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OPAT Profibus Manual

Revision History

Revision	Date	Description
R 1.0	23.11.2009	Based on OPAT V 2.3
R 1.0 pre	30.03.2012	Pre revision
	10.08.2012	additions
R 1.1	22.01.2013	OPAT with OPAT replaced, parameter added
R 1.1	12.03.2013	Some error removed
R 1.2	28.05.2013	Parameter description corrected, added
R 1.3	30.09.2013	Parameter added/changed for SW V34.03*
R 1.3	15.10.2014	0x04 = Set Error/Comp output direct to 24V (disable signalizing of error output)
R 1.4pre	05.11.2014	**Preliminary !!** Profidrive implementation
R 1.4pre	09.12.2014	**Preliminary !!** Profidrive implementation screenshots added
R 1.5	09.12.2014	First released version: Screenshots with new GSD added
R 1.5	26.03.2015	PDF file created
R 1.6	28.03.2015	Error EXCE explanation added
R 1.7	13.11.2015	Additional set value ID for profidrive, New Error ID 0x102. Error in bit definition of DAT.1L
R 1.8	28.10.2016	Added Modbus Error-List
R 1.9	08.12.2017	Corrected response sequence of d1.10 and d1.11 @cmd15
R 2.0	19.02.2018	Parameter E28 added, point 5.7. added
R 2.1	18.04.2018	Parameter and signals for LIMP function changed/added
R 2.2	13.03.2019	Profidrive definition of signal range corrected
R 2.2	15.03.2019	Configuration for Siemens TIA included
R 2.2	07.10.2021	Error in explanation “difference to OPAT” → means difference to DMA
R 2.3	20.10.2021	Information to TIA portal removed

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1 Features

- Supports Profibus-DP Slave in accordance with IEC 61158
- Supports Profibus DPV1
- Maximum 244 Byte input and 244 Byte output data
- Profibus Supports up to 12 Mbaud (auto detect)
- Profibus interface electrical isolated and opto-decoupled
- ProviDrive compatible (telegram 1 communication available)
- Up to 7 CAN Slaves are connectable to one Profibus interface.

1.1 Used GSD File

„HCS0D68.GSD“

1.2 Supported OPAT SW-versions

V34.xx	Profibus Slave and CAN Master with/without CAN Slave modules since V34.03x also the ProfiDrive protocol is implemented.
V31.xx	CAN Slave Version without profibus function

1.3 LED Signalization

1.3.1 Profibus node (Provibus slave/CAN master):

RED LED is on:
- Error is pending
- F.e. no connection to CAN slave, sensor wire fracture …

RED LED is blinking fast (ON=125ms/OFF=125ms)
- No Profibus connection
- PLC Config fault

GREEN LED is on:
- OPAT is enabled

- GREEN LED is blinking slow (ON=500ms,OFF=500ms)
  - OPAT is disabled

1.3.2 CAN slave node:

RED LED is on:
- Error is pending
- Two or more CAN slave have the same Slave address (ROTARY switch)
- F.e. internal CAN communication error counter is full.

RED LED is blinking (ON=400ms,OFF=100ms)
- No CAN connection to CAN master.

GREEN LED is on:
- OPAT is enabled

GREEN LED is blinking slow (ON=500ms,OFF=500ms)
- OPAT is disabled

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1.4 Special information for Multi-Slave nodes

SADR:
Please pay attention to the fact that the first module – the one with the PROFIBUS interface always must have the SADR = 0! The SADR of the other (slave) modules will only be set by means of turn-switch. Here the allowed address range is 1 to 7.

Profibus-address:
If the Profibus-address of the OPAT-Master is changed by means of parameter E24 than the new setting will only by activated after a power-down/power-up sequence.

Setting of the Profibus-address also can be made via the bus itself. For this E24 has to be set to “126” before power-up. Following this the Profibus-address can be changed and the new address will then also be visible in parameter E24.

Changing of the PROFIBUS address by means of parameter E24 will only be executed after a power-up restart.

In case of a CAN communication error the error can be quit by changing the baud rate of CAN slave address.

Should CAN communication error has caused a “bus off” (> 255 error telegrams) than this can only be remedied by executing a power-down reset.

Self-recovery from an CAN communication error can cause several minutes.

1.5 OPAT set up for Multi-Slave nodes with profibus

Before start up please check the parameter setting of the Master and the Slave(s) OPAT.

- Please note the settings of the parameters for the communication between master and slave. For both the parameter E26 must be identical.
- Similarly, the parameter E25 should be set to 1
- The Profibus address is depending on the PLC setting, in this example E24 = 3.

Example for the Master setup:

E 23	0,000	s	Profibus timeout, at 0s the function is deactivated
E 24	3		Profibus address, with 126, reset to automatic address setting
E 25	1		Function of spec. Input
E 26	4		CAN baudrate
E 27	00000001	BIN	Connected CAN-Slaves

If an CAN-slave is connected to the master E27 shows the number of connected slaves.
The position of the displayed "1" results in the slave address of the connected slave.

Example 1, only one Slave with E22 = 1 is connected.

E 27	00000001	BIN	Connected CAN-Slaves

Example 2, only one Slave with E22 = 2 is connected.

E 27	00000010	BIN	Connected CAN-Slaves

Example for the slave (Slave no. 1) setup:

E 22	1		CAN slave address (cannot be set by parameter)
E 23	0,000	s	CAN timeout, at 0s the function is deactivated
E 25	1		Function of spec. Input
E 26	4		CAN baudrate

1.6 General information about TADR (Telegram Address)

TADR is a value which may be written (changed) with each cycle but changing of this value is optional and not mandatory. The value will be defined by the DP-Master.
The purpose is to either check the telegrams by the master or also in order to force sending of a new telegram from the node.
The design of the node is made in a way that the slave or slaves (module or modules in case of multi-slave version) are only responding if a received message from the master contains changed (different) data compared to the previous message.
So TADR can be used to force a response from a slave for example in order to get an update on the current status of the slave even if the other data in the message remain unchanged.
TADR value is valid in the range of 0 to 255 or in hexadecimal 0x00 to 0xFF.

1.7 General information about CMD (Command) and SADR (Slave Address)

Different ways of communication between master and slaves (modules) are possible. The difference is in the CMD instruction.

CMD = 6: Writing of a single parameter-ID of a slave (module) at a node. The selected SADR in the telegram will define which slave is selected fort he communication. In the slave itself the address is set by the DIP-switch (1..7),
Special case: the Profibus node has only one slave (module) connected.
In this case SADR is set to 1 (DIP-switch (1..7)).
Which of the slaves (modules) is selected for communication is again defined in the telegram by the SADR and in the slaves (modules) by setting DIP-switch (1..7),. For more information please refer to section 2.4.

CMD = 3: Reading of one ore more parameters with parameter-ID in rising order. All other definitions from CMD = 6 are also applicable. For more information please refer to section 2.1.

CMD = 15: This instruction allows writing or reading of a (pre-defined) set of parameters. The set of parameters itself is depending on the software version of the slaves (modules); refer also to section 0.
With this instruction all slaves (modules) at a given node with the SADR from 1 to 7 can be reached.
This instruction can not be used for slaves (modules) with a SADR > 7. In this case CMD = 3 and CMD = 6 must be used!
The best is to set SADR at the slaves in rising and consecutive order beginning with SADR =1 (DIP-switch = 1).
In the telegram itself the number of OPAT-Slaves (modules) at the node is defined by SNUM. This at the same time will also define the length of the telegram itself (number of bytes in the telegram).
For more information please refer to section 3.

It is possible to „mix“ the instructions CMD = 3, CMD = 6 and CMD = 15 for one node.

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2 Simple commands

2.1 CMD = 3, Master Read parameters (7 bytes)

Write first…

Byte	Abbreviation	Description
0	TADR	Telegram address, defined by the user, Range 0..255, 0..0xFF
1	SADR	Slave address
2	CMD	Command: 3 = Read multiple parameters by the master
3	IDH	High byte parameter ID of first parameter
4	IDL	Low byte parameter ID of first parameter
5	N-high	High-Byte Number parameters
6	N-low	Low-Byte Number parameters

…Write last

TADR Telegram address, defined by the DP-Master.

SADR Slave address, if more than one Slave is connected to the Profibus port
0 = standard (OPAT-Master) **(Difference to DMA**)
1 to 7 = OPAT-Slave, the **DIP-switch (1..7)** defines the slave address

CMD Command: 3 = Read parameter by the master

IDH,IDL H-Byte and Low-Byte of parameter-ID in HEX
0x0000 .. 0x00A2 = Valid ID-range

N-high High-Byte Number parameters (words), normally zero

N-low Low-Byte Number parameters (words), 1 to 8 (0x08)
(maximal 8 parameters readable at once)

2.2 CMD = 3, Response from Slave (4 + CNT bytes)

Write first…

Byte	Abbreviation	Description
0	TADR	Telegram address, defined by the user, Range 0..255, 0..0xFF
1	SADR	Slave address
2	CMD	Command: 3 = Read multiple parameters by the master
3	CNT	N*2, Number of data bytes
4	DAT1H	High byte value of first parameter
5	DAT1L	Low Byte value of first parameter

If CNT > 2: ……

CNT+2 = N	DATnH	High byte value of last (n)parameter
CNT+3 = N	DATnL	Low Byte value of last (n)parameter

…Write last

TADR Telegram address, defined by the DP-Master.

SADR Slave address, if more than one Slave is connected to the Profibus port
0 = standard (OPAT-Master) **(Difference to DMA**)
1 to 7 = OPAT-Slave, the **DIP-switch (1..7)** defines the slave address

CMD Command: 3 = Read parameter by the master

CNT N*2, Number of data bytes (Maximal 16 data bytes)

IDH,IDL H-Byte and Low-Byte of parameter-ID in HEX
0x0000 .. 0x00B0 = Valid ID-Range

DAT1H.. DAT nH,
DAT1L.. DAT nL, Two data bytes in HEX, without decimal sign
0x7FFF == +32767
0x8000 == -32768

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2.3 CMD = 3, Error from Slave (4 bytes)

Write first…

Byte	Abbreviation	Description
0	TADR	Telegram address, defined by the user, Range 0..255, 0..0xFF
1	SADR	Slave address
2	ERR	Error code
3	EXCE	Exception

…Write last

ERR Error code: 0x83 = Read failed

EXCE Exception:
1 = Command not supported
2 = Wrong ID
3 = CNT== 0 or CNT > 16 (0x10)
4 = Reading of ID failed
5 = timeout slave, address wrong or not installed or
Invalid number of connected slaves
6 = Internal checksum error (CAN connection)
7 = Invalid number of connected slaves
8 = timeout slave, address wrong or not installed
9 = telegram to short, Profibus output buffer to small
10 = No CAN buffer defined, CAN baud rate not defined
11 = Slave sends error byte, command byte unknown
12 = Two or more slaves have the same slave address.

Example for error response:

Module 3 is not installed and **SADR** in the master telegram is set to 3

Byte	Abbreviation	Abbreviation	Description
0	0x23	TADR	Response telegram address (defined by the user)
1	**0x03**	SADR	Actual slave address
2	0x83	ERR	Error, Bit „7“ with command 0x03 is set
3	0x05	EXCE	timeout slave, address wrong or not installed

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2.4 CMD = 6, Master Write single parameter (7 bytes)

Write first…

Byte	Abbreviation	Description
0	TADR	Telegram address, defined by the user, Range 0..255, 0..0xFF
1	SADR	Slave address
2	CMD	Command: 6 = Write single parameter by the master
3	IDH	High byte parameter ID
4	IDL	Low byte parameter ID
5	DATH	High byte of parameter value
6	DATL	Low byte of parameter value

…Write last

TADR Telegram address, defined by the DP-Master.

SADR Slave address, if more than one Slave is connected to the Profibus port
0 = standard (OPAT-Master) **(Difference to DMA**)
1 to 7 = OPAT-Slave, the **DIP-switch (1..7)** defines the slave address

CMD Command: 6 = Write single parameter by the master

IDH,IDL H-Byte and Low-Byte of parameter-ID in HEX
0x0000 .. 0x00B0 = Valid ID-Range

DATH,DATL Two data bytes in HEX, without decimal sign
0x7FFF == +32767
0x8000 == -32768

2.5 CMD = 6, Response from Slave (7 bytes)

Write first…

Byte	Abbreviation	Description
0	TADR	Telegram address, defined by the user, Range 0..255, 0..0xFF
1	SADR	Slave address
2	CMD	Command: 6 = Write single parameter by the master
3	IDH	High byte parameter ID
4	IDL	Low byte parameter ID
5	DATL	High byte of second analogue value
6	DATH	Low byte of first analogue value

…Write last

TADR Telegram address, defined by the DP-Master.

SADR Slave address, if more than one Slave is connected to the Profibus port
0 = standard (OPAT-Master) **(Difference to DMA**)
1 to 7 = OPAT-Slave, the **DIP-switch (1..7)** defines the slave address

CMD Command: 6 = Write single parameter by the master
IDH,IDL H-Byte and Low-Byte of parameter-ID in HEX
0x0000 .. 0x00A2 Valid ID-Range

DATH,DATL Two data bytes in HEX, without decimal sign
0x7FFF == +32767
0x8000 == -32768

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2.6 CMD = 6, Error from Slave (4 bytes)

Write first…

Byte	Abbreviation	Description
0	TADR	Telegram address, defined by the user, Range 0..255, 0..0xFF
1	SADR	Slave address
2	ERR	Error code
3	EXCE	Exception

…Write last

ERR Error code: 0x86 = write failed

EXCE Exception:
1 = Command not supported
2 = Wrong ID
3 = Wrong Data Value
4 = Writing of ID failed
5 = timeout slave, address wrong or not installed or
Invalid number of connected slaves
6 = Internal checksum error (CAN connection)
7 = Invalid number of connected slaves
8 = timeout slave, address wrong or not installed
9 = telegram to short, Profibus output buffer to small
10 = No CAN buffer defined, CAN baud rate not defined
11 = Slave sends error byte, command byte unknown
12 = Two or more slaves have the same slave address.

