



Operating Manual

**Digital Load Cells
FIT[®] and PW18i**

Part 3,

Dosing functions

Part 1: Hardware and Functions

Description of the hardware and the functions of the Digital Load Cells FIT® and PW18i

Part 2: Command Set

Description of the command set for the serial communication of the Digital Load Cells FIT® and PW18i

Part 3: Dosing functions

Description of the command set for the dosing functions of the Digital Load Cells FIT® and PW18i

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Important notes

The complete factory settings are stored nonvolatily and protected against overwriting. The factory settings can be restored with the command TDD0 at any time, if necessary.

The production number set in the factory should not be changed.

You will find further information in the Part 2 of this instruction manual, 'Individual descriptions of the commands'.

Safety Notes

See instruction manual, Part 1.

1 Introduction

The load cell FIT® and PW18i belong to the family of digital load cells, which digitally condition and network with bus capability the measured weight values.

The instruction manual Part 1 describes the functions and connections of the Digital Load Cells FIT® and PW18i.

Part 2 describes the commands for the serial communication.

This Part 3 describes the dosing functions and the related commands (D-version only).

This instruction manual is valid for the following versions of the Digital Load Cells FIT® and PW18i:

You will find the description of these versions in part 1 of the manual.

FIT/H1SR2	FIT/H4SR2	PW18ISR2
FIT/H1LR2	FIT/H4LR2	PW18ILR2
FIT/H1DR2	FIT/H4DR2	PW18IDR2
FIT/H1SR5	FIT/H4SR5	PW18ISR5
FIT/H1LR5	FIT/H4LR5	PW18ILR5
FIT/H1DR5	FIT/H4DR5	PW18IDR5

The Digital Load Cells FIT® and PW18i are abbreviated with “ FIT “ in the following text.

2 Application

The Digital Load Cell FIT[®] in the version 'dosing function' (D) can be used as a dosing scale, bagging scale, or for general filling processes.

In addition to the basic functions of the FIT, it includes commands for dosing control that feature with the following features:

- Two filling rates for coarse and fine flows
- Automatic optimisation of the filling process
- Gross / Net weighing selectable (with automatic taring)
- Automatic checkweighing with tolerance check
- Automatic detection of quantity and cumulative weight
- Bag rupture monitoring in the coarse and fine flow phases

3 Description of the dosing cycle

Weight-time-diagram: Dosing

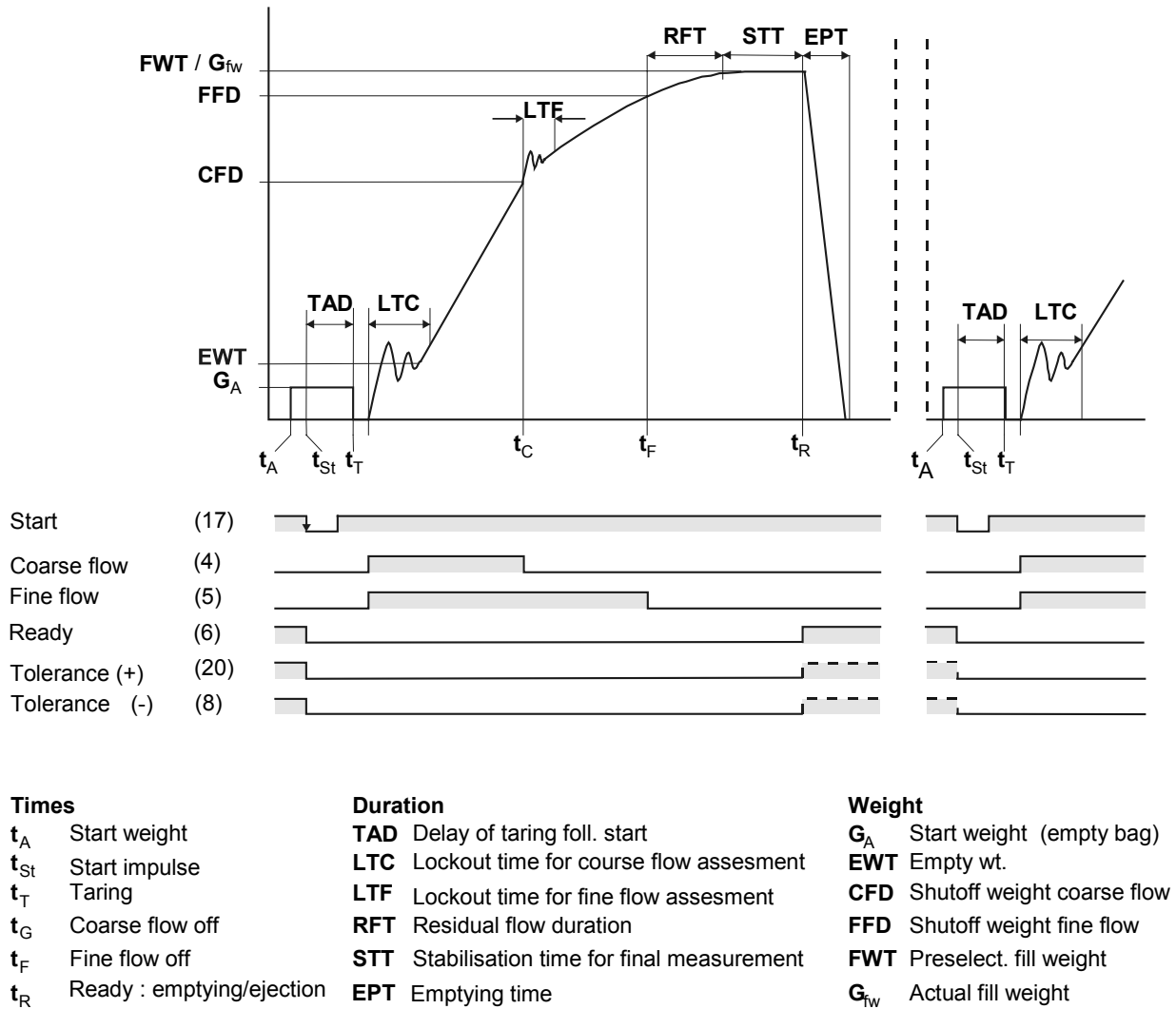


Fig 3.1 Weight-time diagram dosing

The weighing sequence will be described using the weight-time diagram of a bagging weigher (Fig 3.1).

