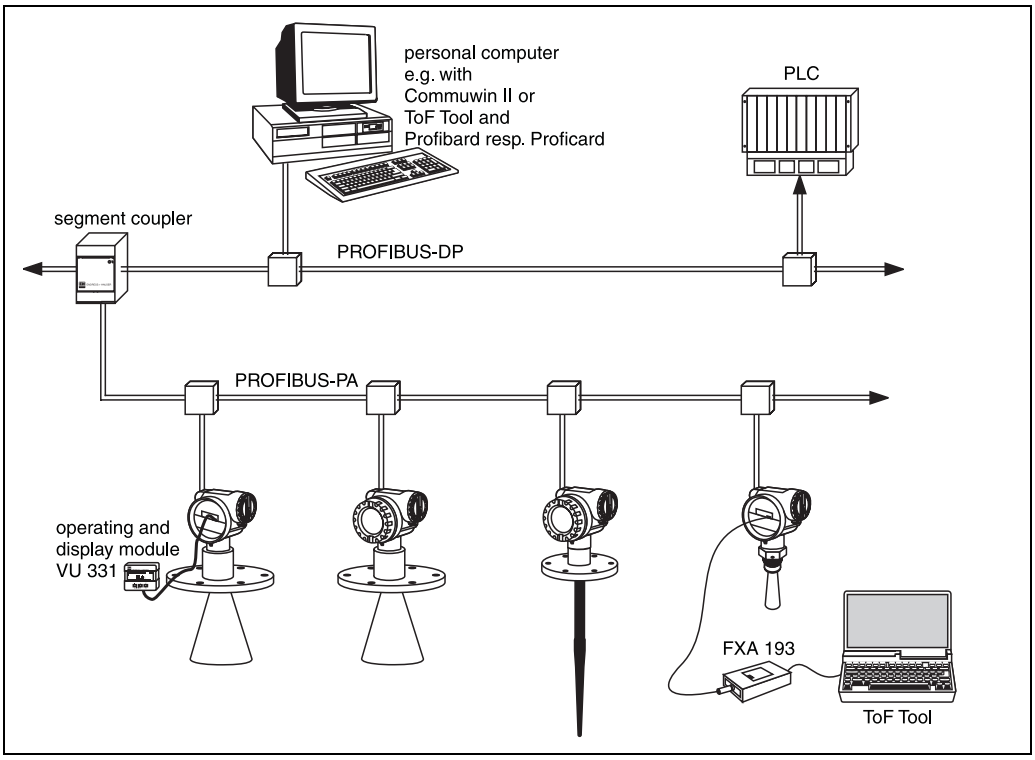
1 Synopsis



A maximum of 32 transmitters can be connected to the bus (only 8 in explosion hazardous areas EEx ia IIC according to the FISCO model). The bus power is supplied by the segment coupler. On-site- as well as remote operation are possible. For detailed information on the PROFIBUS-PA standard refer to Operation Instructions BA 198F/00/de and the standards EN 50 170/DIN 19 245 (PROFIBUS-PA) and EN 50 020 (FISCO model).