Example for error response:

Module 3 is not installed and **SADR** in the master telegram is set to 3

Byte	Abbreviation	Abbreviation	Description
0	0x23	TADR	Response telegram address (defined by the user)
1	**0x03**	SADR	Actual slave address
2	0x86	ERR	Error, Bit „7“ with command 0x06 is set
3	0x05	EXCE	timeout slave, address wrong or not installed

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2.7 Telegram example CMD = 6, CMD = 3

Master wants to write parameter "C1.07" with value 1.000 V:

ID = 0x0030
DATA = 0x3E8 (= 1000 in decimal)
TADR = 0x23
SADR = 0x00 (OPAT-Master)

Byte	Value	Abbreviation
0	0x23	TADR
1	0x00	SADR
2	0x06	CMD
3	0x00	IDH
4	0x30	IDL
5	0x03	DATL
6	0xE8	DATH

Response from Master(module), command was successful executed
ID = 0x0030
DATA = 0x3E8 (= 1.000 V)

Byte	Value	Abbreviation
0	0x23	TADR
1	0x00	SADR
2	0x06	CMD
3	0x00	IDH
4	0x30	IDL
5	0x03	DATL
6	0xE8	DATH

Master wants to read parameter "d1.07":

ID = 0x0007
N = 1, one parameter
TADR = 0x24
SADR = 0x00 (OPAT-Master)

Byte	Value	Abbreviation
0	0x24	TADR
1	0x00	SADR
2	0x03	CMD
3	0x00	IDH
4	0x07	IDL
5	0x00	N-high
6	0x01	N-low

Response from Master (module)
CNT = 2 (2 Bytes)
DATA = 0x0133 (==0.307Af)

Byte	Value	Abbreviation
0	0x24	TADR
1	0x00	SADR
2	0x03	CMD
3	0x00	CNT
4	0x01	DAT1H
5	0x33	DAT1L

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2.8 Additional examples CMD = 6

Examples for set value via Profibus (ID = 0x0027):
SADR = 0x00 (OPAT - Master)

1.) Command signal 0.000 V = 0x0000:

Byte	Value	Abbreviation
0	0x12	TADR
1	0x00	SADR
2	0x06	CMD
3	0x00	IDH
4	0x27	IDL
5	0x00	DATL
6	0x00	DATH

2.) Set value 5.000 V = 0x1388:

Byte	Value	Abbreviation
0	0x12	TADR
1	0x00	SADR
2	0x06	CMD
3	0x00	IDH
4	0x27	IDL
5	0x13	DATL
6	0x88	DATH

3.) Set value 9.999 V = 0x270F:

Byte	Value	Abbreviation
0	0x12	TADR
1	0x00	SADR
2	0x06	CMD
3	0x00	IDH
4	0x27	IDL
5	0x27	DATL
6	0x0F	DATH

4.) Set value –9.999 V = 0xD8F1

Byte	Value	Abbreviation
0	0x12	TADR
1	0x00	SADR
2	0x06	CMD
3	0x00	IDH
4	0x27	IDL
5	0xD8	DATL
6	0xF1	DATH

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3 Complex commands

3.1 CMD = 15, Master writes multiple parameters (3+5·module bytes)

(Fast multi-slave command)

With the rotary-switch on the slave module, the salve address 1..7 can be selected.
The OPAT Master module defines the Profibus node address setting.

Example: If 3 modules are used than E22 must be set to „1“ for the first module on the left, to „2“ for the second module in the middle and to „3“ for the third module closest to the slave (refer also to **Fehler! Verweisquelle konnte nicht gefunden werden.**).
Response telegrams are automatically multiplexed by the Profibus node (refer also to 3.4.2).

Write first…

address	Byte	Structure								Abbreviation	Description	
	0									TADR	Telegram address, defined by the user, Range 0..255, 0..0xFF	
	1	0	1	2	3	4	5	6	7	SNUM	Number of connected slaves (Maximum 7)	
	2	15								CMD	Command: 15 = Write multiple parameter by the master	
	3	0	0	0	0	0	0	0	0	DAT0.1	Control Byte	Byte for special functions
	4		OPAT Master							DAT0.2H	Process Value1	High byte of first “analogue” value
	5									DAT0.2L		Low byte of first “analogue” value
	6									DAT0.3H	Process Value2	High byte of second “analogue” value
	7									DAT0.3L		Low byte of second “analogue” value
	8		1	1	1	1	1	1	1	DAT1.1	Control Byte	Byte for special functions
	9									DAT1.2H	Process Value1	High byte of first “analogue” value
	10									DAT1.2L		Low byte of first “analogue” value
	11									DAT1.3H	Process Value2	High byte of second “analogue” value
	12									DAT1.3L		Low byte of second “analogue” value
	13			2	2	2	2	2	2	DAT2.1	Control Byte	Byte for special functions
	14									DAT2.2H	Process Value1	High byte of first “analogue” value
	15									DAT2.2L		Low byte of first “analogue” value
	16									DAT2.3H	Process Value2	High byte of second “analogue” value
	17									DAT2.3L		Low byte of second “analogue” value
	18				3	3	3	3	3	DAT3.1	Control Byte	Byte for special functions
	19									DAT3.2H	Process Value1	High byte of first “analogue” value
	20									DAT3.2L		Low byte of first “analogue” value
	21									DAT3.3H	Process Value2	High byte of second “analogue” value
	22									DAT3.3L		Low byte of second “analogue” value
	23					4	4	4	4	DAT4.1	Control Byte	Byte for special functions
	24									DAT4.2H	Process Value1	High byte of first “analogue” value
	25									DAT4.2L		Low byte of first “analogue” value
	26									DAT4.3H	Process Value2	High byte of second “analogue” value
	27									DAT4.3L		Low byte of second “analogue” value
	28						5	5	5	DAT5.1	Control Byte	Byte for special functions
	29									DAT5.2H	Process Value1	High byte of first “analogue” value
	30									DAT5.2L		Low byte of first “analogue” value
	31									DAT5.3H	Process Value2	High byte of second “analogue” value
	32									DAT5.3L		Low byte of second “analogue” value
	33							6	6	DAT6.1	Control Byte	Byte for special functions
	34									DAT6.2H	Process Value1	High byte of first “analogue” value
	35									DAT6.2L		Low byte of first “analogue” value
	36									DAT6.3H	Process Value2	High byte of second “analogue” value
	37									DAT6.3L		Low byte of second “analogue” value
	38								7	DAT7.1	Control Byte	Byte for special functions
	39									DAT7.2H	Process Value1	High byte of first “analogue” value
	40									DAT7.2L		Low byte of first “analogue” value
	41									DAT7.3H	Process Value2	High byte of second “analogue” value
	42									DAT7.3L		Low byte of second “analogue” value
….Write last		8	13	18	23	28	33	38	43	Overall telegram length in bytes		

TADR Telegram address, defined by the DP-Master. Range 0..255

SNUM Number of connected OPAT-Slaves (Maximum 7).
The OPAT-Master (SADR = 0) is always included.
Here for multi slave operation the number of present slaves has to be set properly.

CMD Command: 15 = Write multiple parameters by the master

DATx[1].1 Control-Byte: One data byte in HEX, for special functions
0x00 == 0
0xFF == 255

DATx[1].2H, DATx[1].2L Process Value1: Two data bytes in HEX, without decimal sign, for “analogue” values
0x7FFF == +32767
0x8000 == -32768

DATx[1].3H, DATx[1].3L Process Value2: Two data bytes in HEX, without decimal sign, for “analogue” values
0x7FFF == +32767
0x8000 == -32768

x[1].= Module address (set by DIP-switch in each OPAT slave-Module) range 1 to 7.

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3.2 CMD = 15, Response from Slave (9 bytes)

Please pay attention to the fact that in case of multiple slave operation SADR will be changed automatically with each new response.

Example:
When using 2 slaves than the OPAT-master (without DIP-switch) will respond first. After the next "Master-Write" the slave with module address "1" (DIP-switch = 1) will respond and finally the last slave with address "2" (DIP-switch = 2). Than it starts again with The master address "0".
This means that the multiplexer for answering is implemented in the Profibus node. SADR indicates which of the modules has actually send the response.

Write first…

address	Byte	Structure	Abbreviation	Description	
	0	Telegram header	TADR	Telegram address, defined by the user, Range 0..255, 0..0xFF	
	1		SADR	Slave address	
	2		CMD	Command: 15 = Write multiple parameter by the master	
	3	Data of SADR	DAT.1H	Status Word	High byte of module state
	4		DAT.1L		Low byte of module state
	5		DAT.2H	VALUE1	High byte of first "analogue" value
	6		DAT.2L		Low byte of first "analogue" value
	7		DAT.3H	VALUE2	High byte of second "analogue" value
	8		DAT.3L		Low byte of second "analogue" value

…Write last

TADR Telegram address, defined by the DP-Master.

SADR Master or Slave address, if one Slave is connected to the Profibus port
1 to max 7 depending on number of slaves

CMD Command: 15 = Write multiple parameters by the master

DAT.1H,DAT.1L Status word: Two data bytes in HEX, , for module state
0x0000 == 0
0xFFFF == 65535

DAT.2H, DAT.2L, DAT.3H, DAT.3L VALUE1
VALUE2. Two data bytes in HEX, without decimal sign, for analogue values
0x7FFF == +32767
0x8000 == -32768

3.3 CMD = 15, Error from Slave (4 bytes)

Write first…

address	Byte	Abbreviation	Description
	0	TADR	Telegram address, defined by the user, Range 0..255, 0..0xFF
	1	SADR	Slave address
	2	ERR	Error code
	3	EXCE	Exception

…Write last

ERR Error code: 0x8F = write failed

EXCE Exception:
1 = Command not supported
2 = Wrong ID
3 = Wrong Data Value
4 = Writing of ID failed
5 = timeout (CAN connection)
6 = Internal checksum error (Modbus)
7 = Invalid number of connected slaves
8 = timeout slave, address wrong or not installed
9 = telegram to short, Profibus output buffer to small
10 = No CAN buffer defined, CAN baud rate not defined
11 = Slave sends error byte, command byte unknown
12 = Two or more slaves have the same slave address.

Example for error response:

Module 3 is not installed and SNUM in the master telegram is set to 3

Byte	Abbreviation	Abbreviation	Description
0	0x23	TADR	Response telegram address (defined by the user)
1	**0x03**	SADR	Actual slave address
2	0x8F	ERR	Error, Bit „7" with command 0x0F in decimal 15 is set
3	0x08	EXCE	timeout slave, address wrong or not installed

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3.4 Examples, CMD = 15

3.4.1 Only OPAT-master is connected (SW Version 34.xxy)

Enable is set to high at the OPAT-master module.

Master writes set value of 1.000 V to OPAT-master (module) SADR = 0:

Byte	Abbreviation	Abbreviation	Description
0	0x23	TADR	Telegram address, defined by the user, Range 0..255, 0..0xFF
1	0x00	SNUM	0x00 means only OPAT-master
2	0x0F	CMD	0x0F in decimal 15
3	0x00	DAT1.1	Byte for special functions , 0x00 (default value, no bus-disable)
4	(1000)	DAT1.2H	**A1.01,** set value input (Profibus) for (Branch 1)
5		DAT1.2L	0x03E8 (= 1000 in decimal = 1.000V)
6	(0)	DAT1.3H	**A1.02,** feedback value input (Profibus) for (Branch 1)
7		DAT1.3L	0x0000 (= 0 in decimal = 0.000V)

Response OPAT-master module) SADR = 0:

Byte	Abbreviation	Abbreviation	Description
0	0x23	TADR	Response telegram address (defined by the user)
1	0x00	SADR	Actual slave address, 0 = OPAT-master
2	0x0F	CMD	0x0F in decimal 15
3	0x40	DAT1.1H	High byte of module state, Hardware Enable is active, no error
4	0x00	DAT1.1L	Low byte of module state, not used, in this case always zero
5	(1000)	DAT1.2H	**d1.11 Module SADR**
6		DAT1.2L	Actual value, feedback value (Branch 1)
7	(0)	DAT1.3H	**d1.10 Module SADR**
8		DAT1.3L	Set value (internal value) (Branch 1)

(x) = value in decimal.

3.4.2 Multiple-slave (1 OPAT-master and 2 OPAT-slave modules, SW Version 34.xxy/V31.xxy)

The Profibus Address E24 of the OPAT-master is set to the right value (bus error LED is not blinking).
The DIP- switch of the two slave-modules is set to 1, 2.
All modules are powered on, the enable is on at all of the OPAT modules.

Master first write cycle: set value 1.000 V to Master, 2.000 V to slave1 and - 3.000 V to slave2:

Byte	Abbreviation	Abbreviation	Description
0	0x23	TADR	Telegram address, defined by the user, Range 0..255, 0..0xFF
1	0x02	SNUM	0x02 means two slaves (modules) are connected
2	0x0F	CMD	0x0F in decimal 15
3	0x00	DAT0.1	Byte for special functions, 0x00 (default value, no bus-disable)
4	(1000)	DAT0.2H	Set Value A1.01
5		DAT0.2L	0x03E8 (= 1000 in decimal = 1.000V)
6	(0)	DAT0.3H	Set Value A1.02
7		DAT0.3L	0x0000 (= 0 in decimal = 0.000V)
8	0x00	DAT1.1	Byte for special functions, 0x00 (default value, no bus-disable)
9	(2000)	DAT1.2H	Set Value A1.01
10		DAT1.2L	0x07D0 (= 2000 in decimal = 2.000V)
11	(0)	DAT1.3H	Set Value A1.02
12		DAT1.3L	0x0000 (= 0 in decimal = 0.000V)
13	0x00	DAT2.1	Byte for special functions, 0x00 (default value, no bus-disable)
14	(-3000)	DAT2.2H	Set Value A1.01
15		DAT2.2L	0xF448 (= - 3000 in decimal = - 3.000V)
16	(0)	DAT2.3H	Set Value A1.02
17		DAT2.3L	0x0000 (= 0 in decimal = 0.000V)

(x) = value in decimal.

The node will only send a response if **any** data in the telegram received from the Profibus-master has be changed! If the data in a telegram have to remain unchanged than a response from the node to a ”Master write” can be enforced due to a change of the data TADR.
The data of the write command will be immediately forwarded to OPAT-master and all OPAT-slaves (modules). Each response telegram to a write command will automatically contain “new data” from the next master/slave (module). The master/ slaves are automatically multiplexed.

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Response telegrams are automatically multiplexed by the OPAT-master.
In this example, OPAT-master answers first.

Byte	Abbreviation	Abbreviation	Description
0	0x23	TADR	Response telegram address (defined by the user)
1	**0x00**	SADR	OPAT master address
2	0x0F	CMD	0x0F in decimal 15
3	0x40	DAT0.1H	High byte of module state, Hardware Enable is active, no error
4	0x00	DAT0.1L	Low byte of module state, not used, in this case always zero
5	(1000)	DAT0.2H	**d1.11 Module SADR**
6		DAT0.2L	Actual value, feedback value (Branch 1)
7	(0)	DAT0.3H	**d1.10 Module SADR**
8		DAT0.3L	Set value (internal value) (Branch 1)

(x) = value in decimal.

Change telegram address TADR to 0x24 and send same message as before. Next OPAT-slave no. 1 will answer.

Byte	Abbreviation	Abbreviation	Description
0	0x24	TADR	Response telegram address (defined by the user)
1	**0x01**	SADR	Actual slave address
2	0x0F	CMD	0x0F in decimal 15
3	0x40	DAT1.1H	High byte of module state, Hardware Enable is active, no error
4	0x00	DAT1.1L	Low byte of module state, not used, in this case always zero
5	(2000)	DAT1.2H	**d1.11 Module SADR**
6		DAT1.2L	Actual value, feedback value (Branch 1)
7	(0)	DAT1.3H	**d1.10 Module SADR**
8		DAT1.3L	Set value (internal value) (Branch 1)

(x) = value in decimal.

