OPERATING INSTRUCTIONS

PROFIBUS-DP Device-Profile in accordance with Fluid Power Technology

Inhaltsverzeichnis

1 PROFIBUS-DP Technology

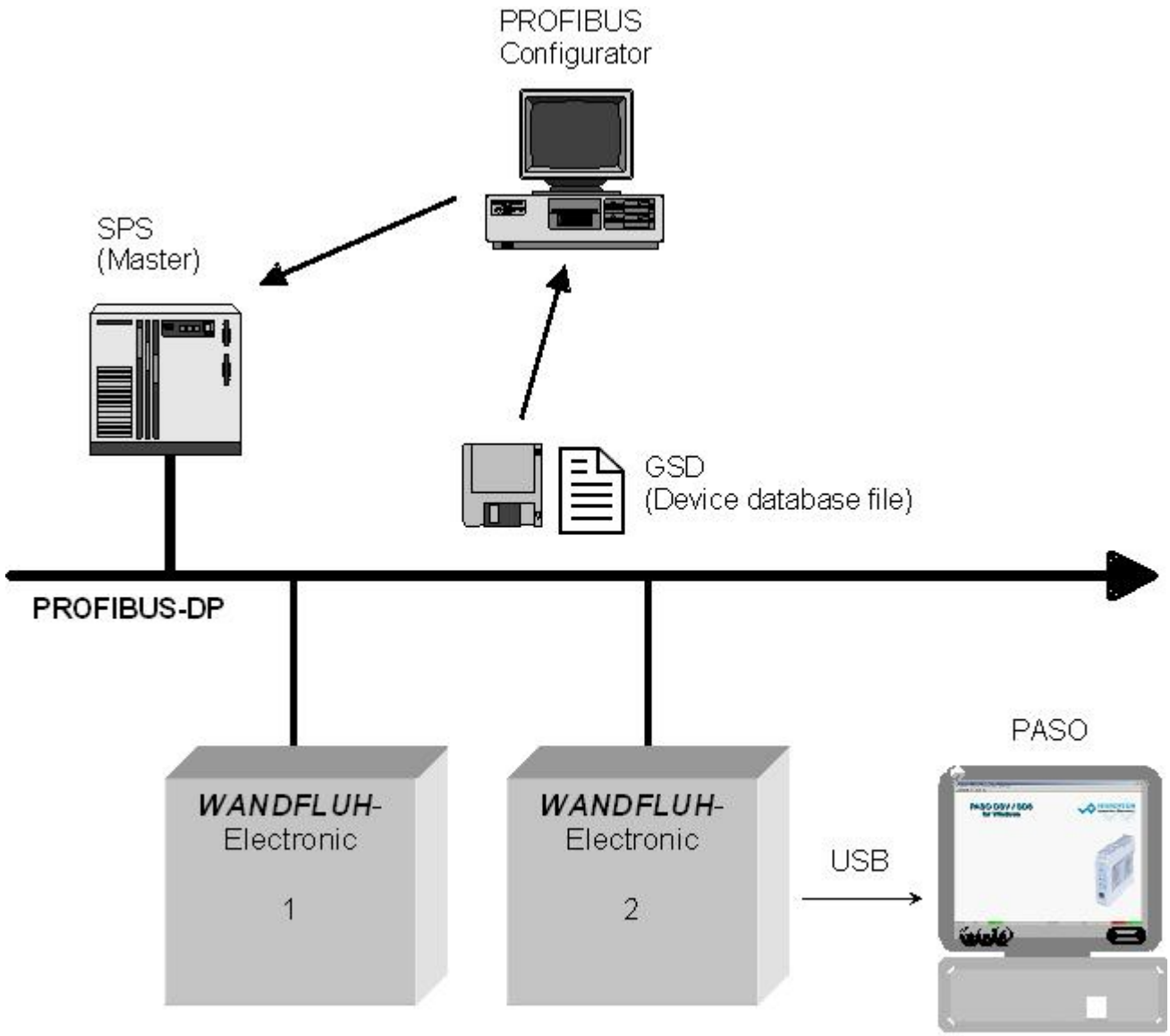
1.1 General

PROFIBUS-DP is a vendor-independent, open field bus standard for a wide range of applications in manufacturing and process automation. Vendor-independence and openness are ensured by the international standards EN 50170 and EN 50254.

PROFIBUS-DP offers functionally graduated communication protocols (Communication Profiles), WANDFLUH is using for the SD6 Electronics the communication profile **DP** (**d**ecentralised **p**eriphery).

PROFIBUS-DP is optimised for fast, time critical data exchange on the field layer. The Fieldbus is used for cyclical and not cyclical data exchange between a Master and its slaves.

PROFIBUS-DP can be used for different device profiles. *WANDFLUH* is using the DSP-408 "Device Profile Fluid Power Technology" profile for its devices.



1.2 Master and Slaves

With -DP, once differs between Master- and Slave-Devices:

- **Master (active Fieldbus participants)**
  These devices determine the data exchange on the Fieldbus and are named therefore as active Fieldbus participant

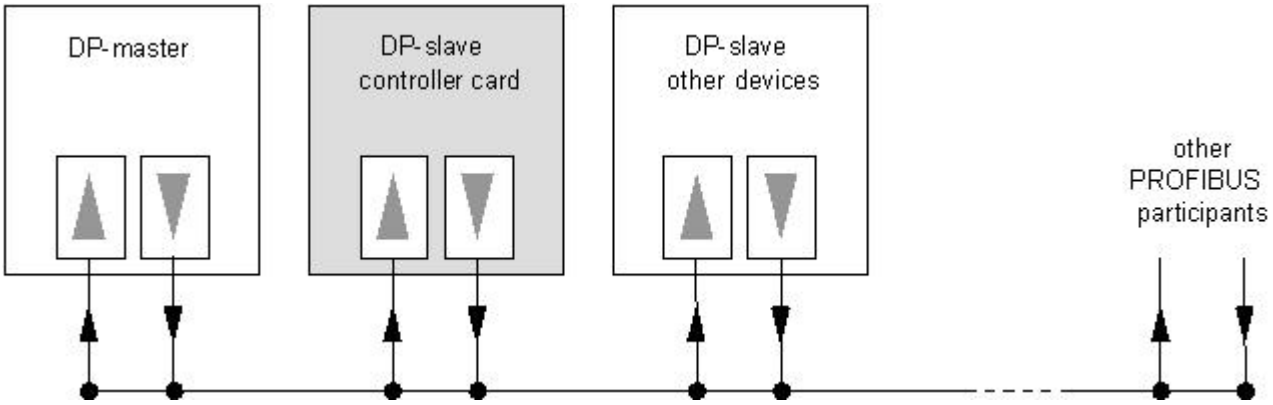
- **Slaves (passive Fieldbus participants)**
  These devices can only receive messages and send data and messages to the Master only on a request.

  The WANDFLUH Electronics are always slaves. In the further documentation, this slave will be named always DP-Slave controller card.

1.3 Data exchange

The data exchange is made through the Master - slave procedure, where the drives are always the slaves. This permits a very fast cyclical data exchange.

For the parameterisation, diagnostic and error handling during the current cyclical data exchange, also not cyclical communication functions are used in additional.



1.4 Communication from words and double words

All used size of words and double words are transmitted in the little endian format. Therefore, the low byte resp. the low word will be transmitted before the high byte resp. the high word (word = 16 bit, double word = 32 bit).

1.5 GSD Files

The characteristic communication features of a PROFIBUS-DP device are defined in the form of an electronic data sheet (Device database, GSD file). WANDFLUH makes available the corresponding GSD file for the DP-Slave controller card.

The GSD files expand the open communication right to the user level. All modern planning tools make it possible to read-in the GSD files during the configuration. As a result, the integration into the PROFIBUS-DP system becomes simple and user friendly.

2 General of cyclical data exchange

2.1 Data structure

The data structure by the cyclical data communication is shared into 2 parts, which will be transmitted in each telegram:

- **Parameter data exchange (PKW, parameter channel)**
  This part of the telegram serves for read and/or write of parameters and for read of error messages.

- **Process data exchange (PZD, process data)**
  This part contains the control word, preset values resp. additional information and feedback values. With the process data, the following data will be transmitted:

  - Control words and preset values (Master => Slave)
  - Status words and feedback values (Slave => Master)

  During the boot up of the Fieldbus system, the Master determines the used telegram type. The selected telegram type will be send automatically to the DP-Slave controller card via the configuration telegram.

2.2 Telegram structure by the cyclical data communication

The telegrams by the cyclical data communication have the following structure:

Protocol frame (Header)	**Data structure (telegram)**		Protocol frame (Trailer)
	Parameter-Id (PKW)	**Processdata (PZD)**	

2.3 Available telegrams

For a description about all available telegram types refer to section "Telegram types 17".

2.4 General

- The selection between the different telegram types with different data length is depending on the performance of the device in the Fieldbus compound.

- For a detailed description about each parameter please refer to section "Parameter description 22".