2 Device address

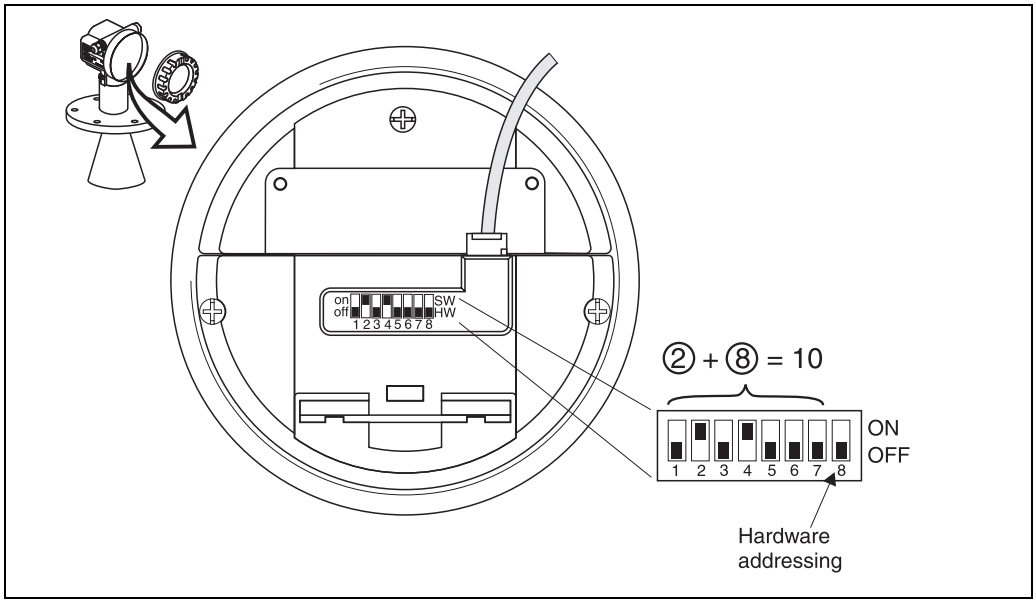
Selecting the device address

- Every PROFIBUS-PA device must be given an address. If the address is not set correctly, the device will not be recognised by the process control system.
- A device address may appear only once within a particular PROFIBUS-PA network, see BA 198F.
- Valid device addresses are in the range 1 and 126. All devices are delivered from the factory with the software address 126.
- The default address can be used to check the function of the device and connect it to an operating PROFIBUS-PA system. Afterwards the address must be changed to allow other devices to be connected to the network.

Software addressing

Software addressing comes into operation, when DIP-switch 8 is in the position "ON". BA 198F/00/en, chap. 5.7 describes, how to set the address in this case.

Hardware addressing



Hardware addressing comes into operation, when DIP switch 8 is in the position "OFF". In this case the address is determinded by the position of DIP-switches 1 to 7 according to the following table:

Switch No.	1	2	3	4	5	6	7
Value in position "OFF"	0	0	0	0	0	0	0
Value in Position "ON"	1	2	4	8	16	32	64

The new address becomes valid 10 seconds after switching.

3 Device database and type files

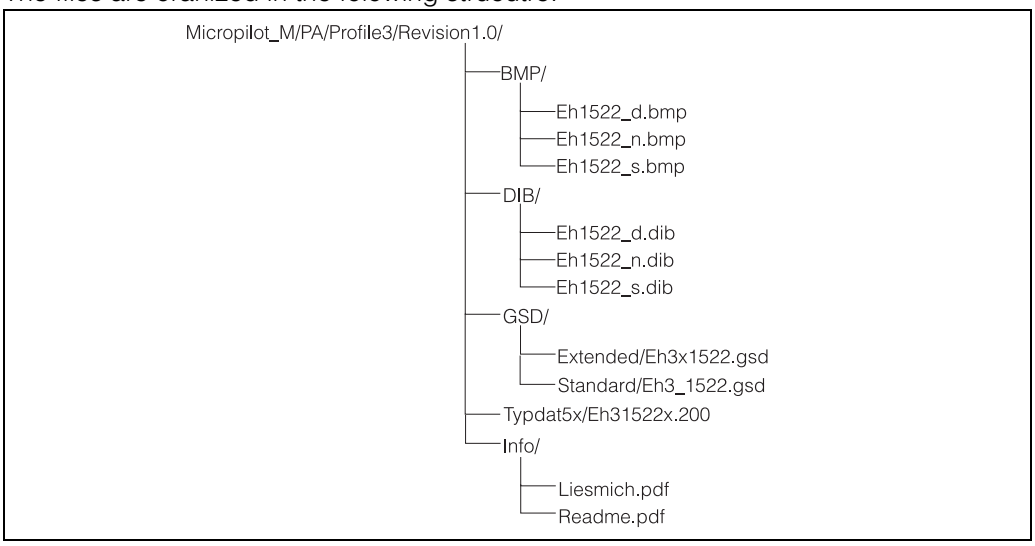
A device database file (GSD) contains a description of the properties of the PROFIBUS-PA device, e.g. the supported transmission rates and the type and format of the digital information output to the PLC.
Additional bitmap files are required in order to represent the device by an icon in the network design software.
Every device is allocated an identity code by the PROFIBUS User Organisation (PNO). This appears in the device data base file name (.gsd). The Micropilot M has the ID number 1522.