Change telegram address TADR to 0x25 and send same message as before Next OPAT-slave no. 2 will answer.

Byte	Abbreviation	Abbreviation	Description
0	0x25	TADR	Response telegram address (defined by the user)
1	**0x02**	SADR	Actual slave address
2	0x0F	CMD	0x0F in decimal 15
3	0x40	DAT2.1H	High byte of module state, Hardware Enable is active, no error
4	0x00	DAT2.1L	Low byte of module state, not used, in this case always zero
5	(-3000)	DAT2.2H	**d1.11 Module SADR**
6		DAT2.2L	Actual value, feedback value (Branch 1)
7	(0)	DAT2.3H	**d1.10 Module SADR**
8		DAT2.3L	Set value (internal value) (Branch 1)

(x) = value in decimal.

Change telegram address TADR to 0x26 and send same message as before. Next OPAT-master will answer again.

Byte	Abbreviation	Abbreviation	Description
0	0x26	TADR	Response telegram address (defined by the user)
1	**0x00**	SADR	OPAT master address
2	0x0F	CMD	0x0F in decimal 15
3	0x40	DAT0.1H	High byte of module state, Hardware Enable is active, no error
4	0x00	DAT0.1L	Low byte of module state, not used, in this case always zero
5	(1000)	DAT0.2H	**d1.11 Module SADR**
6		DAT0.2L	Actual value, feedback value (Branch 1)
7	(0)	DAT0.3H	**d1.10 Module SADR**
8		DAT0.3L	Set value (internal value) (Branch 1)

(x) = value in decimal.

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3.5 CMD = 15, structure of Profibus telegram definition, depending on SW Versions

3.5.1 General

3.5.1.1 Error Message (indication by "Error occurred")

With Parameter E18 the "the 24V output at X7" can be configured as an error indication output.

Errors which are indicated in the Bit (Error occurred) like for example "Over Current" or "Cable Fraction" can be reset with the following action :

- Set input signal for the hardware enable at the according module at terminal X3/1 (9) to "Low" and than go back to "High"
- Setting and resetting of the Bits (0x80) Bus-Disable

Mandatory condition for resetting an error is that the failure causing the error has been cleared or removed.

3.5.1.2 Explanation for "Hardware Enable" and "Software Disable":

With Parameter E25 the "special input X16" can be configured as Enable/disable function
Generally speaking the hardware enable must be present ("high" level) in order to get a signal (current) at the output stages. Besides the hardware enable a software disable can be used in order to "override" the hardware enable. So even if the hardware signal is present, with the according software command the module can be disabled!

This means that the hardware enable can be hardwired and the software disable can be used in order to drop the output signal to zero or also in order to quit errors.

3.5.1.3 Explanation of special functions and module state bits

Attention: Functions and module state bits depend on the used SW version

HW_ENABLE	The signal "D-In Enable" (HW Enable) is activated at the module.
ERROR	An Error has occurred in the DMA module. Different possible problems can cause this. Please refer to the manual for the according DMA version
BUS_DISABLE	The Enable signal was reset by means of Profibus (DMA module is disabled).
Din_1	The "enable function" for the „remote loop controller" (function switches from open loop to closed loop) via the comparator „KOMP_1" is enabled and can be used. Additional mandatory condition: C1.00 must be set to 2 or 4! Remark: d1.12 and d1.13 remain at „0.000 V" as long as the condition for activation „Din_1" has not be set. This will prevent a premature activation of the comparator „KOMP_1".
Dout_1	Indicates that the function „remote loop controller" is active. The module is now working in closed loop mode. Additional mandatory conditions for transition from open loop to closed loop: C1.00 must be set to 2 or 4 Signal Din_1 must be present Comparator KOMP_1 has to be outside of the window, hence signal KOMP_1 = 0. The module will remain in closed loop operation as long as signal Din_1 stays on "High".
DKOMP_1	Output signal of comparator „KOMP_1", s used in order to monitor the signal defined by C1.25. This signal can also be used in order to switches over from open to closed loop: 0 = comparator is not active (out of the determined limits and time delays) 1 = comparator is active (inside the determined limits and time delays).
DKOMP_11	Output signal of comparator „KOMP_11", is used in order to monitor the signal defined by C1.32 0 = comparator is not active (out of the determined limits and time delays) 1 = comparator is active (inside the determined limits and time delays).
Din_2	The "enable function" for the „remote loop controller" (function switches from open loop to closed loop) via the comparator „KOMP_2" is enabled and can be used. Additional mandatory condition: C2.00 must be set to 2 or 4! Remark: d2.12 and d2.13 remain at „0.000 V" as long as the condition for activation „Din_2" has not be set. This will prevent a premature activation of the comparator „KOMP_2"..
Dout_2	Indicates that the function „remote loop controller" is active. The module is now working in closed loop mode. Additional mandatory conditions for transition from open loop to closed loop: C2.00 must be set to 2 or 4 Signal Din_2 must be present Comparator KOMP_2 has to be outside of the window, hence signal KOMP_2 = 0. The module will remain in closed loop operation as long as signal Din_2 stays on "High".
DKOMP_2	Output signal of comparator „KOMP_2", s used in order to monitor the signal defined by C2.25. This signal can also be used in order to switches over from open to closed loop: 0 = comparator is not active (out of the determined limits and time delays) 1 = comparator is active (inside the determined limits and time delays).
DKOMP_22	Output signal of comparator „KOMP_22", is used in order to monitor the signal defined by C2.32 0 = comparator is not active (out of the determined limits and time delays) 1 = comparator is active (inside the determined limits and time delays).
TST_CMP	Set Error/Comp output direct to 24V (disable signalizing of error output). Used to test the comparator or fault output.
CNTRL_1..4	Reserved for special functions
STAT_1..5	Reserved for special functions

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3.5.2 Version: V34.xxy, V31.xxy, closed loop, Mode 3, 4

Telegram structure example with 1 OPAT master module (SNUM = 0), Master writes multiple parameters (3 header +5·module bytes)

Write first…

Comment	Byte	Structure	Abbreviation	Description
	0	Telegram header	TADR	Telegram address, defined by User, Range 0..255, 0..0xFF
	1		SNUM	Number of connected slaves (Maximum 5)
	2		CMD	Command: 15 = Write multiple parameter by the master
	3	Module Data	DAT1.1	**Control byte** | Byte for special functions
	4		DAT1.2H	**Process Value1 = A1.01**
	5		DAT1.2L	Set value input (Profibus) for (Branch 1)
	6		DAT1.3H	**Process Value2 = A1.02**
	7		DAT1.3L	Feedback value input (Profibus) for (Branch 1)
….Write last		8	Overall telegram length in bytes	

Explanation of Byte for special functions (**Control byte**)

Description	Abbreviation	Function of each bit
Byte for special functions	DATx.1	Can be set only if the hardware enable is active. 0x01 = **Din_1**; Set signal Din_1 to active 0x04 = **TST_CMP**; Set Error/Comp output direct to 24V (disable signalizing of error output) 0x10 = **Din_2**; Set signal Din_2 to active 0x80 = **BUS_DISABLE** (Module disable via Profibus) In this mode not applicable, reserved: 0x02 = CNTRL_1 0x08 = CNTRL_2 0x20 = CNTRL_3 0x40 = CNTRL_4
		The special function byte will be set to internal 0x00 (reset) when the hardware enable is inactive.

Response telegram:

Write first…

Comment	Byte	Structure	Abbreviation	Description
	0	Telegram header	TADR	Telegram address, defined by the write command, Range 0..255, 0..0xFF
	1		SADR	Slave address
	2		CMD	Command: 15 = Write multiple parameter by the master
	3	Data of SADR Module	DAT.1H	**Status word** | High byte of module state
	4		DAT.1L	Low byte of module state
	5		DAT.2H	**VALUE1** = d1.11 from module with related SADR
	6		DAT.2L	Actual value, feedback value (Branch 1)
	7		DAT.3H	**VALUE2** = d1.10 from module with related SADR
	8		DAT.3L	Set value (internal value) (Branch 1)
….Write last		9	Overall telegram length in bytes	

Explanation of High and low byte of module state (**Status word**):

Description	Abbreviation	Explanation of each bit
High byte of module state	DAT.1H	0x04 = **HW_ENABLE**, hardware enable active 0x08 = **ERROR**, Error is pending 0x80 = **BUS_DISABLE** is set In this mode not applicable, reserved: 0x01 = STAT_1 0x02 = STAT_2 0x10 = STAT_3 0x20 = STAT_4 0x40 = STAT_5
Low byte of module state	DAT.1L	if "Error occurred" bit is set: error number otherwise: 0x01 = **Din_1** active 0x02 = **Dout_1** active 0x04 = **DKOMP_1** active 0x08 = **DKOMP_11** active 0x10 = **Din_2** active 0x20 = **Dout_2** active 0x40 = **DKOMP_2** active 0x80 = **DKOMP_22** active

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3.5.3 Version: V34.xxy, V31.xxy, closed loop, Mode 6

Telegram structure example with 1 OPAT module (SNUM = 0), Master writes multiple parameters (3 header+5·module bytes)

Write first…

Comment	Byte	Structure	Abbreviation	Description
	0	Telegram header	TADR	Telegram address, defined by User, Range 0..255, 0..0xFF
	1		SNUM	Number of connected slaves (Maximum 5)
	2		CMD	Command: 15 = Write multiple parameter by the master
	3	Module Data	DAT1.1	**Control byte** Byte for special functions
	4		DAT1.2H	**Process Value1 = A1.01**
	5		DAT1.2L	Set value input (Profibus) for (Branch 1)
	6		DAT1.3H	**Process Value2 = A2.02**
	7		DAT1.3L	Feedback value input (Profibus) for (Branch 2)
….Write last		8	Overall telegram length in bytes	

Explanation of Byte for special functions (**Control byte**)

Description	Abbreviation	Function of each bit
Byte for special functions	DATx.1	Can be set only if the hardware enable is active. 0x01 = **Din_1**; Set signal Din_1 to active 0x04 = **TST_CMP**; Set Error/Comp output direct to 24V (disable signalizing of error output) 0x10 = **Din_2**; Set signal Din_2 to active 0x80 = **BUS_DISABLE** (Module disable via Profibus) In this mode not applicable, reserved: 0x02 = CNTRL_1 0x08 = CNTRL_2 0x20 = CNTRL_3 0x40 = CNTRL_4
		The special function byte will be set to internal 0x00 (reset) when the hardware enable is inactive.

Response telegram:

Write first…

Comment	Byte	Structure	Abbreviation	Description
	0	Telegram header	TADR	Telegram address, defined by the write command, Range 0..255, 0..0xFF
	1		SADR	Slave address
	2		CMD	Command: 15 = Write multiple parameter by the master
	3	Data of SADR Module	DAT.1H	**Status word** High byte of module state
	4		DAT.1L	Low byte of module state
	5		DAT.2H	**VALUE1** = d1.11 from module with related SADR
	6		DAT.2L	Actual value, feedback value (Branch 1)
	7		DAT.3H	**VALUE2** = d2.11 from module with related SADR
	8		DAT.3L	Actual value, feedback value (Branch 2)
….Write last		9	Overall telegram length in bytes	

Explanation of High and low byte of module state (**Status word**):

Description	Abbreviation	Explanation of each bit
High byte of module state	DAT.1H	0x04 = **HW_ENABLE**, hardware enable active 0x08 = **ERROR**, Error is pending 0x80 = **BUS_DISABLE** is set In this mode not applicable, reserved: 0x01 = STAT_1 0x02 = STAT_2 0x10 = STAT_3 0x20 = STAT_4 0x40 = STAT_5
Low byte of module state	DAT.1L	if "Error occurred" bit is set: error number otherwise: 0x01 = **Din_1** active 0x02 = **Dout_1** active 0x04 = **DKOMP_1** active 0x08 = **DKOMP_11** active 0x10 = **Din_2** active 0x20 = **Dout_2** active 0x40 = **DKOMP_2** active 0x80 = **DKOMP_22** active

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3.5.4 Version: V34.xxy, V31.xxy, closed loop, Mode 8

Telegram structure example with 1 OPAT module (SNUM = 0), Master writes multiple parameters (3 header +5·module bytes)

Write first…

Comment	Byte	Structure	Abbreviation	Description
	0	Telegram header	TADR	Telegram address, defined by User, Range 0..255, 0..0xFF
	1		SNUM	Number of connected slaves (Maximum 5)
	2		CMD	Command: 15 = Write multiple parameter by the master
	3	Module Data	DAT1.1	**Control byte** | Byte for special functions
	4		DAT1.2H	**Process Value1 = A1.01**
	5		DAT1.2L	Set value input (Profibus) for (Branch 1)
	6		DAT1.3H	**Process Value2 = A2.01 S**
	7		DAT1.3L	Set value input (Profibus) for (Branch 2)
….Write last		8	Overall telegram length in bytes	

Explanation of Byte for special functions (**Control byte**)

Description	Abbreviation	Function of each bit
Byte for special functions	DATx.1	Can be set only if the hardware enable is active. 0x01 = **Din_1**; Set signal Din_1 to active 0x04 = **TST_CMP**; Set Error/Comp output direct to 24V (disable signalizing of error output) 0x10 = **Din_2**; Set signal Din_2 to active 0x80 = **BUS_DISABLE** (Module disable via Profibus) Not applicable, reserved: 0x02 = CNTRL_1 0x08 = CNTRL_2 0x20 = CNTRL_3 0x40 = CNTRL_4
		The special function byte will be set to internal 0x00 (reset) when the hardware enable is inactive.

