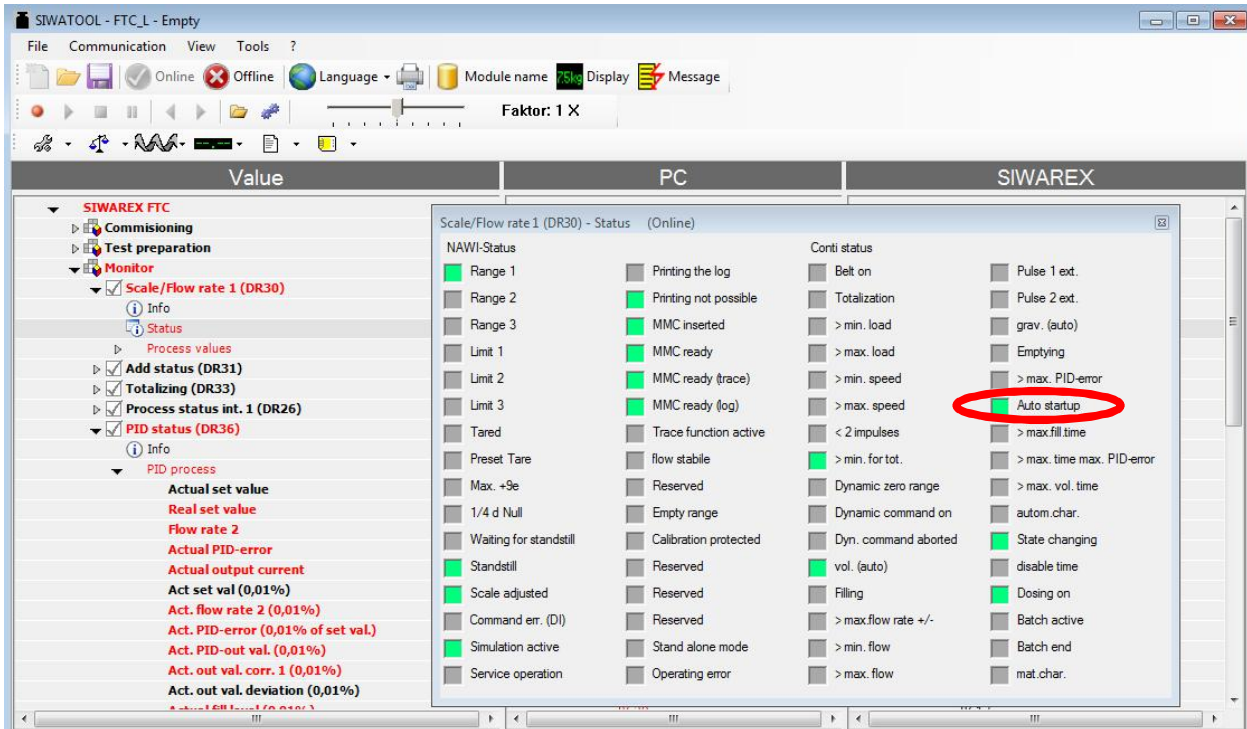
2. The screw device is filled with material.



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



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



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
<b>SIWAREX FTC</b>	
Comissioning	
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 character	
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
<b>SIWAREX FTC</b>		
Comissioning		
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 characteristic		
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)		

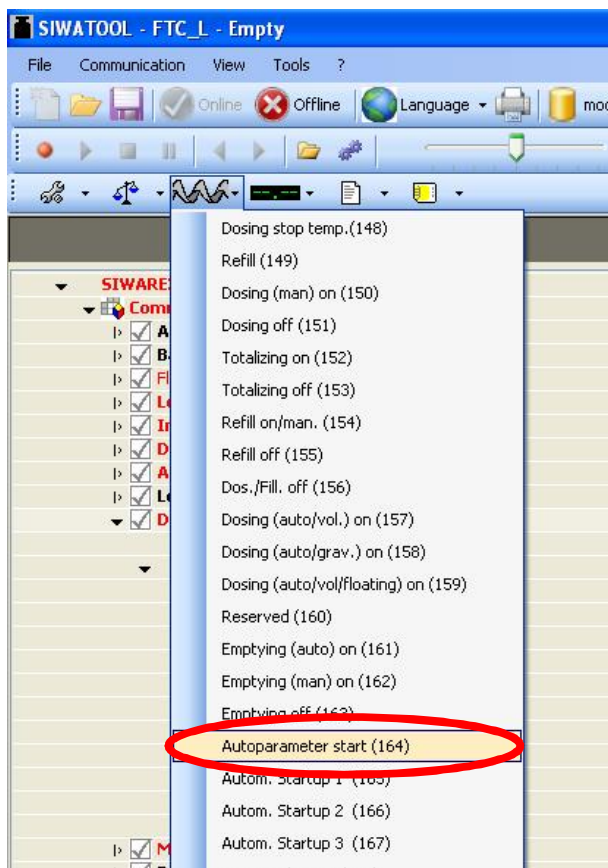
## 2.8 Determination of PID parameters (DR12)

During the execution of command **Autoparameter start (164)** the following parameters will be automatically calculated:

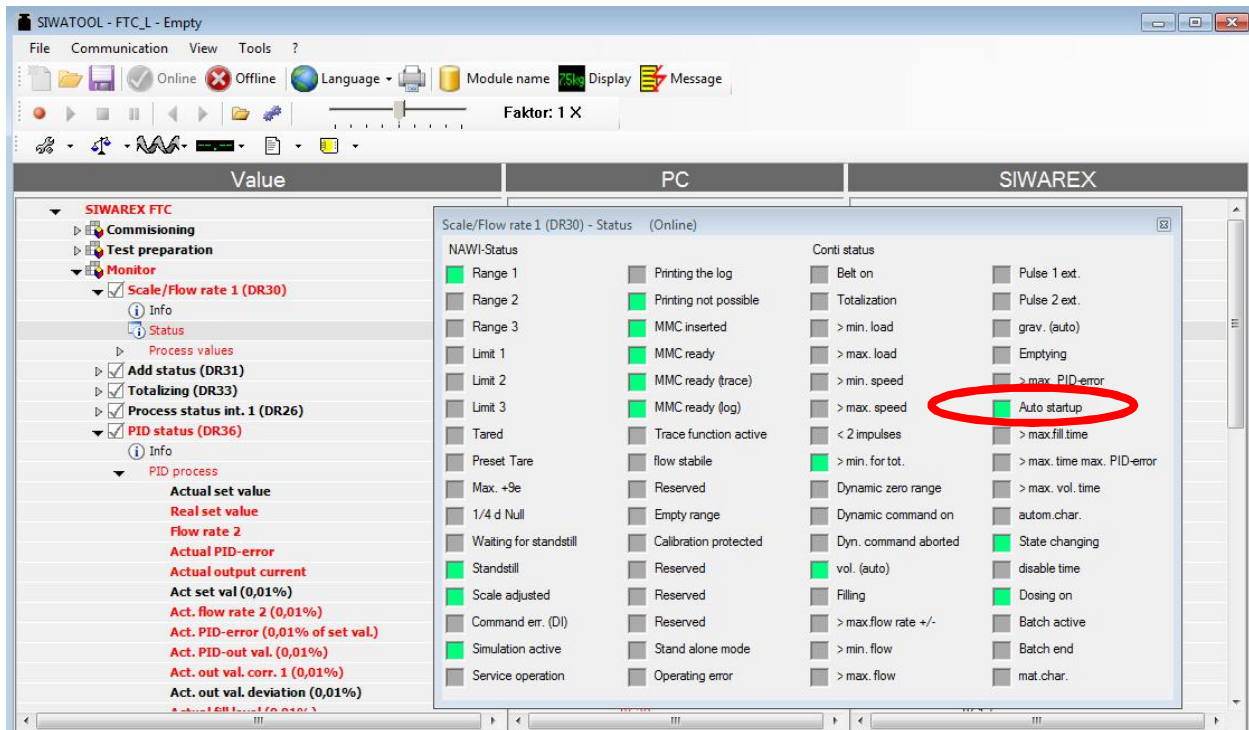
- PID-parameters (DS12)
- Flow rate parameters (DS10)
- Criteria for stability (DS6)

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 active.





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:

The screenshot shows the SIWATOOL - FTC\_L - Empty software interface. The main window displays a tree view of parameters under 'SIWAREX FTC' > 'Commissioning' > 'Loss-in-weigh param. 1 (DR6)'. The 'Parameters' section is expanded, showing a list of parameters and their values. Two parameters are circled in red: 'flow stability time' with a value of 3000, and 'stability weight' with a value of 0.05.

Parameter	Value
Time unit (sec. or h)	h
Standard filling weight	10.0
Standard flow value	10.0
display time (flow)	1000
Flow rate correction factor	1.0
Min. flow limit (0,01%)	2000
Max. flow limit (0,01%)	12500
flow stability time	3000
Start refilling by (0,01%)	3000
End refilling by (0,01%)	9000
settling time	5000
Filling time	0
Filling monitoring time	0
Disable time	0
Resolution display	0.1
after max. filling time	Continue filling
stability weight	0.05
filtering for display	filter 0,5
after max. filling time	Dosing continue
Output by filling	correction
display by filling	Set value

DR10:

SIWATOOL - FTC\_L - Empty

File Communication View Tools ?

Online Offline Language module name 75kg Display Mess

factor: 1 X

Value	PC
<b>SIWAREX FTC</b>	
<b>Commissioning</b>	
<input checked="" type="checkbox"/> Adjustment parameter (DR3)	
<input checked="" type="checkbox"/> Basic parameters (DR4)	
<input checked="" type="checkbox"/> Flow meter (DR55)	
<input checked="" type="checkbox"/> Loss-in-weigh param. 1 (DR6)	
<input checked="" type="checkbox"/> Interface parameter (DR7)	
<input checked="" type="checkbox"/> Date & Time (DR8)	
<input checked="" type="checkbox"/> Application ID (DR9)	
<input checked="" type="checkbox"/> Loss-in-weight param. 2 (DR10)	
Info	
Flow rate	
Internal Cut-off freq. 1	fg = 0.5 Hz
type internal filter 1	critically damped
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. flow rate change +/- (0,0	0
after vol. switch off	no
min. vol. time	5000
Error tolerance time (ms)	7500
type internal filter 2	critically damped
Off after tolerance time	no
<input checked="" type="checkbox"/> Device param. (DR11)	

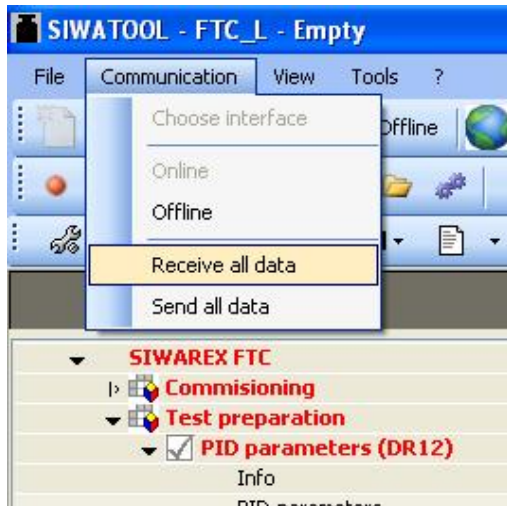
DR12:

The screenshot shows the SIWATOOL - FTC\_L - Empty software interface. The main window displays a tree view on the left and a parameter table on the right. The tree view is expanded to show 'PID parameters (DR12)'. The parameter table lists various PID parameters and their values. Three parameters are circled in red: 'Gain factor Kp min. (x0,01)' with a value of 30, 'Integration time Ti' with a value of 20000, and 'Gain factor Kp max. (x0,01)' with a value of 70. Other parameters include '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), 'Dosing after max. err. Max. tim' (not deactivate), and 'deactivate material. char.' (not deactivate). The interface also shows a menu bar with 'File', 'Communication', 'View', and 'Tools', and a toolbar with various icons. The status bar at the bottom indicates 'factor: 1 X'.