3 Product Description

3.1 General

The present operating instructions represent a PROFIBUS-DP specific extension of the *WANDFLUH*-Electronics operating instructions.

Remark: Please read the operating instructions of the *WANDFLUH*-Electronics beforehand.

3.2 Technical Data

The connection to the PROFIBUS-DP is made via the D-SUB connector on the front plate. The pin occupation correspond to the standard.

D-SUB-plug 9-pole	RS485 galvanic separated • Pin 3 = RxD/TxD-P (receive-/transmit data-positive, B-line) • Pin 8 = RxD/TxD-N (receive-/transmit data -negative, A-line) • Pin 5 = DGND (data transmitting potential Ground to 5V) • Pin 6 = VP (power supply of the bus terminator-P P5V)
M12-connector B-coded	RS485 galvanic separated • Pin 4 = RxD/TxD-P (receive-/transmit data-positive, B-line) • Pin 2 = RxD/TxD-N (receive-/transmit data -negative, A-line) • Pin 3 = DGND (data transmitting potential Ground to 5V) • Pin 1 = VP (power supply of the bus terminator-P P5V)

The DP-salve controller card is using the PROFIBUS-DP V0 specifications.

3.2.1 Transmission technology and baudrate

The DP-Slave controller card detects automatically the adjusted baudrate on the Fieldbus. The following baudrates are possible:

9.6kBaud / 19.2kBaud / 45.45kBaud / 93.75kBaud / 187.5kBaud / 500kBaud / 1.5MBaud / 3.0MBaud / 6.0Mbaud / 12Mbaud

During the setup of the fields system, the Master will set baudrate uniform for all devices on the bus.

3.3 Operating and Indicating elements

The DP-Slave controller card is equipped with a USB-plug for the connection to the parameterisation PASO and provides a 9-pole D-SUB-plug or M12-connector for the PROFIBUS-DP interface.

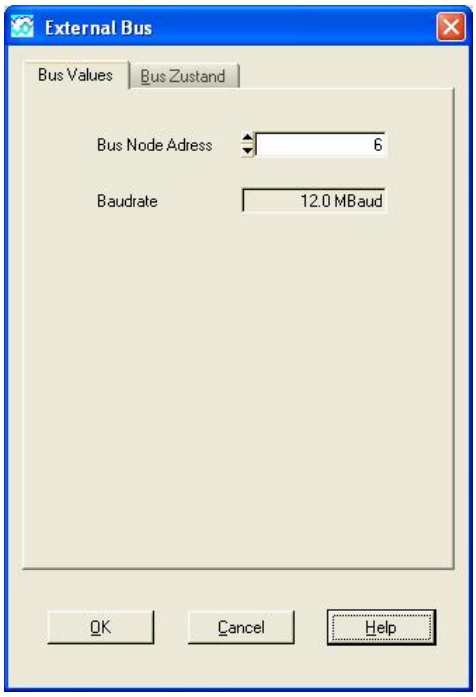
3.4 Fieldbus Settings

The following settings can be made via the parameterisation software PASO:

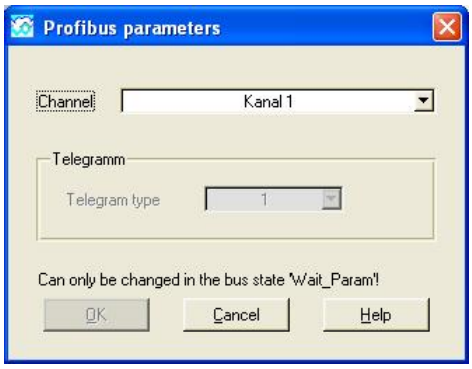
- Bus Node Adress (write and read)
- Baudrate (read only)
- Telegram type (write and read)

This settings can be made in the menu item "Fieldbus_Info" and "Fieldbus_Parameters".

Menu Fieldbus_Info



Menu Fieldbus_Parameters

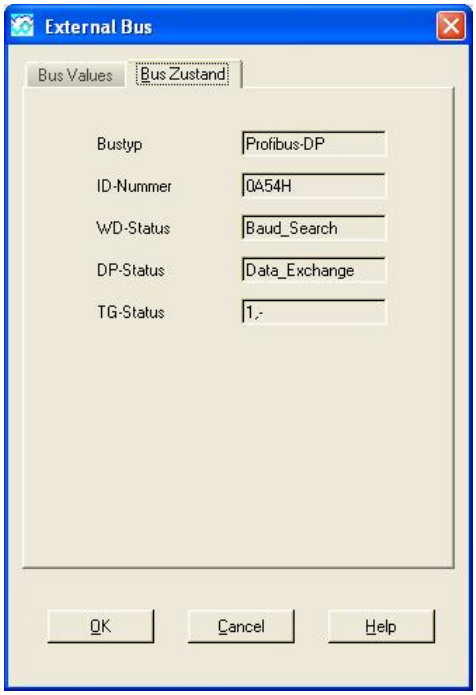


The following parameters can be set resp. will be displayed:

Field	Parameter description	Display
Bus Node Adress	With this parameter, the required node address for the DP-Slave controller card can be set. The value set is saved on the DP-Slave controller card in the non-volatile memory.	0 ... 126
Baudrate	The adjusted Baudrate will be displayed. During the setup of the fields system, the Master will set the Baudrate uniform for all devices on the bus.	9.6kBaud, 19.2kBaud, 45.45kBaud, 93.75kBaud, 187.5kBaud, 500kBaud, 1.5Mbaud, 3.0Mbaud, 6.0Mbaud, 12Mbaud
Telegram type	With this parameter, the default telegram type can be set for each available channel.	1, 2, 3, 4

3.5 Fieldbus Diagnostics

A diagnosis of the Fieldbus is possible at any time via the parameterisation software PASO. This takes place through the menu point "Fieldbus_Info".



The following bus statuses are displayed:

Field	Parameter description	Display
Bus type	The type of the connected Fieldbus	PROFIBUS-DP
ID - number	The identification number of the DP-Slave controller card. This number is predefined fixed.	
WD-Status	The communication on the Fieldbus is supervised permanent through the Watchdog. The current state of the Watchdog is displayed here. **Baud_Search** The baudrate will be searched **Baud_Control** The found baudrate will be checked **DP_Control** The found baudrate is ok. The Watchdog for the Fieldbus is active.	 Baud_Search Baud_Control DP_Control

DP-Status	The DP-Slave controller card can be in different states. The current state will be displayed here. **Wait_Prm** After the start-up, the DP-Slave controller card is waiting for a parameter telegram. All other telegram types will not be handled. No data exchange is possible. **Wait_Cfg** The DP-Slave controller card is waiting for a configuration telegram. All other telegram types will not be handled. No data exchange is possible.	 Wait_Prm Wait_Cfg

	Data_Exchange If the parameter telegram as well as the configuration telegram were ok, the data exchange via the Fieldbus is enable and possible.	Data_Exchange
TG-Status	The current telegram type will be displayed here	

3.6 Connection Example

As a connection example, reference is made to the corresponding operating instructions of the *WANDFLUH* -Electronics.

All relevant digital I/O information is transmitted via the Fieldbus. Therefore no digital inputs should be connected from external.

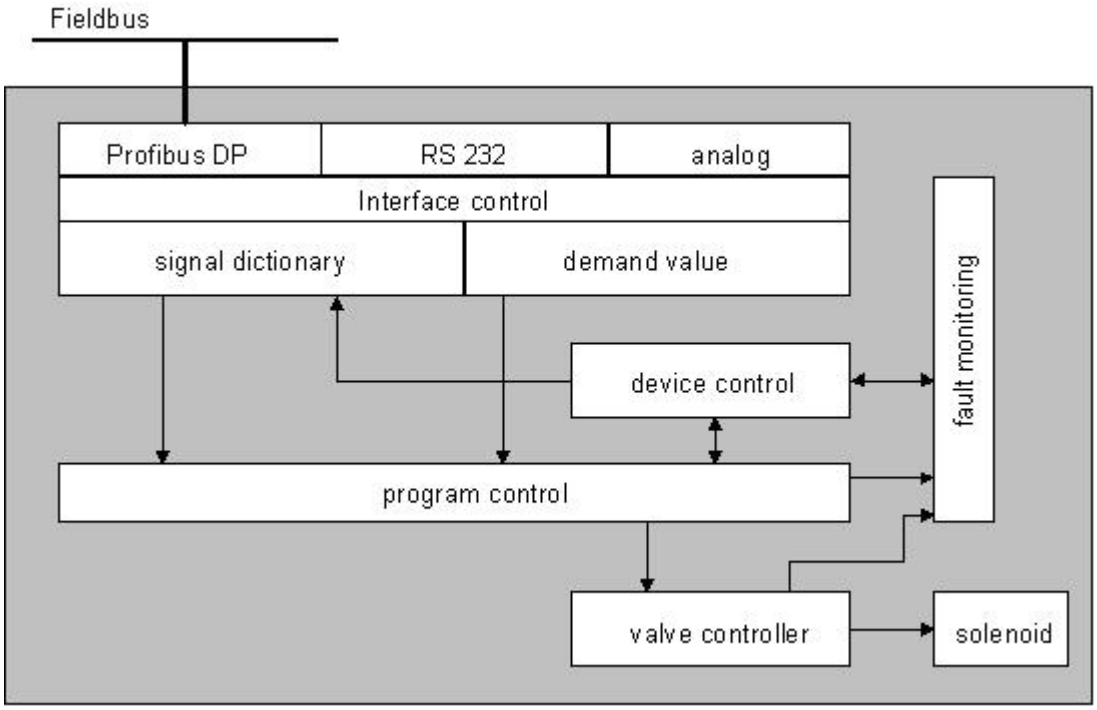
3.7 Parameterisation

The DP-Slave controller card can be parameterised either through the PROFIBUS-DP or through the parameterisation software PASO.

