SIEMENS

Operating Manual

SITRANS F M MAGFLO® & SITRANS F C MASSFLO®

Profibus DP add-on module for USM II transmitters

Order no.: FDK:521H1185

SFIDK.PS.023.B2.02

Contents

1. Introduction

This manual is intended to provide instructions for the installation and use of the Profibus DP add-on module, product code number **FDK:085U0230**, that can be used in the Siemens Flow Instruments USM II family of transmitters, which presently includes MAG 6000 and MASS 6000.

The Profibus DP module is effectively a gateway through which a Profibus master device can have controlled access to a number of Siemens Flow Instruments USM II signal converter parameters.

This manual is not intended to be a complete tutorial on the Profibus protocol, and it is assumed the end user already has a general working knowledge of Profibus DP communications, especially in respect of master station configuration and operation. However an overview is included in the following section to explain some of the fundamental aspects of the protocol.

2. Technical data

Profibus DP specification	
Applicable standard	EN 50170 vol. 2
Physical layer (Transmission technology)	RS 485
Transmission speed	<= 1.5 Mbits/second
Number of stations	Up to 32 per line segment, (maximum total of 126)

Cable specification (Type A)	
Cable design	Two wire twisted pair
Shielding	CU shielding braid or shielding braid and shielding foil
Impedance	35 up to 165 Ohm at frequencies from 3 to 20 Mhz
Cable capacity	< 30 pF per meter
Core diameter	> 0.34 mm², corresponds to AWG 22
Resistance	< 110 Ohm per km
Signal attenuation	Max. 9 dB over total length of line section
Max. bus length	200 m at 1500 kbit/s, up to 1.2 km at 93.75 kbit/s
	Extendable by repeaters

Cyclic services

Input (Master view)	USM II parameter	MAG 6000	MASS 6000
(1) Requires a SENSORPROM® unit containing valid fraction data. (2) Value returned is dependent on the **batch** function. When **ON**, batch progress is returned. When **OFF**, totalizer 2 is returned.	Mass flow		√
	Volume flow	√	√
	Temperature		√
	Density		√
	Fraction A (1)		√
	Fraction B (1)		√
	Pct Fraction A (1)		√
	Totalizer 1	√	√
	Totalizer 2 (2)	√	√
	Batch progress (2)	√	√
Output (Master view)	Totalizer control (hold/reset)	√	√
	Batch control (start, stop…)	√	√
	Batch set-point	√	√
	Batch compensation	√	√

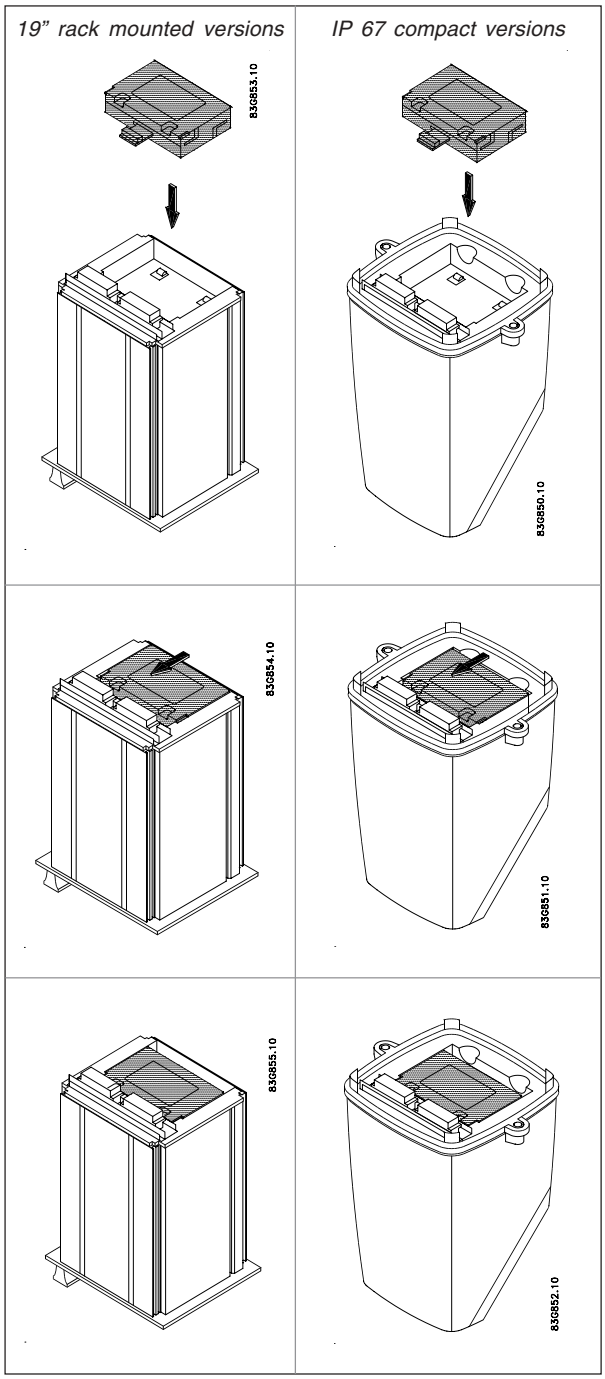
Acyclic services

Device profile		Version 2.0, Class B		
Flow transducer block parameter sets supported		Class 01 Electromagnetic (MAG 6000)		
		Class 03 Coriolis (MASS 6000)		
		USM II parameter	MAG 6000	MASS 6000
(3) In the Profibus flow transducer block this is called the sample rate	***Totalizer***	Reset	√	√
		Direction	√	√
	Process variables	Units	√	√
		Time constant	√	√
		Alarm set-points	√	√
	Batch control	On/Off	√	√
		Set-point	√	√
		Cycle counter	√	√
		Cycle counter reset	√	√
		Mode: Start	√	√
		Pause	√	√
		Resume	√	√
		Stop	√	√
		Maximum batch time	√	√
		Batch compensation	√	√
	General	Sensor size	√	√
		Calibration factor	√	√
		Zero point value		√
		Flow direction	√	√
		Scale upper	√	√
		Scale lower	√	√
		Broadcast interval (3)	√	√
		Low flow cut-off	√	√
	System	Zero point adjust: Auto		√
		Manual		√
		Set to default	√	√
	Error Log/ Pending	Error pending	√	√
		Status log list	√	√
		Reset status list	√	√

3. Installation

3.1 Add-on module

The installation procedure for an add-on module to a Siemens Flow Instruments USM II transmitter is as follows:



1. Unpack the add-on module and insert it in the bottom of the signal converter as shown.

2. Press the add-on module in the direction shown, until it stops and is firmly seated in position

3. This completes the add-on module installation, and the signal converter may now be connected to the terminal box. Communication with the display/keypad and the electrical input/output terminals is established automatically when the power is applied.

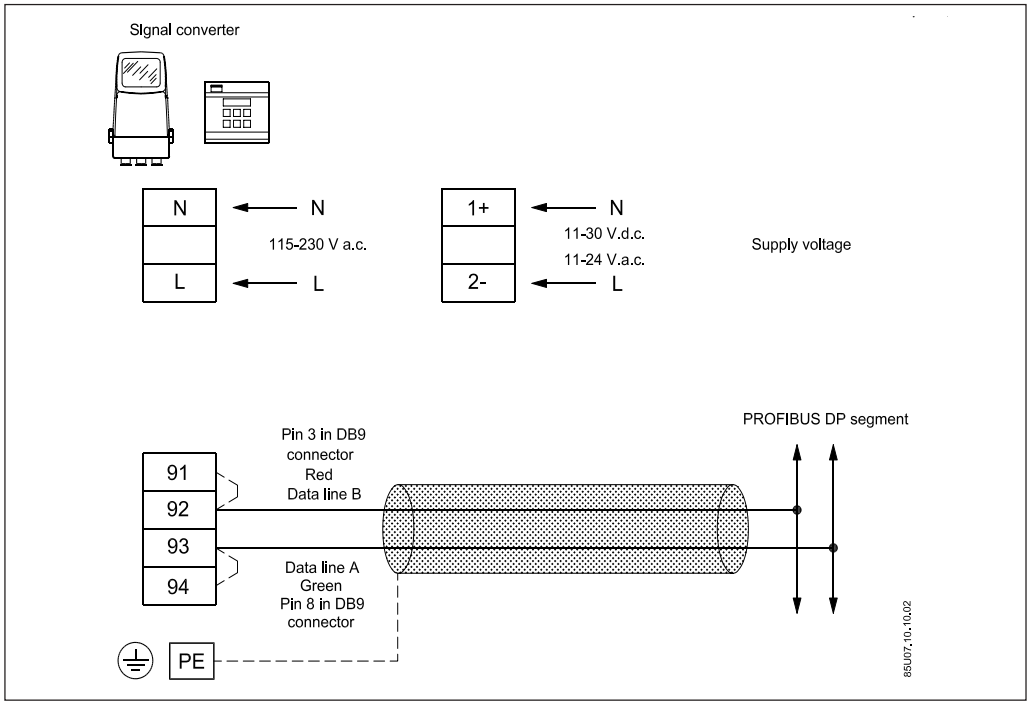
3.2 General connections

On the electrical termination boards for USM II transmitters, additional input/output terminals have been reserved for add-on module functions. The numbering range of these terminals is as follows, but how many are actually used depends on the type of add-on module. Please refer to the relevant handbook for other electrical connection information.

Additional terminals reserved for add-on modules:
MAG 6000: 91 - 97
MASS 6000: 91 - 100

Note
The standard inputs and outputs continue to function and are not affected by the presence of an add-on module. Any existing transmitter electrical connections can remain undisturbed.

