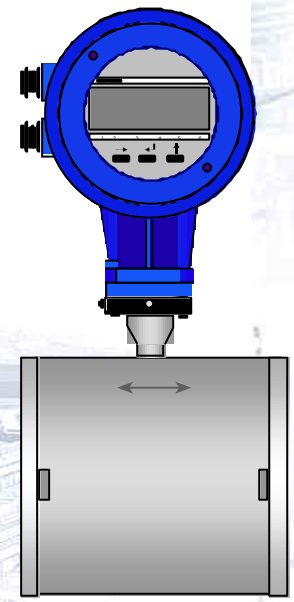
Supplementary Installation and Operating Instructions

UFC030 (UFC 3 Beam)



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CONTENTS:

1 General

These Instructions are supplementary to the "Installation and Operating Instructions (Reference Manual) UFC030 (UFC 3 Beam)". 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.

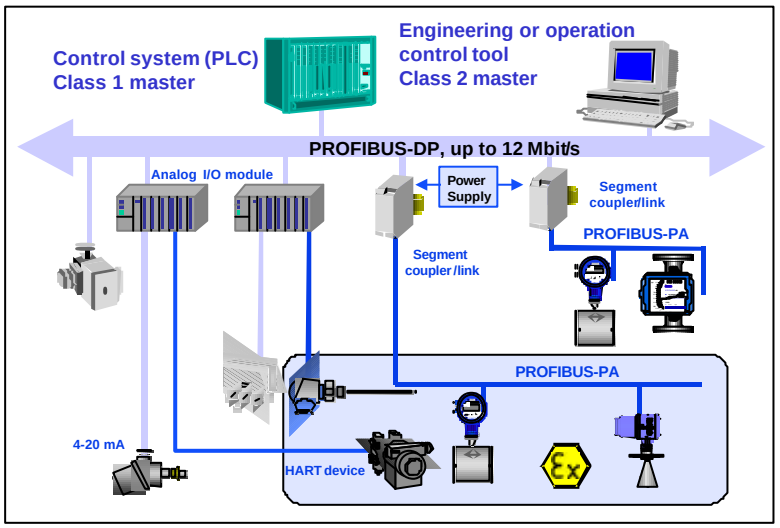
2 Items included with supply

In addition to the standard scope of supply, these Supplementary Instructions for the UFC030 with PROFIBUS-PA interface plus a diskette containing all PROFIBUS device data files (GSD files) available of all KROHNE devices will be included.

3 Software history

Issued	Signal converter		User program			Instructions	
month/year	Hardware	Firmware	Hardware	Operating system	Software	Device	User program
10/03	PROFIBUS-PA Module+Device	MOD3 /031010	PC	Windows 95, 98, NT 4.0, ME, 2000	PDM ≥ V 5.2	--	--

4 PROFIBUS-PA



The diagram above shows a typical instrumentation with PROFIBUS-PA devices in hazardous and non-hazardous locations, including connections 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".

4.1 Profiles

The UFC030 (UFC 3 Beam) supports the PROFIBUS-PA Profile Version 3.0. Additionally, all relevant parameters of the device are accessible via the PROFIBUS-PA interface (if the manufacturer specific Ident-no is chosen and the manufacturer specific GSD-file version is used).

The UFC030 (UFC 3 Beam) defines the following blocks:

- One physical block.
  This block contains the parameters defined in Profile 3.0.
- One transducer block for ultrasonic flow meter devices.
  This block provides the parameters and functions defined in Profile 3.0. Attached you will find here all the values not defined by the profile.
- Three “Analog Input (AI)” function blocks: “Volume Flow”, “Speed of Sound” and “CORR. Volume Flow or HEAT Flow (depends on the current device type selection)”.
- Two “Totalizer (TOT)” function blocks: totalized “Volume” and totalized “CORR. Volume or HEAT (depends on the current device type selection)”.

4.2 Services

The UFC030 supports the following PROFIBUS-PA services being defined in the PROFIBUS-PA Profile 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

The services mentioned above will enable the customer to set the PROFIBUS-PA station address (1), to configure the data telegram for the cyclic data exchange (3/4), to read back the current PROFIBUS-PA configuration (2) and to read the current Diagnostic data (5).

The service “cyclic data exchange” (6) will be used to transmit the function block output values (measurement data) to a master.

4.3 GSD Files

All available GSD files of KROHNE devices – including those of UFC030 (UFC 3 Beam), of course - are supplied together with each device. The GSD file contains information that will be 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.

The UFC030 (UFC 3 Beam) is supporting the entire PROFIBUS-PA profile V 3.0. The device has two Ident-no. and two GSD files:

- **Ident-no. “F501” belongs to the GSD file KROHF501.GSD and includes the complete functionality of the ultrasonic flow meter.**
- **The application of the manufacturer independent Ident-no. “9741” (GSD file “PA_9741.GSD”) provides interchangeability of devices, i.e. an exchange of mass flow meters of different vendors.**

Please follow the instructions in the manual of the host supplier when installing the GSD File (KROHF501.GSD, UFC3_B_n.bmp, UFC3_B_n.dib) into the PLC.

