

D184B093U10 Rev. 02 / 06.2001



CE



Data Link Description

50XE4000

Profibus DP
D184B093U10



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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 value information and to configure the instrument for flow metering. The instrument address can be set at the converter keypad or over the Profibus.

2 Ident No.

The Identification Number 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 converter keypad:
 - Menu Data Link
 - Submenu Slave-Adr
 - Enter the Address with 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 expression Tag-Number originated with the HART-Protocol and is utilized here for reasons of compatibility. In the HART-Protocol it is possible to enter letters. In Profibus, however, only numbers which are within the above value range can be entered.

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 File

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 parameter values 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 can be 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.

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 in blocks (16 Byte). The selection is made using an Index which is always located in Byte 1 and Byte 2. The response from the converter is its present value when Byte 1 and Byte 2 in the response contain 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 by the converter, 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 Unit totalizer
Byte 6 Unit 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 x 10
Temperature = $23.1 \text{ }^{\circ}\text{C}$
is represented by 231.

12 Writing Variables

When writing variables 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 equal to reading. 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 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 resets 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 = $1 \cdot 256 + 244$)
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 = $1 \cdot 256 + 244$)
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 Menu Data Link

The following parameters can be requested:

Adress	Slave Address
Adr.Chg	Change the Slave Address
Id.No.H	Identification Number High Byte
Id.No.L	Identification 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
VerC001A	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 50XE4000

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 Direction Totalizer	Unsigned32	5,6,7,8
Forward Direction 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 that the flow is in the reverse 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 counter overflows

15.1.1.4 Error Register 1

The Error-Register 1 is sent bitwise (from Bit 7 to Bit 0):

Bit		Definition
0	Error 0	Empty pipe
1	Error 1	A/D Converter saturated
2	Error 2	Uref too small
3	Error 3	Flowrate > 130 %
4	Error 4	External zero return
5	Error 5	Defective EEPROM
6	Error 6	Totalizer corrupted
7	Error 7	Urefp too large

15.1.1.5 Error Register 2

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

Bit		Definition
0	Error 8	(Urefn too small)
1	Error 9	Excitation error
2		Max-alarm
3		Min-alarm
4	Error C	(Flowmeter primary data)
5		Function test active
6	Error 6v	(Forward totalizer corrupted)
7	Error 6r	(Reverse totalizer corrupted)



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 direction totalizer overflow
1	Reverse direction totalizer overflow
2	Present flow range in the operating modes "2FR ext" and "2FR auto" 0 = Q _{max} 1 1 = Q _{max} 2
3	New parameter entered from keypad
4	An adjustment routine is active
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 definitions:

Bit	Definition
0	Internal use
1	Internal use
2	Actual flow direction. 0 = Reverse 1 = Forward
3	Not used
4	Test Mode active (Function test with simulator)
5	power supply breakdown identification
6	Not used
7	Not used



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 * 1000 in engineering units	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 Engineering Units.
Units, see Units Qmax

15.1.2.2 Reverse Flow Direction Totalizer

Reverse flow direction totalizer value. Units see (Units Totalizer)

15.1.2.3 Reverse Flow Direction Overflow Counter

Number of totalizer overflows

Error Register 1 and Error Register2, Status Register1 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
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 Totalizer, Forward direction (write only)	Unsigned8	11
RESET Totalizer, Reverse direction (write only)	Unsigned8	12

15.2.1.1 TAG Number = DP Slave Address

The TAG Number simultaneously is the DP Slave Address. **The Slave Address should be changed using the converter keypad or by accessing the Set Slave Address Service of the Profibus DP !**

15.2.1.2 Flowmeter Size

Indication of the flowmeter size by a code number.

Code Number	Meter size DN	Inch
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



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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 Totalizer Units

Indication of the totalizer units by a code number.

Code Number	Units
----------------	-------

000	l
001	hl
002	m3
003	igal
004	gal
005	mgal
006	bbf
007	bls
008	kg
009	t



010	g
011	ml
012	mlt
013	lbs
014	uton
015	User programmable units

15.2.1.4 Units Qmax

Indication of the unit of Qmax by a code number.