3.3 Profibus connection



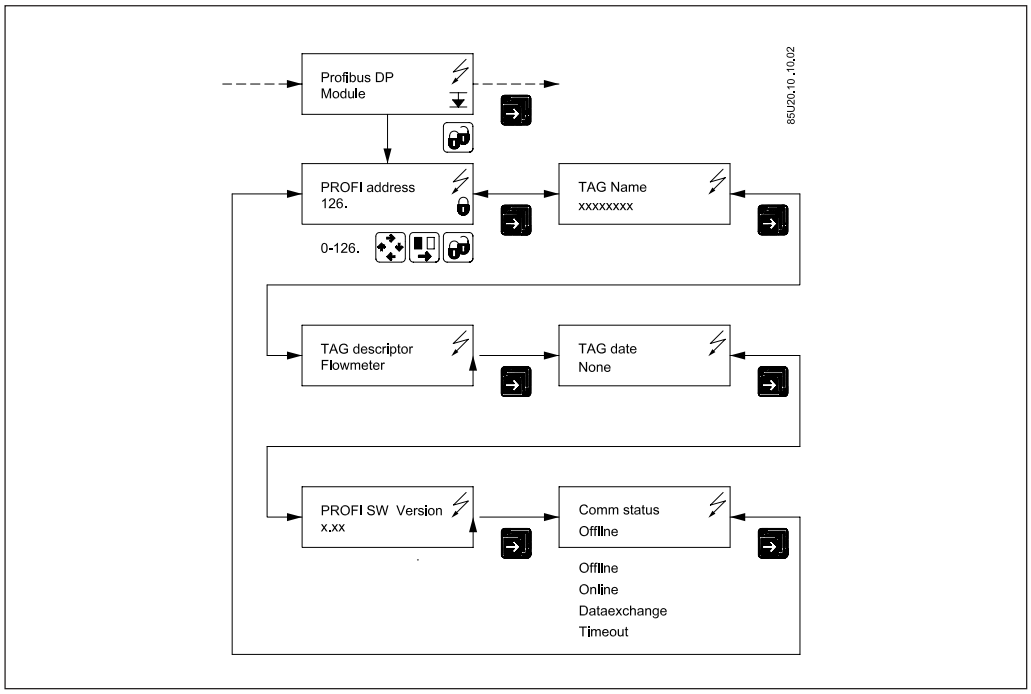
3.4 Termination

All RS 485 based networks must be terminated correct to function properly. A termination must be placed at each end of the segment.
The Profibus module can add a termination by connecting terminals 91 to 92 and 93 to 94.
It is important to use very short wires for this connection.

4. Commissioning

Before communicating with the **Master**, the device address must be selected. This can be done either from the display or from the commissioning software. Please look in to the transmitter manual to locate the Profibus DP module menu.

4.1 Profibus display menu



To change (or view) the Profibus settings from the keypad display.

1. Press [Top key] for two seconds. (**NOTE:** For **"View"** mode only, skip steps 2 & 3).
2. Type in **password (1000)** by pressing [Change key] two times, and then press [Lock key] and hold for two seconds
3. The display now says **"Basic settings"**
4. Press [Forward key] until you reach the **"Profibus DP module"** menu item
5. Press [Lock key]
6. You can now cycle through all the Profibus DP settings by pressing [Forward key]
7. Select **"PROFI address"**
8. Type in the address with the [Change key] and [Next key]
9. Lock the setting with the [Lock key]
10. Press [Top key] for two seconds and you return to 1.

4.2 Menu item explanation

Below the submenus under the main menu „***Profibus DP module***“ are described:

Item	Value	Description
PROFI address	0-126	Device address ***[Factory setting: 126]*** Address number 126 cannot be selected. This address means new device and is programmed from factory.
TAG name	String 0-32 bytes	Can be used to TAG the device. Master class 2 is needed to change the TAG name.
TAG descriptor	String 0-32 bytes	Can be used to describe the TAG. Master class 2 is needed to change the TAG descriptor. ***[Default: „Flowmeter“]***
TAG date	8 bytes	Can be used to date the installation. Master class 2 is needed to change the TAG descriptor. ***[Default: „None“]***
PROFI SW version	x.xx	Firmware version of the Profibus module.
Comm status		This menu can be used in service cases. It displays the state of the device. Following modes are possible: **Offline** The device cannot see a master. Either the master is turned off or poor cabling. **Online** A master is detected, but the device is not configured. **Data Exchange** The device is configured and up and running. **Timeout** The device has been configured, but the watchdog has timed out. Possible error: The master was disconnected.

SENSORPROM® flow memory unit

All of the Profibus DP settings are stored in the add-on module in non-volatile memory.

They are not stored in the SENSORPROM® unit.

This means that if the DP module is exchanged for another DP module, all of the relevant Profibus DP settings will need to be downloaded from the DPM2 master to the device. This also applies to the Profibus station address, which may be entered via the keypad/display on the flowmeter, or alternatively via the bus, if the master supports changing the station address. Please note that the above only applies to the Profibus DP settings. All other flowmeter settings are stored in the SENSORPROM® unit.

4.3 GSD files

A GSD file is needed to be able to configure the master. The GSD file describes what a device can do and what it supports. Some software tools support integration of an individual image of the device. Such image is in the bitmap format and has the extension .BMP.

Following GSD files must be used with this device:

Flowmeter	GSD file	BMP file
MAG 6000	SIxx05a9.gsd	SI05a9n.bmp
MASS 6000	SIxx05A8.gsd	SI05a8n.bmp

Note: xx is the revision of the GSD file.

GSD files and BMP files can be downloaded from the Siemens homepage.

4.4 Configuration of cyclic DataExchange

A central controller that cyclically exchanges data with slave devices on a Profibus network is called a **Master class 1 device**. The master uses a GSD file in order to determine which data can be exchanged. The order of the data in the cyclic message is the same as in the GSD file.

4.4.1 Input data (Master view)

All variables in the input area are 5 bytes in size - a 4-byte float and a statusbyte. The structure of the status-byte is described in ***Appendix A*** in the table called "***DS-33 Value and Status***".

MAGFLO input data order				
Slot order	**Name**	**Configuration value**		**Description**
		[hex]	**[dec]**	
1	Volumeflow	0x94	148	5 bytes (float + status)
2	Totalizer 1	0x94	148	5 bytes (float + status)
3	Totalizer 2 / Batch	0x94	148	5 bytes (float + status)

MASSFLO input data order				
Slot order	**Name**	**Configuration value**		**Description**
		[hex]	**[dec]**	
1	Massflow	0x94	148	5 bytes (float + status)
2	Volumeflow	0x94	148	5 bytes (float + status)
3	Density	0x94	148	5 bytes (float + status)
4	Temperature	0x94	148	5 bytes (float + status)
5	Fraction A	0x94	148	5 bytes (float + status)
6	Fraction B	0x94	148	5 bytes (float + status)
7	Pct. Fraction A	0x94	148	5 bytes (float + status)
8	Totalizer 1	0x94	148	5 bytes (float + status)
9	Totalizer 2 / Batch	0x94	148	5 bytes (float + status)

If any of the input variables are not to be used, the "***Empty Slot***" can be used instead. This reduces the data load on the bus, and the Masters use of address spacing. The "***Empty Slot***" is included in the GSD file.

4.4.2 Output data (Master view)

To be able to control the most common functions via cyclic communication, 4 output blocks are available.

MAGFLO & MASSFLO output data order					
Slot order		Name	Configuration value		Description
			[hex]	[dec]	
MAGFLO	**MASSFLO**				
4	10	Totalizer control	0xA0	160	1 byte
5	11	Batch control	0xA0	160	1 byte
6	12	Setpoint or	0xA4	164	5 bytes (float + status)
		Setpoint (Not PCS7)	0xA3	163	4 bytes (float)
7	13	Compensation or	0xA4	164	5 bytes (float + status)
		Compensation (Not PCS7)	0xA3	163	4 bytes (float)

If any of the output blocks are not to be used, the "***Empty Slot***" can be used instead. This reduces the data load on the bus, and the **Masters** use of address spacing. The "***Empty Slot***" is included in the GSD file.

To ensure 100% detection of the bit combinations, the bit change must be active for a minimum of 100 mS.

Totalizer control
This control consists of 1 Byte.

Bit	7	6	5	4	3	2	1	0
Function	ZA				T2H	T1H	T2R	T1R

T1R = Totalizer 1 reset
T2R = Totalizer 2 reset
T1H = Totalizer 1 hold/run
T2H = Totalizer 2 hold/run
ZA = Zero adjust

The action takes place when the bit changes from 0 to 1, except for T1H and T2H which are in **hold mode** when the bit is 1 and in **run mode** when the bit is 0.

Batch control
This control consists of 1 Byte.

Bit	7	6	5	4	3	2	1	0
Function				BOFM	BOF	USC	BSTP	BSRT

BSRT = Batch start
BSTP = Batch stop
USC = Update set-point and compensation
BOF = Batch ON/OFF (1 = ON; 0 = OFF)
BOFM = Batch ON/OFF MASK (1 = BOF will be detected; 0 = BOF will NOT be detected)

The actions takes place when the bit changes from 0 to 1.

Batch

Set-point and compensation:

Two different configuration formats of set-point and compensation are available. Either the format: float (4 bytes) or float + status (5 bytes).

In Profibus modules firmware version 1.03 and earlier versions, the batch set-point and compensation have the format 0xA3. This format consists of one float and is illustrated below for both set-point and compensation. This format does not comply with PCS7.

