Profibus DP

Data Link Description

Converter for Remote Design MAG-SM for Electromagnetic Flowmeter

D184B093U06 Rev. 01 / 06.2001

ABB

1. Condensed Description

The Profibus Data Link Module APG1000 provides the means to connect the converter to the Profibus DP in accordance with the DIN 19245 Standard as a passive instrument (slave). It is possible to request measurement values and to configure the instrument for flow metering. The instrument number can be set at the instrument keypad or over the Profibus.

2. Ident No.

The Ident No. has been assigned by the Profibus User Organization and is 6666_{hex} (26214_{dec})

3. Number of In- and Outputs

The number of in- and outputs, relative to the Master, is 16 Bytes.

4. Configuration

Only a single configuration is available. The configuration byte is $3F_{hex}$ (63_{dec}). Any other configuration will not be accepted.

5. Parameter Entry

Parameters are entered as described in DIN 19245-3. User parameters are not available.

6. Diagnostics

The design of the diagnostic data corresponds to the descriptions in DIN 19245-3. User specific diagnostic data are not available.

7. Setting the Slave Address

There are two methods for setting the Slave Address:

1. Over the Bus as described in DIN 19245-3.

2. From the instrument keypad:
   Menu Data Link
   Submenu Slave-Adr.
   Set the address using the arrow keys (address range 000, 001 to 126) use always 3 digits
   (if submenu slave-adr is not available, input can be done by menu TAG number)

To 2. The TAG Number Menu originated in the HART-Protocol and is utilized for compatibility. It accepts the entry of letters. For Profibus only numbers may be used that are within the range listed above.

8. Baudrates

The Baudrates supported are:

9.6 kBaud
19.2 kBaud
45.45 kBaud
93.75 kBaud
187.5 kBaud
500 kBaud
1.5 MBaud

The baudrate is automatically recognized by the instrument.

9. GSD Files

The name of the GSD file is ABB_6666.GSD and is included with the shipment.
For the support of different languages additional files are available:
ABB_6666.GSE: english version (identical with the file GSD)
ABB_6666.GSG: german version

10. Variable Types

The variable types are categorized as:

1. Dynamic Variables
2. Static Variables
3. Constants

in blocks of 16 Bytes. Each block can contain a number of variables.

To 1: *Dynamic Variables*
include measurement values which are continuously changing, e.g. flowrate, temperature, totalizer values, etc.. The last four bytes in each block are always Error Register 1,2 and Status Register 1,2 in order to provide a means to check the validity of the measurement values. Dynamic variables are read only. The variable types within one block can be different.

To 2: *Static Variables*
are converter specific variables which do not change during operation but which can be reprogrammed, e.g. damping, Qmax, units totalizer, totalizer reset, temperature measurement ON/OFF, etc.. Static variables are blockwise readable and can be individually written to using an offset to Index 2 (see Writing Variables). The variable types within a block are always the same.

To 3: *Constants*
are converter specific values which cannot be changed, e.g. meter size, flowmeter primary type, etc.. Constants are read only. The variable types within a block are always the same.

11. Reading Variables

The variable are always read blockwise (16 Byte). The selection is made over an Index which is always located in Byte 1 and Byte 2. The response of the converter is the present value when Byte 1 and Byte 2 in the response are the same as the index sent by the Master (echoing). If the value FF_{HEX} (255_{dec}) appears in Byte 1 and Byte 2 then the converter is in the self test mode and operating values are not updated. The self test mode can only be initiated and reset locally from the converter keypad. If the Index sent is unknown the response is always the dynamic variable block 1 (Index 1 = 1, Index 2 = 0).

Example: Read the dynamic variable block 1:
The Master sends (16 Byte):

Byte 1	1	(= Index 1 of dynamic variable block 1)
Byte 2	0	(= Index 2 of dynamic variable block 1)

Byte 3 to Byte 16 arbitrary values.

