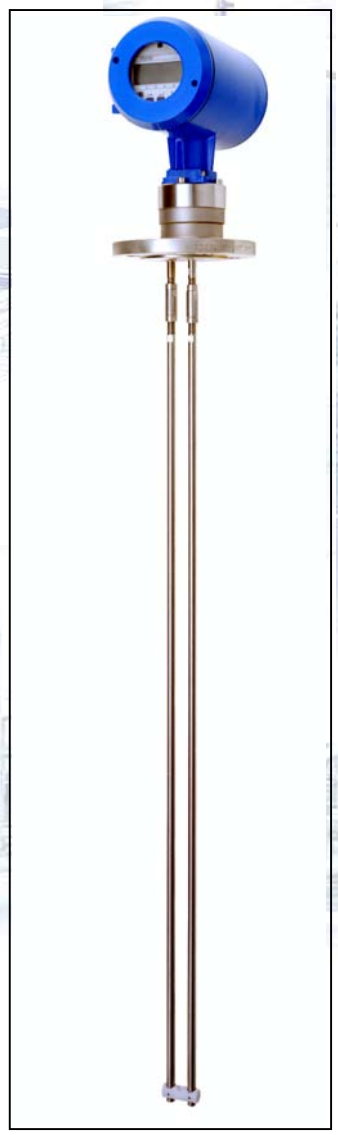
Supplementary Installation and Operating Instructions

BM 100 A



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General

These Instructions are supplementary to the ”Installation and Operating Instructions (Reference Manual) BM 100 A / BM 100EEX ”. The details given there, in particular the Safety Information, are valid and should be observed. These Supplementary Instructions provide only additional information for device operation and connection to a PROFIBUS-PA fieldbus.
Attention: Please set the controller to manual mode before changing parameters of the BM 100 A.

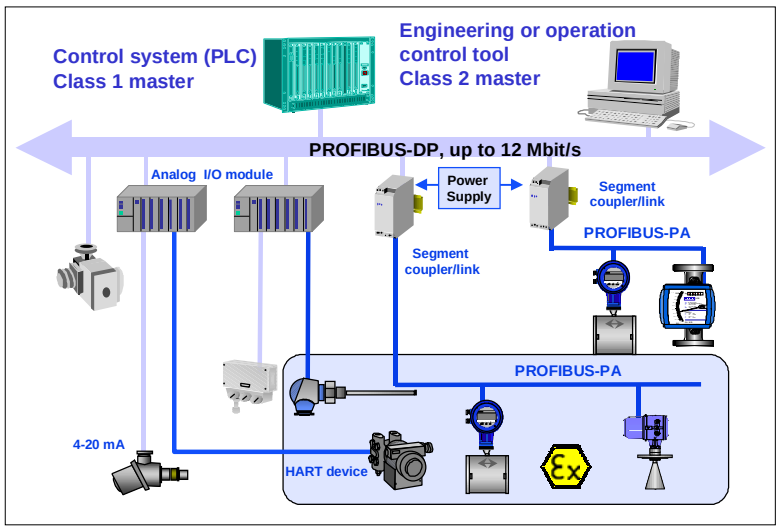
Items included with supply

In addition to the standard scope of supply, these Supplementary Instructions for the BM 100 A with PROFIBUS-PA interface plus a diskette with the available Profibus device data files (GSD files) of all KROHNE devices.

Software history

Issued	Signal converter		User program			Instructions	
month/year	Hardware	Firmware	Hardware	Operating system	Software	Device	User program
07/00	PROFIBUS-PA Module	2.02/000406				12/96+Supplement 07/00	

1. PROFIBUS-PA



The above diagram shows a typical instrumentation with PROFIBUS-PA devices in hazardous and non-hazardous locations, including connection of conventional devices (e.g. with 4-20mA signals) to the PROFIBUS-PA.
The PROFIBUS-PA is normally connected to a segment coupler which, among other things, carries out the conversion to the PROFIBUS-DP. Here, it needs to be noted in particular that the segment coupler is normally set to a fixed baud rate on the DP side.
Further information on the planning and operation of PROFIBUS-PA networks is to be found in the KROHNE brochure ”PROFIBUS-PA networks”.

1.1 PROFIBUS-PA - Services

The BM100A supports the following PROFIBUS services which have been defined in the PROFIBUS-PA-Profil V3.0:

1. DDLM_Set_Slave_Add
2. DDLM_Get_Cfg
3. DDLM_Set_Prm
4. DDLM_Chk_Cfg
5. DDLM_Slave_Diag
6. DDLM_Data_Exchange

Those services are able to set the PROFIBUS station address (1), to configure the data telegramm for the cyclic data exchange (3/4). The actual PROFIBUS configuration (2) and the Diagnostic data can be read (5).

The cyclic data exchange (6) allows to transmit the measurement data to a master. All measurement data are considered as virtuell modules of Type „Analog Input“ (AI).