Byte	3	2	1	0
Parameter	Set-point (Float)			

Byte	3	2	1	0
Parameter	Compensation (Float)			

Version 1.04 of the Profibus module can be configured with the format 0xA3 illustrated above, but also with the format 0xA4 will be accepted in version 1.04. The format 0xA4 consists of one float and a status byte, as illustrated below.

Byte	4	3	2	1	0
Parameter	Status	Set-point (Float)			

Byte	4	3	2	1	0
Parameter	Status	Compensation (Float)			

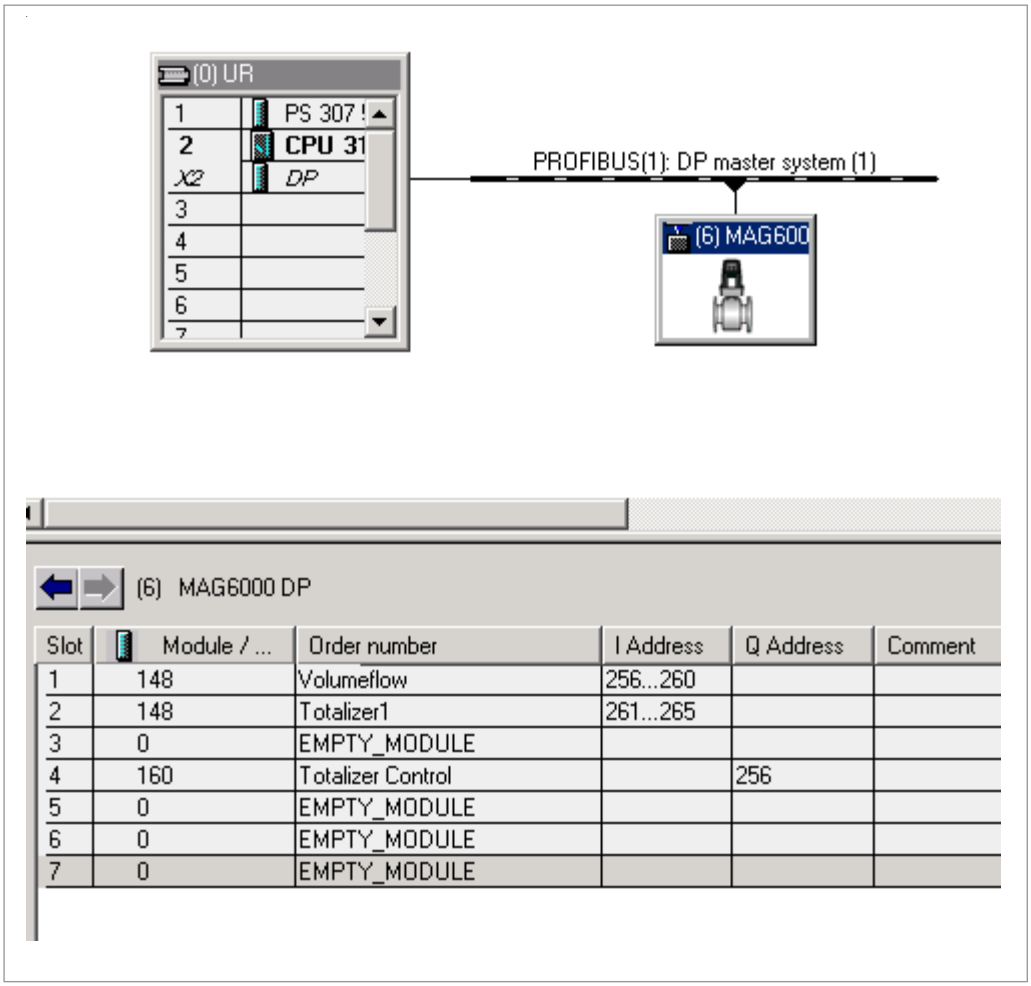
If the status of either the setpoint or compensation is bad or uncertain, then the corresponding value will not be updated in the flowmeter. This means that the parameters only will be accepted if status equals 0x80 or any other value in the category „Good“.

Please refer to **Appendix D** for a detailed description of which steps to take when ***Batching***.

4.5 Configuration with STEP 7

The following examples are from a Siemens STEP 7 project, and demonstrates the use of „***Empty module***“.
In STEP 7 SFC14 should be used for the reading of process values.

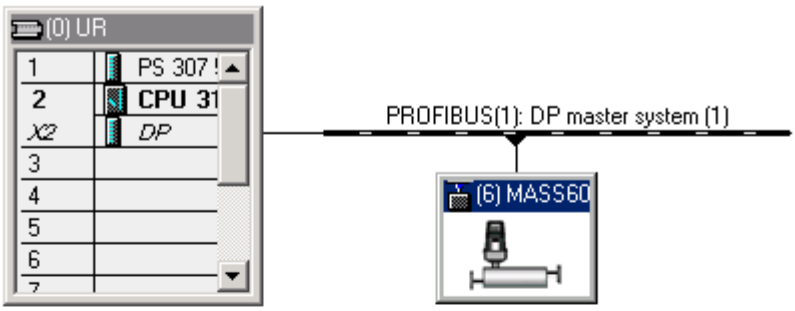
MAG 6000
In this example only „***Volume flow***“, „***Totalizer 1***“ and „***Totalizer control***“ are configured. The others are left out, by using the „***Empty Slot***“.
The order must be the same as in the GSD file. This means that it is not possible to place „***Totalizer 1***“ in SLOT 0 and „***Volume flow***“ in SLOT 1.



Slot	Module / ...	Order number	I Address	Q Address	Comment
1	148	Volumeflow	256...260		
2	148	Totalizer1	261...265		
3	0	EMPTY_MODULE			
4	160	Totalizer Control		256	
5	0	EMPTY_MODULE			
6	0	EMPTY_MODULE			
7	0	EMPTY_MODULE			

MASS 6000

In this example only „***Massflow***“, „***Temperature***“, „***Totalizer 2/Batch***“, „***Batch control***“ and „***Batch Set-point***“ are configured. The others are left out, by using the „***Empty Slot***“.
The order must be the same as in the GSD file. This means that it is not possible to e.g. place „***Temperature***“ in SLOT 0 and „***Massflow***“ in SLOT 3.

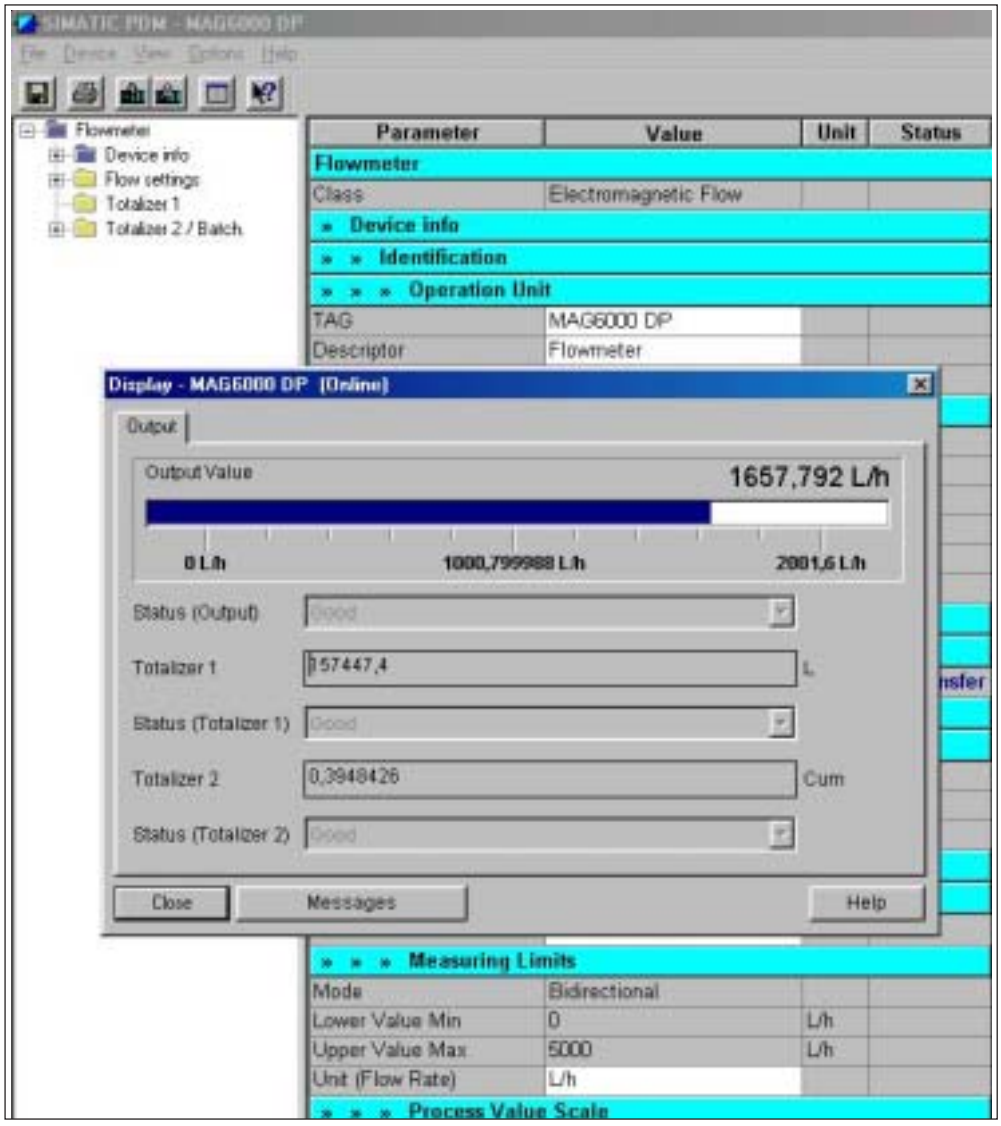


(6) MASS6000 DP

Slot	Module / ...	Order number	I Address	Q Address	Comment
1	148	Massflow	256...260		
2	0	EMPTY_MODULE			
3	0	EMPTY_MODULE			
4	148	Temperature	271...275		
5	0	EMPTY_MODULE			
6	0	EMPTY_MODULE			
7	0	EMPTY_MODULE			
8	0	EMPTY_MODULE			
9	148	Totalizer2/Batch	266...270		
10	0	EMPTY_MODULE			
11	160	Batch Control		256	
12	163	Batch Setpoint (NOT PCS7)		257...260	
13	0	EMPTY_MODULE			

4.6 Configuration with PDM

On a Profibus network a **Master class 2 device** can be used to gain read and write access to parameters. Siemens PDM is a **Master class 2 device**, and supports MAG 6000 and MASS 6000. Below is an example of a MAG 6000 online with PDM.



