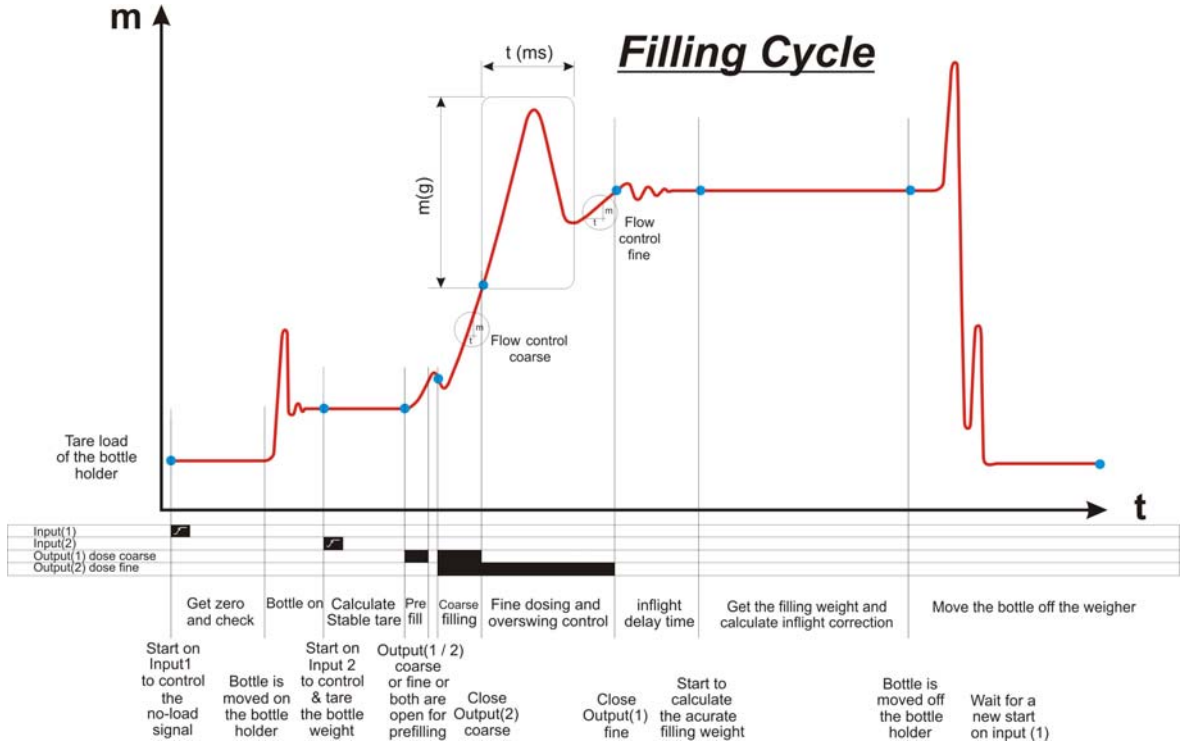
4.12 Filling Commands – PD1 to PD21, DI, SC, AC, GD, DT, SD, TR

Remark: These commands are only available in **firmware version 88.184**.

Note: All setups should be stored with the **SD** command before power off.

The filling process is controlled by the dosing parameters. The parameters are related to the sections shown in the filling cycle.



When a parameter is altered via SDO access, the Gateway sets this new parameter in all LDM modules. Reading involves reading the value from the selected LDM in the backplane. The parameters for the filling process are read and set thru the internal backplane by the 'Read/modify dose parameters' command.

The following commands enable the set-up and control of the built-in filling controller program. The program assumes that the coarse filling valve is connected to LDM 88.1 Output 0 and the fine filling valve is connected to Output 1. A rising edge on Input 0 will initiate the zero check function of the load cell (load cell OK) and a rising edge on Input 1 will initiate the filling cycle. **Note:** see additional **TR** command for soft triggering page 9.