At time t_a a bag will be attached or a filling container placed on the scale; the scale is now loaded with a start weight G_A. At time t_{st} a High-signal is applied for at least 20 ms at input IN2 and thus the automatic dosing sequence started.

3.1 Start

Following an effective start, the outputs "ready signal" (OUT3) and alarm (OUT4) are reset.

- The dosing process is not started, when the following holds

filling weight (**FWT**) = 0 = no filling weight

start weight **G_A** > „fine flow switch off weight“ (**FFD**)

- The dosing process is continued with taring (3.2), when the following holds

Start weight **G_A** > empty weight (**EWT**)

Empty weight (**EWT**) = 0 and the start weight **G_A** < "Coarse flow off weight" (**CFD**)

- The dosing process is continued with coarse dosing (3.3), when the following holds

"Coarse flow off weight" (**CFD**) > Start weight **G_A** > Empty weight (**EWT**)

- The dosing process is continued with fine dosing (3.4), when the following holds

"Coarse flow off weight" (**CFD**) > Start weight **G_A** < "Fine flow off weight" (**FFD**)

3.2 Taring

For taring the taring function must be activated (**TMD** = 1). If **TMD** = 0, taring will not take place.

On expiry of the taring delay period (**TAD**), the start weight **G_A** is tared at the time t_T .

Important:

In spite of an activated taring function (**TMD**=1) taring does **not** take place, if the actual weight > empty weight (**EWT**) or, for an empty weight (**EWT**) = 0, if the actual weight > coarse flow weight (**CFD**). In these cases, it is assumed that the bag or container is already part-filled, and that filling only needs to be completed.

3.3 Coarse dosing

Coarse flow (OUT1) and fine flow (OUT2) become active. At the start of the coarse flow, the "lockout time coarse flow" (**LTC**) prevents the coarse flow from being shut off too early due to peak loads. On expiry of the "lockout time coarse flow" (**LTC**) the "bag rupture monitoring coarse flow" starts up, if it is activated (see diagram for bag rupture monitoring). If the actual weight at time t_g reaches the coarse flow weight (**CFD**), then the coarse flow (OUT1) is switched off.

3.4 Fine dosing

After the coarse flow is switched off, no monitoring of the actual weight with regard to the fine flow weight (**FFD**) is carried out for the duration of the "lockout time fine flow" (**LTF**), thus preventing that the fine flow is shut off too early due to vibrations following "Coarse flow off". On expiry of the "lockout time fine flow" (**LTF**) the "bag rupture monitoring fine flow" starts up, if it is activated (see diagram for bag rupture monitoring). If the actual weight at time t_f reaches the fine flow weight (**FFD**), then the fine flow (OUT2) is switched off.

If fine dosing is started directly, then coarse dosing remains activated until a weight increase is detected (valve open). This is done because many valves only open if they are driven with coarse and fine flow.

3.5 Residual flow

When fine flow is shut off, the Residual flow time (**RFT**) starts up, in order to detect any material still flowing into the container after fine flow has been switched off.

3.6 Checkweighing

During the stabilisation time (**STT**) the actual weight is checked for standstill. If the standstill condition has been met, checkweighing is started, even if the stabilisation time (**STT**) has not yet expired. At the latest on expiry of the response time (**STT**), checkweighing will be started in any case.

During checkweighing the

- actual weight is determined,
- shutoff points for coarse flow (**CFD**) and fine flow (**FFD**) are optimized during activated optimisation (**OSN > 0**),
- tolerance evaluation is effected
- the ready signal (OUT3) becomes active (t_R)
- the cumulative weight (**SUM**) is increased by the actual weight (**FRS**) and the batch counter (**NDS**) is increased.

3.7 Emptying

If emptying time (**EPT**) > 0, then the output for the ready signal (OUT3) is used as an emptying signal. The output (OUT 3) remains active for the duration of the emptying time (**EPT**). The emptying time starts at time t_R .

3.8 Bag rupture monitoring

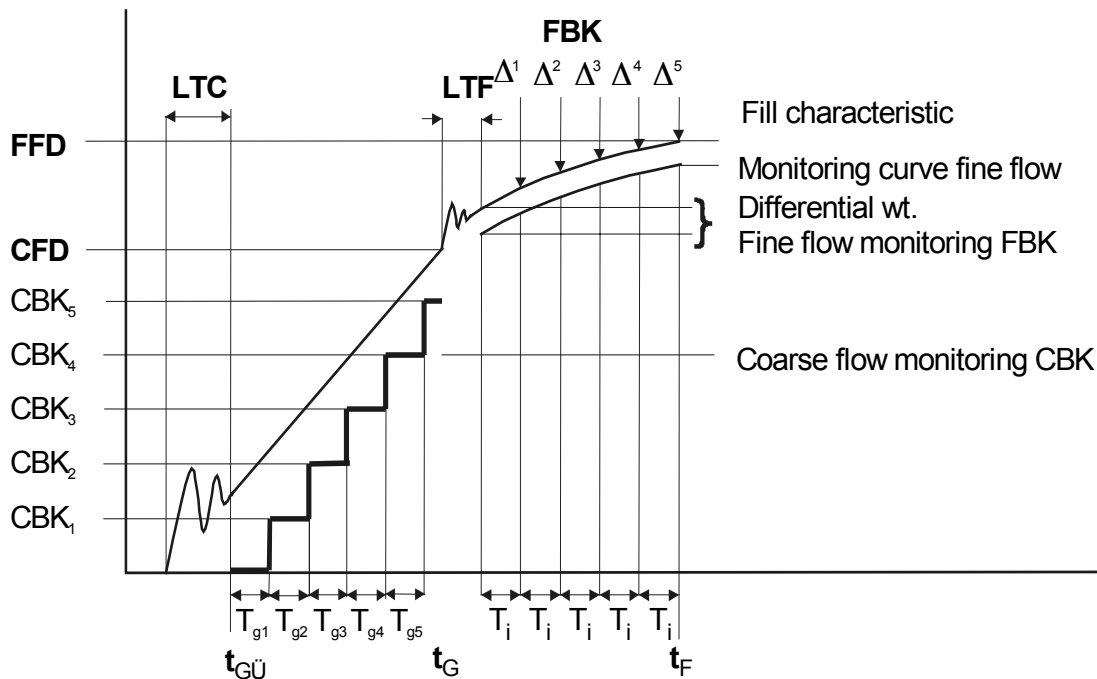


Fig. 3.2 Diagram for bag rupture monitoring

The bag rupture monitoring is subdivided into a coarse flow monitoring **CBK** and a fine flow monitoring **FBK**. The monitoring functions can be activated individually or jointly.