The converter responds with (16 Byte):

Byte 1	1	(= Index 1 of dynamic variable block 1)
Byte 2	0	(= Index 2 of dynamic variable block 1)
Byte 3	Word_high	the percentage flowrate (Integer16)
Byte 4	Word_low	the percentage flowrate(Integer16)
Byte 5	Octet 1 High	the forward totalizer value (Unsigned32)
Byte 6	Octet 2	the forward totalizer value (Unsigned32)
Byte 7	Octet 3	the forward totalizer value (Unsigned32)
Byte 8	Octet 4 Low	the forward totalizer value (Unsigned32)
Byte 9	Not used in this block	
Byte 10	Not used in this block	
Byte 11	Not used in this block	
Byte 12	Not used in this block	
Byte 13	Value of Error Register 1	
Byte 14	Value of Error Register 2	
Byte 15	Value of Status Register 1	
Byte 16	Value of Status Register 2	

Example: Read the static variable block 1:
The Master sends (16 Byte):

Byte 1	16	(= Index 1 of static variable block 1)
Byte 2	0	(= Index 2 of static variable block 1)

Byte 3 to Byte 16 arbitrary values.

The converter responds with (16 Byte):

Byte 1	16	(= Index 1 of static variable block 1)
Byte 2	0	(= Index 2 of static variable block 1)
Byte 3	TAG Number	
Byte 4	Meter size	
Byte 5	Units totalizer	
Byte 6	Units Qmax	
Byte 7	Log Register 1	
Byte 8	Log Register 2	
Byte 9	(Write only)	
Byte 10	(Write only)	
Byte 11	Not used in this block	
Byte 12	Not used in this block	
Byte 13	Not used in this block	
Byte 14	Not used in this block	
Byte 15	Not used in this block	
Byte 16	Not used in this block	

In order to increase the resolution for some values, they are multiplied by factors of x10,x100,x1000.

Example Factors:

Factor x1000:
Density = 1.123 kg/m^3
is represented by 1123.

Factor x100:
Percentage flowrate = 51.12%
is represented by 5112.

Factor x10:
Temperature = 23.1 °C
is represented by 231.

12. Writing Variables

When writing variables, in a manner similar to reading, first select the variable block, using Byte 1 and Byte 2 (=Index 1 and Index 2), in which the variable to be changed is located. In Index 2 add the position of the variable in this block (not the Byte-Position !). Byte 3 to Byte n, dependent on the variable type, contain the new value. For new values with multiplication factors it is important to consider the multiplication factors x10,x100,x1000 ! The converter responds with the Index 1 and Index 2 values that were sent and in Byte 3 to Byte n the present value stored in the converter. If this value is not the same as the value sent then it was not accepted, e.g. when the value is outside of the entry range. The converter will continue to sent the present variable value until the Master sets the Index again at the beginning of the block or in another block.

Example: Write damping value in static variable block 2:
The Master sends (16 Byte):

Byte 1 16 (16 = Index 1 of static variable block 2)
Byte 2 18 (16+2 = Index 2 of static variable block 2, 2nd variable is Damping)
Byte 3 Word_high Damping= 1
Byte 4 Word_low Damping=244 (Example: 5 sec x100 = 500 = 1*256+244)
Byte 5 to Byte 16 arbitrary value.

The converter responds with (16 Byte):

Byte 1 16 (16 = Index 1 of static variable block 2)
Byte 2 18 (16+2= Index 2 of static variable block 2, 2nd variable is Damping)
Byte 3 Word_high Damping= 1
Byte 4 Word_low Damping=244 (Example: 5 sec x100 = 500 = 1*256+244)
Byte 5 to Byte 16 arbitrary value.

after the change is completed.
Example: RESET the totalizer; static variable block 1:

The Master sends (16 Byte):

Byte 1 16 (16 = Index 1 of static variable block 1)
Byte 2 9 (0+9 = Index 2 of static variable block 1, 9th variable is RESET)
Byte 3 to Byte 16 arbitrary value, since it is only a single function without any change in value.

