Communication Modules

Add-on modules
HART

Operating Instructions • 07/2010

SITRANS F

SIEMENS

Contents

1. Introduction

1.1 Scope

The Siemens HART interface for use with SITRANS F flow transmitters: MAG 5000 C, MAG 6000 and MASS 6000, revision 2, complies with HART protocol Revision 5.2. This document specifies all the device specific features and documents HART Protocol implementation details (e.g. the Engineering units supported). The functionality of this device is described sufficiently to allow its proper application in a process and its complete support in HART capable Host Applications.

1.2 Purpose

This specification is designed to compliment the operating manuals for MAG 5000 C, MAG 6000 and MASS 6000 flow transmitters by providing a complete, unambiguous description of this Field Device from a HART communication perspective.
This operating manual does NOT cover MASS 6000 Ex d, MAG 6000 Industry and MAG 6000 Industry Ex d.

1.3 Who should use this document?

The specification is designed to be a technical reference for HART capable Host Application Developers, System Integrators and knowledgeable End Users. It also provides functional specifications (e.g., commands, enumerations and performance requirements) used during Field Device development, maintenance and testing. This document assumes the reader is familiar with HART Protocol requirements and terminology.

1.4 Abbreviations and Definitions

AOM	Add-On-Module
USMII	Concept with flexible plug & play fieldbus modules
SensorProm	Storing unit for all settings
HCF	HART communication foundation
FSK	Frequency Shift Keying physical layer
CN	Capacitance number; capacitance as a multiple of 5000 pF
pF	Picofarad (10^{-12} Farad); unit of electrical capacitance
PV	Primary variable
SV	Secondary variable
TV	Tertiary variable
QV	Quaternary variable

1.5 References

Literature 1 MAG 5000 C/MAG 6000 operating manual Order No FDK-521H0739
Literature 2 MASS 6000 operating manual Order No FDK-521H0991

2. Device Identification

This operating manual covers the specifications of the HART interface for MAG 5000 C, MAG 6000 and MASS 6000.

All HART interfaces are based on the same Firmware and Hardware. Below is a table showing the relations between the flow transmitters and the HART interfaces.

	HART interface		
	FDK:085U0226	FDK:085U0321	Integrated
MAG 5000 C			X
MAG 6000	X		
MASS 6000	X		
MAG 6000 Industry*		X	
MAG 6000 Industry (Ex d)*			X
MASS 6000 Ex d*	X		

* Not described in this operating manual

Devices with the following Firmware version and up are covered in this operating manual.

	Firmware
HART module	2.00
MAG 5000 C	3.03
MAG 6000	3.03
MASS 6000	3.00

All interfaces apply to the following specifications:

Manufacturer Name:	Siemens	Device Type Codes:	24 = MAG5/6000 + variants 25 = MASS 6000
Manufacturer ID code:	42 (2A hex)		
HART Protocol revision:	5.2	Device Revision:	2
Number of Device Variables:	MAG = 3 MASS = 4		
Physical layers support:	FSK		
Physical Device Category:	Current output		
Loop powered:	No		
CN	10		

3. Product overview

This operating manual describes the HART interface for the electromagnetic flowmeter MAG 5000 C, MAG 6000 and the coriolis flowmeter MASS 6000.

The MAG/MASS 6000 series is based on the flexible USM II technology. This includes the **AOM (Add-On-Module)** that provides digital communications capabilities for the USM II transmitters. This approach gives far more flexibility, and greater long-term protection of your signal converter investment, than is possible with factory standard, off-the shelf signal converter designs.
With this easy to use system, providing additional functionality to the already impressive line-up of standard features in your USM II transmitter is as easy as plugging in a small black box. You have total control over *whether* to add anything at all, *what* it will be, and *when* to add it.

The MAG 5000 C has a built-in HART interface, and cannot be mounted with new communication modules.