Parameter	Value
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

PLEASE NOTE:

If the data records, 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**.



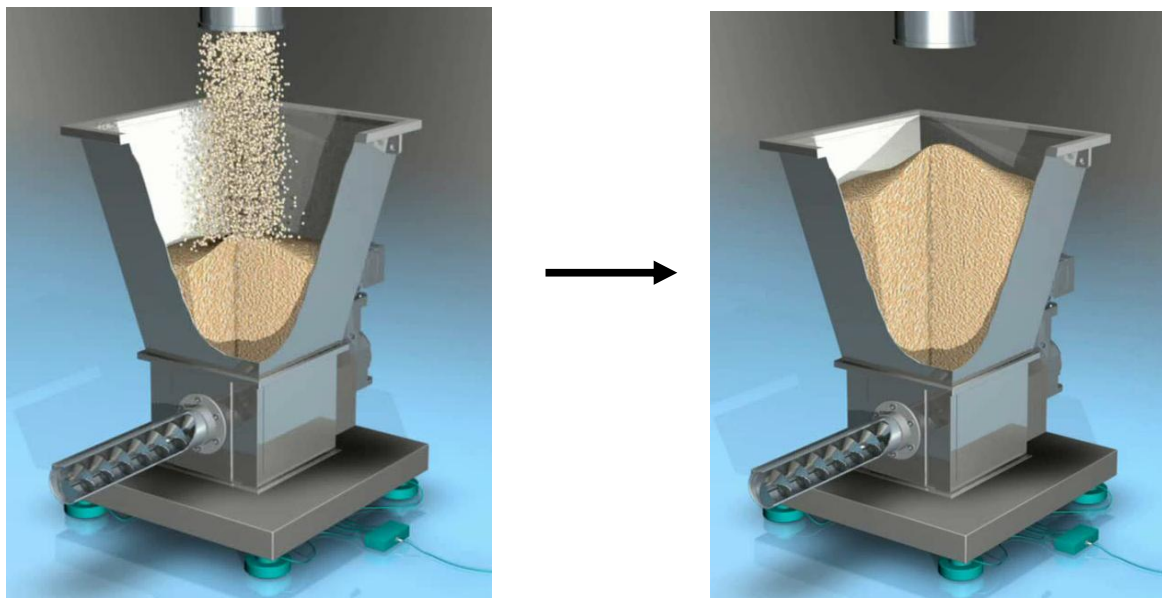
After receiving all data to the Siwatool software, the parameter settings into Siwatool are conform again to the parameter settings into the Siwarex FTC module.

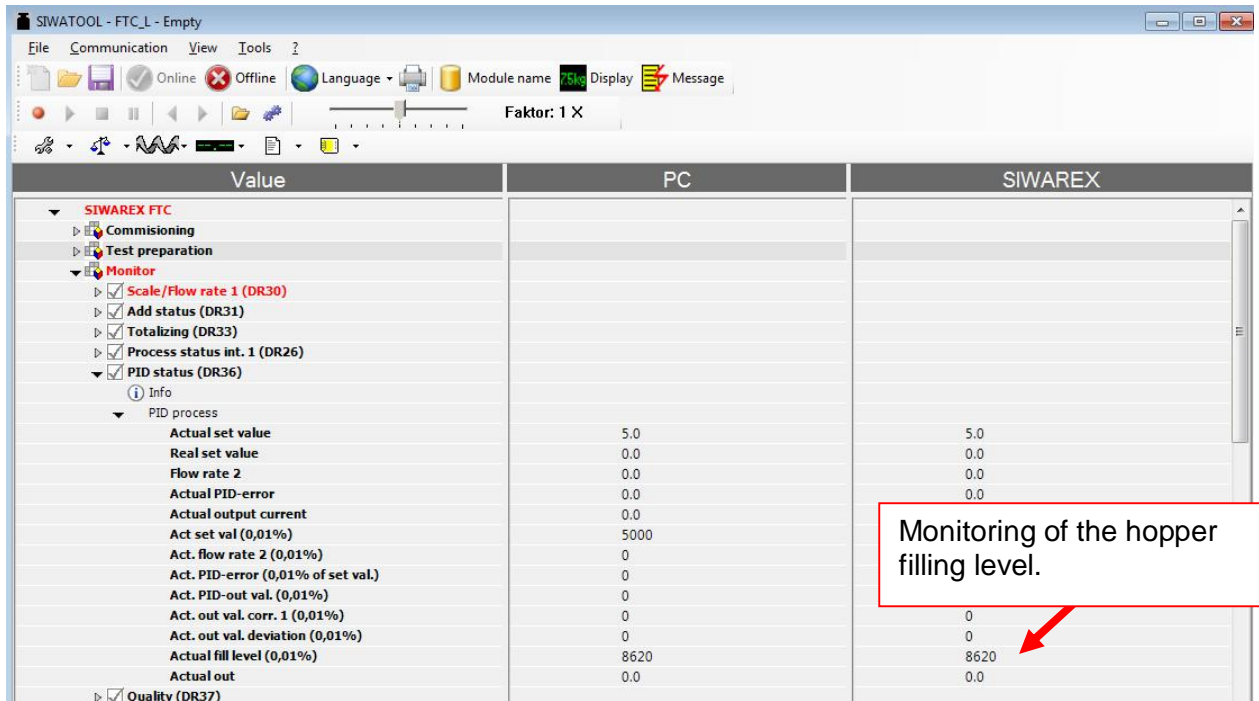
## 2.9 Determination of material characteristic curve (DR13)