The converter responds with (16 Byte):

Byte 1 16 (16 = Index 1 of static variable block 1)
Byte 2 9 (0+9 = Index 2 of static variable block 1, 9th variable is RESET)
Byte 3 to Byte 16 arbitrary value, since it is only a single function without any change in value.
after the totalizer is RESET.

13. Functions in the Data Link Menu

The following parameters in the Data Link menu can be requested:

Adress	Slave Address
Adr.Chg	Change the Slave Address
Id.No.H	Ident Number High Byte
Id.No.L	Ident Number Low Byte
Conv Id	Identification number of the converter
Wdstate	Watchdog status: 0=Baud Search, 1= Baud Control, 2= DP Control
Initerr	Initialization error
Dpstate	DP Status: 0= Wait Prm, 1 = Wait Cfg, 2= Data Exchange
BDrate	Baudrate(kBaud): 3=1500;4=500;5=187.5;6=93.75;7=45.45;8=19.2;9=9.6
Accviol	Access error
GC com	Global Control command
Release	Revision level
OffPass0=Offline,1=Passive Idle	
MUcomu	Status data exchange converter
FreemeH	Free memory High Byte
FreemeL	Free memory Low Byte
EventsH	Events High Byte
EventsL	Events Low Byte
INTconH	Interrupt High Byte
INTconL	Interrupt Low Byte
Prmstat	Station status (Parameter entry)
PrmWdf1	Watchdog Factor 1 (parameter entry)
PrmWdf2	Watchdog Factor 2 (parameter entry)
PrmTSDR	Min TSDR (parameter entry)
PrmID H	Ident No. High (parameter entry)
PrmID L	Ident No. Low (parameter entry)
PrmGrID	Group ID (parameter entry)
PrmSpUs	Special user byte (parameter entry)
Prm OK	Parameter entry OK= 0; parameter entry not OK = 255 (parameter entry)
Prm Len	Parameter length (parameter entry)
CfgData	Configure byte (configuration)
CfgRslt	Status of the configuration
Cfg OK	Configuration OK = 17; configuration not OK = 51; configuration changed = 32

Cfg Len	Configuration length
DiagFlg	Diagnostic flag
DiagLen	Diagnostic length
Out 1 to Out 16	Byte 1 to Byte 16 last sent from Master
In 1 to In 16	Byte 1 to Byte 16 last response from slave
VerB173A	Software version

While the self test functions are active the data in In1 to In16, Out1 to Out16 are not updated. **This also applies to the measurement values which are sent to the Master !** An active self test function is indicated to the Master through the setting of Indices 1 and 2 (Byte 1 and Byte 2 in the data block) to 255_{dec}.

14. Terminal Designations

V1	B	RxD/TxD-P	Receive/Send Data-P
V2	A	RxD/TxD-N	Receive/Send Data -N
V4		VP	Supply voltage plus (P5V)
G2	C	DGND	Data common potential (M5V)

15. Variable Blocks 50SM1000

15.1 Dynamic Variables

15.1.1 Dynamic Variable Block 1

Contents	Variable Type	Position in 16 Byte Block
Index 1 = 1	Unsigned8	1
Index 2 = 0	Unsigned8	2
Percent flowrate * 100	Integer16	3,4
Forward totalizer	Unsigned32	5,6,7,8
Forward overflow counter	Unsigned8	9
Error Register 1	Unsigned8	13
Error Register 2	Unsigned8	14
Status Register 1	Unsigned8	15
Status Register 2	Unsigned8	16

15.1.1.1 Percent Flowrate

Indication of present flowrate in %. A negative value indicates reverse flow direction.