4. Product interfaces

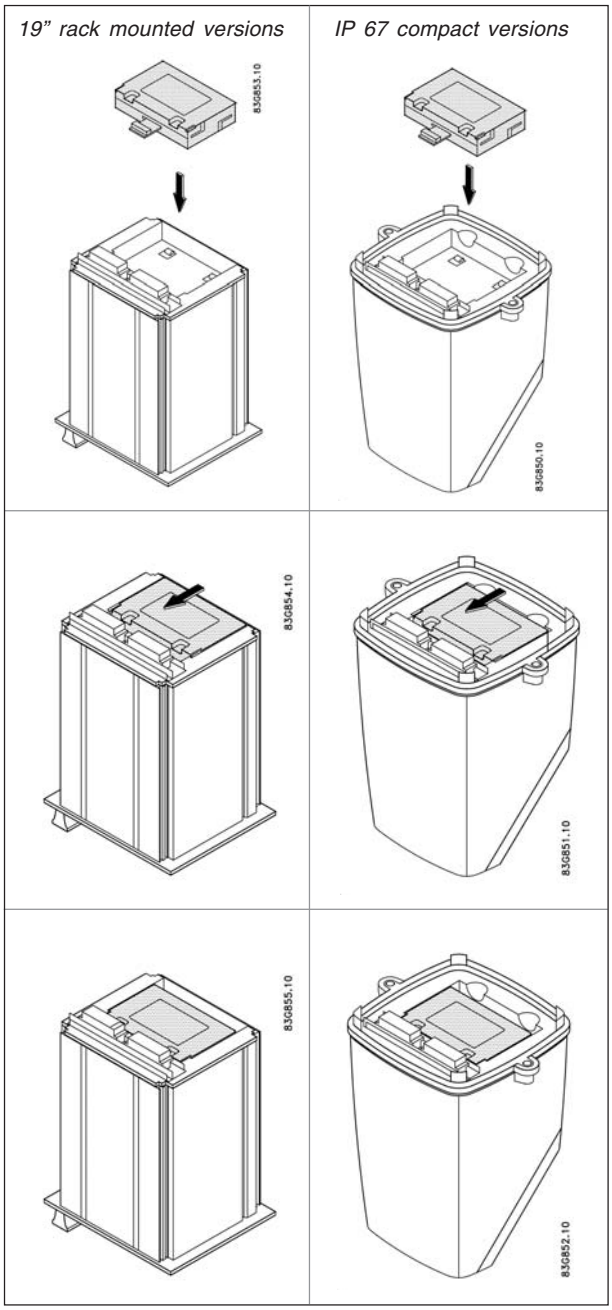
4.1 Mechanical Installation MAG 5000 C HART

The MAG 5000 C HART is delivered with a build-in HART interface. It is not possible to add additional modules to the MAG 5000 C.

4.2 Mechanical Installation MAG/MASS 6000

Before proceeding, please make sure that you have the right HART Add-on module. The correct module for MAG 6000 and MASS 6000 is FDK:085U0226. The order number is located on the label of the module.

The installation procedure for the HART module 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.

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.

4.3 General electrical information

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.

Terminals reserved for add-on modules:
MAG 5000 C: . . . . . 91 - 97
MAG 6000: . . . . . 91 - 97
MASS 6000: . . . . . 91 - 100

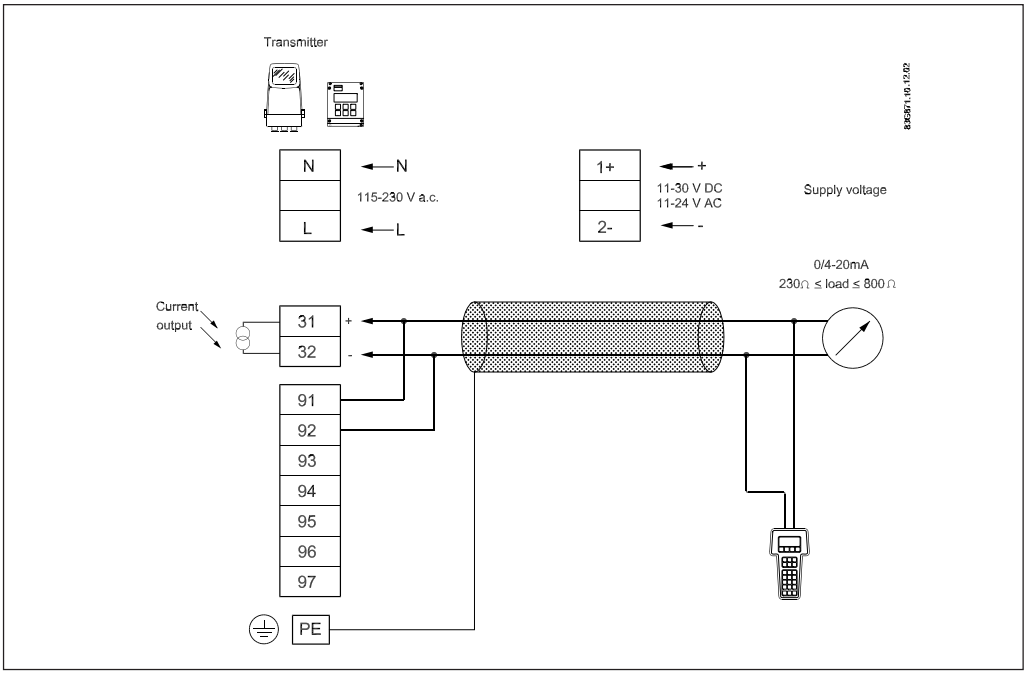
Note
If the MASS 6000 is installed with extra outputs, i.e. have 3 current outputs, 2 digital outputs and 2 relay outputs, then it is not possible to install a HART interface. This is because the extra outputs takes up all terminals.

