SIEMENS

Operating Manual

SITRANS F M MAGFLO® & SITRANS F C MASSFLO®

DeviceNet add-on module

Technical Documentation (handbooks, instructions, manuals etc.) on the complete product range SITRANS F can be found on the internet/intranet on the following links:

English: http://www4.ad.siemens.de/WW/view/en/10806951/133300

Order no.: FDK:521H1189

SFIDK.PS.023.C2.02

Contents

1. Introduction to DeviceNet

This manual is intended to be used both as an instructional and a reference manual. It only briefly touches on the basics of the DeviceNet protocol.

1.1 About this manual

The manual is also intended to serve as a guideline when you specify and optimize your communication system.

Even if you are an experienced DeviceNet programmer, we suggest that you read this manual entirely before you start programming, since important information can be found in all chapters.

1.2 Assumptions

This manual assumes that you use a Siemens Flow Instruments MAG 6000 or MASS 6000 unit with DeviceNet. It also assumes that you are using a PLC or PC, as a master, that is equipped with a serial communication option supporting all the DeviceNet communication services required by your application. Furthermore, it is assumed that all requirements stipulated in the DeviceNet standard as well as those set up in the generic profile and those pertaining to the MAG 6000 or MASS 6000 flowmeters are strickly observed as well as all limitations mentioned fully respected.

1.3 What you should already know

The Siemens Flow Instruments DeviceNet module is designed to communicate with any master abiding by the DeviceNet standard. It is therefore assumed that you have full knowledge of the PC or PLC you intend to use as a master in your system. Any questions pertaining to hardware or software produced by any other manufacturer is beyond the scope of this manual and is of no concern to Siemens Flow Instruments.

If you have questions about how to set up master, master communication or communication to a non Siemens Flow Instruments slave, the appropriate manuals should be consulted.

1.4 Product and environment

DeviceNet is a distributed control network. The DeviceNet protocol is embedded in the add-on module (AOM) and is a communication protocol conforming to the **Open DeviceNet Vendor Association** (ODVA) standard.

The add-on module allows DeviceNet compatible controllers, sensors and network management tools to control, monitor and supervise the MAG 6000/MASS 6000 flowmeter. The add-on module is designed to the DeviceNet system “Protocol for Vendors” as a slave device.

1.5 Network

The MAG 6000/MASS 6000 flowmeter functions as a slave on the DeviceNet network. All addressing and linking the nodes is done at installation time by a network manager tool. The network installer and the network management master have significant influence on how the nodes function on the network. A DeviceNet network can support up to 64 nodes.

1.6 User profile

The end-user is a network manager programmer or controller who sees the DeviceNet add-on module as an invisble bridge to the flowmeter. Control and supervision of the flowmeter will be possible through the standard parameter set.

1.7 Interface to Device-Net network

The interface connection to the DeviceNet network is implemented through a microprocessor with an imbedded CAN controller. For the MAG 6000, two different I/O assemblies are available in the AOM. For the MASS 6000 seven different I/O assemblies are available in the AOM.
The I/O assembly can be controlled by the user. The I/O assembly can only handle polled mode. For explicit messages the interface uses the pre-configured master functionality.

2. Technical data

General specifications:	
Device type	Slave
Baud rates	125, 250, 500 Kbits/s
Max. distance	100-500 meters
Max. number of nodes	64
Supported messaging formats	Polling, explicit messaging
Device type	Generic device
Certified	No

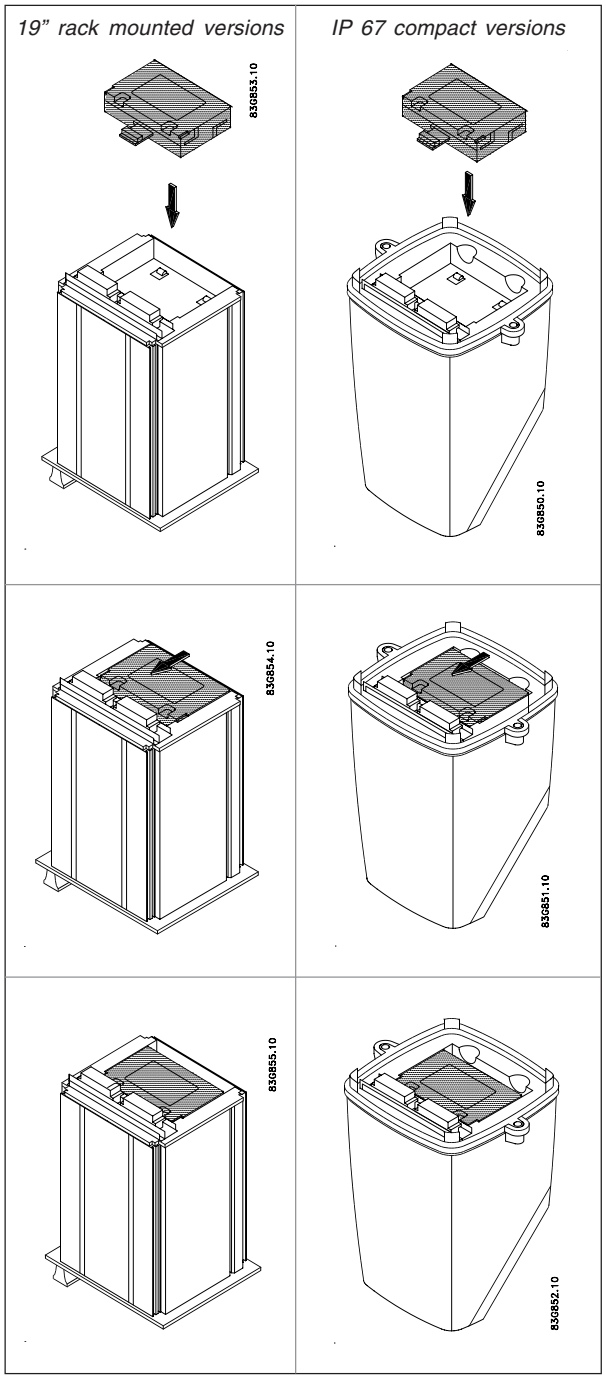
Poll message contents: (depending on configuration)	
Production	All process values. Batch, zero adjust and error status
Consumption	Totalizer and zero adjust control

Functionality:		Parameter:	MAG 6000	MASS 6000
	Process values	Mass flow		√
		Volume flow	√	√
		Temperature		√
		Density		√
		Fraction A		√
		Fraction B		√
		Pct Fraction A		√
		Totalizer 1	√	√
		Totalizer 2	√	√
		Batch progress	√	√
	Totalizer control	Reset	√	√
		Hold/Run	√	√
		Direction	√	√
	Batch control	On/Off	√	√
		Setpoint	√	√
		Cycle counter	√	√
		Cycle counter reset	√	√
		Mode: Start	√	√
		Pause	√	√
		Resume	√	√
		Stop	√	√
		Maximum batch time	√	√
		Batch compensation	√	√
		Lead constant		√
	Zero adjust	Auto	√	√
		Manual	√	√
		Zero adjust time		√
	Info	Flow direction	√	√
		Scale upper	√	√
		Scale lower	√	√
		Empty pipe limit		√
		Calibration factor	√	√
		Sensor size	√	√
		Active error	√	√

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.

