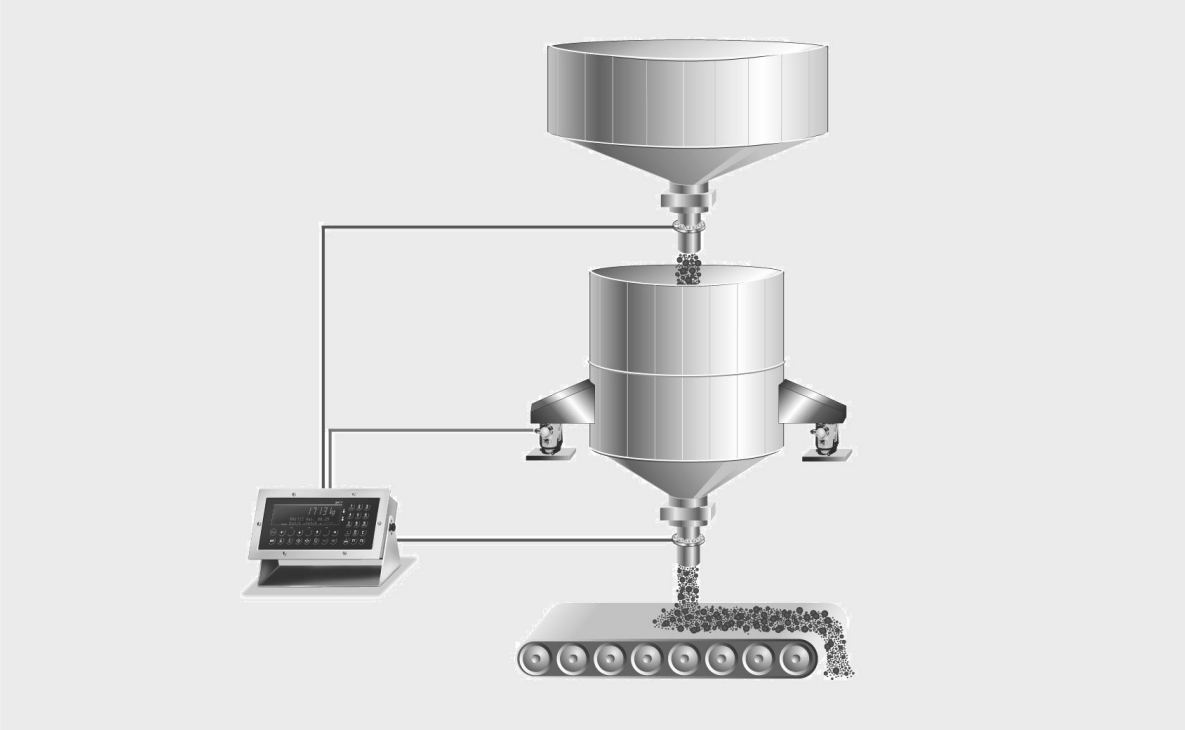
X4, X5, X6 - Application
FLOW Controller

Operating Manual



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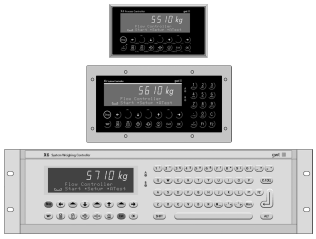

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Wichtig

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1 FUNCTION DESCRIPTION

The FlowController is an application specifically tailored instrument for control of constant material flow rate. The material flow rate is calculated from the weight change in the batch hopper by means of statistic functions. A PI-controller determines a control output value from actual flow rate and flow rate setpoint. This value controls the discharge system via an analog output. This is the most frequent application.

Every process starts with a phase in which the actual flow rate is still unknown. In order to start with a purposeful control output value for the discharge system during this time, a start value table must be provided. This table contains the relation between control output value and flow rate over the complete control range in steps of 10%. When starting a process, the discharge system is controlled by means of a value from this table. If necessary, interpolation between two table entries is possible.
The table can be created manually or automatically. A separate table is made for each material, whereby mechanical adaptations (e.g. replacement of screw feeder with different pitch) can be realized easily. Moreover, the 100% value from the start value table is used for calculation of the relative deviation between setpoint and process value and for limiting the flow setpoint during entry.

More than 30 parameters per material are stored in a database. Configuration must be separate for each material the flow characteristics of which differ from the other materials. The actual configuration parameters Kp (controller amplification) and Ti (controller integration time) can be changed via the operator interface during operation.

The controller setpoint can be provided from various sources: input by the operator, via fieldbus, DDE or OPC, a serial interface and even via an analog input. When using the serial interface or the analog input, cascaded controllers can be built up without external components. A unit measures the material flow rate and provides the result as a setpoint to further instruments.

The controller can be switched off. In this case, the instrument function is reduced to material flow measurement. The discharge or charge can be finished automatically according to a predefined quantity.

With discharge weighing, the weighing hopper can be filled up automatically from a storage bin on request. By automatic refilling, a continuous "infinite" material flow can be generated. During refill, the control output value is frozen, because the loss-in-weight is overlapped by the material refilled into the hopper.

Optionally, the frozen control output value can be modified linearly dependent of gross weight (compression correction). During refilling, this measure compensates the flow rate change dependent of the hopper contents.

1.1 Applications

Three different application ranges are possible with the flow controller

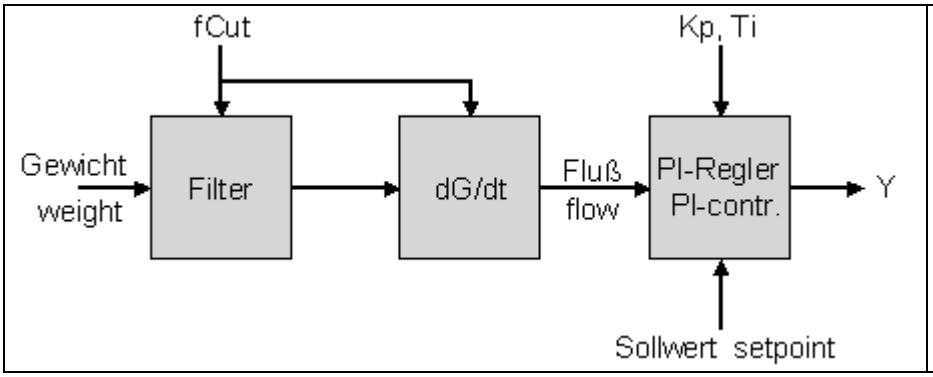
- Measuring the flow rate,
- Controlling the flow rate according to setpoint or as cascaded controller
- Controlling the flow rate according to setpoint for the flow rate and the total

These applications are listed with the relevant parameters in the following table.

Additionally to the flow rate control with predefined setpoint, a flow rate control with external set-point is possible, e.g. for the continuous mixing of two components, were the second component has a fixed percentage of the first.
All possible applications are included in the application software 102.

The three variations are selected only by software configuration from mode-setting: means by [Setup] – [Config] – Param .

Functional block diagram with equation for the flow rate calculation



$$Fluss = \frac{\sum G*t - \frac{\sum G*\sum t}{n}}{\sum t^2 - \frac{\sum t*\sum t}{n}}$$

The processes are distinguished generally by the flow direction of the material.
There are applications

where material is filled in a hopper with controlled or uncontrolled flowrate

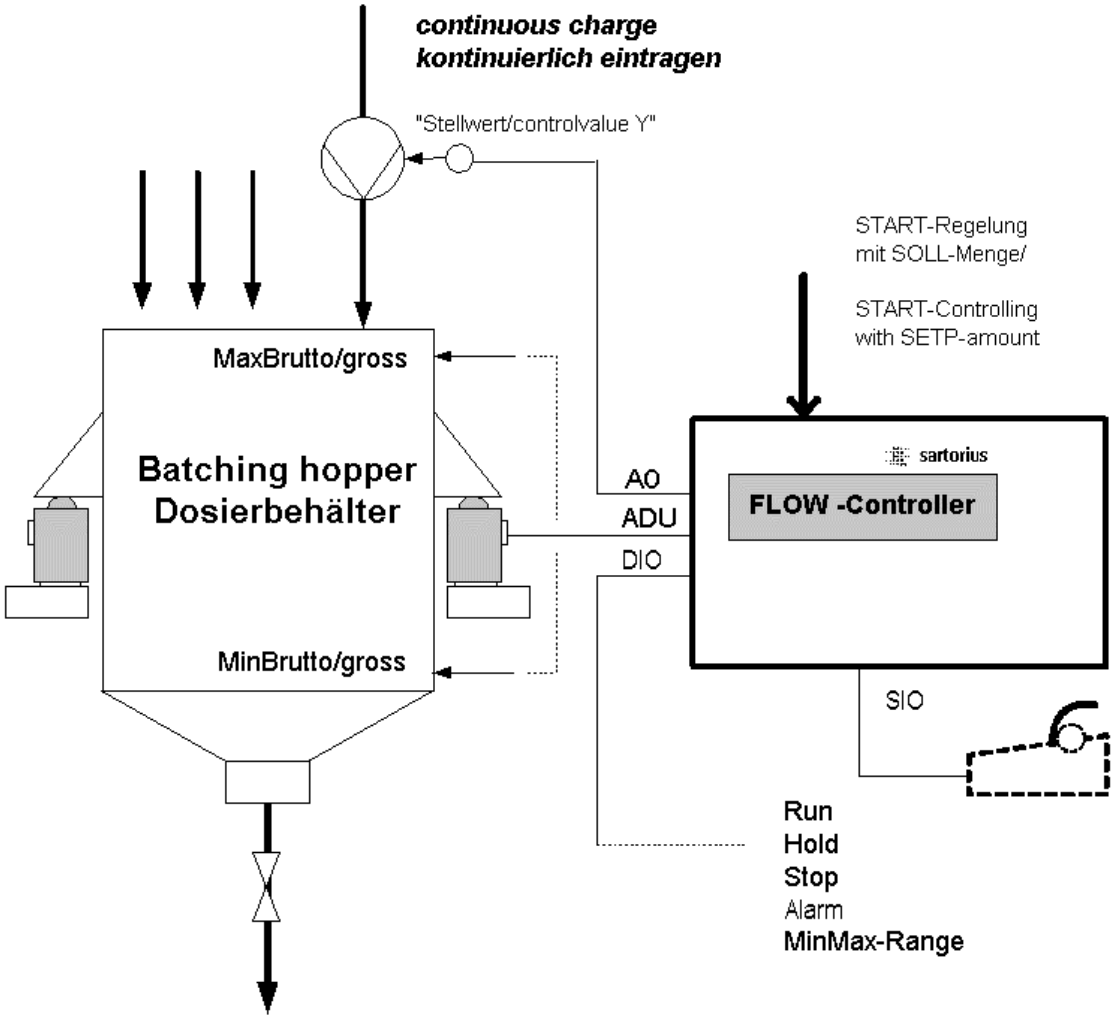
- Material increase/accession

where the material is discharged from a hopper with controlled or uncontrolled flow rate.

- Material decrease/loss

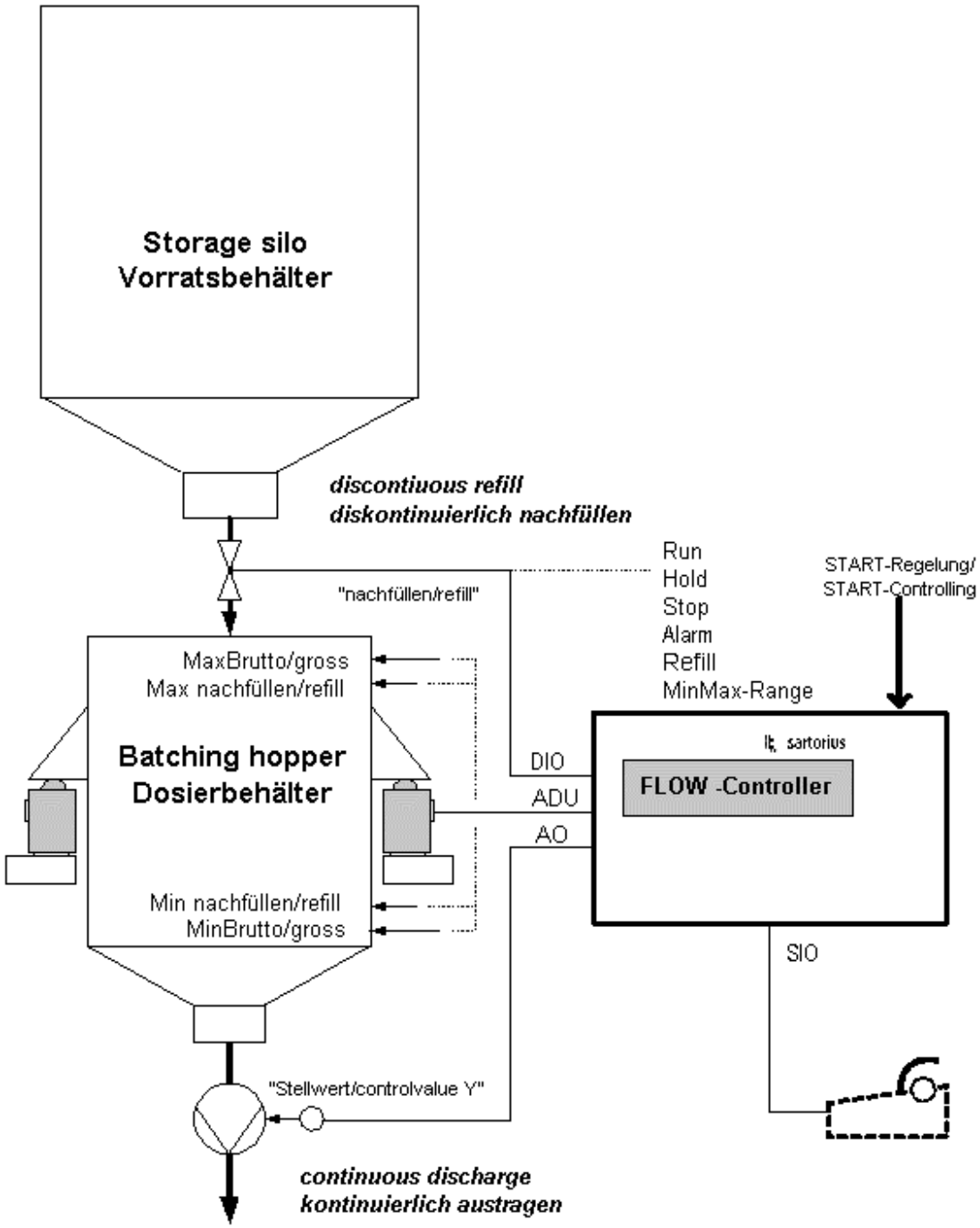
Both processes and the corresponding parameters are shown on the next two pages. The additional parameters to be defined per application are listed with the specific application.

