Profibus DP

Data Link Description

Coriolis Mass Flowmeter
Primary TRIO-MASS / MC
TRU-MASS /10MM2000
Converter 50MM2000

Valid for Software Levels from 50MM2000 9/97
D699B113U01 A.80

D184B093U08 Rev. 01 / 06.2001

ABB

Data Link Description

50MM2000

Profibus DP

D184B093U08

1 Condensed Description

The Profibus Data Link Module APG1000 provides the means to connect a 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 adress 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, as seen by the Master, are 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 structure 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 three digits
   (if submenu slave-adr is not available, input can be done by menu TAG number)

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

8 Baudrates

The following Baudrates are supported:

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 values.

Re 1: *Dynamic Variables*
include measured 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 measured values. Dynamic variables are read only. The variable types within one block can vary.

Re 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 read in blocks 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.

Re 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 variables are always read in blocks (16 Byte). The selection is made using 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 flowrate percentage (Integer16)
Byte 4	Word_low	the flowrate percentage (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 certain values, they are multiplied by factors of x10,x100,x1000.

Example Factors:

Example 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 data value type, contain the new value. For new values with multiplication factors it is important to consider their 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. if the value is outside of the entry range. The converter will continue to send the present value of the variable until the Master sends 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 only a function is called without any change in value.

The totalizer is RESET.

13 Functions in the Data Link Menu

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

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
OffPass	0=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 measured 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 50MM1000

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

15.1.1.1 Percent Flowrate

Indication of mass flowrate in %. 100% is equivalent to Qmax.

15.1.1.2 Forward Totalizer

Indication of the present totalizer value. The totalizer integrates the mass or volume flow based on the units selected.

15.1.1.3 Forward Overflow Counter

Number of totalizer overflows. The totalizer overflows at ten million.

15.1.1.4 Error Register 1

Indication of the values in the Error Register. This register lists the presently active errors. The eight bits of the error register have the following format (’0’ = no error or ’1’ = active error):

Bit7 Bit6 Bit5 Bit4 Bit3 Bit2 Bit1 Bit0
| | | | | | | |

| | | | | | | | Error 0: Sensor amplitude
| | | | | | | Error 1: PLL
| | | | | | Error 2: Driver current
| | | | | Error 3: Flowrate > 130%
| | | | Error 4: External Zero return
| | | Error 5: EEPROM
| | Error 6:Totalizer defect
| Error 7: Temperature measurement

The error register is not changed as a result of the request. See also Error Register 2.

15.1.1.5 Error Register 2

Indication of the second half or the error register. This register provides information about the presently active errors.
The eight bits of the error register have the following format ('0' = no error or '1' = active error):

Bit7 Bit6 Bit5 Bit4 Bit3 Bit2 Bit1 Bit0
| | | | | | | |
| | | | | | | Error 8: Range I_out
| | | | | | Error 9: Driver
| | | | | Error A: Density < 0.5 kg/l
| | | | Error B: Density measurement
| | | Error C: Sensor difference
| | Not used
| Not used
Not used

The error register is not changed as a result of the request.

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
Actual 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

15.1.2.1 Volume Flowrate

The present volume flowrate in the selected volume engineering units.

15.1.2.2 Reverse Totalizer

Reverse totalizer value. Units see (Units Totalizer)

15.1.2.3 Reverse Overflow Counter

Number of reverse totalizer overflows

15.1.3 Dynamic Variable Block 3

Contents	Variable Type	Position in 16 Byte Block
Index 1 = 1	Unsigned8	1
Index 2 = 32	Unsigned8	2
Actual mass flowrate * 1000	Integer32	3,4,5,6
Temperature * 10	Integer16	7,8
Density * 100	Unsigned16	9,10
Error Register 1	Unsigned8	13
Error Register 2	Unsigned8	14

15.1.3.1 Mass Flowrate

The present mass flowrate in the units of Qmax mass.

15.1.3.2 Temperature

The measured temperature in the selected units.

15.1.3.3 Density

The measured density in the selected units.

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
Flowmeter size	Unsigned8	4
Units totalizer	Unsigned8	5
Units Qmax	Unsigned8	6
Log Register 1	Unsigned8	7
Log Register 2	Unsigned8	8
Unused	Unsigned8	9
RESET Log Register 1 and 2 (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 Flowmeter Size

0		DN2	3/32"
1		DN3	1/10"
2		DN6	1/4"
3		DN15	1/2"
4		DN25	1"
5		DN40	1-1/4"
6	D	DN15	1/2"
7	E	DN20	3/4"
8	F	DN25	1"
9	G	DN40	1-1/2"
10	H	DN50	2"
11	I	DN65	2-1/2"
12	J	DN80	3"
13	K	DN100	4"

Note: The meter sizes with additional letters in front are valid for the TRIO-MASS primary, the others for the TRU-MASS primary.