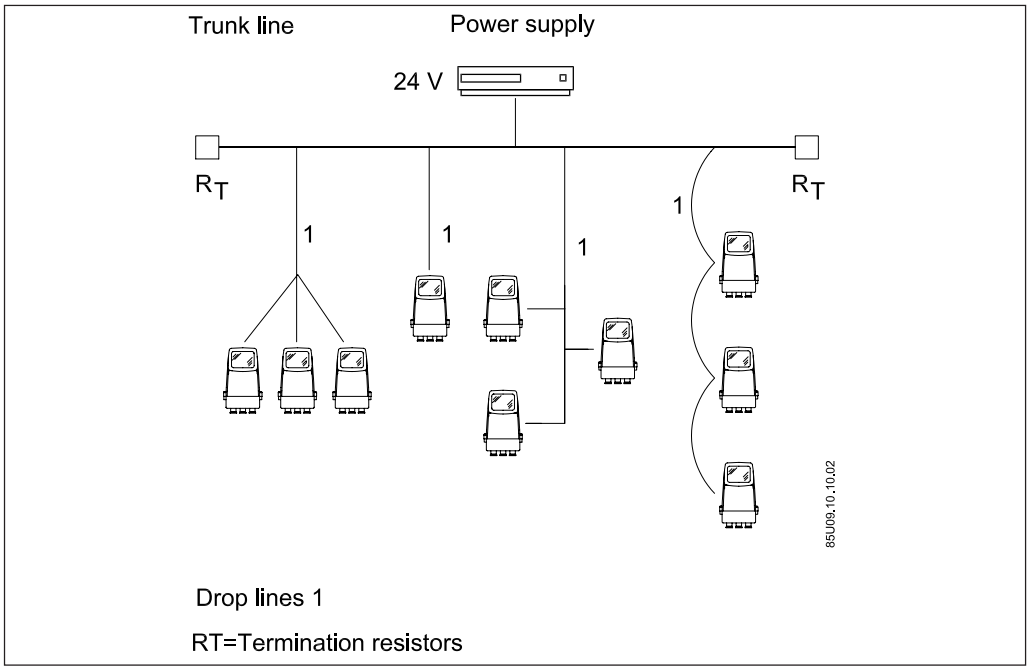
2. Press the add-on module in the direction shown, until it stops and is firmly seated in position

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.

After mounting, the DeviceNet menus are shown in the display and (set table) values are stored in the SENSORPROM® memory unit

3.2 Topology

The DeviceNet allows a mixed **trunk line/drop line** topology. The cable has to be terminated with a resistor of 121 ohm/0.25W in both ends of the cable.

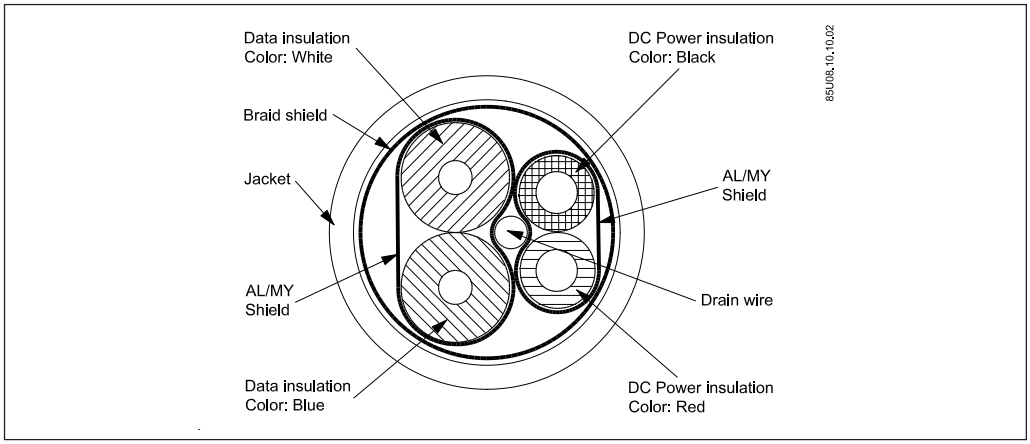


3.3 Cable lengths

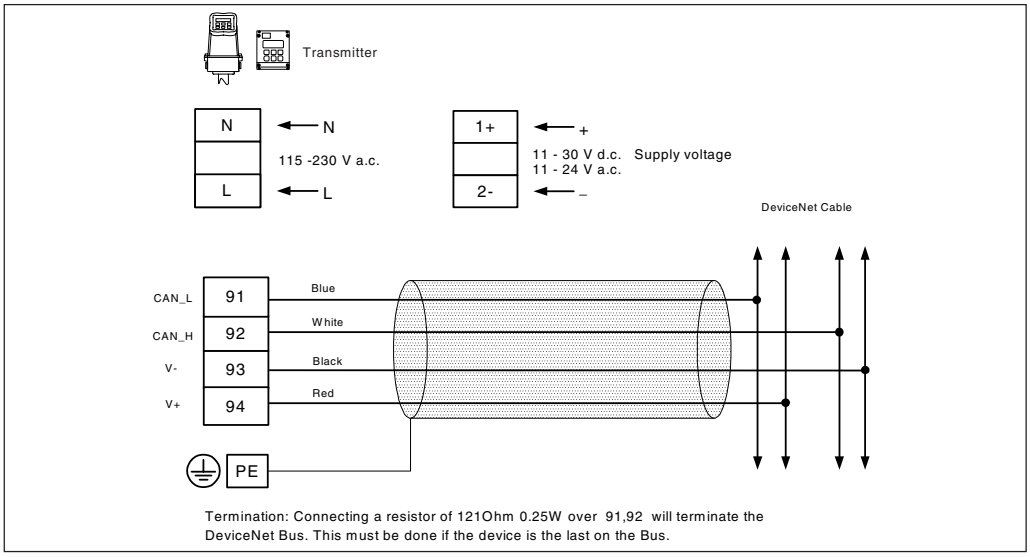
Baud rate	Max. total cable length [m]	Drop length [m]	
		Maximum	Cumulative
125 K baud	500 meters (1640 ft.)	6 meters (20 ft.) for one drop	156 meters (512 ft.)
250 K baud	250 meters (820 ft.)		78 meters (256 ft.)
500 K baud	100 meters (328 ft.)		39 meters (128 ft.)