Material increase



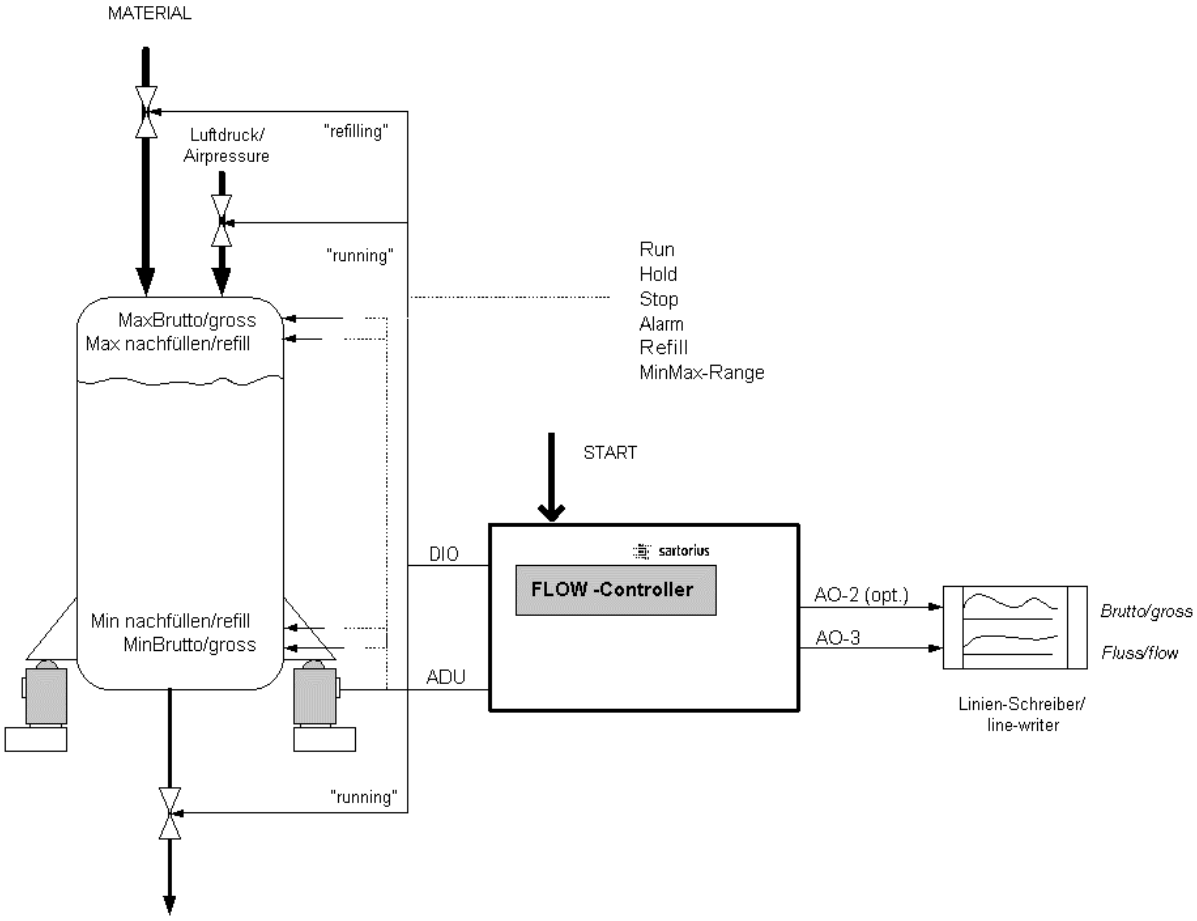
Parameter selection	Subparameter	Function
↓Loss in weight ↑ ↳ No ↳		Hopper weight increases
↓Min. gross ↑ 2 kg		Gross limit monitoring
↓Max. gross ↑ 28 kg		Gross limit monitoring

Material decrease



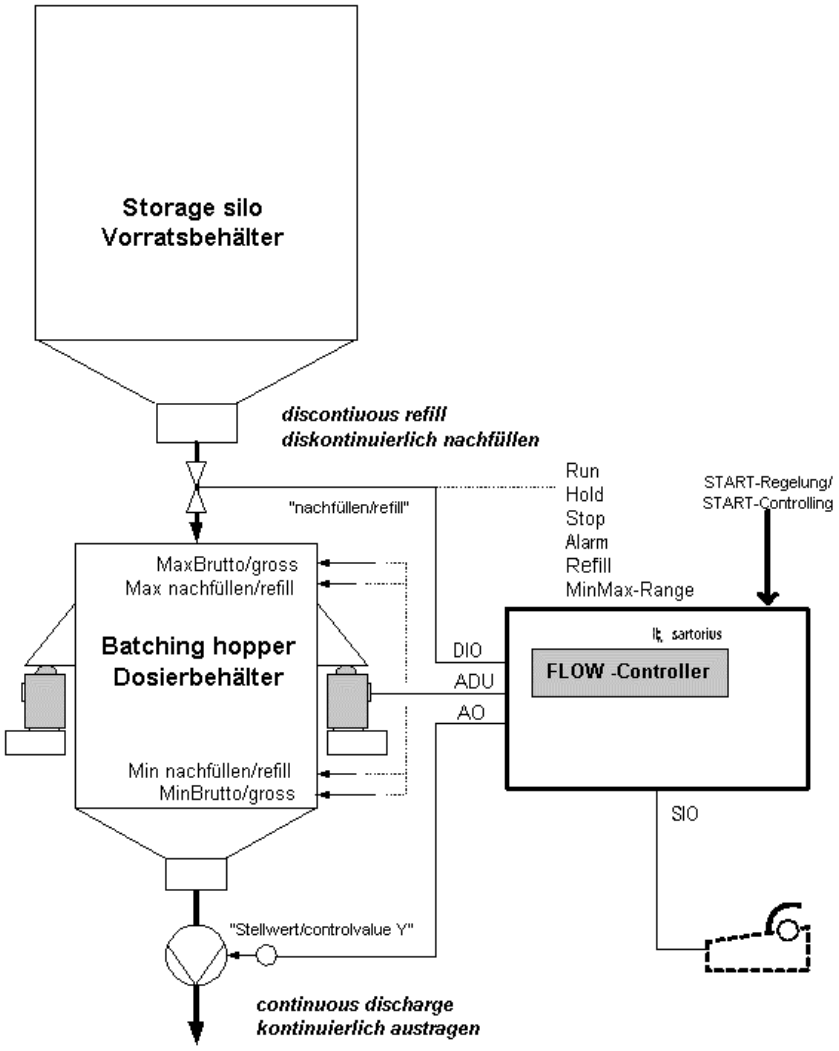
Parameter selection	Subparameter	Function
↓Loss in weight ↑ ↕ Yes ↕		Hopper weight decreases
↓Auto refill ↑ ↕ on ↕	↓Min. for refill ↑ 5 kg	Start REFILL (automatically)
↓Auto refill ↑ ↕ also at start ↕	↓Max. for refill ↑ 45 kg	Stop REFILL (automatically)
	↓Min. gross ↑ 2 kg	Gross limit monitoring
	↓Max. gross ↑ 28 kg	Gross limit monitoring

Measuring the flowrate



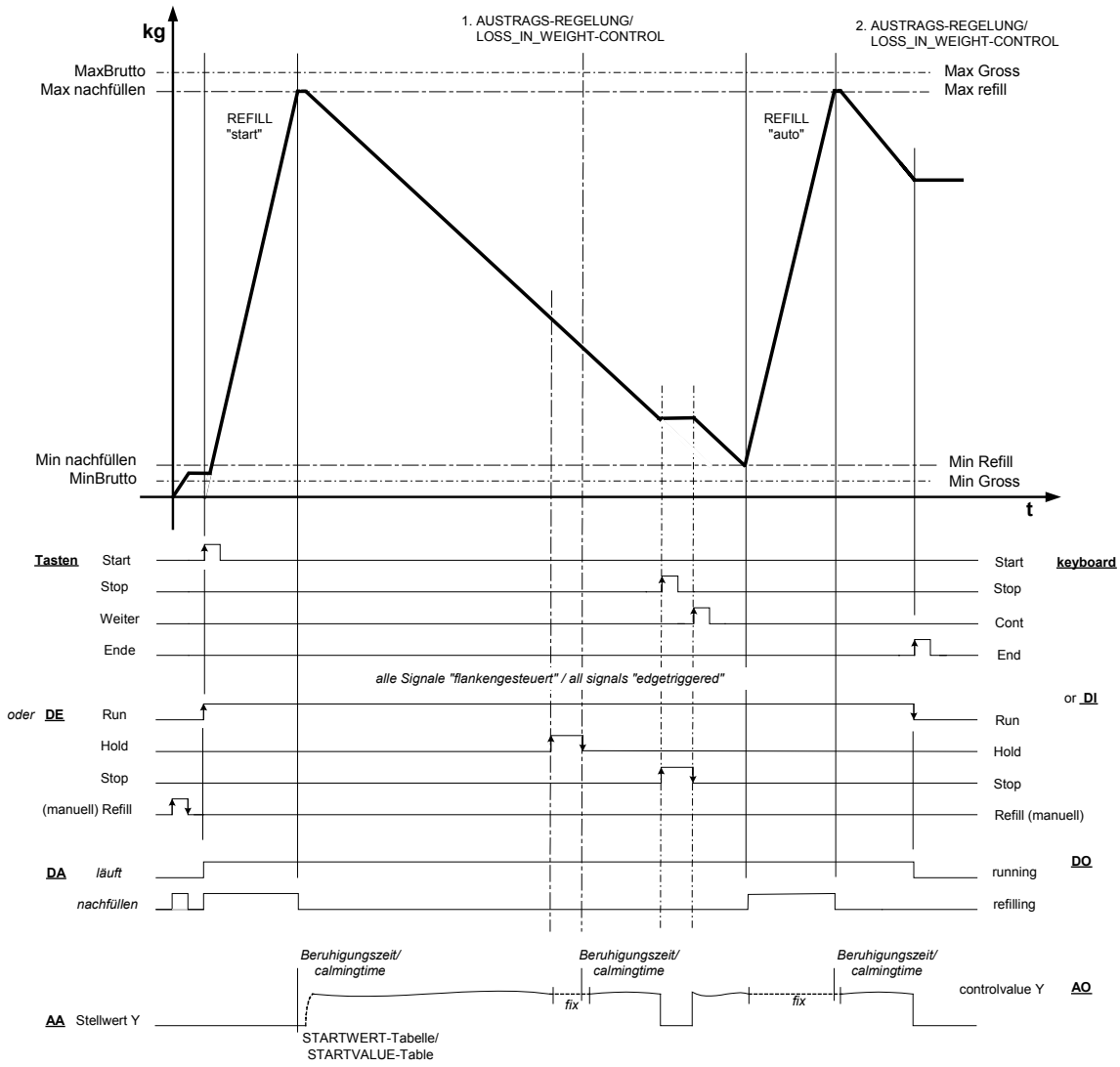
Parameter selection	Subparameter	Function
↓Loss in weight ↑ $ No $		Only flowrate measuring; the weight signal is filtered.
↓Output Slot 3 ↑ $ Flow $		Measuring output for example on a recorder.
	↓Output Slot 3 Art ↑ $ 4 ... 20 mA$	End of REFILL (automatically)
	↓Output Slot 3 ↑ 10 kg/min	Limit monitoring
		Optional 2. analog output card PR 1713/06 required
		Keyboard operation
Start *Refill* Total	↓Output Slot 2 ↑ $ Gross $	Start of the process or manual Refill or Total interval reset.
↓Dest.Water ↑ $ 12345 $		Material selection

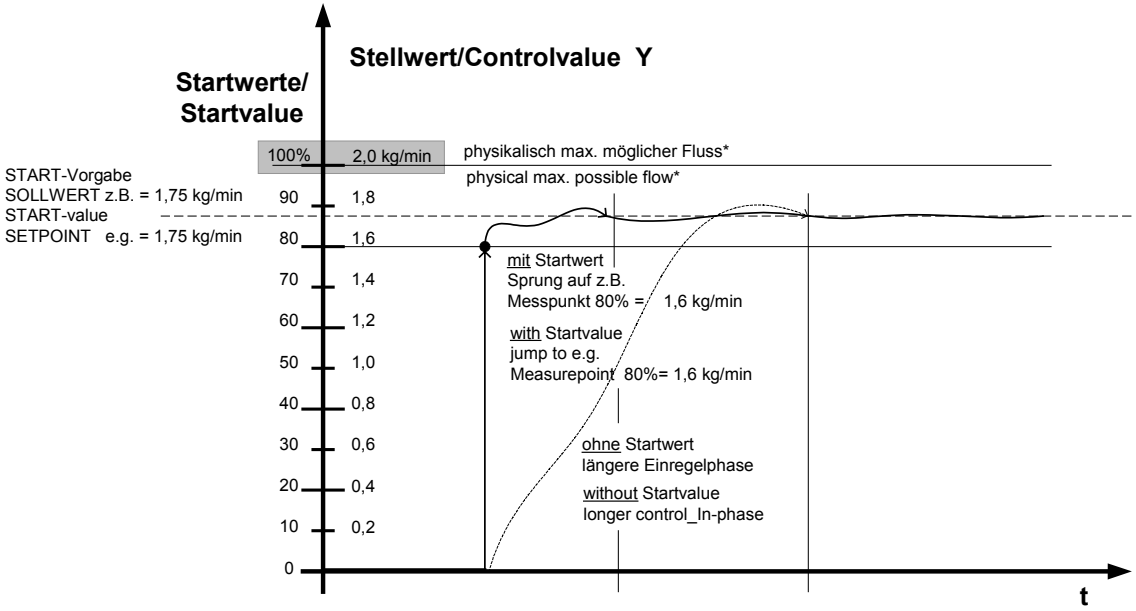
Controlling the flowrate



Parameter selection	Subparameter	Function
↓Flow controller ↑ ⇳ local setpoint ⇳		Input for example via the key-board.
↓Output Slot 3 ↑ ⇳ Flow ⇳		Control value
	↓Output Slot 3 Art ↑ ⇳ 4 ... 20 mA⇳	
	↓Output Slot 3 ↑ 10 kg/min	Maximum flow at 20mA = 100% control value.
		Optional 2. analog output card PR 1713/06 required.
		Keyboard operation
Start ▪Refill▪ Total		START of the controlled process or Refill manually or Erase the Total interval.
↓Dest.Water ↑ ⇳ 12345 ⇳		Material selection
Flow setpoint 2 kg/min		Flow setpoint changeable at any time.

Hopper weight curve depending on the flow control and the control commands



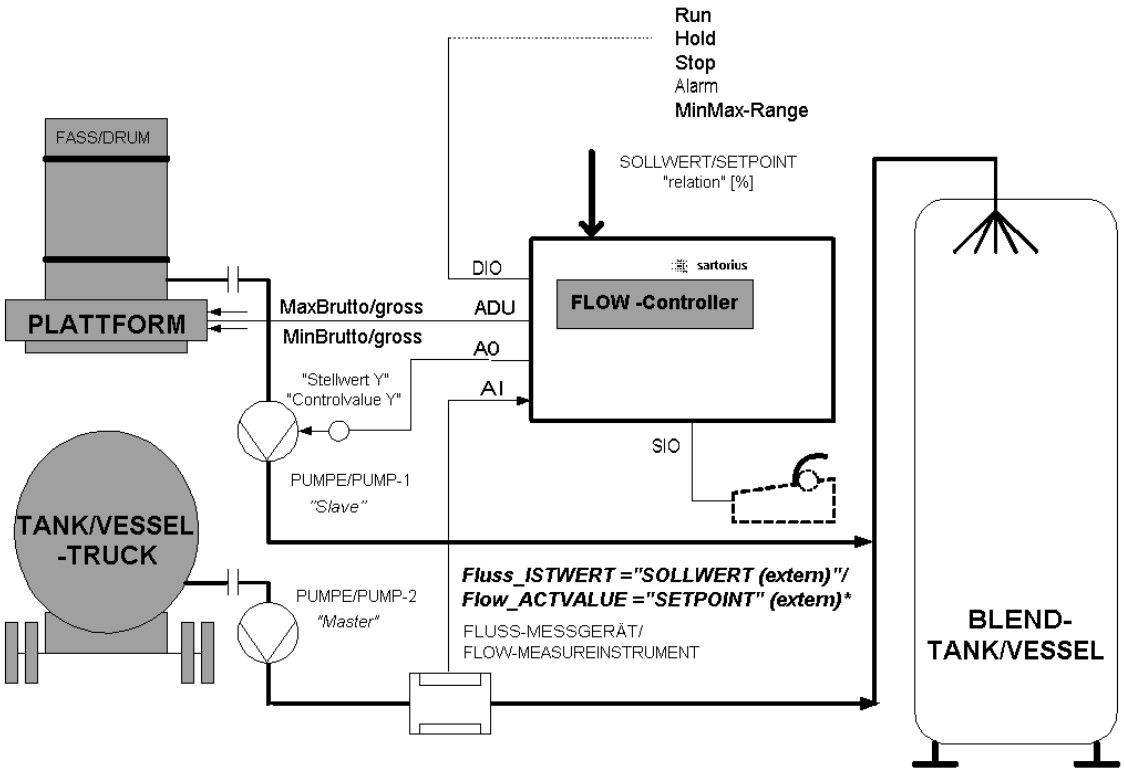


* mindestens dieser 100%-Wert muß definiert/gemessen sein (d.h. Y ungleich 0 kg/min), um ein Flusssollwert beim START verarbeiten zu können ! (Skaliert auch "Y"-AO bei 20mA)

* at least this 100%Value must be defined/measured (means Y uneqal 0 kg/min) before a flowsetpoint at START can toke into operation ! (scaling also "Y"-AO at 20mA)

Cascaded controllers

This application is used when one or more components have to be continuously batched in a fixed percentage of the guiding component to achieve a constant percentage of the components in the mixture.



Parameter selection	Subparameter	Function
↓Flow controller ↑ ↕ external setpoint↕		
↓Input flow setp. ↑ ↕ Slot 3 - analog ↕		Setpoint for example via the analog input.
	↓Input flow ↑ ↕ 4 ... 20 mA↕	
	↓Flow at 20 mA ↑ 5 kg/min	
↓Enter flow setp. ↑ ↕ Yes ↕		Request the Setpointrelation % at start?
↓Output Slot 3 ↑ ↕ Y ↕		
	↓Output Slot 3 Art ↑ ↕ 4 ... 20 mA↕	
	↓Output Slot 3 ↑ 10 kg/min	
		Keyboard operation
Start ▪Refill▪ Total		START of controlled process or Refill manually or Erase the Total interval.
↓Dest.Water ↑ ↕ 12345 ↕		Material selection
↓Flow setpoint ↑ 85 %		Flow setpoint relation in %.