Source of supply
- The GSD-files are available from the following internet address.

ftp://194.196.152.203/pub/communic/gsd/MICROPILOT_M.EXE

- CD-ROM with GSD files for all E+H devices. Order-Code: 50097200
- GSD library of the PROFIBUS User Organisation (PNO):http: //www.PROFIBUS.com

Directory structure
The files are oranized in the folowing strucutre:

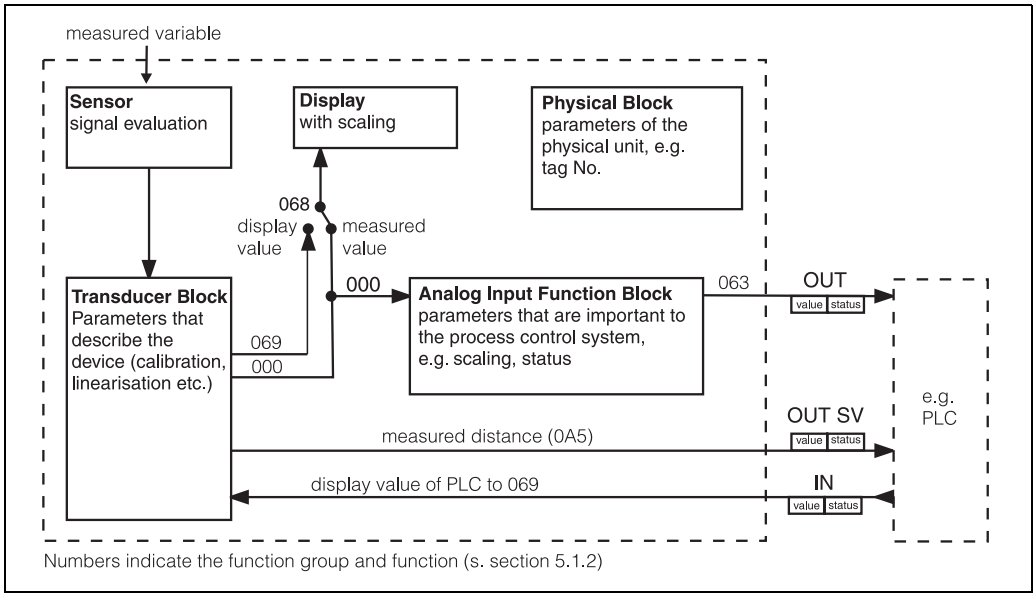


- The GSD files in the directory "Extended" are needed for the network design software STEP 7 of the S7-300/400 PLC family.
- The GSD files in the directory "Standard" are used for PLCs, which do not support an identifier format but only an identifier byte (e.g. PLC5 of Allen-Bradley)
- For the network design tool COM ET200 with Siemens S5 instead of an GSD file the Type file "EH_1522x.200" and instead of the BMP files the DIB files have to be used.

Universal Database File
The PNO also provides an universal database file with the designation PA139700.gsd for devices with one analogue input block. Should this be used instead of the Micropilot M file, then only the process value can be transmitted. The functions secondary and display value are not supported.
The universal profile must also be selected in the function "Ident number (061).

4 Cyclic data exchange

Block model of the Micropilot M FMR 230



The block model shows, which data are exchanged continously (i.e. by cyclic data transfer) between the Micropilot M and the PLC. The numbers refer to the function groups and function.

- After linearization and integration in the transducer block the **"measured value" (000)** is transmitted to the Analog-Input Block. There, it may be scaled and checked for limit transgression, and is written out to the PLC. The parameters of the Analog-Input Block are not available when operating via ToF Tool.
- The function **"select V0H0" (068)** determines, if the main value, or a read in value from the PLC is shown on the display in the field for the main value.
- The **"measured distance" (0A5)** is written out to the PLC as the secondary cyclic value.

Configuration

The data exchange is configured in the network design tool and Commuwin II.

1. Using the network design tool for your PLC, add the Micropilot M to the network, taking care that the address assigned corresponds to that set at the device.
2. Select the Micropilot M and call up the configuration tool: four options appear:
   - "Main Process Value"
   - "2nd Cyclic Value",
   - "Display Value",
   - "FREE PLACE"
3. Select "Main Process Value". If no other values are required, close the configuration window, otherwise
4. Select "2nd Cyclic Value" or "FREE PLACE" (= function deactivated) **and** select "Display Value" or "FREE PLACE" (= function deactivated). Then close the configuration window.
5. Start ToF Tool resp. Commuwin II and open the connection using the PA DPV1 server. Generate a live list, locate the device address and click on "Micropilot M".
6. If a display value is to be shown at the device in the field for the main value, set **"select V0H0" (068)** to "display value" or, if using Commuwin II, set V6H5 = 1 .