4.4 HART electrical connections

The following table shows the connection layout for the USM II HART module:

Terminal	Description
91	HART FSK signal +
92	HART FSK signal -
31	Current output +
32	Current output -
Shield/PE	Shield

In order to have the HART FSK signal combined with the Current output, two connections must be made. Terminal 31 must be connected to 91 and terminal 32 must be connected to 92. Electrical wirering can be seen in the drawing below.



4.5 Current output

A true HART signal consists of a Current output combined with a HART FSK signal. In order to achieve this, connections must be made according to the chapter: HART electrical connections. When a HART module is installed the Current output changes its behaviour in order to comply with HART. This will be explained in the following chapters.

4.5.1 MAG 5000 C/6000

When the HART module is inserted, it automatically turns on the Current output with its factory settings. The HART device with address „0“ is the only device that is allowed to control the Current output loop.

Single point:
When only one device is connected to the network, the HART short address should be set to 0. The Current output is fixed to Volume flow, which is the only process value in this device. Volume flow is also mapped to the PV reading.

In single Pant mode the Current output will have the behaviour as described in the table below.

Parameter	Selection	Comment
Current output:	ON	The Current output is active. ON is selected automatically during power up.
	OFF	The Current output is deactivated. The Current output is forced to 3 mA to indicate a Warning.
Current output mode:	0-20 mA	Not possible. 0 mA can cause HART masters to stop communicating or report errors. This is because values below 4 mA are used for alarms and validation of the current loop.
	4-20 mA	Factory setting.
	4-20 mA + Alarm	Fatal errors = 1,3 mA Pending errors = 2 mA Warning errors = 3 mA

Multidrop:
Multidrop mode is enabled by having the HART short address >0. If the HART short address is different from 0, the Current output will be forced to 4 mA no matter what the Current output settings are. This also means that errors can not be signalled.

4.5.2 MASS 6000

When the HART module is inserted, it automatically turns on the Current output with its factory settings.
The HART device with address „0“ is the only device that is allowed to control the Current output loop.

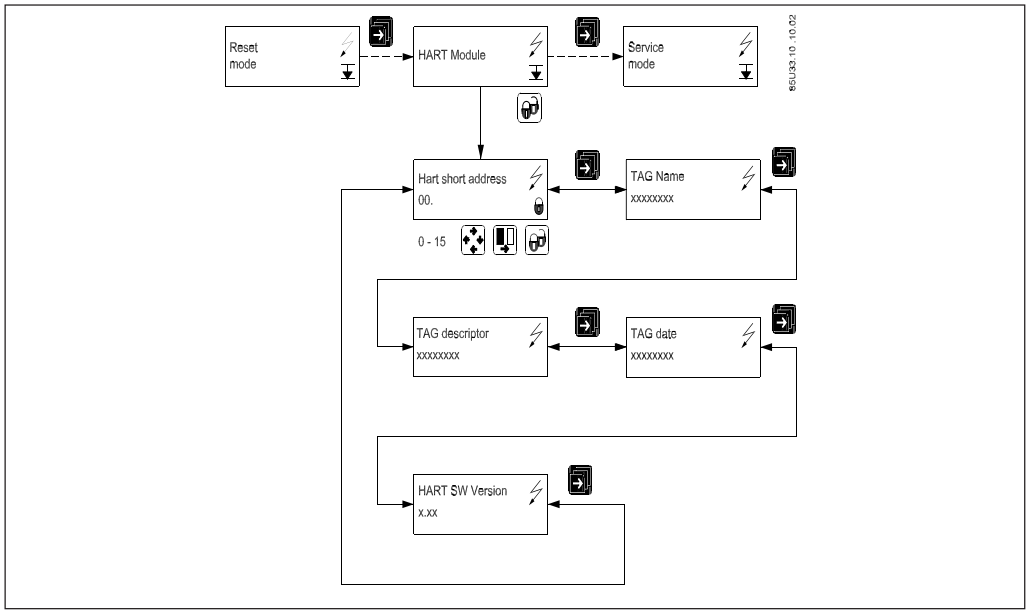
Single point:
When only one device is connected to the network, the HART short address should be set to 0. The Current output is linked to the selected process value. From factory this is Massflow, which also is mapped to the PV reading. Other selections can be made, this will however not influence the PV, which is fixed to Massflow.
In single Pant mode the Current output will have the behaviour as described in the table below.