3.4 Cable specifications

Electrical characteristics	Specifications
Impedance	120 Ohms +/– 10%
Propagation delay	1.36 nSec/ft. (max.)
Cap. between conductors	12 pf/ft. (nominal)
Cap. conductors/shield	24 pf/ft. (nominal)
Cap. unbalance	1200 pf/1000 ft. (max.)
DCR - @20°C	28 Ohms/1000 ft. (max.)
Attenuation	0.29 db/100 ft. @ 125 kHz
	0.50 db/100 ft. @ 250 kHz
	0.70 db/100 ft. @ 500 kHz



3.5 Electrical connection



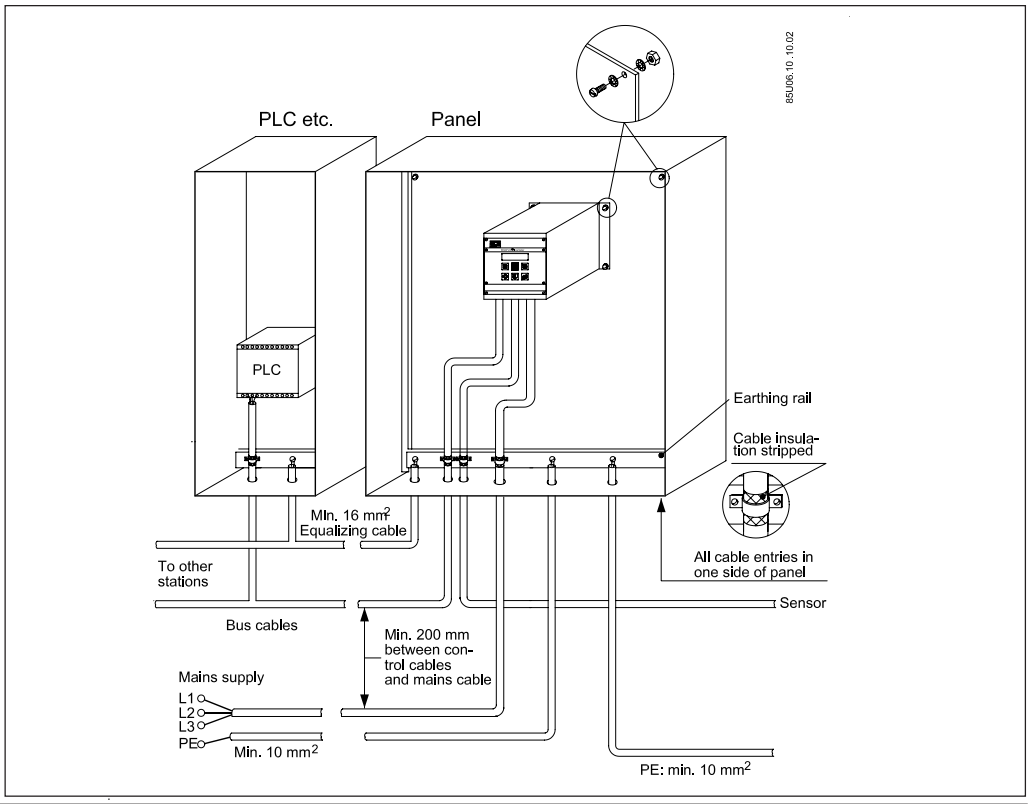
3.6 EMC precautions

The following EMC precautions are recommended to obtain an interference free operation of the Devicenet network. Additional information on EMC can be found in the MAG 6000/MASS 6000 handbooks.

Note
Relevant national and local regulations, for example regarding protective earth connection, must be observed.

The DeviceNet communication cable must be kept away from cables that can contain electrical noise such as motor and mains cables to avoid coupling of noise from one cable to the other. Normally a distance of 200 mm (8 inches) is sufficient, but it is generally recommended to keep the longest possible distance between the cables, especially where cables are running in parrallel over long distances.
The use of separate cable trays for signal cables and high power cables has proven to be a very good practice for eliminating noise coupling.

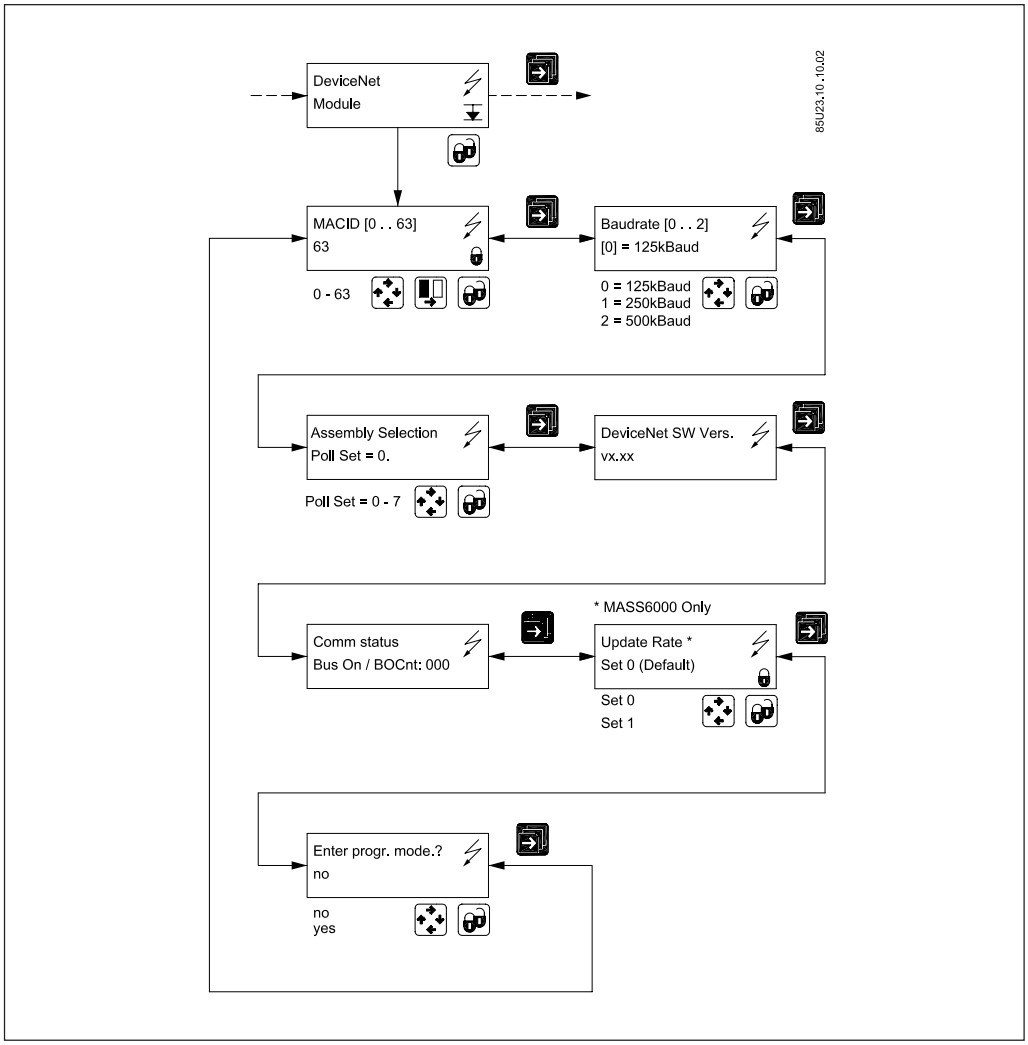
If the DeviceNet has to cross a main cable or other cables that are a source of noise, they must cross eachother at an angle of 90°.



4. Commissioning

Before communicating with the **scanner**, the **MAC ID**, **baud rate** and **assembly selection** must be selected. This can be done either from the local display or from the commissioning software. Please look in to the transmitter manual to locate the DeviceNet module menu.

4.1 DeviceNet display menu



4.1.2 Quick set-up

The MAC ID can be set from the bus or via the keypad display.
To change (or view) the DeviceNet settings from the keypad display.