Response telegram:

Write first…

Comment	Byte	Structure	Abbreviation	Description
	0	Telegram header	TADR	Telegram address, defined by the write command, Range 0..255, 0..0xFF
	1		SADR	Slave address
	2		CMD	Command: 15 = Write multiple parameter by the master
	3	Data of SADR Module	DAT.1H	**Status word** | High byte of module state
	4		DAT.1L	Low byte of module state
	5		DAT.2H	**VALUE1** = d1.11 from module with related SADR
	6		DAT.2L	Actual value, feedback value (Branch 1)
	7		DAT.3H	**VALUE2** = d2.11 from module with related SADR
	8		DAT.3L	Actual value, feedback value (Branch 2)
….Write last		9	Overall telegram length in bytes	

Explanation of High and low byte of module state (**Status word**):

Description	Abbreviation	Explanation of each bit
High byte of module state	DAT.1H	0x04 = **HW_ENABLE**, hardware enable active 0x08 = **ERROR**, Error is pending 0x80 = **BUS_DISABLE** is set Not applicable, reserved: 0x01 = STAT_1 0x02 = STAT_2 0x10 = STAT_3 0x20 = STAT_4 0x40 = STAT_5
Low byte of module state	DAT.1L	if "Error occurred" bit is set: error number otherwise: 0x01 = **Din_1** active 0x02 = **Dout_1** active 0x04 = **DKOMP_1** active 0x08 = **DKOMP_11** active 0x10 = **Din_2** active 0x20 = **Dout_2** active 0x40 = **DKOMP_2** active 0x80 = **DKOMP_22** active

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4 Siemens S7 implementation of the "Multiple-slave-OPAT"

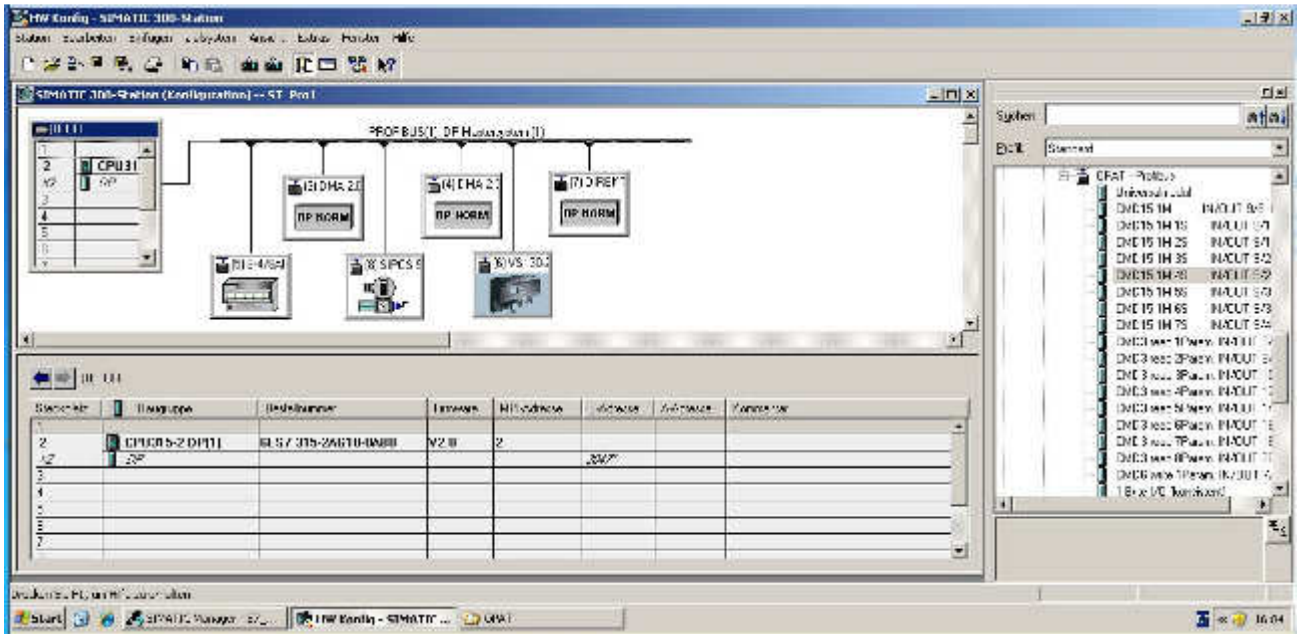
4.1 Hardware configuration

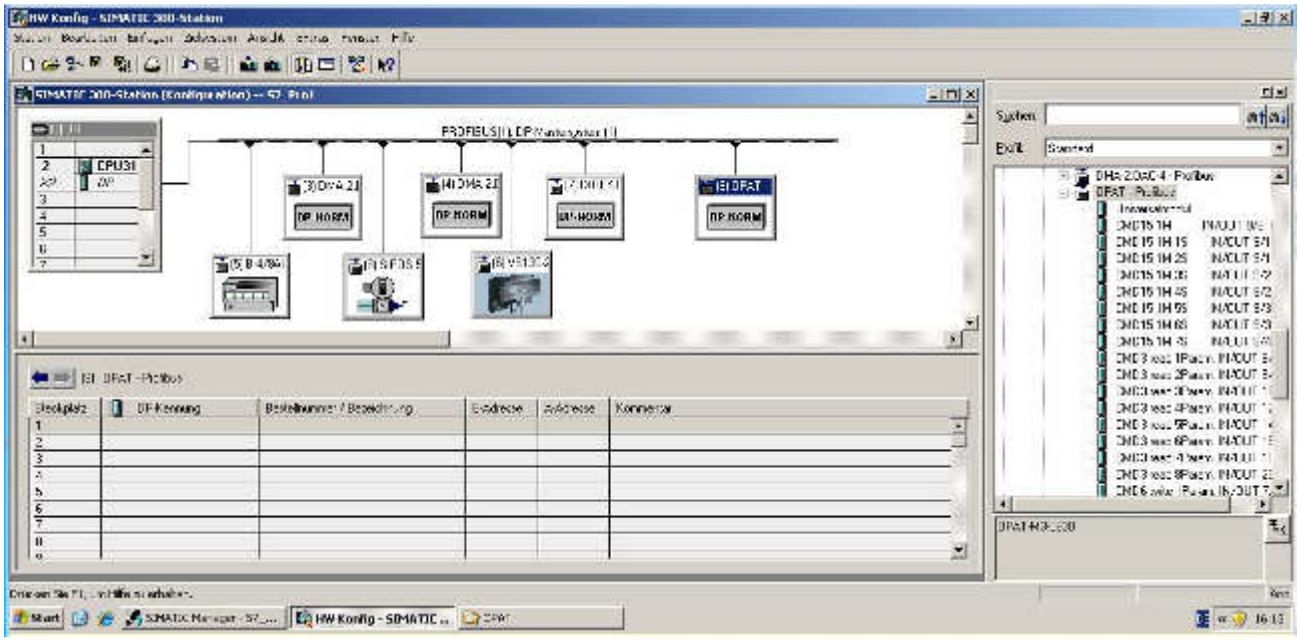
Hardware configuration with program "HW CONFIG", where you can find the OPAT Profibus node.
Valves (Ventile) → "OPAT – Profibus". Chose one of the modules defined in the GSD file. Depending on purpose of using. Modules are predefined for command CMD 15,6,3 telegrams

Select the right byte number of bytes for the output and input buffer depending on number of slaves used.
In this case, with 4 slaves (modules) and 1 master (module), the output buffer is fixed to a minimum of 28 bytes, the input buffer to a minimum of 9 bytes.

Chose for this example the "CMD15 1M 4S IN/OUT 9/28" profile.

Select the correct Profibus address, in this example #09 = 0x09.





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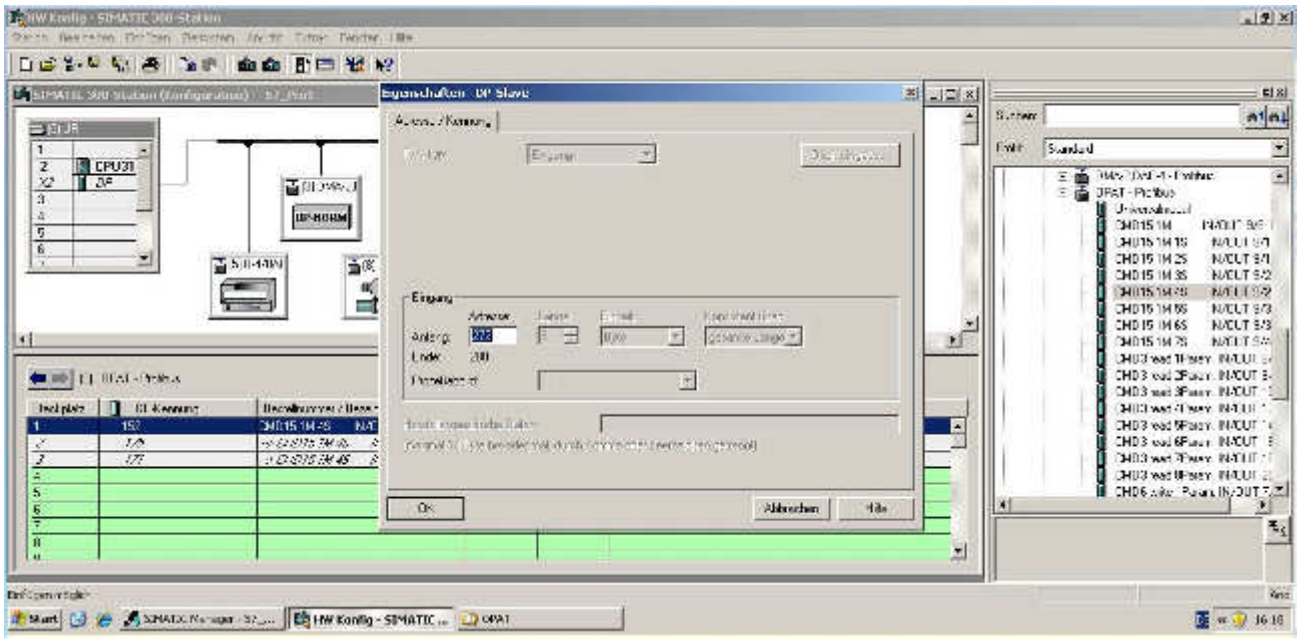
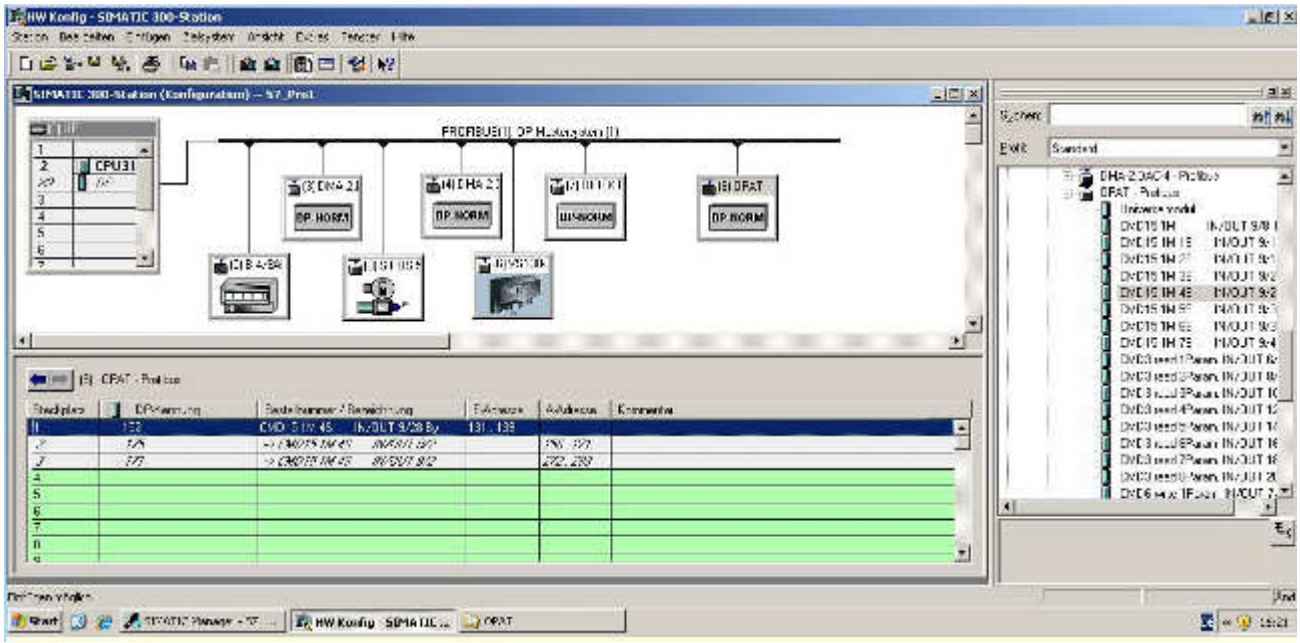
Define 9 byte input length.





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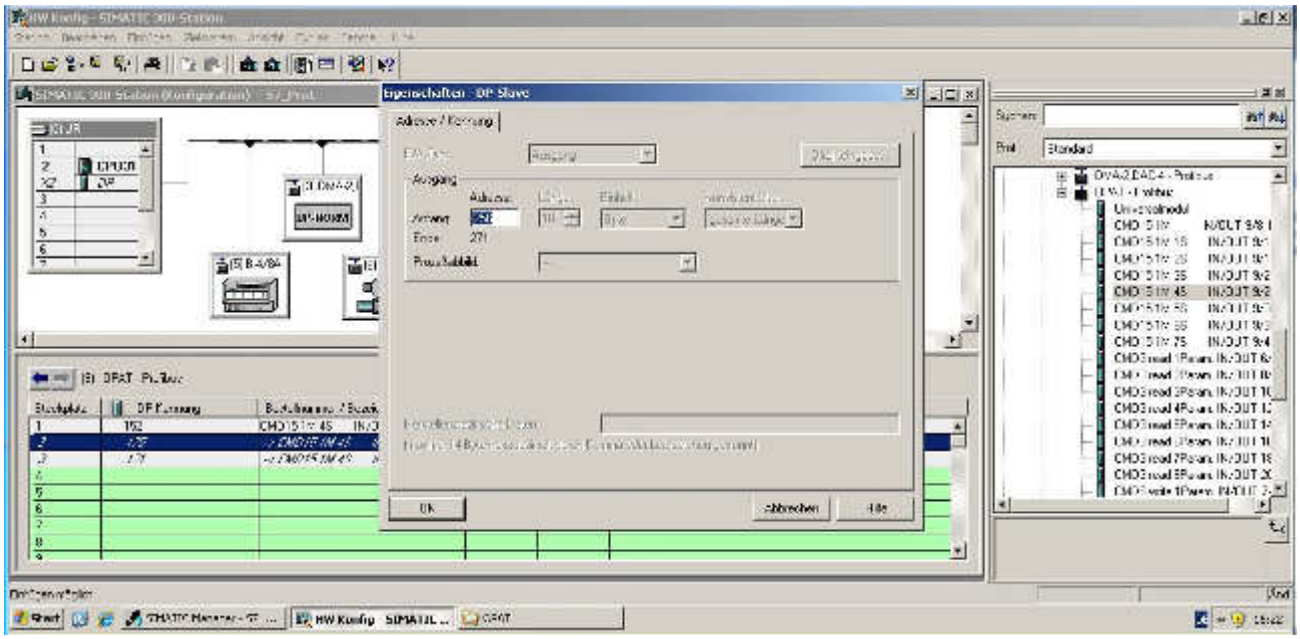
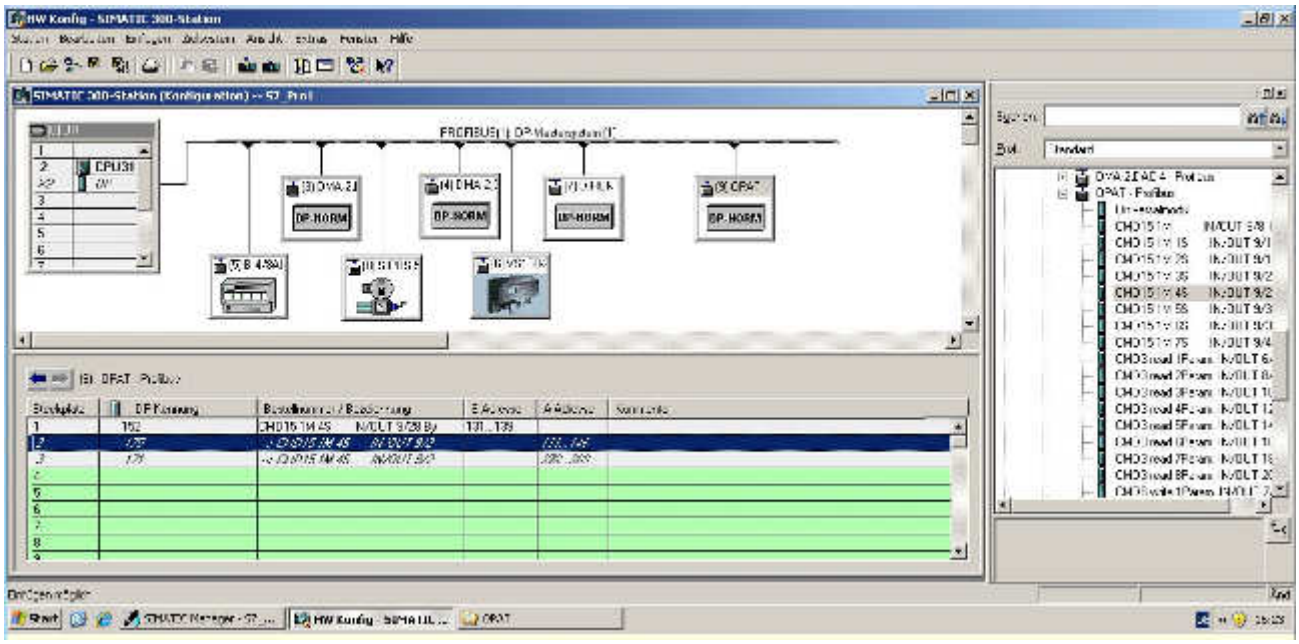
Adjust the first 16 byte of a total of 28 byte output length.