For coarse flow monitoring, after expiry of the lockout time period coarse flow (**LTC**) the actual weight is compared with a weight which is increased each 100 ms by the amount of $0.1 \cdot \text{CBK}$. An undercut is interpreted as a bag rupture.

CBK is the weight which is certainly exceeded after a filling time of 1 second. It is entered by means of the command **CBK**.

$$T_{g1} = T_{g2} = T_{g3} = T_{g4} = T_{g5} = 100\text{ms}$$

$$\text{CBK}_1 = 10\% \text{CBK}, \text{CBK}_2 = 20\% \text{CBK}, \text{CBK}_3 = 30\% \text{CBK} \text{ etc.}$$

The lockout time coarse flow (**LTC**) should be selected such that material flows even still within the lockout time period coarse flow (**LTC**) as already 100ms after expiry of the lockout time coarse flow (**LTC**) the first bag rupture limit value (**CBK₁**) will be monitored. If it is not exceeded, then this is interpreted as a bag rupture. The cause for this may either be "no material" or "no bag". With **CBK=0** the "bag rupture monitoring coarse flow" is deactivated.

For fine flow monitoring, a differential weight (**FBK**) is entered, within the spacing of which a monitoring characteristic follows the filling characteristic. The monitoring characteristic starts with the value (weight value on expiry of the "lockout time fine flow" (**LTF**) – differential weight (**FBK**)). The monitoring characteristic follows the fill characteristic for weight increases (ΔFBK_n). With constant weight or in the event of weight decreases, the monitoring characteristic is unchanged. If the fill characteristic drops below the value of the monitoring characteristic, then this indicates a bag rupture. The differential weight (**FBK**) should be selected to be larger than the variations that normally occur during the fill process. The fine flow monitoring operates with the full measuring speed of 600 measured values / seconds = $1.66\text{ms}(T_i)$. With **FBK=0**, the "bag rupture monitoring fine flow" is deactivated.

3.9 Setting the FIT for dosing tasks

In order to set the FIT for dosing tasks, please proceed as follows:

1. Adjust the user characteristic of the scale.

If the scale is calibrated with its full calibration weight, then you can proceed with item 2.

For a partial load calibration using the command **CWT**, enter the process value which is used to calibrate the scale. 20% to 120% of the nominal load are possible.

2. Unload the scale.

The measured value for the unloaded scale is detected by means of the command **LDW**

3. Now place the calibration weight onto the scale and accept the measured value by means of the command **LWT**.

The scale is now equipped with a user characteristic and provides measured values from 0d to 1 000 000d within the range unloaded scale to nominal load.

4. Use the command **NOV** to enter the required measured value for nominal load.
e.g. for a 50kg scale → **NOV 5000**. The measurement range will then be 0 for unloaded scale and 5000 for the scale loaded with 50kg (this is a resolution of 5000 d and 1d corresponds to 10g). If the scale can be calibrated, please note the permissible number of d.
5. A reduction of the resolution is effected by means of the command **RSN**. If your nominal load is 50kg (example at 4.), but you only wish for a resolution of 1000 d, then use the command **RSN 5**. The last measured value digit now changes in intervals of 5, that is 0, 5, 10, 15 ... 4990, 4995, 5000.
6. Deactivate the limit values (**LIV1,LIV2**) as well as the trigger function (**TRC**).
7. Use the command **IMD 2** to activate the dosing function.
8. Use the command **TDD1**, to store the settings made nonvolatile.

The commands **CWT**, **LDW**, **LWT**, **NOV**, **RSN**, **IMD**, **LIV1**, **LIV2**, **TRC**, and **TDD1** are described in the instruction manual, Part 2.

Important notes:

Shutoff value monitoring speed for coarse flow and fine flow:

The monitoring of the shutoff values is effected with the data rate set by means of the commands ASF,ICR, and FMD. At FMD0, this data rate is only set via the command ICR (ASF is not taken into consideration). At FMD1 the data rate depends on ICR and ASF (see operating instructions Part 3, command FMD).

Example:

FMD0; ICR0, any ASF : → Data rate = 600 measurements/s

FMD0; ICR2, any ASF : → Data rate = 150 measurements/s

FMD0; ICR0, ASF3 : → Data rate = 300 measurements/s

FMD0; ICR0, ASF4 : → Data rate = 150 measurements/s

In order to achieve a high data rate, ICR0 should be set if at all possible. The cut-off frequency can be set via the command ASF.

3.10 Inputs and outputs

The connections and the electrical specifications of the inputs and outputs are described in Part 1 of the instruction manual.

Function of inputs:

Name	active Signal	Description
Break (IN1)	high	interrupts an automatic dosing cycle and resets all outputs.
Start (IN2)	high	starts an automatic dosing cycle

An input signal must be active for at least 20ms.

Function of outputs:

Mode **OMD** = 0

Name	active Signal	Description
Coarse flow (Out1)	high	activates the valve for coarse flow
Fine flow (Out2)	high	activates the valve for fine flow
Completion signal (Out3)	high	is activated after checkweighing and reset by start
Tolerance + (Out4)	high	active after checkweighing if actual weight > Tol +

Mode **OMD** = 1

Name	active Signal	Description
Coarse flow (Out1)	high	activates the valve for coarse flow
Fine flow (Out2)	high	activates the valve for fine flow
Ready signal (Out3)	high	is activated after checkweighing and reset by start
Tolerance Error (Out4)	high	active after checkweighing if Tol + < actual weight < Tol -

Mode **OMD** = 2

Name	active Signal	Description
Coarse flow (Out1)	high	activates the valve for coarse flow
Fine flow (Out2)	high	activates the valve for fine flow
Ready signal (Out3)	high	is activated after checkweighing and reset by start
Alarm (Out4)	high	active on bag rupture

If the emptying time EPT>0 the ready signal is the emptying output (OUT3).