5. Diagnostics

The Profibus slave has the capability of sending diagnostics data, if required. The diagnostics data is split up into, **Standard** diagnostics and **Extended** diagnostics.
The diagnostics data consists of 23 bytes in total. The first 6 bytes are the **Standard** DP diagnostics, and the last 17 Bytes are **Extended** diagnostics.

5.1 Standard diagnostics

Byte	1	2	3	4	5	6
Value	D1	D2	D3	DM	IH	IL

D1: First diagnostic byte

Bit 0: Diag.station does not exist (set by Master)
Bit 1: Diag.Station_not _ready. Slave is not ready for data exchange
Bit 2: Diag.cfg_Fault. Configuration from master is not valid
Bit 3: Diag.ext_diag. Slave has external diagnostics data
Bit 4: Diag.not_supported. Slave does not support called function
Bit 5: Diag.invalid_slave_response. Set by slave to 0
Bit 6: Diag.prm_fault. Faulty parameterised (Ident number etc.)
Bit 7: Diag.master_lock. Other masters cannot parameterise slave

D2: Second diagnostic byte

Bit 0: Diag.Prm_req. Slave must be parameterised again
Bit 1: Diag.Stat_diag. Static diagnostic (Byte Diag-Bits)
Bit 2: Always 1
Bit 3: Diag.WD_ON. Watchdog is active
Bit 4: Diag.freeze_mode. Received freeze command
Bit 5: Sync_mode. Received sync command
Bit 6: Reserved
Bit 7: Diag.deactivated. Set by master

D3: Third diagnostic byte

Bit 0 to 6: Reserved
Bit 7: Diag.ext_overflow

DM: Master address after parameterisation (FF means not parameterised)

IH: Ident number low byte

IL: Ident number high byte

Further information can be found in the Profibus specification.

5.2 Extended diagnostics

Byte	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Value	LG	RE	RE	RE	RE	RE	RE	RE	EP	EP	EP	EP	EP	EP	EP	EP	EP

LG: Length of diagnostic data, fixed to 17

RE: Reserved

EP: Error pending

The ***Error Pending*** is equal to the ***Error Pending*** list accessible from the display of the flowmeter. The meaning of the ***Error Numbers*** can be read in the corresponding flowmeter manual. First error is placed in byte 15. If more errors are present they will be placed in the following bytes. 7F(hex) means no error.

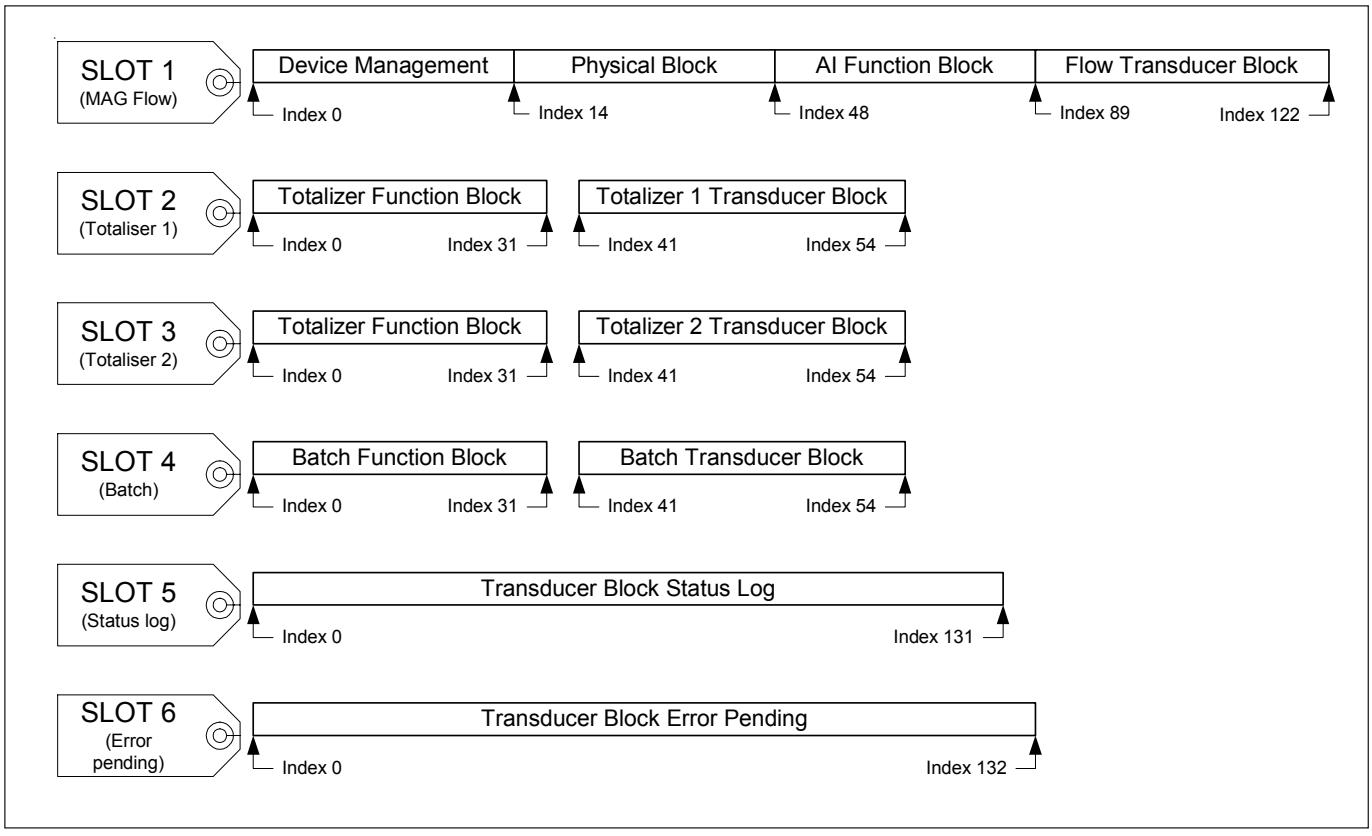
6. Profile description

6.1 Data management within the Profibus DP module

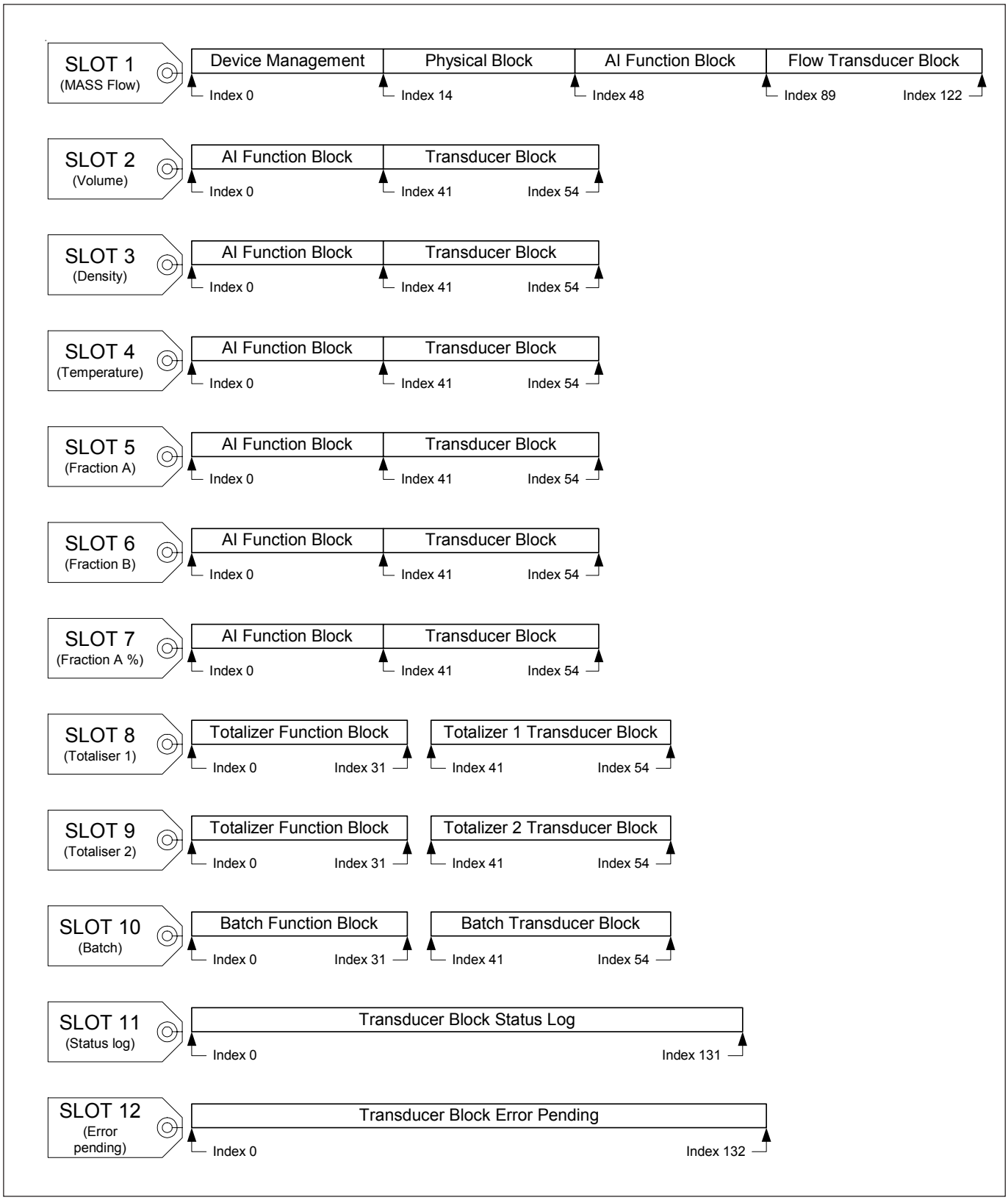
The Siemens Flow Instruments USM II concept means that add-on modules must be compatible with transmitters designed to function with different measurement sensor device types within the USM II family.
Presently this includes the MAG 6000 electromagnetic flow transmitter, and the MASS 6000 coriolis mass flow transmitter. Because the same DP module is used in both transmitter types, the module must present the correct transmitter profile to the Profibus master. This is done during power-up and initialization where the module automatically detects the type of transmitter to which it has been attached, and then communicates the correct slot and index address structure to the bus master.