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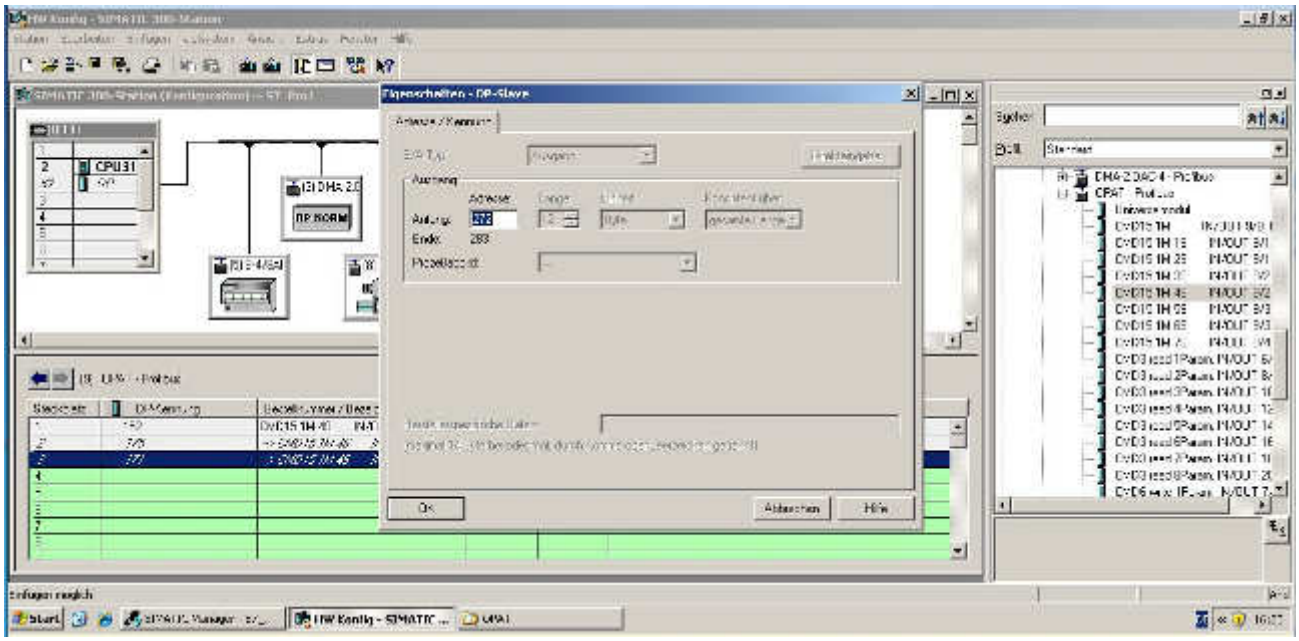
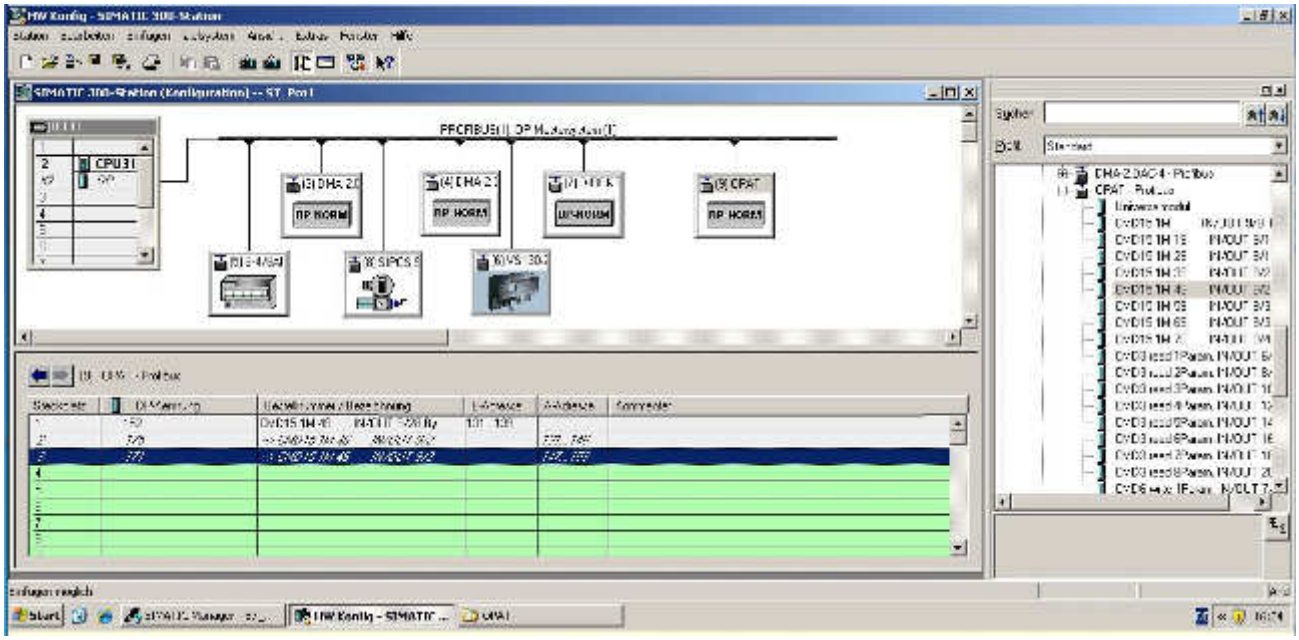
Adjust the remaining 12 byte of a total of 28 byte output length





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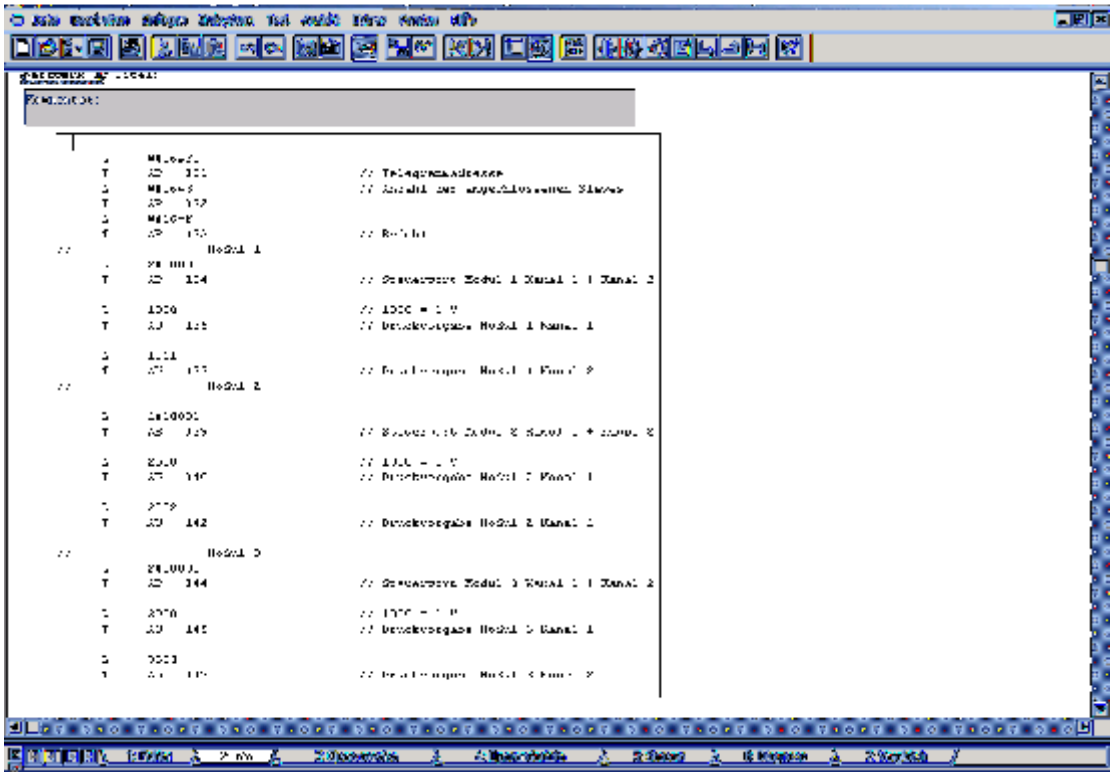
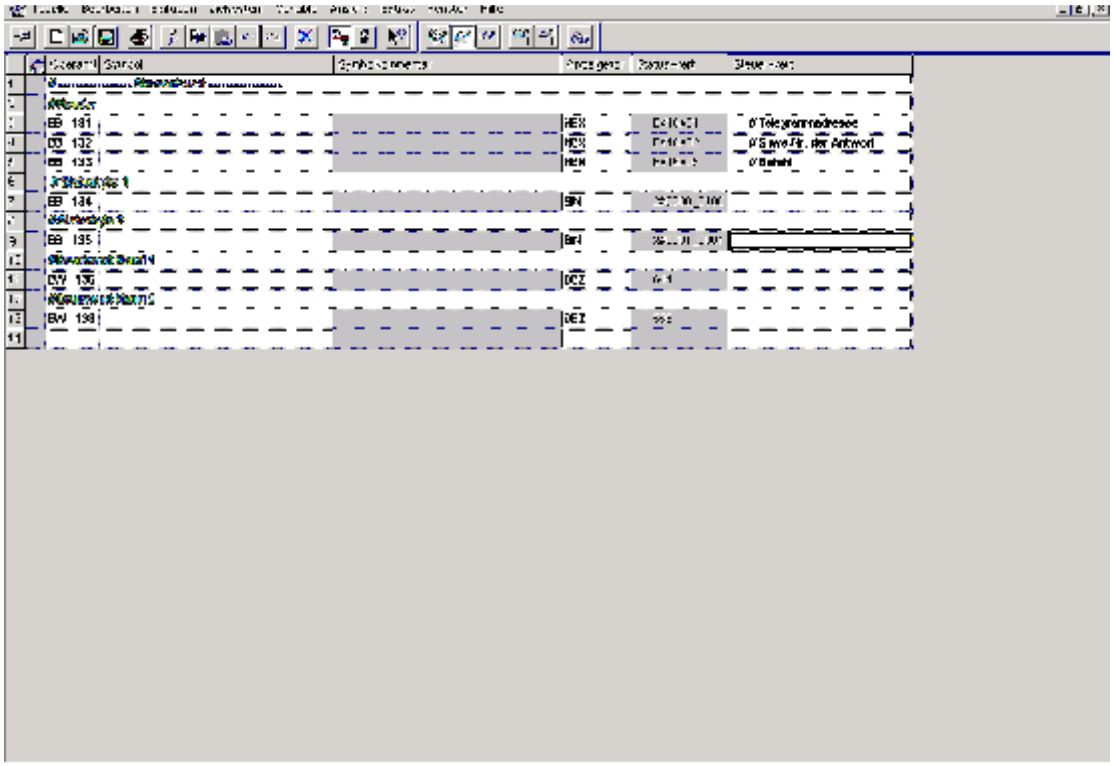
4.2 CMD = 15, protocol configuration

Define the output buffer



Now you can check the input buffer, in this case module 2 have send the response.
You can see the received module slave address at input-byte “EB 132”.



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5 ProfiDrive communication

5.1 Standard telegram 1

This telegram is used to send set values via profidrive to an OPAT Master/Slave.
Module 29 in the GSD file: “Standard telegram 1: closed-loop speed control, PZD length 2/2 words”

Content: n set interface, 16 bit

Table 87 – Definition of standard telegram 1

IO Data number	Setpoint	Actual value
1	STW1	ZSW1
2	NSOLL_A	NIST_A

5.2 Control word 1, STW1 definition

5.2.1 Normalized STW1 Bits

For using the set value Bit 0,1,2,3,4,5,6 and 10 must be set. According to the sequence of the state machine defined in the profidrive specification.

Bit	Significance	
	Speed control mode	Positioning mode
0	ON/OFF	
1	No Coast Stop/Coast Stop (no OFF2/OFF 2)	
2	No Quick Stop/Quick Stop (no OFF3/OFF 3)	
3	Enable Operation/Disable Operation	
4	Enable Ramp Generator / Reset Ramp Generator	Do Not Reject Traversing Task / Reject Traversing Task
5	Unfreeze Ramp Generator / Freeze Ramp Generator	No Intermediate Stop / Intermediate Stop
6	Enable Setpoint/Disable Setpoint	Activate Traversing Task (0 → 1)
7	Fault Acknowledge (0 -> 1)	
8	Jog 1 ON*/Jog 1 OFF*	
9	Jog 2 ON*/Jog 2 OFF*	
10	Control By PLC/No Control By PLC	
11	Device specific	Start Homing Procedure/Stop Homing Procedure
12 to 15	Device-specific	

NOTE: Using the closed-loop speed controlled mode in Application Class 4 with or without DSC (positioning with central interpolation and positioning control), the STW1 bit 4 and 6 ("Enable/Reset Ramp Generator" and "Enable/Disable Setpoint") keep their effectiveness. STW1 bit 5 ("Unfreeze/Freeze Ramp Generator") may be with or without effect. If STW1 bit 5 is without effect, this is indicated by parameter PNU930 = 3.

* optional.

Explanation: The significance for bit value = 1 is to the left of the slash, bit value = 0 to the right.