4 Command overview: dosing function

4.1 Command overview: alphabetic

Command	PW	TDD1	Function	Page
BRK			Break	26
CBK		x	Coarse Break Limit	16
CFD		x	Coarse Flow Disconnect	14
CSN			Clear Cumulative Weight and Batch Counter	29
EPT		x	Emptying Time	22
EWT		x	Empty Weight	19
FBK		x	Fine Break Difference	17
FFD		x	Fine Flow Disconnect	14
FFM		x	Fine Feed Minimum	19
FRS?			Filling Result	27
FWT		x	Filling Weight	13
LTC		x	Lockout Time Coarse	20
LTF		x	Lockout Time Fine	21
LTL		x	Lower Tolerance Limit	15
NDS?			Number of Dosings	29
OMD		x	Output mode	24
OSN		x	Optimisation	25
RFT		x	Residual Flow Time	21
RUN			Run	26
SDO?			State of Dosing	28
STT		x	Stabilisation Time	22
SUM?			Cumulative Weight	28
SYD		x	Systematic Difference	18
TAD		x	Tare Delay	20
TMD		x	Tara Mode	23
UTL		x	Upper Tolerance Limit	15

PW means that the command is password protected, that is, it must be enabled by the command SPW"Password".

TDD1 the parameters characterized by * are initially stored in working memory (RAM) only, that is they are not protected against power failure. Using the command TDD1, the settings you have changed in the working memory are stored nonvolatile in the EEPROM.

Important note:

All parameter inputs are activated immediately. Therefore, these inputs should only be made in a idle state on completion of a dosing process.

4.2 Command overview according to functions

Weight parameter

Command	PW	TDD1	Function	Page
CBK		x	Coarse Break Limit	16
CFD		x	Coarse Flow Disconnect	14
EWT		x	Empty Weight	19
FBK		x	Fine Break Difference	17
FFD		x	Fine Flow Disconnect	14
FFM		x	Fine Feed Minimum	19
FWT		x	Filling Weight	13
LTL		x	Lower Tolerance Limit	15
SYD		x	Systematic Difference	18
UTL		x	Upper Tolerance Limit	15

Time parameters

Command	PW	TDD1	Function	Page
EPT		x	Emptying Time	22
LTC		x	Lockout Time Coarse	20
LTF		x	Lockout Time Fine	21
RFT		x	Residual flow time	21
STT		x	Stabilisation Time	22
TAD		x	Tare Delay	20

Control parameters

Command	PW	TDD1	Function	Page
BRK			Break	26
OMD		x	Output Mode	24
OSN		x	Optimisation	25
RUN			Run	26
TMD		x	Tara Mode	23

Dosing results

Command	PW	TDD1	Function	Page
CSN			Clear Cumulative Weight and Batch Counter	29
FRS?			Filling result	27
NDS?			Number of Dosings	29
SDO?			State of Dosing	28
SUM?			Cumulative Weight	28

PW means that the command is password protected, that is, it must be enabled by the command SPW"Password".

TDD1 the parameters characterized by * are initially stored in working memory (RAM) only, that is they are not protected against power failure. Using the command TDD1, the settings you have changed in the working memory are stored nonvolatile in the EEPROM.

5 Individual descriptions of the commands

5.1 Weight parameter

FWT

Filling Weight

(Fill weight)

Range: Legal for trade on (**LFT=1**) 5 ... 100% of **NOV** (1 000 000 at **NOV=0**)
 Legal for trade off (**LFT=0**) 0 ... 100% of **NOV** (1 000 000 at **NOV=0**)
 Factory setting: 0 (no fill weight)
 Response time: < 10msec
 Parameters: 1
 Password protection: no
 Parameter protection: with **TDD1**

Input: **FWT<Value>;**

Query: **FWT?;**

Effect: The fill weight stored in the FIT is output with +/- 7 digits.
 (e.g. _0005000crlf)

The fill weight is on the FIT characteristic determined by means of the commands **LDW** and **LWT** and it is the nominal value for a dosing process. It is input in display units.

Example:

On a scale, units with a maximum weight of 50kg are to be filled.
 For this purpose, proceed in the sequence described.

Unloaded scale: **LDW;** (Preload is set to 0)
 Load scale with 50kg: **LWT;** (50kg load is accepted as nominal value)
 Characteristic is set.
 Measured value unloaded scale **MSV?;** 0 digit.
 Measured value of the scale loaded with 50kg **MSV?;** 1 000 000 digit (at **COF=3**)

Required measured value output for 50kg load = 5000.
 Command: **NOV5000;**
 Measured value unloaded scale **MSV?;** 0 digit.
 Measured value of the scale loaded with 50kg **MSV?;** 5 000 digit

The required fill weight is now entered with the command **FWT**.

In the case of a non legal for trade scale (**LFT=0**), it is possible to enter as fill weight 0 ... 5000, and in the case of a legal for trade scale (**LFT=1**), 250 (5%) to 5000.

On entry of a fill weight, the following parameters are determined automatically:

CFD	Coarse flow shutoff point	= 50% fill weight
FFD	Fine flow shutoff point	= 95% fill weight
LTL	Lower tolerance limit	= -0.2% fill weight
UTL	Upper tolerance limit	= +0.2% fill weight
FFM	Minimum fine flow	= 1% fill weight
CBK	Bag rupture monitoring, coarse flow	= 0 = deactivated
FBK	Bag rupture monitoring, fine flow	= 0 = deactivated
SYD	Systematic deviation	= 0 = deactivated

CFD**Coarse Flow Disconnect**

(Shutoff point for coarse flow)

Range: 0 ... Fine flow shutoff point (**FFD**) – Minimum fine flow (**FFM**)
 Factory setting: 0 (no fill weight)
 Response time: < 10msec
 Parameters: 1
 Password protection: no
 Parameter protection: with **TDD1**

Input: **CFD<Value>;**

Query: **CFD?;**

Effect: The coarse flow shutoff point stored in the FIT will be output in +/- 7 digits (e.g. 0002500crlf).

On fill weight entry (**FWT**), the coarse flow shutoff point is automatically set to 50% of the fill weight. The coarse flow shutoff point cannot be set higher than the fine flow shutoff point, thus the following results:
 Coarse flow shutoff point (**CFD**)max. = Fine flow shutoff point (**FFD**) – Minimum fine flow (**FFM**).
 With activated optimisation (**OSN**>0) the coarse flow shutoff point is automatically tracked.

