

SIEMENS

SIWAREX FTC

Weighing Module for Loss-in-Weight Applications

Set-up of SIWAREX FTC with SIWATOOL FTC_L

Quick Guide

For modules with order number 7MH4900-3AA01



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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
7MH4900-3AK02

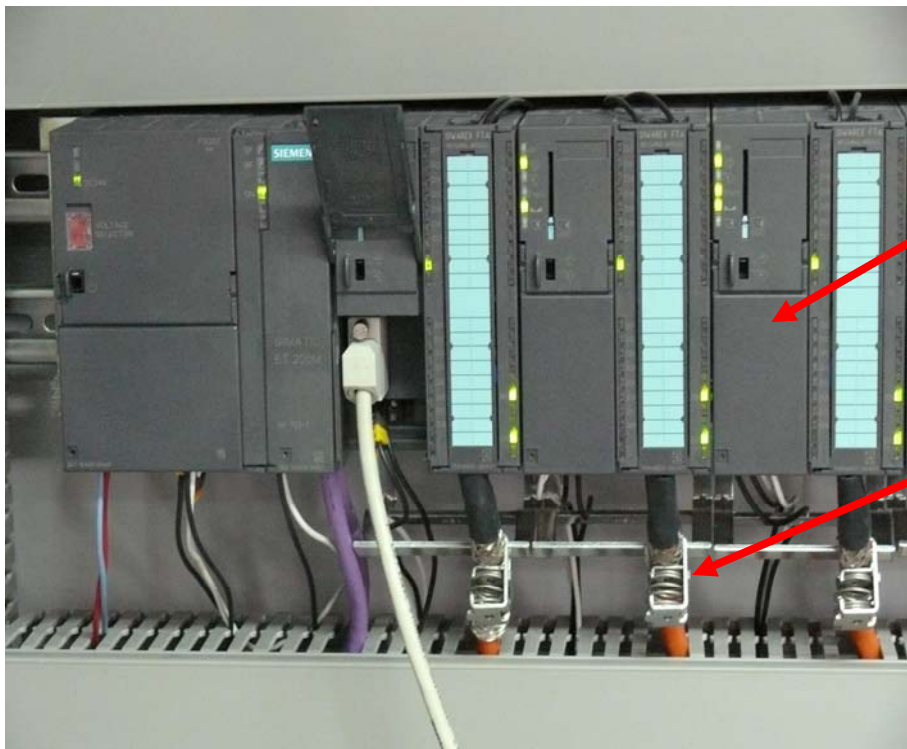


Loss in weight, continuous dosing system



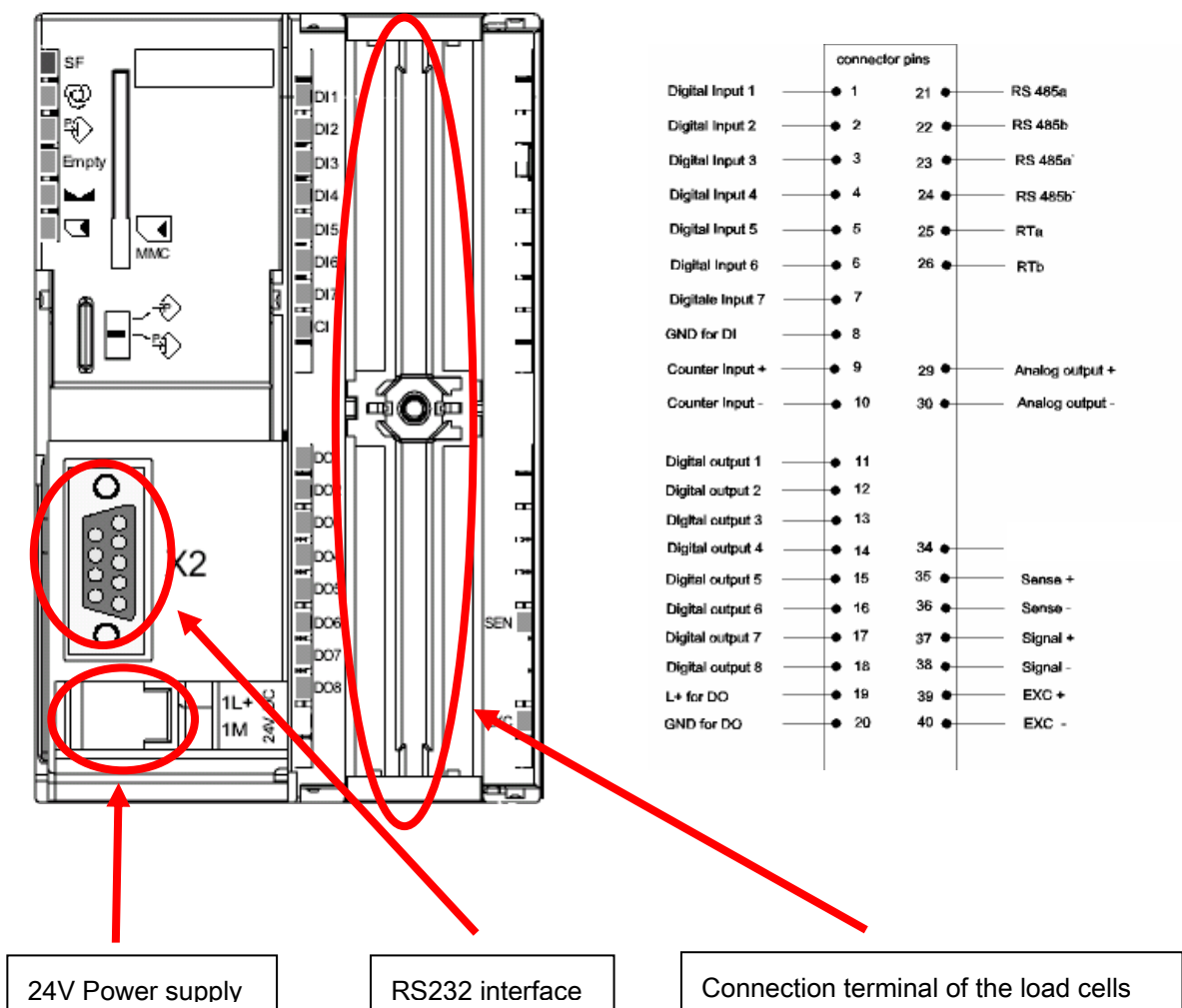
Adjustment weight

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

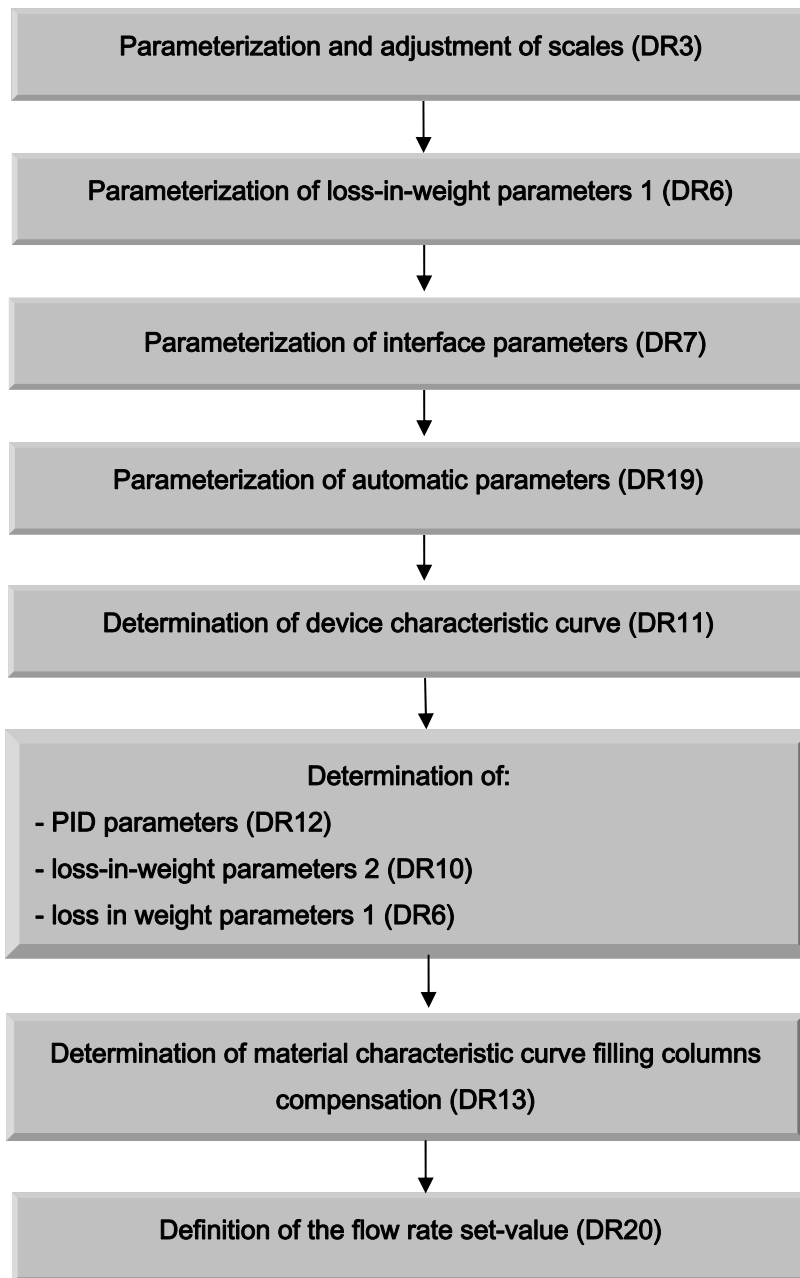


Load Cell Connection:

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

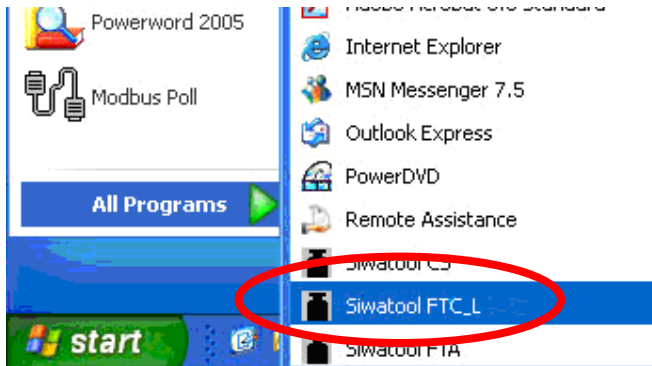
2.1 Steps of Commissioning



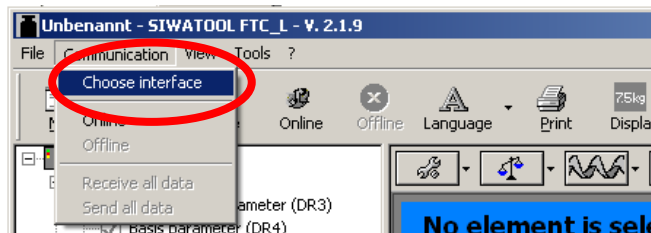
A set-up of various parameters has been installed in the factory. Not all parameters have to be defined during the first commissioning. Only those parameters which have to be defined are mentioned below:

- 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.

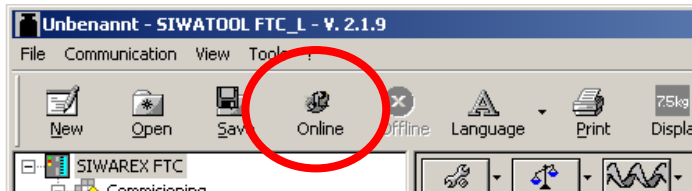
2.2 Start SIWATOOL FTC_L



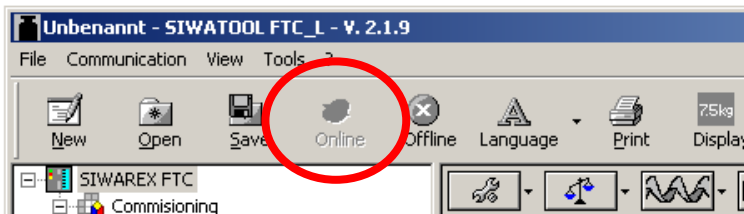
On the SIWATOOL FTC_L interface, select the desired interface, which should be the COM used on your computer.



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.

Adjustment parameter (DR3)

Calibration param. 3 Theoret. Adjustment 1

Info Adjustment Filter Calibration param. 1 Calibration param. 2

Operating mode: Loss-in-weight

Scale name: SIWAREX

Number of weight ranges: 1 Range

Scale division type: Multi-range scale (1... 3)

Zero setting upon start-up: Zero setting switched off

Zero setting at start-up: Switch-on zero setting, not when tare > 0

Automatic zeroing: Automatic zeroing off

Setting: Loss-in-weight

All other settings of this register are not relevant!

Adjustment parameter (DR3)

Calibration param. 3 Theoret. Adjustment 1

Info Adjustment Filter Calibration param. 1 Calibration param. 2

Minimum range 1: 0,0 Minimum range 3: 0,0

Maximum range 1: 2,0 Maximum range 2: 0,0

Resolution range 1: 0,01 Resolution range 3: 0,0

Minimum range 2: 0,0

Maximum range 2: 0,0

Resolution range 2: 0,0

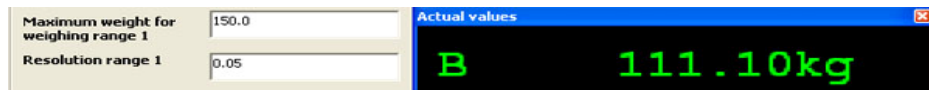
Weighing range: max. weighing range or mass of filling, e.g. 2.0 kg

Setting the resolution range of the scales' display; e.g. 0.01 kg = 10 g

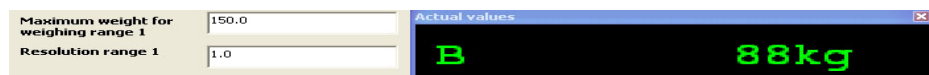
All other settings of this register are not relevant!

"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.