Detailed for OPAT:

Description	Abbreviation	Function of each bit
Device specific Status word 1	**STW1**	**BIT0 = “1” = Enable OPAT** **BIT7 = “1” fault acknowledge, Set this bit to 1 clears an pending error of the OPAT. (The root cause has to be solved first)**

5.2.2 Device specific STW1 Bits

Description	Abbreviation	Function of each bit
Device specific Control word 1	STW1	Can be set only if the hardware enable is active. BIT12 = Set signal Din_1 to active BIT13 = Set Error/Comp output direct to 24V (disable signalizing of error output) BIT14 = Set signal Din_2 to active BIT15 = ----
		The special function byte will be set to internal 0x00 (reset) when the hardware enable is inactive.

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5.3 Set value 1, NSOLL_A definition

Speed set point NSOLL_A 16 bit is normalized to N2 (Refer 5.3.2 of the profidrive standard)
If only the set value by the PLC is used, please check the setting of the parameter E17 (With HCSTool). In this case E17 = 2 is required.

5.3.2 Normalised value: N2, N4

Meaning

Linear normalised value. 0 % corresponds to 0 (0x0), 100 % corresponds to 2^{14} (0x4000) for N2 or 2^{30} (0x40000000) for N4.

Table 3 – N2, N4-Range of values

Coding	Data type	Range of values	Resolution	Length
113	N2	-200 % ≤ r ≤ (200 - 2^{-14}) %	2^{-14} = 0.006 1 %	2 Octet
114	N4	-200 % ≤ r ≤ (200-2^{-30}) %	2^{-30} = 9,3 × 10^{-8} %	4 Octet

Coding

- Representation in twos complement, the MSB (Most Significant Bit) is the bit after the sign bit (SN) of the first octet.
- SN = 0: positive numbers including zero
- SN = 1: negative numbers

100% = 0x4000, means internal of the OPAT set point of 10.0V.

Table 4 – N2, N4-Coding

Octet	Bit							
	8	7	6	5	4	3	2	1
1	SN	2^{0}	2^{-1}	2^{-2}	2^{-3}	2^{-4}	2^{-5}	2^{-6}
2	2^{-7}	2^{-8}	2^{-9}	2^{-10}	2^{-11}	2^{-12}	2^{-13}	2^{-14}
3	2^{-15}	2^{-16}	2^{-17}	2^{-18}	2^{-19}	2^{-20}	2^{-21}	2^{-22}
4	2^{-23}	2^{-24}	2^{-25}	2^{-26}	2^{-27}	2^{-28}	2^{-29}	2^{-30}

5.4 Status word 1, ZSW1 definition

5.4.1 Normalized ZSW1 Bits

Bit	Significance	
	Speed control mode	Positioning mode
0	Ready To Switch On /Not Ready To Switch On	
1	Ready To Operate/Not Ready To Operate	
2	Operation Enabled (drive follows setpoint)/Operation Disabled	
3	Fault Present/No Fault	
4	Coast Stop Not Activated/Coast Stop Activated (No OFF2/OFF2)	
5	Quick Stop Not Activated/Quick Stop Activated (No OFF3/OFF3)	
6	Switching On Inhibited/Switching On Not Inhibited	
7	Warning Present/No Warning	
8	Speed Error Within Tolerance Range / Speed Error Out Of Tolerance Range	Following Error Within Tolerance Range / Following Error Out Of Tolerance Range
9	Control Requested/No Control Requested	
10	f Or n Reached Or Exceeded / f Or n Not Reached	Target Position Reached / Not At Target Position
11	Device-specific	Home Position Set/Home Position Not Yet Set
12	Device-specific	Traversing Task Acknowledgement (0 -> 1)
13	Device-specific	Drive Stopped/Drive Moving
14 to 15	Device-specific	

Detailed for OPAT:

Description	Abbreviation	Function of each bit
Device specific Status word 1	**ZSW1**	**BIT2 = "1" = OPAT is enabled** **BIT3 = "1" = OPAT error appeared, the error number is shown in the NIST1 value.**

5.4.2 Device specific ZSW1 Bits

Description	Abbreviation	Function of each bit
Device specific Status word 1	ZSW1	Can be set only if the hardware enable is active. BIT12 = Signal at Comparator 1 (Komp_1) BIT13 = Signal at Comparator_11 (Komp_11) BIT14 = Controller in closed loop. Signal Dout_1 is set. BIT15 = ---
		Signal Komp_1 and Dout_1 is valid (up to date) when the OPAT is disabled.

5.5 Actual value 1, NIST_A definition

The feedback value d1.11 is shown in Mode 3, normalized to N2 format.

5.3.2 **Normalised value: N2, N4**

Meaning

Linear normalised value. 0 % corresponds to 0 (0x0), 100 % corresponds to 2^{14} (0x4000) for N2 or 2^{30} (0x40000000) for N4.

Table 3 – N2, N4-Range of values

Coding	Data type	Range of values	Resolution	Length
113	N2	-200 % ≤ r ≤ (200-2^{-14}) %	2^{-14} = 0.006 1 %	2 Octet
114	N4	-200 % ≤ r ≤ (200-2^{-30}) %	2^{-30} = 9.3×10^{-9} %	4 Octet

Coding

- Representation in twos complement. the MSB (Most Significant Bit) is the bit after the sign bit (SN) of the first octet.
- SN = 0: positive numbers including zero
- SN = 1: negative numbers

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5.6 Simple Start up the device with the STW1

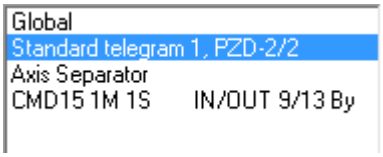
For start up the device without Profidrive equipment, you can follow this example:

- Write STW = 0x400, ZSW = 0x1240 unchanged
- Write STW = 0x40E or 0x406 to the device, wait until ZSW is set to 0x1231
- Write STW = 0x47F, ZSW = 0x1237

5.7 Using both protocols ProfiDrive and CMD15 in parallel

If there is a need to have a mixed structure of Profidrive and CMD15 protocol in one Master- Slave configuration. Please configure in the PLC both structures.

Example: One OPAT-Master, One OPAT-Slave
Configuration:

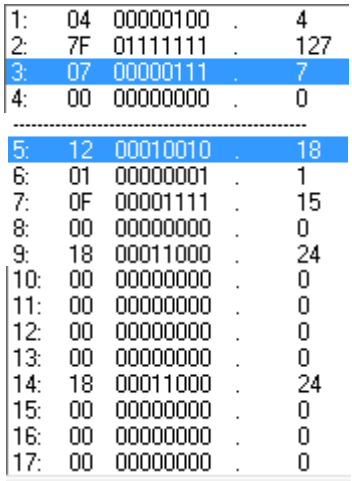


Profidrive Axis for the OPAT-Master

CMD15 for one OPAT-Master and one OPAT-Slave

Master OPAT is defined as a Profidrive-axis, and controlled by the Profidrive cycle.
Slave is only controlled by CMD15

Send telegram by the PLC



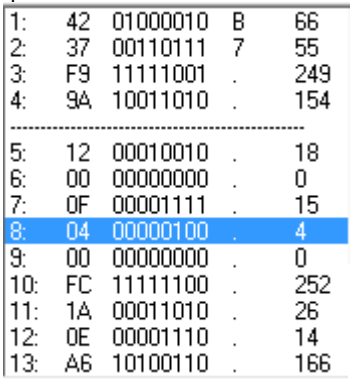
Profidrive part
Set-value = 0x0700 == 1,093V

TADR = 18
SADR = 1 (Master + One Slave)
CMD 15

Data field for OPAT-Master 0x1800 == 6,143V

Data field for OPAT-Slave 0x1800 == 6,143V

Response from Profidrive and OPAT-Master (Module 0)



Profidrive part

Module address 0 (OPAT-Master)

CMD 15 response from OPAT-Master

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Change telegram address (to 19), get the response from the OPAT-Slave

1:	42	01000010	B	66
2:	37	00110111	7	55
3:	F9	11111001	.	249
4:	9A	10011010	.	154
5:	13	00010011	.	19
6:	01	00000001	.	1
7:	0F	00001111	.	15
8:	04	00000100	.	4
9:	04	00000100	.	4
10:	02	00000010	.	2
11:	2D	00101101	-	45
12:	18	00011000	.	24
13:	00	00000000	.	0

Profidrive part

Module address 1 (OPAT-Slave)

CMD 15 response from OPAT-Slave

Now we provoke a cable fracture at Feedback 1 from the OPAT-Master
Change the telegram address to 20, get the response from the OPAT-Master

1:	40	01000000	@	64
2:	3F	00111111	?	63
3:	00	00000000	.	0
4:	02	00000010	.	2
5:	14	00010100	.	20
6:	00	00000000	.	0
7:	0F	00001111	.	15
8:	0C	00001100	.	12
9:	02	00000010	.	2
10:	00	00000000	.	0
11:	00	00000000	.	0
12:	00	00000000	.	0
13:	00	00000000	.	0

Profidrive part

Module address 0 (OPAT-Master)

Bit3 is set = error at OPAT-Master
Error number 2 → cable fracture at FB1
CMD 15 response from OPAT-Master

5.8 Explanation of parameter E 28

With parameter E28 behavior of the master is defined in case of a not connected or lost CAN slave:

- E 28 = 0; same as before, Error --7 appears. error bit in ZSW1 is set, error code 0x07 in ZWS1 is set OPAT follow the state “disabled” because of error.
- E 28 = 1, error bit in ZSW1 is set. ZWS1 still includes the feedback value of the master. The master remains in its previous state.
- E 28 = 2, error 7 is ignored, master is ignoring the lost CAN-slave(s).

In case of a lost CAN-slave the master sends the default status "Switch On Inhibited" for the lost slave. Error bit set and error code 0x07 is shown the ZSW1 value.

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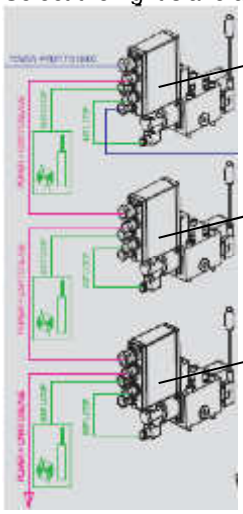
6 Siemens SIMOTION implementation of an 3 axis controller

- Select the right slave address (Rotary switch) for each OPAT in the communication chain.



OPAT-Master = Slot 1. First module in the HW config. (SADR = 0)

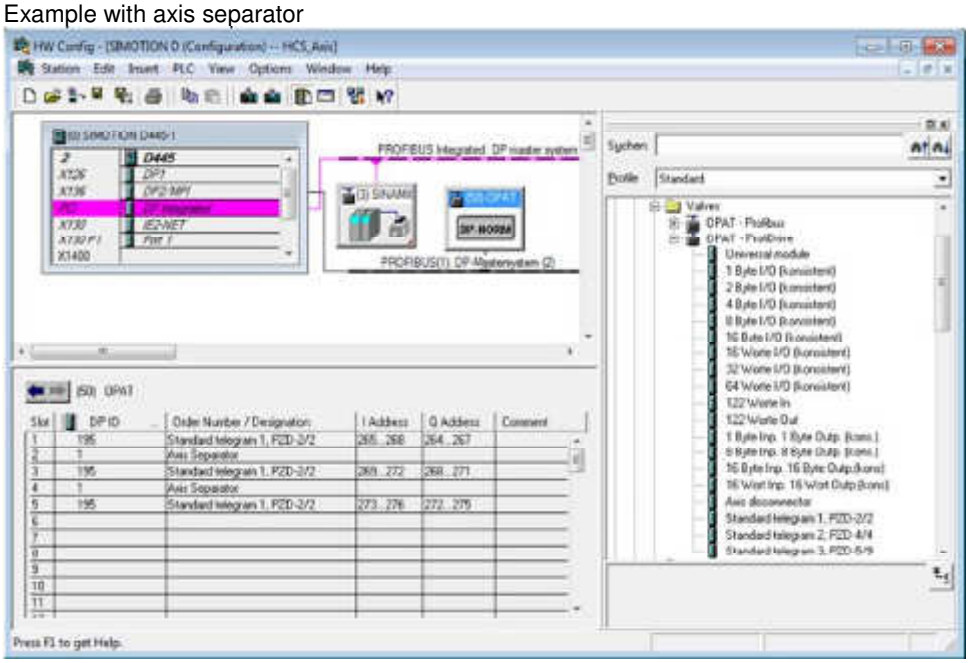
OPAT-Slave1 = Slot 2. Second module in the HW config. SADR = 1)
Set the rotary switch to 1

OPAT-Slave2 = Slot 3. Second module in the HW config. (SADR = 2)
Set the rotary switch to 2

Example for “OPAT Slave” No. 7 

- Choose the standard telegram 1, for each OPAT in the communication chain.

Example with axis separator



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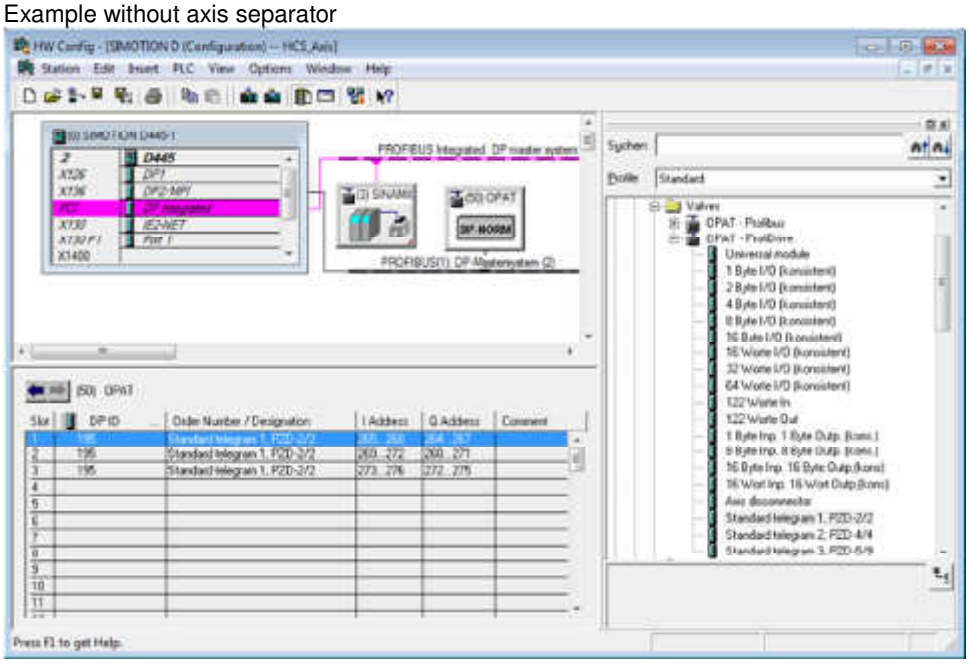
Example without axis separator



7 Configuration for the SIEMENS TIA portal

Call HCS for more information.