4.3.1 Manufacturer specific GSD file: KROHF501.GSD

KROHNE delivers the GSD files with the entire device functionality, which is listed below:

Block Number	Standard-Configuration (function block output value)	KROHF701.GSD Ident-No. F701	
1	Volume Flow	AI-FB	
2	Speed of Sound	AI-FB	
3	Volume Totalizer	Totalizer-FB	
4	CORR. Volume Flow or HEAT Flow *	AI-FB	
5	CORR. Volume- or HEAT- Totalizer *	Totalizer-FB	

AI = Analog Input Function Block
FB = Function Block
• = depends on the current device type selection

Important Notes:

1. To project the PROFIBUS communication network you have to allocate each block to a function. On the PC-S7 from Siemens this will be done with the Tool named “HW- Config”. This tool offers the functions described as follows:
2. It is possible to program an “Empty” block (the code of an “Empty” block is defined as 0x00) on each block number. This means, that for this block no data are transmitted in the cyclic data telegram.
3. There is NO “Totalizer (TOT)” function block allowed on block position 1, 2 and 4! A “Analog Input (AI)” function block or a “Empty” block is allowed here only! That means a “Totalizer (TOT)” function block is not possible at this positions.

   Note: All codes of “Analog Input (AI)” - and “Totalizer (TOT)” – function blocks valid for use will be find in the corresponding GSD files.
4. There is NO “Analog Input (AI)” function block allowed on block position 3 and 5! A “Totalizer (TOT)” function block or a “Empty” block is allowed here only! That means a “Analog Input (AI)” function block is not possible at this positions.
5. There is a choice of 4 different totalizer functions, which can be allocated to the blocks 3 and / or 5. The 4 functions are defined as follows:

Function “Totalizer”	cyclic transfer of the totalizer with status to the master
Function “SetTot_Total”	cyclic transfer of the totalizer with status to the master + cyclic control data from master to the device via the Bytes SetTot
Function “ModeTot_Total”	cyclic transfer of the totalizer with status to the master + cyclic control data from master to the device via the Bytes ModeTot
Function “SetTot_ModeTot_Total”	cyclic transfer of the totalizer with status to the master + cyclic control data from master to the device via the Bytes SetTot and after that ModeTot

Both, the Byte SetTot and ModeTot are being sent cyclical from the Master to the device if these bytes are inserted as output data via the to the PLC configurator. The meaning of these control bytes are as follows:

SetTot:

SetTot =0:	Totalizer is totalizing.
SetTot =1:	Totalizer will be reset to 0 and stays at 0 until SetTot is switched back again to 0. If the value of SetTot changes from “1” to “0” the totalizer starts counting from 0.
SetTot =2:	Totalizer is set to the value defined by PresetTot. PresetTot can be written via a acyclic master (totalizer in block 3 = Slot 3 Index 32; totalizer in block 5 = Slot 5 Index 32).If the value of SetTot changes from “1” to “0” the totalizer starts counting from the current value defined by PresetTot.
SetTot > 2:	not allowed

ModeTot:

ModeTot = 0 totalizer totalizes positive and negative values.

ModeTot = 1 totalizes only positive values.
ModeTot = 2 totalizes only negative values.
ModeTot = 3 totalizer is stopped, no totalization will be done.
ModeTot > 3 not allowed

6. The standard block configuration may be changed by the customer but using the default settings is highly recommended. If the standard block configuration should be changed by the customer a acyclic master tool must be used to change the “channel parameter” value of the block which should be connected to another transducer output value.

4.3.2 Profile specific GSD file: PA_9741.GSD

The functionality of the profile specific GSD file is limited. This GSD file includes only three blocks:
Volume Flow, Speed of Sound (Sound Velocity) and Volume Flow totalizer.

You need the PA_9741 file to use this functionality. Before this, the communication has to be projected and it has to be switched from “full functionality” to “interchangeable basic configuration” by using a master class 2 tool (IDENT_NUMBER_SELECTOR: Slot 0, Index 40 change byte value from 1 to 0). After this has been done, the device has to be projected by using the PA _9741 file.

4.4 Cyclic data exchange

During network configuration the user has to define which function block outputs of the UFC030 (UFC 3 Beam) should be transferred cyclically to the master. The following function block outputs are available in this order:

1. Volume Flow and Status
2. Speed of Sound und Status
3. Volume Totalizer and Status
4. CORR. Volume Flow or HEAT Flow * and Status
5. CORR. Volume- or HEAT- Totalizer * and Status

- depends on the current device type selection

Note: If a function block output is chosen for cyclical data transfer the value "Not_a_Number" (0x7FFFFFFF) will be transmitted if the function block itself is not available (due to the current device type selection). If so the status is "Bad-Out of Service".

Network configuration will be done by a master class 2 tool using one of the GSD files described above. The function block outputs which should be transmitted cyclically may be chosen without any restriction. The order of transmission always remains the same even if a function block is defined as an “Empty” block (if so no function block output data will be send to the master and all function block outputs following the “Empty” block will move up one position).

4.5 Data Structure of Function Block Output Values

The data structure of function block outputs consists of 5 bytes: a 4 byte float value (Float Format according IEEE Standard 754 Short Real Number) followed by a 1 byte status value. If all 5 function block outputs have been projected (see above), 25 byte will be transmitted.

4.5.1 Float Value

First an example of the **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							Mantisse								Mantisse								Mantisse							

Example: 40 F0 00 00 (hex) = 0100 0000 1111 0000 0000 0000 0000 0000 (binary)

Formula: Value $= (-1)^{VZ} * 2^{(Exponent - 127)} * (1 + Mantisse)$

Value = $(-1)^0 * 2^{(129 - 127)} * (1 + 2^{-1} + 2^{-2} + 2^{-3})$
Value = 1 * 4 * (1 + 0,5 + 0,25 + 0,125)
Value = 7,5

4.5.2 Status Value

You will find the meaning of the **status** byte (unsigned integer) by looking at the tables down below:

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
0	1	1	0	0	0			= simulated value
0	1	1	0	0	1			= sensor calibration

Status = good (Non-Cascade)								
1	0	0	0	0	0			= ok
1	0	0	0	0	1			= update event
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 update event
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)	function block output value is ok and can be used without restrictions
Good (Cascade)	will not be supported, because it is not applicable for the device
Uncertain	function block output value can be used but the accuracy can not be guaranteed (e.g. function block outputs value has been frozen or A/D converter is saturated or out of range)
Bad	function block output value is bad don´t use it!