Parameter	Selection	Comment
Current output:	Massflow	The Current output is active. This selection is recommended.
	Volumeflow Density Temperature Fraction A Fraction B Pct. Fraction A	If one of these are selected, the Current output will be linked to this Procees variable. PV will remain Massflow!
	OFF	The Current output is deactivated. The Current output is forced to 3 mA to indicate a Warning.
Current output mode:	0-20 mA	Not possible. 0 mA can cause HART masters to stop communicating or report errors. This is because values below 4mA are used for alarms and validation of the current loop.
	4-20 mA	Factory setting.
	4-20 mA + Alarm	Fatal errors = 1,3 mA Pending errors = 2 mA Warning errors = 3 mA

Multidrop:
Multidrop mode is enabled by having the HART short address >0. If the HART short address is different from 0, the Current output will be forced to 4 mA no matter what the Current output settings are. This also means that errors can not be signalled.

4.6 Local display

When the HART module is inserted in the device, and the transmitter is powered up, a new menu entry is available. The new menu hold all HART relevant information.



To change (or view) the HART 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 wait for two seconds
3. The display now says **"Basic settings"**
4. Press [Forward key] until you reach the **"HART module"** menu item
5. Press [Lock key]
6. You can now cycle through all the HART settings by pressing [Forward key]
7. Press [Top key] for two seconds and you return to 1.

4.6.1 Menu item explanation

The table below describes submenus under the main menu „HART module“.

Item	Value	Description
HART short address	0-15	Device address [Factory setting: 00]
TAG name	8 characters	Can be used to TAG the device.
TAG descriptor	16 characters	Can be used to describe the TAG.
TAG date	3 bytes	Can be used to date the installation.
HART SW version	x.xx	Firmware version of the HART module.

4.6.2 SENSORPROM

All of the transmitter HART settings are stored in the **SENSORPROM.** This means that if the HART module is exchanged for another HART module, all of the relevant HART settings are kept.

5. Device Variables

This Field Device does not expose any Device Variables.

6. Dynamic Variables

The dynamic variables are fixed and can not be mapped to other than the specified PV, SV, TV and QV.

6.1 MAG 5000 C/6000

	Meaning	*Units*
PV	Volume flow	See Table: units
SV	Totalizer 1	See Table: units
TV	Totalizer 2 / Batch	See Table: units
QV	Not implemented	

6.2 MASS 6000

	Meaning	*Units*
PV	Mass flow	See Table: units
SV	Density	See Table: units
TV	Temperature	See Table: units
QV	Volume flow	See Table: units

7. Status Information

This chapter defines all status provided by the flowmeter including: the Device status byte; the Extended Device Status byte; and status information returned in Command 48.

7.1 Device status

Bit	Definition
7	**Device Malfunction** – The device detected a serious error or failure that compromises device operations. This flag is set whenever an error of category „Fatal Error“ is pending in the flowmeter. Detailed information can be found via HART command 48.
6	**Configuration Changed** – An operation was performed that changed the device's configuration. Any HART command, which writes information to the flowmeter, will set this flag. The flag can be reset using command 38. The flag is handled separately for each HART master (primary/ secondary). Note: In the flowmeter, the flag is NOT stored during power cycles.
5	**Cold Start** – A power failure or Device Reset has occurred. This flag is only set in the first response transmitted to a Hart Master after power failure. The flag is handled separately for each HART master (primary/secondary).
4	**More Status Available** – More status information is available via Command 48, Read Additional Status Information. This flag is set, whenever a transmitter specific error or warning is active in the flowmeter.
3	**Loop Current Fixed** – The Loop Current is being held at a fixed value and is not responding to process variations. This flag is always set, if the transmitter is in Multidrop mode – i.e. the Hart address is not zero. This flag is also set in SingleDrop mode, if the flowmeters current output is forced in Service Mode or via Hart Command #40.
2	**Loop Current Saturated** – The Loop Current has reached its upper (or lower) endpoint limit and cannot increase (or decrease) any further. This flag is set whenever the flowmeters overflow warning (error no. 30) is pending.
1	**Non-Primary Variable Out of Limits** – A Device Variable not mapped to the PV is beyond its operating limits. This flag is always zero in the flowmeter (ie not used).
0	**Primary Variable Out of Limits** – The PV is beyound its operating limits. This flag is set whenever the flowmeters overflow warning (error no. 30) is pending.

7.2 Extended device status

The extended device status bits are not supported by the flowmeter. Value is always zero.

7.3 Additional device status (Command 48)

Command 48 returns 25 bytes of data. Bits not listed in the table below are set to zero. For detailed USM II error number descriptions please look in the MAG/MASS manual, Literature 1 and 2.