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List of parameters

Parameters in grey letters are not yet implemented in the OPAT Software.
All values in decimal, for usage as data values they must be converted into Hex
R = read only parameter.
X = implemented, but not active (no access)
W/R = writing and reading possible.

Normally all display values are zero, if the enable signal is not applied.

ID_{Hex}	ID_{dec}	W/R	Name	Function	Unit	Step	Min	Max	Description
0x00	0	R	Vers	Software version	**---**	---	xx.xx	xx.xx	Depends on HW
0x01	1	R	d1.01	Sum of analogue set value	V	1	-9999	9999	-1000 == -1.000 V; 1000 == 1.000 V
0x02	2	R	d1.02	Sum of all post ramp set values	V	1	-9999	9999	
0x03	3	R	d1.03	Set values after linearization	V	1	-9999	9999	
0x04	4	R	d1.04	Value after gain adjustment.	V	1	-9999	9999	
0x05	5	R	d1.05	Signal A	V	1	-9999	9999	
0x06	6	R	d1.06	Signal B	V	1	-9999	9999	
0x07	7	R	d1.07	Current A	A	1	0	5000	1000 == 1.000 A
0x08	8	R	d1.08	Current B	A	1	0	5000	
0x09	9	R	d1.09	Total current	A	1	0	5000	
0x0A	10	R	d1.10	Desired value	V	1	-9999	9999	-1000 == -1.000 V; 1000 == 1.000 V
0x0B	11	R	d1.11	Actual value, feedback value. **Holds the actual value also if OPAT is disabled** (V3x.x4…)	V	1	-9999	9999	
0x0C	12	R	d1.12	Lag error. **Holds the actual value also if OPAT is disabled** (V3x.x4…)	V	1	-9999	9999	
0x0D	13	R	d1.13	Controller output	V	1	-9999	9999	
0x0E	14	R	d2.01	Sum of analogue set value	V	1	-9999	9999	
0x0F	15	R	d2.02	Sum of all post ramp set values	V	1	-9999	9999	
0x10	16	R	d2.03	Set values after linearization	V	1	-9999	9999	
0x11	17	R	d2.04	Value after gain adjustment.	V	1	-9999	9999	
0x12	18	R	d2.10	Desired value	V	1	-9999	9999	
0x13	19	R	d2.11	Actual value, feedback value. **Holds the actual value also if OPAT is disabled** (V3x.x4…)	V	1	-9999	9999	
0x14	20	R	d2.12	Lag error. **Holds the actual value also if OPAT is disabled** (V3x.x4…)	V	1	-9999	9999	
0x15	21	R	d2.13	Controller output	V	1	-9999	9999	
0x16	22	R/W	S1.01	Reserved					
0x17	23	R/W	S1.02	Reserved					
0x18	24	R/W	S1.03	Reserved					
0x19	25	R/W	S1.04	Reserved					
0x1A	26	X	S1.08	reserved					
0x1B	27	R/W	r1.01	Ramp from 0 ⇒ -	s	1	0	3950	1 == 10ms 0 == Ramp function off
0x1C	28	R/W	r1.02	Ramp from – ⇒ 0	s	1	0	3950	
0x1D	29	R/W	r1.03	Ramp from 0 ⇒ +	s	1	0	3950	
0x1E	30	R/W	r1.04	Ramp from + ⇒ 0	s	1	0	3950	

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ID_{Hex}	ID_{dec}	W/R	Name	Function	Unit	Step	Min	Max	Description
0x1F	31	R/W	A1.01	Profibus set value (Branch 1)	V	1	-9999	9999	-1000 == -1.000 V; 1000 == 1.000 V This value is, when written, always active. Cleared by reset, or writing "0". For switching off of the analogue set-value, set E17 = "2"
0x20	32	R/W	A1.02	Profibus feedback value (Branch 1)	V	1	-9999	9999	-1000 == -1.000 V; 1000 == 1.000 V C1.09 has to be switched off in order to avoid interferences
0x21	33	R/W	S2.01	Reserved					
0x22	34	R/W	S2.02	Reserved					
0x23	35	R/W	r2.01	Ramp from 0 □ -	s	1	0	3950	1 == 10ms 0 == Ramp function off
0x24	36	R/W	r2.02	Ramp from – □ 0	s	1	0	3950	
0x25	37	R/W	r2.03	Ramp from 0 □ + (Branch 2)	S	1	0	3950	
0x26	38	R/W	r2.04	Ramp from + □ 0 (Branch 2)	S	1	0	3950	
0x27	39	R/W	A2.01	Profibus set value (Branch 2)	V	1	-9999	9999	-1000 == -1.000 V; 1000 == 1.000 V This value is, when written, always active. Cleared by reset, or writing "0". For switching off of the analogue set-value, set E17 = "2"
0x28	40	R/W	A2.02	Profibus feedback value (Branch 2)	V	1	-9999	9999	-1000 == -1.000 V; 1000 == 1.000 V C2.09 has to be switched off in order to avoid interferences
0x29	41	R/W	C1.00	Controller selection	---	1	0	4	0 = off 1 = P-PT_1-I-DT_1 2 =Remote 3 =dff 4 =Remote + dff
0x2A	42	R/W	C1.01	Safety function	---	1	0	1	0 = off; 1 = on
0x2B	43	R/W	C1.02	Linearization	---	1	0	6	0 = linear; 1 ... 5 = curve1-5 6 = customized curve
0x2C	44	R/W	C1.03	Gain A	V/V	1	0	200	100 == Factor 1.00
0x2D	45	R/W	C1.04	Gain B	V/V	1	0	200	100 == Factor 1.00
0x2E	46	R/W	C1.05	Set value sign and gain	V/V	1	-400	400	100 == Factor 1.00 Sign **and** gain!
0x2F	47	R/W	C1.06	Set value offset	V	1	-9999	9999	-1000 == -1.000 V; 1000 == 1.000 V
0x30	48	R/W	C1.07	Dead band compensation A	V	1	0	9999	1000 == 1.000 V 9.999 V = max. current depending on solenoid selection
0x31	49	R/W	C1.08	Dead band compensation B	V	1	0	9999	

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ID_{Hex}	ID_{dec}	W/R	Name	Function	Unit	Step	Min	Max	Description
0x32	50	R/W	C1.09	Sensor type Attention: No negative controller output possible when 10, 11, 12, 23, 26 is selected!	---	1	0	26	0 = off (used for Profibus application) 1 = 0 ... 20 mA 2 = 4 ... 20 mA 3 = 12 mA ± 8 mA 4 = 0 ... 10 V 5 = 0 ... ± 10 V 6 = 6 V ± 2,5 V 7 = 7,5 V ± 2,5 V 8 = 6 V ± 5 V 9 = 7,5 V ± 5 V 10 = 0 ... 20 mA V (positive contr. outp. only) 11= 4 ... 20 mA V (positive contr. outp. only) 12 = 0 ... 10 V (positive contr. outp. only) 14 = 5V-+3.0V 21 = Bipolar voltage semiautomatic calibration 22 = Unipolar voltage semiauto. calibration 23 = Unipolar volt. semiauto. calibration (positive contr. outp. only) 24 = Bipolar (internal) current semiauto. calibration 25 = Unipolar current semiauto. calibration 26 = Unipolar current semiauto. calibration (positive contr. outp. only)
0x33	51	R/W	C1.10	Actual value gain	V/V	1	0	300	100 == Factor 1.00
0x34	52	R/W	C1.11	Actual value offset	V	1	-9999	9999	-1000 == -1.000 V; 1000 == 1.000 V
0x35	53	R/W	C1.12	Actual value sign	---	---	- 1	+ 1	- 1 = negative 0 = off + 1 = positive
0x36	54	R/W	C1.13	P-Portion K_{P1}	V/V	1	0	400	100 == Factor 1.00
0x37	55	R/W	C1.14	T-Portion for PT1 (to C1.16)	S	1	0	400	100 == 1.00
0x38	56	R/W	C1.15	Threshold (C1.13, C1.16)	V	1	0	9999	1000 == 1.000 V
0x39	57	R/W	C1.16	P-Portion K_{P2}	V/V	1	0	400	100 == Factor 1.00
0x3A	58	R/W	C1.17	I-Portion	V/s	1	0	4000	1000 == 1.000
0x3B	59	R/W	C1.18	D-Portion	Vs	1	0	400	100 == 1.00
0x3C	60	R/W	C1.19	T-Portion for DT1	S	1	0	400	100 == 1.00
0x3D	61	R/W	C1.20	Gain (C1.13 and C1.16)	V/V	1	1	32	2 = Factor 2.00
0x3E	62	R/W	C1.21	Comparator upper level	V	1	-9999	9999	-1000 == -1.000 V; 1000 == 1.000 V
0x3F	63	R/W	C1.22	Comparator lower level	V	1	-9999	9999	
0x40	64	R/W	C1.23	Comparator delay into window	S	1	0	9999	1 == 10 ms 0 == no delay
0x41	65	R/W	C1.24	Comparator delay out of window	S	1	0	9999	

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ID$_{Hex}$	ID$_{dec}$	W/R	Name	Function	Unit	Step	Min	Max	Description
0x42	66	R/W	C1.25	KOMP_1, Comparator selection C1.25 = 4..6: No Signal for remote loop means, when C1.00 is set to 2,4 the comparator not activates the closed loop- controller. In this case the automatic function C1.26 = 2 is possible to use. (On cable fraction automatically switches to open loop). C1.25 = 7..9: The comparator is also active in disabled state. If C1.00 = 1,3. The "closed loop" controller can only be achieved when the comparator set the signal DKOMP_1. Otherwise the controller run in "open loop" when enable is applied.	---	1	0	6	off = Comparator 1 = Compare with d1.10 2 = Compare with d1.11 3 = Compare with d1.12 4 = Compare with d1.10; no signal for remote loop control 5 = Compare with d1.11; no signal for remote loop control 6 = Compare with d1.12; no signal for remote loop control 7 = Compare with d1.10; Always run in "open loop" when signal DKOMP_1 not active 8 = Compare with d1.11; Always run in "open loop" when signal DKOMP_1 not active 9 = Compare with d1.12; Always run in "open loop" when signal DKOMP_1 not active
0x43	67	R/W	C1.26	Cable fracture detection feedback	---	---	0	2	0 = off 1 = cable fracture detection on 2 = Cable fracture detection on, only in closed loop
0x44	68	R/W	C2.00	Controller selection	---	1	0	4	0 = off 1 = P-PT$_1$-I-DT$_1$ 2 =Remote 3 =dff 4 =Remote + dff
0x45	69	R/W	C2.01	Safety function	---	1	0	1	0 = off; 1 = on
0x46	70	R/W	C2.02	Linearization	---	1	0	5	0 = linear; 1 ... 5 = curve
0x47	71	R/W	C2.03	Gain A	V/V	1	0	200	100 == Factor 1.00
0x48	72	R/W	C2.04	Gain B	V/V	1	0	200	100 == Factor 1.00
0x49	73	R/W	C2.05	Set value sign and gain	V/V	1	-400	400	100 == Factor 1.00 Sign **and** gain!
0x4A	74	R/W	C2.06	Set value offset	V	1	-9999	9999	-1000 == -1.000 V; 1000 == 1.000 V
0x4B	75	R/W	C2.07	Dead band compensation A	V	1	0	9999	1000 == 1.000 V 9.999 V = max. current depending on solenoid selection
0x4C	76	R/W	C2.08	Dead band compensation B	V	1	0	9999	
0x4D	77	R/W	C2.09	Sensor type	---	1	0	0	0 = off (used for Profibus application)
0x4E	78	R/W	C2.10	Actual value gain	V/V	1	0	300	100 == Factor 1.00
0x4F	79	R/W	C2.11	Actual value offset	V	1	-9999	9999	-1000 == -1.000 V; 1000 == 1.000 V
0x50	80	R/W	C2.12	Actual value sign	---	---	- 1	+ 1	- 1 = negative 0 = off + 1 = positive
0x51	81	R/W	C2.13	P-Portion K_{P1}	V/V	1	0	400	100 == Factor 1.00
0x52	82	R/W	C2.14	T-Portion for PT1 (to C1.16)	S	1	0	400	100 == 1.00
0x53	83	R/W	C2.15	Threshold (C1.13, C1.16)	V	1	0	9999	1000 == 1.000 V
0x54	84	R/W	C2.16	P-Portion K_{P2}	V/V	1	0	400	100 == Factor 1.00
0x55	85	R/W	C2.17	I-Portion	V/s	1	0	4000	1000 == 1.000
0x56	86	R/W	C2.18	D-Portion	Vs	1	0	400	100 == 1.00
0x57	87	R/W	C2.19	T-Portion for DT1	S	1	0	400	100 == 1.00
0x58	88	R/W	C2.20	Gain (C1.13 and C1.16)	V/V	1	1	32	2 = Factor 2.00
0x59	89	R/W	C2.21	Comparator upper level	V	1	-9999	9999	-1000 == -1.000 V; 1000 == 1.000 V
0x5A	90	R/W	C2.22	Comparator lower level	V	1	-9999	9999	

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0x5B	91	R/W	C2.23	Comparator delay into window	S	1	0	9999	1 == 10 ms 0 == no delay
0x5C	92	R/W	C2.24	Comparator delay out of window	S	1	0	9999	
0x5D	93	R/W	C2.25	KOMP_2, Comparator selection C2.25 = 4..6: No Signal for remote loop means, when C1.00 is set to 2,4 the comparator not activates the closed loop- controller. In this case the automatic function C2.26 = 2 is possible to use. (On cable fraction automatically switches to open loop).	---	1	0	6	off = Comparator 1 = Compare with d2.10 2 = Compare with d2.11 3 = Compare with d2.12 4 = Compare with d2.10; no signal for remote loop control 5 = Compare with d2.11; no signal for remote loop control 6 = Compare with d2.12; no signal for remote loop control
0x5E	94	R/W	C2.26	Cable fracture detection feedback	---	---	0	2	0 = off 1 = cable fracture detection on 2 = Cable fracture detection on, only in closed loop
0x5F	95	R	E 00	Operation mode (depends on HW + SW version)	---	1	3	4	3 = Closed loop one valve 4 = Closed loop on application/process 6 = Closed loop, one valve one process 8 = Closed loop, two processes
0x60	96	R/W	E 01	Reserved					
0x61	97	R/W	E 02	Push-Pull function	---	---	0	4	0 = off 1 = active 2 = common “+” for solenoids (Remark: only for max 0,8 A current) 3 = full bridge 4 = off + solenoid monitoring
0x62	98	R/W	E 03	Solenoid selection A	---	1	1	7	1 = 0,150 A 2 = 0,150 A 3 = 0,150 A 4 = 0,240 A 5 = 0,500 A 6 = 0,630 A 7 = 0,800 A
0x63	99	R	E 04	P-Portion current contr. Energization A	---	1	0	9999	Default for 0,630 A solenoid
0x64	100	R	E 05	I-Portion current contr. Energization A	---	1	0	9999	
0x65	101	R	E 06	P-Portion cur. contr. de- energization A	---	1	0	9999	
0x66	102	R	E 07	I-Portion cur. contr. de- energization A	---	1	0	9999	
0x67	103	R/W	E 08	Ramp selection	---	1	0	1	0 = digital set v. (time constant) 1 = all set v. (rise constant.)
0x68	104	R/W	E 09	Time delay enable signal	s	1	0	9999	1 = 1.00s
0x69	105	R/W	E 10	Solenoid current adaptation A	---	1	50	110	Variable adjustment of max. current 100 == Factor 1.00
0x6A	106	R/W	E 11	Initial current solenoid A	V	1	0	3000	3.000 V = 30 % of max. rated current
0x6B	107	R/W	E 12	Initial current solenoid B	V	1	0	3000	
0x6C	108	R/W	E 13	Dither Amplitude A	V	1	0	3000	
0x6D	109	R/W	E 14	Dither Frequency A	Hz	1	1	300	---
0x6E	110	R/W	E 15	Selection set point S1.06 (U/I)	---	1	0	7	0 = S1.06 voltage input active 1 = 0 … 20 mA w/o cable fract. det. 2 = 10 mA ± 10 mA w/o cable fract. det. 3 = 4 … 20 mA w/o cable fract. det. 4 = 4 …. 20 mA with cable fract. det. 5 = 12 mA +- 8 mA w/o cable fract. det. 6 = 12 mA +- 8 mA with cable fract. det. 7 = 5V+-5V w/o cable fract. det.
0x6F	111	R/W	E 16	Reserved					
0x70	112	R/W	E 17	Set value activation mode	---	1	0	2	0 = analogue set input active 2 = only digital set value active