Code Number	Units
000	l/s
001	l/min
002	l/h
016	hl/s
017	hl/min
018	hl/h
032	m ³ /s
033	m ³ /min
034	m ³ /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

See Error Register 1

Differences from the Error Registers:

The contents of the Error Log Registers is not automatically reset. Errors once encountered remain stored and must be manually reset.

An additional difference:

The Bit 5 is set in the Error-Log-Register, when the values in the RAM-Sector no longer agree with those in the EEPROM and Restart is released.

15.2.1.6 Log Register 2

See Error Register 2

15.2.1.7 RESET Log Register 1 and 2

Resets both Error Log Registers

15.2.1.8 RESET Forward Flow Direction Totalizer

Resets the forward flow direction totalizer and overflow counter

15.2.1.9 RESET Reverse Flow Direction Totalizer

Resets the reverse flow direction totalizer and 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 [%] * 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 [%]

Programming the Low Flow Cutoff value in %.
Data range: 0 * 100 to 10 * 100

15.2.2.2 Damping

Damping in seconds.

Data range:

0.5 * 100 to 100 * 100 (6 1/4 Hz)

0.25 * 100 to 100 * 100 (12 1/2 Hz)

0.125 * 100 to 100 * 100 (25 Hz)

15.2.2.3 System Zero

Programming the system zero in Hz. A negative entry indicates reverse flow.
Data range: $\pm 50 * 10$ 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 of Qmax.

Units see "Units Qmax"

Data range: $0.05 * 1000$ to $1.0 * 1000$ RangeMax (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
Excitation Frequency	Unsigned8	5
Totalizer Function	Unsigned8	6

15.2.4.1 Operating Mode

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

Code	Operating
Number Mode	
0	Standard
1	Fast

15.2.4.2 Filter ON/OFF

Filter on / off.

0 = off, 1 = on.

The present status of the filter can be accessed by using "Mode Register 2".



15.2.4.3 Excitation Frequency

Programming of the excitation frequency using a code number

Code Excitation
Number

0	6 1/4 Hz AC/DC
1	7 1/2 Hz AC/DC
2	12 1/2 Hz AC/DC
3	15 Hz AC/DC
4	25 Hz AC/DC
5	30 Hz AC/DC
6	6 1/4 Hz DC
7	7 1/2 Hz DC
8	12 1/2 Hz DC
9	15 Hz DC
10	25 Hz DC
11	30 Hz DC
12	3 1/8 Hz DC
13	3 3/4 Hz DC
14	Negative constant excitation
15	Positive constant excitation

15.2.4.4 Totalizer Function

The function assigned to the totalizer can be set using a code number. The present function setting can be accessed by using "Mode Register 2".

Code	Totalizer Function
0	Standard (2 separate totalizers, one each for the forward and reverse flow directions)
1	Difference totalizer

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: $0.1 * 10$ 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 in Hz
Data range: 0 to 3000

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 Empty Pipe Detector 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 RangeMax (QmaxDN)

Indication of RangeMax. Units see (Units Qmax).



15.3.2.2 Instrument Number

Indication of the instrument number of the converter

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	0 1	Empty pipe detector off on
1	0 1	Flow direction indication normal inverse
2	0 1	RangeMax fixed programmable
3		—
4	0 1	Flow direction Forward / reverse Forward
5	0 1	RangeMax velocity 10 m/s 33.33 ft/s
6	0 1	Filter off on
7		—

**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	0	Totalizer mode standard
	1	difference totalizer
1	0	Voltage supply AC
	1	DC
2	0	Entry limits for Qmax $Q_{max} \geq 0.05 \text{ RangeMax}$
	1	$Q_{max} \geq 0.02 \text{ RangeMax}$
3	0	Alarm, empty pipe detector off
	1	on
4		Operating mode
5		Operating mode
6		Operating mode
7		Operating mode
	Bit 7, 6, 5, 4	Mode
	0 0 0 0	Standard
	0 1 X X	Fast



ABB Automation Products GmbH

Dransfelder Str. 2, D-37079 Goettingen

Tel.: +49 (0) 5 51 9 05 - 0

Fax: +49 (0) 5 51 9 05 - 777

<http://www.abb.com/automation>