FFD**Fine Flow Disconnect**

(Fine flow, shutoff point)

Range: 0 ... 120% of **NOV** (1200000 at **NOV**=0)
 Factory setting: 0 (no fill weight)
 Response time: < 10msec
 Parameters: 1
 Password protection: no
 Parameter protection: with **TDD1**

Input: **FFD<Value>;**

Query: **FFD?;**

Effect: The fine flow shutoff point stored in the FIT will be output in +/- 7 digits (e.g. 0002500crlf).

On fill weight entry (**FWT**), the fine flow shutoff point is automatically set to 95% of the fill weight. The fine flow shutoff point cannot be set lower than the coarse flow shutoff point. If a lower fine flow shutoff point is entered, then the coarse flow shutoff point is automatically set to fine flow shutoff point – Minimum fine flow.
 With activated optimisation (**OSN**>0) the fine flow shutoff point is automatically tracked.

LTL**Lower Tolerance Limit**

(Lower tolerance limit)

Range: 0 ... 160% of **NOV** (1600000 at **NOV=0**)
 Factory setting: 0 (no fill weight)
 Response time: < 10msec
 Parameters: 1
 Password protection: no
 Parameter protection: with **TDD1**

Input: LTL<Value>;**Query:** LTL?;**Effect:** The "lower tolerance limit" value stored in the FIT will be output in +/- 7 digits (e.g. 0004990crf).

On fill weight entry (**FWT**), the "lower tolerance limit" is automatically set to **FWT – 0,2%FWT**.
 If the dosing result (**FRS**) drops below the preset tolerance value, then the dosing status (**SDO**) BIT 6 is set to 1. At **OMD=1** the output OUT4 becomes active. (See command description **OMD**). The flag "value below tolerance" is deleted at the next start-up.

Example: Fill weight (**FWT**) = 5000. The "lower tolerance limit" is set to 4990.

UTL**Upper Tolerance Limit**

(Upper tolerance limit)

Range: 0 ... 160% of **NOV** (1600000 at **NOV=0**)
 Factory setting: 0 (no fill weight)
 Response time: < 10msec
 Parameters: 1
 Password protection: no
 Parameter protection: with **TDD1**

Input: UTL<Value>;**Query:** UTL?;**Effect:** The "upper tolerance limit" value stored in the FIT will be output in 7 digits complete with sign. (e.g. 0004990crf)

On fill weight entry (**FWT**), the "upper tolerance limit" is automatically set to **FWT +0.2%FWT**.
 If the dosing result (**FRS**) exceeds the preset tolerance value, then the dosing status (**SDO**) BIT 5 is set to 1. At **OMD=1** the output OUT4 becomes active too. (See command description **OMD**). The flag "tolerance exceeded" is cleared at the next start-up.

Example: Fill weight (**FWT**) = 5000. The "upper tolerance limit" is set to 5010.

CBK**Coarse Break Limit**

(Bag rupture monitoring, coarse flow)

Range: 0 ... 160% of **NOV** (1600000 at **NOV**=0)
 Factory setting: 0 (deactivated)
 Response time: < 10msec
 Parameters: 1
 Password protection: no
 Parameter protection: with **TDD1**

Input: **CBK<Value>;**

Query: **CBK?;**

Effect: The "bag rupture limit value" stored in the FIT will be output in +/- 7 digits (e.g. 000300crf).

As "bag rupture limit value", a weight is entered which is certainly exceeded 1 second after expiry of the lockout time period coarse flow (**LTC**). The FIT calculate from this value a step-shaped control characteristic in 100ms steps.

After expiry of the lockout time coarse flow (**LTC**) until coarse flow off, the actual weight is compared with this characteristic. An undercut is interpreted as a bag rupture.

In the event of a bag rupture

coarse flow and fine flow are deactivated

In dosing status, (**SDO**) BIT 7 (Alarm) is set to 1. At **OMD**=2 the output OUT4 becomes active. (See command description **OMD**).

The dosing control system goes into a STOP condition.

The user has the option to continue the dosing process by initiating Start; in so doing, the optimisation calculation is left out; or the user initiates a BREAK to terminate the dosing process.

Causes that lead to a bag rupture during coarse flow:

- ... the actual material increase is lower than the limit value specified.
- ... no material emerges (filling pipe is blocked)
- ... The "lockout time coarse flow" (**LTC**) is set to a value which is too short; material only emerges when bag rupture monitoring is already active.
- ... Bag is broken or it is not available

FBK**Fine Break Difference**

(Bag rupture monitoring, fine flow)

Range: 0 ... 160% of **NOV** (1600000 at **NOV=0**)
 Factory setting: 0 (deactivated)
 Response time: < 10msec
 Parameters: 1
 Password protection: no
 Parameter protection: with **TDD1**

Input: **FBK<Value>;**

Query: **FBK?;**

Effect: The "bag rupture limit value" stored in the FIT will be output in +/- 7 digits (e.g. 000300crlf).

The monitoring curve follows the filling curve at a distance set by FBK command, as long as the change in weights (difference) remains positive. When the weight is constant or decreasing, the monitoring curve is unchanged. When the monitoring curve is intersected by the filling curve a bag rupture will be indicated. The monitoring curve and the filling curve are compared every 1.6 msec.

The monitoring starts on expiry of the "lockout time fine flow" (**LTF**).

In the event of a bag rupture

coarse flow and fine flow are deactivated

In dosing status, (**SDO**) BIT 7 (Alarm) is set to 1. At **OMD=2** the output OUT4 becomes active. (See command description **OMD**).

The dosing control system goes into a STOP condition.

The user has the option to continue the dosing process by initiating Start; in so doing, the optimisation calculation is left out; or the user initiates a BREAK to terminate the dosing process.

Causes that lead to a bag rupture during fine flow:

- ... the bag tears open, material trickles out faster than it is being filled in
- ... the bag ruptures

SYD**Systematic Difference**
(Systematic deviation)

Range: 0 ... $\pm 5\%$ of **NOV** (50000 at **NOV=0**)
Factory setting: 0 (deactivated)
Response time: < 10msec
Parameters: 1
Password protection: no
Parameter protection: with **TDD1**

Input: **SYD<Value>;**

Query: **SYD?;**

Effect: The "systematic difference" value stored in the FIT will be output in +/-7 digits (e.g. 000300crlf).

The "systematic difference" can be used to compensate for material that is typically removed from, or added to, a unit after checkweighing. It can also be used for the better adherence to a non-symmetric tolerance. Here, a positive value means that more is filled in (nominal weight (**FWT**)+ System). Difference(**SYD**) and a negative value means that less is filled in (nominal weight (**FWT**)- System). Difference(**SYD**)).