4 Description of the Function of Device Profile DSP-408

The device profile explains the data and their format, which are exchanged between the PROFIBUS-DP Master and the DP-Slave controller card. The device profile is based on the specification of the profile „Fluid Power Technology“ as defined by the VDMA (the German Engineering Federation). The device profile has been defined for hydraulic devices, such as: proportional valves, hydrostatic pumps and hydrostatic drives.

4.1 Device architecture



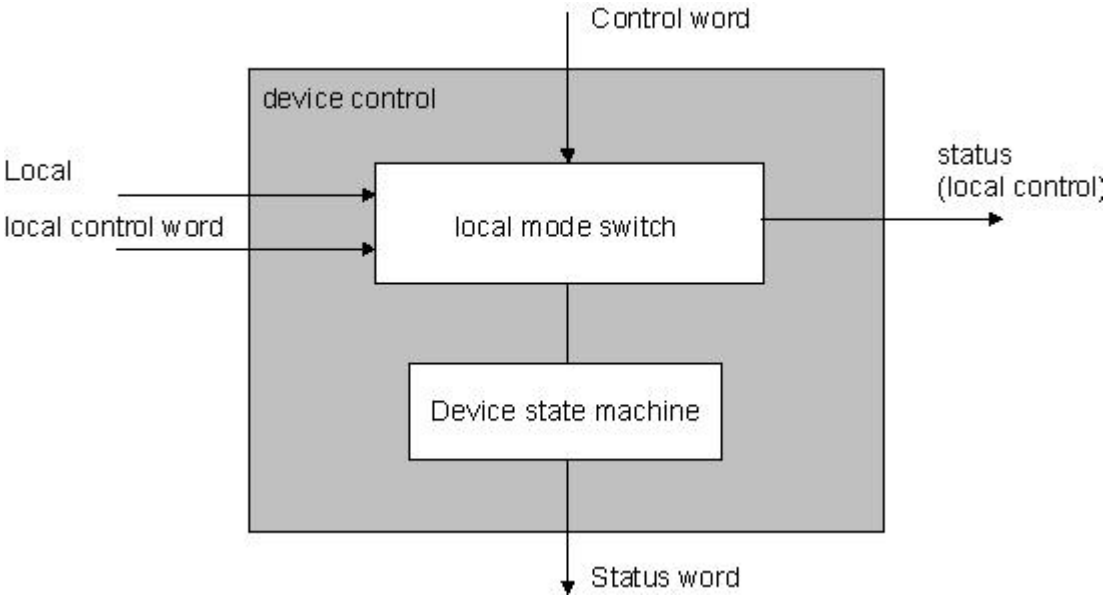
The DP-Slave controller card contains the complete Hardware of the *WANDFLUH*-Electronics. This Hardware includes the interface for the Fieldbus and the interface for the parameterisation software PASO. Also included are the solenoid outputs for the cylinder.

The Fieldbus control is made through a higher level Fieldbus Master.

The local control can be made either via digital in- and outputs or via the parameterisation software PASO.

4.2 Device Control

The following picture shows the principle function of the DP-Slave controller card.



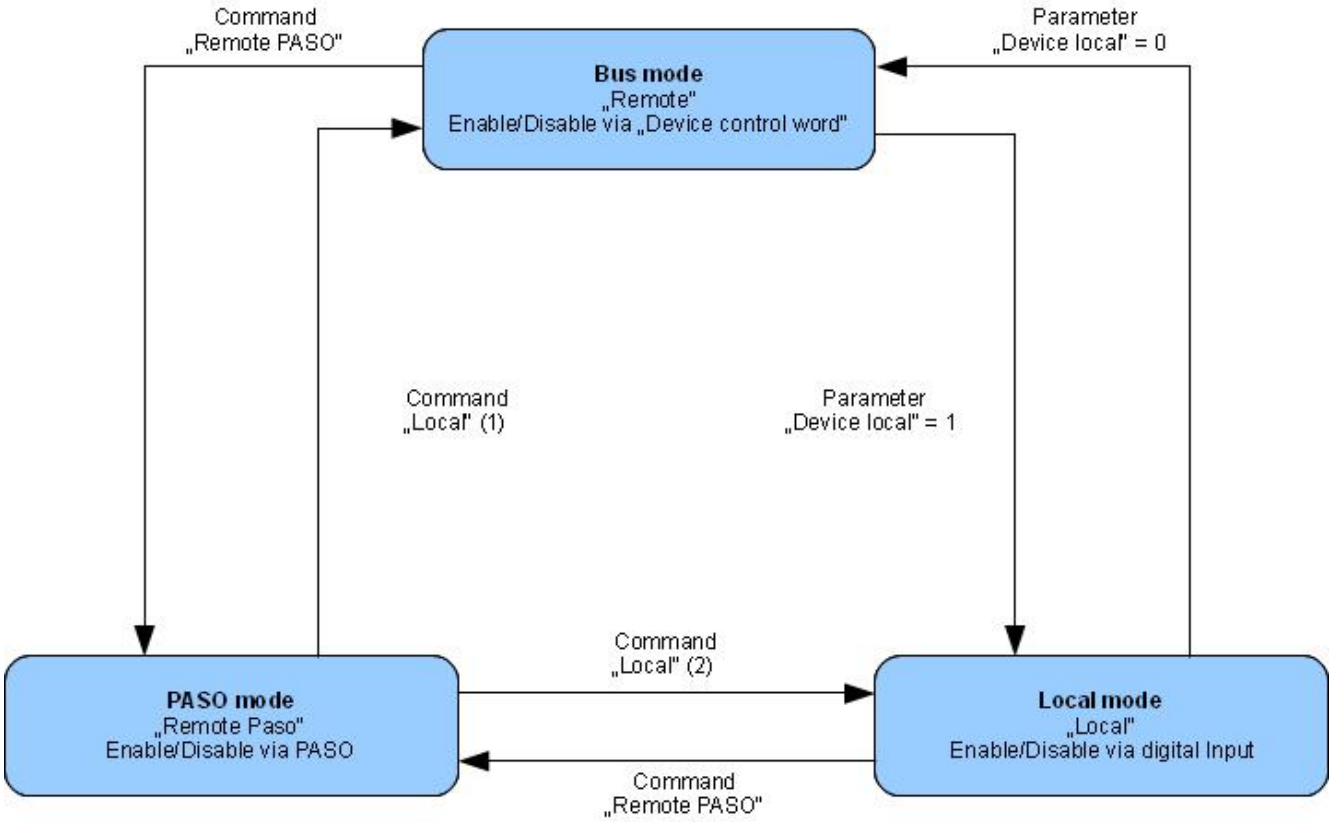
4.2.1 Operating mode

Local mode ("local")
The local mode has 2 states: "Disabled" and "Enabled", switch over through the digital input.
To activate the Local mode from the PASO, the PASO parameter "Operating mode = local" (window "Valve operation") must be sent (condition: *WANDFLUH*–Electronics -state "Init" or "Disabled").
To activate the Local mode from the bus, the bus parameter "Device local" = 1 must be sent via the Fieldbus (condition: *WANDFLUH*-Electronics -state "Init" or "Disabled").

PASO mode ("Remote PASO")
The local mode has 2 states: "Disabled" and "Enabled", switch over through the PASO command "Enable" resp. "Disable".
To activate the PASO mode from the bus resp. local mode, the PASO command "Valve operation" must be activated (condition: Device-state "Init" or "Disabled").

Bus mode ("Remote")
In the Bus mode, the control commands will be set resp. displayed through the Fieldbus. The Bus mode has several states (refer to chapter "Device State Machine 12"), switch over through the Bus parameter "Device control word".
To activate the Bus mode from the PASO mode, the PASO command "Local" must be activated (condition: *WANDFLUH*-Electronics -state "Init" or "Disabled").
To activate the Bus mode from the local mode, the bus parameter "Device local=0" must be sent via the CAN-bus (condition: *WANDFLUH*-Electronics -state "Init" or "Disabled").

This picture shows the different possibilities of switch over the different states.



- A transition to a new mode is only possible if the device is in state "Init" or "Disable".

- (1) if "Device local" = 0
- (2) if "Device local" = 1

- In state „PASO mode“ sending of parameter "Device local" through fieldbus also possible.