The „Quality-Substatus“- and „Limit“-Bits will 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 value is bad or uncertain. This is the only way to check the meaning of the transmitted measurement values.

4.6 Diagnosis

If the device internal diagnostic functions will detect an error additional information will be send to the Master (for further information have a look at the UNIT_DIAG_BIT(i) definitions of the corresponding GSD-file)

5 Electrical Connection

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

5.1 Interconnection of devices in the hazardous area

A PROFIBUS-PA network in the hazardous area should be projected in accordance with actual regulations:

- all electrical components which should be connected to the bus must be approved according the hazardous area regulations,
- the approved input values of the field devices (Uo, Io, Po) must match with the output values of the power supply (e.g. segment coupler) which means $U_i \leq U_o$, $I_i \leq I_o$ and $P_i \leq P_o$.
- the maximum length of each trunk cable does not exceed 1000 m,
- the maximum length of each spur cable does not exceed 30 m,
- the values of the cable are within the following ranges R´=15...150Ω/km; L´=0,4...1mH/km; C´=80...200nF/km,

5.2 Bus cable

Cable length between any devices should be less then 1900 m. Further limitations to the cable than the hazardous area limitations are not existent. Nevertheless a twisted pair and overall shielded cable is strongly recommended. A good quality cable could have the following data (Type A):

impedance at 31.25 kHz	100 Ω ±20 %
DC resistance (per conductor)	22 Ω/km
capacity unbalanced	< 2 nF/km
attenuation at 39 kHz	< 3,0 dB

5.3 Shielding and grounding

For an optimum electromagnetic compatibility of systems it is extremely important that the system components and particularly the bus cables connecting the components be shielded. This shields should be connected in a way that they will look like “one non interrupted, unbroken shield” (if possible).

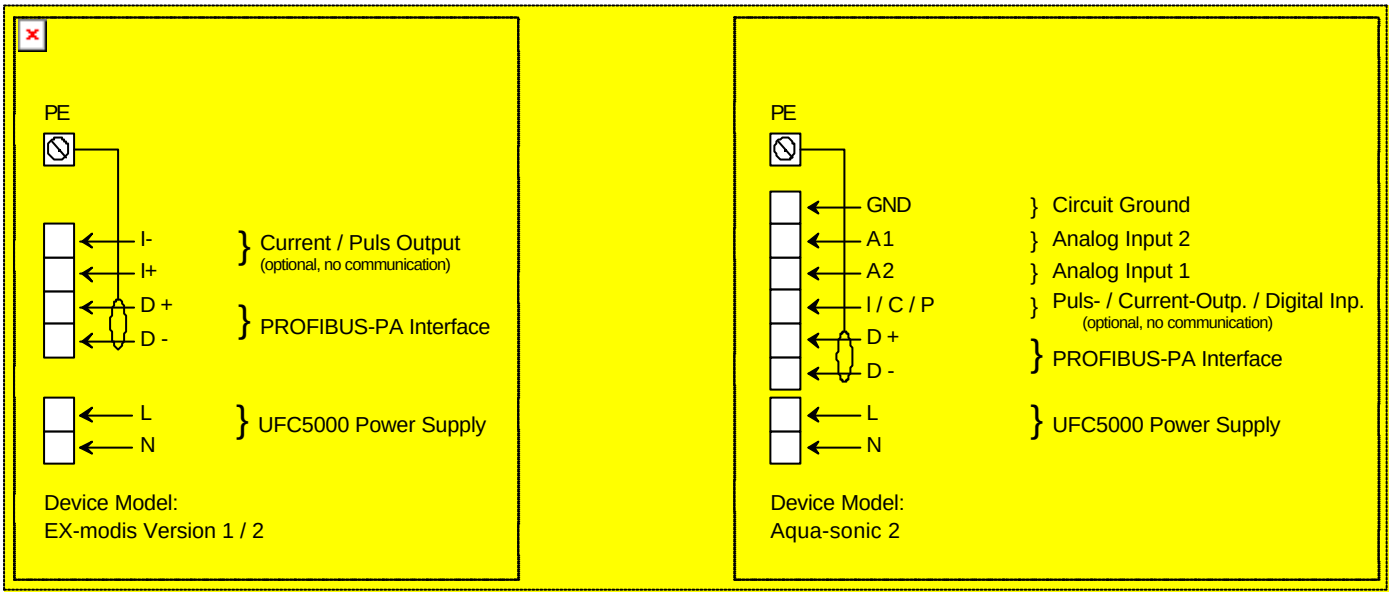
Hence it follows that, for use in non-hazardous duty systems, the cable shield should be grounded as often as possible.
In “Ex“ systems with adequate equipotential bonding in the hazardous and non-hazardous location along the entire fieldbus installation, multiple grounding of the shield is also of advantage.

Note: The use of twisted and shielded cables is strongly recommended, otherwise EMC protection of the ultrasonic flow meter cannot be assured.

5.4 PROFIBUS-PA connection

Connect the bus cable as shown in the figure.