Much of the device configuration information within the address blocks is standard information and is common to USM II transmitters (both MAG 6000 and MASS 6000). The following sections in this document deal with the overall structure and parameters within the slots, blocks, and indexes. Differences between SITRANS F M MAGFLO® and SITRANS F C MASSFLO® are explained, and additional comments are given where necessary to clarify the use or understanding of a particular index.

6.2 SITRANS F M MAGFLO® Slot/index diagram



6.3 SITRANS F C MASSFLO® Slot/index diagram



6.4 Slot/index description

6.4.1 Device management

DEVICE MANAGEMENT						
Absolute index within slot	Relative index within block	Name	Data type	Bytes	Access	Comments
0	0	Header composition		14	r	
1	1	Composite_List_Directory_Entries		100	r	

6.4.2 Physical block

PHYSICAL BLOCK						
Absolute index within slot	Relative index within block	Name	Data type	Bytes	Access	Comments
14	0	BLOCK OBJECT	DS-32	20	r	
15	1	ST_REV	uns16	2	r	
16	2	TAG_DESC	octstr/ vis str	32	r/w	
17	3	STRATEGY	uns16	2	r/w	
18	4	ALERT_KEY	uns8	1	none	Not supported
19	5	TARGET_MODE	uns8	1	r/w	
20	6	MODE_BLK	DS-37	3	r	
21	7	ALARM_SUM	DS-42	8	r	Not supported
22	8	SOFTWARE-REVISION	octstr	16	r	
23	9	HARDWARE-REVISION	octstr	16	r	
24	10	DEVICE-MAN-ID	uns16	2	r	
25	11	DEVICE-ID	octstr	16	r	Transmitter serial number
26	12	DEVICE-SER-num	octstr	16	r	Sensor serial number
27	13	DIAGNOSIS	octstr	4	r	Refer to separate table for Physical Block diagnostics bit coding
28	14	DIAGNOSIS_EXTENTION	octstr	6	none	Not supported
29	15	DIAGNOSIS_MASK	octstr	4	r	
30	16	DIAGNOSIS_MASK_EXTENTION	octstr	6	none	Not supported
31	17	DEVICE_CERTIFICATION	octstr	16	none	Not supported
32	18	SECURITY_LOCKING	uns16	2	none	Not supported
33	19	FACTORY_RESET	uns16	2	w	0 = No action 1 = Set to default 2 = Save all 3 = Re-establish settings
44	30	DESCRIPTOR	octstr	32	r/w	
45	31	DEVICE_MESSAGE	octstr	32	r/w	
46	32	DEVICE_INST_DATE	octstr	8	r/w	
47	33	VIEW_1			r	

6.4.3 Analog input function block

ANALOG INPUT FUNCTION BLOCK (SLOT 1)						
Absolute index within slot	Relative index within block	Name	Data type	Bytes	Access	Comments
48	0	BLOCK OBJECT	DS-32	20	r	
49	1	ST_REV	uns16	2	r	
50	2	TAG_DESC	octstr/ vis str	32	r/w	
51	3	STRATEGY	uns16	2	r/w	
52	4	ALERT_KEY	uns8	1	none	
53	5	TARGET_MODE	uns8	1	r/w	
54	6	MODE_BLK	DS-37	3	r	Default = AUTO
55	7	ALARM_SUM (not implemented)	DS-42	8	r	
58	10	OUT	DS-33	5	r	Measured variable with status. This value is the same as the cyclic value.
59	11	PV_SCALE	DS-36	11	r/w	
60	12	OUT_SCALE	DS-36	11	r/w	
62	14	CHANNEL	uns16	2	r/w	
64	16	PV_FTIME	float	4	r/w	Filter time in sec.
67	19	ALARM_HYS	float	4	r/w	Hysteresis in eng. units of LIM
69	21	HI_HI_LIM	float	4	r/w	
71	23	HI_LIM	float	4	r/w	
73	25	LO_LIM	float	4	r/w	
75	27	LO_LO_LIM	float	4	r/w	
78	30	HI_HI_ALM	DS-39	16	r	
79	31	HI_ALM	DS-39	16	r	
80	32	LO_ALM	DS-39	16	r	
81	33	LO_LO_ALM	DS-39	16	r	
82	34	SIMULATE	DS-50	6	r/w	
83-87	35-39	Reserved by PNO				
88	40	VIEW_1			r	

ANALOG INPUT FUNCTION BLOCK (SLOT 2-7 - MASSFLO® only)						
Absolute index within slot	Relative index within block	Name	Data type	Bytes	Access	Comments
0	0	BLOCK OBJECT	DS-32	20	r	
1	1	ST_REV	uns16	2	r	
2	2	TAG_DESC	octstr/ vis str	32	r/w	
3	3	STRATEGY	uns16	2	r/w	
4	4	ALERT_KEY	uns8	1	none	
5	5	TARGET_MODE	uns8	1	r/w	
6	6	MODE_BLK	DS-37	3	r	Default = AUTO
7	7	ALARM_SUM (not implemented)	DS-42	8	r	
10	10	OUT	DS-33	5	r	Measured variable with status. This value is the same as the cyclic value.
11	11	PV_SCALE	DS-36	11	r/w	
12	12	OUT_SCALE	DS-36	11	r/w	
14	14	CHANNEL	uns16	2	r/w	
16	16	PV_FTIME	float	4	r/w	Filter time in sec.
19	19	ALARM_HYS	float	4	r/w	Hysteresis in eng. units of LIM
21	21	HI_HI_LIM	float	4	r/w	
23	23	HI_LIM	float	4	r/w	
25	25	LO_LIM	float	4	r/w	
27	27	LO_LO_LIM	float	4	r/w	
30	30	HI_HI_ALM	DS-39	16	r	
31	31	HI_ALM	DS-39	16	r	
32	32	LO_ALM	DS-39	16	r	
33	33	LO_LO_ALM	DS-39	16	r	
34	34	SIMULATE	DS-50	6	r/w	
35-39	35-39	Reserved by PNO				
40	40	VIEW_1			r	

6.4.4 Flow transducer block

FLOW TRANSDUCER BLOCK (SLOT 1)						
Absolute index within slot	Relative index within block	Name	Data type	Bytes	Access	Comments
89	0	BLOCK OBJECT	DS-32	20	r	
90	1	ST_REV	uns16	2	r	
91	2	TAG_DESC	octstr/ vis str	32	r/w	
92	3	STRATEGY	uns16	2	r/w	
93	4	ALERT_KEY	uns8	1	none	
94	5	TARGET_MODE	uns8	1	r/w	
95	6	MODE_BLK	DS-37	3	r	
96	7	ALARM_SUM (not implemented)	DS-42	8	r	
97	8	FLOWRATE	float	4	r	MAG = Volume flow MASS = Mass flow
98	9	NOMINAL_SIZE	float	4	r/w	Access is determined by SENSORPROM®
99	10	FILTER_TYPE (not implemented)	uns8	1	none	
100	11	DEVICE_MODE	uns8	1	r/w	Always bi-directional
101	12	FLOWRATE_UNITS	uns16	2	r/w	
102	13	SELF_CHECKING	uns8	1	none	Not applicable
103	14	CALIBRATION_FACTOR	float	4	r/w	Access determined by SENSORPROM®
104	15	ZERO_POINT	float	4	r/w	MAG = Sensor offset MASS = Zero offset
105	16	FLOW_DIRECTION	uns8	1	r/w	
106	17	UPPER_SENSOR_LIMIT	float	4	r	MAG = Scale upper MASS = Mass flow scale upper
107	18	LOWER_SENSOR_LIMIT	float	4	r	MAG = Scale upper MASS = Mass flow scale upper
108	19	SAMPLE_RATE	float	4	r	MAG = Flow rate broadcast interval MASS = Mass flow rate broadcast interval
109	20	EPD_THRESHOLD	float	4	r/w	MAG = Not supported MASS = Empty pipe limit
110	21	LOW FLOW CUTOFF*)	float	4	r/w	PROFIBUS values only. Not associated with low flow cut off in the flowmeter. See description below.
111	22	MASS_FLOWRATE	float	4	r	MASS only
112	23	MASS_FLOWRATE_UNIT	uns16	2	r	MASS only
113	24	ZERO_POINT_ADJUST	uns8	1	r/w	MASS only
114	25	OSCILLATION_FREQ:	float	4	r	MAG = Not applicable MASS = Sensor frequency
115	26	VORTEX_FREQ	float	4	none	Not applicable
116	27	VOLUME_FLOW	float	4	r	MASS only
117	28	VOLUME_FLOW_UNITS	uns16	2	r/w	MASS only
118	29	TEMPERATURE	float	4	r	MASS only
119	30	TEMPERATURE_UNITS	uns16	2	r/w	MASS only
120	31	DENSITY	float	4	r	MASS only
121	32	DENSITY_UNITS	uns16	2	r/w	MASS only
122	33	VIEW_1			r	