DI Filling status **[2400sub01]**

Issuing the DI command, will return via DOP software a result in the format **I:000** (only low byte). [CANbus has both filling status bytes available.]

Master (PC / PLC) sends	Device responds	Result
DI	**I:000**	Status filling process
DI	**I:068**	- Dose program running - Tare out of range (no filling)

This result can be decoded according to the table below:

Low byte filling status		[high byte filling status]	
0	Idle	0	Idle
1	Coarse valve open	256	Waiting for 2nd trigger
2	Fine valve open	512	Bottle on, calculating tare
4	Dose program running	768	Pre-filling
8	Not used	1024	Main Filling
16	Not used	1280	Fine Filling
32	Not used	1536	In-flight delay
64	Tare out of range – no filling this cycle	1792	Post fill calculations
128	Zero out of range	2048	Post Filling

SC Start cycle **[2005sub01]**

Issuing the **SC** command (which has no parameters), will start the filling cycle, i.e. the 'Dose program running' status bit will be set and the program will wait for a trigger pulse on input 0. If the load cell zero check function is not required, set PD3 to "0". The system then waits for a trigger pulse on input 1.

AC Abort cycle **[2005sub02]**

Issuing the AC command (which has no parameters), will abort the filling cycle immediately, i.e. the 'Dose program running' status bit will be reset, the valves will be shut off and the dosing program will stop.

GD Get the last dosed weight **[2001sub04]**

Issuing the GD command, will return the last dosed weight value in the format **D+01.100**.

Master (PC / PLC) sends	Device responds	Result
GD	**D+01.100**	Dosed weight 1.100 d

[With the CANopen gateway a TPDO2 with the dosed weight is sent when the filling cycle ends. The weight value will be the dosed weight if everything is OK, or zero if the filling was aborted internally, e.g. Bag Rupture.]

DT Get the last tare weight **[2001sub05]**

Issuing the DT command, will return the last tare weight value recorded by the filling program, in the format **T+00.500** .

Master (PC / PLC) sends	Device responds	Result
DT	**T+00.500**	Tare weight 500 d

PDn Read/modify dosing parameters

Issuing the PD command with one parameter (PDn) will return the value of the n'th parameter in the format **P15:+00500**. Issuing the PD command with two parameters (PDn x) will change the n'th parameter to the value x.

Note: In this version of software all the parameters will be set to zero by the factory default (FD) command.

"_" means Space button on keyboard

Available parameters:

PD1 Pre-fill mode **[2200sub01]**

Available 1st Pre-fill modes are:	Available 2nd Pre-fill modes are:
0 = No 1st pre-filling	0 = No 2nd pre-filling
1 = 1st Pre-filling with the coarse valve only	4 = 2nd Pre-filling with the coarse valve only
2 = 1st Pre-filling with the fine valve only	8 = 2nd Pre-filling with the fine valve only
3 = 1st Pre-filling with both valves	12 = 2nd Pre-filling with both valves

Secondary pre-filling mode: add to the values of 1st pre-filling mode.

Request / Setting

Master (PC / PLC) sends	Device responds	Result
PD1	**P1:+00000**	No pre-filling
PD1_2	**OK**	Pre-filling with fine valve only

PD2 In-flight correction **[2200sub02]**

Correction factor for the in-flight value in percent. Range: 0 … 50 %.

Request / Setting

Master (PC / PLC) sends	Device responds	Result
PD2	**P2:+00010**	In-flight correction 10%
PD2_25	**OK**	Set In-flight correction to 25%

PD3 Average Time zero check load cell **[2200sub03]**

Time (in milliseconds = ms) during which the load cell zero check average is calculated.
Range: 0 … 65535 msec.

Request / Setting

Master (PC / PLC) sends	Device responds	Result
PD3	**P3:+00200**	Average zero check over 200 ms
PD3_400	**OK**	Set zero check time to 400 ms

Note: By setting PD3 to 0 the zero check function of the load cell will be skipped, no pulse on input 0 is required.