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:

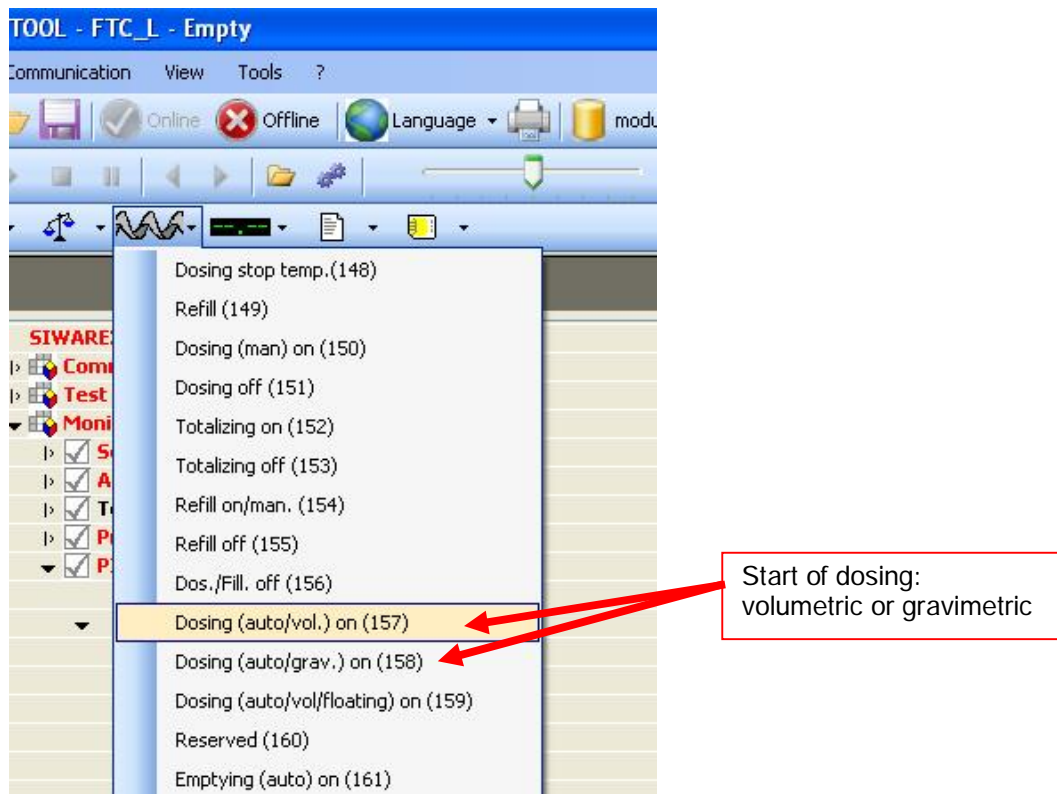
1. The hopper will be filled to at least to 90% of the standard filling weight:





Value	PC	SIWAREX
<b>SIWAREX FTC</b>		
Comisioning		
Test preparation		
Monitor		
Scale/Flow rate 1 (DR30)		
Add status (DR31)		
Totalizing (DR33)		
Process status int. 1 (DR26)		
PID status (DR36)		
Info		
PID process		
Actual set value	5.0	5.0
Real set value	0.0	0.0
Flow rate 2	0.0	0.0
Actual PID-error	0.0	0.0
Actual output current	0.0	0.0
Act set val (0,01%)	5000	
Act. flow rate 2 (0,01%)	0	
Act. PID-error (0,01% of set val.)	0	
Act. PID-out val. (0,01%)	0	
Act. out val. corr. 1 (0,01%)	0	
Act. out val. deviation (0,01%)	0	
Actual fill level (0,01%)	8620	8620
Actual out	0.0	0.0
Quality (DR37)		

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



TOOL - FTC\_L - Empty

Communication View Tools ?

Online Offline Language modu

Factor: 1 X

SIWAREX

Comi

Test

Moni

Scale/Flow rate 1 (DR30)

Add status (DR31)

Totalizing (DR33)

Process status int. 1 (DR26)

PID status (DR36)

Info

PID process

Dosing stop temp.(148)

Refill (149)

Dosing (man) on (150)

Dosing off (151)

Totalizing on (152)

Totalizing off (153)

Refill on/man. (154)

Refill off (155)

Dos./Fill. off (156)

Dosing (auto/vol.) on (157)

Dosing (auto/grav.) on (158)