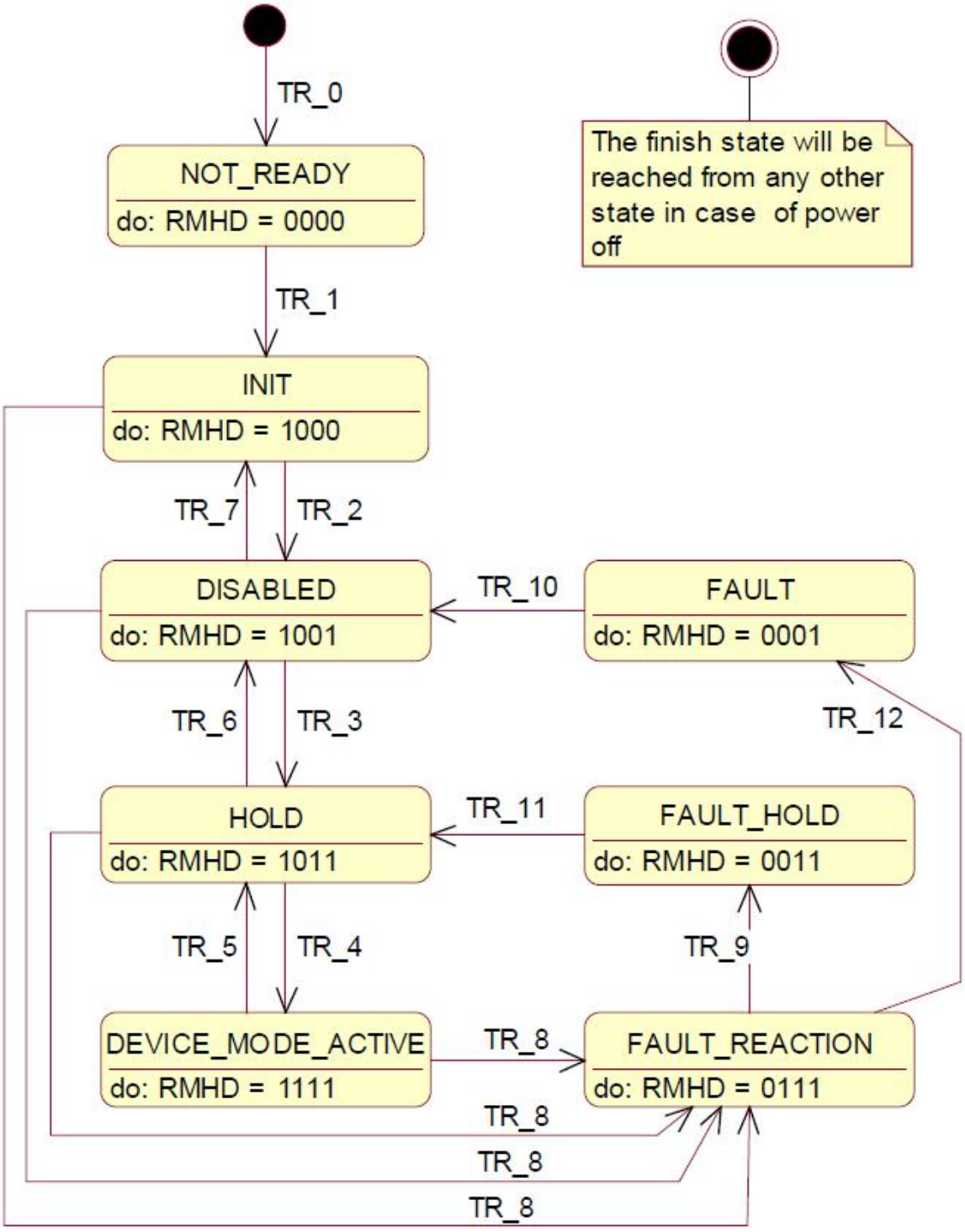
4.2.2 State machine

In the following, with the help of a status diagram it is described, how the start-up of the DP-Slave takes place and which statuses are reached when and how.

The following table describes the possible states and what is done in these states:

Zustand	description
NOT_READY	• The supply voltage is present on the *WANDFLUH*-Electronics • Self test is running • The device functions are disabled
INIT	• Device parameters can be set • Initialisation of device parameters with stored values • The device functions are disabled • It's possible to activate the "PASO remote" mode
DISABLED	• Device parameters can be set • The device functions are disabled • In this state "ControlMode" and "DeviceMode" can be set. • It's possible to activate the "PASO remote" mode
HOLD	• Device parameters can be set

	• The last set-point value present is maintained active • The set-point value of the status DEVICE_MODE_ACTIVE is not active • Device modes setting is disabled
DEVICE_MODE_ACTIVE	• Device parameters can be set • The operating mode selected with the parameter "ControlMode" and the device mode selected with the parameter "DeviceMode" are active • Changing the operating mode is not possible (the writing of the parameter "DeviceMode" is responded to negatively)
FAULT_HOLD	• Device parameters can be set • The feedback value present is read or the set-point value of the HOLD status is active • To leave this state, the corresponding transitions in the table below have to be executed.
FAULT	• Device parameters can be set • The device functions are disabled • To leave this state, the corresponding transitions in the table below have to be executed
FAULT_REACTION	• This status is reached, if the device is not anymore ready for operation • Device parameters can be set • The device function can be disabled or enabled



RMHD = R: Status word "Ready" (bit 3)
M: Status word "Device mode active enable" (bit 2)
H: Status word "Hold enable" (bit 1)
D: Status word "Disable" (bit 0)

The following table describes the transitions from one status to the next one:

Übergang	description	Controlwort Bit								
			7	6	5	4	3	2	1	0

		R	M	H	D
TR_0	Switching-on the supply voltage	Internal transition			
TR_1	Device initialisation successfully completed	Internal transition			
TR_2	Bit "Disable" active	x	x	x	1
TR_3	Bit "Hold enable" active	x	x	1	1
TR_4	Bit "Device mode active enable" active	x	1	1	1
TR_5	Bit "Device mode active enable " not active	0	x	x	
TR_6	Bit "Hold enable" not active	0	0	x	
TR_7	Bit "Disable" not active	0	0	0	
TR_8	Error present	Internal transition			
TR_9	Error reaction successful (HOLD active)	Internal transition			
TR_10	Error reset (return to the status DISABLED). The “reset fault” bit in the control word imperatively has to change from 0 to 1	x	0	x	0
		?			
		x	1	x	0
TR_11	Error reset (return to status HOLD). The “reset fault” bit in the control word imperatively has to change from 0 to 1	x	0	x	1
		?			
		x	1	x	1
TR_12	Error reaction successful (DISABLED active)	Internal transition			

RMHD = R: Controlword "Reset Fault" (Bit 3)
M: Controlword "Device mode active enable" (Bit 2)
H: Controlword "Hold enable" (Bit 1)
D: Controlword "Disable" (Bit 0)

4.3 Program Control

The *WANDFLUH*-Electronics through the fieldbus can be set to the following operating modes; in doing so, one differentiates between the Control mode and the Device mode:

Controle mode	Description
Local operating mode	The MD2 is operated through the local possibilities such as e.g. the digital inputs and outputs or PASO.
Spool position control open loop vpoc (1)	A proportional spool valve is driven with a set-point value, the set-point value is proportional to the valve opening. The spool position is not recorded and controlled (open loop). **This control mode is only selectable with amplifier.**
Pressure control valve open loop vprc (3)	A proportional pressure control valve is driven with a set-point value; the set-point value is proportional to the valve pressure. The pressure is not measured and controlled with a pressure sensor (open loop). **This control mode is selectable with amplifier a. controller.**
Pressure control valve closed loop vprc (4)	A proportional pressure control valve with 1 solenoid is driven with a set-point value; the set-point value is proportional to the valve pressure. The pressure is measured and controlled with a pressure sensor (closed loop). **This control mode is only selectable with controller.**
Open loop movement dcol (6)	A proportional spool valve is driven with a set-point value; the set-point value is proportional to the position of the axis. The Position is not measured and controlled with a position sensor (open loop). **This control mode is only selectable with controller.**
Velocity control axis dsc (7)	A proportional flow valve is driven with a set-point value; the set-point value is proportional to the valve flow. The flow is measured and controlled with a flow sensor (closed loop). **This control mode is only selectable with controller.**
Position control axis dpc (9)	A proportional spool valve is driven with a set-point value; the set-point value is proportional to the position of the axis. The position is measured and controlled with a position sensor (closed loop). **This control mode is only selectable with controller.**
Pressure control valve closed loop 2-solenoids (-5)	**Wandfluh - specific** A proportional pressure control valve with 2 solenoids is driven with a set-point value; the set-point value is proportional to the valve pressure. The pressure is measured and controlled with a pressure sensor (closed loop). **This control mode is only selectable with controller.**
2-Point controller with 1 solenoid. (-6)	**Wandfluh – specific** Control of a 1-solenoid valve with a switching solenoid in closed loop (with feedback signal). It can only be activated one solenoid (correspond to solenoid driver 1). **This control mode is only selectable with controller.**
2-Point controller with 2 solenoids. (-7)	**Wandfluh – specific** Control of a 2-solenoid valve with switching solenoids resp. of two 1-solenoid valves with one switching solenoid each in closed loop (with feedback signal). Two solenoids can be activated. **This control mode is only selectable with controller.**

3-Point controller with 2 solenoids. (-8)	**Wandfluh – specific** Control of a 1-solenoid valve with a switching solenoid in closed loop (with feedback signal). It can only be activated one solenoid (correspond to solenoid driver 1). **This control mode is only selectable with controller.**

Device mode	Description
Set-point value setting through the bus	The set-point-value setting for the CANopen-Slave takes place through the fieldbus. This corresponds to the standard device mode.
Set-point value setting locally	The set-point value setting for the CANopen-Slave takes place locally.