***)** See next page

LOW FLOW CUT OFF*)
When the flow is zero, noise can disturb the measurement resulting in the appearance of a low flow value. This can be a problem because the Totalizers count this as an actual flow. To eliminate this, **Low flow cut off** can be used.
Two independent **Low flow cut off** parameters are available. One can only be accessed via the keypad display and another, which can only be accessed via Profibus.
Flow values received via the Profibus interface are not cut off by the **Low flow cut off** parameter that can be set via the keypad display, only the Totalizers are.
In the Profibus profile another **Low flow cut off** parameter is available. This parameter will only have influence on the primary measurement value received via Profibus. Hence it will not have any influence on any values in the keypad display or any other values received via Profibus.
Below is illustrated how the two different **Low flow cut off** parameters work:

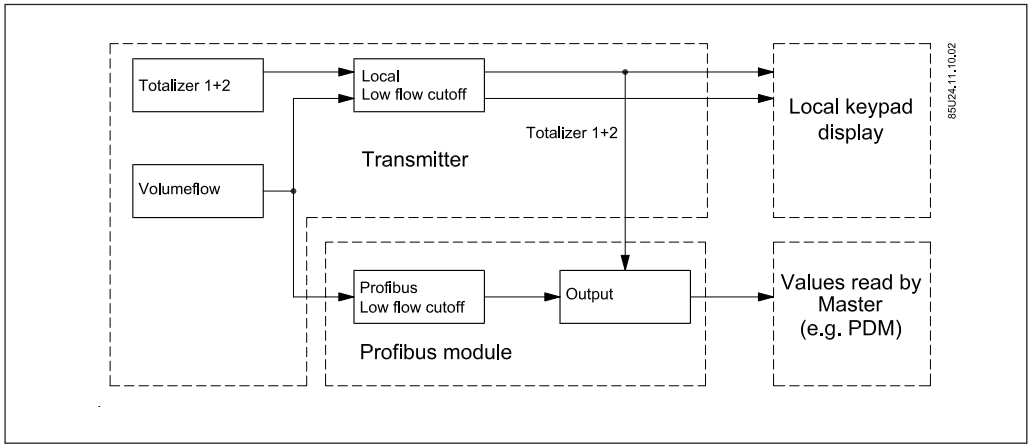


Figure: Low flow cut off dependencies in SITRANS F M MAGFLO MAG 6000.

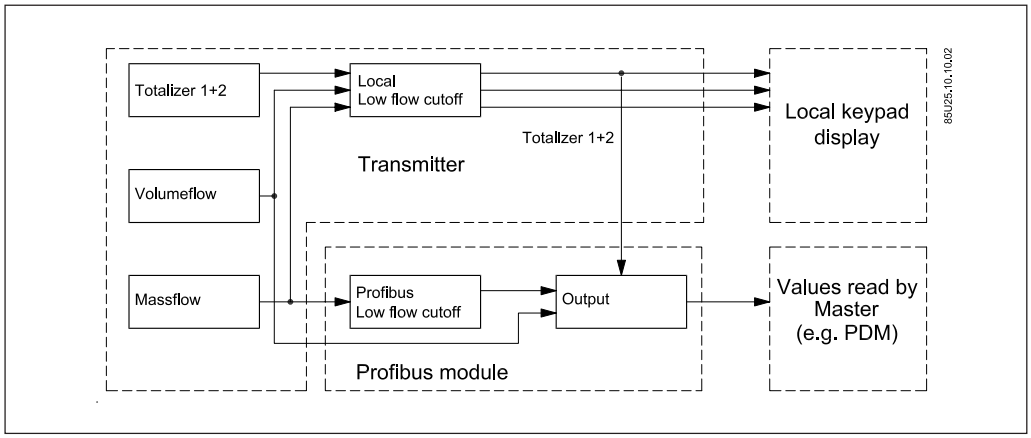


Figure: Low flow cut off dependencies in SITRANS F C MASSFLO MASS 6000.

6.4.5 Transducer blocks, (SITRANS F C MASSFLO® only)

TRANSDUCER BLOCKS (SLOT 2 – 7) (MASS 6000 ONLY)						
Absolute index within slot	Relative index within block	Name	Data type	Bytes	Access	Comments
41	0	BLOCK OBJECT	DS-32	20	r	
42	1	ST_REV	uns16	2	r	
43	2	TAG_DESC	octstr/ vis str	32	r/w	
44	3	STRATEGY	uns16	2	r/w	
45	4	ALERT_KEY	uns8	1	none	
46	5	TARGET_MODE	uns8	1	r/w	
47	6	MODE_BLK	DS-37	3	r	
48	7	ALARM_SUM (not implemented)	DS-42	8	r	
49	8	VALUE	float	4	r	SLOT 2 = Volumeflow
						SLOT 3 = Temperature
						SLOT 4 = Density
						SLOT 5 = Fraction A
						SLOT 6 = Fraction B
						SLOT 7 = Fraction A%
53	12	UNIT	uns16	2	r/w	
54	13	VIEW_1			r	

Because the SITRANS F C MASSFLO® supports multiple ***Process Variables***, extra slots have been configured to accommodate these. As shown earlier in the SITRANS F C MASSFLO® slot/index overview diagram these extra slots are each made up of an ***Analogue Function Block*** and a ***Transducer Block***.

6.4.6 Totalizers

As shown in the slot/index overview diagrams, the totalizers occupy slots 2 - 3 for SITRANS F M MAGFLO®, and 8 - 9 for SITRANS F C MASSFLO®. The structure of these is as follows:

TOTALIZER FUNCTION BLOCK						
Absolute index within slot	Relative index within block	Name	Data type	Bytes	Access	Comments
0	0	BLOCK OBJECT	DS-32	20	r	
1	1	ST_REV	uns16	2	r	
2	2	TAG_DESC	octstr/ vis str	32	r/w	Default = Totalizers 1
3	3	STRATEGY	uns16	2	r/w	
4	4	ALERT_KEY	uns8	1	r/w	
5	5	TARGET_MODE	uns8	1	r/w	
6	6	MODE_BLK	octstr/ vis str	3	r	Not relevant for totalizers
7	7	ALARM_SUM	DS-42	8	r	
10	10	OUT TOTAL	DS-33	5	r	Actual totalized value with status
12	12	TOT UNITS	uns16	2	r/w	MASS 6000 can have either Volumeflow or Massflow units. See description below.
14	14	CHANNEL	uns16	2	r/w	Totalizer 1 refers to Totalizer 1 transducer block. Totalizer 2 refers to Totalizer 2 **or** Batch transducer block
15	15	RESET_TOT	uns8	1	w	**0 = CANCEL**
						1 = RESET
16	16	MODE_TOT	uns8	1	r/w	**0 = UP**
						2 = HOLD
18	18	FAIL_TOT	uns8	1	r	Always set to 0 = RUN

6.4.6 Totalizers *(continued)*

TOTALIZER FUNCTION BLOCK						
Absolute index within slot	Relative index within block	Name	Data type	Bytes	Access	Comments
20	20	POLAR TOT	uns8	1	r/w	**0 = BALANCED** (NET) - default
						1 = POSITIVE
						2 = NEGATIVE
22	22	ALARM_HYS	float	4	r/w	
23	23	ALARM_SUM (not implemented)	float	4	r/w	
24	24	HI_LIM	float	4	r/w	
25	25	HI_HI_ALM	DS-39	16	r	
26	26	HI_ALM	DS-39	16	r	
31	31	VIEW_1			r	

Totalizer units
The MASS 6000 can totalise Massflow, Fraction A, Fraction B and Volumeflow. This means that TOT_UNITS can be either Mass or Volume units. A write error will be returned if writing a Volume unit when Massflow, Fraction A or Fraction B is selected. Likewise if trying the opposite. Therefore it is necessary to notice if the Totalizers are set to Massflow, Fraction A, Fraction B or Volumeflow. Totalizer 1 is default set to Massflow, and Totalizer 2 is default set to Volumeflow.

Totalizer 2 or Batch
The Batch functionality uses the Totalizer 2. Therefore, when Batch is ON the user has no control of totalizer 2.