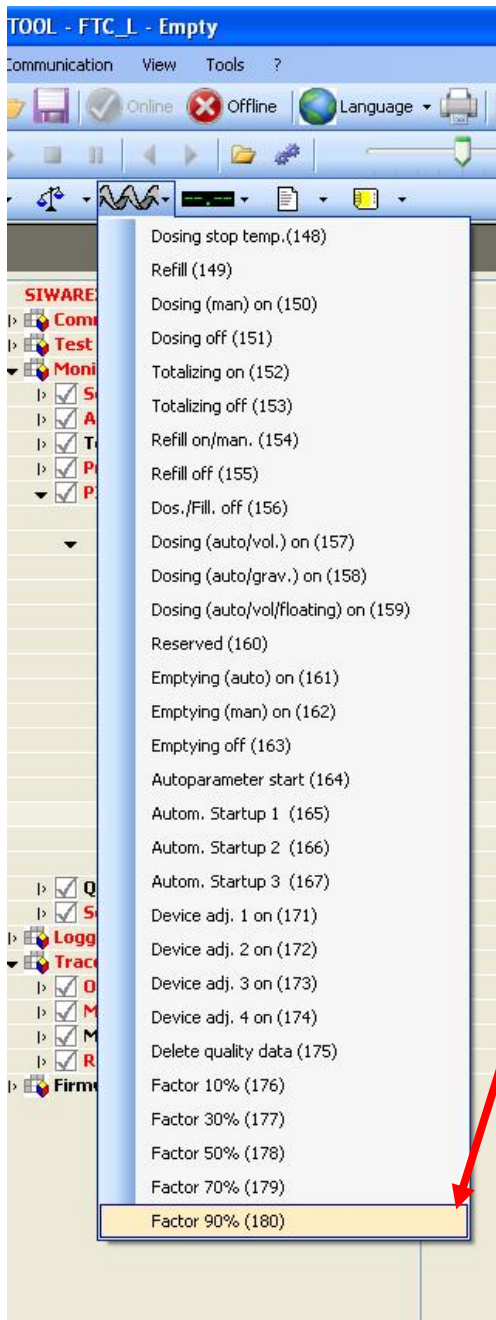
Dosing (auto/vol/floating) on (159)

Reserved (160)

Emptying (auto) on (161)

Start of dosing:  
volumetric or gravimetric

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



At 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.

Value	PC
<b>SIWAREX FTC</b>	
<b>Commisioning</b>	
<input checked="" type="checkbox"/> Adjustment parameter (DR3)	
<input checked="" type="checkbox"/> Basic parameters (DR4)	
<input checked="" type="checkbox"/> Flow meter (DR55)	
<input checked="" type="checkbox"/> Loss-in-weigh param. 1 (DR6)	
<input checked="" type="checkbox"/> Interface parameter (DR7)	
<input checked="" type="checkbox"/> Date & Time (DR8)	
<input checked="" type="checkbox"/> Application ID (DR9)	
<input checked="" type="checkbox"/> Loss-in-weight param. 2 (DR10)	
<input checked="" type="checkbox"/> Device paarm. (DR11)	
<input checked="" type="checkbox"/> Material parm. (DR13)	
Info	
Characteristic param.	
Reserved	0.0
Factor by 10 %	10000
Factor by 30 %	10000
Factor by 50 %	10000
Factor by 70 %	10000
Factor by 90 %	10000
<input checked="" type="checkbox"/> Dig. LC paramset (DR12)	
<b>Test preparation</b>	



## 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:

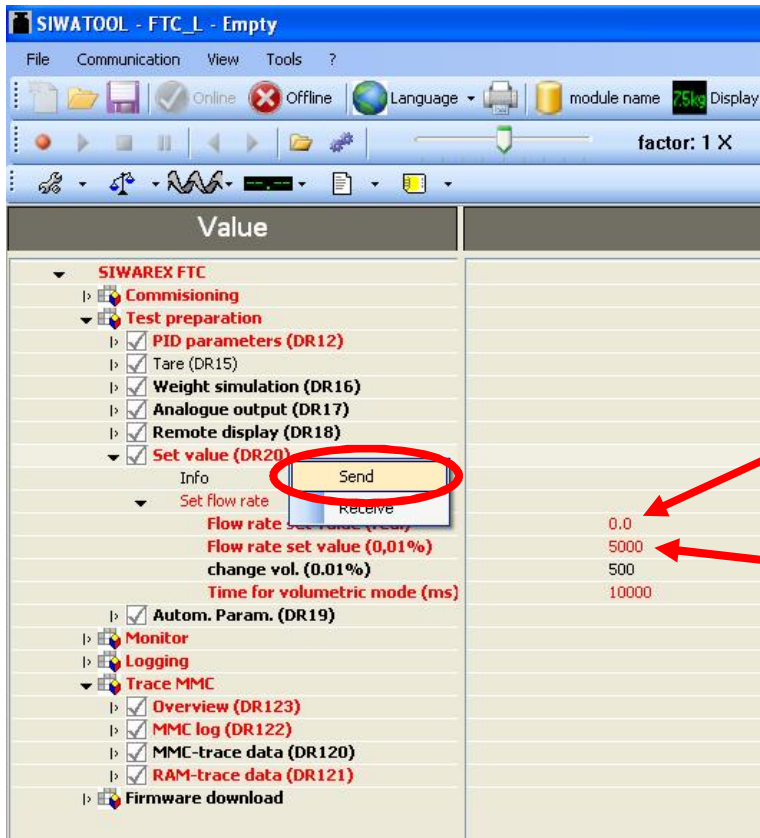
Quantity per time unit *or*:  
%- value of the nominal flow rate

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:

The screenshot shows the SIWATOOL - FTC\_L - Empty software interface. The main window displays a tree view of parameters under 'SIWAREX FTC' > 'Commisioning'. The 'Loss-in-weigh param. 1 (DR6)' is expanded to show its 'Parameters' section. The 'Time unit (sec. or h)' is set to 'h' and the 'Standard flow value' is set to '10.0'. Two red arrows point from text boxes to these values: one from 'Time unit' to 'h' and one from 'Nominal flow rate' to '10.0'.

Parameter	Value
Time unit (sec. or h)	h
Standard filling weight	10.0
Standard flow value	10.0
display time (flow)	1000
Flow rate correction factor	1.0
Min. flow limit (0,01%)	2000
Max. flow limit (0,01%)	12500
Flow stability time	2000

## 2.11 Save the calibration data's into a file

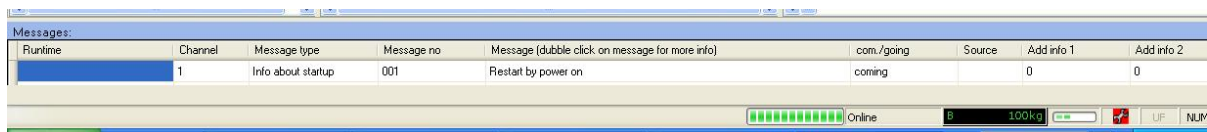
Transfer all data from the SIWAREX FTC to the PC.