Byte	Bit	Meaning	Class
0	0	Set if any **Warnings** are active – See bytes18-21 below	
	1	Set if any **Permanent errors** are active – See bytes 14-17 below	mode
	2	Set if any **Fatal errors** are active – See bytes 1-5 below	
1	0-7	**USM Fatal Error 60, 61, 62, 63, 70, 71, 80, 81** (bit 0 corresponds to error 60, bit 7 to error 81)	error
2	0-7	**USM Fatal Error 82, 83, 84, 96, 97, 64, 65, 66** (bit 0 corresponds to error 82, bit 7 to error 66)	error
3	0-7	**USM Fatal Error 67, 68, 69, 72, 73, 74, 75, 76** (bit 0 corresponds to error 67, bit 7 to error 76)	error
4	0-2	**USM Fatal Error 77, 78, 79** (bit 0 corresponds to error 77, bit 2 to error 79)	error
5	0-7	Reserved (=0)	
6	0-7	Extended Device Status Not supported (=0)	mode
7	0-7	Device Operating Mode Not supported (=0)	mode
8-10	0-7	Analog Channel Saturated Not supported (=0)	mode
11-13	0-7	Analog Channel Fixed Not supported (=0)	mode
14	0-7	**USM Permanent Error 40, 41, 42, 43, 44, 45, 46, 47** (bit 0 corresponds to error 40, bit 7 to error 47)	error
15	0-7	**USM Permanent Error 48, 49, 94, 95, 50, 51, 52, 53** (bit 0 corresponds to error 48, bit 7 to error 53)	error
16	0-5	**USM Permanent Error 54, 55, 56, 57, 58, 59** (bit 0 corresponds to error 54, bit 5 to error 59)	error
17	0-7	Reserved (=0)	
18	0-7	**USM Warning 20, 21, 22, 23, 24, 30, 31, 90** (bit 0 corresponds to error 20, bit 7 to error 90)	warning
19	0-7	**USM Warning 91, 92, 93, 25, 26, 27, 28,2 9** (bit 0 corresponds to error 91, bit 7 to error 29)	warning
20	0-7	**USM Warning 32, 33, 34, 35, 36, 37, 38, 39** (bit 0 corresponds to error 32, bit 7 to error 39)	warning
21-24	0-7	Reserved (=0)	

8. Universal Commands

This device supports the following Universal Commands.

Command Number and Funktion	Data in Command	Data in Response
0 Read unique identifier	None	Byte 0 "254" (expansion) Byte 1 Manufacturer ID Byte 2 Mfr. device. Type Byte 3 Number of preamble Byte 4 Universal Command revision Byte 5 transmitter specific command revision Byte 6 software revision Byte 7 hardware revision Byte 8 device function flag Byte -11 Device ID number
1 Read primary variable	None	Byte 0 PV unit code Byte 1-4 Primary variable
2 Read Current & % of range	None	Byte 0-3 current (mA) Byte 4-7 % of range
3 Read Current & four variables	None	Byte 0-3 Current Byte 4 PV unit code Byte 5-7 PV Byte 9 SV unit code Byte 10-13 SV Byte 14 TV unit code etc. Byte 15-18 TV Byte 19 QV unit code etc. Byte 20-23 QV
6 Write polling address	Byte 0 =Short address	As in command
11 Read unique id associated with tag	Byte 0-5 TAG (8 characters)	As Command 0
12 Read message	None	Byte 0-23 Message
13 Read Tag, Descriptor & Date	None	Byte 0-5 Tag Byte 6-17 descriptor Byte 18-20 date
14 Read PV sensor number	None	Byte 0-2 sensor serial number Byte 3 unit code for sensor limits and min. span Byte 4-7 upper sensor limit Byte 8-11 lower sensor limit Byte 12-15 minimum span
15 Read PV output information	None	Byte 0 alarm select code Byte 1 transfer code Byte 2 Upper and lower range values unit code Byte 3-6 Upper range value Byte 7-10 Lower range value Byte 11-14 Damping value (sec) Byte 15 Write protect code = 1 Byte 16 Private-label distributor code
16 Read final assembly number	None	Byte 0-2 Final assembly number
17 Write Message	Byte 0-23 Message	As in command
18 Write tag, descriptor and date	Byte 0-5 TAG Byte 6-17 Descriptor Byte 18-20 Date	As in command
19 Write final assembly number	Byte 0-2 Final assembly number	As in command

9. Common-Practice Commands

This device supports the following Common-Practice Commands.

Command Number and Function	Data in Command	Data in reply
33 Read transmitter variables		Not implemented
34 Write damping value	Byte 0-3 Byte 0-1 Damping value in sec.	As in command
35 Write range values	Byte 0 range unit code Byte 1-4 upper range Byte 5-8 lower range	As in command
36 Set upper range		Not implemented
37 Set lower range		Not implemented
38 Reset config. Flag	None	None
39 EEPROM control	Byte 0 0= burn EEPROM 1= restore from EEPROM	As in command
40 Enter/exit fixed current mode	Byte 0-3 Current (mA) Current = 0 ⇒ Exit fixed Current mode	Byte 0-3 Actual current (mA) On exit (Data in command = 0), the response is always 4 mA
41 Perform transmitter self-test		Not implemented
42 Perform master reset (Set to default)	None	None (Busy for approx. 30 seconds after reply)
43 Set PV zero	None	None HART will respond, command not implemented“ in the cases that PV zero is not supported by the application.
44 Write PV units	Byte 0 PV units code	As in command
45 Trim DAC Zero		Not implemented
46 Trim DAC gain		Not implemented
47 Write transfer function		Not implemented
48 Read additional transmitter status	None	See chapter 7, describing status information
49 Write PV sensor serial number		Not implemented
50-56		Not implemented
57-58 Read/Write unit tag		Not implemented
59 Write number of preambles	Byte 0 Number of response preamble bytes	As in command
60-107		Not implemented
108 Write burst mode command number	Byte 0 Burst mode command number 1, 2 or 3 supported	As in command
109 Burst mode control	Byte 0 0 = exit, 1 = enter	As in command
110 Read all dynamic variables	None	Not implemented