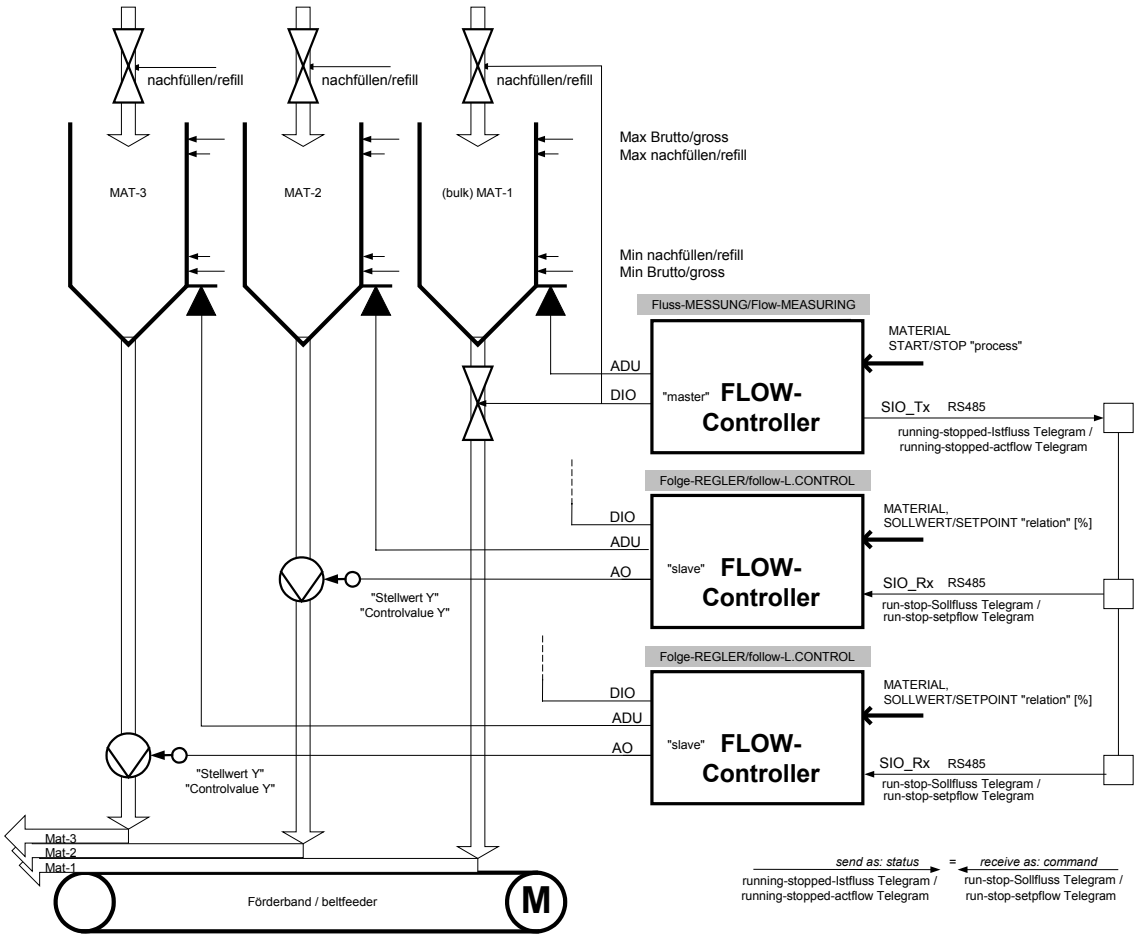
Recommended procedure for the configurationof a cascaded controller

1. Finish the configuration of the master. Note the configuration data for the analog output, e. g. 4... 20 mA, where 20 mA correspond to 10 kg/min.

2. Configure the slave completely except the cascaded controller input. Configure the analog input with the same data the analog output of the master has been configured, e.g. 4...20 mA, where 20 mA correspond to 10 kg/min.

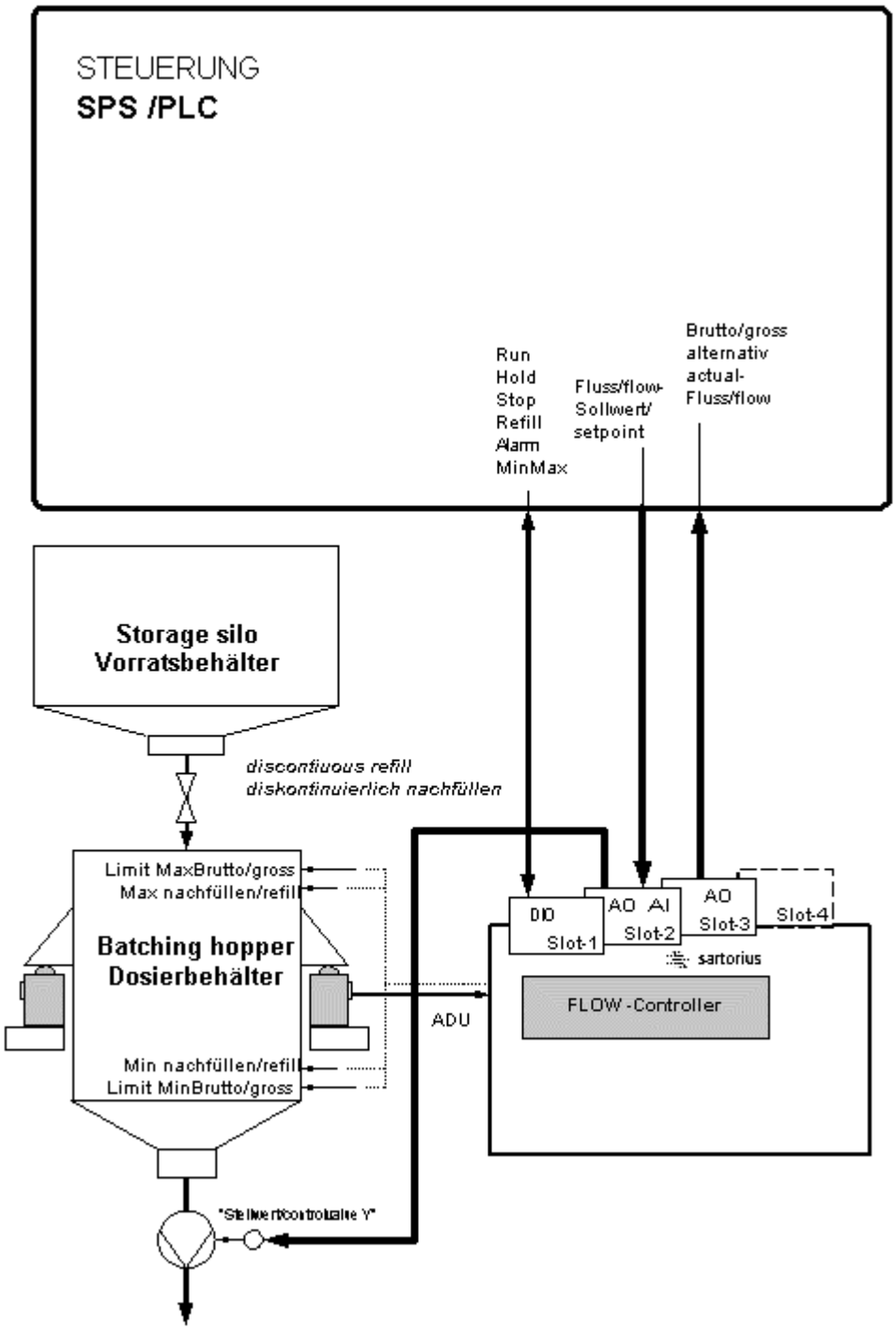
3. Adjust the flow setpoint of the slave to the requested relation, e.g. 50 %, if the master is set to 2 kg/min and the slave shall deliver 1 kg/min. This corresponds to the master–slave- ratio of 2 : 1.

Continuous material premix via material multilayer



Parameter selection	Subparameter	Function
↓Loss in weight ↑ % No %		**Master: Serial output**
↓Ser. remote mode ↑ % Flow %	↓Serial remote out ↑ % Slot 2 - RS485 %	.
Start ▪Refill▪ Total		
↓ Gravel coarse ↑ % 08 %		
↓Flow controller ↑ % external setpoint%	↓Inp. flow setpoint↑ % Slot 2 - RS485 %	**Slave: Serial input**
	↓Output Slot 3 ↑ % Y %	
	↓Output Slot 3 Art ↑ % 4 ... 20 mA%	
	↓Output Slot 3 ↑ 10 kg/min	**Keyboard operation**
Start ▪Refill▪ Total		START of the flow controlled process or Refill manually or Erase the Total interval.
↓ Gravel fine ↑ % 03 %		Material selection
↓Flow setpoint ↑ 15 %		Flow setpoint relation in %.

Example: Controlling from a PLC (with dig-IO, AIO) equivalent also via fieldbus realizable



Parameter selection	Subparameter	Function
↓Flow controller ↑ $ external setpoint$		
↓Input flow setp. $ Slot 2 - analog $		Setpoint for example via the analog input.
	↓Input flow ↑ $ 4 ... 20 mA$	
	↓Flow at 20 mA ↑ 5 kg/min	
↓Enter flow setp. ↑ $ No $		No request of Setpoint-relation at start (internal preset = 100%)
↓Output Slot 2 ↑ $ Y $		select: Control value Y
	↓Output Slot 2 Art ↑ $ 4 ... 20 mA$	
	↓Output Slot 2 ↑ 10 kg/mi	
↓Output Slot 3 ↑ $ Fluss $		select: actual flow
	↓Output Slot 3 ↑ $ 4 ... 20 mA$	
	↓Outp3 Flow @ 20 mA↑ 5 kg/min	
		Keyboard operation
Start ▪Refill▪ Total		START of controlled process or Refill manually or Erase the Total interval.
↓Dest.Water ↑ $ 12345 $		Material selection

1.2 Structure of the system

The flow control system comprises the following components:

- FlowController FLOW-X4, FLOW-X5 or FLOW-X6
- Load cells
- Cable junction box
- Analog output signal for controlling the discharge system
- Serial interface for data communication
- Digital inputs/outputs for process control
- Mechanical and electrical components for material transport
- Optional printer for configuration and material parameters, report after production end or actual total.

FLOW-Application version 3.00 or higher is required. A closed control loop including load cells, weight indicator, software for flowrate measurement, software PI-controller, analog output, power interface (e.g. frequency inverter) and discharge system (e.g. screw feeder) is built up. The weight can be measured also via an external indicator, e.g. connection by means of XBPI protocol.

1.3 Indicator functions

Based on the firmware, the FlowController has a number of indicator functions which are also available in this application, as long as no production was started.

- Display of gross weight, net weight, tare
- Set/reset tare weight (function not useful for this application)
- Set gross weight to zero (function not useful for this application)
- Weight display or remote display (for the weight value)

1.4 Delivery condition

The FlowControllers FLOW-X5 and FLOW-X6 comprise the following hardware and software options; the differences for FLOW-X4 are indicated:

1) In slot 1 is the digital in-/output card PR 1713/17 with 6 optocoupler inputs and 8 opto coupler outputs plugged. For FLOW-X4 is the digital in-/output card PR 5510/12 with 6 opto coupler inputs and 12 optocoupler outputs plugged.
2) In slot 2 is the serial interface card PR 1713/04 (for FLOW-X4 card PR 5510/04) with 1 interface RS232 and 1 interface RS 485 fitted.
3) In slot 3 is the analog output card PR 1713/06 (for FLOW-X4 card PR 5510/06) mit 0/4...20 mA-output signal fitted.
4) FLOW-Applicationsoftware R3.00 with firmware Release 3.12 or newer with a matching BIOS.
5) The application software licence 102.
6) Moreover, the FlowController is delivered with a CD with operating manuals and installation manuals in German and English language.

1.5 Options

For FLOW-X5 and FLOW-X6 the serial interface card PR1713/04 in slot 2 can be replaced by an analog output card PR 1713/06 with an output signal of 0/4...20 mA. If a second analog card is fitted, operation with fieldbus or Ethernet card is not possible due to power consumption reasons.

Instead of the analog output card PR 1713/06 in slot 3 also the analog in-/output card PR 1713/07 with 4 additional inputs can be used. This is necessary if a cascaded controller with an analog setpoint input has to be setup.

In slot 4 a fieldbus card for digital data input and output of weight values and setpoints can be installed. Alternatively an Ethernet card with data exchange via DDE or OPC can be installed. In both cases no second analog card may be installed.

With X5, X6 the weight value for the process can be provided by an external scale (e.g. Sartorius with XBPI-protocol).

List of the optional moduls for the Flow Controllers FLOW-X4, FLOW-X5 and FLOW-X6. With X5, X6 maximum 4 moduls can be installed in a FlowController. *For detailed information please refer to the corresponding installation manuals.*

	For FLOW-X5 and FLOW-X6	Slot 1	Slot 2	Slot 3	Slot 4
PR 1713/04	Serial I/O RS485/422 + RS232				--
PR 1713/06	Analog out		• x1		--
PR 1713/07	1 Analog out / 4 analog in		• x1	• x1	--
PR 1713/14	Ethernet interface	--	--	--	• x1
PR 1713/12	Control I/O 4/4 opto				--
PR 1713/15	Control I/O 4/4 relay and opto				--
PR 1713/17	Control I/O 6/8 opto (common GND)				--
PR 1721/01	Profibus interface	--	--	--	• x1
PR 1721/02	Interbus interface	--	--	--	• x1
PR 1721/04	Devicenet interface	--	--	--	• x1

* If a card is inserted in slot 4, no 2nd analog output card is allowed in slot 1 or 2.

	For FLOW-X4	Slot 1	Slot 2	Slot 3	Slot 4
PR 5510/04	Serial I/O RS485/422 + RS232			--	--
PR 5510/06	Analog out	--	--		--
PR 5510/07	1 Analog out / 4 analog in	• x1	• x1	--	--
PR 5510/12	Control I/O 6/12 opto			--	--
PR 5510/14	Ethernet interface	--	--	--	• x1
PR 1721/31	Profibus interface	--	--	--	• x1
PR 1721/32	Interbus interface	--	--	--	• x1
PR 1721/34	Devicenet interface	--	--	--	• x1
PR 1721/35	CC-Link	--	--	--	• x1

With X4 maximum 2 plus 1xPR 5510/06 moduls can be installed in a FlowController. *For detailed information please refer to the corresponding installation manuals.*

• x1	= Note restrictions due to high power consumption! *
	= Installed and prefered position

* If a card is inserted in slot 4, no 2nd analog output card is allowed in slot 2.

1.6 Operating manuals

This operating manual describes only the

- X5-FLOW controller function and operation

further the

- differences to FLOW-X4 and FLOW-X6 are indicated

including

- configuration, data entry to tables, production and data output

and the FLOW specific

- fieldbus-variables and datatypes

All other information inclusive **installation and calibration** is given in the **installation-manuals** of PR 5510 for X4, PR 5610 for X5 and PR 5710 for X6.

Information about installation and handling to other units via fieldbus communication, please see for X5, X6 the PR 1721 Fieldbus Manual or the PR1713/14 Ethernet-manual,
for X4 the own X4 Network / fieldbus-manual.

In this also the FLOW independend

- "Indicator"(gross, net, tare-weight) fieldbus variables and datatypes are descript.

2 Operator Interface

2.1 Display

The weight display permits the indication of 7-digit weight values with decimal point and unit. Furthermore, the total weight and the actual flow rate without unit can be displayed. The weight unit is selectable for tons, kilograms, grams or lbs. In addition to the numeric output value, two text lines with 20 characters each can be displayed. The remaining display symbols are shown in the following table:

Status-anzeige	Beschreibung
B G	Gross weight display Gross weight = net weight + tare weight (B is only active in NTEP mode).
NET	Net weight display.
T	The stored tare or initial weight is displayed.

Status-anzeige	Beschreibung
→0←	The weight value is within +/- ¼ d.
◺◿	Weight standstill.
◇	The process with regulated flow rate is busy.
◇	Slowly flashing: Refill of batching hopper. Quickly flashing:Stop.

2.2 Keypad

The functions of the front panel keys are nearly identical for FLOW-X4, FLOW-X5 and FLOW-X6. Differences are indicated and described in detail. The symbols on the front panel keys and their signification are:

Indicator keys	Description
	While pressing this key, the gross weight is displayed (*B – gross weight*).
	While pressing this key, the tare weight is displayed.
	Tare and reset tare. This key has no relevant function for the Flow Controllers.

Indicator keys	Description
	Print-out of menu depending data such as configuration data, material data or total.
	Weighing point selection. **Attention! WP B may not be selected, as a restart of the process after power down is inhibited**
	Set gross weight to zero, provided that - weight in standstill - weight within zero set range - not tared

Menu keys	Description
	Exit from the actual menu and continue operation at the next higher level.
	Softkey: select function
	Scroll down through menu functions
	Scroll up through menu functions
	Display of further menu functions, which are indicated by the double arrow ⁝.