Micropilot M → SPS (Input Data)Micropilot M → PLC
A PLC can read the input data of Micropilot M from the response telegram of the Data_Exchange service. The cyclic data telegram has the following structure:

Index Input-Data	Data	Access	Format/Remarks
0, 1, 2, 3	Main value (level)	read	32 bit floating point number (IEEE-754)
4	Status code for main value	read	see "Status codes" (see page 6)
5, 6, 7, 8	Secondary value (measured distance)	read	32 bit floating point number (IEEE-754)
9	Status code for secondary value	read	see "Status codes" (see page 6)

SPS → Micropilot M (Output Data)
The output data from the PLC for the local display are structured as follows:

Index Output-Data	Data	Access	Format/Remarks
0, 1, 2, 3	Display value	write	32 bit floating point number (IEEE-754)
4	Status code for Display value	write	see "Status codes" (see page 6)

IEEE-745 Floating Point Number
The measured value is transmitted as a IEEE 754 floating point number, whereby

Measured value = $(-1)^S \times 2^{(E-127)} \times (1+F)$

Byte 1								Byte 2							
Bit 7	Bit 6	Bit5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Sign (S)	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}
	Exponent (E)							Mantissa (F)							

Byte 3								Byte 4							
Bit 7	Bit 6	Bit5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
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}
Mantissa (F)															

Example

40 F0 00 00 (hex) = 0**100 0000 1**111 0000 0000 0000 0000 0000 (bin)

$= (-1)^0 \times 2^{(129 - 127)} \times (1 + 2^{-1} + 2^{-2} + 2^{-3})$

$= 1 \times 2^2 \times (1 + 0.5 + 0.25 + 0.125)$

$= 1 \times 4 \times 1.875$

$= 7.5$

Stauts codes

The status codes comprise one byte and have got the following meaning:

Status-Code	Device status	Significance	Primary value	Secondary value
00 Hex	BAD	non-specific	x	x
1F Hex	BAD	out-of-service (target mode)	x	
40 Hex	UNCERTAIN	non-specific (simulation)	x	x
47 Hex	UNCERTAIN	last usable value (Fail-safe-Mode aktiv)	x	
48 Hex	UNCERTAIN	Ersatzmenge (fail-Safe mode active)	x	
4C Hex	UNCERTAIN	initial value (fail-Safe mode active)	x	
5C Hex	UNCERTAIN	Configuration error (limits not set correctly)	x	
80 Hex	GOOD	OK	x	x
84 Hex	GOOD	Active block alarm (static revision counter incremented)	x	
89 Hex	GOOD	LOW_LIM (alarm active)	x	
8A Hex	GOOD	HI_LIM (alarm active)	x	
8D Hex	GOOD	LOW_LOW_LIM (alarm active)	x	
8E Hex	GOOD	HI_HI_LIM (alarm active)	x	

If a stauts other than "GOOD" is sent to the device, the display indicates an error.

5 Acyclic data exchange

The device parameters in the physical block, transducer block and analog input block, as well as the device management can be accessed by a Class 2 PROFIBUS-DP master (e.g. Commuwin II) using the acyclic data services.

Slot/index tables
The device parameters are listed in the following tables. The parameters are accessed via the slot and index number. Slot 2 obnly contains service parameters and is not included in the table.
The Analog-Input and physical blocks contain standard parameters, block parameters and manufacturer-specific parameters. The transducer block is E+H specific.
The parameters of the Analog-Input block are not available when operating via the display or via ToF Tool

Device Management

Parameter	E+H Matrix	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
Directory object header		1	0	12	Array of UNSIGNED16	x		constant
Composite list directory entries		1	1	24	Array of UNSIGNED16	x		constant
GAP Directory continuous		1	2-8					
GAP reserved		1	9-15					

Analog-Input-block

Parameter	E+H Matrix	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
Standard parameters								
Block Data		1	16	20	DS-32	x		constant
Static revision		1	17	2	UNSIGNED16	x		non-vol.
Device tag		1	18	32	OSTRING	x	x	static
Strategy		1	19	2	UNSIGNED16	x	x	static
Alert key		1	20	1	UNSIGNED8	x	x	static
Target Mode		1	21	1	UNSIGNED8	x	x	static
Mode		1	22	3	DS-37	x		dynamic non-vol. constant
Alarm summary		1	23	8	DS-42	x		dynamic
Batch		1	24	10	DS-67	x	x	static
Gap		1	25					
Block parameters								
Out	V6H2 (Wert) V6H3 (Status)	1	26	5	DS-33	x		dynamic
PV Scale	V0H5 V0H6	1	27	8	Array of FLOAT	x	x	static
Out Scale		1	28	11	DS-36	x	x	static
Linearisation type		1	29	1	UNSIGNED8	x	x	static
Channel		1	30	2	UNSIGNED16	x	x	static
Gap		1	31					
PV fail safe time		1	32	4	FLOAT	x	x	non-vol.
Fail safe type		1	33	1	UNSIGNED8	x	x	static
Fail safe value		1	34	4	FLOAT	x	x	static
Alarm Hysteresis		1	35	4	FLOAT	x	x	static