1. Press and hold [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] . The display shows **"Edit mode"** for two seconds
3. The display now shows/displays **"Basic settings"**
4. Press [Forward key] until you reach the **"DeviceNet module"** menu item
5. Press [Lock key]
6. You can now cycle through all the DeviceNet settings by pressing [Forward key]
7. Select **"MACID [0..63]"**
8. Type in the address with the [Change key] and [Next key]
9. Lock the setting with the [Lock key]
10. Select **"Baud rate [0..2]"**
11. Select the desired baud rate with the [Change key]
12. Lock the setting with the [Lock key]
13. Select **"Assembly selection"**
14. Select the desired **"Polled I/O data size"** with the [Change key]
15. Lock the setting with the [Lock key]
16. Select **"Update rate"**
17. Select the desired PDO update rate with the [Change key]
18. Lock the settings with the [Lock key]
19. Press [Top key] for two seconds to return to 1

4.1.3 Menu item explanation

If the DeviceNet option has been fitted correctly into the flowmeter, the menu structure will show a new group of parameters:

DeviceNet module

This group of parameters will be explained in detail in this chapter.

Mac ID (MAC ID)	
Selection	
0 - 63	63

Function
Every station connected to the same bus must have an unique address. The address can only be set by using the keypay display or via explicit messaging.

Baud rate (Baud rate)	
Value	
125 K baud	(125 K baud)
250 K baud	(250 K baud)
500 K baud	(500 K baud)

Function
Selection of the DeviceNet transmission speed. It must correspond to the transmission speed of the master and the other DeviceNet nodes.

Assembly selection (POLL set)	
Value	
Assembly selection 1/2	[POLL set 0]
Assembly selection 100/2	[POLL set 1]
Assembly selection 101/2	[POLL set 2]
Assembly selection 102/2	[POLL set 3]
Assembly selection 103/2	[POLL set 4]
Assembly selection 104/2	[POLL set 5]
Assembly selection 105/2	[POLL set 6]

Function
Assembly selection parameter changes the active I/O assembly instance of the Bus module. If the Bus module is installed in a MAG 6000, only selection 1 and 2 are possible.

Changes to this parameter takes effect immediately. Use with care on a running system.

Description of the selection MAG 6000
• ***Assembly selection 0:*** 1 Word for control of the MAG 6000, 6 words for feed back
• ***Assembly selection 1:*** 1 Word for control of the MAG 6000, 7 words for feed back

Description of the selection MASS 6000
• ***Assembly selection 1/2:*** 1 Word for control of the MASS 6000, 6 words for feed back
• ***Assembly selection 100/2:*** 1 Word for control of the MASS 6000, 5 words for feed back
• ***Assembly selection 101/2:*** 1 Word for control of the MASS 6000, 7 words for feed back
• ***Assembly selection 102/2:*** 1 Word for control of the MASS 6000, 9 words for feed back
• ***Assembly selection 103/2:*** 1 Word for control of the MASS 6000, 11 words for feed back
• ***Assembly selection 104/2:*** 1 Word for control of the MASS 6000, 15 words for feed back
• ***Assembly selection 105/2:*** 1 Word for control of the MASS 6000, 9 words for feed back

DeviceNet software version (DeviceNet SW version)	
Value	Read only
No control panel access	

Communication status (Comm status)	
Value	Read only
No control panel access	

Update rate of measured values (Update rate)	
Value	
2 Hz	(0)
10 Hz	(1)

Function
This function is only implemented in the MASS 6000. When using this parameter the user can determine how often the MASS 6000 transmits new values of the mass flow to the DeviceNet Bus module.

Enter programming mode (Enter Prog mode ?)	
Value	
No	(0)
Yes	(1)

Function
This function sets the DeviceNet option into a special mode where it is possible to reprogram the firmware of the DeviceNet option through the DeviceNet Bus module.

4.2. System configuration

The system configuration of a DeviceNet master and a Siemens Flow Instruments flowmeter can be split up into two parts.

The first part is the setting of DeviceNet communication related parameters. These are: baud rate, station address/MAC ID and I/O assembly.
With the MAG 6000/MASS 6000 these parameters can be set by the local panel. None of these parameters can be set by mechanical switches.
After the baud rate, station address/MAC ID and I/O assembly are set. A reboot at the flowmeter is necessary in order for the changes to take effect.

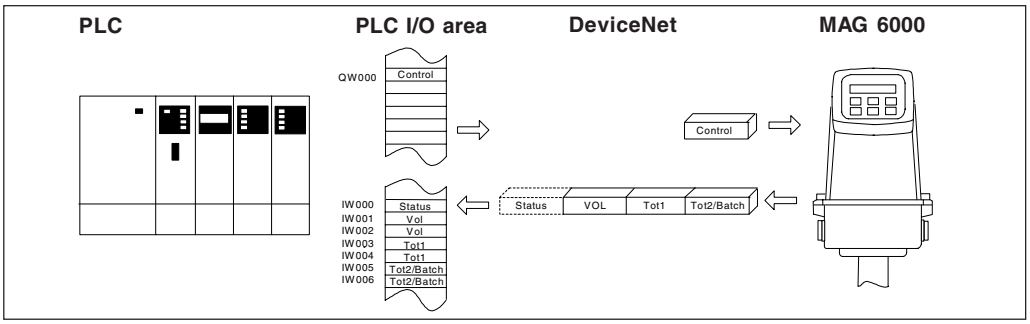
After a reboot the second and larger area of a system configuration is the setting of application related parameters. For offline configuration Siemens Flow Instruments provides you with English EDS files. Contact your local Siemens Flow Instruments supplier or the internet for the EDS files. Another important configuration parameter is the selection of communication mechanisms that enable an efficient and responsive I/O system. The DeviceNet option for the MAG 6000/MASS 6000 allows the following communication mechanisms:

- Polled I/O
- Explicit messaging

The use of **bit strobe I/O** or **change-of-state (COS)/cyclic I/O** is not implemented in the DeviceNet option and will lead to a malfunction if invoked.

4.3 Polled I/O MAG 6000

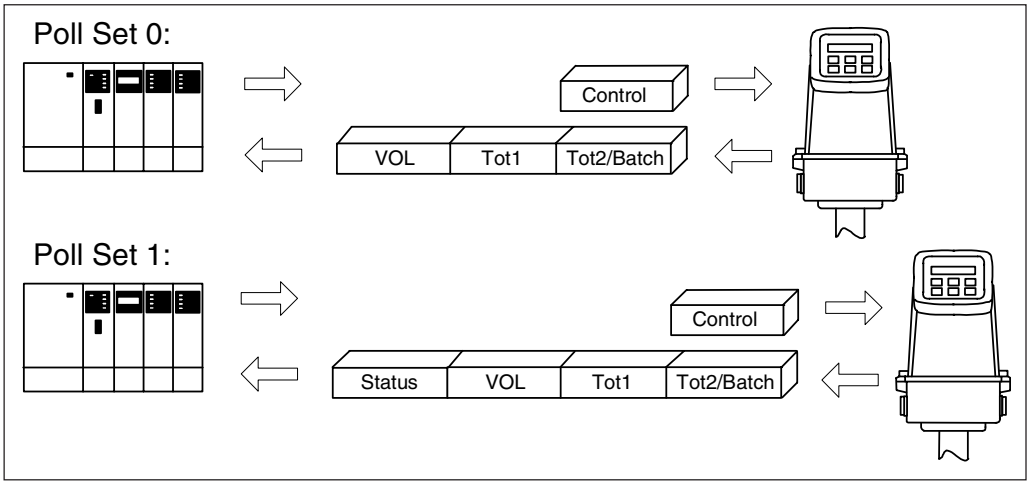
The MAG 6000 has two different predefined I/O assembly instances for process data. The default I/O transfer is shown in the drawing below with solid lines.
The dashed box shows the second I/O assembly instance where a status word is added to the input area.