- **Connect the cable cores to the terminals described as PA+ and PA-.**
- **Polarity reversal will not have any effect.**
- **The cable shield should be connected with minimum length to the PE functional ground.**
- **The equipotential bonding conductor must be connected to the device by connecting it to PE functional ground**



6 Menu Settings for PROFIBUS-PA

For a detailed description please check the Installation and Operating Instructions manual of the device. **The following <u>settings should be done before</u> the UFC030 (UFC 3 Beam) will be connected with the PROFIBUS-PA network. Note that the address can be also set by using the communication service "Set slave address" via the master tool.**

Function (Fct.)	Description
3.9.1 PROTOCOL	• PROFIB PA
3.9.3 PR/FF ADDR	• Set address Range: 000 - 126 for PROFIBUS-PA (default 126)

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 the PROFIBUS-PA service "set_slave_add".

7 Important Notes

7.1 Parameter "meter_type" of UFC030

If "meter_type" will be changed by a service technician the below mentioned procedure must be carried out step by step to avoid UFC030 malfunctions depending on an inconsistent data set of the PROFIBUS-PA module.

1. ***UFC030 (Converter) data set must be reset to factory values first (Menu: 5.1.1 -> FACT PARAM)***
2. ***"meter_type" must be changed into the device type required***
3. ***UFC030 (Converter) data set must be saved again as factory values***
4. ***A factory reset (factory reset = 1 / cold start) must be carried out via PDM (or any other PROFIBUS-PA Master Tool available) to guarantee a consistent data set of both units (UFC030 converter and UFC030 PROFIBUS-PA module)***

8 Technical Data

	Hardware		Software
Physical	IEC 61158-2; 31,25kbit/s; voltage mode	GSD	GSD file supplied on diskette or at http://www.krohne.de
Connection	independent of polarity	Device profile	Profile compact class B, V3.0
Base current	10,5 mA	Address range	0...126; default 126 0 to 125 via "set_slave_add" 0 to 126 via "Local Display" (Fct. 3.9.1 & 3.9.3)
FDE	yes: separate fault disconnection electronics provided	Operator control	local display and operator interface at device.
Fault current	6 mA; (fault current = max. continuous current – base current).	SAP's	3; the number of Service Access Points is typically equal of the maximum number of master class 2 (operating) tools
Starting current	lower than the base current	Function Blocks	1 PB 1 TB 3 AI 2 TOT
"Ex" approval	EEx ia IIC T6 or EEx ib IIC/IIB T6, details see manual		

Possible function block outputs [default unit]:

	Analog Input	**Totalizer**
default configuration	FB1: volume flow [m3/h] FB2: speed of sound [m/s] FB4: corr. volume flow [m3/h] or heat flow [MJ/s]*	FB3: volume totalizer [m3] FB5: corr. volume totalizer [m3] or heat totalizer [MJ]*

* depends on current device type

9 Device Description for the SIMATIC Process Device Manager (PDM)

9.1 Installation

If the UFC 030 Device Description is not already installed on the PDM System a so called *Device Install* is needed (available on floppy disk from KROHNE or as download from KROHNE internet page).
For installing the DD with the Device Install refer to the *"PDM Manual"* section *"Utilities"* / *"Device Install"*. Please read also the "readme.txt", which is contained in the Device Install.