Parameter	E+H Matrix	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
Gap		1	36					
HI HI Limit		1	37	4	FLOAT	x	x	static
Gap		1	38					
HI Limit		1	39	4	FLOAT	x	x	static
Gap		1	40					
LO Limit		1	41	4	FLOAT	x	x	static
Gap		1	42					
LO LO Limit		1	43	4	FLOAT	x	x	static
Gap		1	44-45					
HI HI Alarm		1	46	16	DS-39	x		dynamic
HI Alarm		1	47	16	DS-39	x		dynamic
LO Alarm		1	48	16	DS-39	x		dynamic
LO LO Alarm		1	49	16	DS-39	x		dynamic
Simulate		1	50	6	DS-51	x	x	non-vol.
Out unit text		1	51	16	OSTRING	x	x	static
Gap reserved		1	52-50					
AI Block View 1		1	61	18	OSTRING	x		dynamic
Gap		1	62-64					

Phy sical block

Parameter	E+H Matrix	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
Standard parameters								
Block Data		1	65	20	DS-32	x		constant
Static revision		1	66	2	UNSIGNED16	x		non-vol.
Device tag	VAH0	1	67	32	OSTRING	x	x	static
Strategy		1	68	2	UNSIGNED16	x	x	static
Alert key		1	69	1	UNSIGNED8	x	x	static
Target mode		1	70	1	UNSIGNED8	x	x	static
Mode		1	71	3	DS-37	x		dynamic non-vol. constant
Alarm summary		1	72	8	DS-42	x		dynamic
Block parameters								
Software revision		1	73	16	OSTRING	x		constant
Hardware revision		1	74	16	OSTRING	x		constant
Device manufacturer ID		1	75	2	UNSIGNED16	x		constant
Device ID		1	76	16	OSTRING	x		constant
Device serial number		1	77	16	OSTRING	x		constant
Diagnosis		1	78	4	OSTRING	x		dynamic
Diagnosis extension		1	79	6	OSTRING	x		dynamic
Diagnosis mask		1	80	4	OSTRING	x		constant
Diagnosis mask ext.		1	81	6	OSTRING	x		constant
Device certification		1	82	32	OSTRING	x	x	non-vol.
Security locking	V9H9	1	83	2	UNSIGNED16	x	x	non-vol.
Factory reset	V9H5	1	84	2	UNSIGNED16		x	non-vol.
Descriptor		1	85	32	OSTRING	x	x	static
Device message		1	86	32	OSTRING	x	x	static
Device instal. data		1	87	8	OSTRING	x	x	static
Gap reserved		1	88					

Parameter	E+H Matrix	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
Ident number select	V6H0	1	89	1	UNSIGNED8	x	x	static
HW write protection		1	90	1	UNSIGNED8	x	x	static
Gap reserved		1	91-97					
Gap		1	98-102					
E+H parameters								
Matrix error code	V9H0	1	103	2	UNSIGNED16	x		dynamic
Matrix last error code	V9H1	1	104	2	UNSIGNED16	x	x	dynamic
Up Down features		1	105	1	OSTRING	x	x	constant
Up Down control		1	106	1	UNSIGNED8		x	dynamic
Up Down data		1	107	20	OSTRING	x	x	dynamic
Bus address	V9H4	1	108	1	UNSIGNED8	x		dynamic
Matrix dev. softw. numb.	V9H3	1	109	2	UNSIGNED16	x		dynamic
PA set unit to bus	V6H1	1	110	1	UNSIGNED8	x	x	static
PA input value	V6H6	1	111	6	FLOAT+U8+U8	x	x	dynamic
PA select main value	V6H5	1	112	1	UNSIGNED8	x	x	dynamic
PA profile revision	V6H7	1	113	16	OSTRING	x		constant
Gap		1	114-118					
Gap reserved		1	119 - 125					
Phys. Block View 1		1	126	17	OSTRING	x		dynamic
Gap		1	127-129					