10. Device-Specific Commands

This device supports the following Device-Specific Commands. Except from command 170 and 171, these commands are reserved for software tools like PDM, AMS and HC275/375.

Command Number and Function	Data in Command	Data in reply
128 Read Integer8	Byte 0 CANAPP.ID Byte 1 Attribute.ID Byte 2 Attribute Qual Byte 3-4 Index	Byte 0 Integer 8 value
129 Read Integer16	Byte 0 CANAPP.ID Byte 1 Attribute. ID Byte 2 Attribute Qual Byte 3-4 Index	Byte 0-1 Integer 16 value
130 Read Integer32	Byte 0 CANAPP.ID Byte 1 Attribute.ID Byte 2 Attribute Qual Byte 3-4 Index	Byte 0-3 Integer 32 value
131 Read Unsigned8	Byte 0 CANAPP.ID Byte 1 Attribute.ID Byte 2 Attribute Qual Byte 3-4 Index	Byte 0 Byte
132 Read Unsigned16	Byte 0 CANAPP.ID Byte 1 Attribute.ID Byte 2 Attribute Qual Byte 3-4 Index	Byte 0-1 Two bytes
133 Read Unsigned32	Byte 0 CANAPP.ID Byte 1 Attribute.ID Byte 2 Attribute Qual Byte 3-4 Index	Byte 0-3 Four bytes
134 Read Float32	Byte 0 CANAPP.ID Byte 1 Attribute.ID Byte 2 Attribute Qual Byte 3 Unit code Byte 4-5 Index	Byte 0-3 Float **Comment:** When reading values with no unit, the unit code must be 251 (No unit)
135 Read Float64	Byte 0 CANAPP.ID Byte 1 Attribute.ID Byte 2 Attribute Qual Byte 3-4 Index	Byte 0-7 Float 64
136 Read VisibleString	Byte 0 CANAPP.ID Byte 1 Attribute.ID Byte 2 Attribute Qual Byte 3-4 Index	Byte 0 Length of Message Byte 1-x User message <32 bytes
137 Read OctetString	Byte 0 CANAPP.ID Byte 1 Attribute.ID Byte 2 Attribute Qual Byte 3-4 Index	Byte 0 Length of Message Byte 1-x User message <32 bytes
138 Read OctetString w/parameters	Byte 0 CANAPP.ID Byte 1 Attribute.ID Byte 2 Attribute Qual Byte 3-4 Index Byte 5 Length Byte 6-n parameter 1 … and bytes up to the limit given by the length byte	Byte 0 Length of Message Byte 1-x User message <32 bytes
140 Write Float32	Byte 0 CANAPP.ID Byte 1 Attribute.ID Byte 2 Attribute Qual Byte 3 Reserved (0x00) Byte 4-5 Index Byte 6-9 Float Byte 10 Unit code	Byte 0-3 Float Byte 4 Unit Code