Adjustment parameter (DR3)

Info	Adjustment	Filter	Calibration param. 1	Calibration param. 2
Calibration param. 3				
Theoret. Adjustment 1				
Standstill time (ms)	1000	Regulations	----	
Standstill range	0,1	Weight unit	kg	
Max. waiting time for standstill (ms)	2000	Weight unit (large)	t	
Zero set val. - (%)	10	Length unit	m	
Zero set val. + (%)	10	Determination time (Adjust., Taring, Zeroing)	10000	
Zeroing val. - (%)	1	Weight factor	1000,0	
Zeroing + (%)	3			
Tare max. val. T- (%)	100			
DS_003_PARAM_020	DS_003_PARAM_02			

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

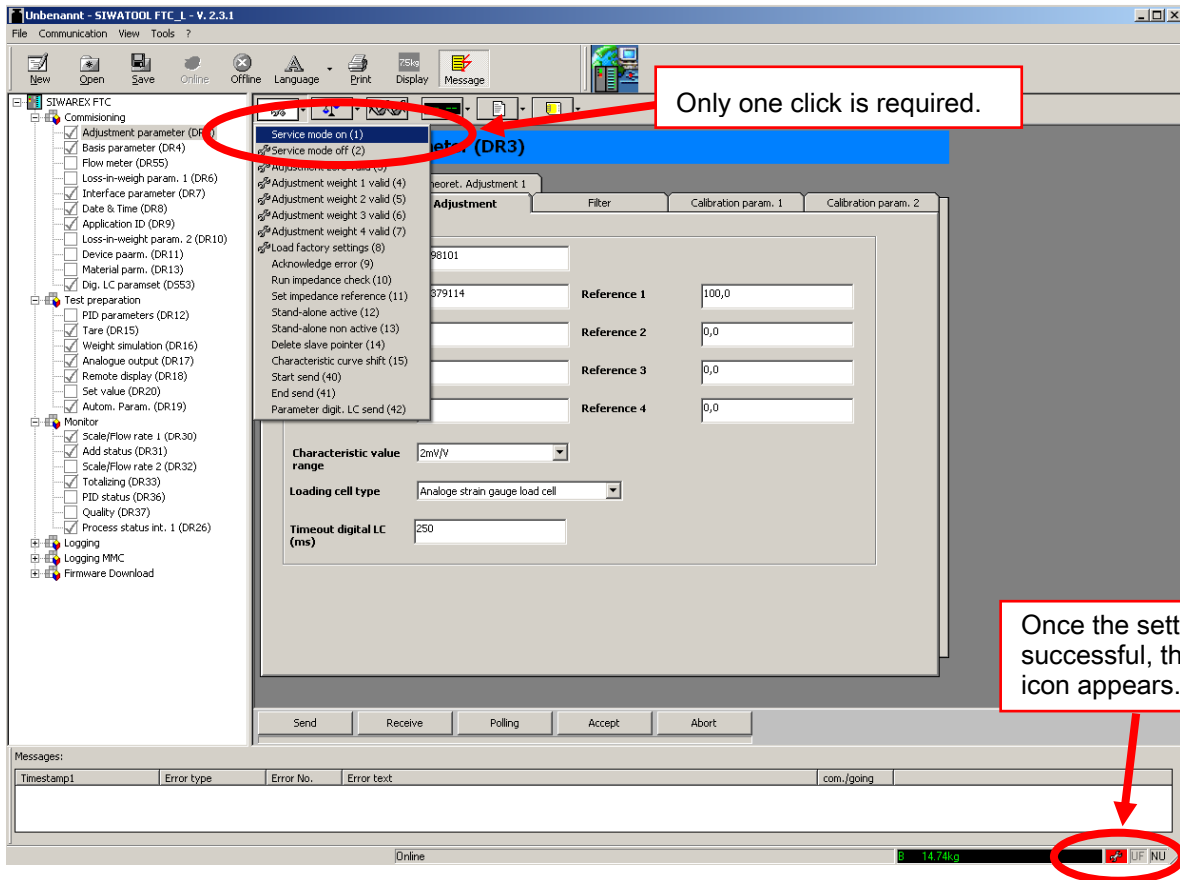
Adjustment parameter (DR3)

Calibration param. 3	Theoret. Adjustment 1	Filter	Calibration param. 1	Calibrat
Info				
Adjustment				
Adjustment digits for zero	12567388	Reference 1	2,0	
Adjustment digits 1	13090515	Reference 2	0,0	
Adjustment digits 2	0	Reference 3	0,0	
Adjustment digits 3	0	Reference 4	0,0	
Adjustment digits 4	0			
Characteristic value range	2mV/V			
Loading cell type	Analoge strain gauge load cell			
Timeout digital LC (ms)	0			

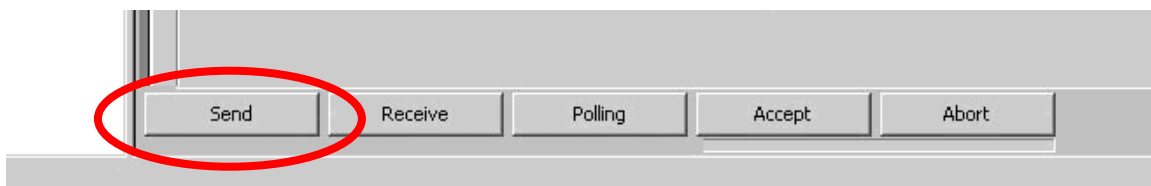
Enter the adjustment weight (e.g. "150.0") as "Reference 1"

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

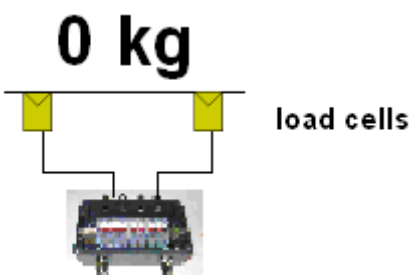
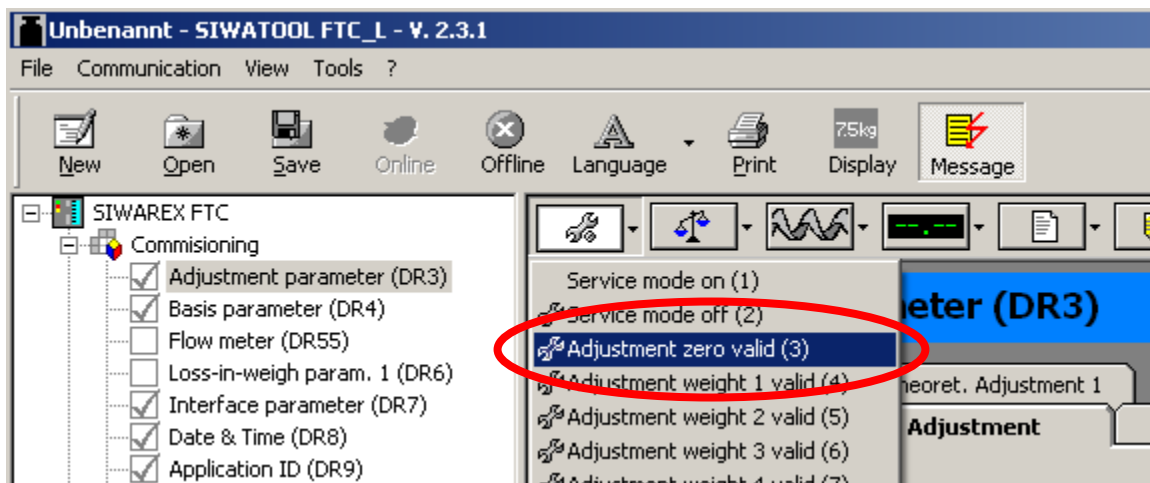
After setting the parameters of the DR3, the Service mode has to be switched on.



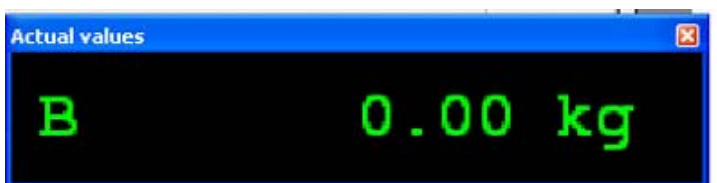
Afterwards click **Send** so that the DR3 is sent to the FTC module.



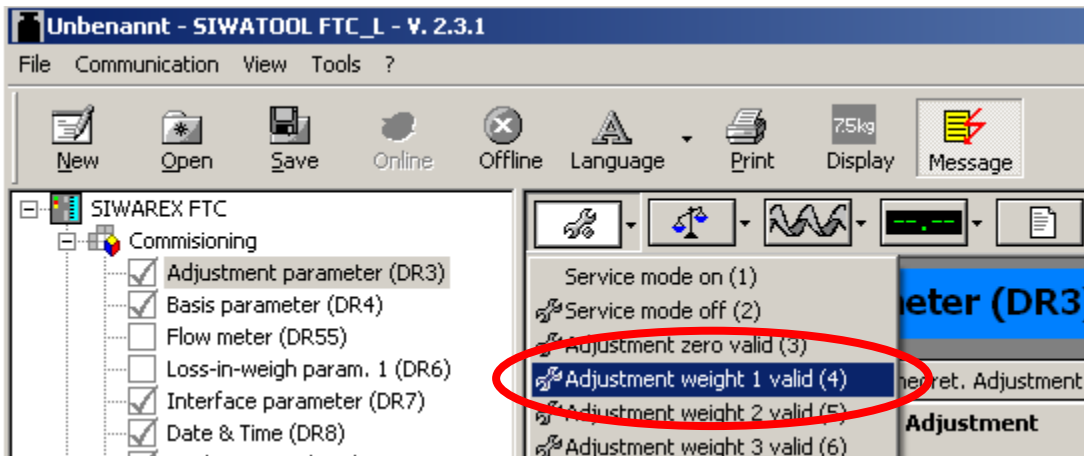
Ensure that the scale is empty (not loaded) and click **Adjustment zero valid (3)**.



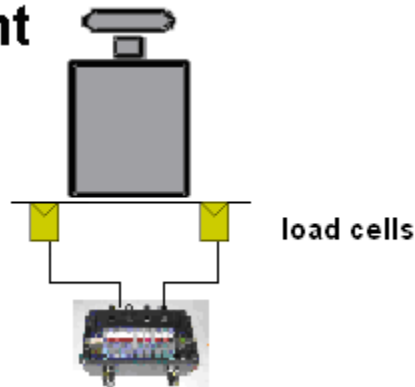
After that the displayed value is as follows:



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



**Adjustment
weight**

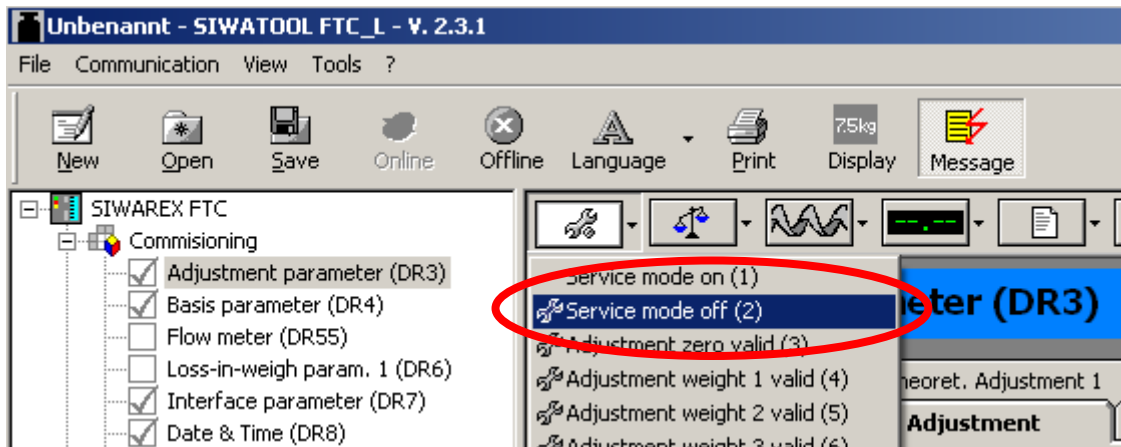


The weight becomes the adjustment weight (e.g. 150kg) and the adjustment is complete.

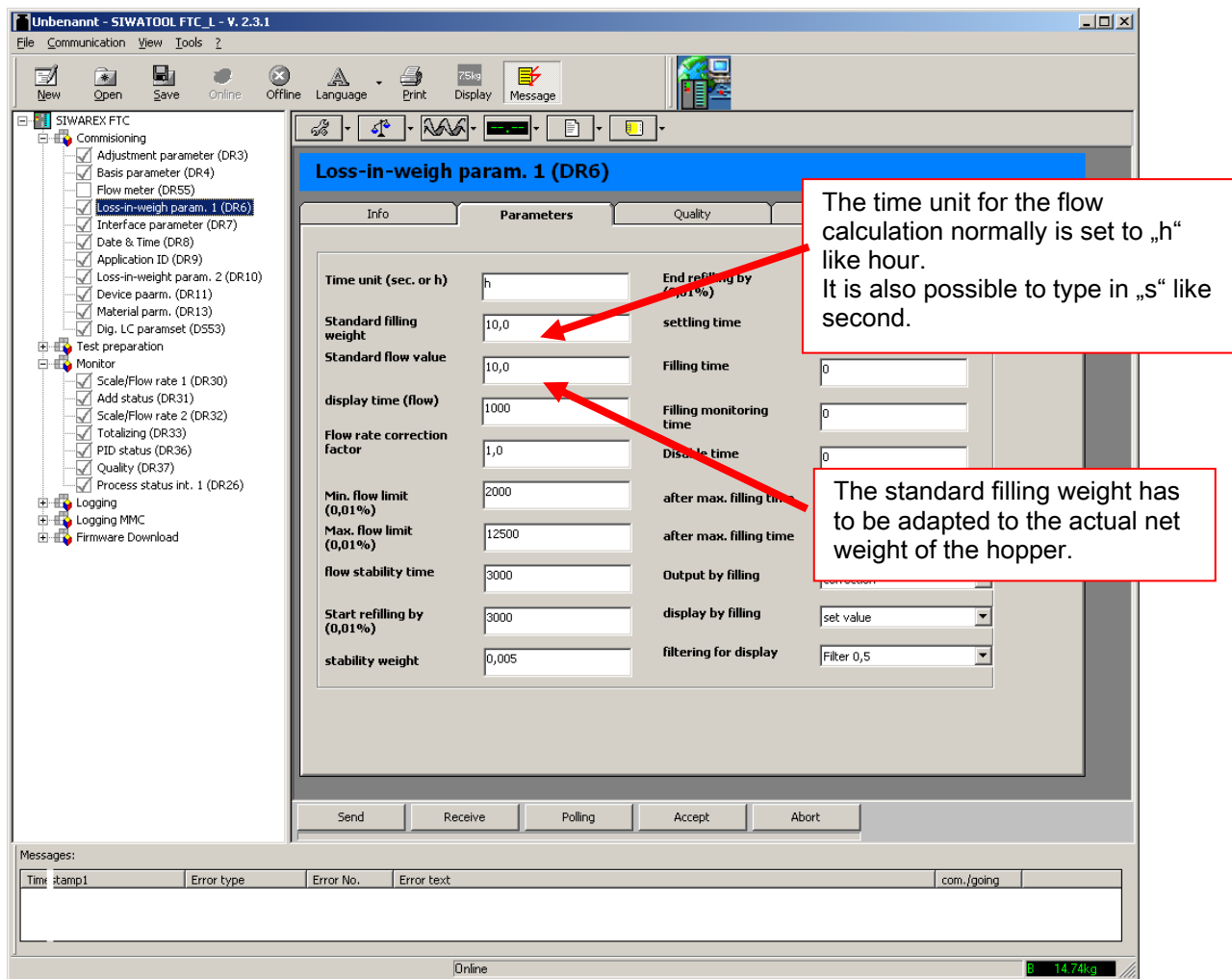


If the corresponding weight is now changed it will be equal to the actual weight and exact accuracy will be achieved.