E+H specific level transducer block

Parameter	E+H Matrix	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
Standard parameter								
Block data		1	130	20	DS-32	x		const.
Static revision		1	131	2	UNSIGNED16	x		non-vol.
Device tag		1	132	32	OSTRING	x	x	static
Strategy		1	133	2	UNSIGNED!&	x	x	static
Alert key		1	134	1	UNSIGNED8	x	x	static
Target mode		1	135	1	UNSIGNED8	x	x	static
Mode		1	136	3	DS-37	x		dynamic non-vol. static
Alarm summary		1	137	8	DS-42	x		dynamic
E+H parameters								
Measured value	V0H0	1	138	4	FLOAT	x		dynamic
gap			139					
tank shape	V0H2	1	140	1	UNSIGNED8	x	x	static
medium cond.	V0H3	1	141	1	UNSIGNED8	x	x	static
process cond.	V0H4	1	142	1	UNSIGNED8	x	x	static
empty calibration	V0H5	1	143	4	FLOAT	x	x	static
full calibration	V0H6	1	144	4	FLOAT	x	x	static
pipe diameter	V0H7	1	145	4	FLOAT	x	x	static
gap			146 - 147					
output on alarm	V1H0	1	148	1	UNSIGNED8	x	x	static
gap			149					
outp. echo loss	V1H2	1	150	1	UNSIGNED8	x	x	static
ramp %span/min	V1H3	1	151	4	FLOAT	x	x	static
delay time	V1H4	1	152	2	UNSIGNED16	x	x	static

Parameter	E+H Matrix	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
safety distance	V1H5	1	153	4	FLOAT	x	x	static
in safety dist.	V1H6	1	154	1	UNSIGNED8	x	x	static
ackn. alarm	V1H7	1	155	1	UNSIGNED8	x	x	static
overspill protection	V1H8	1	156	1	UNSIGNED8	x	x	static
gap			157 - 167					
level/ullage	V3H0	1	168	1	UNSIGNED8	x	x	static
linearisation	V3H1	1	169	1	UNSIGNED8	x	x	static
customer unit	V3H2	1	170	1	UNSIGNED16	x	x	static
table no.	V3H3	1	171	1	UNSIGNED8	x	x	static
gap		1	172					
input volume	V3H5	1	173	4	FLOAT	x	x	static
max. scale	V3H6	1	174	4	FLOAT	x	x	static
diameter vessel	V3H7	1	175	4	FLOAT	x	x	static
check distance	V4H1	1	179	1	UNSIGNED8	x	x	static
range of mapping	V4H2	1	180	4	FLOAT	x	x	static
start mapping	V4H3	1	181	1	UNSIGNED8	x	x	static
pres. map. dist.	V4H4	1	182	4	FLOAT	x		dynamic
cust. Tank map	V4H5	1	183	1	UNSIGNED8	x	x	static
echo quality	V4H6	1	184	1	UNSIGNED8	x		dynamic
offset	V4H7	1	185	4	FLOAT	x	x	static
output damping	V4H8	1	186	4	FLOAT	x	x	static
blocking dist.	V4H9	1	187	4	FLOAT	x	x	static
instrument_addr.	V5H0	1	188	1	UNSIGNED8	x		dynamic
ident number	V5H1	1	189	1	UNSIGNED8	x	x	static
set unit to bus	V5H2	1	190	1	UNSIGNED8	x	x	static
out value	V5H3	1	191	4	FLOAT	x		dynamic
out status	V5H4	1	192	1	UNSIGNED8	x		dynamic
simulation	V5H5	1	193	1	UNSIGNED8	x	x	static
gap		1	194					
2nd cyclic value	V5H7	1	195	1	UNSIGNED8	x	x	static
select V0H0	V5H8	1	196	1	UNSIGNED8	x	x	static
input value	V5H9	1	197	4	FLOAT	x		dynamic
gap		1	198					
display contrast	V6H1	1	199	1	UNSIGNED8	x	x	static
language	V6H2	1	200	1	UNSIGNED8	x	x	static
back to home	V6H3	1	201	2	INT16	x	x	static
format display	V6H4	1	202	1	UNSIGNED8	x	x	static
no. decimals	V6H5	1	203	1	UNSIGNED8	x	x	static
sep. character	V6H6	1	204	1	UNSIGNED8	x	x	static
display test	V6H7	1	205	1	UNSIGNED8	x	x	static
gap		1	206 - 227					
present error	V9H0	1	228		STRUCT	x		dynamic
previous error	V9H1	1	229		STRUCT	x		dynamic
clear last error	V9H2	1	230	1	UNSIGNED8	x	x	static
reset	V9H3	1	231	2	UNSIGNED16	x	x	static
unlock parameter	V9H4	1	232	2	UNSIGNED16	x	x	static
measured dist.	V9H5	1	233	4	FLOAT	x		dynamic
measured level	V9H6	1	234	4	FLOAT	x		dynamic
gap		1	235					