1.2 Network Configuration

1.2.1 GSD file

All available GSD files of KROHNE devices – including those of the BM 100 A, of course - are supplied together with each device. The GSD contains information that is needed for project planning of the PROFIBUS-DP/PA communication network. The relevant data files must be loaded into the network configuration system before start-up of the bus system.
For example, the following applies to **COMET 200** or **COM PROFIBUS** from Siemens:

- all GSD files (*.GSD) into the directory of the GSD files, e.g. *\GSD
- all BMP files (*.BMP) into the directory of the bit maps, e.g. *\BITMAPS

In **STEP7,** the GSD file is automatically copied into the respective directory with “install new GSD”. After that, the bit map file must be copied into the directory *\SIEMENS\STEP7\S7data\Nsbmp. Following “catalog updating” the device can be placed in the project. This will then enable the cyclic communication (measured values and status).

1.2.2 Cyclic data exchange

During network configuration the user has to define which measurement values of the BM100A should be transfered cyclicly to the master. The following measurement data are available in this order:

1. Volume/Level * and Status
2. Level und Status
3. Distance and Status
4. Ullage Volume ** and Status
5. Interface Volume **/*** and Status
6. Interface Level *** and Status
7. Interface Distance *** and Status
8. Interface Layer *** and Status

(*) Volume will only be transmitted if the Volume Table has been programmed. If the Volume Table is missing both the first and second value (module) is Level.
(**) This module is only available if the Volume Table has been programmed. If the Volume Table is missing the value "Not_a_Number" will be transmitted. The status is "Bad-Out of Service".
(***) This module is only available if the Interface option has been activated in the device. If the Interface option is not available the value "Not_a_Number" (0x7FFFFFFF) will be transmitted. The status is "Bad-Out of Service".

Network configuration will be done by a master tool. using the GSD file. It is freely choosable which of the above mentioned measurement values (modules) should be transmitted cyclicly. All those measurement values which should be transmitted an Analog Input Function Block (AI-FB) should be assigned to. The code is 0x94. Some masters need the so called Extended Format. Please use 0x42, 0x84, 0x08, 0x05 instead of 0x94. Those measurement values which should not be transmitted an empty module has to be assigned to. The code is 0x00. All following modules will move one module (5 Bytes) forward. The order of modules remain the same. If for example Volume and Interface Level has been configured, 10 Bytes will be transmitted only.

Units
Independent from the units within the local operating display Level and Distance values will be transmitted in „m“ always. Depending from the volume table Volume will be transmitted as cubic metres (m3) or tons (t).

1.3 Meaning of measurement and status information

Each configured measurement value is a 4 Byte Float Format according IEEE Standard 754 Short Real Number. A status byte follows each measurement value. That means each measurement value consists of 4 byte value plus 1 byte status. Other measurement values will directly follow as 5 Byte package if configured.
First an example of the float format:

Float Format

Byte n								Byte n+1								Byte n+2								Byte n+3							
Bit7	Bit6							Bit7	Bit6							Bit7								Bit7							
VZ	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	2^{-1}	2^{-2}	2^{-3}	2^{-4}	2^{-5}	2^{-6}	2^{-7}	2^{-8}	2^{-9}	2^{-10}	2^{-11}	2^{-12}	2^{-13}	2^{-14}	2^{-15}	2^{-16}	2^{-17}	2^{-18}	2^{-19}	2^{-20}	2^{-21}	2^{-22}	2^{-23}
	Exponent								Mantissa								Mantissa								Mantissa							

Example: 40 F0 00 00 (hex) = 0100 0000 1111 0000 0000 0000 0000 0000 (binary)
Calculation: Value = $(-1)^{VZ} * 2^{(Exponent - 127)} * (1 + Mantissa)$
Value = $(-1)^{0} * 2^{(129 - 127)} * (1 + 2^{-1} + 2^{-2} + 2^{-3})$
Value = 1 * 4 * (1 + 0,5 + 0,25 + 0,125) = **7,5**

Status (1 Byte)

Quality		Quality-Substatus				Limits		
Gr	Gr	QS	QS	QS	QS	Qu	Qu	
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
0	0							= bad
0	1							= uncertain
1	0							= good (Non Cascade)

Status = bad								
0	0	0	0	0	1			= configuration error
0	0	0	0	1	1			= device failure
0	0	0	1	0	0			= sensor failure
0	0	0	1	1	1			= out of service

Status = uncertain								
0	1	0	0	0	1			= last usable value
0	1	0	0	1	1			= initial value (value before first measurement)
0	1	0	1	1	0			= sub-normal (appears if level or interface level has been frozen)

Status = good								
1	0	0	0	0	0			= ok
1	0	1	0	0	1			= maintenance required

Status = Limits								
						0	0	= ok
						0	1	= low limited
						1	0	= high limited
						1	1	= constant

Check the first two quality bits in order to get the quality information of the measurement value:

Good (non Cascade)	measurement value is ok and can be used without restrictions
Uncertain	measurement value can be used but the accuracy can not be guaranteed (e.g. measurement value has been frozen or A/D converter is saturated)
Bad	measurement value is bad don´t use it

The „Quality-Substatus“- and „Limit“-Bits can be used for further diagnostics or limit checking.