TOTALIZER TRANSDUCER BLOCK						
Absolute index within slot	Relative index within block	Name	Data type	Bytes	Access	Comments
41	0	BLOCK OBJECT	DS-32	20	r	
42	1	ST_REV	uns16	2	r	
43	2	TAG_DESC	octstr/ vis str	32	r/w	
44	3	STRATEGY	uns16	2	r/w	
45	4	ALERT_KEY	uns8	1	r/w	
46	5	TARGET_MODE	uns8	1	r/w	
47	6	MODE_BLK	DS-37	3	r	
48	7	ALARM_SUM	DS-42	8	r	
49	8	OUT_VALUE	float	4	r	
53	12	TOT_UNITS	octstr/ vis str	2	r	
54	13	VIEW_1		17	r	

6.4.7 Batch

As shown in the slot/index overview diagrams, the batch function occupies slot 4 for SITRANS F M MAGFLO®, and 10 for SITRANS F C MASSFLO®. The ***Batch Function Block*** is based on the ***Totalizer Function Block*** and shares almost identical structure. The **totalizer 2** and the **Batch Function Blocks** are exclusive, only one of these can exist at a time in the USM II Profibus module. If the ***Batch*** functionality is activated, then ***Totalizer 2*** is excluded and cannot be used for totalizing. ***Totalizer 2*** can be used if ***Batch*** is deactivated.

BATCH FUNCTION BLOCK						
Absolute index within slot	Relative index within block	**Name**	**Data type**	**Bytes**	**Access**	**Comments**
0	0	BLOCK OBJECT	DS-32	20	r	
1	1	ST_REV	Uns16	2	r	
2	2	TAG_DESC	octstr/ vis str	32	r/w	
3	3	STRATEGY	Uns16	2	r/w	
4	4	ALERT_KEY (not supported)	Uns8	1	r/w	
5	5	TARGET_MODE	Uns8	1	r/w	
6	6	MODE_BLK	octstr/ vis str	3	r	
7	7	ALARM_SUM	DS-42	8	r	
10	10	AMOUNT_DONE	DS-33	5	r	Batch total amount
12	12	BATCH_UNITS	Uns16	2	r/w	Units for batch
14	14	CHANNEL	Uns16	2	r/w	0 = CANCEL
						1 = RESET
15	15	CYCLE CNT RESET	Uns8	1	w	0 = UP (Not supported)
						1 = DOWN (Not supported)
						2 = HOLD (Not supported)
						3 = BATCH (Not supported)
						4 = START
						5 = STOP
						6 = PAUSE
						7 = RESUME
						8 = OFF (Not selected)
16	16	MODE BATCH	Uns8	1	r/w	
18	18	FAIL BATCH	Uns8	1	r	Can only be 0 = RUN
20	20	POLAR TOT	Uns8	1	r	Not applicable - not supported
21	21	BATCH ON OFF	Uns8	1	r/w	
22	22	ALARM_HYS	float	4	r/w	
23	23	HI_HI_LIM	float	4	r/w	
24	24	HI_LIM	float	4	r/w	
25	25	HI_HI_ALM	DS-39	16	r	
26	26	HI_ALM	DS-39	16	r	
27	27	TIMEOUT	Uns32	4	r/w	
28	28	CYCLE COUNTER	Uns32	4	r	
29	29	COMPENSATION	float	4	r/w	
30	30	SETPOINT	float	4	r/w	
31	31	VIEW_1			r	

Batch units

The MASS 6000 can Batch Massflow, Fraction A, Fraction B and Volumeflow. This means that BATCH_UNITS can be either Mass or Volume units. A write error will be returned if writing a Volume unit when Massflow, Fraction A or Fraction B is selected. Likewise if trying to write a Mass unit when Volumeflow is selected. Therefore it is necessary to notice if the Batch is set to Massflow, Fraction A, Fraction B or Volumeflow. Batch is default set to Massflow.

6.4.7 Batch *(continued)*

BATCH TRANSDUCER BLOCK

Absolute index within slot	Relative index within block	Name	Data type	Bytes	Access	Comments
41	0	BLOCK OBJECT	DS-32	20	r	
42	1	ST_REV	uns16	2	r	
43	2	TAG_DESC	octstr/ vis str	32	r/w	
44	3	STRATEGY	uns16	2	r/w	
45	4	ALERT_KEY	uns8	1	r/w	
46	5	TARGET_MODE	uns8	1	r/w	
47	6	MODE_BLK	DS-37	3	r	
48	7	ALARM_SUM	DS-42	8	r	
49	8	OUT_VALUE	float	4	r	
53	12	TOT_UNITS	octstr/ vis str	2	r/w	
54	13	VIEW_1		17	r	

6.4.8 Status log transducer block

STATUS LOG TRANSDUCER BLOCK

Absolute index within slot	Relative index within block	Name	Data type	Bytes	Access	Comments
0	0	BLOCK OBJECT	DS-32	20	r	
1	1	ST_REV	uns16	2	r	
2	2	TAG_DESC	octstr/ vis str	32	r/w	
3	3	STRATEGY	uns16	2	r/w	
4	4	ALERT_KEY	uns8	1	r/w	
5	5	TARGET_MODE	uns8	1	r/w	
6	6	MODE_BLK	octstr/ vis str	3	r	
7	7	ALARM_SUM (not implemented)	DS-42	8	r	
128	128	ACCEPTION_LEVEL	uns8	1	r/w	
129	129	STATUSLOG_LIST	octstr	60	r	
130	130	RESET	uns8	1	w	
131	131	VIEW_1		14	r	

6.4.9 Error pending transducer block

ERROR PENDING TRANSDUCER BLOCK

Absolute index within slot	Relative index within block	Name	Data type	Bytes	Access	Comments
0	0	BLOCK OBJECT	DS-32	20	r	
1	1	ST_REV	uns16	2	r	
2	2	TAG_DESC	octstr/ vis str	32	r/w	
3	3	STRATEGY	uns16	2	r/w	
4	4	ALERT_KEY	uns8	1	r/w	
5	5	TARGET_MODE	uns8	1	r/w	
6	6	MODE_BLK	octstr/ vis str	3	r	
7	7	ALARM_SUM (not implemented)	DS-42	8	r	
14	14	SYSTEM_ERROR_STATE	uns8	1	r	
128	128	ACCEPTION_LEVEL	octstr	1	r/w	
131	131	ERRORPENDING_LIST	uns8	60	r	
132	132	VIEW_1		14	r	

APPENDIX A

Profibus data structures

Profibus defines a wide variety of special data types and structures. The following are used:

Data structures			
Name	**Abbreviation**	**Size**	**Comment**
Block structure	DS-32	20	Used for all headers
Value&Status - Floating point	DS-33	5	Used for measured variables (AI). See further explanation below
Scaling	DS-36	11	Used in Function Blocks. See further explanation below
Mode	DS-37	3	Function Block modes: Actual, Possible, and Normal
Alarm Float	DS-39	16	
Simulation parameter	DS-50	6	

DS-33 Value & status | PV Float value | Status |

Status information for DS-33

Category	Meaning	PROFI bit-code	USM II mapping	USM II error code
Bad	Sensor failure	000100 xx	Transmitter specific fatal error	70-79
	Device failure	000011xx	Profibus DP module failure	-
Uncertain	Sensor failure	010100xx	Transmitter specific permanent failure	50-59
	Device failure	010011xx	USM II fatal error	60-69
Good	Sensor failure	10001000	Transmitter specific warning	30-39
			Transmitter specific information	10-19
	Device failure	10001100	USM II permanent error	40-49
			USM II warnings	20-29
			USM II information	1-9
	OK	10000000		
	Low limit alarm	10001001	Lo - alarm - warning	
	Low limit alarm	10001101	Lo-Lo - alarm - critical	
	High limit alarm	10001010	Hi - alarm - warning	
	High limit alarm	10001110	Hi-Hi - alarm - critical	
	Constant	xxxxxx11		

Note
Cascade is not possible with the **Analogue Input Function Block** and therefore related status is not used.

USM II error codes can be found in the respective MAG 6000 or MASS 6000 manual.

DS-36 Scaling			
Value	**Data Type**	**OUT Scale**	**PV Scale**
100 %	Float	UpperScale	Upper scale in user selected units
0%	Float	LowerScale	Lower scale in user selected units
Unit Code	Unsign16	Unit Code (HCF)	Unit code (HCF)
Decimals		Decimals	Decimals

DS-39 Alarm float		
Action	**Data Type**	**Returns**
Unacknowledged	Unsign8	0
Alarm state	Unsign8	No Alarm = 0 , Alarm = 1
Time stamp	Time value	USM II relative time used for time stamp. Time stamp is the time since the event happened. The unit is minutes.
Subcode	Unsign16	0 = No errors (will only display process alarms)
Value	Float	For FB this is the OUT value

DS-50 Simulation float		
Action	**Data Type**	**Returns**
Simulate status	Unsign8	Similar to status byte in Float & Status
Simulate value	Float	Value set by operator
Simulate en/disable	Unsign8	Disable = 0, Enable = 1