Parameter	E+H Matrix	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
application par.	V9H8	1	236	1	UNSIGNED8			dynamic
gap		1	237					
tag no.	VAH0	1	238		STRING	x		const
profile version	VAH1	1	239		STRING	x	x	static
protocol+sw-no.	VAH2	1	240		STRING	x		const
gap		1	241					
serial no.	VAH4	1	242		STRING	x	x	static
distance unit	VAH5	1	243	2	UNSIGNED16	x	x	static
gap		1	244 - 245					
download mode	VAH8	1	246	1	UNSIGNED8	x	x	static
gap		1	247					
input level semi auto	V3H4	1	248	4	FLOAT	x		dynamic
input level manual	V3H4	1	249	4	FLOAT	x	x	static
simulation level	V5H6	1	250	4	FLOAT	x	x	static
simulation volume	V5H6	1	251	4	FLOAT	x	x	static
TB view_1		1	252	22	OSTRING	x	x	static

Data strings

In der Slot/Index table some data types, e.g. DS-33 are marked by an asterisk. These are data strings according to the PROFIBUS-PA specifications part 1, Version 3.0. They contain several elements, which are addressed by an additional subindex. The following table gives an example.

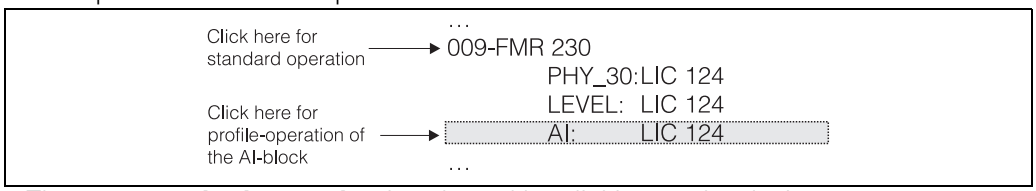
Data type	Subindex	Typ	Size [bytes]
DS-33	1	FLOAT	4
	5	UNSIGNED8	1

6 Parameter access via Commuwin II

The block parameters can be accessed by a PROFIBUS-DP Class 2 master, for example, Commuwin II. Commuwin II runs on an IBM-compatible computer or laptop. The computer must be equipped with a PROFIBUS interface, i.e. PROFIBOARD for PCs and PROFICARD for laptops. During the system integration, the computer is registered as a Class 2 master.

Connection
- Profiboard for connection to a Laptop
- Proficard for connection to a PC

Generating the device list
- The PA-DPV1 server must be installed. The connection to Commuwin II is opened selecting the PA-DPV1 server in the "Open connection" function in the "Connect" menu. The empty device list appears.
- The function "Display with tags" in the "Connect" menu generates the live list with measuring point tags.
- Two operation modes are possible:



- The **E+H standard operation** is selected by clicking on the device name
- The **profile operation** is selected by clicking on the tag for the appropriate block (e.g. "AI: LIC 124" for the Analog-Input block of the Micropilot M)
- The settings are entered in the device menu.

Device menu
The device menu allows matrix or graphical operation to be selected.

- In the case of **matrix operation**, the device or profile parameters are displayed in a matrix. For the standard operation this is the E+H standard matrix. For the profile operation this is the matrix of the selected blockA parameter can be changed when the corresponding matrix field is selected.
- In the case of **graphical operation**, the operating sequence is shown in a series of templates with parameters. For profile operation, the pictures Diagnosis, Scaling, Simulation and Block are of interest.

Note!
The Micropilot M can also be operated locally using the keys. If operation is prevented by the keys being locked locally, parameter entry via communication is not possible either.

Note!
Further information on Commuwin II is given in the following E+H documentation:
- System Information: SI 018F/00/en “Commuwin II”
- Operating Manual: BA 124F/00/en “Commuwin II” operating program