PD4 Delay Time tare average **[2200sub04]**

Delay time between the trigger pulse being applied to input 1 and the start of tare averaging.
Range: 0 .. 65535 msec.

Request / Setting

Master (PC / PLC) sends	Device responds	Result
PD4	**P4:+00200**	Delay time tare average 200 ms
PD4_100	**OK**	Set delay time to 100 ms

PD5 Average Time tare weight **[2200sub05]**

Time during which the tare weight average is calculated. This function allows the correct tare value to be acquired although there may be a lot of vibrations on a (rotating) filling machine.
Range: 0 … 65535 msec.

Request / Setting

Master (PC / PLC) sends	Device responds	Result
PD5	**P5:+00300**	Tare average time 300 ms
PD5_250	**OK**	Set tare average time to 250 ms

PD6 Delay time after pre-filling **[2200sub06]**

Delay time at end of pre-filling, after valve(s) shut off. Range: 0 ... 65535 msec.

Request / Setting

Master (PC / PLC) sends	Device responds	Result
PD6	**P6:+00000**	No delay time
PD6_250	**OK**	Set delay time to 250 ms

PD7 Blanking time after coarse valve shuts off **[2200sub07]**

After the coarse valve shuts off, a weight peak may occur because of a surge or splash of the product being filled. Range: 0 ... 65535 msec.

Request / Setting

Master (PC / PLC) sends	Device responds	Result
PD7	**P7:+00100**	Blanking time is 100 ms
PD7_250	**OK**	Set blanking time to 250 ms

PD8 In-flight delay time after fine valve shuts off **[2200sub08]**

After the fine valve shuts off, a weight peak may occur because of a surge or splash of the product being filled. Range: 0 ... 65535 msec.

Request / Setting

Master (PC / PLC) sends	Device responds	Result
PD8	**P8:+00100**	Delay time is 100 ms
PD8_250	**OK**	Set delay time to 250 ms

PD9 Dosed weight average time **[2200sub09]**

Time during which the filled weight average will be calculated. This function allows you to acquire the correct filled weight although there may be a lot of vibrations on a (rotating) filling machine. Range: 0 … 65535 msec.

Request / Setting

Master (PC / PLC) sends	Device responds	Result
PD9	**P9:+00100**	Average time is 100 ms
PD9_500	**OK**	Set average time to 500 ms

PD10 Zero tolerance **[2200sub10]**

Load cell zero tolerance check (in increments). This is the allowable deviation from the unloaded load cell zero (no bottle or box). If the unloaded load cell zero is outside this window, the filling process will not start. With this function you can easily check to see if a load cell has been over-loaded. Range: 0 … 99999 increments.

Request / Setting

Master (PC / PLC) sends	Device responds	Result
PD10	**P10:+00100**	Load cell zero check tol. is 100 d
PD10_5000	**OK**	Set tolerance to 5000 d

Example: PD10_5000 means that the zero point of unloaded load cell must be within the window ± 500.0 g relative to the reference zero [when cal. 1 kg = 10.000 increments].

PD11 Tare reference weight **[2200sub11]**

Tare reference weight (in increments). This is the nominal weight of the empty bottle/box. Range: 0 ... 99999.

Request / Setting

Master (PC / PLC) sends	Device responds	Result
PD11	**P11:+00400**	Tare reference weight is 400 d
PD11_230	**OK**	Set tare reference to 230 d

Example: PD11_230 means the reference tare weight is 23.0 g [when cal. 1 kg = 10.000 increments].

PD12 Tare weight tolerance **[2200sub12]**

Tare weight tolerance (in increments). This is the allowable deviation of the tare weight (bottle or box). If the tare weight value is outside this window the filling process will not start. Range: 0 … 99999.