Menu keys	Description
	Move cursor left during editing and selection of values, if ⁝ is displayed.
	Move cursor right during editing and selection of values, if ⁝ is displayed.
	Enter / execute / confirm. FLOW-X6 has an additional Enter key.
	Backspace / delete. With FLOW-X4 as second function via the key  .
	Also used as space.

Indicator keys	Description
	Stops the flow controlled process.

Indicator keys	Description
	Programmable function key. For Flow Controllers with fixed function „Start refill“.
	Programmable function key. No function for FlowControllers.

2.3 Operating concept

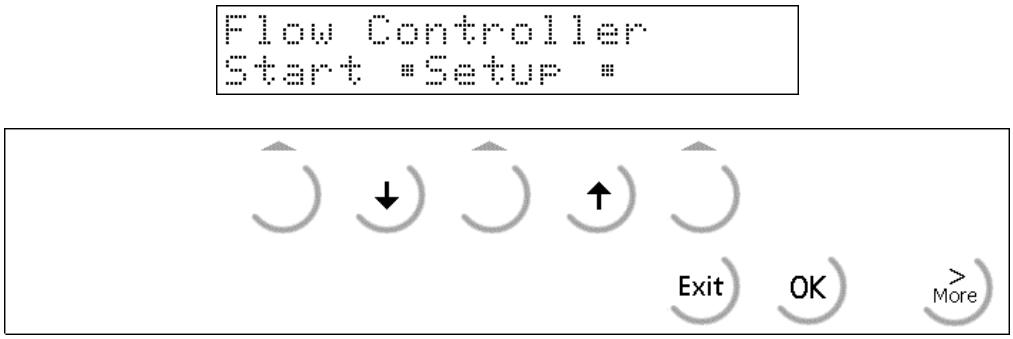
As described above in the function description the FlowControllers can be used in different applications, and the configuration of the FlowController is adapted to the requirements of the application. According to this configuration the display of irrelevant operating steps is suppressed. Is for example the flow control function not used, all related operating steps are omitted.
This operating manual describes the most frequent configuration. In the relevant chapters of this manual the different choices for the confuguration are described in detail. The basic applications are:

- Only measurement of the material flow rate.
- Controlled material flow rate with local setpoint.
- Controlled material flow rate with external setpoint (via serial or analog interface).

In this manual is only the operation of the FlowController FLOW-X5 explained in detail, as the operation of the other FlowControllers is almost identical. Differences for FLOW-X4 and FLOW-X6 are, if necessary, explained in detail.

2.3.1 Operation via softkeys

The operation of the FlowControllers is menu-guided. For this purpose, the controllers are provided with a softkey functionality: The three softkeys with the upward arrow below the display have the function described in the lower text line. With FLOW-X6 the softkeys look like this .



Selection of the menu functions is made by pressing the corresponding softkey .
If more than three functions can be selected, the double arrow indicates, that further functions can be displayed and called up by pressing key . Key can be used to leave a menu. After pressing this key, the operation is continued at the next higher level.

2.3.2 Selection via the scroll keys

Key arrow down permits scrolling forward through the menu functions, key arrow up permits scrolling backwards through the menu functions.
Key can be used to leave the menu and to continue the operation at the next higher level.
Key permits the selection of the menu item displayed between .

2.3.3 Selection via the MORE key

If the display line for the softkey functions shows the double arrow further functions can be displayed and called up by pressing key . Divergent from FLOW-X5 is this key on FLOW-X4 located at the lower left corner. With PRO-X6 this key is located at the lower right corner of the alpha keyboard.

2.3.4 Entry of alphanumeric characters

In the alphanumeric input mode, a flashing cursor is displayed in the input field. Access to this mode is automatically done by pressing an alphanumeric key. For FLOW-X4 please refer to the chapter MORE-key.

Several functions are allocated to each alphanumeric key. By pressing a key once, the first character, e.g. 'A', is displayed in the cursor position. After pressing the same key a second time, 'B' is displayed in the cursor position, and after pessing a third time, 'C' is displayed, etc. After the last possible function, the first one is displayed again.
The entry of a character is completed by pressing another character key, or key arrow right .

Press key arrow left to return to the previous character. By pressing the delete key C, the character is deleted from the display.

If only numeric values must be entered for an entry, letters are not enabled. Therefore, the entry of values such as 555 is possible by pressing the key three times without the arrow key.

Due to the double function of the keys for FLOW-X4 alphsnumeric characters are indicated at the lower right edge of the keys.

Key X5	Key X4	Character For FLOW-X4 only via More key	Remark
1 #"()=	1 #"()=	#"()=$?!%1	Comma, decimal point or colon can be entered using the dot key .
2 ABC	2 ABC	ABCabc2	
3 DEF	3 DEF	DEFdef3	
4 GHI	4 GHI	GHIghi4	Values with sign are also entered by pressing the dot key , once for minus and twice for plus.
5 JKL	5 JKL	JKLjkl5	
6 MNO	6 MNO	MNOmno6	
7 PQRS	7 PQRS	PQRSpqrs7	
8 TUV	8 TUV	TUVtuv8	
9 WXYZ	9 WXYZ	WXYZwxyz9	Every entry is completed by pressing key OK.
. -+*/	.-+*/	-+*/:;_'&,<>	
0 ÄÖÜ	0 ÄÖÜ	ÄÖÜäöüß0	Input of a space is possible using key 0 ÄÖÜ.

2.3.5 External process control

All operating functions are handled via display and keypad. Scale configuration is possible via an external terminal.
Control functions are possible via the digital inputs, fieldbus interface and communication. All digital signals are flank-triggered, i.e. all control functions can be used in parallel. This applies also to setpoints. This means that only changed data are taken over. This is necessary for overwriting the cyclically transmitted data of a PLC by the operator.
Some data are available at the digital outputs, via fieldbus or via communication.
During operation as a cascaded controller, the flow setpoint is transmitted as analog value or via a serial interface. In this case, manual setpoints, or setpoints defined via fieldbus and communication are relative to the cascaded controller setpoint just received.

3 POWER ON AT THE FLOW CONTROLLER

This paragraph describes the FlowController starting procedure after connection to the supply voltage. Dependent of the status which the instrument was in before switching off or supply voltage interruption, the instrument starts with different menus.

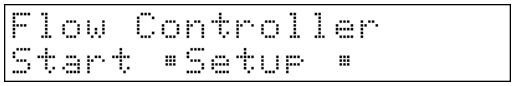
Caution! With a new instrument the clock is probably not running, because the battery jumper of X5, X6 different to X4 are not closed. Please set clock once *See* [Setup] – [Set Clock].

The sequence of the steps for commissioning is:

- Scale calibration and configuration (refer to the corresponding Installation Manual).
- Parameter adjustment (refer to 4.1 application parameters).
- Create at least one material and adjust the filter
- Create the start value table (refer to 4.2 material table)
- Adjust the controller parameters
- After power failure or switch-off, the FlowController generally starts exactly with the menu, in which it was when switch-off or power failure occurred. A running process is stopped. The user has to decide on canceling or continuation.

3.1 Switching on a new controller

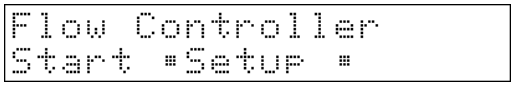
The instrument makes a warmstart with the preset data in the main menu. The FlowController application is indicated on the upper display line. On the lower line, the function of the two softkeys **[Start]** and **[Setup]** is displayed.



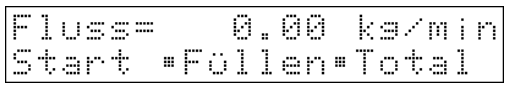
[Start] = Start of the flow control process
[Setup] = Setup with calibration, configuration and function selection for further parameters.

3.2 Switching on after power down

The unit makes a warmstart with all data from the last operating status and goes into the main menu.



After power failure during a flow control process, the instrument makes a warmstart and returns to the process step in which power failure occurred. The interrupted process can be continued or canceled. For further information, please go to chapter **5** Production.



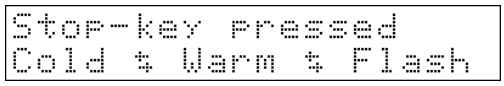
3.3 Switching on with the Stop-key pressed

The unit starts with the boot menu. The following functions can be selected:

[Cold] Coldstart with deletion of user programs and production data. All other parameters remain unchanged. A coldstart is always required after changes of software, installed hardware option or scale parameters, e.g. from kg into lb.

[Warm] All data remain unchanged.

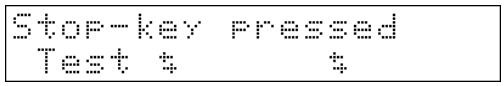
[Flash] Loading a new firmware and/or Bios and/or user user programs into the instrument.



For further information please refer to chapter **[Reboot]** in the corresponding Installation Manual.

Key 

can also be pressed to display and select the function **[Test].** This is an instrument hardware test. For further information please refer to the corresponding Installation Manual.



Basic setup and operation of the instrument are possible only via keypad and display. The operation is menu-guided at all operating levels, via alphanumeric keys, fixed function keys, programmable keys and softkeys.

4 SETUP AND CONFIGURATION

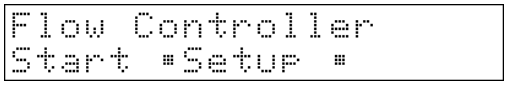
In the setup menu, all parameters can be adjusted. They are dependent of firmware, application packages, released licences and built-in options. Detailed information on all menu items is given in the corresponding Installation Manual.

Caution! With a new instrument the clock is probably not running, because the battery jumper of X5, X6 different to X4 are not closed. Please set clock once *See* [Setup] – [Set Clock].

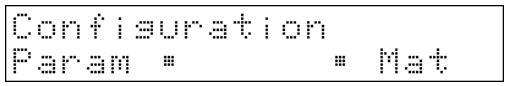
Detailed information on calibration is given in the corresponding Installation Manual. All remaining basic adjustment functions are described in detail in this manual and can be handled only via display and keypad. After changing the scale type (e.g. into external indicator via XBPI protocol), the 'Setup' program must be left for some internal initializations. Otherwise, flow speed 0.0 is displayed during filter and controller configuration.
FlowController configuration is possible only via display and keypad on the instrument. Configuration covers all parameters which are not relevant for the scale. The table below provides a survey of the parameter entries required for the application.

Setup	
- Configuration	
- Parameter entry	
- Loss in weight	Yes | No
- Flow unit	kg/min | kg/h | t/min | t/h |g/s| g/min | g/h | kg/s| lb/h | lb/min | lb/s
- Decimals	0 | 1 | 2 | 3 | 4 (digits behind the decimal point)
- Auto refill	Yes | No
- Min. for refill	0 ... FSD
- Max. for refill	0 ... FSD
- Stop at total	Yes | No
- Automatic report	Yes | No
- Min. gross	0 ... FSD
- Max. gross	0 ... FSD
- Calming time	0 ... 100 s
- Flow controller	off | local setpoint | external setpoint
- Input flow setp.	Slot 3 - analog | Builtin | Slot 2 – RS232 | Slot 2 – RS485
- Input flow	0 … 20 mA | 4 ... 20 mA
- Flow at 20 mA	0 ... maximum flow
- Enter flow setpoint	Yes | No
- Serial remote out	off | Builtin | Slot 2 – RS232 | Slot 2 – RS485
-- Ser. remote mode	Flow | Flow setpoint
- Output Slot 2	Y | Flow | Flow setpoint | Gross
-- Output Slot 2 Art	0 … 20 mA | 4 ... 20 mA
-- Output 2 flow @ 20 mA	0 ... maximum flow
- Output Slot 3	Y | Flow | Flow setpoint | Gross
-- Output Slot 3 mode	0 … 20 mA | 4 ... 20 mA
-- Output 3 flow @ 20 mA	0 ... maximum flow
- Simulation	Yes | No
-- max Simulation	feeder performance e.g. 2 kg/min
- Material table	
- New	
- Modify	
- Delete	

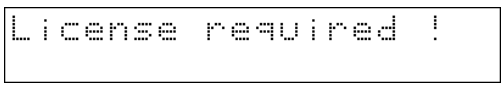
Access to the configuration is from the main menu via **[Setup],** by pressing ↓ (or several times ↑) and OK.



The input menu for configuration with the items **[Param]** for parameter entry and **[Mat]** for the material table is displayed.



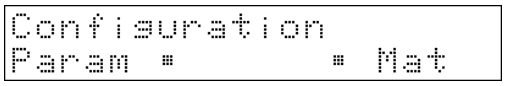
Unless application licence 102 was already entered, the following message is displayed before access to the configuration:



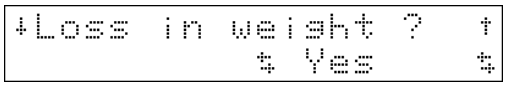
4.1 Application parameters

In the application parameters, material-independent parameters are defined and stored in EAROM. The definition of parameters 'Loss in weight', Flow unit' and 'Decimals' before the first material entry is indispensable. The configuration cannot be called up, if the system clock is stopped; message 'System clock stopped' (refer to the Installation Manual **[Setup] – [Set time and date]**).

Access to the parameter entry is with **[Param].**

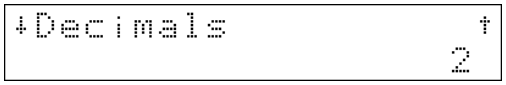


Select **'Loss-in-weight'** (Yes) or **'gain-in-weight'** (No) with ← or →, store with OK, ↓ or ↑.



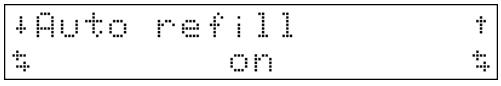
Enter the flow unit. Select with ← and →, store with OK, ↓ or ↑.

Enter the digits behind the decimal point with numeric keys 0 to 4; store with OK, ↓ or ↑.



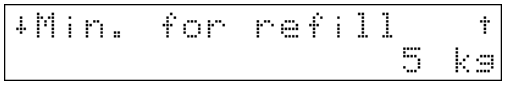
Only with 'Loss-in-weight': select the refill mode with ← and → : Selection between

[off] : no automatic refill
[on] : automatic refill during material flow
[also at start] : automatic refill even before start and during material flow.

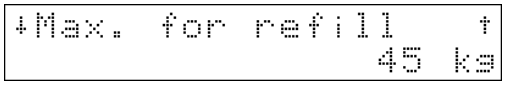


Store with OK, ↓ or ↑. With the automatic refill of the hopper a continuous material feed can be achieved.

Only with 'Automatic refill': specify the min. refill level (≤ fsd, decreasing content level) with the numeric keys; store with OK, ↓ or ↑. This parameter has to be entered for automatc refill and should be sufficiently high to have sufficient material available.

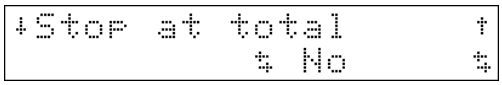


Only with 'Automatic refill': enter the max. refill level (≤ fsd, increasing content level) via the numeric keys,

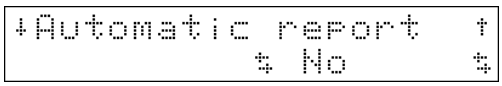


store with [OK], [↓] or [↑]. This parameter has to be entered to terminate the automatic or manual refill. . The material density should be taken into account to prevent scale overflow.

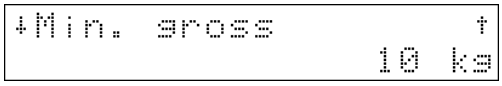
Select the switch-off mode with [←] and [→], store with [OK], [↓] or [↑]. With the function activated, a total amount is requested at production start. When reaching the total amount, the material flow is switched off. An overshoot is not taken into account.



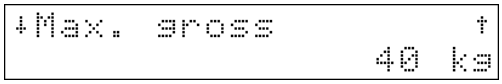
Select the automatic report with [←] and [→], store with [OK], [↓] or [↑]. With 'Yes', a report is printed out at production end.



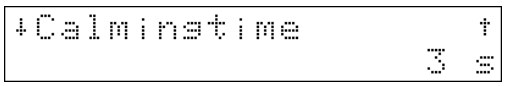
Enter the min. limit (≤ fsd) using the numeric keys; store it by pressing [OK], [↓] or [↑]. Gross weights below this value set an output. The value is without importance for the operation.



Enter the max. limit (≤ fsd) using the numeric keys, store it with [OK], [↓] or [↑]. Gross weights below this value set an output. The value is without importance for operation.

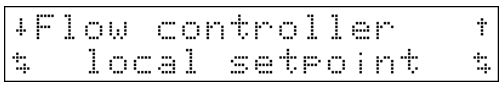


Enter the calming time between 0 and 100s via the numeric keys, store with [OK], [↓] or [↑]. The calming time delays the return to a controlled output e.g. after **[Hold]** , **[Refill]** and with **[Finishing]** to get the totalizing**.** Also used for transient effect waitingtime between the 10th stepping with autom. startvalue generation.