The Service mode can be switched off.

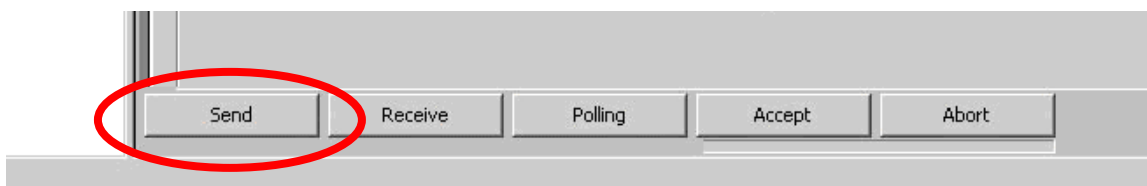


2.4 Parameterization of loss-in-weight parameters 1 (DR6)



All other settings of this register are not relevant!

Click **Send** 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.

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

Interface parameter (DR7)

Digital outputs Digital inputs MMC **Analogue output** RS232/RS485

Info S7-Interface S7-Alarm

Process value for 0/4 mA: 0,0

Process value for 20 mA: 100,0

Replacement value for analogue output at OD: 0,0

Source for the analogue output: PID-control output

Current range for the analogue output: 0 .. 20mA

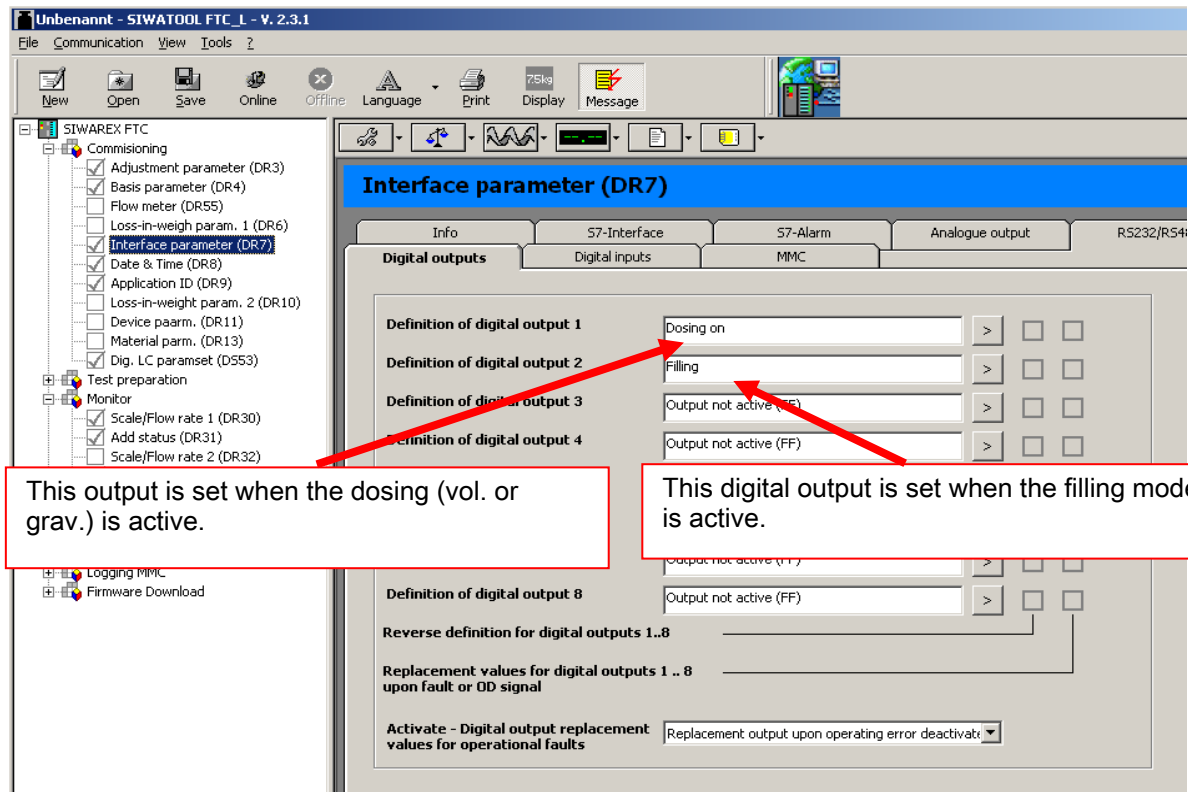
Parameter has to be „0.0“ (= 0.0% of the flow rate)

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

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

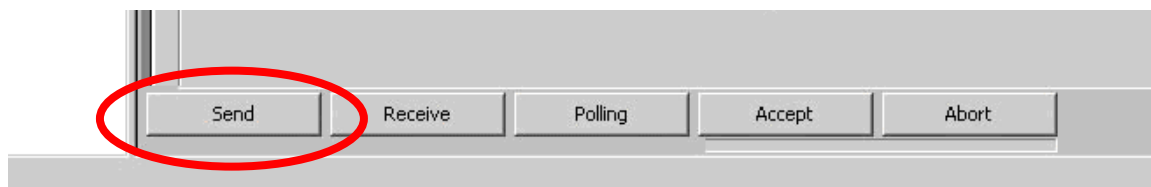
The current range for the frequency converter has to be selected.
- „0 .. 20mA“ or
- „4 .. 20mA“

This digital output can be defined as „Dosing on“



All other settings of this register are not relevant!

Click **Send**, 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%

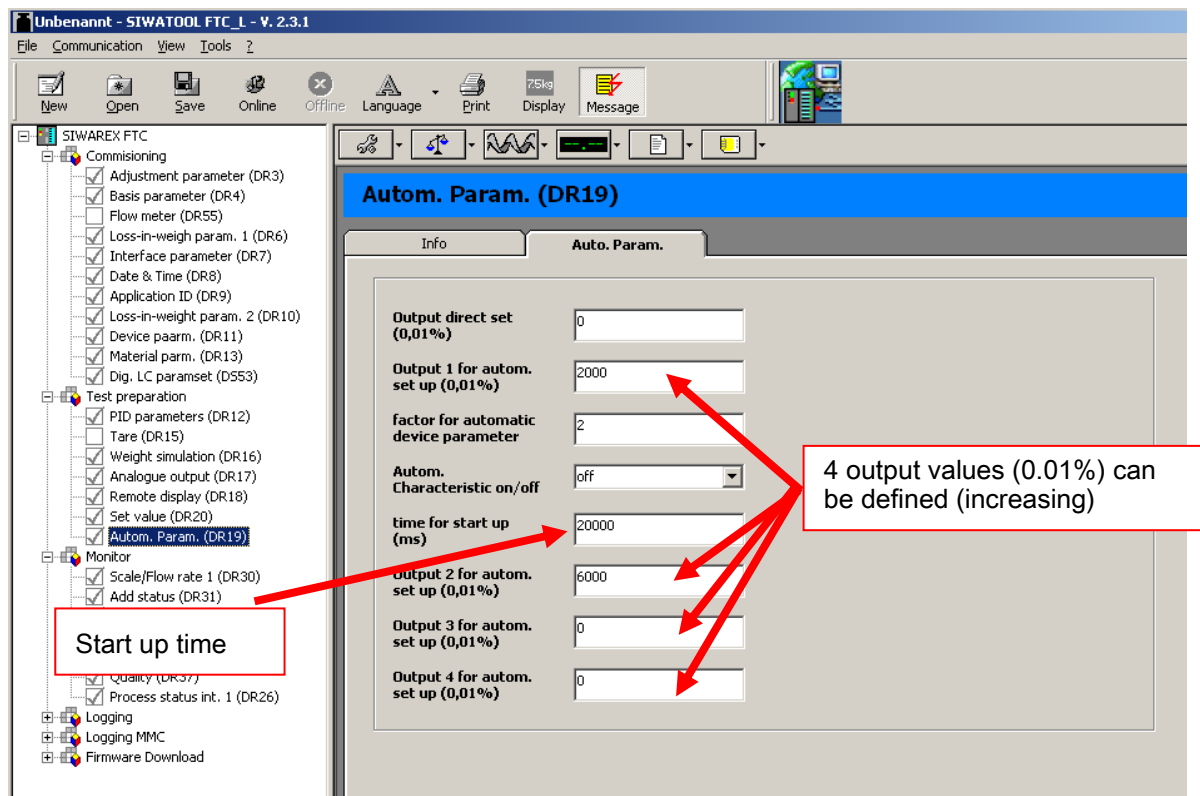
2. Start up time for an analogue output value:

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

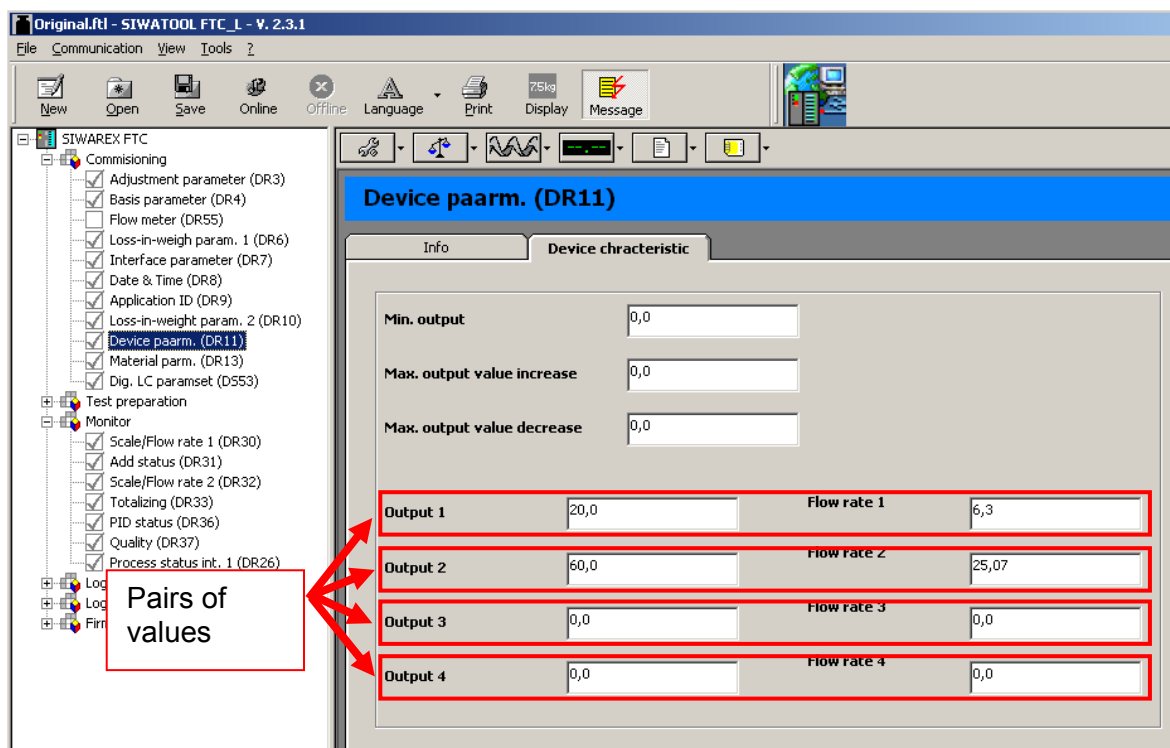
3. The output values **Output 3 for automat. set up (0,01%)** and **Output 4 for autom. set up (0,01%)** will not be used: Both parameters are equal zero.

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.

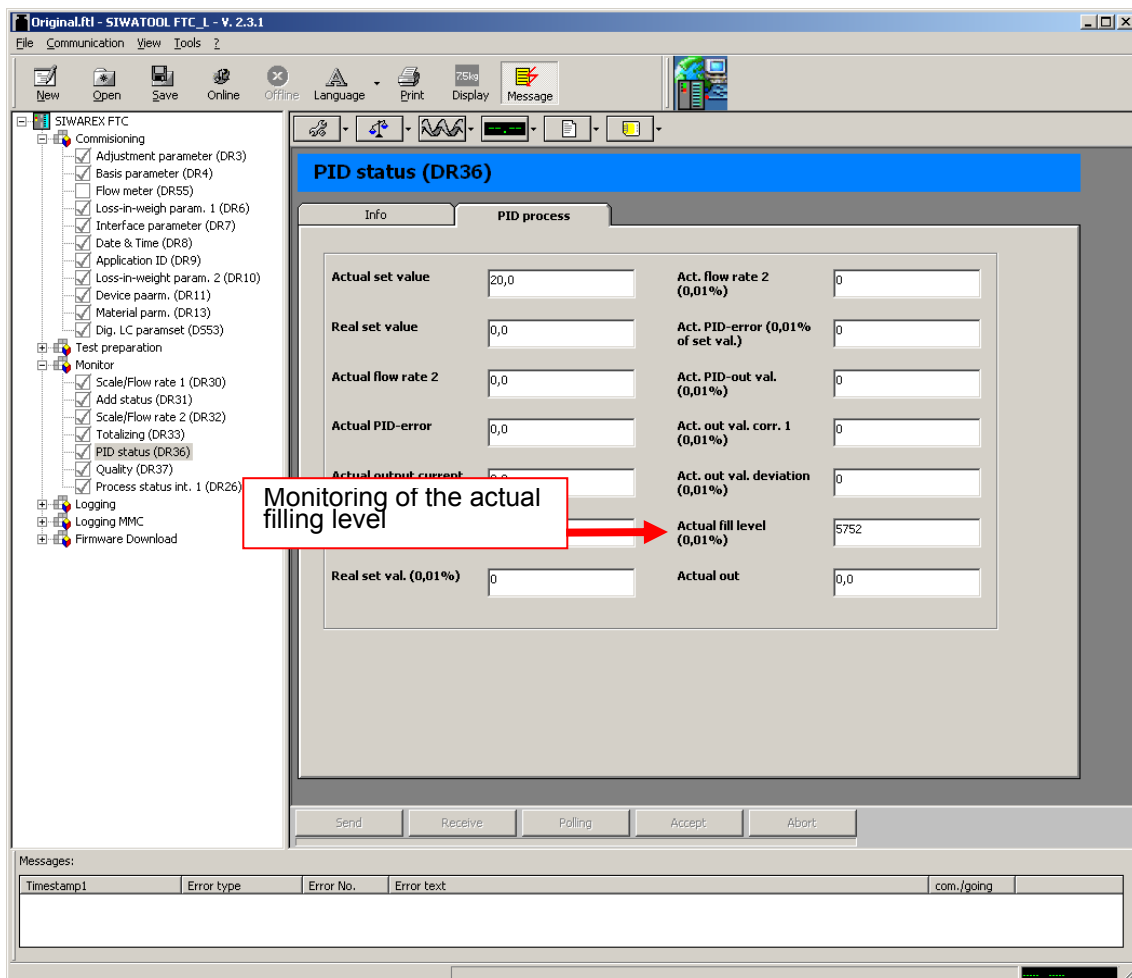
Those pairs of values (max. 4) are stored in a DR 11.