Example 1 : When a 50kg bag is dropped, the bag clamp typically removes 200g of material.

Set parameter "Syst. Difference" to 200g. The FIT now operates as if the nominal weight was 50.2 kg, and also optimises itself to this value.

Example 2 :A 50kg bag of cement has a tolerance of +300g/-150g.

In order to place the nominal value nearer the centre of the tolerance range, enter 100g as "system difference", thus pushing the nominal value into the centre of the tolerance range.

FFM**Fine Feed Minimum**

(Minimum fine flow share)

Range: 0 ... 120% of **NOV** (1200000 at **NOV=0**)
 Factory setting: 0 (deactivated)
 Response time: < 10msec
 Parameters: 1
 Password protection: no
 Parameter protection: with **TDD1**

Input: **FFM<Value>;****Query:** **FFM?;****Effect:** The "minimum fine flow share" stored in the FIT will be output in +/- 7 digits (e.g. 000300crlf).

The "minimum fine flow value" specifies how closely the coarse flow shutoff point may be set to the fine flow shutoff point. Thus, with lumpy goods, the distance coarse flow / fine flow is to be set such that in any case fine flow will start running. With lumpy goods, the "minimum fine flow" should be set to be somewhat larger than the heaviest piece. The coarse flow shutoff point cannot become less than 0, even if the fine flow minimum value is set higher than the fine shutoff (**FFD**).

Note: In order to achieve a dosing result which is as constant as possible, it is important that the "minimum fine flow" is preset such that the dosing process is always terminated with fine flow.

Example: The nominal value is set to 5000d = 50.00kg.
 MIN. FINE FLOW = 50d = 0.50kg
 Fine flow shutoff point = 4970d = 49.70 kg
 Coarse flow shutoff point max. 4970d – 50d = 4920d (49.20kg)

EWT**Empty Weight**

(Empty weight)

Range: 0 ... 160% of **NOV** (1600000 at **NOV=0**)
 Factory setting: 0 (deactivated)
 Response time: < 10msec
 Parameters: 1
 Password protection: no
 Parameter protection: with **TDD1**

Input: **EWT<Value>;****Query:** **EWT?;****Effect:** The "empty weight value" stored in the FIT will be output in +/- 7 digits (e.g. 000300crlf).

The parameter empty weight specifies up to what weight the scale is to be regarded as empty by definition, that is, up to what weight taring may be effected.

If, after start-up (**RUN**), a bag has a weight > empty weight (**EWT**) this means that the bag must not be tared, but – depending on its actual weight - it will simply be filled up to completion by coarse flow or fine flow.

If the empty weight = 0 and if taring is set at start-up (**TMD**), then after start-up any weight < coarse flow shutoff point (**CFD**) is tared.

5.2 Time parameters

Using the commands **TAD**, **LTC**, **LTF**, **RFT**, **STT**, **EPT**, the times required for the dosing process can be preset.

All time parameters have a setting range from 10ms to 100000ms = 1min 40s. The lowest resolution is 10ms.

TAD

Tare Delay (Taring delay time)

Range: 0 ... 10000 (* 10ms)
 Factory setting: 0 (deactivated)
 Response time: < 10msec
 Parameters: 1
 Password protection: no
 Parameter protection: with **TDD1**

Input: **TAD<Value>;**

Query: **TAD?;**

Effect: The "tare delay value" stored in the FIT will be output in 5 digits. (e.g. 00020crLf)

Following a start command (**RUN**), the tare delay time needs to expire before taring takes place. This time can be used in order to fade out faults caused by bag attachment or container placement. On expiry of the taring delay period, taring is effected; the scales should be at rest for this purpose.

If it is found at start-up that the empty weight or the coarse shutoff point has been exceeded, there will be no waiting for this time, and taring is not effected either.

LTC

Lockout Time Coarse (Lockout time for coarse flow monitoring)

Range: 0 ... 10000 (* 10ms)
 Factory setting: 0 (deactivated)
 Response time: < 10msec
 Parameters: 1
 Password protection: no
 Parameter protection: with **TDD1**

Input: **LTL<Value>;**

Query: **LTC?;**

Effect: The "lockout time coarse flow monitoring" value stored in the FIT will be output in 5 digits. (e.g. 00020crLf)

For the preset duration, after the coarse flow has been activated, the comparison of the actual weight for reaching the "coarse flow shutoff point" is locked. Based on experience it is possible to state that the time should be approximately 10% of the coarse dosing time. If bag rupture monitoring "coarse flow" (**CBK**) is used, the time duration must be sufficiently long so that even within the lockout time material starts running into the container.

If the coarse flow cuts in and the weighing goods flow into the container, it is possible – in particular with lumpy goods – that the first parts rattling onto the load cell generate peak loads, which will cause the "coarse flow shutoff value" to be exceeded already.

This time does not delay the filling process.

LTF**Lockout Time Fine**

(Lockout time for fine flow monitoring)

Range: 0 ... 10000 (* 10ms)
 Factory setting: 0 (deactivated)
 Response time: < 10msec
 Parameters: 1
 Password protection: no
 Parameter protection: with **TDD1**

Input: LTF<Value>;

Query: LTF?;

Effect: The "lockout time fine flow monitoring" value stored in the FIT will be output in 5 digits. (e.g. 00020crLf)

The "lockout time fine" starts with "coarse flow off" and locks – for the preset period - the comparison of the actual weight for reaching the "fine flow shutoff point". When shutting off coarse flow, transient processes may occur that exceed the "fine flow shutoff point". Based on experience it is possible to state that the time should be approximately 10% of the fine dosing time.

This time does not delay the filling process.

RFT**Residual Flow Time**

Range: 0 ... 10000 (* 10ms)
 Factory setting: 0 (deactivated)
 Response time: < 10msec
 Parameters: 1
 Password protection: no
 Parameter protection: with **TDD1**

Input: RFT<Value>;

Query: RFT?;

Effect: The "residual flow time value" stored in the FIT will be output in 5 digits. (e.g. 00020crLf)

The residual flow time starts after fine flow off for the duration of the preset time period. During this time period material is detected which still flows on into the unit after the fine flow has been shut off. The material quantity which flows into the container during the residual flow time, should be low and – as much as possible – the same for each dosing process.