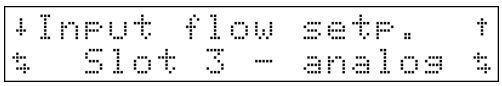
Select the controller function with [←] and [→], store it with [OK], [↓] or [↑]. Selection is between

[off]
[local setpoint] (entry, fieldbus, DDE / OPC)
[external setpoint] (cascaded controller via serial or analog interface)



Only with cascaded controller**: Select the remote input** with [←] and [→], store it with [OK], [↓] or [↑]. Selection is between

[Slot 3 – analog] (only with PR1713/07 in Slot 3)
[Builtin]
[Slot 2 – RS232] (only with PR1713/04 in Slot 2)
[Slot 2 – RS485] (only with PR1713/04 in Slot 2)

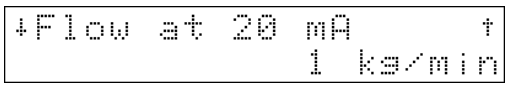


Only with analog setpoint input of a cascaded controller:

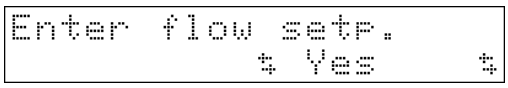
Select the analog setpoint input mode with ← and →, store it with OK, ↓ or ↑. Selection is between

[0 ... 20 mA]
[4 ... 20 mA]

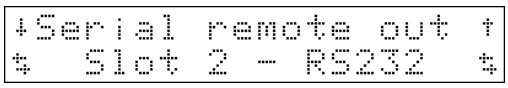
Only with analog setpoint input of a cascaded controller: **scaling of the analog setpoint input**. Enter the flow at 20 mA using the numeric keys, store it with OK, ↓ or ↑.



Input of setpoint before start, if external setpoint analog or seriell. If yes in %; if no always 100 %, if data source not Flow-X4 or Flow-X5.

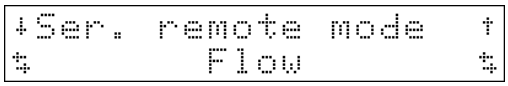


Not with cascaded controller: **Select the serial remote output** with ← and →, store it with OK, ↓ or ↑. Selection is between



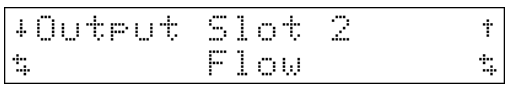
[off]
[Builtin]
[Slot 2 – RS232] (only with PR1713/04 in Slot 2)
[Slot 2 – RS485] (only with PR1713/04 in Slot 2)

Only with the serial remote output activated, not with cacaded controllers: **Serial remote mode,** Select with ← and →, store with OK, ↓ or ↑. Selection is between



[Flow]
[Flow setpoint]

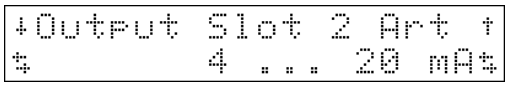
Only with analog output in Slot 2: **Analog output 2**, select with ← and →, store with OK, ↓ or ↑. Selection is between



[off]
[Y]
[Flow]
[Flow setpoint]
[Gross]

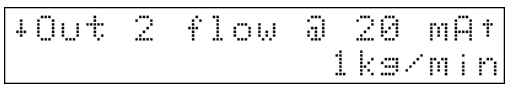
[Y] and **[Flow setpoint]** can be selected only with the controller activated.

Only with analog output in Slot 2: **Select the analog output 2 mode** with ← and →, store with OK, ↓ or ↑. Selection is between



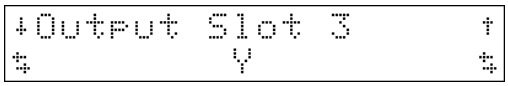
[0 ... 20 mA]
[4 ... 20 mA]

Only with analog output in Slot 2: A**nalog output 2 scaling**. Enter the flow at 20 mA using the numeric keys, store it with OK , ↓ or ↑.



Only with analog output in Slot 3: **Analog output 3**, Select with ← and → , store with OK , ↓ or ↑. Selection is between

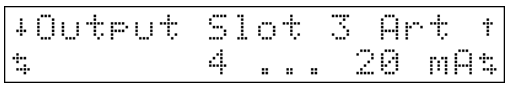
[Y]
[Flow]
[Flow setpoint]
[Gross]



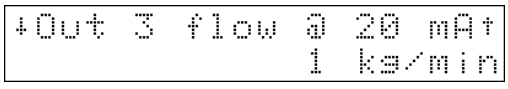
[Y] and **[Flow setpoint]** can be selected only with the controller activated.

Only with analog output in Slot 3: **Select the analog output 3 mode** with ← and → , store it with OK , ↓ or ↑. Selection is between

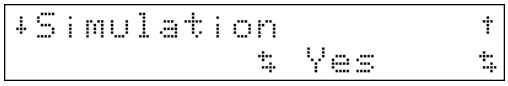
[0 ... 20 mA]
[0 ... 20 mA]



Only with analog output in Slot 3: **Analog output 3 scaling**. Enter the flow at 20 mA with the numeric keys, store it with OK , ↓ or ↑.

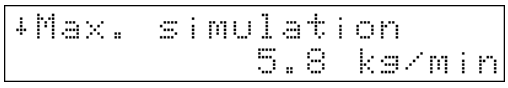


If the CAL-switch is open, a simulation of the material flow can be activated.



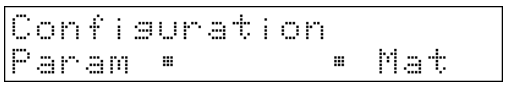
Switch on or off with ← and → .
With Off-On switching the hopper weight is initializied to empty or max_refill (only access facility for the autom. weight-simulation)

Enter the maximum flow rate (Y = 100%) with numerical keys, store with OK , ↓ or ↑.



Display menu for the storage function of the actual configuration data. This menu is displayed only if data have been changed. By entry of 'Yes' or 'No', the confi-guration menu re-appears.

In addition to that the menu can left with Exit .



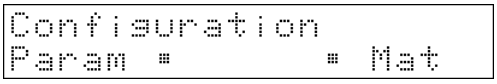
The configuration data can be printed out with key ⊙, if a printer is connected and configured. For this, see also chapter **6** Print data.

Example of a controlled loss-in-weight:

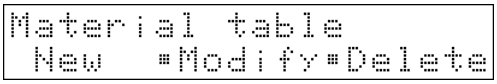
```
Configuration           FlowController 2.10
-----------------------------------------------------
Date/Time               2002.09.03 15:21
Scale                   50.00 kg
Mode                    Loss
Format flow             0.00 kg/min
Automatic Refill        5.00 ... 45.00 kg
Stop at total           yes
Automatic report        yes
Weight limits           10.00 ... 40.00 kg
Calmingtime             3 s
Loop controller         local setpoint
Serial remote output    Slot 2 - RS232    Flow
Output slot 3           Y                 4 … 20 mA
```

4.2 Material table

Access to the material table is with **[Mat].**

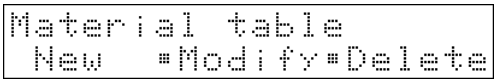


Menu functions **[New]** , **[Modify]** or **[Delete]** . These functions are listed separately.

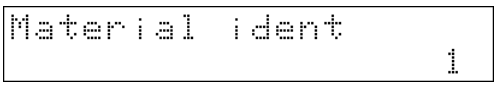


4.2.1 Entry of new materials

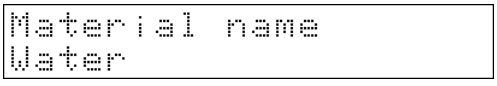
Softkey **[New]** can be used to proceed to the entry of a new material.



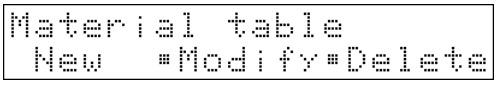
Enter a max. 8-digit material ident, store it with OK, ↓ or ↑.



Enter the material name with the alphanumeric keys, max. 18 characters, store it with OK , ↓ or ↑.

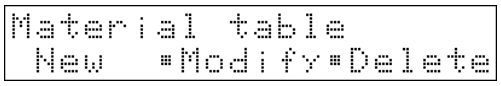


Menu **[New]** , **[Modify]** or **[Delete]**.



4.2.2 Change material data

Softkey **[Modify]** can be used for entry of parameters for a selected material. The material called up last is displayed. Scroll through the entered materials with ↓ and ↑ or enter a material ident. Press More to select direct entry of the name of the material to be found. Select the material with OK . Selection menu **[Filter], [Table]** and **[Ctrl].**



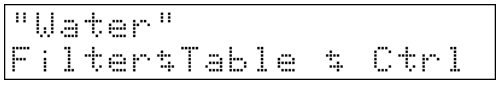
Not all menu items are available for the various configurations. With more than 3 possible menu items, the level can be changed by pressing ← and → .

[Filter]
[Limit]
[Print]
Additional with controller activated
[Table]
[Ctrl]
[Print]
Additional with loss-in-weight
[Compr]

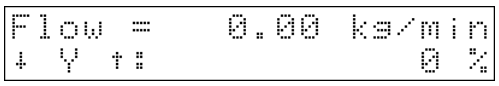
For the first configuration, adjusting must be done in the order of description. With subsequent process optimization, each menu item can be selected directly without consideration of the order.

Filter

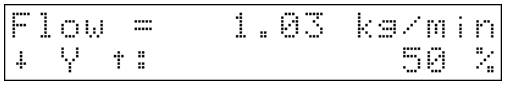
Select the filter setting with [Filter]. The filter suppresses disturbances from the process. The cut-off frequency should be as high as possible. The flow rate measurement time behaviour is derived from the adjusted filter cut-off frequency. Variations of the measured flow rate should not exceed 1% of the maximum flow rate. The filter setting determines the overall flow measurement and control behaviour. For this reason, adjusting should be done with utmost care This method is not a simulation and based on real material flow!



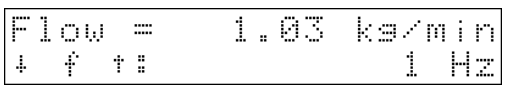
The actual flow rate and control output value 'Y' or cut-off frequency 'f' are displayed; change with ↓ and ↑ .



Enter a control output value 'Y' into the working point, normally approx. 50%; store with OK , ↓ or ↑.



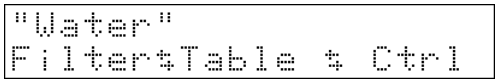
If the flow rate varies by more than 1%, the cut-off frequency has to be reduced. If the flow rate is too stable the cutoff frequency can be increased.



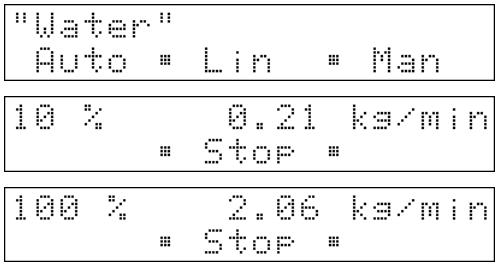
Enter cutoff frequency 'f' between 0,01 and 5 Hz, store with OK , ↓ or ↑.

Start values

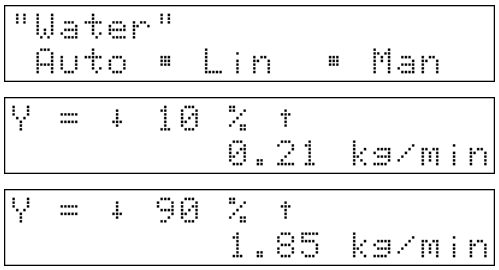
Only with the flow control function activated: generate a start value table with [Table]. Menu functions 'Auto', 'Lin' and 'Man' are displayed and can be used for automatic measurement of the start value table in 10% steps, linear calculation by means of a 10% and a 90% value or entry using table data for the discharge element. A table is provided for every material. Preference should be given to automatic table generation.



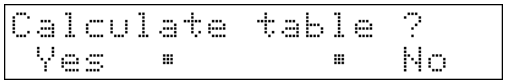
Automatically measured start value table – creation with [Auto]. The flow rates for the selected material are included for control output values from 0 to 100% in steps of 10%. This method is not a simulation and based on real material flow! The time per step is 16/cutoff frequency + calming time.



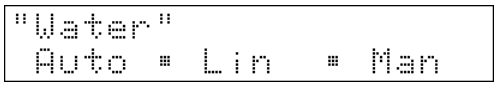
Calculation of a linear start value table - creation with [Lin]. Specify the flow rates for control output value 10% and 90%, change with ↓ and ↑, store with Exit, ↓ or ↑.
This method of calculating the start values is only applicable for output systems with a linear ratio between control output signal and flow rate e.g. screw feeder.



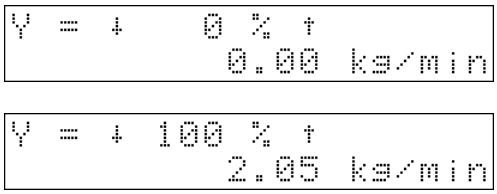
Display menu for table calculation.



Return to the selection menu 'Auto', 'Lin' and 'Man' by entry of 'Yes' or 'No' .

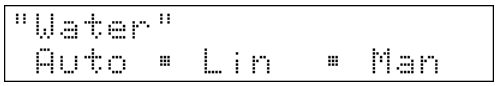


Entry of the start value table – creation manually with [Man]. This method can be used, if discharge is not possible, although theoretical discharge system values are available such as a screw feeder output diagram and a defined material.
Enter the flow rates for the selected material for control output values from 0 to 100% in steps of 10% and stoer it with OK.

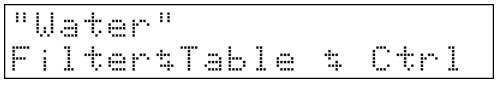


Attention: It is an unconditional must to define Y = 100% with a flowrate greater than 0 kg/min, in other case the 20mA-output current is not scalled, means output Y is always = 0mA and as consequence of that at start no FlowSetpoint-Entry is accepted.

Leave the menu with Exit. Automatic return to the selection menu **[Auto], [Lin]** and **[Man].**



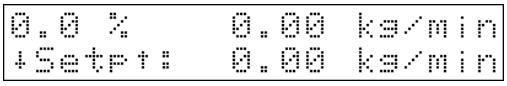
Return to the selection menu **[Filter], [Tab]** and **[Ctrl]** with Exit.



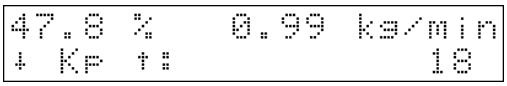
Flow controller

Only with the flow controller activated: Adjust the controller with [Ctrl]. Control output value, current flow rate and setpoint for controlled discharge are displayed. Attention, the control output value follows the setpoint faster than the actual flow rate, i.e. it is suited better for assessment of the line-out behaviour.

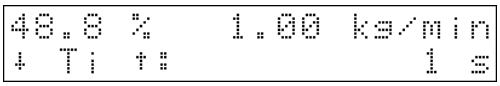
Enter the setpoint, store with [OK], [↓] or [↑]. Note the flow rate increase and adapt the control amplification accordingly. For this, we recommend observing control output value Y. *See also the graph on the next page*. This method is not a simulation and based on real material flow!



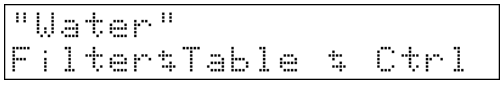
Enter the control amplification Kp between 0 and 1000, store with [OK], [↓] or [↑].



Enter the time constant Ti between 0.1 and 1000s, store with [OK]. Adjustment is iterative , see also the following hints and the graph on the next page.
After adjusting the filter, the automatic proposal value for Ti is the reciprocal value 1/f of the selected cut-off frequency. Leave the controller adjustment with [Exit].



Return to the selection menu **[Filter], [Tab]** and **[Ctrl]** [Exit]
.