Using the command **Automat. Startup1 (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%).

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

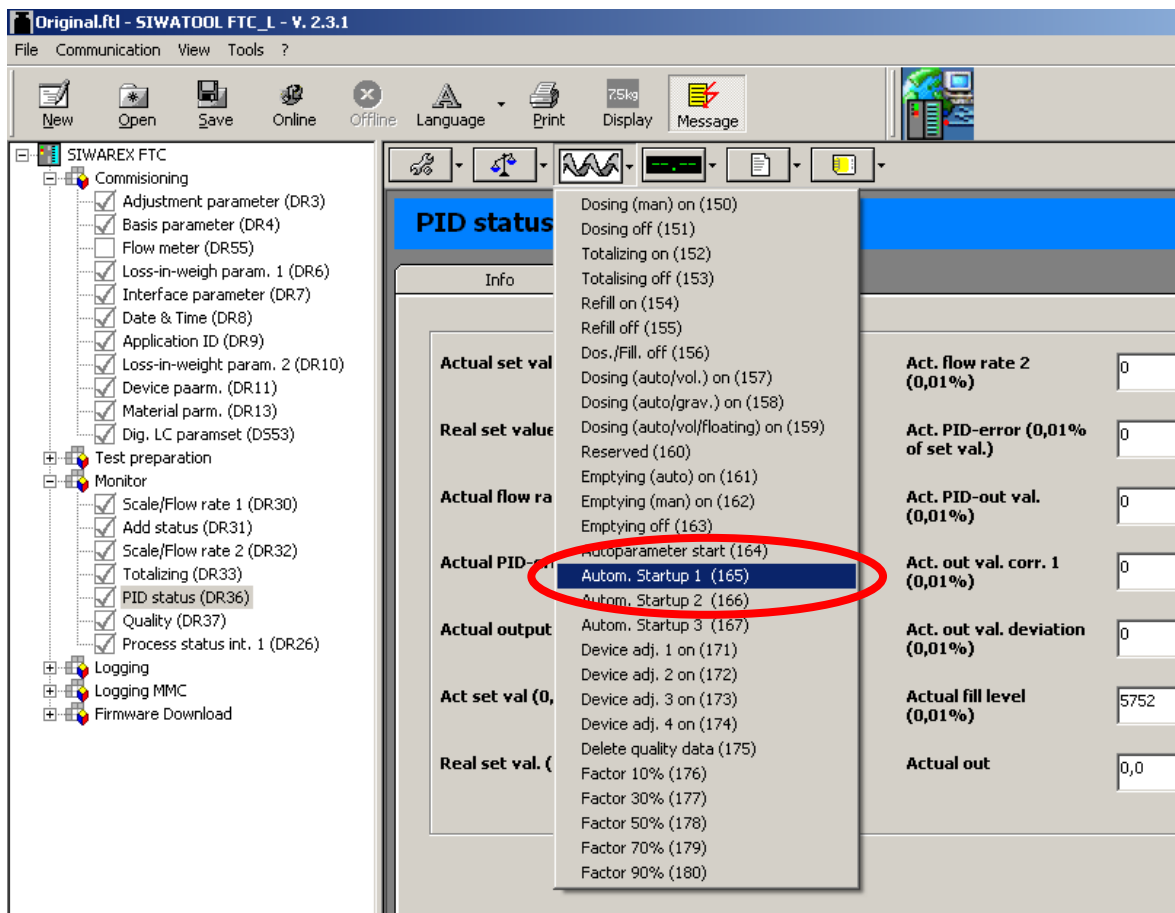
1. The hopper should be filled to more than 90%.
2. The filling level has to be above the limit value for refill (start refilling in DR 6)



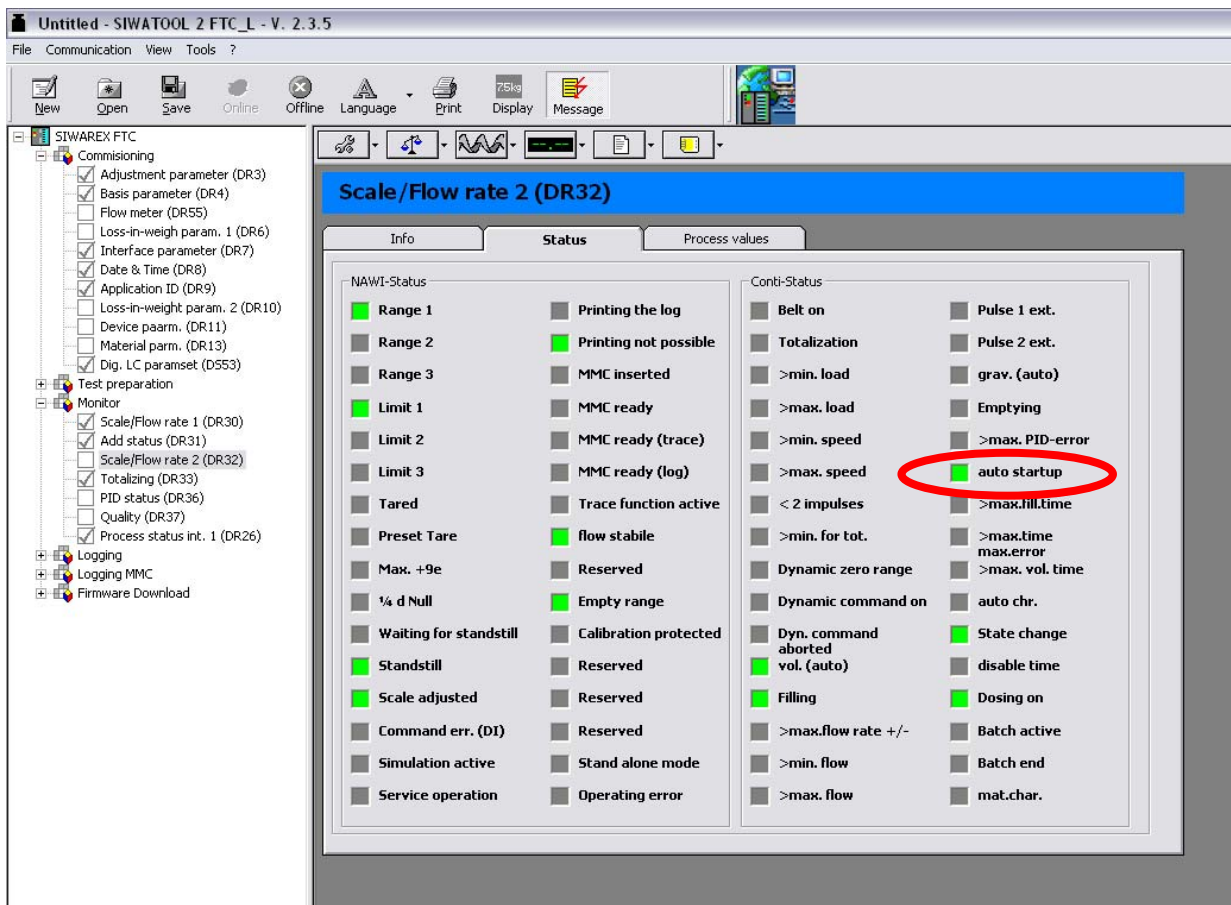
2. The screw device is filled with material.



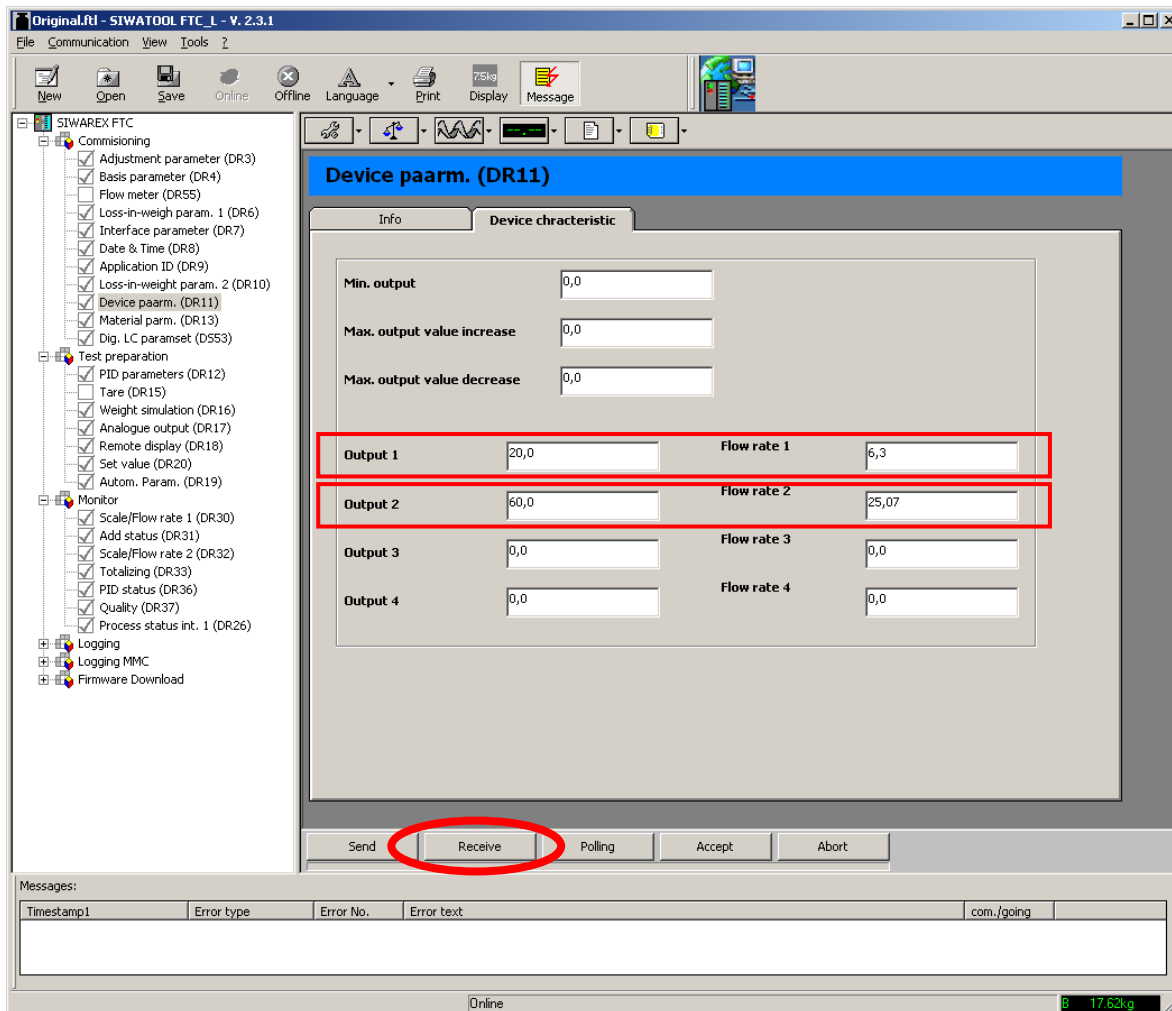
3. The command **Automat. Startup1 (165)** will be executed:



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



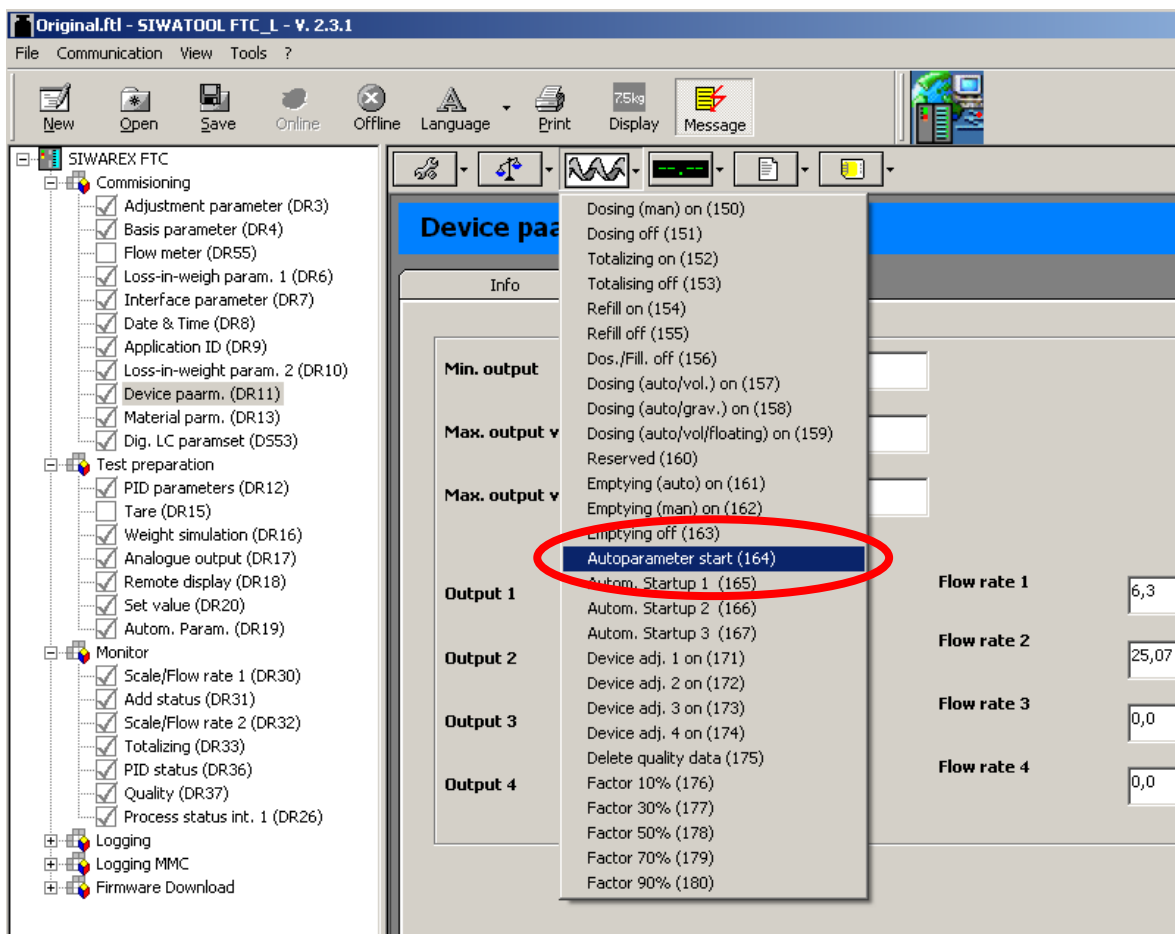
2.8 Determination of PID parameters (DR12)