The detection of the residual flow time is important for correct optimisation and for a precise actual weight. This time depends very strongly from the conveying organs.

The residual flow time does not really prolong a dosing process, for if the material is not detected, dosing becomes imprecise.

STT**Stabilisation Time**

Range: 0 ... 10 000 (*10ms)
 Factory setting: 0 (deactivated)
 Response time: < 10msec
 Parameters: 1
 Password protection: no
 Parameter protection: with **TDD1**

Input: STT<Value>;

Query: STT?;

Effect: The "response time value" stored in the FIT will be output in 5 digits. (e.g. 00020crLf)

During this time checkweighing takes place (the actual weight is measured). Checkweighing is executed at standstill within the preset time.

If no standstill is found within the stabilisation time, the actual weight is determined in any case when this stabilisation time has expired.

If standstill monitoring is deactivated, then this means standstill and there will be no waiting: checkweighing is started immediately.

The weight measured after stabilisation time is the filling result. This weight is the input for the optimization.

EPT**Emptying Time**

Range: 0 ... 10 000 (*10ms)
 Factory setting: 0 (deactivated)
 Response time: < 10msec
 Parameters: 1
 Password protection: no
 Parameter protection: with **TDD1**

Input: EPT<Value>;

Query: EPT?;

Effect: The "empty time value" stored in the FIT will be output in 5 digits. (e.g. 00020crLf)

Emptying can be effected via the output "ready signal" (OUT3).

If emptying time (**EPT =0**) is deactivated, then output OUT3 functions as a ready signal that is, it becomes active after checkweighing and is only reset together with the next start.

If emptying time (**EPT >0**) is entered, then output OUT3 functions as an emptying output; it becomes active after checkweighing and is reset on expiry of the emptying time.

5.3 Control parameters

Control parameters are commands that influence the functions of the dosing control system. This includes the commands **TMD**, **OMD**, **OSN**, **RUN**, **BRK**

TMD

Tare Mode

(after start taring)

Range: 0 ... 1
Factory setting: 0 (deactivated)
Response time: < 10msec
Parameters: 1
Password protection: no
Parameter protection: with **TDD1**

Input: **TMD<Value>;**

Query: **TMD?;**

Effect: The "tare mode value" stored in the FIT will be output with 1 digit. (e.g. 0cr1f)

User setting 0 After start-up (**RUN** or IN 2) no taring is effected. A preset tare time (**TAD**) is not waited for.

User setting 1 After start-up (**RUN** or IN 2) and on expiry of the preset tare delay taring is effected, and subsequently coarse and fine flows are connected in. The precondition is that the measured value < empty weight (**EWT**).

OMD**Output Mode**
(Output mode)

Range: 0 ... 2
 Factory setting: 0 (deactivated)
 Response time: < 10msec
 Parameters: 1
 Password protection: no
 Parameter protection: with **TDD1**

Input: OMD<Value>;

Query: OMD?;

Effect: The "output mode value" stored in the FIT will be output with 2 digits. (e.g. 00crlf)

Using this command, the meaning of output 4 can be changed.

OMD setting	Meaning of the outputs			
	OUT1	OUT2	OUT3	OUT4
00	coarse flow	fine flow	Ready signal / emptying	Tolerance +
01	coarse flow	fine flow	Ready signal / emptying	Tolerance fault
02	coarse flow	fine flow	Ready signal / emptying	Alarm

Whether output OUT3 represents the ready signal or emptying, is determined by entering the emptying time (**EPT**).

OSN**Optimisation**

Range: 0 ... 3
 Factory setting: 0 (deactivated)
 Response time: < 10msec
 Parameters: 1
 Password protection: no
 Parameter protection: with **TDD1**

Input: OSN<Value>;

Query: OSN?;

Effect: The "optimisation value" stored in the FIT will be output in 2 digits. (e.g. 00crlf)

0	The optimisation is deactivated; after checkweighing no optimisation of the shutoff points for coarse and fine flows is carried out.
1	highest optimisation level
3	lowest optimisation level

The efficiency of optimisation (that is, the quantity of the maximum adjustment of shutoff points per optimisation step) can be set corresponding to the deviation from the dosing result (actual weight). The table shows the setting of the correction factor in relation to the effectiveness of optimisation to be set.

Effectiveness of optimisation (OSN)	Deviation of the actual weight from the nominal weight in %		
	1	0.2	0.2...0.4
2	0.6	0.6...1.2	> 1.2
3	2	2...4	> 4
Correction factor	0.25	0.5	1

The alteration of the fine flow shutoff point is calculated as follows:

$$\Delta \text{Fine flow - shutoff point} = \text{Fill weight}_{\text{nom}} - \text{fill weight}_{\text{act}} \times \text{correction factor}$$

If coarse flow optimisation is activated, the minimum fine flow weight guarantees compliance with the tolerances specified. A further minimisation of the fine flow share by increasing the coarse flow share is prevented by this limit

Coarse flow optimisation: The coarse flow shutoff point will be automatically set as close as possible to the fine flow shutoff point such that the dosing time is as short as possible.

Fine flow optimisation: The fine flow shutoff point is automatically adjusted such that a precise dosing result is achieved.

Minimum fine flow weight: The minimum fine flow weight is the smallest possible difference between coarse and fine flow shutoff point

Example: Nominal weight 50, 00 kg
 Actual weight 49, 65 kg
 Actual value tolerance 0, 35 kg
 Deviation 0, 70 % The following correction factors result from this:

Correction factor (**OSN1**) 1
 Correction factor (**OSN2**) 0, 5
 Correction factor (**OSN3**) 0, 25

Δ Fine flow shutoff point = 0.35 kg x 1 = 0,35 kg (**OSN1**)

Δ Fine flow shutoff point = 0.35 kg x 0.5 = 0.175 kg (**OSN2**)

Δ Fine flow shutoff point = 0.35 kg x 0.25 = 0.0875 kg (**OSN3**)

For the next dosing cycle, the fine flow shutoff point is increased by 0.35 kg at **OSN=1**, by 0.175kg at **OSN=2**, and by 0.0875kg at **OSN=3**.

RUN

RUN
 (Start dosing)

Range: ---
 Factory setting: ---
 Response time: < 20msec
 Parameters: 0
 Password protection: no
 Parameter protection: no data to be protected

Input: RUN;

The command **RUN** starts the automatic dosing process. The result outputs of a preceding dosing, namely tolerance and, ready signal are reseted. The dosing status (**SDO**) is also cleared.