4.4 Cyclical process data exchange (PZD)

The data exchange is made with consistence about the whole length of the input- and output data. The transmission correspond to the little endian format (refer to section "Data exchange 4").

4.4.1 Telegram types

The following telegram types are available on the DP-Slave controller card. They are shared into:

- Data exchange **with** parameter channel
  with 4 words for parameters and 3 words for data exchange → telegram type 1
- Data exchange **without** parameter channel
  with 3 words for data exchange → telegram type 2
- Data exchange **with** parameter channel
  with 4 words for parameters and 2 words for data exchange → telegram type 3
- Data exchange **without** parameter channel
  with 2 words for data exchange → telegram type 4

	Control Mode						
	1 (Spool position control open loop)	3 (Druck- / Mengenventil Steuerung)	4, -5 (Druck- / Mengenventil Regelung)	6 (Open loop movement)	7 (Velocity control axis)	9 (Position control axis)	-6, -7, -8 (n-point controller)
Telegram type	3 / 4	3 / 4	3 / 4	1 / 2	1 / 2	1 / 2	1 / 2
Profibus-Amplifier	selectable		not selectable				
Profibus-Controller	selectable						

Standard telegram 1
The telegram type 1 is defined by the "PROFIBUS Profile Fluid Power Technology" (standard telegram) and is used for the *WANDFLUH*-Electronics in control mode 6 (Open loop movement), 7 (Velocity control axis) and 9 (Position control axis).

	Word 0	Word 1		Word 2	Word 3
Parameter (PKW)	PKE	Res	IND	PWE	

	Word 4	Word 5	Word 6
PZD receive data	Control Word	Command value	

	Word 4	Word 5	Word 6
PZD transmit data	Status Word	Feedback value	

Standard telegram 2
The telegram type 2 is defined by the "PROFIBUS Profile Fluid Power Technology" (standard telegram) and is used for the *WANDFLUH*-Electronics in control mode 6 (Open loop movement), 7 (Velocity control axis) and 9 (Position control axis).

	word 0	word 1	word 2
PZD receive data	Control Word	Command value	

	word 0	word 1	word 2
PZD transmit data	Status Word	Feedback value	

Standard telegram 3
The telegram type 3 is defined by the "PROFIBUS Profile Fluid Power Technology" (standard telegram) and is used for the *WANDFLUH*-Electronics in control mode 1 (Spool position control open loop), 3 (Pressure control valve open loop) and 4 (Pressure control valve closed loop).

	word 0	word 1		word 2	word 3
Parameter (PKW)	PKE	Res	IND	PWE	

	word 4	word 5
PZD receive data	Control Word	Command value

	word 4	word 5
PZD transmit data	Status Word	Feedback value

Standard telegram 4
The telegram type 4 is defined by the "PROFIBUS Profile Fluid Power Technology" (standard telegram) and is used for the *WANDFLUH*-Electronics in control mode 1 (Spool position control open loop), 3 (Pressure control valve open loop) and 4 (Pressure control valve closed loop).

	word 0	word 1
PZD receive data	Control Word	Command value

	word 0	word 1
PZD transmit data	Status Word	Feedback value

4.4.2 Receive data (Master à Slave, command values)

Parameter	Length (word)
Control word	1
Command value	Telegram type 1 / 2: 2 Telegram type 3 / 4: 1

4.4.3 Transmit data (Slave à Master, feedback values)

Parameter	Length (word)
Status Word	1
Feedback value	Telegram type 1 / 2: 2

4.5 Cyclical parameter data exchange (PKW)

The parameter data exchange is made via the PKW (parameter channel). With the PKW, parameter can be written (Master → Slave) or read (Slave → Master) through the Fieldbus. Exactly one parameter can be written resp. read in one telegram.

The below table shows the structure of the PKW:

PKW							
word 0		word 1		word 2		word 2	
byte 0	byte 1	byte 2	byte 3	byte 4	byte 5	byte 6	byte 7
PKE		Res	IND	PWE			

PKE: parameter signature value
IND: block number
Res: reserved
PWE: parameter value

The instructions and responses are coded in the parameter signature word PKE:

PKE															
bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit 8	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
AK				Res				PNU							

AK: instruction / response signature
Res: reserved
PNU: parameter number

The below table shows the possible instruction / response signatures:

AK			
instruction signature	function	response signature	
		positive	negative
0	no instruction	0	
1	parameter value read	1, 2, 11	7
2	parameter value write (word)	1	7
3	parameter value write (double word)	2	7
4 - 9	reserved		
10	parameter value write (byte)	11	7

In case an instruction can not be processed, the slave responses with a negative response signature (negative = error code), in normal case with a positive response signature.

The parameter value is located to the PWE in the following bytes::

- with parameter length 'word' (instruction signature = 2): byte 6 and byte 7

- with parameter length 'double word' (instruction signature = 3): byte 4, byte 5, byte 6 and byte 7
- with parameter length 'byte' (instruction signature = 10) byte 7

In case the slave responses with an error (response signature = 7), an error message will be located in byte 6 and byte 7 of the PWE. The below table shows the possible error codes:

error code	semantic
0	undefined PNU
1	parameter not changeable
2	lower or upper value range limit overflow
3	undefined IND
5	data type error
18	other errors
201	Invalid parameter
202	The selected parameter can't be read
203	The solenoid choice contained in the value is except range
204	The array index contained in the value is except range
205	The array element cannot be read
206	The array element cannot be described
207	The characteristic optimisation cannot be switched on because of incorrect characteristic values

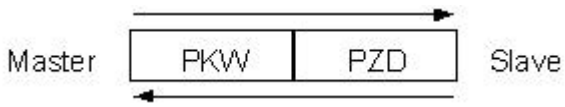
Remark:
An error message can occur, if a value assignment is not certified in the current control mode or status or in the current mode of operation. Further informations you will find in the associated parameter description.

The below table shows the connection between the data type and parameter length:

data type	parameter length
int8	byte (1 byte)
uint8	byte (1 byte)
int16	word (2 bytes)
uint16	word (2 bytes)
int32	double word (4 bytes)
uint32	double word (4 bytes)
float	double word (4 bytes)
vstring(n)	n bytes

4.5.1 Description of the parameter transmission process

On each request from the Master, the slave will send a response.



Example 1:

The parameter "Imin A" should be written with the value 450mA.

- data type = uint16 → parameter length = word → AK = 2h
- parameter number = 73 → PNU = 49h
- block number = 3 → IND = 03h
- value = 450 → PWE = 00h 00h 01h c2h

Instruction signature (Master → Slave):

PKW								
word 0			word 1		word 2		word 3	
PKE			Res	IND	PWE			
AK	RES	PNU						
2h	0h	49h	00h	03h	00h	00h	01h	C2h

Response signature (Slave → Master):

PKW								
word 0			word 1		word 2		word 3	
PKE			Res	IND	PWE			
AK	RES	PNU						
1h	0h	49h	00h	03h	00h	00h	01h	C2h

- AK = 1h → 1 = positive response signature for a parameter length = word

Example 2:

The parameter "Dither frequency" should be read.

- data type = uint8 → parameter length = byte → AK = 1h
- parameter number = 98 → PNU = 62h
- block number = 3 → IND = 03h

Instruction signature (Master → Slave):

PKW								
word 0			word 1		word 2		word 3	
PKE			Res	IND	PWE			
AK	RES	PNU						
1h	0h	62h	00h	03h	00h	00h	00h	00h

Response signature (Slave → Master):

PKW								
word 0			word 1		word 2		word 3	
PKE			Res	IND	PWE			
AK	RES	PNU						
Bh	0h	62h	00h	03h	00h	00h	00h	64h

- AK = Bh → 11 = positive response signature for a parameter length = byte
- PWE = 00h 00h 00h 64h → 100 = value of the parameter

4.6 Scaled parameter

By parameter with an unit (e.g. mm, psi, l/min, etc.), the adjusting range and the resolution depends on the selected unit. The following table shows the connection

Unit	Range	Resolution
Free unit	0 .. 15000000	1 / 1000
mm	0 .. 15000000	
Deg	0 .. 360000	
Zoll	0 .. 100000	
bar	0 .. 500000	
psi	0 .. 8000000	
kN	0 .. 1000000	
Mpa	0 .. 50000	
l/min	0 .. 500000	
m/s	0 .. 2000	
inch/s	0 .. 10000000	
1/Min	0 .. 100000	
Deg/s	0 .. 360000	

4.7 Internal bus resolution

In the Device Profile in accordance with DSP-408 device profile "Fluid Power Technology", an internal resolution value is defined. This value is -16384 ... 16383. This scaling can with the help of PASO be adjusted to a given set point to be able to adapt.

