Supplementary Installation and Operating Instructions

BM70 A / P

KROHNE Messtechnik GmbH & Co. KG · Ludwig-Krohne-Str. 5 · D-47058 Duisburg
Tel.: 0203-301 309 · Fax: 0203-301389 · e-mail: krohne@krohne.de

General

These Instructions are supplementary to the ”Installation and Operating Instructions (Reference Manual) BM 70 A/P” dated 5/98. 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 70 A/P.

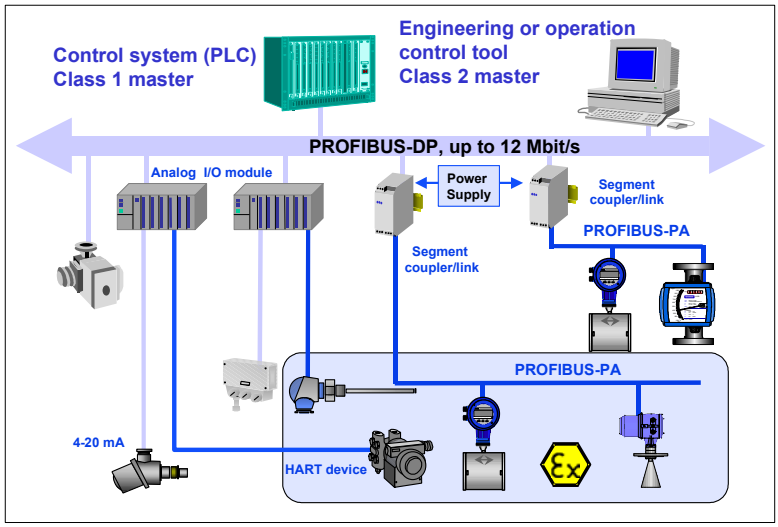
Items included with supply

In addition to the standard scope of supply, these Supplementary Instructions for the BM 70 A/P with PROFIBUS-PA interface plus a diskette with all available device master files of KROHNE devices.

Software history

Issued	Signal converter		User program			Instructions	
month/year	Hardware	Firmware	Hardware	Operating system	Software	Device	User program
09/98	PROFIBUS-PA Module	1.00				05/98+Supplement 09/98	
05/99	PROFIBUS-PA Module	3.01/990519	PC	Windows 95, 98, NT 4.0	PDM ≥ V4.1.1(12.99)	05/98+Supplement 05/99, 08/99, 12/99	
02/00	PROFIBUS-PA Module+Device	3.03/991231	PC	Windows 95, 98, NT 4.0	PDM ≥ V4.1.1(12.99)	05/98+Supplement 02/00	
07/00	PROFIBUS-PA Module+Device	3.03/000622	PC	Windows 95, 98, NT 4.0	PDM ≥ V4.1.1(12.99)	05/98+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 GSD

All available GSD files of KROHNE devices – including those of the BM 70 A/P, 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 project planning system/master 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” (in the HW-Config Menu: EXTRAS). After that, the bit map 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 PROFIBUS-PA profile

The BM 70 A/P supports the PROFIBUS-PA profile Version 2.0. Additionally, all parameters in the device are offered via the PROFIBUS-PA interface. Within the BM 70 A/P, the following blocks are included:

- Two Function Blocks (FB) Analog Input (AI) plus Volume:
  Level (default unit “m”) - Function Block AI
  Distance (default unit „m“) - Function Block AI
  Volume (default unit „m^3“) - as cyclic value
  Changing the unit
  A change of the unit can be done only via the PROFIBUS by an operating tool. The units for level and distance are realised according to the Profile 2.0. It can be changed via an operating tool which supports Profile 2.0.
  The volume unit can be changed via the acyclic parameter in Slot 1, Index 175. Therefore an operating tool which supports slot and index addressing is needed. Another possibility is to use the PDM tool from Siemens because the BM 70 A/P has been integrated completely.
  Volume table
  The volume table is being used to calculate the volume by using the level plus a conversion table called volume table. This volume table has to be integrated into the BM 70 A/P. The calculated volume value is available as a cyclic value plus status. The volume table can be written to the device only by KROHNE because PROFIBUS doesn´t support this feature at the moment.
- One transducer block for Level
  This block provides the parameters defined in Profile 2.0.
- One physical block
  This block contains the parameters defined in Profile 2.0, and also all device-specific parameters in the form of an appendix.