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

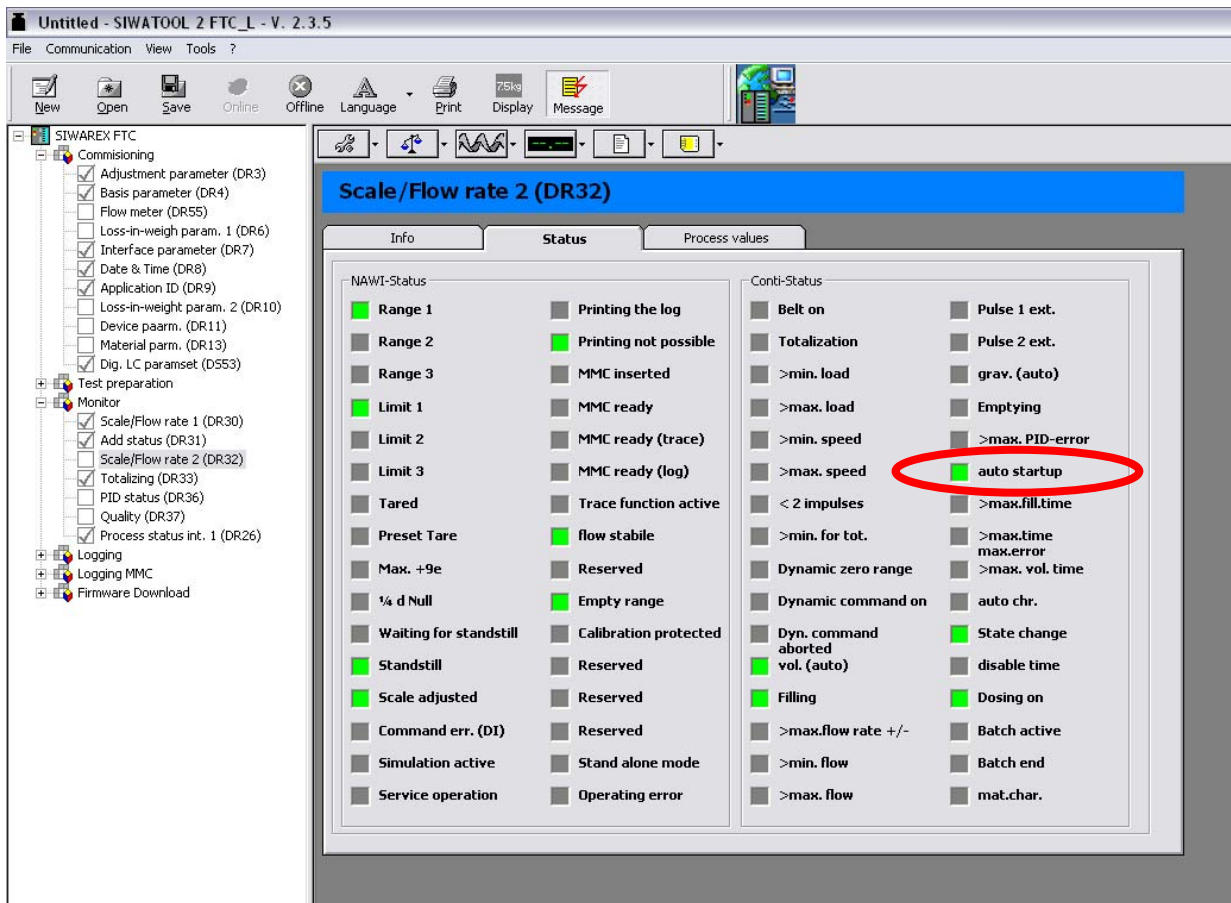
- PID-parameters (DS12)
- Flow rate parameters (DS10)
- Criteria for stability (DS6)

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% und 60%).

The duration for each output value is corresponding to the start-up time (e.g. 20sec)

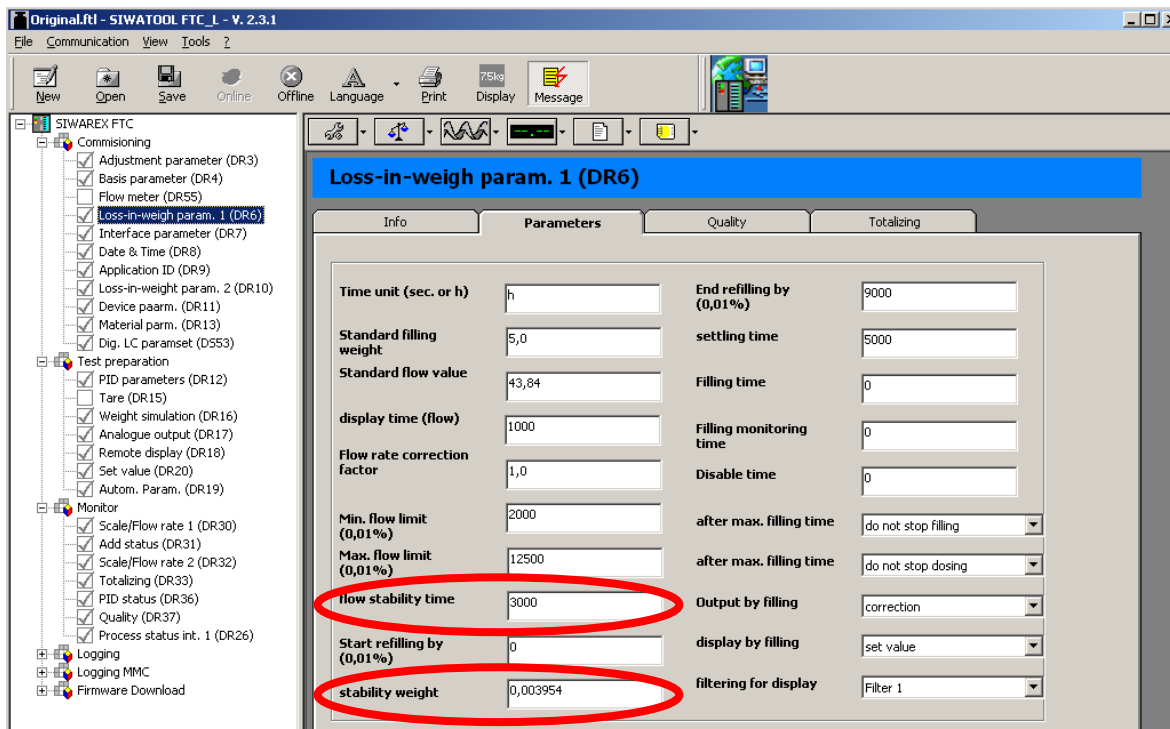


While running the batch the status flag **auto startup** in DR32 is active.

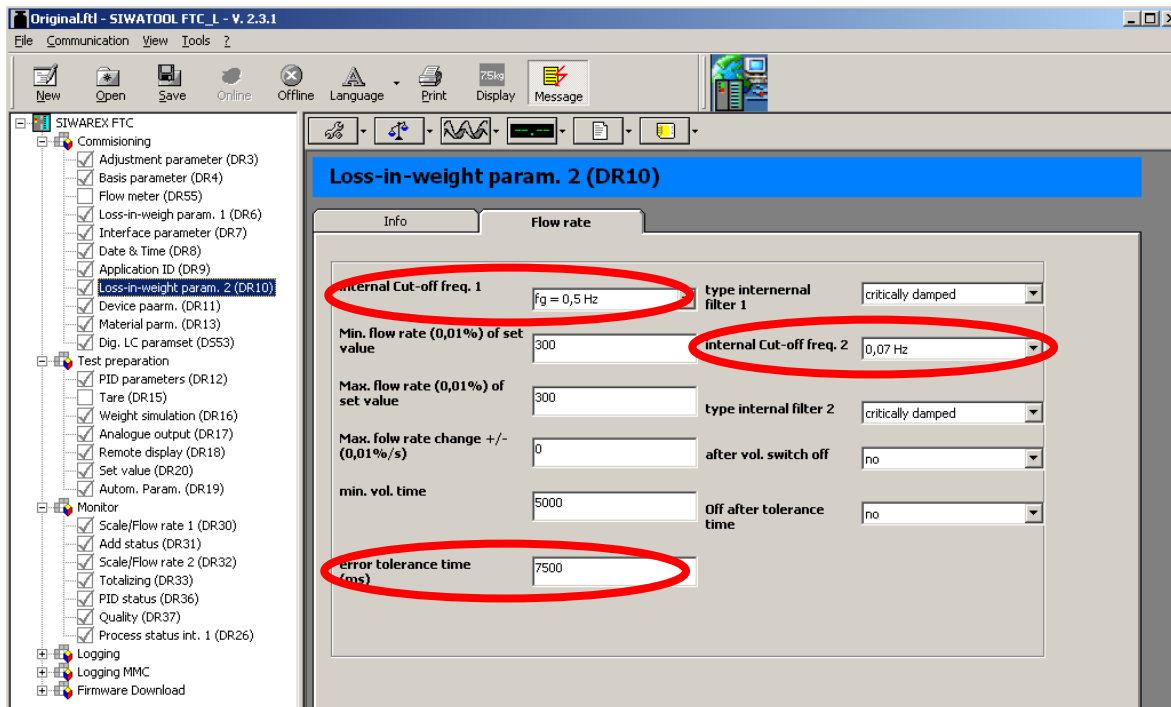


After finishing the autostart procedure all these automatically calculated parameters can be monitored in DR 12, DR10 and DR6:

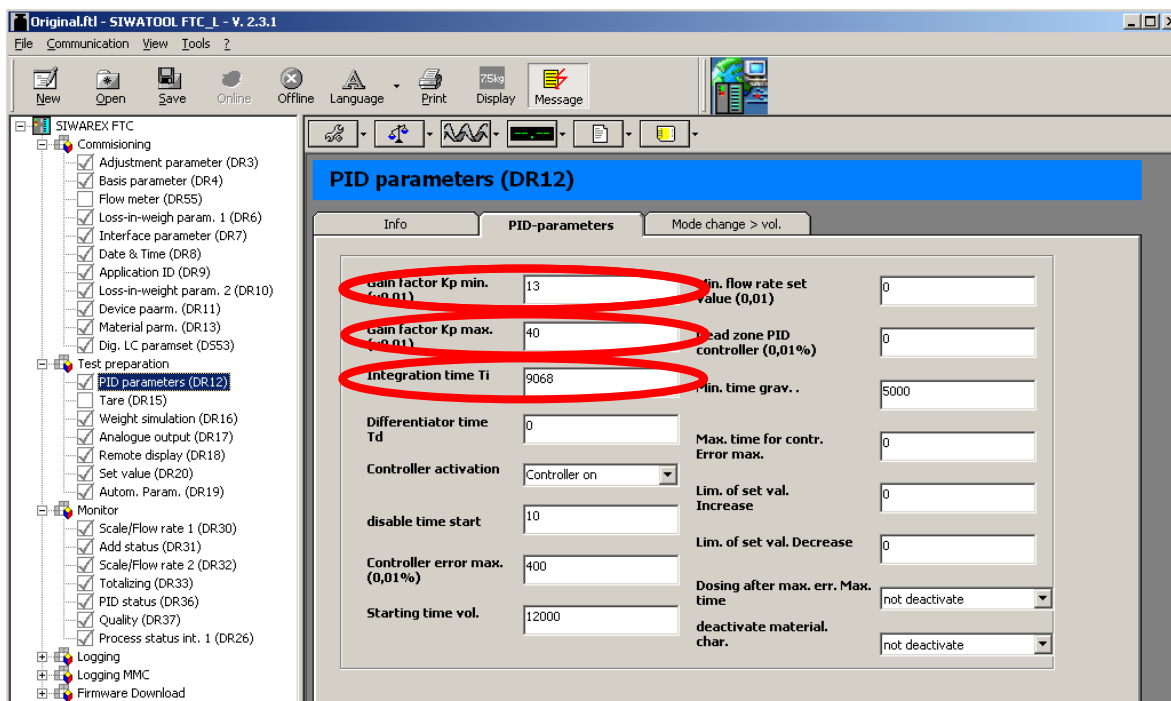
DR6:



DR10:

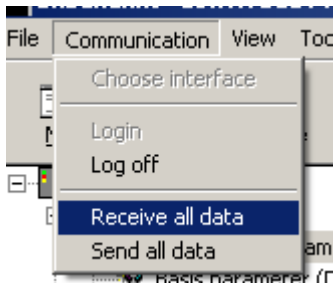


DR12:



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**.



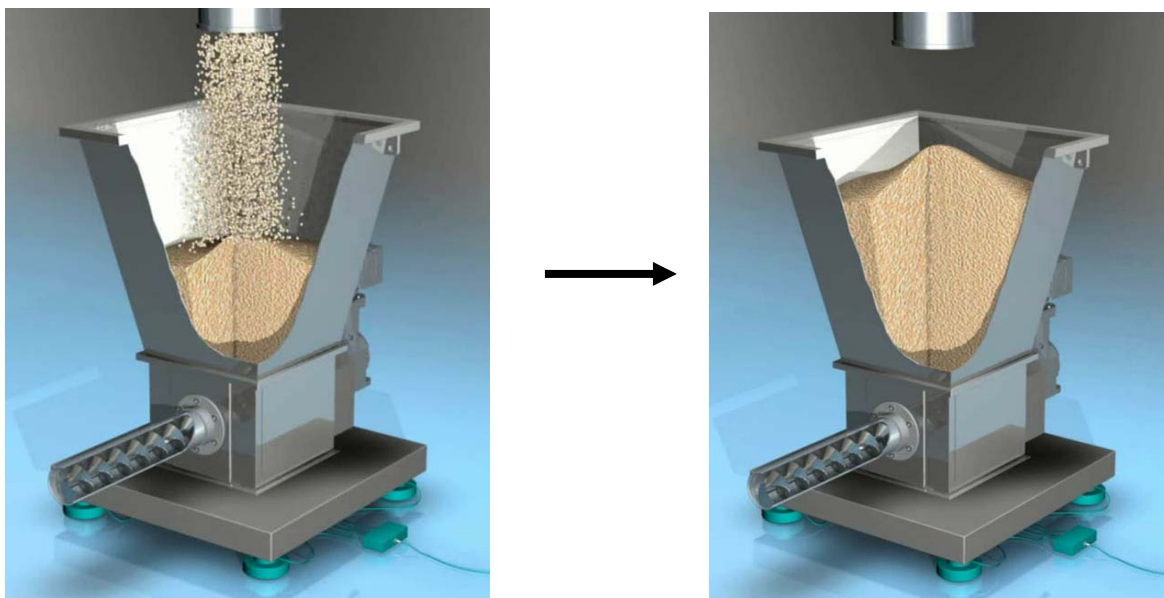
After receiving all data to the Siwatool software, the parameter settings into Siwatool are conform again to the parameter settings into the Siwarex FTC module.