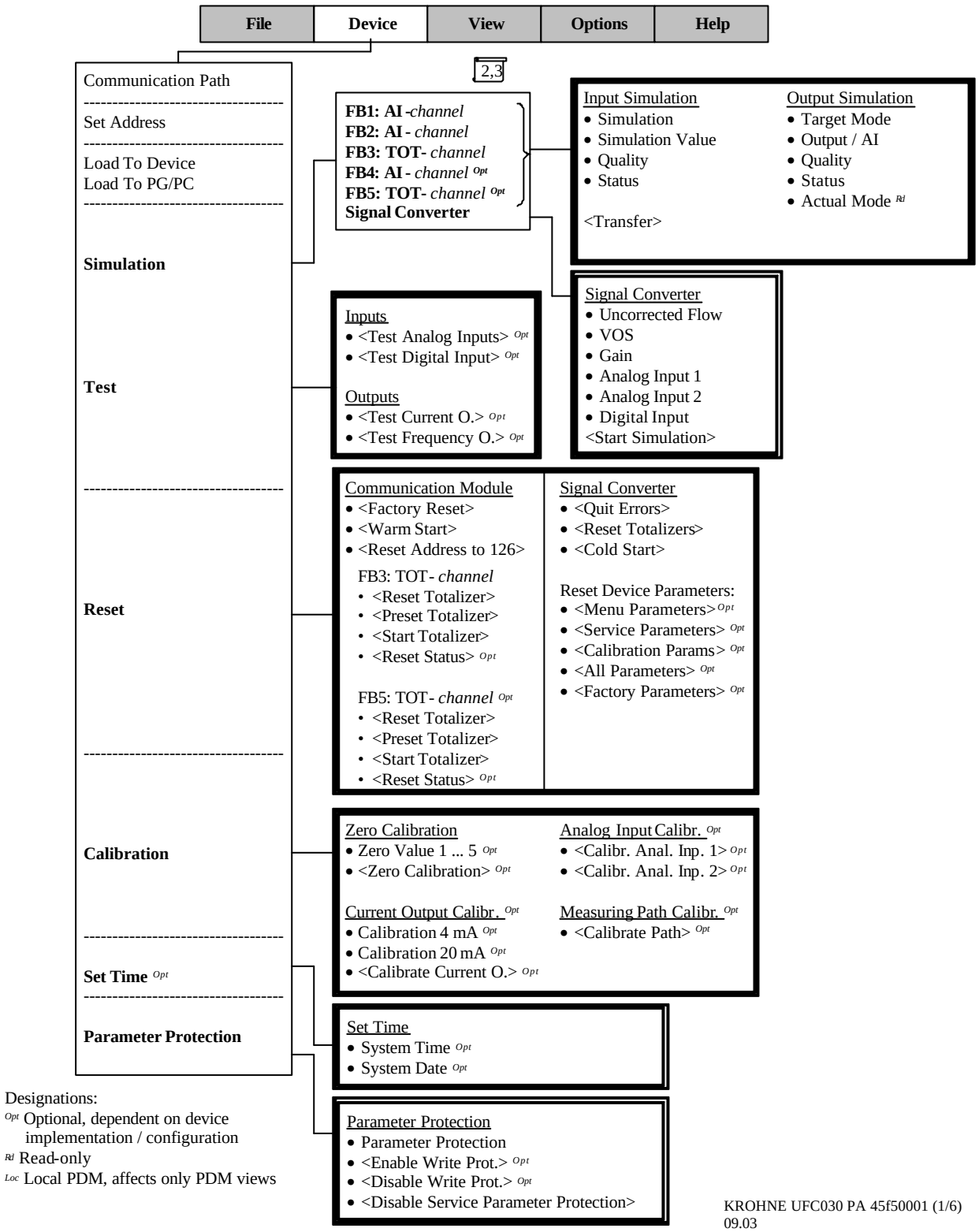
9.2 Operating

Refer to the UFC 030 Menu Tree PDM (Attachment A).
Due to PROFIBUS and PDM requirements and conventions the UFC 030 operation differs from operation via local keypad and the following peculiarities should be kept in mind:.

- The online help of each parameter contains its function number as a reference to the device's local display and the "Installation and Operating Instructions".
- If the device is operated via its local keypad no write operation can be performed via the PROFIBUS interface at the same time. Please check in case the flag 'Device is controlled via its keypad' in 'View / Details / Signal Converter State'.
- There are several complex dependencies between the parameters of the UFC 030. These dependencies can't be handled correctly to the full extent in the online dialogs of the PDM parameter table. Therefore it is recommendable to switch these dialogs for the parameter table off. (See menu 'Options / Customize / Table / online dialog in the table available').
- In order to find out whether the setting of the device is still the same as the parameter set stored in PDM compare the 'Static Revision No.' of the respective PROFIBUS Block. (The current Static Revision No. is displayed on the window 'View / Device Status / <block name>').

Attachment A

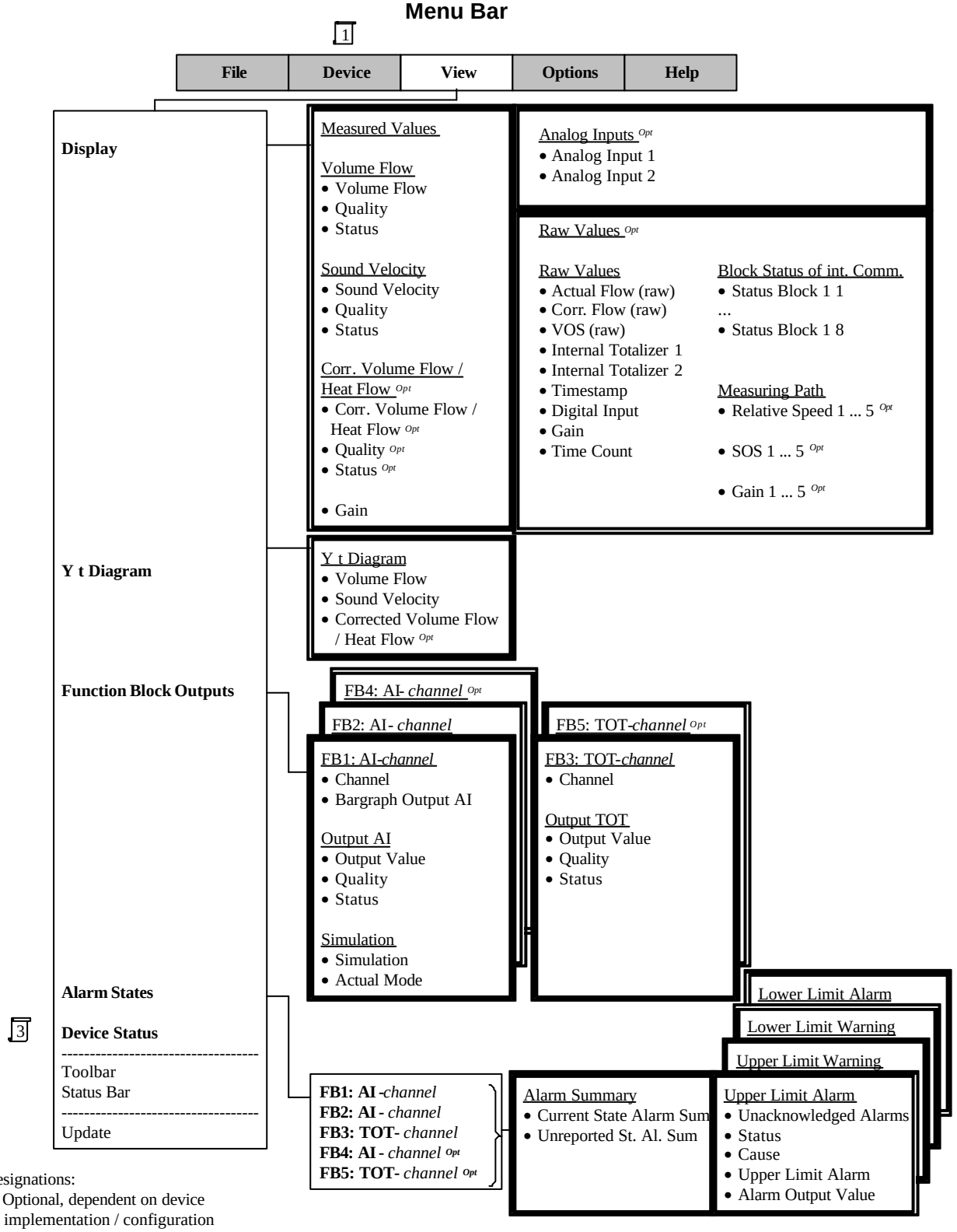
UFC030 Menu Tree PDM
Menu Bar



Designations:
Opt Optional, dependent on device implementation / configuration
Rd Read-only
Loc Local PDM, affects only PDM views