15.1.1.2 Forward Totalizer

Totalizer value for the forward direction. For units see "Units totalizer"

15.1.1.3 Forward Overflow Counter

Number of totalizer overflows

15.1.1.4 Error Register 1

The Error-Register 1 is sent bitwise (from Bit 7 to Bit0):

Bit	Definition	
0	Error1	A/D-Converter pos. saturated
1	Error2	Uref too small
2	Error3	Flowrate > 130%
3	Error4	External Zero return
4	Error5	EEPROM defective
5	Error1	A/D-Converter neg. saturated
6	Error7	Urefp too large
7	Error8	Urefn too large

15.1.1.5 Error Register 2

Indications same as Error Register 1. The individual bits have the following definition:

Bit	Definition	
0	Error0	Empty pipe detector
1		Power supply breakdown recognition
2	Error9	Excitation
3		Max-Alarm
4		Min-Alarm
5		Function test active
6		
7		

15.1.1.6 Status Register 1

8-Bit Register. Indication of the corresponding decimal value. The individual bits have the following definition:

Bit	Definition
0	Forward totalizer overflow
1	Reverse totalizer overflow
2	
3	New parameter entered from keypad
4	
5	Flowrate is below the low flow cutoff range
6	
7	Instrument alarm. Alarm activated see "Error Register 1" and "Error Register 2"

15.1.1.7 Status Register 2

8-Bit Register. Indication of the corresponding decimal value. The individual bits have the following definition:

Bit	Definition
0	
1	
2	Present flow direction. 0 = Reverse 1 = Forward
3	
4	
5	
6	
7	

15.1.2 Dynamic Variable Block 2

Contents	Variable Type	Position in 16 Byte Block
Index 1 = 1	Unsigned8	1
Index 2 = 16	Unsigned8	2
Volume flowrate in eng'g units * 1000	Integer32	3,4,5,6
Reverse totalizer	Unsigned32	7,8,9,10
Reverse overflow counter	Unsigned8	11
Error Register 1	Unsigned8	13
Error Register 2	Unsigned8	14
Status Register 1	Unsigned8	15
Status Register 2	Unsigned8	16

15.1.2.1 Volume Flowrate in Engineering Units

Flowrate in direct reading engineering units.
Units see "Units Qmax"

15.1.2.2 Reverse Totalizer

Reverse direction totalizer value. Units see "Units totalizer"

15.1.2.3 Reverse Overflow Counter

Number of totalizer overflows

Error Register 1 and Error Register2, Status Register 1 and Status Register 2 same as Dynamic Variable Block 1 !

15.2 Static Variables

15.2.1 Static Variable Block 1

Contents	Variable Type	Position in 16 Byte Block
Index 1 = 16	Unsigned8	1
Index 2 = 0	Unsigned8	2
TAG Number = DP Slave Address	Unsigned8	3
Meter size	Unsigned8	4
Units totalizer	Unsigned8	5
Units Qmax	Unsigned8	6
Log Register 1	Unsigned8	7
Not used	Unsigned8	8
Not used	Unsigned8	9
RESET Log Register 1 (write only)	Unsigned8	10
RESET Forward totalizer (write only)	Unsigned8	11
RESET Reverse totalizer (write only)	Unsigned8	12

15.2.1.1 TAG Number = DP Slave Address

The TAG Number is also the DP Slave Address. **Changes to the Slave Address should only be made from the keypad or by using the Set Slave Address Service in the Profibus DP !**

15.2.1.2 Meter Size

Indication of the meter size by a code number.

Code Number	Meter size	
000	3	1/10"
001	4	5/32"
002	5	3/16"
003	6	1/4"
004	8	5/16"
005	10	3/8"
006	15	1/2"
007	20	3/4"
008	25	1"
009	32	1-1/4"
010	40	1-1/2"

011	50	2"
012	65	2-1/2"
013	80	3"
014	100	4"
015	125	5"
016	150	6"
017	200	8"
018	250	10"
019	300	12"
020	350	14"
021	400	16"
022	450	18"
023	500	20"
024	600	24"
025	700	28"
026	750	30"
027	800	32"
028	900	36"
029	1000	40"
030	1100	42"
031	1200	48"
032	1300	50"
033	1400	54"
034	1500	60"
035	1600	64"
036	1700	66"
037	1800	72"
038	2000	78"
039	2100	84"
040	2200	88"
041	2300	92"
042	2400	96"
043	1	1/25"
044	1.5	1/16"
045	2	3/32"
046	1350	52"