1.3 Meaning of measurement and status information

During integration of the KROHNE device into the PROFIBUS master you can choose which values should be transferred via PROFIBUS. This can be done by using the GSD file. Each value which is a 4 Byte Float Format according IEEE Standard 754 Short Real Number a status byte follows. 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 during integration. Below the meaning of the float format and the status byte is described:

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**

Meaning of the status byte (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)
1	1							= good (Cascade) - not supported

Status = bad								
0	0	0	0	0	0			= non-specific
0	0	0	0	0	1			= configuration error
0	0	0	0	1	0			= not connected
0	0	0	0	1	1			= device failure
0	0	0	1	0	0			= sensor failure
0	0	0	1	0	1			= no communication (last usable value)
0	0	0	1	1	0			= no communication (no usable value)
0	0	0	1	1	1			= out of service

Status = uncertain								
0	1	0	0	0	0			= non-specific
0	1	0	0	0	1			= last usable value
0	1	0	0	1	0			= substitute-set
0	1	0	0	1	1			= initial value
0	1	0	1	0	0			= sensor conversion not accurate
0	1	0	1	0	1			= engineering unit violation (unit not in the valid set)
0	1	0	1	1	0			= sub-normal
0	1	0	1	1	1			= configuration error

Status = good (Non-Cascade)								
1	0	0	0	0	0			= ok
1	0	0	0	0	1			= active block alarm
1	0	0	0	1	0			= active advisory alarm (priority < 8)
1	0	0	0	1	1			= active critical alarm (priority > 8)
1	0	0	1	0	0			= unacknowledged block alarm
1	0	0	1	0	1			= unacknowledged advisory alarm
1	0	0	1	1	0			= unacknowledged critical alarm
1	0	1	0	0	0			= initiate fail safe
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
Good (Cascade)	not supported because it´s not applicable for measurement devices

Diagnostics

If the device has been 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 (see Section 7.8 in the Installation and Operating Instructions)

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 $U_I \leq U_o$, $I_I \leq I_o$ und $P_I \leq P_o$.

2.2 Bus cable

Further limitations to the cable than the FISCO limitations are not existent. Nevertheless a twisted pair and shielded cable is 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

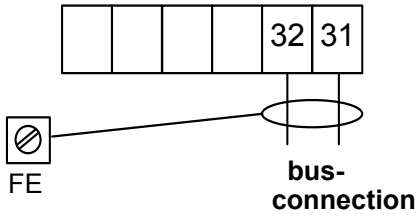
For optimum electromagnetic compatibility of systems it is extremely important that the system components, and particularly the bus cables connecting the components, be shielded and that such shields - if possible - form an unbroken cover, electrically speaking.
Hence it follows that, for use in non-hazardous 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 70 A/P cannot be assured.

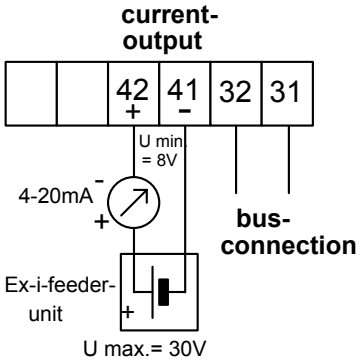
2.4 PROFIBUS-PA connection

Connect the bus cable as shown in the figure.

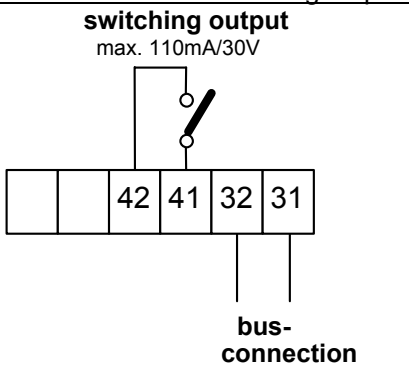
- Connect cable cores to terminals 31 and 32.
- Polarity reversal will not have any effect.
- The cable shield should be connected with minimum length to the functional ground FE.
- The equipotential bonding conductor must be connected to the device, if necessary via the outer U-clamp ground terminal.



PROFIBUS-PA with current output:



PROFIBUS-PA with switching output:



3. Menu settings for PROFIBUS-PA (see Section 8.4 in the Installation and Operating Instructions)

The following settings need to be made for operation of the BM 70 A/P 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	Default value	Description
3.3.5 BAUDRATE	Select 31250 Bd.	31250 Bd.	If Fct. 3.3.7 is set to ”PROFIBUS”, the baud rate is fixed at 31250 Bd.
3.3.6 ADDRESS	Input 0 ... 126	126	If Fct. 3.3.7 is set to ”PROFIBUS”, the default value of the address is 126.
3.3.7 PROTOCOL	Select HART KROHNE/PC PROFIBUS	PROFIBUS	Selection of the communications protocol. Set to PROFIBUS when delivered. (only when appropriate hardware provided)

4. Technical data, PROFIBUS Ident-No. F901

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		
Fault current	6 mA; (fault current = max. continuous current – base current)	Address range	0-126, default 126, “set slave address” not supported
Starting current	lower than base current	Operator control	local display and operator interface at device
”Ex” approval	EEx ia IIC T6 or EEx ib IIC/IIB T6 in conformity with the FISCO model	SAP`s	1; typically the number of service access points is equal to the number of class 2 masters (operating tools)
Connection	independent of polarity		