Following description is valid, if the MAG 6000 is set to 0 in the submenu **„Assembly selection“** under DeviceNet. The master slave connection for a MAG 6000 consists of one **control word** and six **process data words**. In the output area, word 0 (zero) is the **control word** sent to the MAG 6000. In the input area, word 0 (zero) and word 1 represent the **volume**. Word 2 and 3 represent the actual **value of totalizer** 1. Word 4 and 5 represent **totalizer 2**. By selecting batch functionality in the MAG 6000 the **totalizer 2** value will change behavior. Then every time a batch is started, this value is reset and will show the actual amount for the running batch.

4.3.1 I/O description

The available I/O assembly instances are organized as shown in the drawing below:



4.3.2 Process data formats

The **volume flow**, **totalizer 1 & 2** are represented as 32 bit floating point numbers and each uses two words of input space on the master.

Floating point numbers are represented by two fixed point numbers. These two fixed point-numbers are:

$$(\text{MANTISSA}) \times 2^{(\text{EXPONENT})}$$

The floating point numbers are sent in following format:

High word		Low word
31	Bit number	0
S EXPONENT		MANTISSA

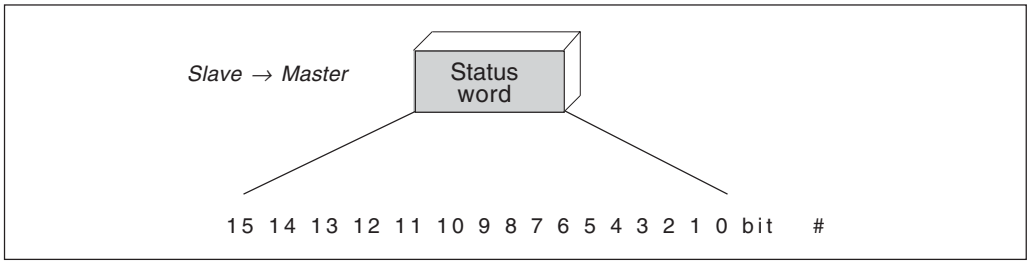
Where:
Bit 31: Sign bit
Bit 23 - 30: EXPONENT
Bit 0 - 22: MANTISSA

The **volume flow** is measured in m^3/s.
The **totalizers** are measured in m^3.

4.3.3 Status word

The **status word** is used to inform the master of the actual status of the batch and the zero adjust function of the MAG 6000.

Note
The **status word** is only active if the submenu **„Assembly selection“** under DeviceNet is set to 1.



Bit	Bit = 0	Bit = 1
00	Reserved	
01	Reserved	
02	Reserved	
03	Reserved	
04	Reserved	
05	Reserved	
06	Reserved	
07	Reserved	
08	Batch stop	Batch running
09	No action	Batch paused
10	Zero adjust finish	Zero adjust active
11	Reserved	
12	Reserved	
13	Reserved	
14	Reserved	
15	No error	Internal error

Bit 00 through 07:
Reserved

Bit 08, Batch run:
Bit 08 = "0" => Batch is finished
Bit 08 = "1" => Batch is running

Bit 09, Batch pause:
Bit 09 = "0" => No action
Bit 09 = "1" => Batch is set on pause

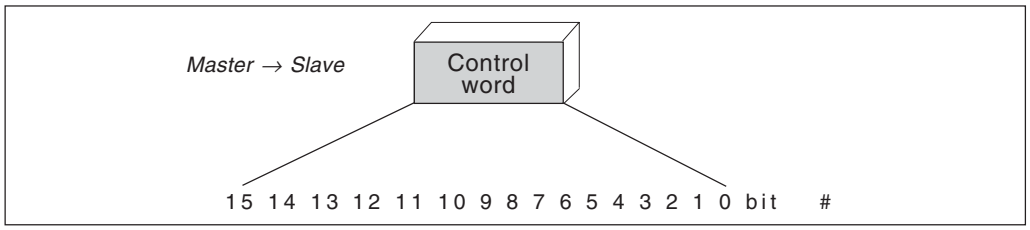
Bit 10, ZADJ_active:
Bit 10 = "0" => Zero adjust finished or not running
Bit 10 = "1" => Zero adjust not finished/running

Bit 11 through 14:
Reserved

Bit 15, Error:
Bit 15 = "0" => No errors
Bit 15 = "1" => Internal error, e.g. communication between DeviceNet option and MAG 6000 is lost

4.3.4 Control word

The control word is used to control the **totalizers** and activate the zero adjust function of the MAG 6000 from a master (e.g. a PC or PLC).



Bit	Bit = 0	Bit = 1
00	No action	T1 reset
01	Bit 00 inactive	Activate bit 00
02	No action	T2 reset
03	Bit 00 inactive	Activate bit 02
04	T1 run	T1 hold
05	Bit 00 inactive	Activate bit 04
06	T2 run	T2 hold
07	Bit 00 inactive	Activate bit 06
08	No action	Zero adjust
09	Bit 00 inactive	Activate bit 08
10	Reserved	
11	Reserved	
12	Reserved	
13	Reserved	
14	Reserved	
15	Reserved	

Bit 00, T1R_Cmd:
Bit 00 = "0" => No action
Bit 00 = "1" => Totalizer 1 resets

Bit 01, T1R_Mask:
Bit 01 = "0" => T1R_Cmd will not take effect
Bit 01 = "1" => T1R_Cmd will take effect

Bit 02, T2R_Cmd:
Bit 02 = "0" => No action
Bit 02 = "1" => Totalizer 2 resets

Bit 03, T2R_Mask:
Bit 03 = "0" => T2R_Cmd will not take effect
Bit 03 = "1" => T2R_Cmd will take effect

Bit 04, T1HR_Cmd:
Bit 04 = "0" => Totalizer 1 enters run mode
Bit 04 = "1" => Totalizer 1 enters hold mode

Bit 05, T1HR_Mask:
Bit 05 = "0" => T1HR_Cmd will not take effect
Bit 05 = "1" => T1HR_Cmd will take effect

Bit 06, T2HR_Cmd: (See note)
Bit 06 = "0" => Totalizer 2 enters run mode
Bit 06 = "1" => Totalizer 2 enters hold mode

Bit 07, TH2R_Mask:
Bit 07 = "0" => T2HR_Cmd will not take effect
Bit 07 = "1" => T2HR_Cmd will take effect

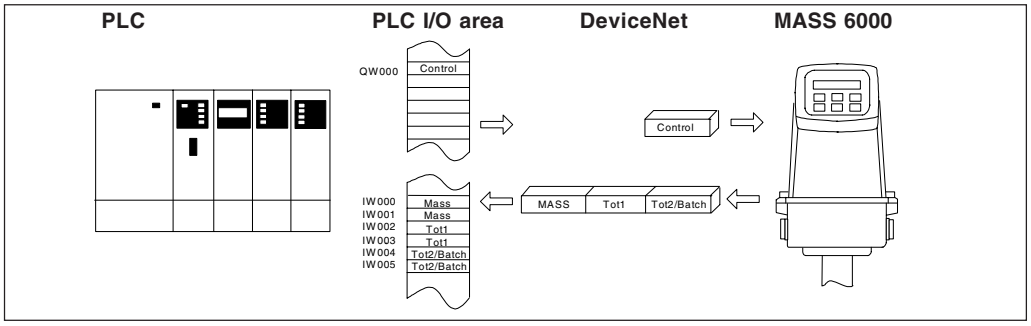
Bit 08, ZADJ_Cmd:
Bit 08 = "0" => No action
Bit 08 = "1" => Converter performs a zero adjust