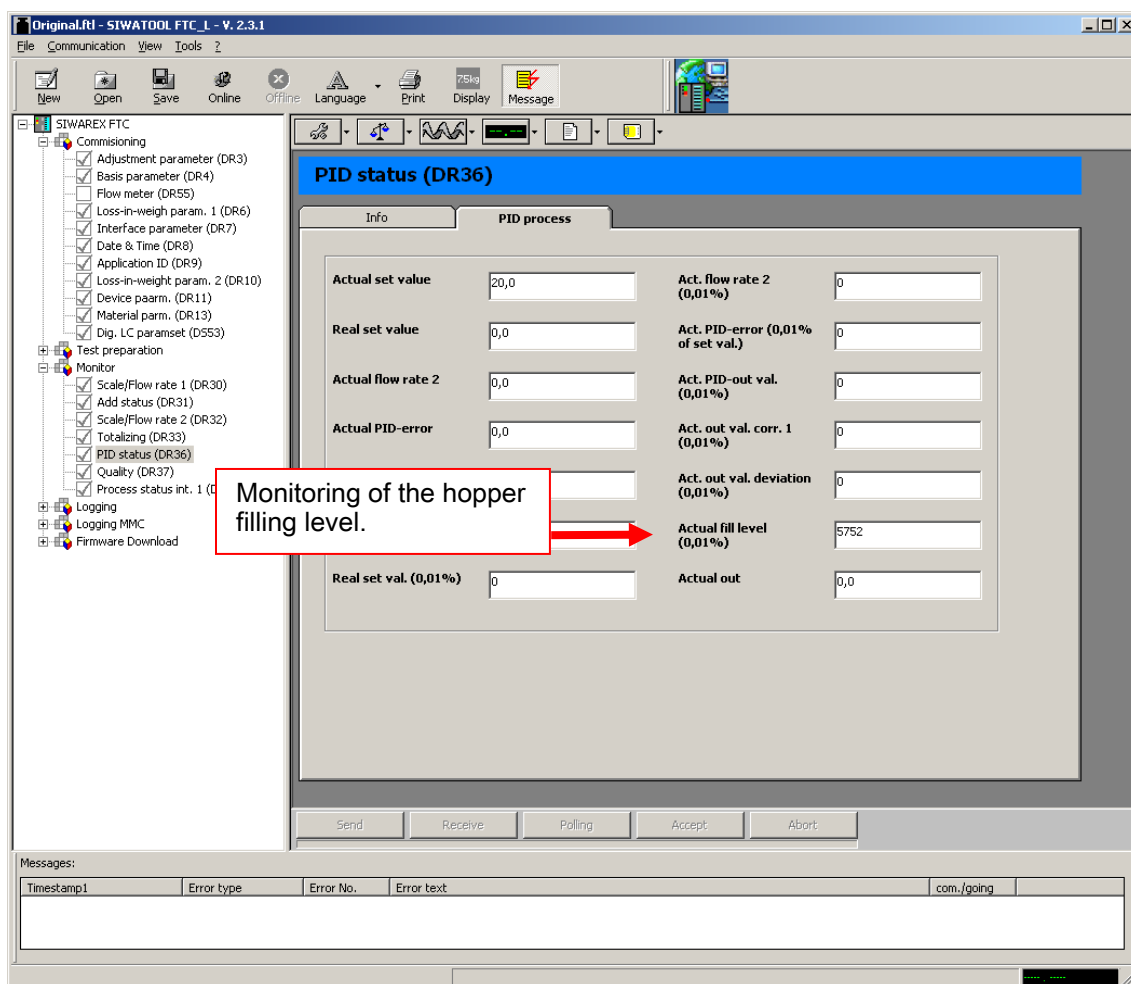
2.9 Determination of material characteristic curve (DR13)

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).

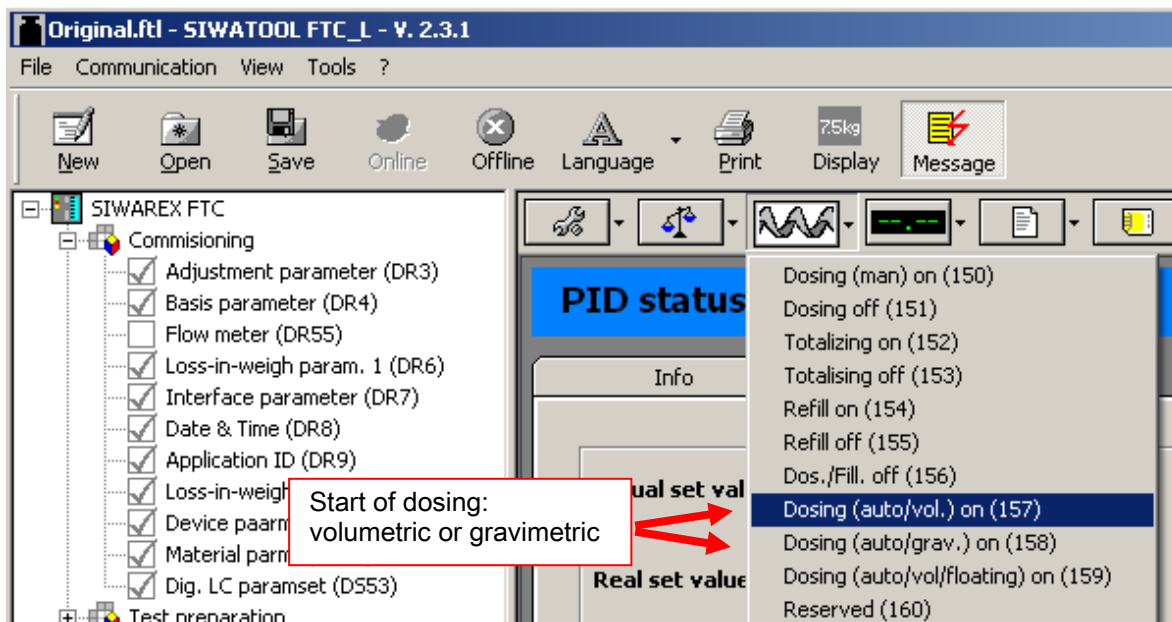
In the following the material characteristic curve will be calculated:

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

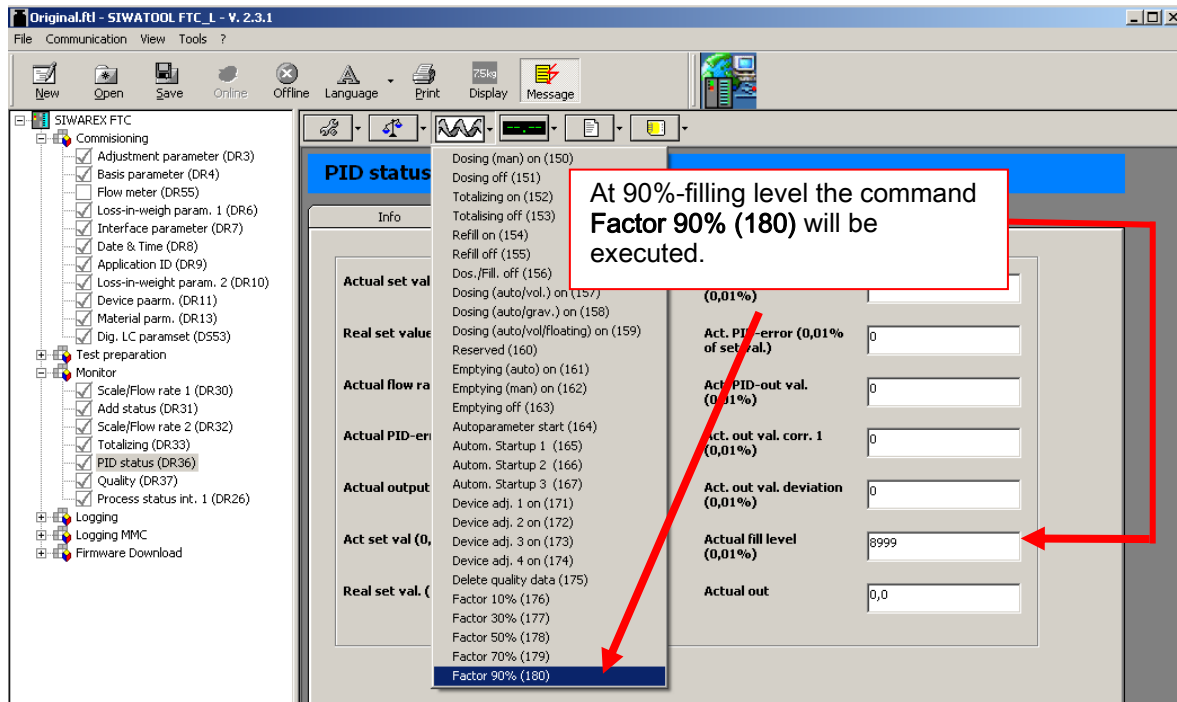




2. Start dosing **Dosing (auto/vol.)** on (157) or **Dosing (auto/grav.)** on (158):



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



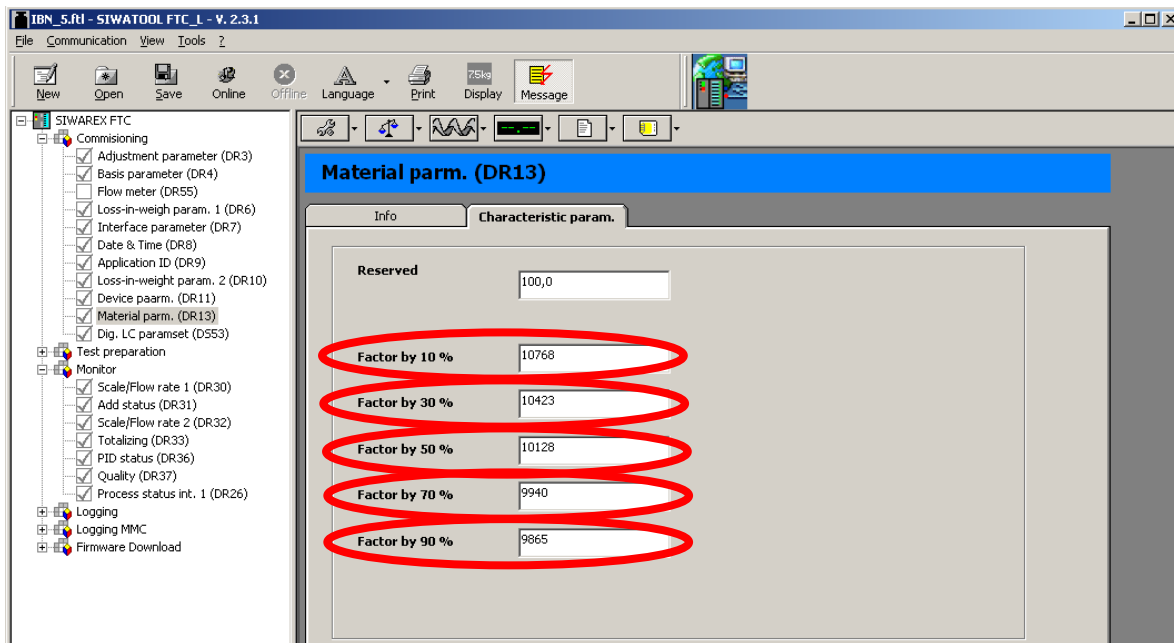
4. Reaching the 70%-filling level the command **Factor 70% (179)** will be executed.

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 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:

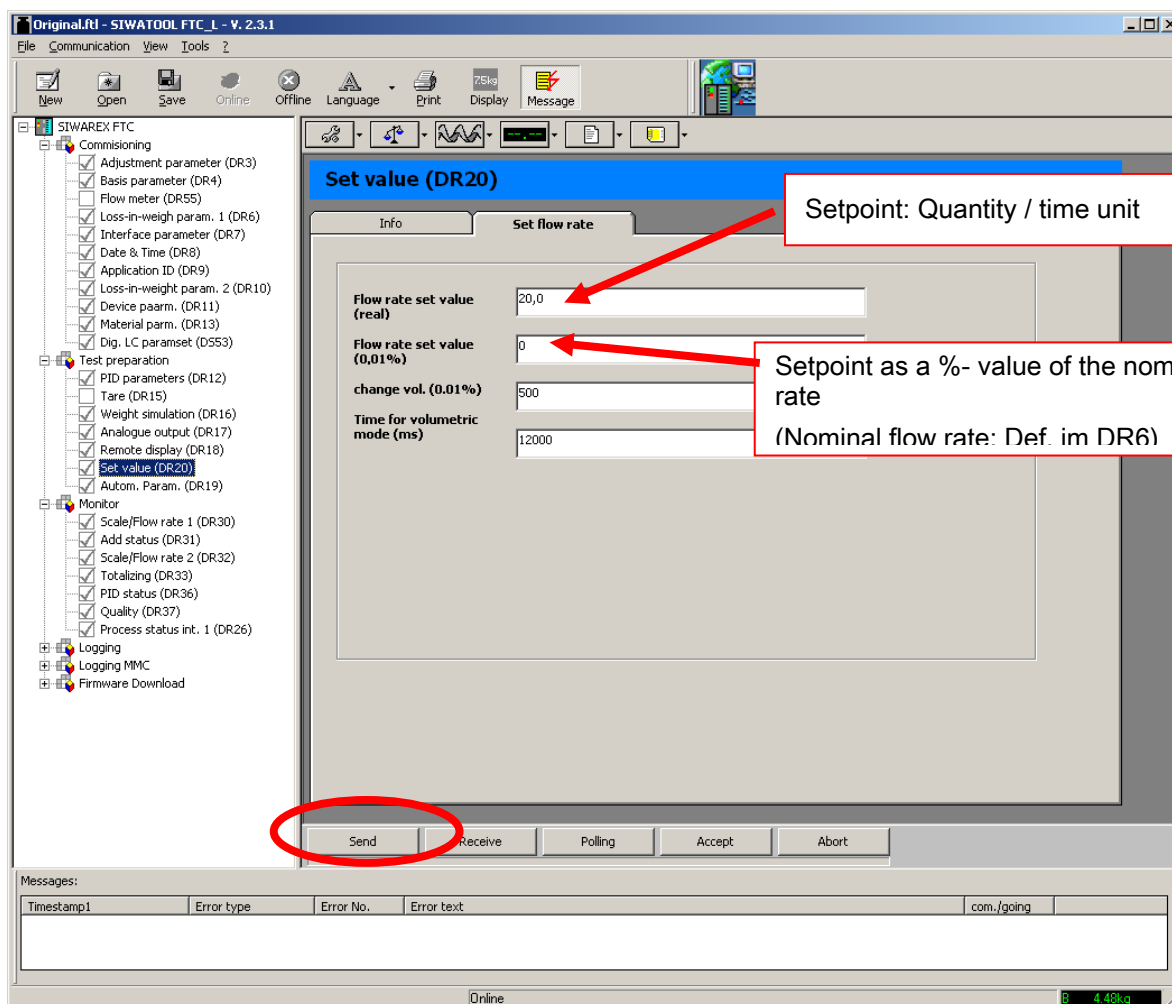
- Quantity per time unit *or*:
- %- value of the nominal flow rate