Attention: The status should be watched always because a valid number will be transmitted even if the status of the measurement is bad or uncertain. This is the only chance to check the meaning of the transmitted measurement values.

Diagnostics
If the device has detected an error, additional diagnostic information will be send to the master. The meaning of the additional information is described within the GSD file under UNIT_DIAG_BIT(i).

2. Electrical connection

For a detailed description please check the Installation and Operating Instructions manual of the device.

2.1 Interconnection of devices in the hazardous location

We recommend that a PROFIBUS-PA network in the hazardous location be projected in accordance with PTB's FISCO model (see KROHNE brochure "PROFIBUS-PA networks"). The FISCO-Model may be used, if:

- all electrical components which should be connected to the bus must be approved according the FISCO model (even the termination),
- the maximum cable length does not exceed 1000 m,
- the values of the cable are within the following ranges R´=15...150Ω/km; L´=0,4...1mH/km; C´=80...200nF/km,
- the approved input values of the field devices (Uo, Io, Po) are matchable with the output values of the power supply (e.g. segmment coupler) which menas $U_I \leq Uo$, $I_I \leq Io$ und $P_I \leq Po$.

2.2 Bus cable

Further limitations to the cable than the FISCO limitations are not existent. Nevertheless a twisted pair and shielded cable strongly recommended. The good quality cable could have the following data: 44Ω/km, <90nF/km, <3dB attenuation at 39kHz and 100 Ohm impedance at 31,25kHz.

2.3 Shielding and grounding

For optimum electromagnetic compatibility of systems it is extremely important that the system components, and particularly the bus cables connecting the components, be shielded and that such shields - if possible - form an unbroken cover, electrically speaking.
Hence it follows that, for use in non-hazardous duty systems , the cable shield should be grounded as often as possible.
In "Ex" systems an adequate equipotential bonding in the hazardous and non-hazardous location along the entire fieldbus installation is strongly recommended. Multiple grounding of the shield is also of advantage.

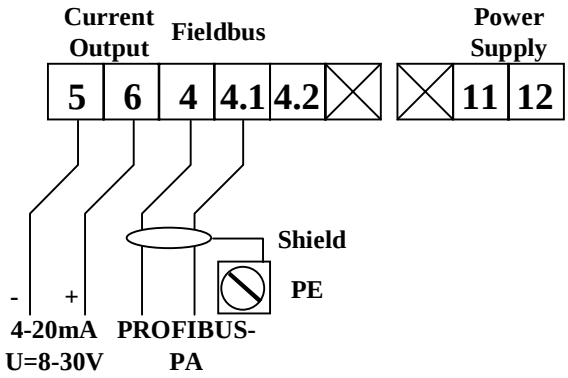
Note: The use of twisted and shielded cables is strongly recommended, otherwise EMC protection of the BM 100 A cannot be assured.

2.4 PROFIBUS-PA connection

Connect the bus cable as shown in the figure.

- Connect cable cores to terminals 4 and 4.1.
- Polarity reversal will not have any effect.
- The cable shield should be connected with minimum length to the ground PE.
- The equipotential bonding conductor must be connected to the device, if necessary via the outer U-clamp ground terminal.

PROFIBUS-PA with Current Output



3. Menu settings for PROFIBUS-PA

For a detailed description please check the Installation and Operating Instructions manual of the device. The following settings need to be made for operation of the BM 100 A on a PROFIBUS-PA network. Note that the service “set slave address” is not being supported. Therefore the address can only be set by way of the local display and operator interface.

Function (Fct.)	Input range		Description
1.6.1 BAUDRATE	Select	19200 Bd.	This is the baudrate of the internal communication interface of the device (not PROFIBUS-PA). The value must not be changed.
1.6.2 ADDRESS	Input	0 ... 126	Settings out of the range will be ignored. If out of range 126 will be used as default value. Address can be changed via local display or via Profibus.

The Profibus address can be changed via the Profibus service “Set_Slave_Address”. The input range is 0...125 according to the Profibus specification. Address 126 is the default address and cannot be set via Profibus.

4. Technical data, PROFIBUS Ident-No. EE01

Hardware		Software	
Physical	to IEC 61158-2 and the FISCO model	GSD	all KROHNE GSD files supplied on diskette
Bus characteristics	9... 30 V; 0.3 A max. ; 4.2 W max.	Device profile	complete implementation of Profile B, V2.0
Base current	10 mA	Functional blocks	level [m], distance [m], in addition volume [m^3] as cyclic value plus status mentioned units are default units
FDE	yes: separate fault disconnection electronics provided	Address range	0-126, default 126, “set slave address” not supported
Fault current	6 mA; (fault current = max. continuous current – base current)	Operator control	local display and operator interface at device
Starting current	lower than base current	SAP`s	1; typically the number of service access points is equal to the number of class 2 masters (operating tools) which can be operated simultaneously
”Ex” approval	EEx ia IIC T6 or EEx ib IIC/IIB T6 in conformity with the FISCO model		
Connection	independent of polarity		