Command Number and Function	Data in Command		Data in reply	
141 Write Integer8	Byte 0 Byte 1 Byte 2 Byte 3 Byte 4-5 Byte 6	CANAPP.ID Attribute.ID Attribute Qual Reserved (0x00) Index (2 bytes) Integer8	Byte 0	Integer value
142 Write Integer16	Byte 0 Byte 1 Byte 2 Byte 3 Byte 4-5 Byte 6-7	CANAPP.ID Attribute.ID Attribute Qual Reserved (0x00) Index (2 bytes) Integer16	Byte 0-1	Integer value
143 Write Integer32	Byte 0 Byte 1 Byte 2 Byte 3 Byte 4-5 Byte 6-9	CANAPP.ID Attribute.ID Attribute Qual Reserved (0x00) Index (2 bytes) Integer32	Byte 0-3	Integer value
144 Write Unsigned8	Byte 0 Byte 1 Byte 2 Byte 3 Byte 4-5 Byte 6	CANAPP.ID Attribute.ID Attribute Qual Reserved (0x00) Index (2 bytes) Unsigned 8	Byte 0	One byte
145 Write Unsigned16	Byte 0 Byte 1 Byte 2 Byte 3 Byte 4-5 Bytes 6-7	CANAPP.ID Attribute.ID Attribute Qual Reserved (0x00) Index (2 bytes) Unsign16	Byte 0-1	Two bytes
146 Write Unsigned32	Byte 0 Byte 1 Byte 2 Byte 3 Byte 4-5 Byte 6-9	CANAPP.ID Attribute.ID Attribute Qual Reserved (0x00) Index (2 bytes) Unsign32	Byte 0-3	Four bytes
147 Write VisibleString	Byte 0 Byte 1 Byte 2 Byte 3 Byte 4-5 Byte 6-x	CANAPP.ID Attribute.ID Attribute Qual Reserved (0x00). Index (2 bytes) VisibleString	Byte 0 Byte 1-x	Length of Message User message <32 bytes
148 Write OctetString	Byte 0 Byte 1 Byte 2 Byte 3 Byte 4-5 Byte 6-x	CANAPP.ID Attribute.ID Attribute Qual Reserved (0x00) Index (2 bytes) OctetString	Byte 0 Byte 1-x	Length of Message User message <32 bytes
150 Request Set mode	Byte 0	Bit0: SaveMode on(1)off(0) Bit1: ServiceMode on(1) off(0) - Bit0 is least sign. Bit of Byte 0	As in command	
154 Req/rel UserLock	Byte 0	Request = 1, Release = 0	As in command	
160 Action	Byte 0 Byte 1 Byte 2	CANAPP.ID Attribute.ID Attribute Qualifier	As in command	
170 Set Unit code	Byte 0 Byte 1 Byte 2	Variable 0=PV, 1=SV, 2=TV, 3=QV, 4= Totalizer 1 5= Totalizer 2 Unit code Reserved (0x00)	As in command	

Command Number and Function	Data in Command	Data in reply
171 Read totalizer	Byte 0 Totalizer no. 0 = Totalizer 1 1 = Totalizer 2	Byte 0 Unit code Byte 1-4 Totalizer value Byte 5 Totalizer no.
172 Read status data	Byte 0 log type 0 = Error Pending 1 = Status Log	Byte 0 As in command Byte 1-18 9 logs consisting of two bytes, Canapp_ID + Error Number
173 Read status timestamp	Byte 0 log type Byte 1 Canapp_ID Byte 2 ErrorNumber	Byte 0-2 As in command Byte 3-12 days, hours and minutes
180 Write Currentoutput1 (MASS 6000 only)	Byte 0 0 = Off 1 = Massflow 2 = Fraction A 3 = Fraction B 4 = Volumeflow 5 = Sensor temperature 6 = Density 7 = Pct. Fraction A	As command
181 Read Currentoutput1 (MASS 6000 only)	None	Byte 0 0 = Off 1 = Massflow 2 = Fraction A 3 = Fraction B 4 = Volumeflow 5 = Sensor temperature 6 = Density 7 = Pct. Fraction A
182 Write Digitaloutput1	Byte 0 0 = Off 1 = Pulse 2 = Frequency 3 = Error level 4 = Error number 5 = Direction/Limit 6 = Batch	As command
183 Read Digitaloutput	None	Byte 0 0 = Off 1 = Pulse 2 = Frequency 3 = Error level 4 = Error number 5 = Direction/Limit 6 = Batch
184 Write Relayoutput1	MAG 5000 C/6000 Byte 0 0 = Off 3 = Error level 4 = Error number 5 = Direction/Limit 6 = Batch 7 = Cleaning MASS 6000 Byte 0 0 = Off 3 = Error level 4 = Error number 5 = Direction/Limit	As command

Command Number and Function	Data in Command	Data in reply
185 Read Relayoutput1	None	MAG 5000 C/6000 Byte 0 0 = Off 3 = Error level 4 = Error number 5 = Direction/Limit 6 = Batch 7 = Cleaning MASS 6000 Byte 0 0 = Off 3 = Error level 4 = Error number 5 = Direction/Limit
186 Write Digitalinput1	MAG 5000 C/6000 Byte 0 0 = Off 1 = Start Batch 2 = Hold/continue Batch 3 = Stop Batch 4 = Zero Adjust 5 = Totalizer reset 6 = Force output 7 = Freeze output 8 = $Q_{max.}2$ (night) 9 = Manual Cleaning MASS 6000 Byte 0 0 = Off 1 = Start Batch 2 = Hold/continue Batch 3 = Stop Batch 4 = Zero Adjust 5 = Totalizer reset 6 = Force output 7 = Freeze output	As command
187 Read Digitalinput1	None	MAG 5000 C/6000 Byte 0 0 = Off 1 = Start Batch 2 = Hold/ continue Batch 3 = Stop Batch 4 = Zero Adjust 5 = Totalizer reset 6 = Force output 7 = Freeze output 8 = $Q_{max.}2$ (night) 9 = Manual Cleaning MASS 6000 Byte 0 0 = Off 1 = Start Batch 2 = Hold/ continue Batch 3 = Stop Batch 4 = Zero Adjust 5 = Totalizer reset 6 = Force output 7 = Freeze output