Bit 09, ZADJ_Mask:
Bit 09 = "0" => ZADJ_Cmd will not take effect
Bit 09 = "1" => ZADJ_Cmd will take effect

Bit 10 through 15:
Reserved

4.4. Polled I/O MASS 6000

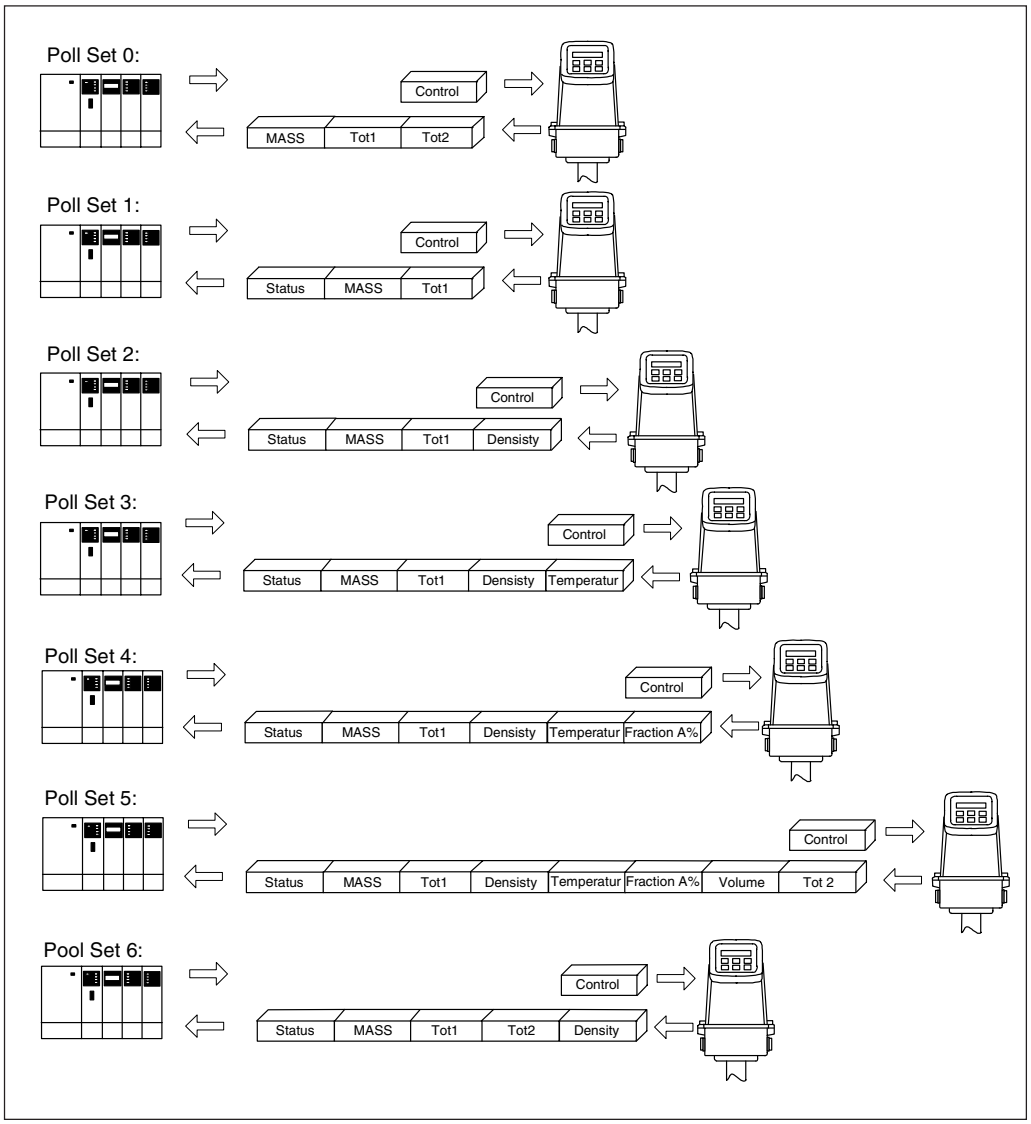
The MASS 6000 has seven different predefined I/O assembly instances for process data. The default I/O transfer is shown in the drawing below.



Following description is valid, if the MASS 6000 is set to 0 in the submenu **„Assembly selection“**. The master/slave connection for a MASS 6000 consists of one **control word** and six **data process words**. In the output area, word 0 (zero) is the **control word** sent to the MASS 6000. In input area, word 0 (zero) and word 1 represent the **mass flow**. Word 2 and 3 represent the actual **value of totalizer 1**. Word 4 and 5 represent **totalizer 2**. When selecting batch functionality in the MASS 6000, the **totalizer 2** value will change behavior. Then every time a batch is started, **totalizer 2** is reset and will show the actual amount for the running batch.

4.4.1 I/O description

The available I/O assembly instances are organized as shown in the drawing below:



4.4.2 Process data formats

The **mass flow, volume flow, density, temperature, fraction and totalizer 1 & 2** are represented as 32 bit floating point numbers and uses two words of input space each of the master.

Floating point numbers are represented by two fixed point numbers. These two fixed point-numbers are:

$$(\text{MANTISSA}) \times 2^{(\text{EXPONENT})}$$

The floating point numbers are sent in the following format:

High word		Low word
31	Bit number	0
S EXPONENT	MANTISSA	

Where:
Bit 31: Sign bit
Bit 23 - 30: EXPONENT
Bit 0 - 22: MANTISSA

The mass flow is measured in kg/s.

The totalizers depend on the totalizer mode (mass flow or volume flow).

If totalizer mode = mass flow: xx kg

If totalizer mode = volume flow: xx m^3

Temperature in °C

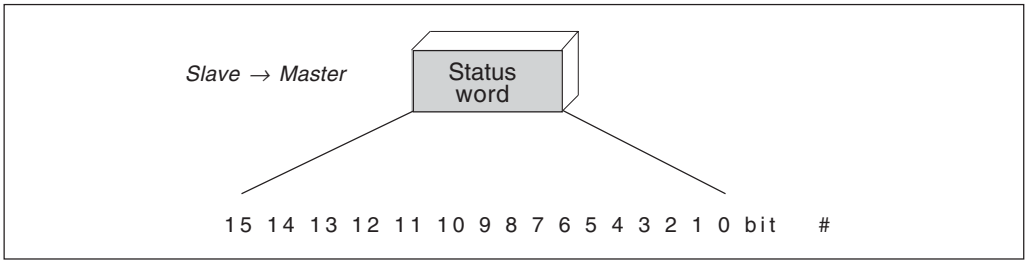
Fraction flow in kg/s

Fraction % i %

Volume flow in m^3/s

4.4.3 Status word

The **status word** is used to inform the master of the actual status of the batch and the zero adjust function of the MASS 6000.
The **status word** is only active if the submenu „**Assembly selection**“ under DeviceNet is set to 1 or greater.