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0x71	113	R/W	E 18	Error/Comparator Output at X7.	---	1	0	13	off = X7 = 24V (max. 200mA) 1 = when Error, X7 high impedance 2 = Comp_1 positiv logic 3 = Comp_1 negativ logic 4 = Comp_2 positiv logic 5 = Comp_2 negativ logic 6 = Dout_1 positiv logic 7 = Dout_1 negativ logic 8 = Dout_2 positiv logic 9 = Dout_2 negativ logic 10 = Comp_1(and)Comp_2 positiv logic 11 = Comp_1(and)Comp_2 negativ logic 12 = Comp_1(or)Comp_2 positiv logic 13 = Comp_1(or)Comp_2 negativ logic
0x72	114	R/W	E19	Reserved					
ID_{Hex}	**ID_{dec}**	**W/R**	**Name**	**Function**	**Unit**	**Step**	**Min**	**Max**	**Description**
0x73	115	R/W	E20	Reserved					
0x74	116	R/W	E21	Reserved					
0x75	117	X	FB1M	Reserved					
0x76	118	X	FB1o	Reserved					
0x77	119	X	FB1f	Reserved					
0x78	120	X	DOUT	Reserved					
0x79	121	X	D_IO	Reserved					
0x7A	122	X	D_IN	Reserved					
0x7B	123	X	Uout	Reserved					
0x7C	124	X	Umon	Reserved					
0x7D	125	X	1_E4	Reserved					
0x7E	126	X	1_E5	Reserved					
0x7F	127	X	1_E6	Reserved					
0x80	128	X	1_E7	Reserved					
0x81	129	X	2_E4	Reserved					
0x82	130	X	2_E5	Reserved					
0x83	131	X	2_E6	Reserved					
0x84	132	X	2_E7	Reserved					
0x85	133	X	3_E4	Reserved					
0x86	134	X	3_E5	Reserved					
0x87	135	X	3_E6	Reserved					
0x88	136	X	3_E7	Reserved					
0x89	137	X	4_E4	Reserved					
0x8A	138	X	4_E5	Reserved					
0x8B	139	X	4_E6	Reserved					
0x8C	140	X	4_E7	Reserved					
0x8D	141	X	5_E4	Reserved					
0x8E	142	X	5_E5	Reserved					
0x8F	143	X	5_E6	Reserved					
0x90	144	X	5_E7	Reserved					
0x91	145	X	6_E4	Reserved					
0x92	146	X	6_E5	Reserved					
0x93	147	X	6_E6	Reserved					

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0x94	148	X	6_E7	Reserved					
0x95	149	X	7_E4	Reserved					
0x96	150	X	7_E5	Reserved					
0x97	151	X	7_E6	Reserved					
0x98	152	X	7_E7	Reserved					
0x99	153	X	User	Reserved					
0x9A	154	R	So.in	Reserved					
0x9B	155	R/W	E2.03	Solenoid selection B	---	1	1	7	1 = 0,315 A 2 = 0,315 A 3 = 0,350 A 4 = 0,400 A 5 = 0,500 A 6 = 0,630 A 7 = 0,800 A
0x9C	156	R	E2.04	P-Portion current contr. Energization B	---	1	0	9999	Default for 0,630 A solenoid
0x9D	157	R	E2.05	I-Portion current contr. Energization B	---	1	0	9999	
0x9E	158	R	E2.06	P-Portion cur. contr. de- energization B	---	1	0	9999	
0x9F	159	R	E2.07	I-Portion cur. contr. De- energization B	---	1	0	9999	
0xA0	160	R/W	E2.10	Solenoid current adaptation B	---	1	50	110	Variable adjustment of max. current 100 == Factor 1.00
0xA1	161	R/W	E2.13	Dither Amplitude B	V	1	0	3000	3000 V = 30 % of max. rated current
0xA2	162	R/W	E2.14	Dither Frequency B	Hz	1	1	300	---
0xA3	163	R	E 22	CAN Slave Address (OPAT –Slave- only)	---	1	1	8	adress given from DIP-Switch
0xA4	164	R/W	C1.27	Hysteresis command A	V	1	0	9999	1000 == 1.000 V
0xA5	165	R/W	C2.27	Hysteresis command B	1	1	0	9999	
0xA6	166	R/W	C1.28	KOMP_11, Comparator upper level	V	1	-9999	9999	-1000 == -1.000 V; 1000 == 1.000 V
0xA7	167	R/W	C1.29	KOMP_11, Comparator lower level	V	1	-9999	9999	
0xA8	168	R/W	C1.30	KOMP_11, Comparator delay into window	S	1	0	9999	1 == 10 ms 0 == no delay
0xA9	169	R/W	C1.31	KOMP_11, Comparator delay out of window	S	1	0	9999	
0xAA	170	R/W	C1.32	KOMP_11, Comparator selection	---	1	0	3	0 = off 1 = Set value 2 = Actual value 3 =Lag error
0xAB	171	R/W	C2.28	KOMP_22, Comparator upper level	V	1	-9999	9999	-1000 == -1.000 V; 1000 == 1.000 V
0xAC	172	R/W	C2.29	KOMP_22, Comparator lower level	V	1	-9999	9999	
0xAD	173	R/W	C2.30	KOMP_22, Comparator delay into window	S	1	0	9999	1 == 10 ms 0 == no delay
0xAE	174	R/W	C2.31	KOMP_22, Comparator delay out of window	S	1	0	9999	

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0xAF	175	R/W	C2.32	KOMP_22, Comparator selection	---	1	0	3	0 = off 1 = Set value 2 = Actual value 3 =Lag error
0xB0	176	R/W	-	Internal Digital Switches (Read/Set) Signal Dout_1 = 1; controller 1 run in closed loop. Dout_2 = 1; controller 2 run in closed loop.	---	---	0	**0xFFFF**	0x0001 = Din_1 active (Read/Write) 0x0002 = Dout_1 active (Read only) 0x0004 = DKOMP_1 active (Read only) 0x0008 = DKOMP_11 active (Read only) 0x0010 = Din_2 active (Read/Write) 0x0020 = Dout_2 active (Read only) 0x0040 = DKOMP_2 active (Read only) 0x0080 = DKOMP_22 active (Read only) 0x0400 = Enable active 0x0800 = Error (Read only) 0x8000 = Bus Disable Card (Read/Write)
0xB1	177	R/W	E 23	OPAT-Master: Profibus telegram timeout window OPAT-Slave: CAN telegram timeout window	S	1	0	9999	1 == 10 ms 0 == function deactivated
0xB2	178	R/W	E 24	Profibus Address	---	1	0	126	126 = Address setting by Profibus master
0xB3	179	R/W	E 25	Logic and function definition of special Input	---	1	0	4	0 = Function: no function Logic: Output stages normally disabled 1 = Function: no function Logic: Output stages normally enabled 2 = Function: Enable Output stages Logic: 24V Input, enabled 3 = Function: Enable Output stages Logic: 24V Input disabled 4 = Function: Reset address setting Enable Output stages Logic: 24V Input, enabled 5 = Function: Reset address setting Disable Output stages Logic: 24V Input disabled
0xB4	180	R/W	C1.33	I-Portion output value limitation (loop 1)	V	1	0	9999	1000 == 1.000 V
0xB5	181	R/W	C2.33	I-Portion output value limitation (loop 2)	V	1	0	9999	1000 == 1.000 V
0xB6	182	R/W	C1.36	Sensor signal correction factor for values < 0 (related to C1.10)	V	1	-100	100	-100 = -1.00V; 1000== 1.00 V
0xB7	183	R/W	E 26	CAN Baudrate, only applicable if the CAN function is allowed. Note: settings via Profibus only active after Reboot.	---	1	0	1	0 = CAN disabled 1 = 20Kbit/s 2 = 20Kbit/s 3 = 50Kbit/s 4 = 125Kbit/s 5 = 250Kbit/s 6 = 500Kbit/s 7 = 800Kbit/s 8 = 1Mbit/s
0xB8	184	X	--	Reserved					
0xB9	185	R/W	E Clr	Reset error	---	1	0	1	1 = Reset error signal. After writing, this parameter is set again to 0
0xBA	186	R	E 27	Connected CAN-Slaves	BIN	2^{n-1}	0	255	Every Slave counts as binary value of his Adress-ID. F.E. 64 = 0x40 = only Slave with ID=7 is active
0xBB	187	X	--	Reserved					
0xBC	188	X	--	Reserved					
0xBD	189	X	--	Reserved					

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0xBE	190	X	--	Reserved					
0xBF	191	X	--	Reserved					
0xC0	192	X	--	Reserved					
0xC1	193	X	--	Reserved					
0xC2	194	X	--	Reserved					
0xC3	195	R/W	C2.36	Sensor signal correction factor for values < 0 (related to C2.10)	V	1	-100	100	-100 = -1.00V; 1000== 1.00 V
0xC4	196	R/W	C1.37	Spool overlap compensation A	V	1	0	9999	1000 == 1.000 V 9.999 V = max. current depending on solenoid selection
0xC5	197	R/W	C1.38	Spool overlap compensation B	V	1	0	9999	1000 == 1.000 V 9.999 V = max. current depending on solenoid selection
0xC6	198	R/W	L1.x0	Customer linearization curve (fix)	V	1	0	0	1000 == 1.000 V
0xC7	199	R/W	L1.y0	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xC8	200	R/W	L1.x1	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xC9	201	R/W	L1.y1	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xCA	202	R/W	L1.x2	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xCB	203	R/W	L1.y2	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xCC	204	R/W	L1.x3	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xCD	205	R/W	L1.y3	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xCE	206	R/W	L1.x4	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xCF	207	R/W	L1.y4	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xD0	208	R/W	L1.x5	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xD1	209	R/W	L1.y5	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xD2	210	R/W	L1.x6	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xD3	211	R/W	L1.y6	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xD4	212	R/W	L1.x7	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xD5	213	R/W	L1.y7	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xD6	214	R/W	L1.x8	Customer linearization curve (fix)	V	1	9999	9999	1000 == 1.000 V
0xD7	215	R/W	L1.y8	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xD8	216	X	--	Reserved					
0xD9	217	X	--	Reserved					
0xDA	218	R/W	L2.x0	Customer linearization curve (fix)	V	1	0	0	1000 == 1.000 V
0xDB	219	R/W	L2.y0	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xDC	220	R/W	L2.x1	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xDD	221	R/W	L2.y1	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xDE	222	R/W	L2.x2	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xDF	223	R/W	L2.y2	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xE0	224	R/W	L2.x3	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xE1	225	R/W	L2.y3	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xE2	226	R/W	L2.x4	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xE3	227	R/W	L2.y4	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xE4	228	R/W	L2.x5	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xE5	229	R/W	L2.y5	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xE6	230	R/W	L2.x6	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xE7	231	R/W	L2.y6	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xE8	232	R/W	L2.x7	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xE9	233	R/W	L2.y7	Customer linearization curve	V	1	0	9999	1000 == 1.000 V

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ID_{Hex}	ID_{dec}	W/R	Name	Function	Unit	Step	Min	Max	Description
0xEA	234	R/W	L2.x8	Customer linearization curve (fix)	V	1	9999	9999	1000 == 1.000 V
0xEB	235	R/W	L2.y8	Customer linearization curve	V	1	0	9999	1000 == 1.000 V
0xEC	236	X	--	Reserved					
0xED	237	R	C1.40	Stored data of sensor type of the semi-automatic calibration	---	1	21	26	
0xEE	238	X	--	Reserved					
0xEF	239	X	--	Reserved					
0xF0	240	X	--	Reserved					
0xF1	241	X	--	Reserved					
0xF2	242	X	--	Reserved					
0xF3	243	X	--	Reserved					
0xF4	244	X	--	Reserved					
0xF5	245	X	--	Reserved					
0xF6	246	X	--	Reserved					
0xF7	247	X	--	Reserved					
0xF8	248	X	--	Reserved					
0xF9	249	X	--	Reserved					
0xFA	250	X	--	Reserved					
0xFB	251	X	--	Reserved					
0xFC	252	X	--	Reserved					
0xFD	253	X	--	Reserved					
0xFE	254	X	--	Reserved					
0xFF	255	X	--	Reserved					
0x100	256	R/W	B1.01	ProfiDrive set value (Branch 1)	V	1	-9999	9999	-1000 == -1.000 V; 1000 == 1.000 V This value is, when written, always active. Cleared by reset, or set to “0” by the Profidrive sequence. For switching off of the analogue set-value, set E17 = “2”
0x101	257	R/W	B2.01	ProfiDrive set value (Branch 2)	V	1	-9999	9999	-1000 == -1.000 V; 1000 == 1.000 V This value is, when written, always active. Cleared by reset, or set to “0” by the Profidrive sequence. For switching off of the analogue set-value, set E17 = “2”
0x102	258	R	ERR	Internal Error of the device	-	-	0	99	0 = no error present. 2 = wire break sensor 1 4 = wire break sensor 2 5 = overload of current >22mA sensor1 6 = overload of current >22mA sensor2 7 = CAN error, no connection to slave or master 8 = Wire break at the output stages 9 = wire break on set value 10 = CAN error, receiving error 11 = Profibus error, no connection to PLC 12 = CAN error, no connection to CAN Master 13 = CAN timeout error 23 = Calibration error
0x103	259	R/W	E 28	Handling of CAN communication error of the master when connection to slave fails	---	1	0	2	0 = No connection to Slave causes error-7 and disable 1 = No connection to Slave causes error-7, but the master follow the enable signal 2 = No connection error is completely suppressed

END