The command **RUN** has the same effect as the signal 'start' at input IN2.

The command **RUN** as well as the signal 'start at IN2' only have an effect, if the FIT is in dosing mode (**IMD=2**). The command **RUN** is answered with ?, if the FIT is not in dosing mode.

BRK

Break
 (Break dosing)

Range: ---
 Factory setting: ---
 Response time: < 20msec
 Parameters: 0
 Password protection: no
 Parameter protection: no data to be protected

Input: BRK;

The command **BRK** cancels the automatic dosing process. All outputs are deactivated; the dosing status is cleared. The command **BRK** has the same effect as the signal 'Break' at input IN1. The command **BRK** as well as the signal 'Break' at IN1 only have an effect, if the FIT is in dosing mode (**IMD=2**), the command **BRK** is answered with ?, if the FIT is not in dosing mode.

5.4 Dosing results

FRS?

Filling Result (Dosing status)

Range:	Integer ± 32767 Long Integer ± 8388607 ASCII ±1638399
Factory setting:	ASCII
Response time:	< 10msec
Parameters:	---
Password protection:	no
Parameter protection:	no data to be protected

Query: FRS?;

Outputs the most recent dosing result. The output format can be selected with the command **COF** as for **MSV?**). If output with status is selected (e.g. **COF4**, **COF8**, **COF9**), the dosing status for the fill weight is output as status (e.g. tolerance-). The information output in the dosing status is described at (**SDO**). At hardware start (IN2) and **COF+128** (e.g. **COF139** ASCII is dosing result plus dosing status)

Automatic dosing result output according to checkweighing:

At start via input IN2:

COF i+ 128;	Following each checkweighing the FIT will transmit the dosing result (Example COF139 ; ASCII+Status) All commands to the FIT are not answered or executed. In order to execute other commands, proceed as follows:
STP ;	stops this output mode
COF i+128;	Command all FIT commands are permissible activates the automatic output mode

At start via the command **RUN**

STP ;	stop " automatic transmission of the dosing result"
RUN ;	Start dosing process
COF i+ 128;	After checkweighing the FIT will transmit the 1 st dosing result
STP ;	stop " automatic transmission of the dosing result"
RUN ;	Restart dosing process
COF i+ 128;	After checkweighing the FIT will transmit the 2nd dosing result
etc.	

The dosing result will be output automatically after checkweighing. In this mode (the FIT is in a duration measurement mode such as **MSV?0**), communication with the FIT will only be possible again after an **STP** command, even a start via **RUN** is not possible in this operating mode.

SDO?**State of Dosing**
(State of dosing)

Range: ASCII 0..255 (3 digit)
 Factory setting: ---
 Response time: < 10msec
 Parameters: ---
 Password protection: no
 Parameter protection: no data to be protected

Query: SDO?;

Outputs the current dosing state. The dosing status is BIT coded. The individual BITS have the following meaning:

BIT (Nr.)	7	6	5	4	3	2	1	0
Value	128	64	32	16	8	4	2	1
Description	Alarm	Tolerance -	Tolerance +	ready signal or emptying	Checkweighing	residual flow	Fine flow	Coarse flow

BIT No. 0 ... 7: active =1, ... inactive = 0

Alarm (BIT 7 = 1) at bag rupture, if bag rupture monitoring is activated.

The status information is additive and output as a decimal number 0...255.

Example: Response to **SDO?**; 080crlf means tolerance minus (64) and ready signal (16)

SUM?**Cumulative Weight**
(Total sum value)

Range: ASCII 2 147 483 647 (32Bit)
 Factory setting: 0
 Response time: < 10msec
 Parameters: ---
 Password protection: no
 Parameter protection: no data to be protected

Query: SUM?;

With each dosing result, the cumulative value memory is increased by the dosing result (and the batch counter). With **SUM?**; the cumulative value of the dosing results that have occurred so far, or since the last CSN command, is output. The cumulative value memory does not overflow, it remains unchanged at the top end if it is not cleared (CSN). The cumulative value memory and the batch counter always run together, that is, the cumulative value memory represents the cumulative value of the dosing results for the quantity output with the **NDS?** command.

NDS?**Number of Dosings**
(batch counter)

Range: ASCII 65 535 (16BIT)
Factory setting: 0
Response time: < 10msec
Parameters: ---
Password protection: no
Parameter protection: no data to be protected

Query: NDS?;

With each dosing result, the batch counter is increased by 1. With **NDS?** the existing quantity counter level, or the level accumulated since the most recent CSN command, is output. The batch counter does not run over, it remains unchanged at the top end if it is not cleared (CSN). The cumulative value memory and the batch counter always run together, that is, the cumulative value memory represents the sum of the dosing results for the quantity output with the **NDS?** command.

CSN**Clear cumulative weight and batch Counter**

Range: ---
Factory setting: ---
Response time: < 10msec
Parameters: ---
Password protection: no
Parameter protection: no data to be protected

Input: CSN;

The batch counter and the cumulative weight memory are reset to 0.

6 Example for communication in dosing mode

1. **RUN**; or "low signal" on IN2 Start dosing process
2. **MSV?**; Reading the measured values with measured value status

The measured value output with measured value status is effected in the binary formats **COF 8**, **COF12**, and in the ASCII formats **COF9**, **COF11**.
In dosing mode (IMD=2), the measured value status information also comprises information about the dosing status.

Contents of the measured values status with **IMD=2**:

BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0
Alarm	Ready signal / emptying	fine flow	coarse flow	Standstill	ADU overflow	Gross overflow	Net overflow

BIT No. 0 ... 7: active =1, ... inactive = 0

Alarm (BIT 7 = 1) at bag rupture, if bag rupture monitoring is activated.

The status information is additive and output as a decimal number 0...255.

Example: Status = 064 (BIT 6 = 1) means ready signal (64)
 In the measured value status, the end of dosing (BIT6 = 1) can be monitored.

3. Read dosing results
If in measured value status BIT 6 = 1, the dosing process is terminated, and the results formed in connection with this dosing process can be read:

FRS?; Read dosing result
 In the formats COF8, COF12, or COF9,COF11 the dosing result is output in combination with the dosing status. The contents of the dosing status is described at **SDO**.

SUM?; Read cumulative weight

NDS?; Read batch counter

For a new start of the dosing process refer to point 1.



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