15.2.1.3 Units Totalizer

Indication of the totalizer units by a code number with the following definition:

Code	Unit

Number

000	l
001	hl
002	m3
003	igal
004	gal
005	mgal
006	bbl
007	bls
008	kg
009	t
010	g
011	ml
012	mlt
013	lbs
014	uton
015	user programmable unit

15.2.1.4 Units Qmax

Indication of the Qmax units by a code number with the following definition:

Code Number | Unit

000	l/s
001	l/min
002	l/h
016	hl/s
017	hl/min
018	hl/h
032	m3/s
033	m3/min
034	m3/h
048	igal/s
049	igal/min
050	igal/h
064	mgd
065	gpm
066	gph
080	bbl/s

081	bbl/min
082	bbl/h
096	bls/day
097	bls/min
098	bls/h
112	kg/s
113	kg/min
114	kg/h
128	t/s
129	t/min
130	t/h
144	g/s
145	g/min
146	g/h
160	ml/s
161	ml/min
162	ml/h
176	mlt/min
177	mlt/h
178	mlt/d
192	lbs/s
193	lbs/min
194	lbs/h
208	uton/min
209	uton/h
210	uton/d
224	Prog.units/s
225	Prog.units/min
226	Prog.units/h

15.2.1.5 Log Register 1

Differences to the Error Register:
The contents of the Error Log Register are not automatically reset. Errors once detected remain stored and must be manual cleared.
A further difference:
Bit 5 is set in the Error-Log-Register when the data in the RAM area no longer coincides with the data in the EEPROM causing a Restart to be released.

The Log-Register 1 is sent bitwise (from Bit 7 to Bit0):

Bit	Definition	
0	Error1	A/D-Converter pos. saturated
1	Error2	Uref too small
2	Error3	Flowrate > 130%
3	Error4	External Zero return
4	Error5	EEPROM defective
5	Error0	Empty pipe
6	Error7	Urefp too large
7	Error8	Urefn too large

15.2.1.6 RESET Log Register 1

Resets the Error Log Register

15.2.1.7 RESET Forward Totalizer

Clears the forward totalizer and the overflow counter

15.2.1.8 RESET Reverse Totalizer

Clears the reverse totalizer and the overflow counter

15.2.2 Static Variable Block 2

Contents	Variable Type	Position in 16 Byte Block
Index 1 = 16	Unsigned8	1
Index 2 = 16	Unsigned8	2
Low flow cutoff value [%] * 100	Unsigned16	3,4
Damping* 100	Unsigned16	5,6
System zero * 10	Integer16	7,8
Density *1000	Unsigned16	9,10

15.2.2.1 Low Flow Cutoff Value [%]

Programming the low flow cutoff value %.
Data range: 0 * 100 to 10 * 100

15.2.2.2 Damping

Damping in seconds.
Data range: 0.125 * 100 to 100 * 100

15.2.2.3 System Zero

Programming the system zero value in Hz. A negative entry indicates reverse flow.
Data range: ± 1500 * 10 Hz

15.2.2.4 Density

Density in g/cm3.
Data range: 0.01 * 1000 to 5 * 1000

15.2.3 Static Variable Block 3

Contents	Variable Type	Position in 16 Byte Block
Index 1 = 16	Unsigned8	1
Index 2 = 32	Unsigned8	2
Qmax 1 * 1000	Unsigned32	3,4,5,6

15.2.3.1 Qmax 1

Programming the Qmax value.

Units see "Units Qmax"

Data range: 0.05 * 1000 to 1.5 * 1000 QmaxDN

15.2.4 Static Variable Block 4

Contents	Variable Type	Position in 16 Byte Block
Index 1 = 16	Unsigned8	1
Index 2 = 48	Unsigned8	2
Operating mode	Unsigned8	3
Filter ON/OFF	Unsigned8	4

15.2.4.1 Operating Mode

Setting the operating mode using a code number. The operating mode setting can be requested in "Mode Register 2".