4.8 Parameter description

In the following section, all parameters, which can be adjusted via PKW (refer to section „Cyclical parameter data exchange (PKW) 19“) will be descripted.

The error code 0 (invalid PNU) can be sent back for different reasons:
- if the current hardware or software execution does not support the parameter
- if the selected control mode (refer to section „Device control mode“ page 40) does not support the parameter
- if the selected mode of operation (refer to section "Mode of operation" page 42) does not support the parameter

The error code 1 (Selected parameter can’t be changed) can be sent back for different reasons:
- the parameter can be only read
- the parameter can be only changed, if the *WANDFLUH*-Electronics is blocked (status „INIT“ or „DISABLED“, refer to section "State machine 12")

ATTENTION: Parameters, which can be transmitted either as PKW or as PZD will become always the value of the PZD transmission. Because of this, it makes no sense to overwrite these parameters with another PKW-value.

Note: A detailed description about the function of each parameter you will find in the corresponding operating instructions of the *WANDFLUH*-Electronics

4.8.1 Parameter description

Ind	Pnu	Description	Control-mode	Datatype	min. value	max. value
0	37	Device control word 28		UINT16	-32768	32767
0	38	Device Statusword 29		UINT16		

Ind	Pnu	Description	Control-mode	Datatype	min. value	max. value
0	39	device mode 29		UINT8	1	2
0	40	device control mode 30		INT8	-128	127
0	41	device local 30		UINT8	0	1
0	50	device capability 30		UINT32		
0	51	Store Parameter 30		INT32	-2147483648	2147483647
0	52	Reset Default 31		INT32	-2147483648	2147483647
0	55	Device temperature 31		INT16		
11	21	dcol set point 31	dcol	INT32	-2147483648	2147483647
11	42	dcol ramp type 31	dcol	INT8	-128	127
11	46	dcol dvg ramp acceleration time negative 31	dcol	UINT16	0	51000
11	49	dcol dvg ramp acceleration time positive 31	dcol	UINT16	0	51000
11	55	dcol dvg ramp deceleration time negative 32	dcol	UINT16	0	51000
11	58	dcol dvg ramp deceleration time positive 32	dcol	UINT16	0	51000
12	21	dpc set point 32	dpc	INT32	-2147483648	2147483647
12	100	dpc actual value 32	dpc	INT32		
12	103	dpc control deviation 32	dpc	INT32		
12	140	dpc cm type 33	dpc	INT8	-2	2
12	147	dpc cm delay time 33	dpc	INT16	0	100
12	150	dpc cm threshold 33	dpc	INT32	0	2147483647
13	21	dsc set point 33	dsc	INT32	-2147483648	2147483647
13	100	dsc actual value 33	dsc	INT32		
13	103	dsc control deviation 34	dsc	INT32		
13	112	dsc cm type 34	dsc	INT8	-2	2
13	119	dsc cm delay time 34	dsc	INT16	0	100
13	122	dsc cm threshold 34	dsc	INT32	0	2147483647
21	21	vpoc set point 34	vpoc	INT16	-32768	32767
21	43	vpoc ramp type 35	vpoc	INT8	-128	127
21	47	vpoc dvg ramp acceleration time negative 35	vpoc	UINT16	0	51000
21	50	vpoc dvg ramp acceleration time positive 35	vpoc	UINT16	0	51000
21	56	vpoc dvg ramp deceleration time negative 35	vpoc	UINT16	0	51000
21	59	vpoc dvg ramp deceleration time positive 35	vpoc	UINT16	0	51000
22	21	vprc set point 35	vprc (open-loop) vprc (closed-loop)	INT16	-32768	32767
22	43	vprc ramp type 36	vprc (open-loop)	INT8	-128	127
22	47	vprc dvg ramp acceleration time negative 36	vprc (open-loop)	UINT16	0	51000
22	50	vprc dvg ramp acceleration time positive 36	vprc (open-loop)	UINT16	0	51000
22	56	vprc dvg ramp deceleration time negative 36	vprc (open-loop)	UINT16	0	51000
22	59	vprc dvg ramp deceleration time positive 36	vprc (open-loop)	UINT16	0	51000
22	144	vprc actual value 36	vprc (closed-loop)	INT16		
22	147	vprc control deviation 36	vprc (closed-loop)	INT16		
22	150	vprc cm type 37	vprc (closed-loop)	INT8	-2	2
22	157	vprc cm delay time 37	vprc (closed-loop)	INT16	0	100
22	160	vprc cm threshold 37	vprc (closed-loop)	INT16	0	16384
220	0	actual value mode 37	n-point vprc (closed-loop) dpc dsc	UINT8	1	2
220	1	actual value input 16 bits 37	n-point vprc (closed-loop) dpc dsc	INT16	-32768	32767
220	2	actual value input 32 bits 37	n-point vprc (closed-loop) dpc	INT32	-2147483648	2147483647

Ind	Pnu	Description	Control-mode	Datatype	min. value	max. value
			dsc			
222	0	actual value signal type 37	n-point vprc (closed-loop) dpc dsc	UINT8	0	4
222	1	used analogue input for actual value 38	n-point vprc (closed-loop) dpc dsc	INT8	-1	3
222	2	used digital input for actual value 38	n-point vprc (closed-loop) dpc dsc	INT8	-1	1
222	4	Actual value cablebreak detection 38	n-point vprc (closed-loop) dpc dsc	UINT8	0	1
222	5	Actual value cablebreak detection lower limit 38	n-point vprc (closed-loop) dpc dsc	INT32	0	2147483647
222	6	Actual value cablebreak detection upper limit 38	n-point vprc (closed-loop) dpc dsc	INT32	0	2147483647
222	7	actual value min interface 38	n-point vprc (closed-loop) dpc dsc	INT32	-2147483648	2147483647
222	8	actual value max interface 39	n-point vprc (closed-loop) dpc dsc	INT32	-2147483648	2147483647
222	9	actual value min bus interface 39	n-point vprc (closed-loop) dpc dsc	INT32	-32768	32767
222	10	actual value max bus interface 39	n-point vprc (closed-loop) dpc dsc	INT32	-32768	32767
222	11	actual value min reference 39	n-point vprc (closed-loop) dpc dsc	INT32	0	2147483647
222	12	actual value max reference 39	n-point vprc (closed-loop) dpc dsc	INT32	0	2147483647
224	0	Channel enablement 40		UINT8	0	2
224	1	used digin for channel enablement 40		INT8	-1	1
224	2	Mode of operation 40	vprc (open-loop) dcol vpoc	UINT8	0	3
224	3	Used digin for solenoid B 40	vprc (open-loop) dcol vpoc	INT8	-1	1
224	4	Solenoid type 40		UINT8	0	2
224	5	Error handling mask 41		UINT16	0	65535
224	6	Error handling reaction 41		UINT8	0	3
224	7	Error handling used digout 41		UINT8	-1	0
224	8	Function handling mask 41		UINT8	0	255
224	9	Function handling used digout 41		UINT8	-1	0
224	10	Valve type 41		UINT8	0	1