APPENDIX B

Coding of physical block diagnostics

Bit	Mnemonic	Description	Mask	Comments and USM II mapping	USM II error code
0	DIA_HW_ELECTR	Hardware failure of Profibus module	1	Profibus HW failure	
1	DIA_HW_MECH	Failure of mechanics - not supported	0		
2	DIA_TEMP_MOTOR	Motor temperature too high - not supported	0		
3	DIA_TEMP_ELECTR	Not supported	0		
4	DIA_MEM_CHKSUM	Memory checksum error	1	SENSORPROM checksum error	61 20
5	DIA_MEASUREMENT	Failure in measurement	1	Transmitter specific fatal error	70-79
6	DIA_NOT_INIT	Device not initialised - not supported	0		
7	DIA_INIT_ERROR	Self calibration failed - not supported	0		
8	DIA_ZERO_ERROR	Zero point error - not supported	0		
9	DIA_SUPPLY	Power supply failed - not supported	0		
10	DIA_CONF_INVAL	Configuration invalid - CHK CONFIG	1	SENSORPROM ID Parameter range	62 41
11	DIA_WARMSTART	Re-start-up carried out	1	Set during the initialisation phase. Is reset by **„Run“**	
12	DIA_COLDSTART	New-start-up	0	The USM II Profibus module cannot differentiate between cold and warm start-up. Warm start-up is set during the initialisation phase.	
13	DIA_MAINTENANCE	Maintenance required - not supported	0	No specific condition to set this bit is seen.	
14	DIA_CHARACT	Characterisation invalid - not supported	0		
15-30		Reserved by PNO	0		

APPENDIX C

SI-Units used in USM II products

SITRANS F M MAGFLO®

Volume flow	m^3/s
Totalizers	m^3

SITRANS F C MASSFLO®

Mass flow	kg/s
Volume flow	m^3/s
Density	kg/m^3
Temperature	°C
Fraction flow (A,B)	kg/s
Fraction flow A pct	% (percent)
Totalizer 1 & 2	kg or m^3 depending on totalizer mode (i.e. mass flow or volume flow)
Batch	Same as totalizers

Note
°C for temperature is not strictly speaking an SI unit. This should be K (Kelvin), but K is of little practical significance to most users, hence the use of °C (Celcius).

APPENDIX D

Batching with Profibus

The flowmeter includes a **Batch controller**. This means that it can control a valve or similar from the digital output. The **Batch** can be started in many ways; from the local display, via the digital input or from Profibus.
The following will describe **Batch control** from Profibus.

Steps to take when batching:

- Set up amount to be batched
- Start batch
- Poll for status
- When (status = stopped), prepare a new batch

The actual amount batched can differ from the set-point due to delays in valves, pressurizing flexible pipes etc. Therefore a fixed compensation can be set up using the ***„Compensation“*** parameter:

- Make one batch (precision increases if an average is calculated from several batches)
- Find the deviation
- Write the deviation to the ***„Compensation“*** parameter

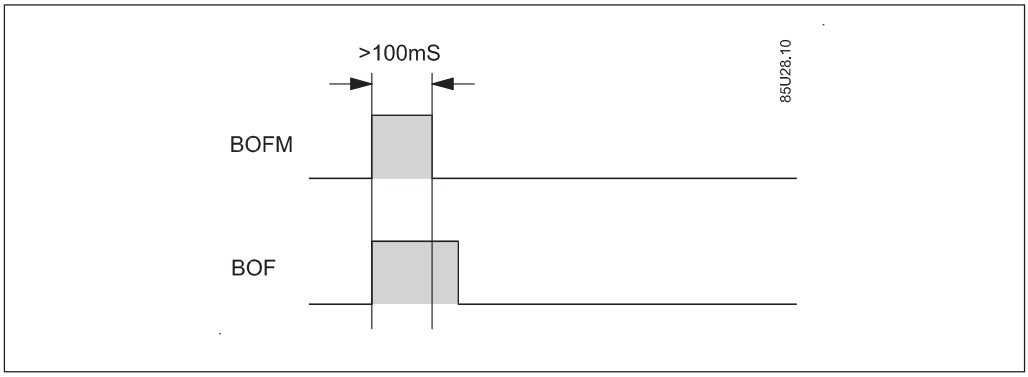
From Profibus the control can be done either cyclic (DPV0) or acyclic (DPV1). A Class 1 Profibus Masters can use the cyclic control, whereas a Class 2 Master like Simatic PDM can access the acyclic control.
The acyclic control is straight forward to use, whereas the cyclic control needs some more explanation.

Cyclic Batch control

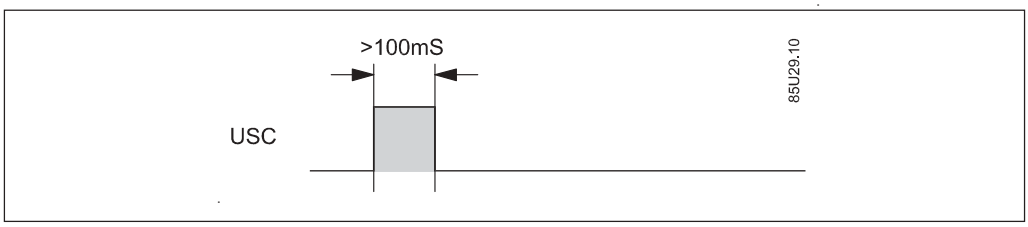
Three modules can be configured for the use of Batch; **Batch Control, Batch Set-point** and **Batch Compensation**. The **Batch Control** module is mandatory, and **Batch Set-point** and **Compensation** are optional. This means that **Batch Set-point** and/or **Compensation** cannot be configured without also configuring **Batch Control**.
The modules are described in the chapter: Output data (Master view).
Below is described the required steps to take when **Batching**.

Batch ON/OFF mask (BOFM)
This bit masks the Batch ON/OFF (BOF). If BOFM is „0“ then the state of BOF is ignored. When BOFM is „1“ the state of BOF is detected and acted upon.

Batch ON/OFF (BOF)
To be able to Batch the Batch function must be set active. To set Batch active, set BOF = „1“, and set BOFM „1“ for minimum 100 mS and then back to „0“. Now BOF can be set back to „0“, and Batch is active. To deactivate Batch, set BOFM to „1“ (condition: BOF = „0“) for minimum 100 mS and then back to „0“.
Setting Batch = ON will change the behavior of Totalizer 2. Totalizer 2 will now show the progress of the Batch. Making a Batch start will set Totalizer 2 = Set-point, and Totalizer 2 will count down to zero.

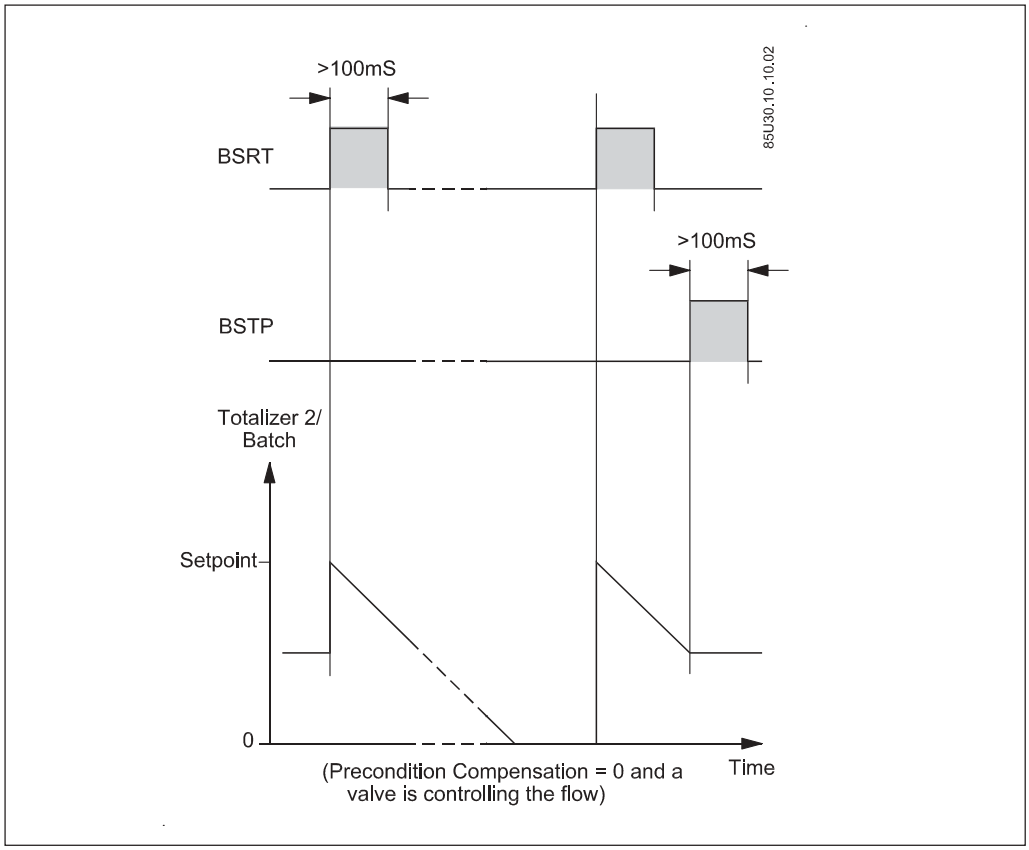


Update Set-point and Compensation (USC)
On the positive edge from „0“ to „1“ this bit updates the values of **Set-point** and **Compensation** in the flowmeter.



Batch Start (BSRT)
On the positive edge from „0“ to „1“ this bit starts the Batch. (Precondition: Batch is active). If a Batch is already in progress, the command will be ignored. A new Batch can be started when Totalizer 2 is <= zero.

Batch Stop (BSTP)
On the positive edge from „0“ to „1“ this bit stops an ongoing Batch. (Precondition: Batch is active). If a Batch is already stopped, the command will be ignored.



We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are always welcomed.

Technical data subject to change without prior notice.

Siemens Flow Instruments A/S
Nordborgvej 81
DK-6430 Nordborg

Order no.: FDK:521H1185-02
Printed in: Denmark