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

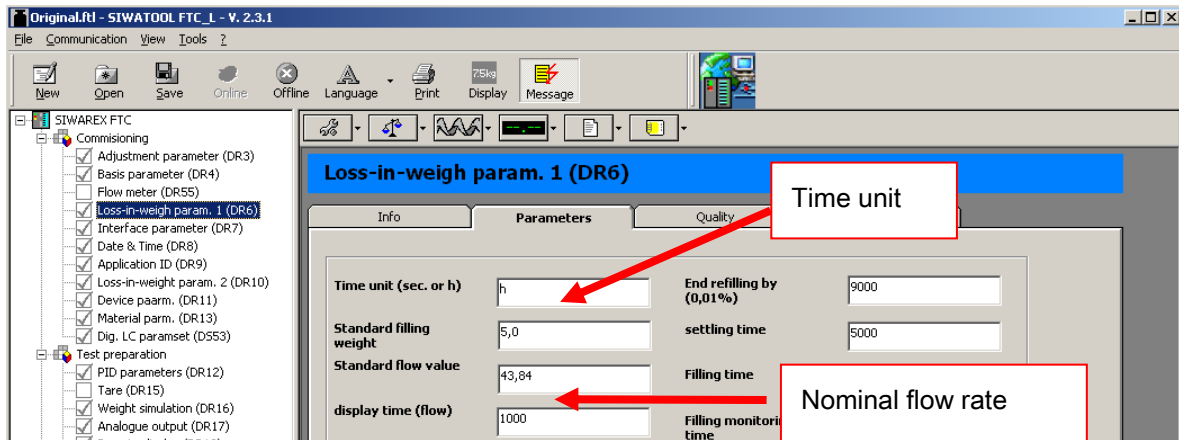
If the change of the flow rate set-value is more than the **set-value treshold (0.01%)** the system switches to the volumetric mode for a certain time period **Time for volm. mode (ms)**. If the set-value threshold is equal „0“ there will be no change of the operating mode.

DR20: Definition of the flow rate set-value:

Push the button **Send**, to send the parameters of DR20 to the SIWAREX FTC weighing module.

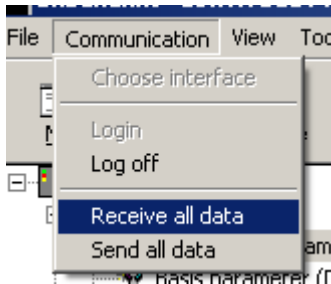


DR6: Definition of time unit and nominal flow rate:

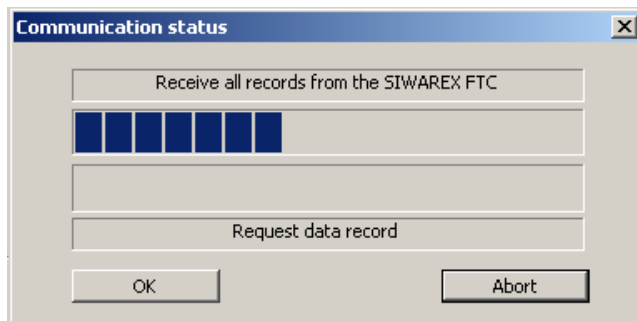


2.11 Save the calibration data's into a file

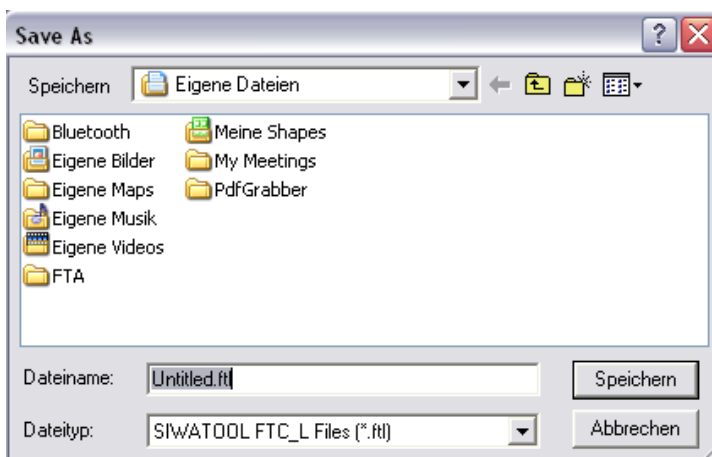
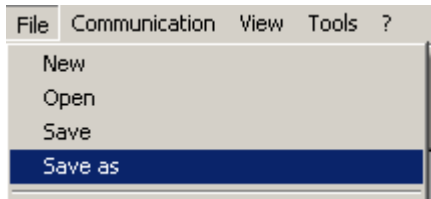
Transfer all data from the SIWAREX FTC to the PC.



During the transmission from the Siwarex FTC module to the PC, the following message window appears:



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

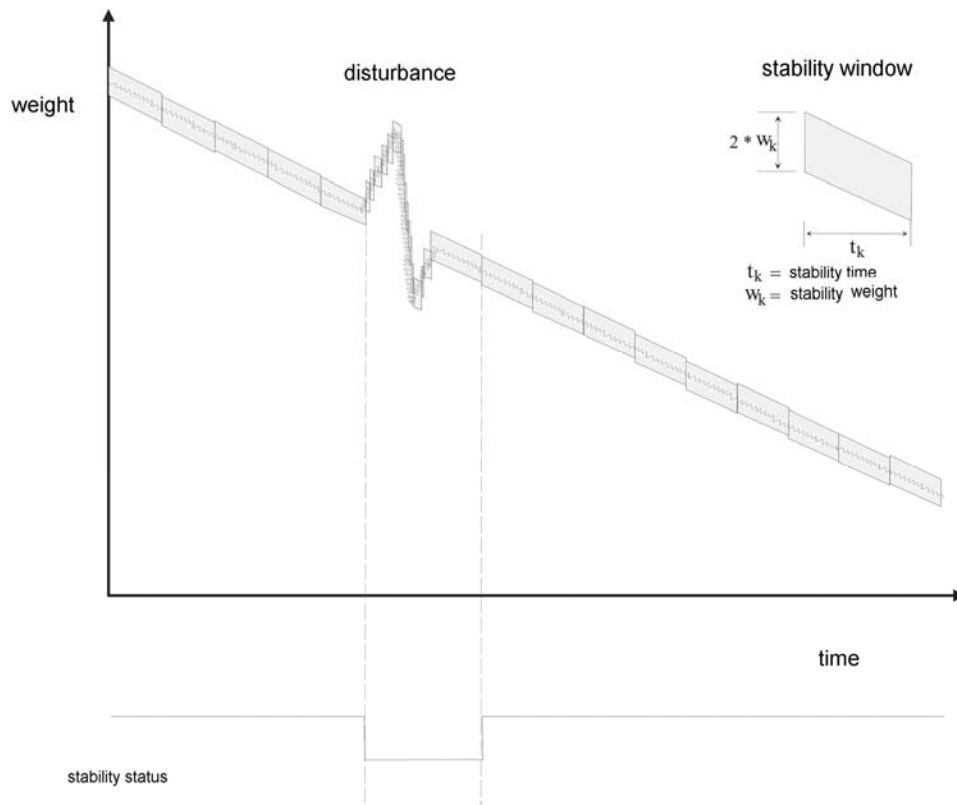
In case of violation of the stability criteria over a certain time period the Siwarex FTC module switches to the volumetric mode. The monitoring of the stability criteria is done as described below:

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

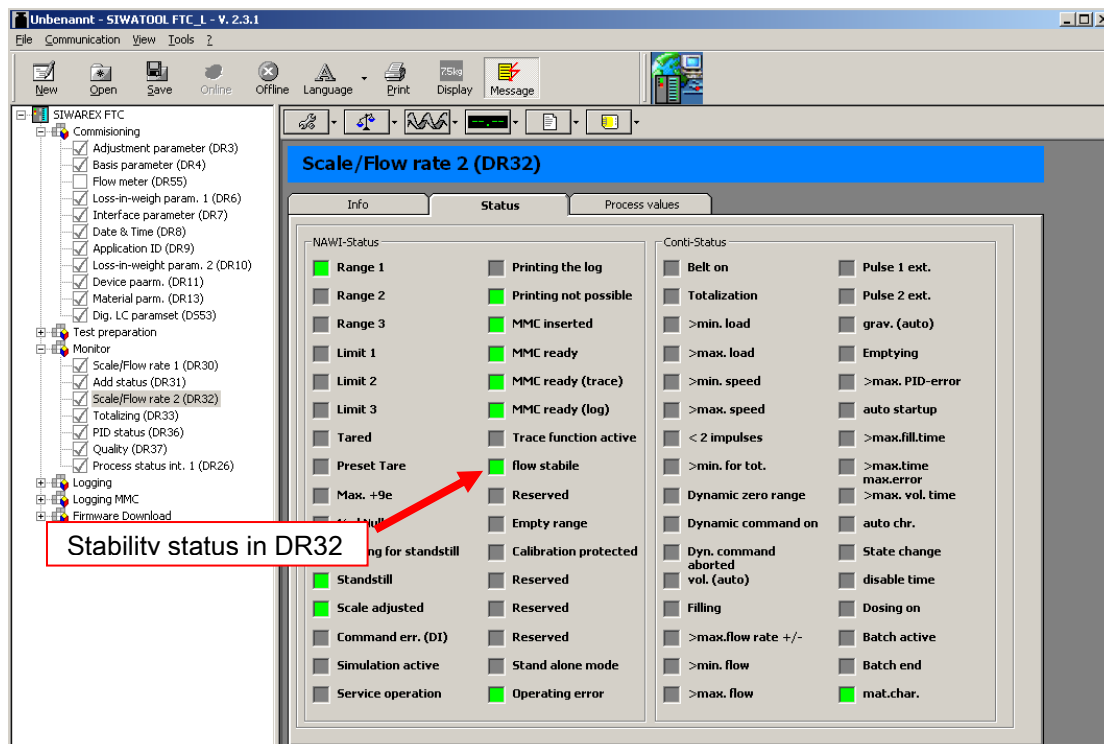
The weight value (filtered according to parameters in DR6) is checked for a certain time period (time of stability flow in DR 6) against a maximum change of weight (**Stability weight** in DR 6). This means the systems monitors if the weight stays within the stability window.

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

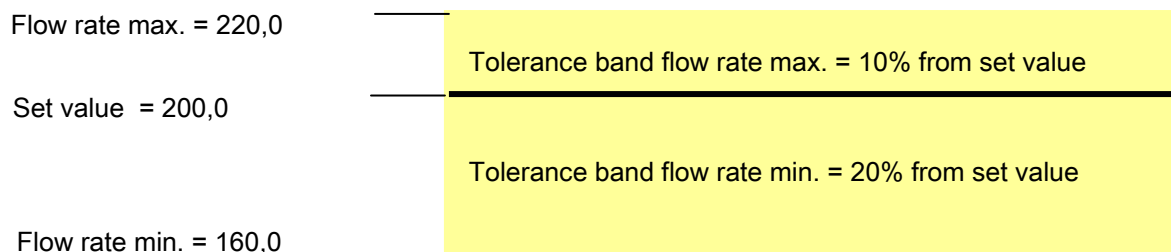
Beside the monitoring of the stability criteria there is also the option to switch to the volumetric mode of operation by cross-checking the actual flow rate with Min/Max flow rate limits. The conditions for these cross checks can be defined by the operator in DR 12.

1. 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.
2. 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.
3. 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.

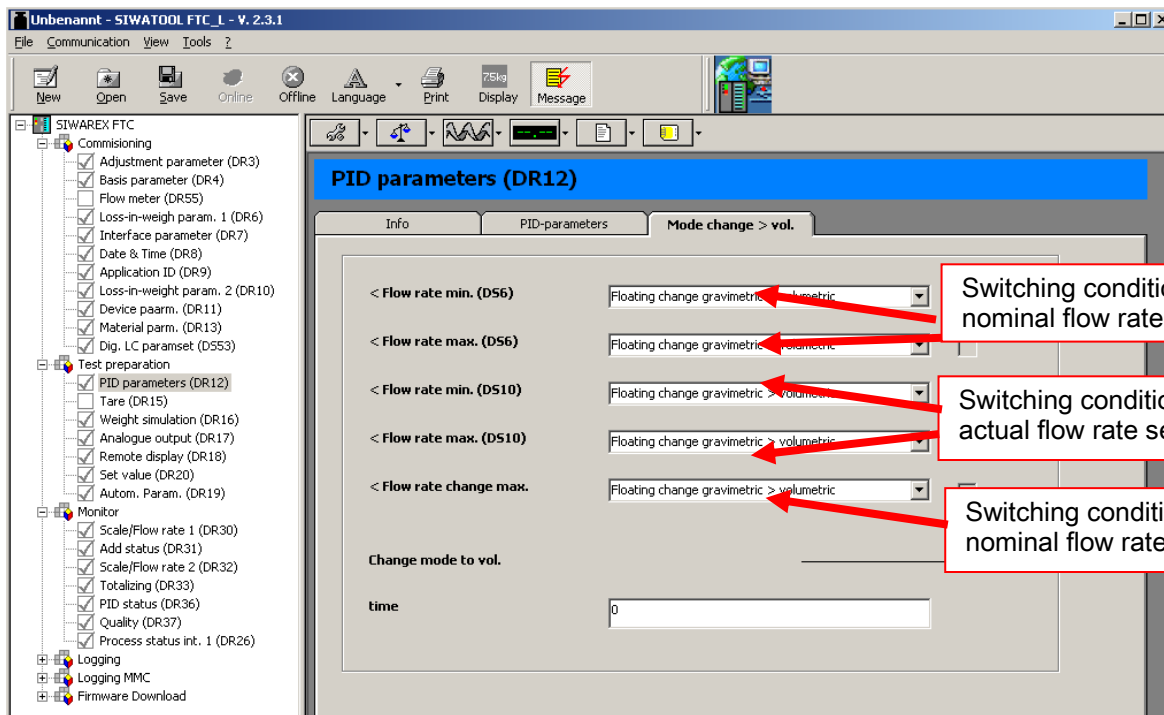
- Flow rate min. (0,01%) related the nominal flow rate
- Flow rate max. (0,01%) related the nominal flow rate
- Flow rate min. (0,01%) related to the actual set point
- Flow rate max. (0,01%) related to the actual set point
- Max. change of flow rate +/- (0,01%/s)

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

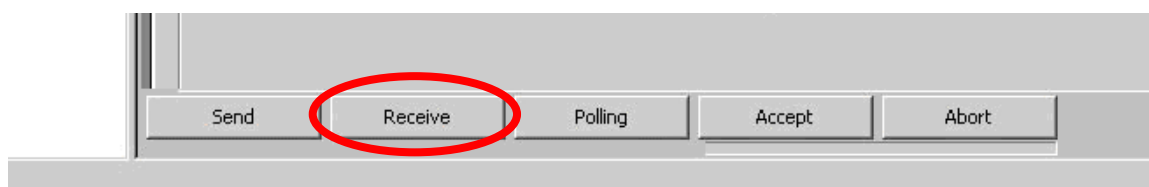


4 Optimizing the system parameters using the trace function

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.