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

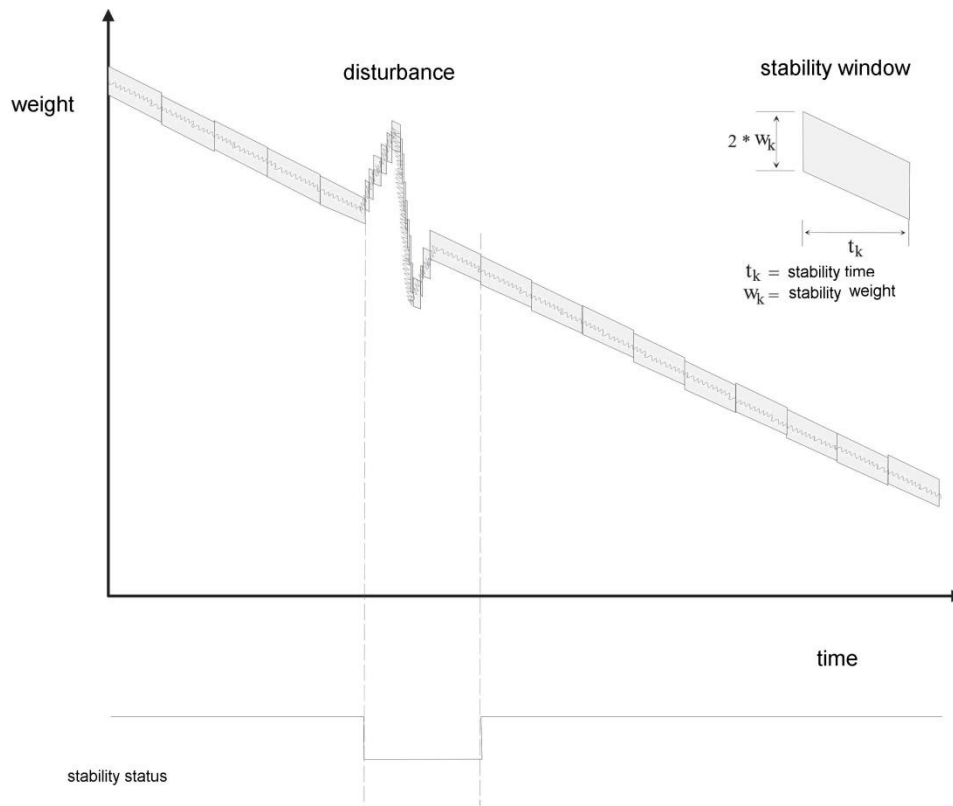
In case of violation of the stability criteria over a certain time period the Siwarex FTC module switches to the volumetric mode. The monitoring of the stability criteria is done as described below:

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.

Scale/Flow rate 2 (DR32) - Status (Online)

NAWI-Status		Conti status	
<input checked="" type="checkbox"/> Range 1	<input type="checkbox"/> Printing the log	<input type="checkbox"/> Belt on	<input type="checkbox"/> Pulse 1 ext.
<input type="checkbox"/> Range 2	<input checked="" type="checkbox"/> Printing not possible	<input type="checkbox"/> Totalization	<input type="checkbox"/> Pulse 2 ext.
<input type="checkbox"/> Range 3	<input type="checkbox"/> MMC inserted	<input type="checkbox"/> > min. load	<input type="checkbox"/> grav. (auto)
<input type="checkbox"/> Limit 1	<input type="checkbox"/> MMC ready	<input type="checkbox"/> > max. load	<input type="checkbox"/> Emptying
<input checked="" type="checkbox"/> Limit 2	<input type="checkbox"/> MMC ready (trace)	<input type="checkbox"/> > min. speed	<input type="checkbox"/> > max. PID-error
<input checked="" type="checkbox"/> Limit 3	<input type="checkbox"/> MMC ready (log)	<input type="checkbox"/> > max. speed	<input type="checkbox"/> Auto startup
<input type="checkbox"/> Tared	<input type="checkbox"/> Trace function active	<input type="checkbox"/> < 2 impulses	<input type="checkbox"/> > max. fill. time
<input type="checkbox"/> Preset Tare	<input checked="" type="checkbox"/> flow stabile	<input type="checkbox"/> > min. for tot.	<input type="checkbox"/> > max. time max. PID-
<input type="checkbox"/> Max. +9e	<input type="checkbox"/> Reserved	<input type="checkbox"/> Dynamic zero range	<input type="checkbox"/> > max. vol. time
<input type="checkbox"/> 1/4 d Null	<input type="checkbox"/> Empty range	<input type="checkbox"/> Dynamic command on	<input type="checkbox"/> autom. char.
<input type="checkbox"/> Waiting for standstill	<input type="checkbox"/> Calibration protected	<input type="checkbox"/> Dyn. command	<input type="checkbox"/> State changing
<input checked="" type="checkbox"/> Scale adjusted	<input type="checkbox"/> Reserved	<input type="checkbox"/> vol. (auto)	<input type="checkbox"/> disable time
<input type="checkbox"/> Command err. (DI)	<input type="checkbox"/> Reserved	<input type="checkbox"/> Filling	<input type="checkbox"/> Dosing on
<input type="checkbox"/> Simulation active	<input type="checkbox"/> Stand alone mode	<input type="checkbox"/> > max. flow rate +/-	<input type="checkbox"/> Batch active
<input checked="" type="checkbox"/> Service operation	<input type="checkbox"/> Operating error	<input type="checkbox"/> > min. flow	<input type="checkbox"/> Batch end
		<input type="checkbox"/> > max. flow	<input checked="" type="checkbox"/> mat. char.