KROHNE UFC030 PA 45f50001 (1/6) 09.03

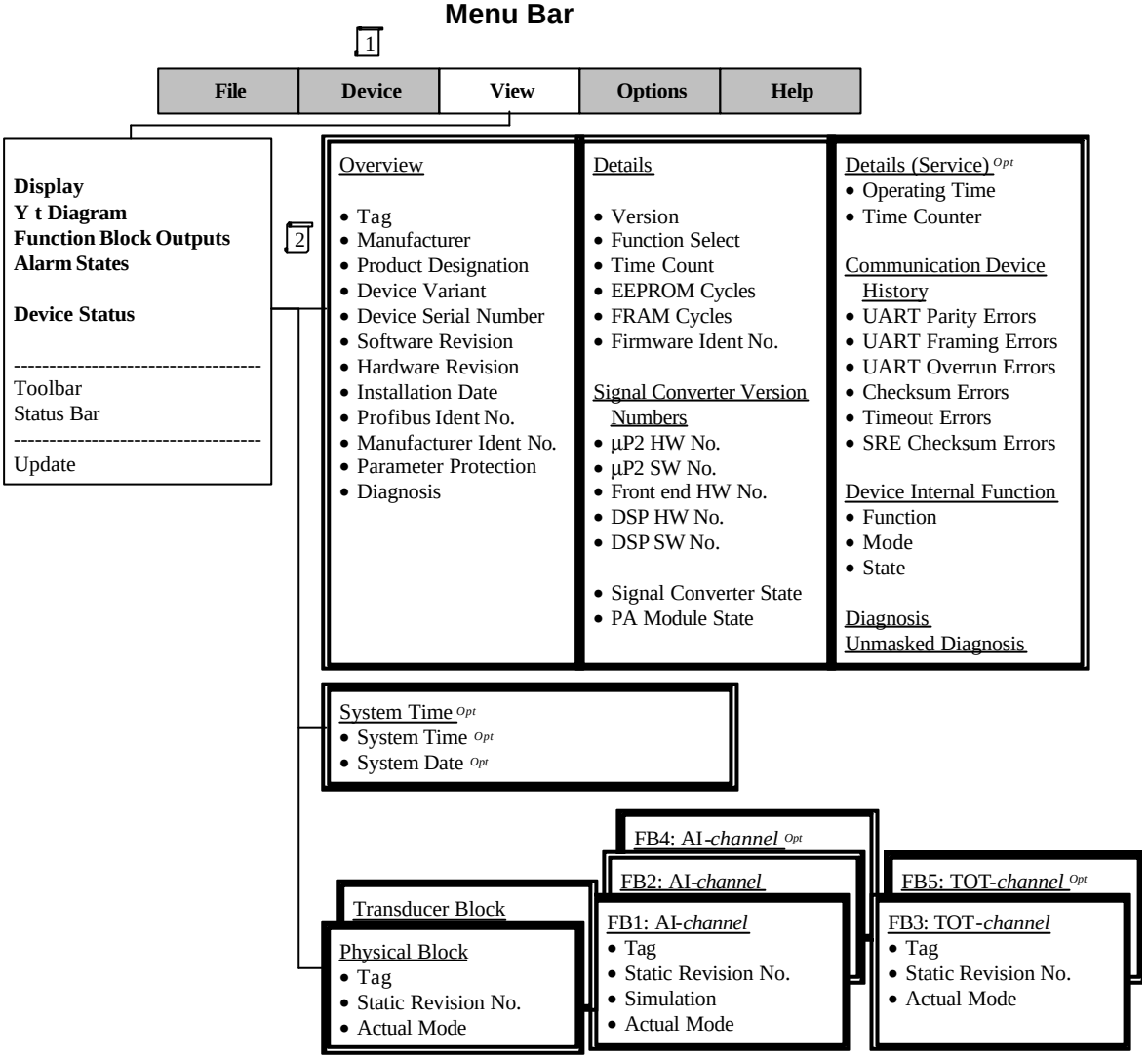
UFC030 Menu Tree PDM
Menu Bar



Designations:
Opt Optional, dependent on device implementation / configuration
Rd Read-only
Loc Local PDM, affects only PDM views