Code Number	Operating Mode
0	Standard
1	Piston pump

15.2.4.2 Filter ON/OFF

Filter on / off.
0 =off, 1 = on.

The present setting can be requested in "Mode Register 2".

15.2.5 Static Variable Block 5

Contents	Variable Type	Position in 16 Byte Block
Index 1 = 16	Unsigned8	1
Index 2 = 64	Unsigned8	2
Pulse factor * 10	Unsigned16	3,4
Pulse width * 10	Unsigned16	5,6

15.2.5.1 Pulse Factor

Pulse factor for the scaled pulse output.
Data range: 0.001 * 10 to 1000 * 10.

15.2.5.2 Pulse Width

Pulse width for the scaled pulse output in ms.
Data range: 0.032 * 10 to 2000 * 10.

15.2.6 Static Variable Block 8

Contents	Variable Type	Position in 16 Byte Block
Index 1 = 16	Unsigned8	1
Index 2 = 112	Unsigned8	2
Empty pipe detector	Unsigned16	3,4

15.2.6.1 Empty Pipe Detector

Threshold for the empty pipe detector
Data range: 0 to 255

15.2.7 Static Variable Block 22

Contents	Variable Type	Position in 16 Byte Block
Index 1 = 32	Unsigned8	1
Index 2 = 80	Unsigned8	2
Empty pipe detector ON/OFF	Unsigned8	3

*15.2.7.1 **Detector Empty Pipe ON/OFF***

0 off
1 on

15.3 Constants

15.3.1 Constant Block 1

Contents	Variable Type	Position in 16 Byte Block
Index 1 = 0	Unsigned8	1
Index 2 = 16	Unsigned8	2
Converter recognition	Unsigned8	3

15.3.1.1 Converter Recognition

The code numbers are:

XH1000	02
XM1000	03
A5400	07
SM1000	08
ES7000	09
XP1000	10
XM2000	12
XE4000	13
XH2000	14
VM1000	15
MM2000	16
D10A5486	17
XF4000	18
UD2000	19

15.3.2 Constant Block 2

Contents	Variable Type	Position in 16 Byte Block
Index 1 = 0	Unsigned8	1
Index 2 = 32	Unsigned8	2
QmaxDN * 1000	Unsigned32	3,4,5,6
Instrument number	Unsigned32	7,8,9,10

15.3.2.1 QmaxDN

Indication of QmaxDN. Units see "Units Qmax"

15.3.2.2 Instrument Number

Indication of the converter instrument number

15.3.3 Constant Block 4

Contents	Variable Type	Position in 16 Byte Block
Index 1 = 0	Unsigned8	1
Index 2 = 64	Unsigned8	2
Mode Register 1	Unsigned8	3
Mode Register 2	Unsigned8	4

15.3.3.1 Mode Register 1

8-Bit Register. Indication of the corresponding decimal value. The individual bits have the following definition:

Bit	Contents	Definition
0		-
1		Direction indication
	0	Normal
	1	Inverse
2		QmaxDN
	0	Fixed
	1	Programmable
3		-
4		Flow direction
	0	Forward-/reverse
	1	Forward
5		QmaxDN velocity.
	0	10 m/s
	1	33.33 ft/s
6		-
7		Excitation frequency
	0	50Hz
	1	60Hz

15.3.3.2 Mode Register 2

8-Bit Register. Indication of the corresponding decimal value. The individual bits have the following definition:

Bit	Contents	Definition
0		Entry limits Qmax
	0	Qmax ≥ 0.05 QmaxDN
	1	Qmax ≥ 0.02 QmaxDN
1		External zero adjust over A1
	0	Locked
	1	Unlocked
2	-	
3		Empty pipe detector
	0	off
	1	on
4		Alarm Empty pipe detector
	0	off
	1	on
5		-
6		Filter
	0	off
	1	on
7		Operating mode
	0	Standard
	1	Piston pump

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