Request / Setting

Master (PC / PLC) sends	Device responds	Result
PD12	**P12:+00020**	Tare weight tolerance is 20 d
PD12_50	**OK**	Set tare tolerance to 50 d

Example: PD12_20 means the deviation of tare weight is 2.0 g [when cal. 1 kg = 10.000 increments].

PD13 Pre-fill level 1st set-point **[2200sub13]**

Pre-fill level (in increments). This is the weight value required at the end of the 1st pre-filling process. Range: 0 … 99999.

Request / Setting

Master (PC / PLC) sends	Device responds	Result
PD13	**P13:+00500**	Pre-filling level is 500 d
PD13_750	**OK**	Set pre-filling to 750 d

Example: PD13_750 means pre-filling with 75.0 g [when cal. 1 kg = 10.000 increments].

PD14 Fine-fill weight **[2200sub14]**

Fine-fill weight (in increments). This is the part of the total filling weight carried out by the fine filling valve. Range: 0 … 99999.

Request / Setting

Master (PC / PLC) sends	Device responds	Result
PD14	**P14:+00500**	fine-fill weight is 500 d
PD14_1000	**OK**	Set fine-fill weight to 1000 d

Example: PD14_1000 means fine filling with 100.0 g [when cal. 1 kg = 10.000 increments].

PD15 Filling weight **[2200sub15]**

This is the target filling weight (in increments). Range: 0 … 99999.

Request / Setting

Master (PC / PLC) sends	Device responds	Result
PD15	**P15:+04000**	filling weight is 4000 d
PD15_5000	**OK**	Set filling weight to 5000 d

Example: PD15_5000 means total filled weight is 500.0 g [when cal. 1 kg = 10.000 increments]

Remark: Coarse filling weight is automatically calculated as the result of:
filling weight minus fine filling weight minus in-flight weight.

PD16 In-flight weight **[2200sub16]**

In-flight weight (in increments) is the weight falling into the container after the fine valve shuts off. Range: 0..99999.

Request / Setting

Master (PC / PLC) sends	Device responds	Result
PD16	**P16:+00108**	In-flight weight is 108 d
PD16_200	**OK**	Set in-flight weight to 200 d

Example: PD16_108 means an In-flight weight value of 10.8 g [when cal. 1 kg = 10.000 increments].

Note: Refer to the correction factor PD2, the shut off setpoint for the fine valve will be optimized for the next filling cycle etc..

PD17 Pre-fill level, 2nd set-point **[2200sub17]**

Pre-fill level (in increments). This is the weight value required at the end of the 2nd pre-filling process. Range: 0 … 99999.

Request / Setting

Master (PC / PLC) sends	Device responds	Result
PD17	**P17:+00550**	Sec. pre-filling level is 550 d
PD17_750	**OK**	Set sec. pre-filling to 750 d

Example: PD17_750 means a secondary pre-fill level of 75.0 g [when cal. 1 kg = 10.000 increments].

PD18 Filling timeout value **[2200sub18]**

The LDM subtracts the various delays and average times (P3..P9) from the timeout period 'PD18' and uses the 'remaining' fill time and Fill-weight to calculate a minimum filling slope. If the weight doesn't stay between this minimum slope and twice the minimum slope the LDM aborts the filling cycle and reports a filling failure. The Filling cycle will also be aborted if the timeout value P18 expires.

Master (PC / PLC) sends	Device responds	Result
PD18	**P18:+02000**	Timeout is 2000 ms
PD18_3000	**OK**	Set timeout to 3000 ms

Note: If P18 = 0, the timeout is disabled.

PD19 Underweight post-fill time **[2200sub19]**

If the averaged dosed value is less than the required weight this parameter controls the post fill time in milliseconds. After a post-fill the dosed weight is recalculated. If this parameter is zero no post filling occurs.

Master (PC / PLC) sends	Device responds	Result
PD19	**P19:+00080**	Post-fill time is 80 ms
PD19_100	**OK**	Set post-fill time to 100 ms

Note: If P19 = 0, the post filling is disabled.