Stability status in 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)“



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.

The screenshot shows the SIWATOOL software interface. The left pane displays a tree view of parameters, with 'PID parameters (DR12)' expanded. The right pane shows the configuration for 'PID parameters (DR12) - Mode change > vol.'. Three red arrows point from callout boxes to specific parameters:

- Arrow 1 points to '< Flow rate min. (DS6)'. Callout: 'Switching condition related to the nominal flow rate DR6'.
- Arrow 2 points to '< max. flow rate (DS10)'. Callout: 'Switching condition related to the actual flow rate set point in DR10'.
- Arrow 3 points to '< Flow rate change max.'. Callout: 'Switching condition related to the nominal flow rate in DR10'.

Value	PC
Gain factor Kp min. (x0,01)	
Integration time Ti	
Differentiator time Td	
Controller activation	
disable time start	
Controller error max. (0,01%)	
Starting time vol.	
Min. flow rate set value (0,01)	

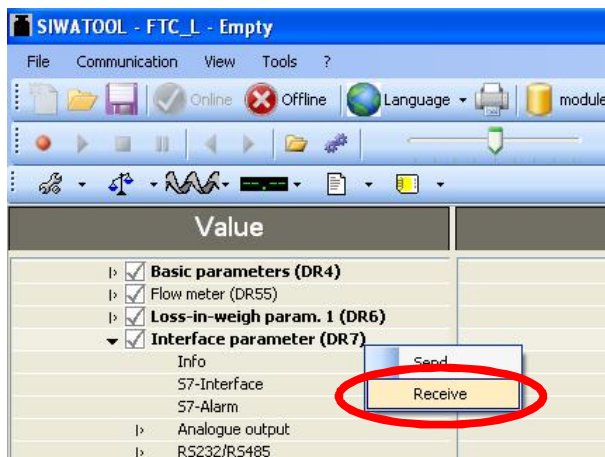


## 4 Optimizing the system parameters using the trace function

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:

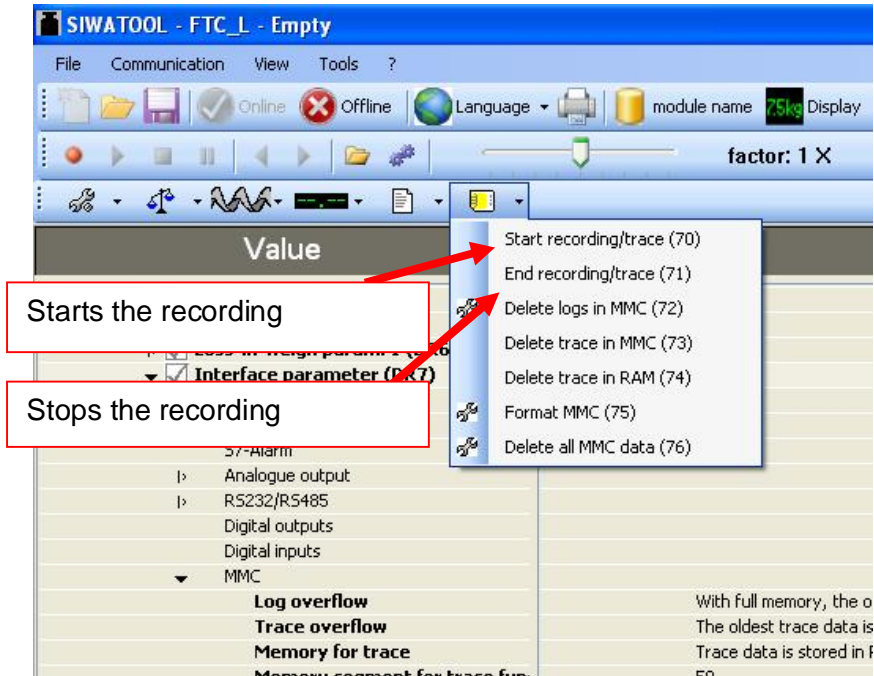
Value 10ms x n means  
e.g.:  
10ms x 10 = 100ms  
each 100ms a Trace-ID will  
be recorded.

Value	PC
<input checked="" type="checkbox"/> Interface parameter (DR7)	
Info	
S7-Interface	
Send data record	
Receive data record	
Log overflow	With full memory, the oldest entries are overwritten
Trace overflow	The oldest trace data is overwritten when the card is full
Memory for trace	Trace data is stored in RAM
Memory segment for trace function (%)	50
Memory segment for logs (%)	50
Trace function recording cycle	10
<input checked="" type="checkbox"/> Date & Time (DK8)	

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) :