Ind	Pnu	Description	Control-mode	Datatype	min. value	max. value
225	0	Used digin for ramp enable 42	vprc (open-loop) dcol vpoc	UINT8	-1	1
228	0	n-point controller set point 42	n-point	INT32	-2147483648	2147483647
228	1	n-point controller actual value 42	n-point	INT32		
228	2	n-point controller threshold value 1 42	n-point	INT32	-2147483648	2147483647
228	3	n-point controller threshold value 2 43	n-point	INT32	-2147483648	2147483647
228	4	n-point controller threshold value 3 43	n-point	INT32	-2147483648	2147483647
228	5	n-point controller threshold value 4 43	n-point	INT32	-2147483648	2147483647
228	6	n-point control deviation 44	n-point	INT32		
228	7	n-point cm type 44	n-point	INT8	-2	2
228	8	n-point cm delay time 44	n-point	UINT16	0	100
228	9	n-point cm threshold 44	n-point	INT32	0	2147483647
232	0	demand value signal type 45		UINT8	0	4
232	1	used analogue input for demand value 45		INT8	-1	3
232	2	used digital input for demand value 45		INT8	-1	1
232	4	demand value cablebreak detection 45		UINT8	0	1
232	5	demand value cablebreak detection lower limit 45		INT32	0	2147483647
232	6	demand value cablebreak detection upper limit 45		INT32	0	2147483647
232	7	demand value min interface 46		INT32	-2147483648	2147483647
232	8	demand value max interface 46		INT32	-2147483648	2147483647
232	9	demand value min bus interface 46		INT32	-32768	32767
232	10	demand value max bus interface 46		INT32	-32768	32767
232	11	demand value min reference 46	n-point vprc (closed-loop) dpc dsc	INT32	0	2147483647
232	12	demand value max reference 47	n-point vprc (closed-loop) dpc dsc	INT32	0	2147483647
232	13	demand value deadband enable 47	vprc (open-loop) dcol vpoc	UINT8	0	1
232	14	demand value deadband 47	vprc (open-loop) dcol vpoc	INT16	0	16384
238	0	fixed command values enable 47		INT8	0	1
238	1	Dig. input count for fixed command values 48		INT8		
238	2	fixed command values used digin 1 48		INT8	-1	1
238	3	fixed command values used digin 2 49		INT8	-1	1
238	4	fixed command values used digin 3 49		INT8	-1	1
238	5	fixed command values count 50		INT8		
238	6	fixed command value 1 50		INT32	-2147483648	2147483647
238	7	fixed command value 2 51		INT32	-2147483648	2147483647
238	8	fixed command value 3 51		INT32	-2147483648	2147483647
238	9	fixed command value 4 52		INT32	-2147483648	2147483647
238	10	fixed command value 5 52		INT32	-2147483648	2147483647
238	11	fixed command value 6 53		INT32	-2147483648	2147483647
238	12	fixed command value 7 53		INT32	-2147483648	2147483647
240	0	demand value positive velocity 54	n-point vprc (closed-loop) dpc dsc	INT32	0	2147483647
240	1	demand value negative velocity 54	n-point vprc (closed-loop)	INT32	0	2147483647

Ind	Pnu	Description	Control-mode	Datatype	min. value	max. value
			dpc dsc			
240	2	target window enable 54	n-point vprc (closed-loop) dpc dsc	INT8	0	2
240	3	target window delay time 54	n-point vprc (closed-loop) dpc dsc	INT16	0	100
240	4	target window threshold 55	n-point vprc (closed-loop) dpc dsc	INT32	0	2147483647
240	5	solenoid-off window enable 55	n-point vprc (closed-loop) dpc dsc	INT8	0	2
240	6	solenoid-off window delay time 55	n-point vprc (closed-loop) dpc dsc	INT8	0	100
240	7	solenoid-off threshold 55	n-point vprc (closed-loop) dpc dsc	INT32	0	2147483647
240	8	Displayed unit 56	n-point vprc (closed-loop) dpc dsc	INT8	0	12
240	9	command feed forward 56	n-point vprc (closed-loop) dpc dsc	INT16	0	10000
240	10	velocity feed forward 56	n-point vprc (closed-loop) dpc dsc	INT16	0	10000
240	11	Integrator enable 56	n-point vprc (closed-loop) dpc dsc	INT8	0	1
240	12	reduction of I-part if outside I-windows 56	n-point vprc (closed-loop) dpc dsc	INT8	0	2
240	13	Kp positive 56	n-point vprc (closed-loop) dpc dsc	INT16	0	25000
240	14	Kp negative 56	n-point vprc (closed-loop) dpc dsc	INT16	0	25000
240	15	Ti positive 57	n-point vprc (closed-loop) dpc dsc	INT16	0	10000
240	16	Ti negative 57	n-point vprc (closed-loop) dpc dsc	INT16	0	10000
240	17	I window positive 57	n-point vprc (closed-loop) dpc dsc	INT32	0	2147483647

Ind	Pnu	Description	Control-mode	Datatype	min. value	max. value
240	18	I window negative 57	n-point vprc (closed-loop) dpc dsc	INT32	0	2147483647
240	19	I inner window positive 58	n-point vprc (closed-loop) dpc dsc	INT32	0	2147483647
240	20	I inner window negative 58	n-point vprc (closed-loop) dpc dsc	INT32	0	2147483647
240	21	D time positive 58	n-point vprc (closed-loop) dpc dsc	INT16	0	10000
240	22	D time negative 58	n-point vprc (closed-loop) dpc dsc	INT16	0	10000
240	23	D value positive 59	n-point vprc (closed-loop) dpc dsc	INT16	0	10000
240	24	D value negativ 59	n-point vprc (closed-loop) dpc dsc	INT16	0	10000
250	0	used solenoid driver 1 59		INT8	-1	1
250	1	solenoid 1 enable 59		UINT8	0	2
250	2	solenoid 1 enable used digin 59		UINT8	0	1
250	3	solenoid 1 inversion 59		UINT8	0	1
250	4	Imin always active solenoid 1 59		UINT8	0	1
250	5	solenoid 1 cablebreak detection 59		UINT8	0	1
250	6	solenoid 1 Imin 60		INT16	0	16384
250	7	solenoid 1 Imax 60		INT16	0	16384
250	8	solenoid 1 dither function 60		UINT8	0	1
250	9	solenoid 1 dither period 60		INT16	2	250
250	10	solenoid 1 dither amplitude 60		INT16	0	16384
250	11	solenoid 1 switch on threshold 60		INT16	0	16384
250	12	solenoid 1 switch off threshold 61		INT16	0	16384
250	13	solenoid 1 switch reduction time 61		UINT16	0	10000
250	14	solenoid 1 switch reduction value 61		INT16	0	16384
250	15	solenoid 1 lower I-min (S1578) 61		INT16	0	16384
250	16	solenoid 1 lower I-max (S1578) 61		INT16	0	16384
251	0	solenoid 1 characteristic optimisation enable 61		INT8	0	1
251	1	solenoid 1 characteristic optimisation point count 61		INT8		
251	2	solenoid 1 characteristic optimisation point 1 62		INT32	-2147483648	2147483647
251	3	solenoid 1 characteristic optimisation point 2 62		INT32	-2147483648	2147483647
251	4	solenoid 1 characteristic optimisation point 3 63		INT32	-2147483648	2147483647
251	5	solenoid 1 characteristic optimisation point 4 63		INT32	-2147483648	2147483647
251	6	solenoid 1 characteristic optimisation point 5 64		INT32	-2147483648	2147483647
251	7	solenoid 1 characteristic optimisation point 6 64		INT32	-2147483648	2147483647
251	8	solenoid 1 characteristic optimisation point 7 65		INT32	-2147483648	2147483647
251	9	solenoid 1 characteristic optimisation point 8 65		INT32	-2147483648	2147483647
251	10	solenoid 1 characteristic optimisation point 9 66		INT32	-2147483648	2147483647
252	0	used solenoid driver 2 66		INT8	-1	1

Ind	Pnu	Description	Control-mode	Datatype	min. value	max. value
252	1	solenoid 2 enable 67		UINT8	0	2
252	2	solenoid 2 enable used digin 67		UINT8	0	1
252	3	solenoid 2 inversion 67		UINT8	0	1
252	4	Imin always active solenoid 2 67		UINT8	0	1
252	5	solenoid 2 cablebreak detection 67		UINT8	0	1
252	6	solenoid 2 Imin 67		INT16	0	16384
252	7	solenoid 2 Imax 67		INT16	0	16384
252	8	solenoid 2 dither function 68		UINT8	0	1
252	9	solenoid 2 dither period 68		INT16	2	250
252	10	solenoid 2 dither amplitude 68		INT16	0	16384
252	11	solenoid 2 switch on threshold 68		INT16	0	16384
252	12	solenoid 2 switch off threshold 68		INT16	0	16384
252	13	solenoid 2 switch reduction time 68		UINT16	0	10000
252	14	solenoid 2 switch reduction value 68		INT16	0	16384
252	15	solenoid 2 lower I-min (S1578) 68		INT16	0	16384
252	16	solenoid 2 lower I-max (S1578) 69		INT16	0	16384
253	0	solenoid 2 characteristic optimisation enable 69		INT8	0	1
253	1	solenoid 2 characteristic optimisation point count 69		INT8		
253	2	solenoid 2 characteristic optimisation point 1 69		INT32	-2147483648	2147483647
253	3	solenoid 2 characteristic optimisation point 2 70		INT32	-2147483648	2147483647
253	4	solenoid 2 characteristic optimisation point 3 70		INT32	-2147483648	2147483647
253	5	solenoid 2 characteristic optimisation point 4 71		INT32	-2147483648	2147483647
253	6	solenoid 2 characteristic optimisation point 5 71		INT32	-2147483648	2147483647
253	7	solenoid 2 characteristic optimisation point 6 72		INT32	-2147483648	2147483647
253	8	solenoid 2 characteristic optimisation point 7 72		INT32	-2147483648	2147483647
253	9	solenoid 2 characteristic optimisation point 8 73		INT32	-2147483648	2147483647
253	10	solenoid 2 characteristic optimisation point 9 73		INT32	-2147483648	2147483647

4.8.1.1 Device control word

The control word is bit coded, i.e., each individual bit has a certain control function. The table below lists the individual functions with the bit belonging to it.