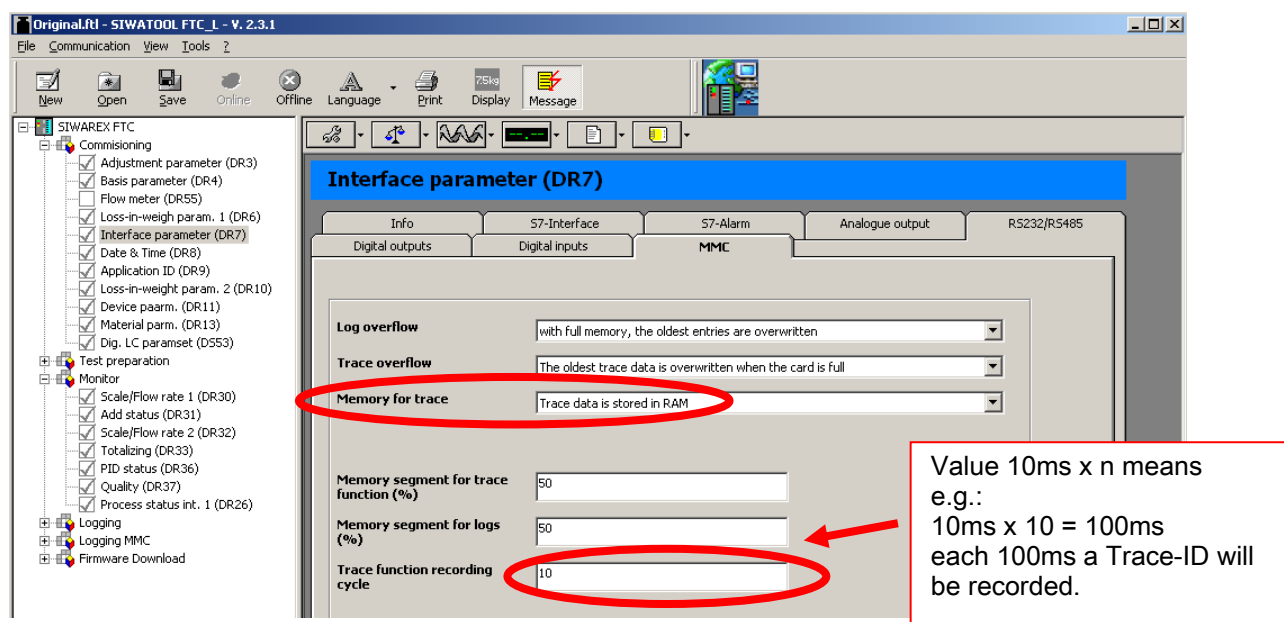
Preparation of a trace:

Using the Button **"Receive"** data (DR 7) will be read from the weighing module.

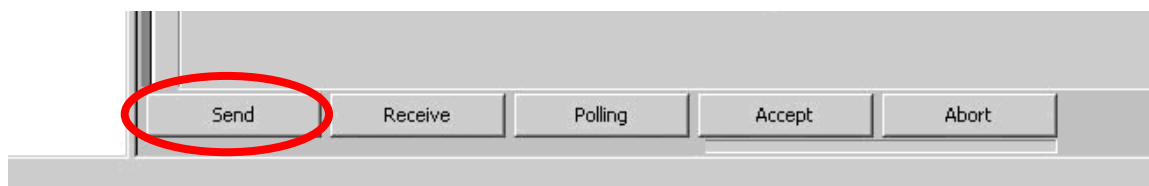


The following parameters can be changed:

- Memory for trace
- Trace function recording cycle

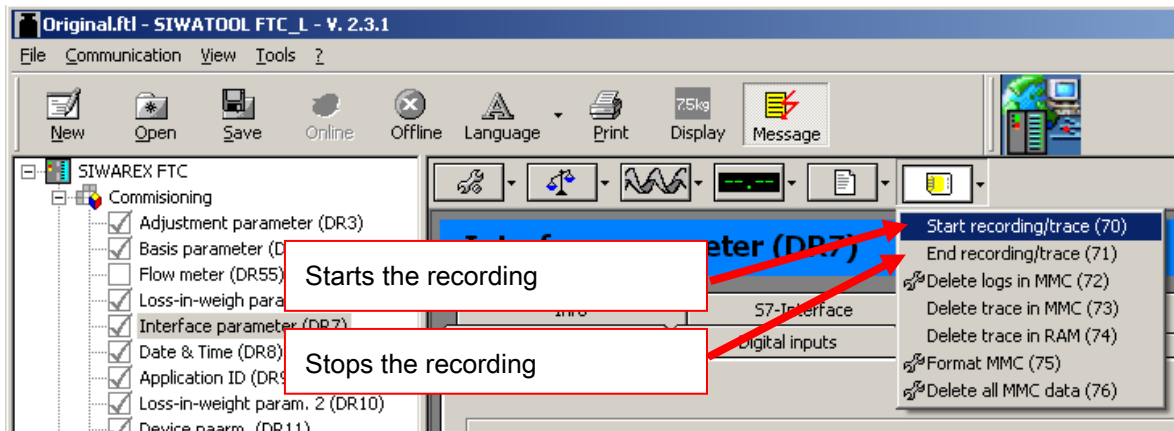


Using the button **"Send"** the data can be sent to the Siwarex module:



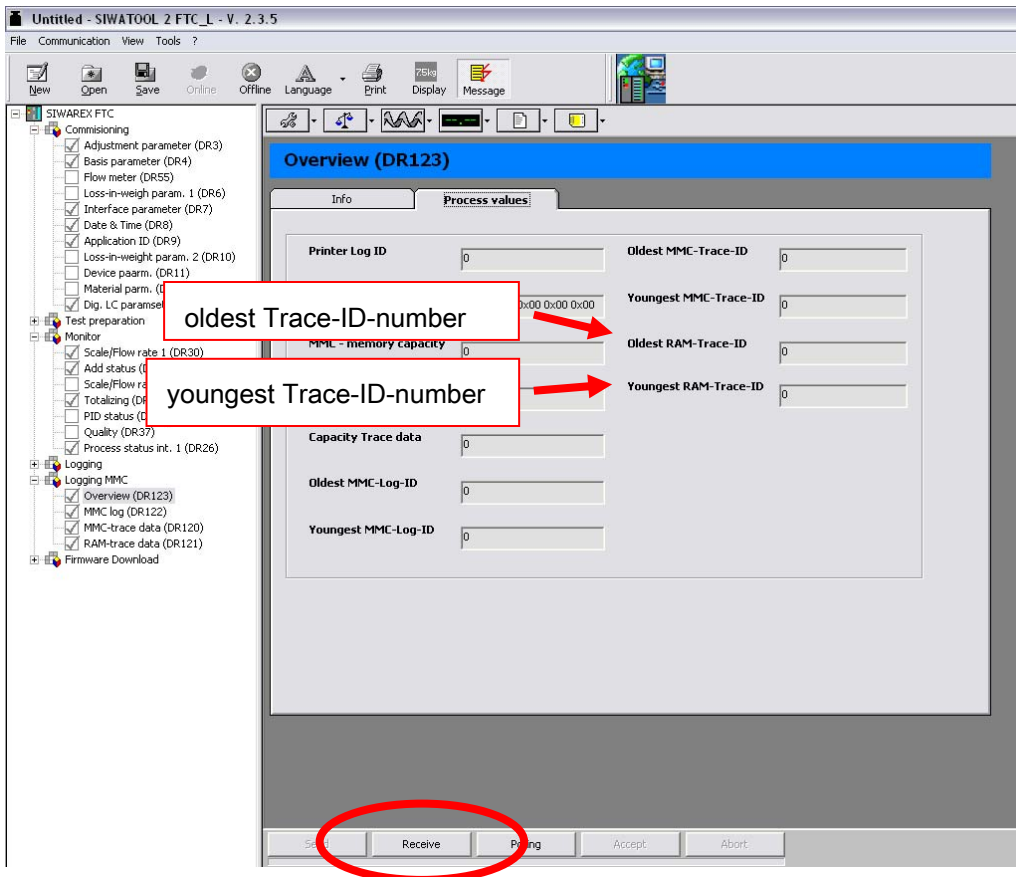
Running the trace:

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

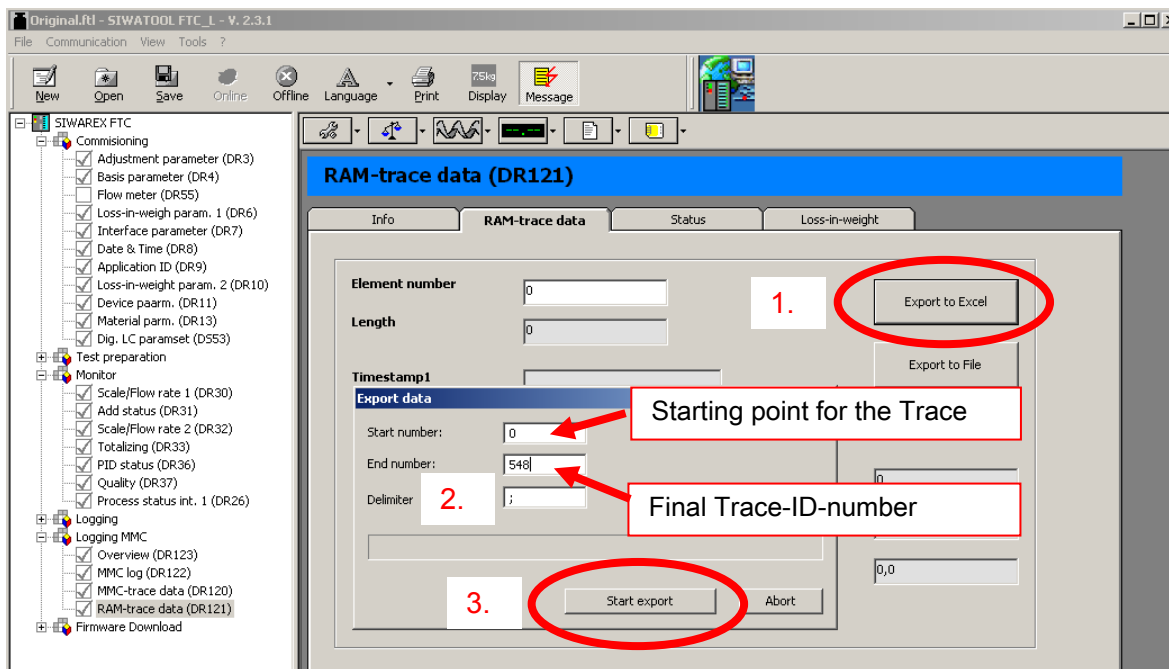


Export of data to Excel (or *.csv-file) :

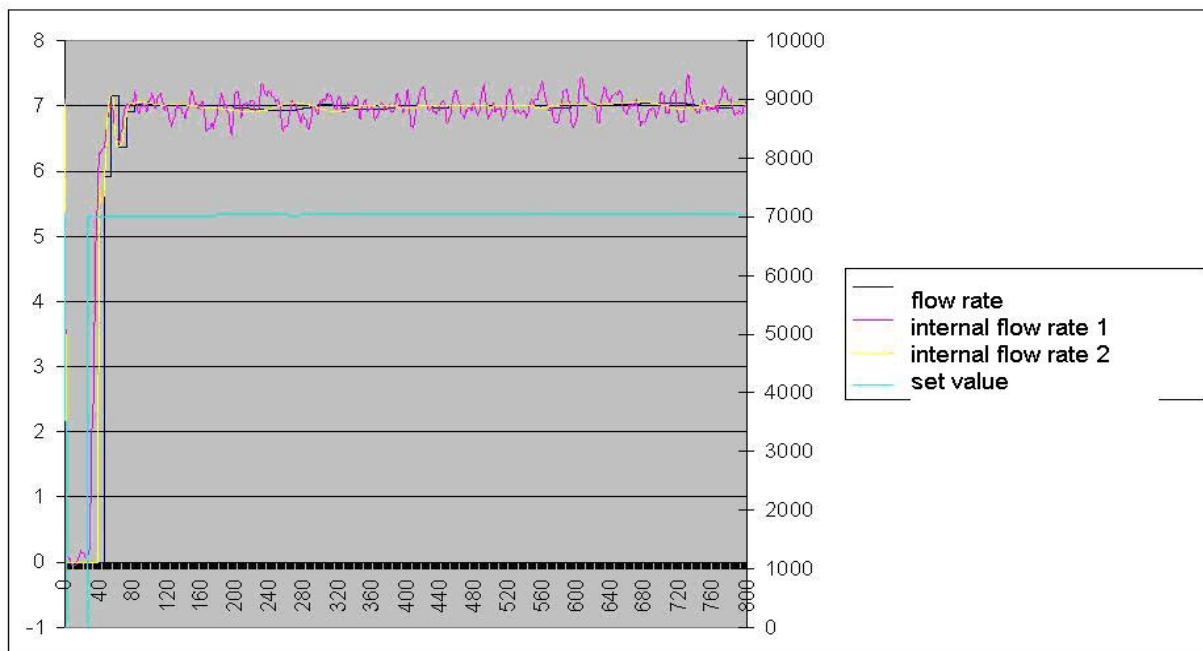
Pushing the button **“Receive”** in DR123 the recorded Trace-ID-numbers can be read.
In the following example there are traces with the ID-numbers „0“ to „548“:



Via DR121 the recorded Trace-data can be exported into Excel (or in a *.csv-file).
Before pushing the Buttons “Export to Excel” (or “Export to File”) the Trace-ID numbers have to be entered (in the example „0“ and „548“. Afterwards the button “Start export” 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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