PD20 Tare interval **[2200sub20]**

In some cases where the object being filled is not a new bottle, but say a box that is being emptied after each fill, the tare function is not necessary in every filling cycle. When parameter 20 is 0 (zero) taring only takes place in the very first filling cycle. When parameter 20 is 1 (one, default) the taring takes place in every filling cycle. Otherwise parameter 20 can be set to the number of filling cycles which have to occur before a tare measurement is taken again.

Master (PC / PLC) sends	Device responds	Result
PD20	**P20:+00001**	Tare each filling cycle
PD20_100	**OK**	Set tare at each 100th filling cycle

Example: PD20_100 means next tare after 100 filling processes.

PD21 Bag Rupture Blanking **[2200sub21]**

The control of filling slope is disabled for P21 milli-seconds from opening the coarse valves to allow oscillation on the weight during the first part of the filling.

Master (PC / PLC) sends	Device responds	Result
PD21	**P21:+00200**	Filling slope disabled for 200 ms
PD21_500	**OK**	Set fill. slope disabled for 500 ms

SD Save the dosing setup parameters **[2004sub04]**

With this command the settings of the "Dosing Parameters" will be saved in the EEPROM.

Request / Setting

Master (PC / PLC) sends	Device responds	Result
SD	**OK**	Dosing parameters saved
SD	**ERR**	Error

TR Trigger **RPDO2 [00 80]**

This command will start the measuring cycle in the same way as the hardware trigger input. The result is sent as a TPDO2 with source = LDM#.

Master (PC / PLC) sends	Device responds	Result
TR	**OK**	Trigger started

Note: This function can be used as a soft trigger to start a filling process (firmware 88.184)

4.12.1 Filling Process

The filling process is started by a ‘Start cycle’ command from the CAN gateway once the LDM 88.1 filling parameters have been loaded.

Once started, the filling process can be either waiting for a trigger or be in the process of filling. While waiting for the trigger, the filling cycle can be started by a ‘Trigger’ command. If a ‘Trigger’ is sent while filling is in progress the LDM 88.1 will respond with a ‘Not ready’ message.
If PD5 isn’t zero the LDM will wait PD4 milliseconds before determining the tare weight by averaging the weight for PD5 milliseconds.

If PD5 is zero a tare of zero will be used, and no tare phase takes place.

If PD1 is not zero the LDM will pre-fill in the mode as set by PD1 until the weight reaches PD13, then a second pre-fill takes place until the weight reaches PD17. Then if PD6 is not zero the LDM88.1 will turn off the valves and wait PD6 milliseconds.
Then the LDM 88.1 enter the main filling phase with both valves opened until “PD15-PD14”, where the coarse valve will be closed, and fine-filling will continue until target weight PD15, where all valves are closed (if the coarse valve has been closed by external command, fine-filling will just continue anyway: the fine fill will just have started somewhat earlier).

After the filling is complete the actual dosed weight is measured by averaging the weight for PD9 milliseconds, and a difference from the actual desired weight is calculated and used to fine-tune the cut-off setting for the fine-fill phase. If PD19 is not zero and the dosed weight is less than the desired filling weight then the fine filling is resumed for PD19 milliseconds and the new dosed weight is averaged. The post fill step will be repeated until the measured weight is higher than or equal to the desired filling weight. The new weight is not used in the calculation of the in-flight value. At this point the dosed Tare Value is fetched by the Gateway and sent through the network to the CAN controller.

The filling cycle can be aborted at any time. The **AC** command terminates the filling process completely. After that you must issue a **SC** command before you can trigger another filling.

Whilst any valves are open the filling rate is monitored according to which valves are actually open. If a direct command alters the valve state, the monitoring changes its internal control slope according to the new setting. In this way the CAN controller may introduce different filling algorithms while still maintaining monitoring of the filling slope.

In the post-fill situation the LDM 88.1 checks that the weight actually increases.