15.2.1.3 Totalizer Units

0	g
1	kg
2	t
3	lb
4	ml
5	l
6	m3
7	ft3
8	ugal
9	igal
10	bbl

15.2.1.4 Qmax Units (Qm)

0	g/s
1	g/min
2	g/h
3	kg/s
4	kg/min
5	kg/h
6	kg/d
7	t/min
8	t/h
9	t/d
10	lb/s
11	lb/min
12	lb/h
13	lb/d

15.2.1.5 Log Register 1

Indication of the contents of the Log Register 1. The bits correspond to those in Error Register 1. In this log register all errors, regardless of when they occurred, are permanently stored. They can be cleared by "RESET Log Register 1 and 2".
The eight bits of the Log Register 1 have the following format ('0' = no error or '1' = active error):

```
Bit7 Bit6 Bit5 Bit4 Bit3 Bit2 Bit1 Bit0
 |    |    |    |    |    |    |    |
 |    |    |    |    |    |    |    Error 0: Sensor amplitude
 |    |    |    |    |    |    Error 1: PPL
 |    |    |    |    |    Error 2: Driver current
 |    |    |    |    Error 3: Flowrate > 130%
 |    |    |    Error 4: External Zero return
 |    |    Error 5: EEPROM
 |    Error 6:Totalizer defect
 Error 7: Temperature measurement
```

The log register is not changed as a result of the request.

15.2.1.6 Log Register 2

Indication of the contents of the Log Register 2. The Bits correspond to those in Error Register 2. In this log register all errors, regardless of when they occurred, are permanently stored. They can be cleared by "RESET Log Register 1 and 2".
The eight bits of the Log Register 2 have the following format ('0' = no error or '1' = active error):

```
Bit7 Bit6 Bit5 Bit4 Bit3 Bit2 Bit1 Bit0
 |    |    |    |    |    |    |    |
 |    |    |    |    |    |    |    Error 8: Range I_out
 |    |    |    |    |    |    Error 9: Driver
 |    |    |    |    |    Error A: Density < 0.5 kg/l
 |    |    |    |    Error B: Density measurement
 |    |    |    Error C: Sensor difference
 |    |    Not used
 |    Not used
 Not used
```

The log register is not changed as a result of the request.

15.2.1.7 RESET Log Register 1 and 2 (write only)

15.2.1.8 RESET Forward totalizer (write only)

15.2.1.9 RESET Reverse totalizer (write only)

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
Operating density (measured value) *1000	Unsigned16	9,10

15.2.2.1 Low Flow Cutoff Value

The low flow cutoff value corresponds to Qmin. When the flowrate is less than this value it is set 0. The units are the selected flowrate units.

15.2.2.2 Damping Value

The units are seconds. The value represents the time it takes the converter to reach 63% of its final value after a step change in the flowrate.
Data range: 0.2 *100 <= Entry <= 100.0 *100

15.2.2.3 System Zero Value

15.2.2.4 Operating Density (Measured Value)

See also Dynamic Variable Block 3

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 * 1000	Unsigned32	3,4,5,6

15.2.3.1 Qmax

Programming and indication of Qmax. This value corresponds to 100% flowrate in the selected units.

15.2.4 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

15.2.4.1 Pulse Factor

The units are the totalizer units selected (pulses / totalizer unit). This is a function of the units selection for the totalizer.

Data range: 0.001 *10 <= Entry <= 1000.0 *10

15.2.4.2 Pulse Width

Width of the pulse output. The units are milliseconds. Warning: The pulse width must be set to a value less than the minimum time between two pulses!

Data range: 0.016 *10 <= Entry <= 1000 *10

15.2.5 Static Variable Block 10

Contents	Variable Type	Position in 16 Byte Block
Index 1 = 16	Unsigned8	1
Index 2 = 144	Unsigned8	2
Temperature units	Unsigned8	3
Density units	Unsigned8	4
Qmax mass units	Unsigned8	5

15.2.5.1 Temperature Units

The temperature values are automatically converted to the new units (Example: 20C -> 68F).

0 Degrees Celsius
1 Degrees Fahrenheit

15.2.5.2 Density Units

0 g/ml
1 g/cm3
2 g/l
3 kg/l
4 kg/m3
5 lb/ft3
6 lb/ugl

15.2.5.3 Qmax Units

Mass flowrate units for Qmax. All values are automatically converted to the new units (Example: 1 kg/s -> 3600 kg/h).

0 g/s
1 g/min
2 g/h
3 kg/s
4 kg/min
5 kg/h
6 kg/d
7 t/min
8 t/h
9 t/d
10 lb/s
11 lb/min
12 lb/h
13 lb/d

15.2.6 Static Variable Block 13

Contents	Variable Type	Position in 16 Byte Block
Index 1 = 16	Unsigned8	1
Index 2 = 192	Unsigned8	2
Hold time for measured value	Unsigned8	3
Density damping	Unsigned8	4
Noise reduction ON/OFF	Unsigned8	5

15.2.6.1 Measured Hold Time Value

The hold time units are seconds [s]

15.2.6.2 Damping Density

The damping units are seconds [s]

15.2.6.3 Noise Reduction 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

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
RangeMax * 1000	Unsigned32	3,4,5,6
Instrument number	Unsigned32	7,8,9,10

15.3.2.1 RangeMax

Indication of the maximum volume flowrate for the flowmeter primary. The units are the selected volume flowrate units..

15.3.2.2 Instrument Number

Indication of the instrument number. There is an individual number for each instrument manufactured.

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