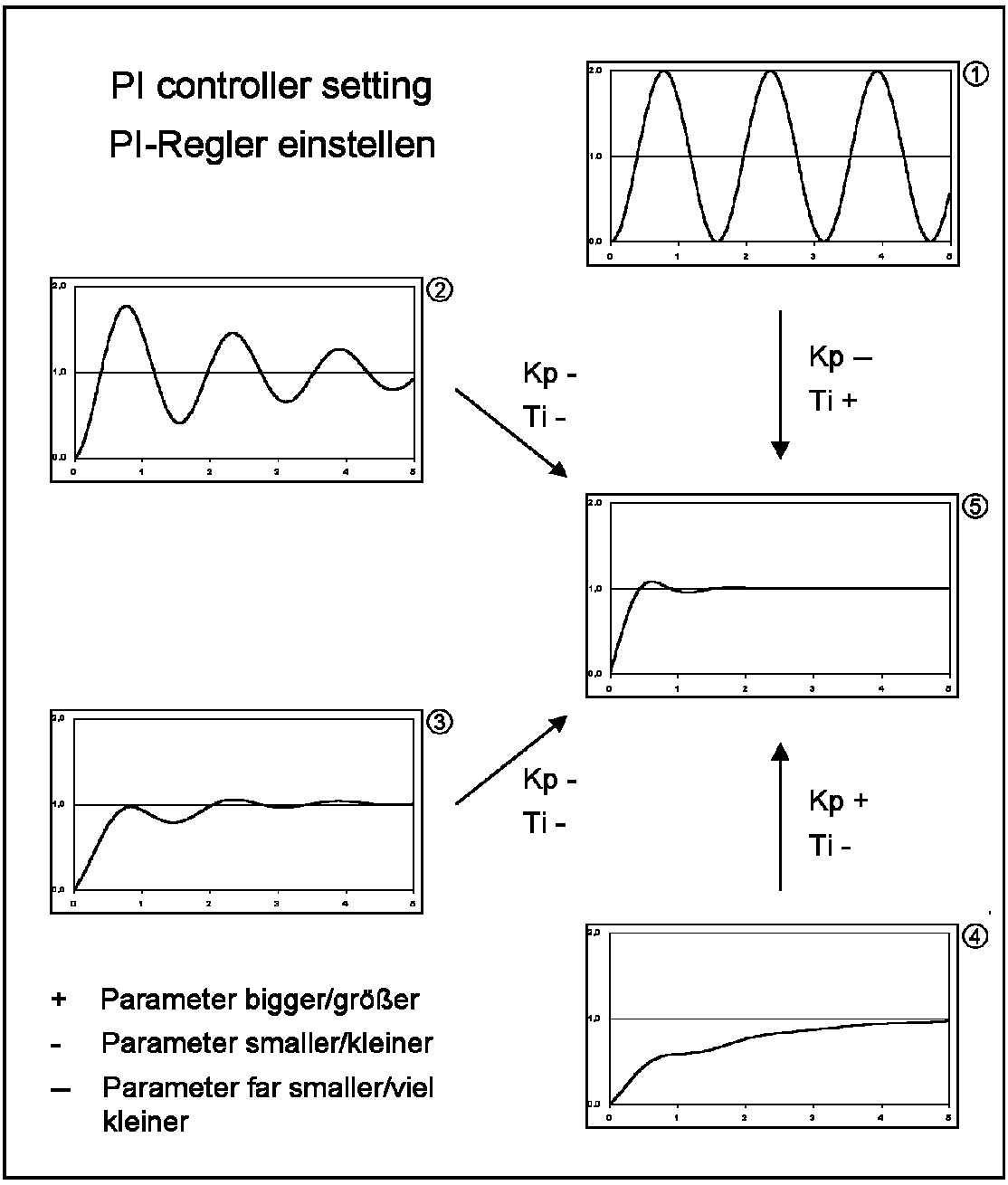


In the following survey, five diagrams **with coordinates Y-axis control output signal Y and X-axis time t** show the effect of controller parameters Kp and Ti on the control behaviour after a step jump function.

Jump function (abruptly change/switchOn of a setpoint-values):
Enter a setpoint change from 0% (transient effect gone) to xx% : Type in a value and close with OK. Watch the resulting actual flowvalue and compare with the diagrams, to find out the necessary changes of Kp and Ti. After that, set back to 0% and wait for falling transient effect before input of a new xx%-value for next jump function.

Required is an optimum line-out behaviour: the setpoint should be reached without overshoot, if possible, and within a minimum of time. This behaviour is shown in **diagram 5**.

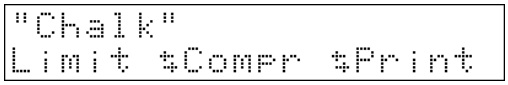
In all other cases, corrective measures which are explained in detail are necessary. In order to observe the controller behaviour, changing the setpoint is possible, or a weight change can be used.



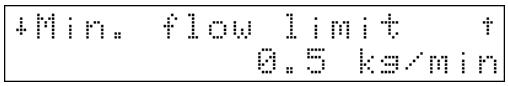
- In **diagram 1,** control amplification Kp is much too high and time constant Ti is too small. Therefore, the controller oscillates. Reduce Kp to attenuate the oscillation, as shown in diagram 2.
- In **diagram 2,** control amplification Kp is too high and time constant Ti is too small. To reach the required result with optimum line-out behaviour, reduce Kp and increase Ti.
- In **diagram 3** control amplification Kp and time constant Ti are too high. Consequently, line-out is dampened with some overshoot. Reduce Kp and Ti to reach the required result with optimum line-out.
- In **diagram 4,** control amplification Kp is too small and time constant Ti is too high. Therefore, the oscillation is dampened considerably and, in the worst case, line-out to the setpoint can be only asymptotic. Increase Kp and reduce Ti to reach the required result.

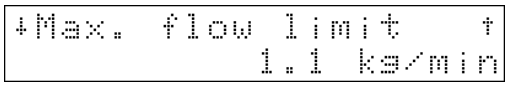
Note: The approach to the optimum values for Kp and Ti is an iterative process, which should be based mainly on the change of Kp. The value for Ti proposed after filter adjustment is usually close to the optimum, because the time behaviour is determined largely by the flow rate measurement.

Adjusting the flow limit: Limiting the flow is possible. Entry and function of the limit values are dependent of configuration.

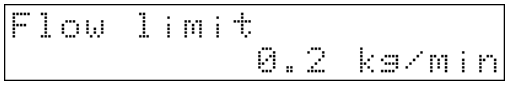


Controller is not active: Enter two limit values (e.g. 0.5 and 2.4 kg/min) which are allocated to two outputs.

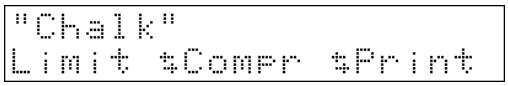




Controller is active: enter a symmetric, relative limit value (e.g. 0.2 kg/min), which is also allocated to the two outputs. The absolute limit values are calculated from the instantaneous setpoint +/- limit value. I.e. the limits are shifted synchronously to the setpoint. The conrol output values related to the limit values are calculated via the start value table. Higher or lower control output values are limited. With widely varying material properties, limiting must not be set to close tolerances, or must even be switched off by setting the value to 0.0.



Only with the controller activated and loss-in-weight: **Select the compression correction** with **[Compr]. C**ompression correction shall be done with the same material and setpoint and with the controller lined out for each material.

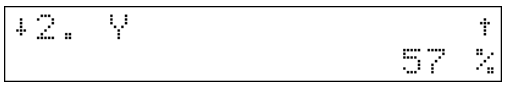


Activate the compression correction: select **[Yes]** or **[No]** with ← or →, store with OK, ↓ or ↑.

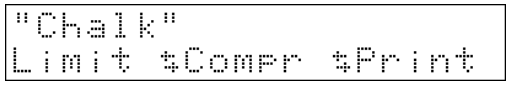
Here, value pairs for control output value Y and the related gross weight with the hopper almost empty and with the hopper as full as possible must be measured. The required data can be determined only during normal operation. The entry can be disabled first with a new material. After determining the values, function activation and entry of the value pairs are possible. During refilling, the discharged quantity cannot be measured. Therefore, the control output value without compression correction is freezed during this time. With correction, the control output value is tracked according to he entered data. This improves the material flow accuracy during refilling.

Only with the correction activated: **Enter the 1st segment point for compression correction with** Y 1 and gross weight 1.

Only with the correction activated: **Enter the 2nd segment point for compression correction with** Y 2 and gross weight 2.

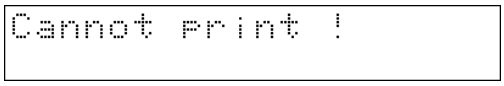


Store the values and return to the material menu with OK.

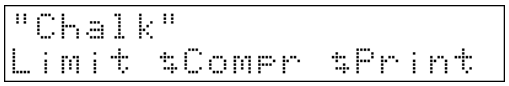


Select the print function with [**Print**] or key ⊙. If a printer is connected and configured, the selected material data are printed out. See also **6** Print data.

Otherwise, the following error message is displayed during 3 s:



Return to the selection menu.

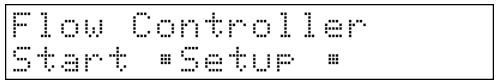


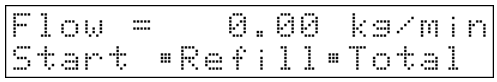
5 PRODUCTION

Chapter Production deals with application 'constant loss-in-weight', whereby material is discharged at constant flow rate from a hopper. This is the normal FlowController application.
Application 'constant addition of weight' is the inverse process and completely identical, except that the weight in the hopper increases. Refilling and compression correction are not available in this operating mode. For the rest, operation is unchanged.
In configurations 'Controller not activated', 'Cascaded controller' and 'Stop at total', operating steps are omitted, or have a different meaning. In these cases, a note is given. Basically, however, the procedure of production start-up or of an operating step is unchanged.

5.1 Start of application

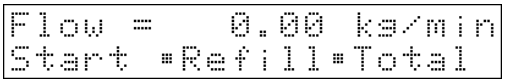
Access to the start menu for the application is from the main menu via **[Start].**
The FlowController is in the stand-by menu. From this menu, further menus can be called up.



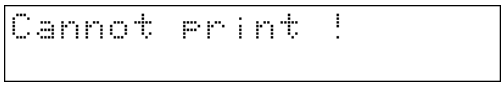


5.1.1 Reset total

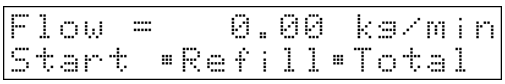
Access is via **[Total].** The total can be reset at any time. With **[Yes],** the production report (total) is printed out as stated below.



Unless a printer is connected and configured, the following error message is output after 3 s:



With **[No]**, after the error message, printing or Exit, the flow controller returns to the stand-by menu.

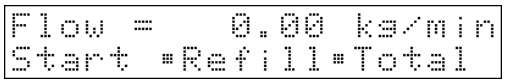


5.2 Start and operation of the process

The process can be started using various methods. For preparation of an external start, the method described in this manual must be realized via the instrument controls (Material and setpoint determination), without actually starting. The external start methods are

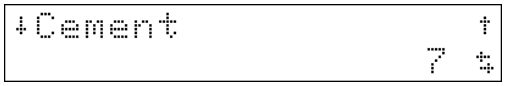
- digital input
- fieldbus interface
- communication interface
- remote operation of a cascaded controller (analog or serial)

Starting the process manually is done from the stand-by menu via **[Start].**

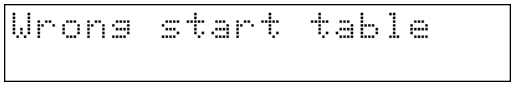


The material called up last is displayed.

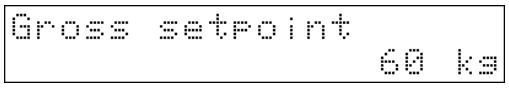
Via scroll keys and another material can also be selected. Press key to store the displayed material.



If no start table available, the start will be aborted with the following error message.

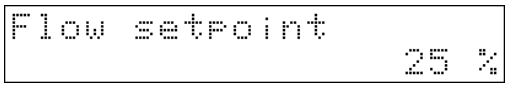


Only with automatic switch-off configured: **Enter the gross setpoint**. The proposed value can be changed and stored with .

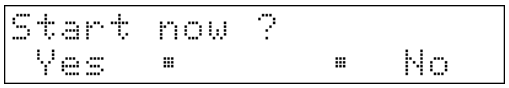


Display the flow setpoint for the selected material. The proposed value can be changed and stored with .

With the instrument configured as a cascaded controller setpoint entry is relative in % (≤ 1000 %) of the setpoint input. This input can be suppressed by configuration.



Press **[Yes]** to start the process in the display mode selected last, or **[No]** to store the entered data for a subsequent start using the various methods.



During the process, a selection menu offering the following functions is displayed:

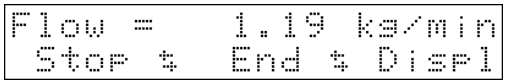
Dependent of actual configuration and process condition, various functions to influence process or display are available. There are various combinations of menu items. A survey is given below:

- Stop / Continue
- Refill / End
- Display switchover
- Total reset
- Change limits
- Freeze / Enable process
- Change gross setpoint
- Adjust controller

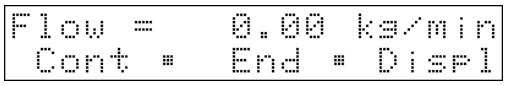
If necessary, press keys or several times to display the relevant menu item.

5.2.1 Stop, continue or terminate the process

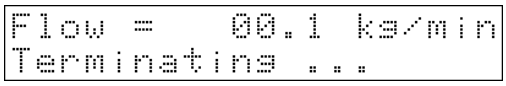
Terminating the process is possible only via key **[Stop]** (see **5.2** Start of process).



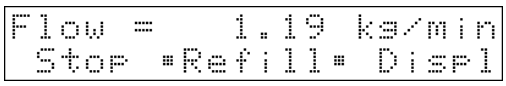
If the material discharge was stopped, the lozenge flashes and the process can be continued with **[Cont]** or terminated with **[End].**



In case of termination, a message is displayed during the calming time. If configured, a report is printed out.



The FlowController returns to the start menu.

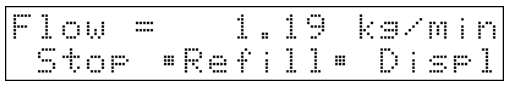


The report production report (after production) is printed after production end, if an automatic printout was configured. See chapter 6.

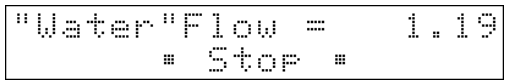
5.2.2 Refilling the hopper

This function is available only with loss in weight.
The min. limit value for automatic refill is monitored continuously.

When exceeding the lower limit value, the hopper is refilled automatically, if configured.



The FlowController freezes the process with the last control output value and reenables it only after refill is switched off at the max. filling limit. Refilling can also be interrupted by pressing key **[Stop]**. In both cases, the process is continued.



Manual refilling is also possible by pressing key **[Filling].**

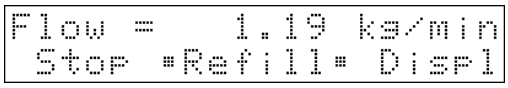
5.2.3 Display switchover

Dependent of configuration, various displays can be allocated to the first text line. The material name excepted, key 

can be pessed for display of the same value on the large weight indicator, alternatingly with the gross weight from the scale. The gross weight from the scale excepted, display of all values on the weight indicator is without dimension. The possible values are:

		no Stop at total		with Stop at total	
		controller off	controller on	controller off	controller on
FSoll	Flow setpoint		X		X
Fluss	Flow	X	X	X	X
Y	Y		X		X
Total	Total	X	X	X	X
Mat	Material	X	X	X	X
BSoll	Gross setpoint			X	X
Netto	Net			X	X

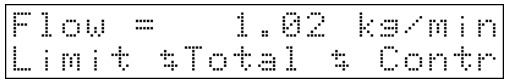
Press key **[Displ]** for changing over to display selection.



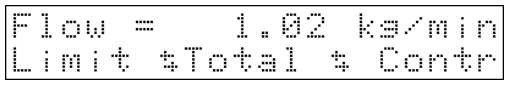
The relevant softkey can be used to display the required value according to the table given above. In this example: the current flow is just being displayed.

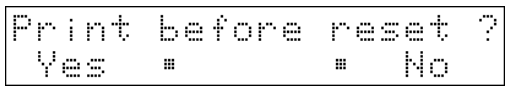
5.2.4 Reset total

Whilst the process is busy, access is via More and **[Total].**



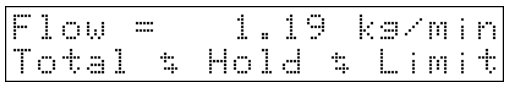
Press **[Yes]** to print a production report (total) before re-setting. With **[No],** reset is without print-out. Press Exit, the total weight is not reset. Note: All reports contain the current total weight.





5.2.5 Changing flow limits

Whilst the process is busy, access is by pressing ← or → and **[Limit]** several times, if necessary**.**

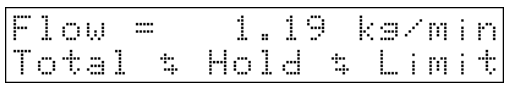


Changing the flow limits during operation must be done analogously as described on page 27.

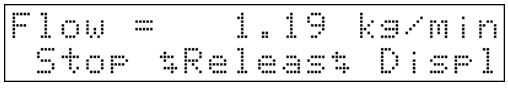
5.2.6 Freezing / enabling the process

Interruptions of the controlled flow rate are required, when the scale is affected by medium-term disturbances during the process, whilst the material output must be continued. This is e.g. the case with short-term work on the batching hopper, or when refilling the hopper during the process. For this, the process is frozen with the last control output value Y. The flow rate pertaining to the frozen control output value is integrated to update the total. After the end of disturbance, control is re-enabled.