KROHNE UFC030 PA 45f50001 (2/6)
09.03

UFC030 Menu Tree PDM
Menu Bar



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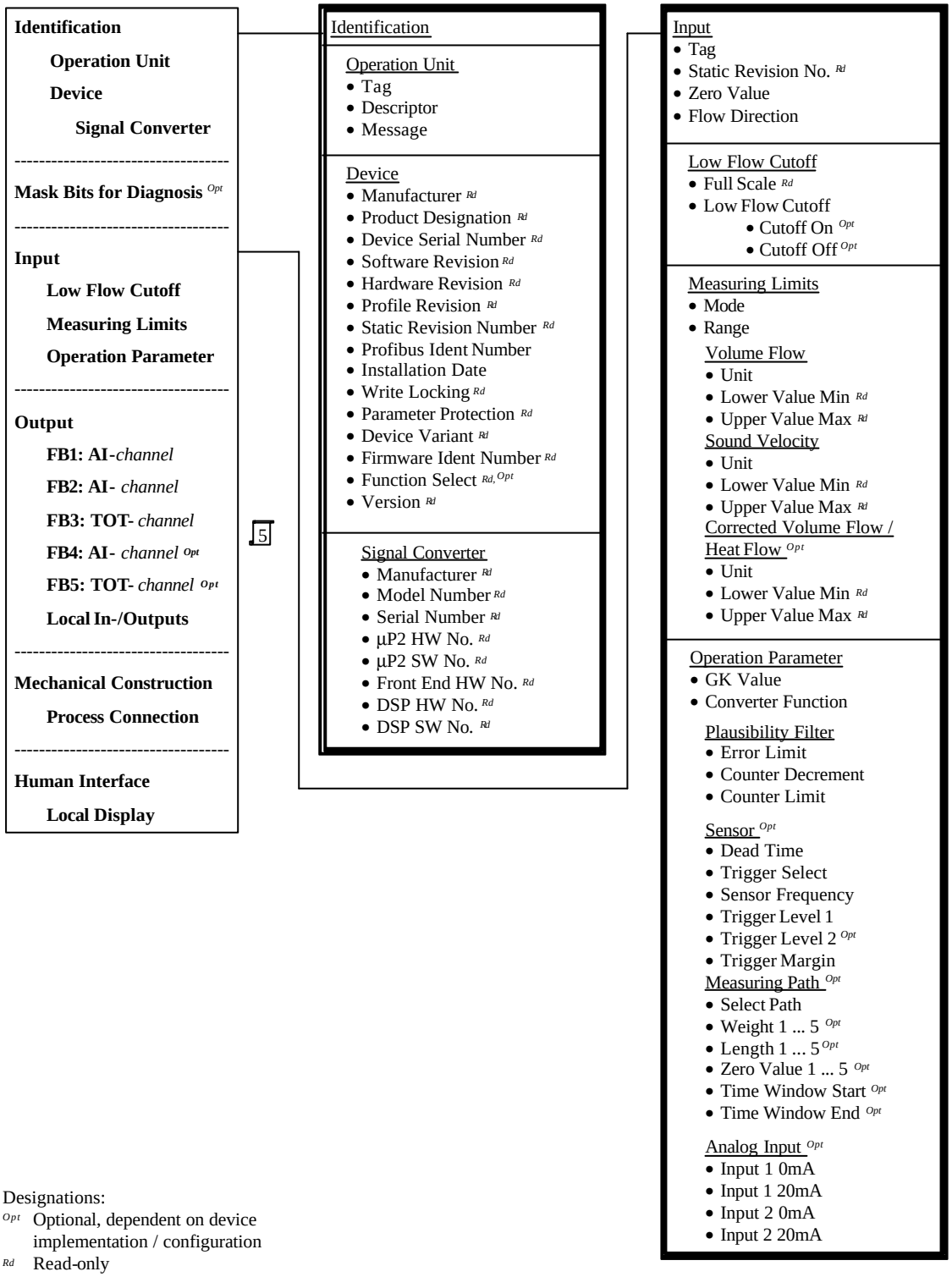
UFC030 Menu Tree PDM
Parameter Table



Designations:

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Loc Local PDM, affects only PDM views

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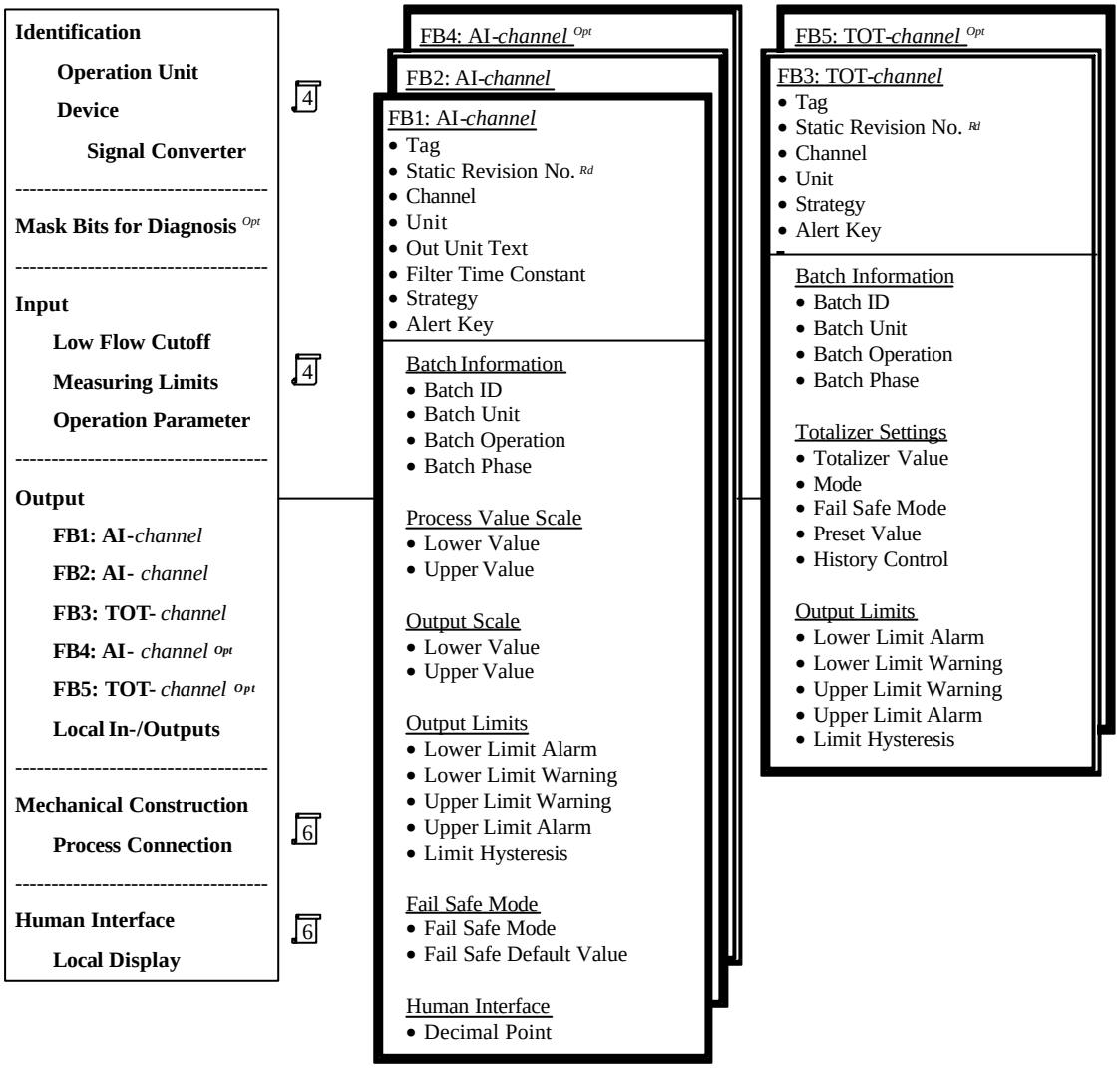