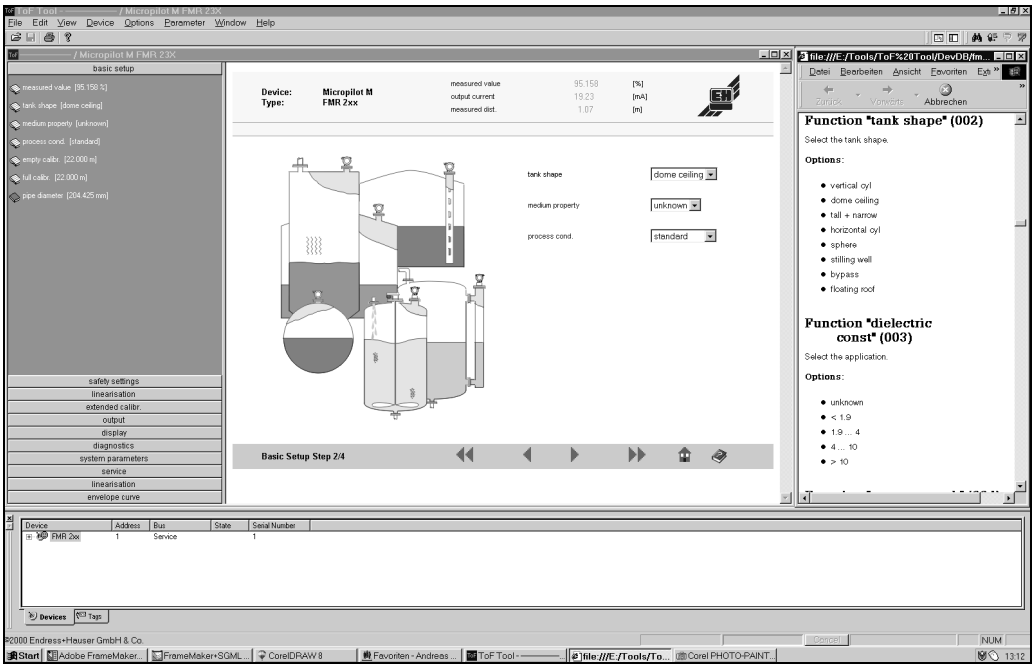
7 Parameter access via ToF Tool

The ToF Tool is a graphical operating software for instruments from Endress+Hauser that operate based on the time-of-flight principle. It is used to support commissioning, securing of data, signal analysis and documentation of the instruments. It is compatible with the following operating systems: Win95, Win98, WinNT4.0 and Win2000.
The ToF Tool supports the following functions:
- Online configuration of transmitters
- Signal analysis via envelope curve
- Loading and saving of instrument data (Upload/Download)
- Documentation of measuring point

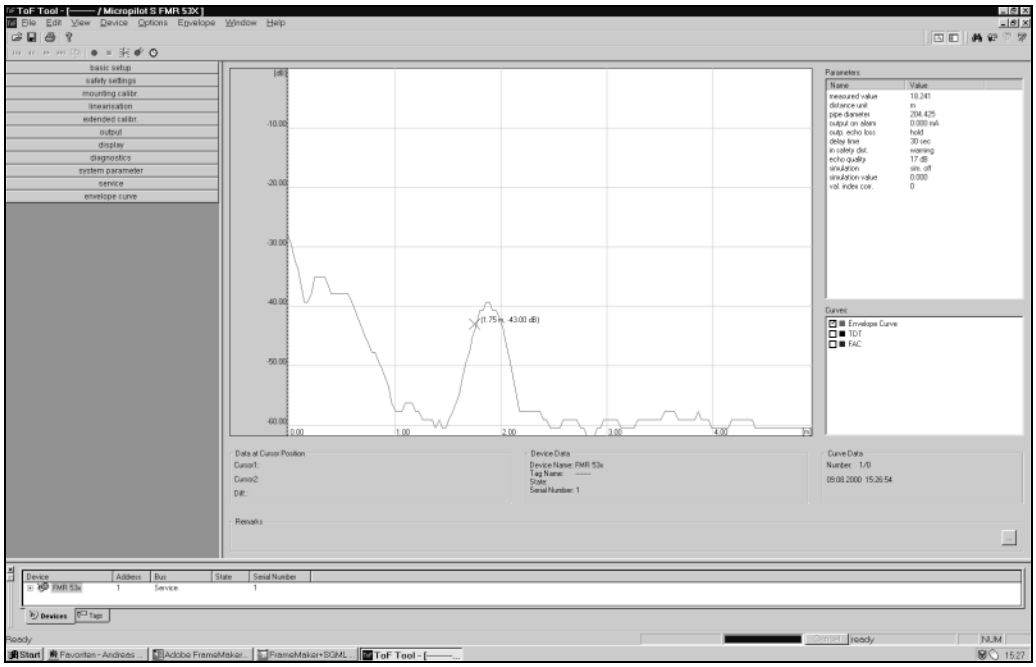
Note!
The parameters of the Analog-Input block are presently not accessible via ToF Tool.

Note!
Further information you may find on the CD-ROM, which is enclosed to the instrument.

Menu-guided commissioning



Signal analysis via envelope curve:



Connection options:
- Profiboard for connection to a Laptop
- Proficard for connection to a PC

Note!
The Micropilot M can also be operated locally using the keys. If operation is prevented by the keys being locked locally, parameter entry via communication is not possible either.