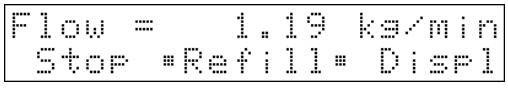
Whilst the process is busy, access is by pressing ← or → several times, if necessary. **[Hold]** switches off control and freezes the last control output value.



The lozenge flashes slowly and material flow discharge is continued with the old rate. The compression correction remains effective also in this condition. E.g. the hopper can be refilled manually.

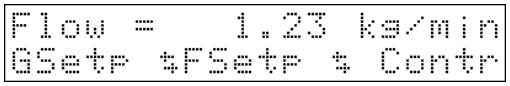


Press **[Releas]** to continue controlled material output.



5.2.7 Changing the gross setpoint

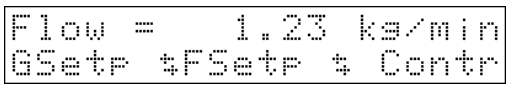
Whilst the process is busy, access is by pressing ← or → and **[GSetp]** several times, if necessary. The switch-off point after transport of a preset quantity can be changed in this menu.



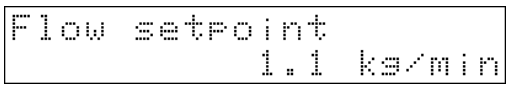
Store the new value with OK.

5.2.8 Changing the flow setpoint

Press **[FSetp]** to change the flow setpoint and store with OK. If the flow is out of the preset limits with flow limiting activated, control output value Y is set immediately to the value pertaining to the limit value. This saves time for line-out to the new setpoint.



The new value is stored with OK.

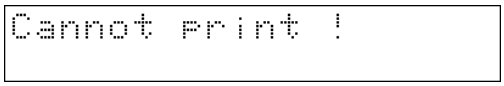


5.2.9 Adjusting the controller

The controller adjustment procedure deviation from the basic adjustment described on page 20 concerns only one point: with the instrument configured as a cascaded controller, a relative setpoint in % instead of an absolute value must be specified.

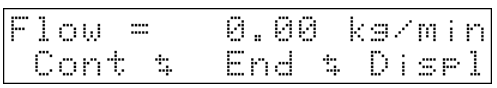
5.2.10 Printing process data (actual)

Print-out of the actual process data is always possible via key ⎙. If a printer is connected and configured, the following data are printed out as shown in the example below. For this, see chapter 6.
Unless a printer is connected and configured, the following error message is displayed during 3 seconds:
Subsequently, the previous information is displayed again.



5.3 Power failure

With power failure, the process is interrupted. After power recovery, the same menu as before mains failure is displayed and the lozenge flashes quickly.
[Cont] continues the process in the display mode active last.



6 PRINT OUT

6.1 Print-out examples

The FlowController has various reports for print-out. Some of these reports can be configured freely by PC program "Nice Label Express".
Dependent of the menu item in which the FlowController is, the data pertaining to the menu item can be printed out, provided that a printer is connected and configured.

	Configurable with "Nice Label Express"
1. Production report (actual)	Yes
2. Production report (after production)	Yes
3. Production report (total)	Yes
4. Material data	No
5. Configuration data	No
6. Setup-Data	No

6.1.1 Produktion report (actual)

The report is printed during or after the production on pressing key  .
How to print out this production report is described in chapter 5.
Unless a Nice Label Express layout was defined, the report will be printed out in the following format.
When using "Nice Label Express", layouts "repact.lbl" must be used for editing.
The data made available in the relevant format are explained in section "Nice Label Express".

Print-out example:

```
Report
-------------------------------------------
Date / Time           2002.09.03 16:04
Material              Chalk
Item                  79
Flow setpoint         1.20 kg/min
Actual flow           1.19 kg/min
Gross setpoint        60.00 kg
Net                   8.27 kg
Total weight          45679.09 kg
```

6.1.2 Production report (after production)

This report is printed after production end, if an automatic printout was configured.
How to print out this production report is described in chapter 5.
Unless a Nice Label Express layout was defined, the report will be printed out in the following format.
When using "Nice Label Express", layouts "repfin.lbl" must be used for editing.
The data made available in the relevant format are explained in section "Nice Label Express".

Print-out example:

```
Report
-------------------------------------------
Date / Time           2002.09.03 15:49
Material              Chalk
Ident                 79
Flow setpoint         1.20 kg/min
Gross setpoint        60.00 kg
Net                   60.00 kg
Total weight          4567.24 kg
```

6.1.3 Production report (total)

The report is printed after total weight reset.
How to print out this production report is described in chapter 5.
Unless a Nice Label Express layout was defined, the report will be printed out in the following format.
When using "Nice Label Express", layouts "reptot.lbl" must be used for editing.
The data made available in the relevant format are explained in section "Nice Label Express".

Print-out example:

```
Report

Date / Time           2002.09.03 15:46
Material              Chalk
Ident                 79
Total weight          673.26 kg
```

6.1.4 Material data

How to print out this production report is described in chapter 4.2.

Print-out example:

```
Material                FlowController 2.12

Date/Time               2002.09.13 11:38
Name                    Chalk
Material ident          79
Filter                  1.25 Hz
Kp                      8.00
Ti                      1.60 s
Flow limit              0.20 kg/min
Last gross setpoint     60.00 kg
Last net                550.07 kg
Table of start values
                   0 %  0.01 kg/min
                  10 %  0.21 kg/min
                  20 %  0.42 kg/min
                  30 %  0.62 kg/min
                  40 %  0.81 kg/min
                  50 %  1.03 kg/min
                  60 %  1.22 kg/min
                  70 %  1.46 kg/min
                  80 %  1.64 kg/min
                  90 %  1.84 kg/min
                 100 %  2.06 kg/min
Compr. Correction       yes
                 Y 1    48.50 %
             1. gross    7.02 kg
                 Y 2    46.40 %
             2. gross   43.50 kg
```

6.1.5 Configuration data

The configuration data print-out is described in section "Application parameters" chapter 4.1.

Print-out example:

```
Configuration           FlowController 3
-----------------------------------------------------
Date/Time               2002.09.03 15:21
Scale                   50.00 kg
Mode                    Loss
Format flow             0.00 kg/min
Automatic Refill        5.00 ... 45.00 kg
Stop at total           yes
Automatic report        yes
Weight limits           10.00 ... 40.00 kg
Calmingtime             3 s
Loop controller         local setpoint
Serial remote output    Slot 2 - RS232    Flow
Output slot 3           Y                 4 ... 20 mA
```

6.1.6 Setup-Data

The set-up data print-out is described in the Installation Manual.

6.2 Nice Label Express

Reports could be printed directly from the program or via a configuration file from "Nice Label Express (NLE)". With this file, the layout of a report could be altered. The name of the NLE-file is e.g. "repact.lbl". Does no layout file exist from NLE, the report is printed in a fixed form.
To create a self-defined report, program Nice Label Express is required. With these reports, all variable contents (e.g. weights) and fixed texts (e.g. "Flow setpoint ") are transmitted to the report via variables. As fixed texts are also transmitted into the print report, the user can create his language adaptations in many cases using "TranslateIt" also for NLE. In this case, "Nice Label Express" is not necessary.
For "Nice Label Express", a fixed variable structure from the application is made available.

Variable for NLE	Type	Description	Production report (actual)	Production report (after production)	Production report (total)
actDT	STR18	actual date and time	✕	✕	✕
Name	STR18	name of material	✕	✕	✕
Ident	STR18	material identification number	✕	✕	✕
FSetp	STR18	actual, absolute flow setpoint	✕	✕	✕
rFSetp	STR18	actual, relative flow setpoint,(cascaded controller)	✕	✕	✕
Flow	STR18	actual flow speed	✕	✕	✕
GSetp	STR18	gross setpoint	✕	✕	✕
Net	STR18	actually discharged weight	✕	✕	✕
FlowLim	STR18	symmetric flow limit value	✕	✕	✕
Flow1Lim	STR18	min. flow limit value	✕	✕	✕
Flow2Lim	STR18	max. flow limit value	✕	✕	✕
fCut	STR18	filter cut-off frequency	✕	✕	✕
Kp	STR18	proportional controller amplification	✕	✕	✕
Ti	STR18	controller integration time	✕	✕	✕
Min	STR18	min. limit for refilling	✕	✕	✕
Max	STR18	max. limit for refilling stop	✕	✕	✕
Total	STR18	discharged overall quantity	✕	✕	✕

Language-dependent texts, to be translated with TranslateIt:

Variable for NLE	Type	Description	Production report (actual)	Production report (after production)	Production report (total)
TactDT	STR20	'Date / time'	✕	✕	✕
TRepo	STR20	'Report'	✕	✕	✕
TName	STR20	'Name'	✕	✕	✕
TIdent	STR20	'Ident'	✕	✕	✕
TFSetp	STR20	'Flow setpoint'	✕	✕	✕
TFlow	STR20	'Actual flow'	✕	✕	✕
TGSetp	STR20	'Gross setpoint'	✕	✕	✕
TNet	STR20	'Net'	✕	✕	✕
TFLim	STR20	'Flow limit'	✕	✕	✕
TF1Lim	STR20	'Lower flow limit'	✕	✕	✕
TF2Lim	STR20	'Upper flow limit'	✕	✕	✕
TfCut	STR20	'Filter cutoff'	✕	✕	✕
TKp	STR20	'Controller constant'	✕	✕	✕
TTi	STR20	'Ctrl. time constant'	✕	✕	✕
TMin	STR20	'Start refill at'	✕	✕	✕
TMax	STR20	'Stop refill at'	✕	✕	✕
TTotal	STR20	'Total weight'	✕	✕	✕

7 INTERFACES TO THE PROCESS

7.1 Scratchpad memory

In the scratchpad memory, specific signals are allocated to selected areas. These signals can be used by the DDE-interface or the OPC-interface.

SPM addresses	Signals	Descriptions
MX1024	Flow < FSetp - Limit (read), or fixed limit value without controller	BOOL [1]
MX1025	Flow > FSetp + Limit (read), or fixed limit value without controller	BOOL
MX1026	Common error (read)	BOOL [2]
MX1027	Hold	BOOL [3]
MX1029	Stop	BOOL
MX1030	Run	BOOL
MX1031	Refill	BOOL [5]
MX1032	Cascaded controller active	BOOL [4]
MD33	Flow (read)	DINT in config. format
MD34	Flow setpoint (write)	DINT in config. format [6, 7]
MD35	Flow setpoint (read)	DINT in config. format
MD36	Material-ID (read)	DINT [8]
MD37	Control output value Y (read)	DINT in % * 100
MD38	Gross setpoint (write)	DINT in the format of the scale [6, 9]
MD39	Gross setpoint (read)	DINT in the format of the scale
MD40	Reserved for simulation	

[1] The limits are set only if run bit MX1030 =true, after the system has settled.
[2] The **common error** is set, when

- the main program is not busy,
- no licence number was entered,
- with refilling during rest condition,
- if the scale does not provide a weight value,
- if the start sequence was not executed so far
- if the actual material was deleted.

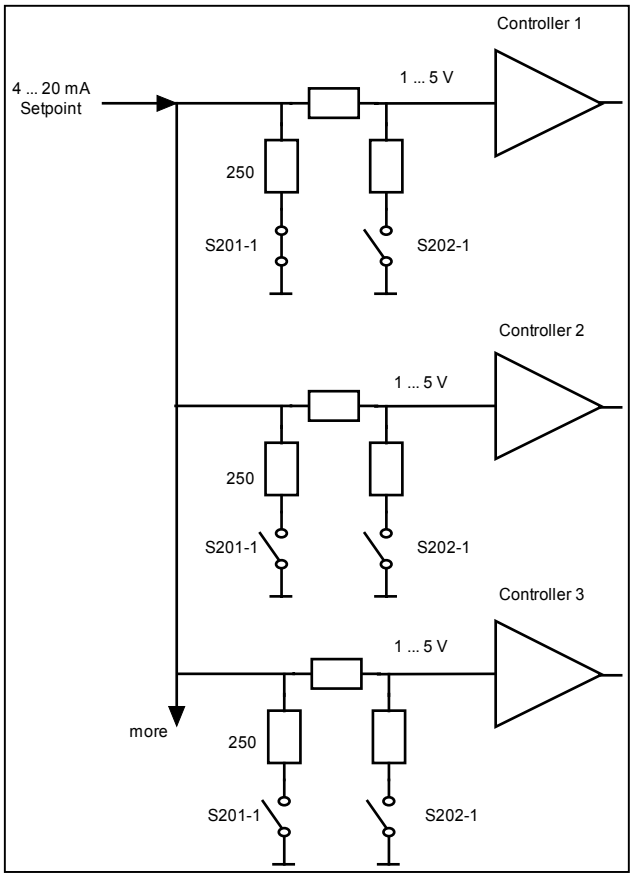
>>> As long as the common error is set, no start should be made ! <<<

[3] In the 'Hold 'status, the controller is frozen.
[4] This bit marks a cascaded controller. In this case, all external setpoints are relative to the controller setpoint input (serial protocol or analog input.).
[5] Refill may only occur, if the controller output is stable, i.e.minimum 16/f after starting. The function is available only with loss in weight.
[6] Setpoint will be stored only, if it was changed.
[7] Sequence of digits, the value is = 1230 (as DINT) e.g. with display 12.30 kg/min .
[8] No material selection via field bus or DDE / OPC.
[9] Sequence of digits, the value is = 12340 (as DINT) e.g. with display 12.340 kg.

7.2 Analog in-/outputs

Analog input	Signals	Remarks
Slot 3 (IW 3.0)	Setpoint with cascaded controller	See configuration, PR1713/07 required
Analog outputs	**Signals**	**Remarks**
Slot 2 (QW 2.0)	Configurable	Option, only without serial interfaces
Slot 3 (QW 3.0)	Configurable	Always provided

With cascaded controllers, the setpoint is provided via the 1st **analog input** of the 3rd socket (if configured). Normally, the source is the 4 ... 20 mA output of another PR5610. The valid setpoint range is 4 ... 20 mA. Values below 4 mA are interpreted as 0. Values above 2 mA (hysteresis 1.9 ... 2.1 mA) start the controller. With 0 ... 20 mA configured, automatic start is not possible.



Only with **one** of the cascaded controllers, S201-1 must be closed (250 Ω for current/voltage conversion, input 4...20 mA corresponding to 1 ...5 V). For further cascaded controllers S201-1 must be open. S202-1 must be open with all cascaded controllers (high-impedance input max. 5 V). With input overdrive in both directions, the common error is set for min. 3s.

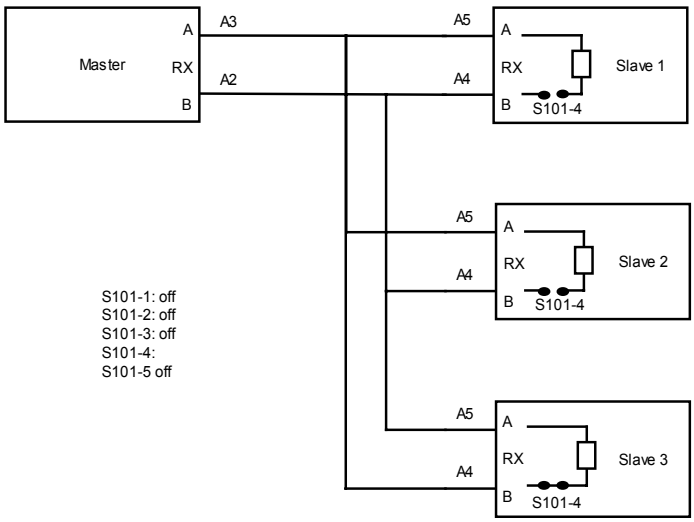
The a**nalog output** can be configured independently in slot 2 or/and 3. The possibilities are dependent of the configuration.
The analog output can be assigned to gross weight, current controller setpoint, measured flow or control output value. Additional selection is 0...20 or 4...20 mA. Gross scaling is within 0 (= 0 or 4 mA) and FSD (= 20 mA). Setpoint and flow scaling is by the configuration parameters. Y range is 0 ... 100 %.

Y: The control output signal is taken to the final correcting element via the analog output as 0...20 or 4...20 mA for material flow control. An output voltage of 0...10 or 2...10V required must be measured at a 500 Ω resistor during current flow.

Flow: The measured flow is output according to the configured scaling. For connection of a cascaded controller, configuration 4...20 mA should always be selected. With the measurement switched off, 0 mA is output. Negative flow values are not displayed.