Comment: Index must always be 0,0

11. Tables

11.1 Volume flow unit codes

Unit code	Description	Note
15	Cubic feet per minute	
16	US gallons per minute	
17	Liters per minute	
18	UK gallons per minute	
19	Cubic meters per hour	
22	US gallons per second	
23	Million US gallons per day	
24	Liters per second	
25	Million liters per day	
26	Cubic feet per second	
27	Cubic feet per day	
28	Cubic meters per second	
29	Cubic meters per day	
30	UK gallons per hour	
31	UK gallons per day	
122	Normal liters per hour	Same as l/h
130	Cubic feet per hour	
131	Cubic meters per minute	
136	US gallons per hour	
137	UK gallons per second	
138	Liters per hour	
235	US gallons per day	
240	Milli liters per second	
241	Milli liters per minute	
242	Milli liters per hour	
243	Hector liters per second	
244	Hecto liters per minute	
245	Hecto liters per hour	
247	BBL per second	31 USG
248	BBL per minute	31 USG
249	BBL per hour	31 USG
250	BBL per day	31 USG
251	No conversion	

11.2 Volume unit codes

Unit code	Description	Note
40	Gallons	
41	Liters	
42	Imperial gallons	
43	Cubic meters	
46	Barrels	41 USG
110	Bushels	
111	Cubic yards	
112	Cubic feet	
124	BBL liquid	31,5 USG
166	Normal cubic meters	Same as Cubic meters
167	Normal liters	Same as liters
168	Standard cubic feet	Same as cubic feet
236	Hector liters	
247	Bbl	31 USG
251	No Conversion	

11.3 Mass flow unit codes

Unit code	Description	Note
70	Grams per second	
71	Grams per minute	
72	Grams per hour	
73	Kilograms per second	
74	Kilograms per minute	
75	Kilograms per hour	
76	Kilograms per day	
77	Metric tons per minute	
78	Metric tons per hour	
79	Metric tons per day	
80	Pounds per second	
81	Pounds per minute	
82	Pounds per hour	
83	Pounds per day	
84	Short tons per minute	
85	Short tons per hour	
86	Short tons per day	
87	Long tons per hour	
88	Long tons per day	
251	No Conversion	

11.4 Mass unit codes

Unit code	Description	Note
60	Grams	
61	Kilograms	
62	Metric tons	
63	Pounds	
64	Short tons	
65	Long tons	
125	Ounce	
251	No Conversion	

11.5 Temperature unit codes

Unit code	Description	Note
32	Degrees Celsius	
33	Degrees Fahrenheit	
35	Kelvin	
251	No Conversion	

11.6 Density unit codes

Unit code	Description	Note
91	Grams per cubic centimetre	
92	Kilograms per cubic meter	
93	Pounds per gallon	
94	Pounds per cubic foot	
95	Grams per milliliter	
96	Kilograms per liter	
97	Grams per liter	
98	Pounds per cubic inch	
246	Tons per cubic meter	
251	No Conversion	

12. Performance

12.1 Sampling rates MAG 5000 C/6000

PV digital calculation (Volume flow)	Equals the Excitation frequency
SV digital calculation (Totalizer 1)	2 per second
TV digital calculation (Totalizer 2 / Batch)	2 per second
Analog output update	Equals the Excitation frequency

The excitation frequency is dependent on the sensor type and size. Large sensors have low excitation frequencies and small sensors have high excitation frequencies (up to 30 Hz). The excitation frequency can be viewed in the local keypad display under „Sensor characteristics“ menu.

12.2 Sampling rates MASS 6000

PV digital calculation (Massflow)	2 per second
SV digital calculation (Density)	2 per second
TV digital calculation (Temperature)	2 per second
QV digital calculation (Volume flow)	2 per second
Analog output update	30 per second

13. Annex A Capability Checklist

Manufacturer	Siemens
Model	SITRANS F M Magflo MAG 5000 C SITRANS F M Magflo MAG 6000 SITRANS F C Massflo MASS 6000
Device type	Transmitter
HART protocol revision	5.2
Device descriptions	PDM
Number of dynamic variables	MAG: 3 MASS: 4
Mappable dynamic variables	No
Number of Common-Practice commands	12
Number of Device-Specific commands	35
Bits of additional device status	76 bits informational (25 bytes in total)
Alternative operating modes	No
Burst Mode	Yes
Write protect	No

For more information

www.siemens.com/flow

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

Subject to change without prior notice
Order No.: A5E03089708
Lit. No.: A5E03089708-01
SFIDK.PS.023.F2.02

A5E03089708

www.siemens.com/processautomation