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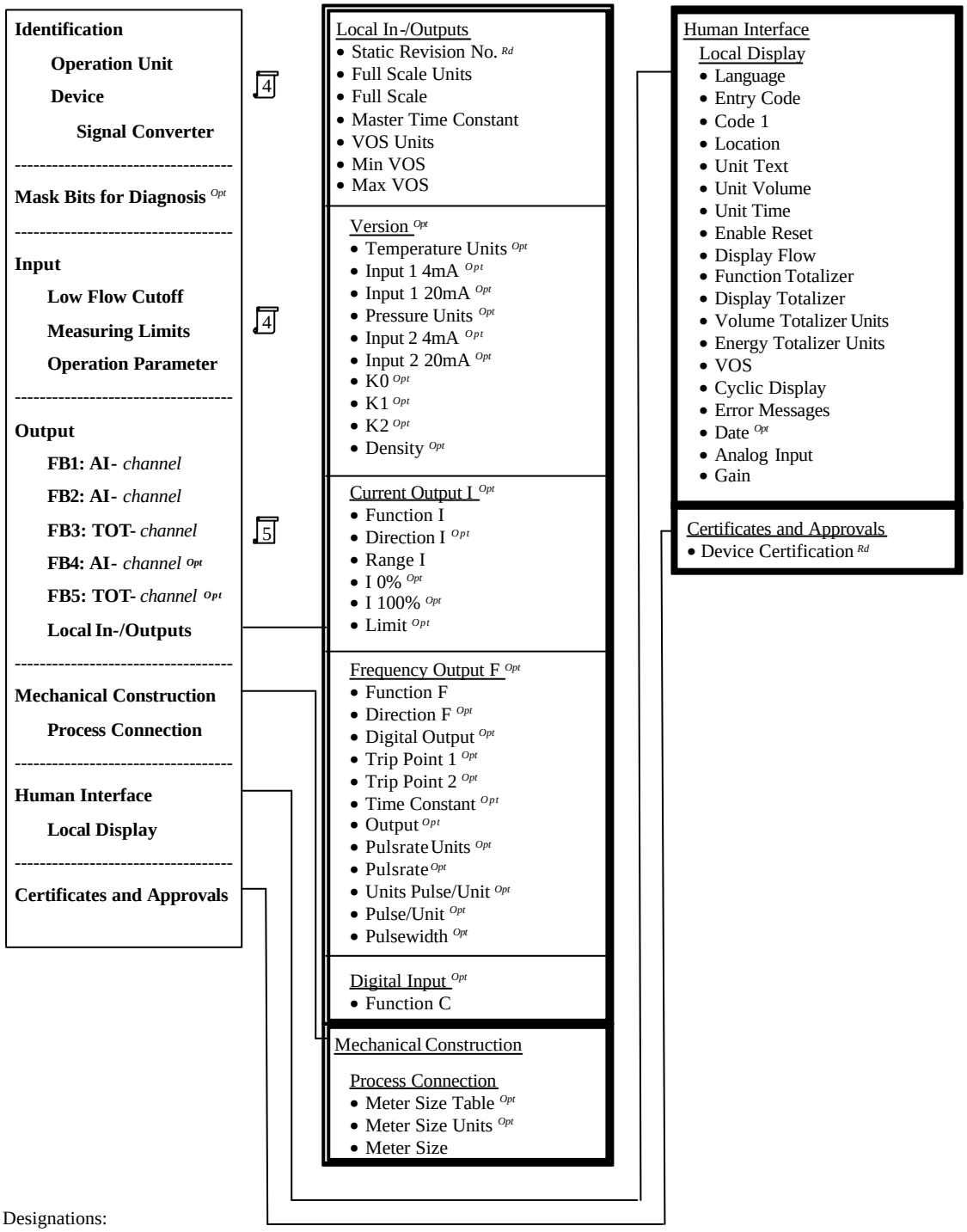
UFC030 Menu Tree PDM
Parameter Table



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