7.3 Serial in-/outputs

The serial interface is supported only in Slot 2.
Instead of the analog interface, a serial interface for remote control of the cascaded controllers can be used. The interface. should be RS422 (RS232 is also possible with only one controlled instrument). With RS422, the connections are as shown in the diagram opposite.
The output is active, if an interface was assigned in the configuration. The remote control output is used for control of the connected instrument during production. The following message is sent at intervals of 300 ms:



STX<run><stop>;<flow>;<crc>ETX

The elements are represented by 'printable' ASCII characters and separated by ';' .

run '0' or '1' corresponds to run bit MX 1030 and switches the process on and off
stop '0' or '1' corresponds to stop bit MX 1029 and switches the pause on and off
flow setpoint in kg/min or lb/min, either measured or master setpoint
crc CRC check

The remote control input is used for transmitting information from the master unit to the control system.
Telegrams with CRC error are ignored. Three successive CRC errors set common error MX 1026 for min. 3 s. Reception is monitored. After 3 s without telegram reception, common error MX1026 for min. 3 s is set. Despite common error setting, discharge is continued with the last setpoint. Stopping the process is in the user's responsibility.

7.4 Digital in-/outputs

The function allocations to the digital inputs and outputs are fixed and cannot be changed.

Digital inputs	**Signals**	**Remarks**
1 (IX 1.0)	Hold	Flank set/reset MX1027
2 (IX 1.1)	Stop	Flank set/reset MX 1029
3 (IX 1.2)	Run	Flank set/reset MX1030
4 (IX 1.3)	Refill	Flank set/reset MX1031
Digital outputs	**Signals**	**Remarks**
1 (QX 1.0)	Refill	Copy of MX1031 [1]
2 (QX 1.1)	Run	Copy of MX1030
3 (QX 1.2)	Stop	Copy of MX1029
4 (QX 1.3)	Common error	Copy of MX1026
5 (QX 1.4)	Flow < FSetp - Limit	Copy of MX1024
6 (QX 1.5)	Flow > FSetp + Limit	Copy of MX1025
7 (QX 1.6)	Hold	Copy of MX1027
8 (QX 1.7)	Gross out of range	Copy of MX1033

8 FIELDBUS INTERFACE

The fieldbus interface of the FlowController can be used for data exchange and operates in the slave mode for Profibus, Interbus-S or DeviceNet. With this interface one or more scales can be connected and controlled from a communication master (e.g. Siemens S7 Profibus). Data on the fieldbus are processed every 20 ms.
Via this interface process parameters, material parameters and controller parameters can be read and set. The fieldbus interface provides an 8-byte data output and an 8-byte data input. Via input bytes 0...3 the input of analog values, e.g. setpoint, in format DINT (double integer) into the FlowController is possible. Weights are always in DINT in 'kg' or 'lb' depending on the configuration of the scale.

8.1 Configuration

The configuration parameters can be selected in menu section **[Setup] - [Fieldbus]:**

[Protocol] The protocol, e.g. Profibus-DP, can be selected.
[Scale Interface] For using the fieldbus interface as described here, parameter 'Scale Interface' must be set to **[enabled].** Related to the marked Items in the read/write Overviewtables (background)

The configuration parameters for batching processes can be selected in menu section **[Setup] - [Software Parameter]:**

[S88.01 Interface] parameter **[S88.01 Interface]** must be set to **[off]**.

8.2 Application protocol

The interface works with a 8-byte write window and a 8-byte read window per weighing point. The windows are allocated to the weighing points. The fieldbus exchanges data cyclically with each slave. This means: in every cycle, 8 bytes are written and 8 bytes are read, also if no data contents are changed. Via window 2 (allocated to WP B), the firmware functions and WP-specific functions are available. The functions related to the instrument are handled via window 1 (allocated to WP A).
The application protocol described here is independent of the selected fieldbus and explained as seen from the fieldbus master.

8.2.1 Read window

In this window, data are transmitted from the slave (Scale) to the master.
The first four bytes are used for reading a data value. The type of these data is written in byte 4. The data type corresponds to the requirement in the write data window.
Bytes 6 and 7 contain status bits independent of the read value data type. For status bit reading and writing of direct control bits, a procedure is not required. The general system bits and the status bits are always present and need not be requested in particular. The direct control bits are also available continuously.

Byte 0	read data: MSB
Byte 1	"
Byte 2	"
Byte 3	read data: LSB
Byte 4	Echo of *read data type* request
Byte 5	status bits
Byte 6	status bits
Byte 7	status bits

Procedure for reading a parameter:

1. Write the data / parameter type into byte 4 of the write window (e.g. net weight) as *read data type request*.
2. Wait, until in 4th byte of the read window, the echo of *read data type request* is equal to the *read data type request* of the 4th byte in the write window.
3. Now, the value is available in byte 0 to 3.

8.2.2 Write window

This window is used to transmit data from the master to the slave (scale).
The first four bytes are used for writing a data value. The type of these data is described in byte 5.
The bits in byte 6 and 7 are independent of the write value data type in direct access.

Byte 0	write data: MSB
Byte 1	"
Byte 2	"
Byte 3	write data: LSB
Byte 4	read data type request
Byte 5	write data type
Byte 6	direct control bits
Byte 7	direct control bits

Procedure for parameter writing:

1. wait, until *write_handshake* = 0 in the read window (PR5610 is ready to receive new data)
2. write value in byte 0 to 3
3. write data type in byte 5 (*write data type request*)
4. wait, until *write_handshake* = 1 (Log Controller confirms data reception) write 0 in byte 5 (*write data type request*) -> *write_handshake* is set to 0.

8.3 Data formats

Various data formats are used in the interface description:

DINT Most data values are transmitted in the form of a four-byte double-integer value; 32-bit values with polarity sign.

Example: write the fixtare weight value 844.

Write window:

byte number	0	1	2	3	4	5	6	7
value	00	01	03	4C		1F		

Example: read negative gross weight value -2.

Read window:

byte number	0	1	2	3	4	5	6	7
value	FF	FF	FF	FE	08			

UINT Positive 16-bit value.

Example: line number = 1, 2, 3...65535

Write window:

byte number	0	1	2	3	4	5	6	7
value			00	1A		9D		

USINT Positive 8-bit value.

Example: restart mode = 0, 1, 2, 3 or 4

Write window:

byte number	0	1	2	3	4	5	6	7
value				01		87		

Characters ASCII characters; 8-bit number.

Example: recipe names [characters1...4] = hex52, 45, 43, 31 for name 'REC1'

Write window:

byte number	0	1	2	3	4	5	6	7
value	52	45	43	31		96		

The **REAL** format to IEEE 754 ; IEC 60559

REAL : 32 Bit = 1 Bit sign, 8 Bit Exponent bias 127, 23 Bit Mantissa

Example: 200 = 43 48 00 00

```
   4    3    4    8    0    0    0    0
0100 0011 0100 1000 0000 0000 0000 0000
s|       |                   |
 eee eeee e                   |
       1.mmm mmmm mmmm mmmm mmmm mmmm
```

Sign = 0
Exponent = 10000110= 134 - bias 127 = 7
Mantisse = 1.100 1000 0000 0000 0000 0000 = 1,5625 * 2^7 = 200

```
              ! !    !
              ! !    1:2^4= 0,0625
              ! 1:2^1     = 0,5
              !             =1,0              Total= 1,5625
```

STRING is always 20 characters long and transmitted in portions of 5 * 4 characters.

8.4 Read data

All read values are addressed by *read data_type request*

Value in byte 4 *Read data type_request* All other addresses are reserved		Read data in byte 0...3 (parameters)
Dec	Hex	
4	04	Exponent/unit/step width
8	08	Gross [DINT]
9	09	Net [DINT]
10	0A	Tare [DINT]
12	0C	Gross x 100
14	0E	FSD value [DINT]
23	17	Current flow rate
24	18	Flow Setpoint [DINT]
25	19	Control Output value Y [DINT]
26	1A	Material ID [DINT]
27	1B	Gross Total-Setpoint [DINT]

Fixed functions can be activated via the bits of bytes 6 and 7 according to the table given below.

	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Byte 5	Write hand-shake	Power fail	Refill	Stop	Cascaded controller	Gross limit		
Byte 6	Limit 1	Limit 2	Combined error	Hold	Run	Tare active	Calibra-tion ac-tive	Test active
Byte 7	Dimmed	Standstill	Within zero set range	Zero within 1/4d	Below zero	Higher than overload	Higher than FSD	Error in analog converter

Note: The addresses and control bits shown with gray background are handled by the firmware part of the interface. All signals are edge triggered. The controller reacts on changes only.

Byte 5

Write handshake	0 = PR 5610 is ready to receive new data
Power fail	RAM-data have changed due to a power failure (without batterie buffering) or a cold start. The "power fail" status must be reset by setting the signal "reset power fail" (bit 5 of byte 7) of the write data.
Refill	Automatic refill is active.
Stop	The process is stopped and can be restarted or aborted.
Cascaded controller	Indication that the flow setpoint is a relative value to the setpoint input of the cascaded controller.
Gross limit	Limit for the cumulated weight.

Byte 6

Limit 1	Upper filling level, stopps the automatic refill.
Limit 2	Lower filling level, starts the automatic refill.
Combined error	Refer to chapter 9 Error messages.
Hold	The process continues with frozen flow rate, e.g. during automatic refill.
Run	The process is active.
Tare active	The scale is tared
Calibration active	The scale is or has been configured. Is this bit = 1, all scale parameters (expo/unit/step) have to be read again. It will be set after power-on and will be rest after reading of FSD.
Test active	Scale is in test mode.

Byte 7

Dimmed	Weight outside W&M conditions. Weight value shows no unit anymore. See W&M conditions: **[Setup] – [Weighingpoints].**
Standstill	Weight is in standstill condition.
Within zero set range	Weight is within zero set range.
Zero within 1/4d	Weight is zero (+/-tolerance < 1/4d)
Below zero	Weight is below zero
Higher than overload	Weight exceeds FSD + overload range
Above FSD	Weight exceeds FSD (maximum scale value FSD e.g. 5000kg), but is lower than FSD + overload.
Error in analog converter	Scale is in error condition e.g. 'err 3'. Instead of a weight an error number is shown in the display and in gross, net or tare weight.

8.5 Write data

All write values are addressed by *write data type request*. The data typical for a WP are accessible via various write windows. Access to the WP-independent data is via the write window of WP A or WP B.

Value in byte 5 *Write data type_request*		Write data in byte 0...3 (parameters)	
Dec	Hex		
0 to 15	00 to 0F	reserved	
24	18	flow setpoint in configured* format [DINT]	
27	1B	gross setpoint in configured format [DINT]	
112	70	Set zero	no write data required
113	71	Tare	no write data required
114	72	Reset tare	no write data required
115	73	Activate test	no write data required
116	74	Reset test	no write data required

Direct control bits (write bits for the fieldbus master)

	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Byte 6	Run	Hold	Stop	Refill				
Byte 7			Reset powerfail	Test off	Test on	Reset tare	Tare	Set zero

Note: The addresses and control bits with gray background are handled by the firmware part of the interface. All control bits react only on a 0 -> 1 transition. To detect a transition, the respective status has to be present for at least 40ms.

Byte 6

Run	Start of the process.
Hold	The process continues with frozen flow rate, e.g. during automatic refill.
Stop	The process will be stopped.
Refill	The hopper will be refilled.

Byte 7

Reset power fail	Reset power fail flag.
Test off	Deactivate analog test.
Test on	Activate the analog test.
Reset tare	Tare will be reset.
Tare	Scale will be tared.
Set zero	Weight will be set to zero, if it is within the zero set range.

8.6 Reading weights

8.6.1 Weight value

For reading weights, only the required weight type must be written into byte 4 of the write window (*read data type request*). When the weight value is available, the type is returned in byte 4 of the read window. If the weight request remains unchanged, the most recent weight is always updated.
Parallel to that, the status information in byte 7 has to be read.

Write window:

byte number	0	1	2	3	4	5	6	7
value					08			

Read window:

byte number	0	1	2	3	4	5	6	7
value	00	00	11	B4	08			

The displayed numeric value is read out without units and digits behind the decimal point.
Negative values are represented in 2 complement.

Example: Negative weight is -12

Read window:

byte number	0	1	2	3	4	5	6	7
value	FF	FF	FF	F4	08			

8.6.2 Exponent, unit, step width

Exponent, weight unit and step width are normally unchanged with a scale and need to be read only once by type 4.

Write window:

byte number	0	1	2	3	4	5	6	7
value					04			

Read window:

byte number	0	1	2	3	4	5	6	7
value	02	03	02	00	04			

The signification of the first three single bytes is:

Byte 0: exponent
- 0 = 0000 no digits behind the decimal point
- 1 = 000.0
- 2 = 00.00
- 3 = 0.000

Byte 1: unit
- 1 = mg
- 2 = g
- 3 = kg
- 4 = t
- 5 = lb (pounds)
- 6 = l (liters)

Byte 2: step width 1, 2, 5, 10, 20, 50

In this example, the previous weight must be read as 45,32kg with step width 2 .

8.7 Taring, zero setting

For handling scale functions such as taring and zero setting, the individual bits in byte 7 of the write window are used (assignment). The relevant function is handled by a 0-1 transition of the corresponding bit. For detecting the transition, the respective status has to be present for at least 40ms.

Signification of bits in write byte 7

Bit 7 Set the fixtare value to the actual weight
Bit 6 Tare the scale with the fixtare value
Bit 5 Reset power fail flag
Bit 4 Deactivate analog test
Bit 3 Activate the analog test
Bit 2 Reset tare
Bit 1 Set tare
Bit 0 Set the scale to zero, when the weight is within the zero set range.

Example:

When the scale is within the permitted zero set range, this function is handled once.

Write window: byte number / value

0	1	2	3	4	5	6	7
							01

8.8 Write setpoint

Example:

Write window: byte number / value

0	1	2	3	4	5	6	7
00	00	00	64		18		

The setpoint weight value in decimal representation at address 24 (hex 18) is: 100.
The displayed numeric value is written without units and digits behind the decimal point. Normally, exponent, weight unit and step width do not undergo further changing with a scale and can be read once by type 4. See definition in section Read weights.

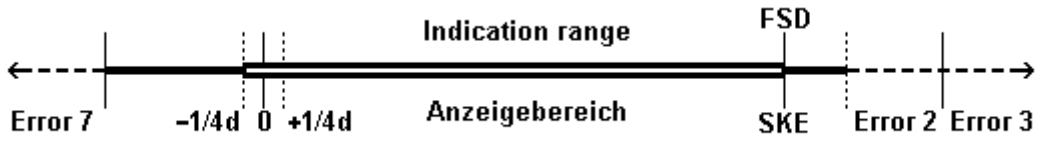
9 Error Messages

The FlowController indicates an error on the display, e.g. 'Error X'. The controller is automatically switched in the status 'Stopped', and the output signal 'Refill' is switched off. The bit 'Combined error' MX1026 is set. After remedial action the Flow Controller returns in the normal operating mode, but remains in the status 'Stopped'. An operator action is required. The output signal 'Refill' is released and the bit 'Combined error' MX 1026 is reset.

9.1 Error messages on the weight display

The error statuses of the analog section are output on the weight display. The displayed error is coded as 'Error X' . The error table below shows the meaning of the indicated errors.

Error messages on the weight display	
Error 1	internal arithmetic overflow (faulty calibration values)
Error 2	input voltage is above FSD + overload
Error 3	input voltage is above the permissible range of 36 mV. However, an error in the analog section, a defective load cell, or a cable break are also possible.
Error 4	weight value exceeds display digits
Error 5	weight is not available, e.g. weighing point is busy
Error 7	input voltage is negative or incorrect load cell connection
Error 8	ADC error, e.g. internal ADC defective or overloaded
Error 9	No communication with weighing point
Error 11	Weight is not available
Error 15	Serial number check failed



9.2 Error messages on the alphanumeric display

These error messages belong to the firmware and are explained in the corresponding installation manual.

10 USED ABBREVIATIONS

Abbr.	Signification / comment
ASCII	Standard for description of characters during data transmission
BOOL	Data type, 1 single bit
CRC	Method for safeguarding a data transmission
d	Scale stepwidth
DINT	Data type, 32-bit integer value with polarity sign
EAROM	Erasable memory only for reading during operation
f	Cut-off frequency for the built-in flow rate measurement filter
FSD	Fullscale value of the scale
ID	Identification number e.g. of a material
IX ...	Port address for an input bit
Kp	PI-controller gain
MD ...	Double integer address (32-bit) in the scratchpad memory
MX ...	Bit address in the scratchpad memory
NLE	NiceLabelExpress, Sartorius PC program
PI	Controller type with proportional and integrating function
QX ...	Port address for an output bit
RS ...	Standard for description of the hardware of a serial interface
SPS	Programmable controller
Ti	PI controller time constant
WP	Weighing point, i.e. this scale
Y	Controller output signal, control output value for the discharge element
Y1/G1	1st segment point from gross weight and control output value for compression correction
Y2/G2	2nd segment point from gross weight and control output value for compression correction

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