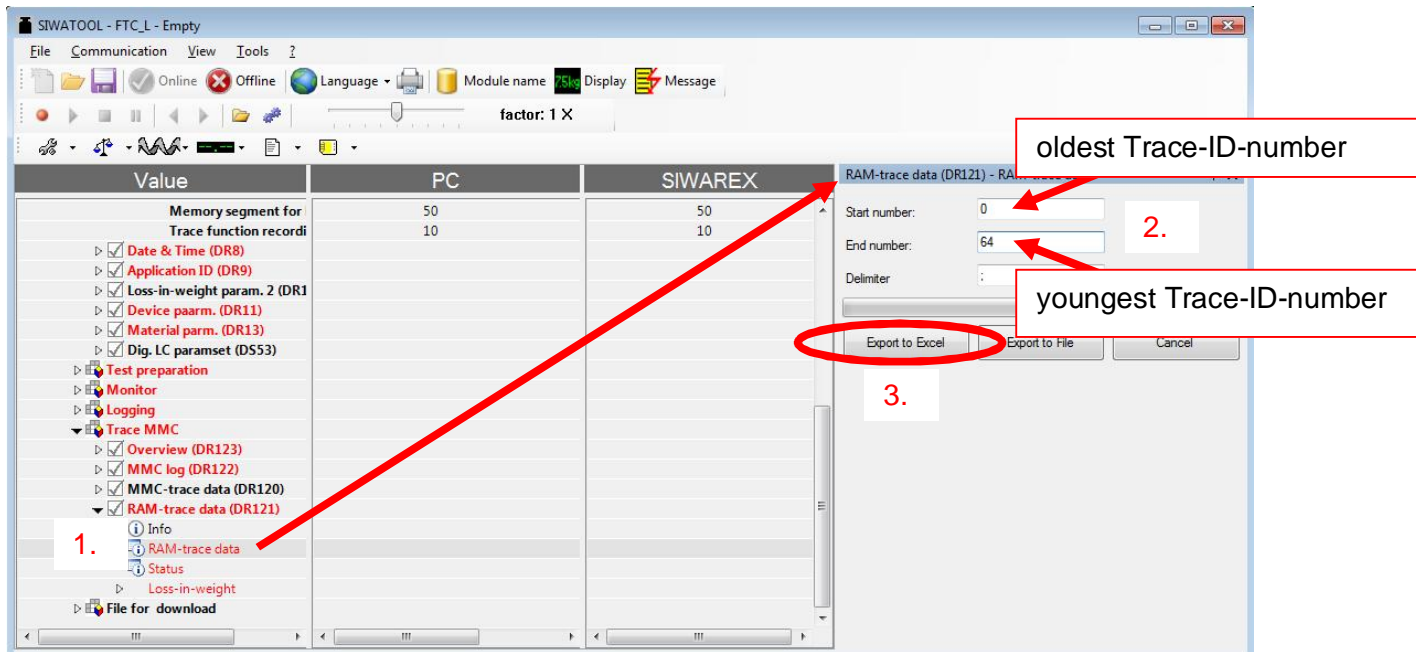
In DR123 the recorded Trace-ID-numbers can be seen.

In the following example there are traces with the ID-numbers „0“ to „64“:

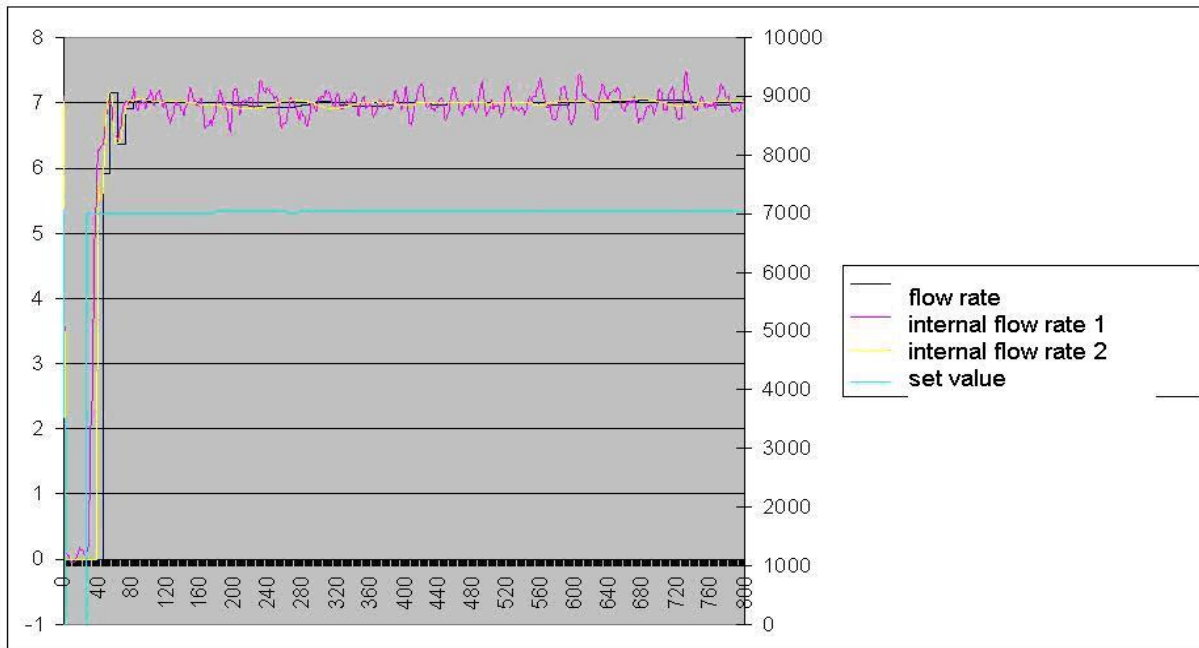
The screenshot shows the SIWATOOL interface with the 'Value' column highlighted by a red circle. The 'Trace MMC (DR123)' section is expanded, showing a table of process values. The 'SIWAREX' column contains the recorded Trace-ID-numbers. Two red boxes with arrows point to the values 0 and 64, labeled 'oldest Trace-ID-number' and 'youngest Trace-ID-number' respectively.

Parameter	Value	SIWAREX
Printer Log ID	0	0
MMC ID	0x01 0x50 0x00 0x02 0xCF	0x01 0x50 0x00 0x02 0xCF
MMC - memory capacity	65142784	65142784
Capacity Log data	32556544	32556544
Capacity Trace data	2097152	2092472
Oldest MMC-Log-ID	0	0
Youngest MMC-Log-ID	83	0
Oldest MMC-Trace-ID	0	0
Youngest MMC-Trace-ID	0	0
Oldest RAM-Trace-ID	0	0
Youngest RAM-Trace-ID	0	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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