Bit	Bit = 0	Bit = 1
00	Reserved	
01	Reserved	
02	Reserved	
03	Reserved	
04	Reserved	
05	Reserved	
06	Reserved	
07	Reserved	
08	Batch stop	Batch running
09	No action	Batch paused
10	Zero adjust finish	Zero ajust active
11	Reserved	
12	Reserved	
13	Reserved	
14	Reserved	
15	No error	Internal error

Bit 00 through 07:
Reserved

Bit 08, Batch run:
Bit 08 = "0" => Batch finished
Bit 08 = "1" => Batch running

Bit 09, Batch pause:
Bit 09 = "0" => No action
Bit 09 = "1" => Batch set on pause

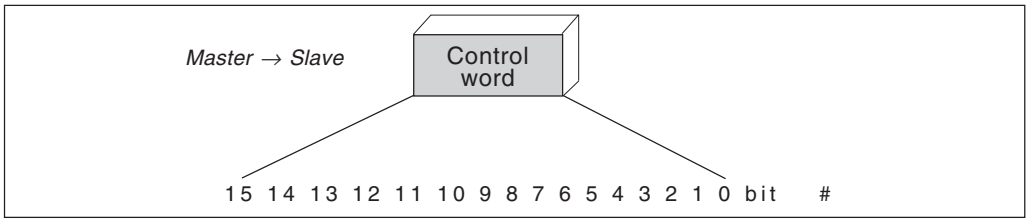
Bit 10, ZADJ_active:
Bit 10 = "0" => Zero adjust finished or not running
Bit 10 = "1" => Zero adjust not finished/ running

Bit 11 through 14:
Reserved

Bit 15, Error:
Bit 15 = "0" => No errors
Bit 15 = "1" => Internal error, e.g. communication between DeviceNet option and MASS 6000 is lost

4.4.4 Control word

The control word is used to control the **totalizers** and activate the zero adjust function of the MASS 6000 from a master (e.g. a PC or PLC).



Bit	Bit = 0	Bit = 1
00	No action	T1 reset
01	Bit 00 inactive	Activate bit 00
02	No action	T2 reset
03	Bit 00 inactive	Activate bit 02
04	T1 run	T1 hold
05	Bit 00 inactive	Activate bit 04
06	T2 run	T2 hold
07	Bit 00 inactive	Activate bit 06
08	No action	Zero adjust
09	Bit 00 inactive	Activate bit 08
10	Reserved	
11	Reserved	
12	Reserved	
13	Reserved	
14	Reserved	
15	Reserved	

Bit 00, T1R_Cmd:
Bit 00 = "0" => No action
Bit 00 = "1" => Totalizer 1 resets

Bit 01, T1R_Mask:
Bit 01 = "0" => T1R_Cmd will not take effect
Bit 01 = "1" => T1R_Cmd will take effect

Bit 02, T2R_Cmd:
Bit 02 = "0" => No action
Bit 02 = "1" => Totalizer 2 resets

Bit 03, T2R_Mask:
Bit 03 = "0" => T2R_Cmd will not take effect
Bit 03 = "1" => T2R_Cmd will take effect

Bit 04, T1HR_Cmd:
Bit 04 = "0" => Totalizer 1 enters run mode
Bit 04 = "1" => Totalizer 1 enters hold mode

Bit 05, T1HR_Mask:
Bit 05 = "0" => T1HR_Cmd will not take effect
Bit 05 = "1" => T1HR_Cmd will take effect

Bit 06, T2HR_Cmd: (See note)
Bit 06 = "0" => Totalizer 2 enters run mode
Bit 06 = "1" => Totalizer 2 enters hold mode

Bit 07, TH2R_Mask:
Bit 07 = "0" => T2HR_Cmd will not take effect
Bit 07 = "1" => T2HR_Cmd will take effect

Bit 08, ZADJ_Cmd:
Bit 08 = "0" => No action
Bit 08 = "1" => Converter performs a zero adjust

Bit 09, ZADJ_Mask:
Bit 09 = "0" => ZADJ_Cmd will not take effect
Bit 09 = "1" => ZADJ_Cmd will take effect

Bit 10 through 15:
Reserved

5. DeviceNet object classes

5.1 Class code 0x01, identity

For class code 0x01, the following ***instance ID's*** are available:

Instance	Name	MAG	MASS	Description
0	Class designator	-	-	No attributes are shared between the instances
1	Identity	√	√	

For class code 0x01, the following ***instance attributes*** have been implemented:

Attribute	Access	Name	Data type	Description
1	Get	Vendor ID	UINT	Siemens Vendor Code = 862
2	Get	Device type	UINT	Generic device = 0
3	Get	Product code	UINT	MAG 6000 = 3
				MASS 6000 = 4
4	Get	Revision	Struct of USINT	Software version of DeviceNet option
5	Get	Status	WORD	
6	Get	Serial number	UDINT	
7	Get	Product name	String	MAG 6000: MAG 6000 DeviceNet module
				MASS 6000: MASS 6000 DeviceNet module

5.2 Class code 0x03, DeviceNet

For class code 0x03, the following ***instance ID's*** are available:

Instance	Name	MAG	MASS	Description
0	Class designator	√	√	
1	DeviceNet	√	√	

For class code 0x03, the following ***class attributes*** have been implemented:

Attribute	Access	Name	Data type	Description
1	Get	Revision	UINT	Revision of the DeviceNet object Class

For class code 0x03, the following ***instance attributes*** have been implemented

Attribute	Access	Name	Data type	Description
1	Set	MAC ID	USINT	Node address
2	Set	Baud rate	USINT	0: 125kBaud
				1: 250kBaud
				2: 500kBaud
3	Set	BOI	BOOL	
4	Set	Bus-off counter	USINT	Set: Reset counter
				Get: Actual counter value
5	Get	Allocation information	Struct of Bytes	
8	Get	MAC ID Switch Value	USINT	Returns the new MAC ID that will be used after a reboot
9	Get	Baud rate switch Value	USINT	Returns the new Baud Rate that will be used after a reboot

Changing the **MAC ID** and **Baud rate** will not take effect until a reboot has occurred.

(continued)

5.3 Class code 0x04, I/O Assembly

For class code 0x04, the following ***instance ID's*** have been implemented for the ***MAG 6000***:

Instance	Data size	Type	Description
1	2 bytes	Output	Control word
2	12 bytes	Input	Byte 1-4 = Volume flow
			Byte 5-8 = Totalizer 1
			Byte 9-12 = Totalizer 2
100	14 bytes	Input	Byte 1-2 = Status
			Byte 3-6 = Volume flow
			Byte 7-10 = Totalizer 1
			Byte 11-14 = Totalizer 2

For class code 0x04, the following ***instance ID's*** have been implemented for the ***MASS 6000***:

Instance	Data size	Type	Description
1	2 bytes	Output	Control word
2	12 bytes	Input	Byte 1-4 = Mass flow
			Byte 5-8 = Totalizer 1
			Byte 9-12 = Totalizer 2
100	10 bytes	Input	Byte 1-2 = Status
			Byte 3-6 = Mass flow
			Byte 7-10 = Totalizer 1
101	14 bytes	Input	Byte 1-2 = Status
			Byte 3-6 = Mass flow
			Byte 7-10 = Totalizer 1
			Byte 11-14 = Density
102	18 bytes	Input	Byte 1-2 = Status
			Byte 3-6 = Mass flow
			Byte 7-10 = Totalizer 1
			Byte 11-14 = Density
			Byte 15-18 = Temperature
103	22 bytes	Input	Byte 1-2 = Status
			Byte 3-6 = Mass flow
			Byte 7-10 = Totalizer 1
			Byte 11-14 = Density
			Byte 15-18 = Temperature
			Byte 19-22 = Pct. Fraction A
104	30 bytes	Input	Byte 1-2 = Status
			Byte 3-6 = Mass flow
			Byte 7-10 = Totalizer 1
			Byte 11-14 = Density
			Byte 15-18 = Temperature
			Byte 19-22 = Pct. Fraction A
			Byte 23-26 = Volume flow
			Byte 27-30 = Totalizer 2
105	18 bytes	Input	Byte 1-2 = Status
			Byte 3-6 = Mass flow
			Byte 7-10 = Totalizer 1
			Byte 11-14 = Totalizer 2
			Byte 15-18 = Density

5.4 Class code 0x05, Connection

For class code 0x05, the following ***instance ID's*** are available:

Instance	Name	MAG	MASS	Description
0	Class designator	-	-	No attributes are shared between the instances
1	Explicit to messages	√	√	
2	Polled I/O	√	√	

(continued)

For class code 0x05, the following ***instance attributes*** have been implemented:

Attribute	Access	Name	Data type	Description
1	Get	State	USINT	State of the object
2	Get	Instance_type	USINT	Indicates either I/O or messages connection
3	Get	Transportclass_ trigger	BYTE	Defines behaviour of the connection
4	Get	Produced connection ID	UINT	CAN identifier field when the connection transmits
5	Get	Consumed connection ID	UINT	An identifier field value that denotes messages to be received
6	Get	Initial communication characteristics	BYTE	Defines the message group(s) across which productions and consumptions associated with this connection received
7	Get	Produced connection size	UINT	Maximum number of bytes transmit ted across this connection
8	Get	Consumed connection size	UINT	Maximum number of bytes received across this connection
9	Set rate	Expected package	UINT	Defines timing associated with this connection
12	Get	Watch dog timeout action	USINT	Defines how to handle inactivity/watch dog timeout
13	Get	Produced connection path lengh	UINT	Number of bytes in the produced connection path attribute
14	Set	Produced connection path	Array of USINT	Specifies the application object(s) to which data is/are to be produced by these connection objects
15	Get	Consumed connection path lenght	UINT	Number of bytes in the comsumed connection path attribute
16	Get	Consumed connection path	Array of USINT	Specifies the application object(s) that is/are to receive the data consumed by this connection objects
17	Get	Production inhibit time	UINT	Inhibit time

5.5 Class code 0x65, process data

For class code 0x65, the following ***instance ID's*** are available:

Instance	Name	MAG	MASS	Description
0	Class designator	-	-	No attributes are shared between the instances
1	Volume flow	√	√	
2	Mass flow	-	√	
3	Density	-	√	
4	Temperature	-	√	
5	Fraction A	-	√	
6	Fraction B	-	√	
7	Pct. fraction A	-	√	

For class code 0x65, the following ***instance attributes*** have been implemented:

Attribute	Access	Name	Data type	Description
100	Get	fval	REAL	The process value as floating point number
101	Get	iVal***)**	INT	The process value as integer number
102	Set	scale	REAL	Scaling factor for iVal

***)** The iVal is fVal multiplied with scale and casted to a 16 bit integer

(continued)

5.6 Class code 0x66, totalizer

For class code 0x66, the following ***instance ID's*** are available:

Instance	Name	MAG	MASS	Description
0	Class designator	-	-	No attributes are shared between the instances
1	Totalizer 1	√	√	
2	Totalizer 2	√	√	

For class code 0x66, the following ***instance attributes*** have been implemented:

Attribute	Access	Name	Data type	Description
100	Get	fVall	REAL	Process value as floating point number
101	Get	iVal	INT	Process value as integer number
102	Set	Scale	REAL	Scaling factor for iVal
110	Set	Direction	USINT	0: negative 1: positive 2: netto 3-255: reserved
111	Set	Reset	USINT	1: reset totalizer 0,2-255 reserved
112	Set	RunHold	USINT	0: run 1: hold 2-255: reserved

5.7 Class code 0x67, batch

For class code 0x67, the following ***instance ID's*** are available:

Instance	Name	MAG	MASS	Description
0	Class designator	-	-	No attributes are shared between the instances
1	Batch	√	√	

For class code 0x67, the following ***instance attributes*** have been implemented:

Attribute	Access	Name	Data type	Description
101	Set	Mode	USINT	0: off 1: on
102	Set	Command	USINT	Set: 0: stop 1: start 2: pause 3: resume 4-255: reserved Get: 0: finished 1: running 2: paused
103	Set	Setpoint	REAL	Amount to Batch
104	Set	Compensation	REAL	Compensation amount
105	Set	LeadConstant	REAL	MASS 6000 only
106	Set	TimeoutActive	USINT	0: off 1: on
107	Set	Timeout	UDINT	Batch timeout in seconds
110	Get	CycleCounter	UDINT	Batch counter
111	Set	CycleCounterReset	USINT	0: No action 2-255 Reserved 1: Reset

(continued)

5.8 Class code 0x69, system info

For class code 0x69, the following ***instance ID's*** are available:

Instance	Name	MAG	MASS	Description
0	Class designator	-	-	No attributes are shared between the instances
1	System info	√	√	

For class code 0x69, the following ***instance attributes*** have been implemented:

Attribute	Access	Name	Data type	Description
100	Get	Error	UDINT	See next table for explanation

Number	Category	Time stamp
Bit 31..24	Bit 23..22	Bit 21..0
Error number	0: Information 1: Warning 2: Permanent 3: Fatal	Time in minutes since error occured

The most significant error is reported.

5.9 Class code 0x6A, converter

For class code 0x6A, the following ***instance ID's*** are available:

Instance	Name	MAG	MASS	Description
0	Class designator	-	-	No attributes are shared between the instances
1	Converter	√	√	

For class code 0x6A, the following ***instance attributes*** have been implemented:

Attribute	Access	Name	Data type	Description
100	Get	Flow direction	USINT	
103	Get	Mass flow scale upper	REAL	MASS 6000 only
104	Get	Mass flow scale lower	REAL	MASS 6000 only
118	Get	Empty pipe limit	REAL	MASS 6000 only
150	Set	Zero adjust	USINT	Set: 0: Reserved 1: Start 2: Reset finished bit Get: 0: Idle 1: In progress 2: Finished
151	Set	Zero adjust time	UINT	MASS 6000 only
152	Set	Manual zero point	REAL	

(continued)

5.10 Class code 0x6B, sensor

For class code 0x6B, the following ***instance I/D's*** are avilable:

Instance	Name	MAG	MASS	Description
0	Class designator	-	-	No attributes are shared between the instances
1	Sensor	√	√	

For class code 0x6B, the following ***instance attributes*** have been implemented:

Attribute	Access	Name	Data type	Description
100	Get	Sensor size	STRING	
101	Get	Calibration factor	REAL	

APPENDIX A

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).

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.

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