MSB								LSB							
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
High - Byte								Low - Byte							

Bit	Name	Description
0	Disable (D)	These bits form the device control commands. Refer to the description of the device state machine.
1	Hold enable (H)	
2	Device mode active (M)	
3	Reset fault (R)	Resets an error/fault
4	Reserved	
5	Reserved	
6	Reserved	
7	Reserved	
8	Reserved	
9	Reserved	
10	Reserved	

11	Reserved	
12	Reserved	
13	Reserved	
14	Reserved	
15	Manufacturer-specific	

4.8.1.2 Device Statusword

The status word is bit coded, i.e., each individual bit has a status display function. The table below lists the individual functions with the bit belonging to it.

MSB								LSB							
Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
High - Byte								Low - Byte							

Bit	Name	Description
0	Disable (D)	These bits determine the device condition. Refer to the description of the device state machine.
1	Hold enable (H)	
2	Device mode active (M)	
3	Ready (R)	
4	Reserved	
5	Reserved	
6	Reserved	
7	Reserved	
8	Reserved	
9	Ramp running	The preset value ramp is active (only in device mode 1 and 3)
10	Reserved	
11	Reserved	
12	Window reached	The target window is reached (only in device mode 4, 7 and 9)
13	Reserved	
14	Reserved	
15	Manufacturer-specific	

4.8.1.3 device mode

Ind	Pnu	Datatype	Range
0	39	UINT8	1: Command value from fieldbus 2: Command value local

4.8.1.4 device control mode

Ind	Pnu	Datatype	Range
0	40	INT8	1: Schieberventil ohne Kolbenlage-Regelung (vpoc) 3: Pressure/flow valve open loop (vprc) 4: Pressure/flow valve closed loop (vprc) 6: Position open loop (dcol) 7: Speed control closed loop (dsc) 9: Position closed loop (dpc) -5: Pressure control closed loop 2-sol (vprc) -6: 2-point controller 1-sol (n-point) -7: 2-point controller 2-sol (n-point) -8: 3-point controller 2-sol (n-point)

4.8.1.5 device local

Ind	Pnu	Datatype	Range
0	41	UINT8	0: Control-word via fieldbus 1: Control-word local

4.8.1.6 device capability

Ind	Pnu	Datatype	Range
0	50	UINT32	Bit 0..13 = reserved Bit 14 = n-point controller (WANDFLUH specific) Bit 15 = Vendor specific Bit 16 = Hydraulic drive Bit 17 = Position open loop Bit 18 = Speed controller Bit 19 = P/Q controller Bit 20 = Position controller Bit 21-23 = reserved Bit 24 = Hydraulic proportional valve Bit 25 = Spool position control open loop (without LVDT) Bit 26 = Spool position control closed loop (with LVDT) Bit 27 = Pressure control valve open loop (without feedback sensor) Bit 28 = Pressure control valve closed loop (with feedback sensor) Bit 29 = P/Q Valve Bit 30 = reserved Bit 31 = Modular device (can have various functions)

4.8.1.7 Store Parameter

Store all changed device parameters into non-volatile memory (EEPROM).

Ind	Pnu	Datatype	Range
0	51	INT32	0: Do nothing 0x73 0x61 0x76 0x65 (= 's' 'a' 'v' 'e'): Store all parameters into the non-volatile memory

4.8.1.8 Reset Default

All device parameters will be set to default values.

Ind	Pnu	Datatype	Range
0	52	INT32	0: Do nothing 0x6C 0x6F 0x61 0x64 (= 'l' 'o' 'a' 'd'): All device parameters will be set to default values

4.8.1.9 Device temperature

Actual, internal temperature if the WANDFLUH-Elektronic in °C.

Ind	Pnu	Datatype	Range
0	55	INT16	-55 .. +150

4.8.1.10 dcol set point

Control-mode	Ind	Pnu	Datatype	Range
vpoc (open-loop)	21	21	INT16	Min .. Max Bus Interface
vprc (open-loop) vprc (closed-loop)	22	21	INT16	
dcol (open-loop)	11	21	INT32	
dsc	13	21	INT32	
dpc	12	21	INT32	
n-point	228	0	INT32	

4.8.1.11 dcol ramp type

Ind	Pnu	Datatype	Range
11	42	INT8	0: Ramp off 3: Ramp on -1: enable ramp via dig. Input

4.8.1.12 dcol dvg ramp acceleration time negative

Ind	Pnu	Datatype	Range
11	46	UINT16	0 .. 51000: 0 .. 51000ms

4.8.1.13 dcol dvg ramp acceleration time positive

Ind	Pnu	Datatype	Range
11	49	UINT16	0 .. 51000: 0 .. 51000ms

4.8.1.14 dcol dvg ramp deceleration time negative

Ind	Pnu	Datatype	Range
11	55	UINT16	0 .. 51000: 0 .. 51000ms

4.8.1.15 dcol dvg ramp deceleration time positive

Ind	Pnu	Datatype	Range
11	58	UINT16	0 .. 51000: 0 .. 51000ms

4.8.1.16 dpc set point

Control-mode	Ind	Pnu	Datatype	Range
vpoc (open-loop)	21	21	INT16	Min .. Max Bus Interface
vprc (open-loop) vprc (closed-loop)	22	21	INT16	
dcol (open-loop)	11	21	INT32	
dsc	13	21	INT32	
dpc	12	21	INT32	
n-point	228	0	INT32	

4.8.1.17 dpc actual value

Control-mode	Ind	Pnu	Datatype	Range
vprc (closed-loop)	22	144	INT16	-16384 .. 16383: refer to "Internal bus resolution 22"
dsc	13	100	INT32	Min- .. Max-Reference: refer to "Scaled parameter 22"
dpc	12	100	INT32	
n-point	228	1	INT32	

4.8.1.18 dpc control deviation

Control-mode	Ind	Pnu	Datatype	Range
vprc (closed-loop)	22	147	INT16	-16384 .. 16383: refer to "Internal bus resolution 22"
dsc	13	103	INT32	Min- .. Max-Reference: refer to "Scaled parameter 22"
dpc	12	103	INT32	
n-point	228	6	INT32	

4.8.1.19 dpc cm type

Ind	Pnu	Datatype	Range
12	140	INT8	0: off 2: Trailing window monitoring on -2: Trailing window monitoring on (raises error)

4.8.1.20 dpc cm delay time

Ind	Pnu	Datatype	Range
12	147	INT16	0 .. 100: 0 .. 100ms

4.8.1.21 dpc cm threshold

By parameter with an unit (e.g. mm, psi, l/min, etc.), the adjusting range and the resolution depends on the selected unit. The following table shows the connection

Unit	Range	Resolution
Free unit	0 .. 15000000	1 / 1000
mm	0 .. 15000000	
Deg	0 .. 360000	
Zoll	0 .. 100000	
bar	0 .. 500000	
psi	0 .. 8000000	
kN	0 .. 1000000	
Mpa	0 .. 50000	
l/min	0 .. 500000	
m/s	0 .. 2000	
inch/s	0 .. 10000000	
1/Min	0 .. 100000	
Deg/s	0 .. 360000	

4.8.1.22 dsc set point

Control-mode	Ind	Pnu	Datatype	Range
vpoc (open-loop)	21	21	INT16	Min .. Max Bus Interface
vprc (open-loop) vprc (closed-loop)	22	21	INT16	
dcol (open-loop)	11	21	INT32	
dsc	13	21	INT32	
dpc	12	21	INT32	
n-point	228	0	INT32	

4.8.1.23 dsc actual value

Control-mode	Ind	Pnu	Datatype	Range

vprc (closed-loop)	22	144	INT16	-16384 .. 16383: refer to "Internal bus resolution 22"
dsc	13	100	INT32	Min- .. Max-Reference: refer to "Scaled parameter 22"
dpc	12	100	INT32	
n-point	228	1	INT32	

4.8.1.24 dsc control deviation

Control-mode	Ind	Pnu	Datatype	Range
vprc (closed-loop)	22	147	INT16	-16384 .. 16383: refer to "Internal bus resolution 22"
dsc	13	103	INT32	Min- .. Max-Reference: refer to "Scaled parameter 22"
dpc	12	103	INT32	
n-point	228	6	INT32	

4.8.1.25 dsc cm type

Ind	Pnu	Datatype	Range
13	112	INT8	0: off 2: Trailing window monitoring on -2: Trailing window monitoring on (raises error)

4.8.1.26 dsc cm delay time

Ind	Pnu	Datatype	Range
13	119	INT16	0 .. 100: 0 .. 100ms

4.8.1.27 dsc cm threshold

By parameter with an unit (e.g. mm, psi, l/min, etc.), the adjusting range and the resolution depends on the selected unit. The following table shows the connection

Unit	Range	Resolution
Free unit	0 .. 15000000	1 / 1000
mm	0 .. 15000000	
Deg	0 .. 360000	
Zoll	0 .. 100000	
bar	0 .. 500000	
psi	0 .. 8000000	
kN	0 .. 1000000	
Mpa	0 .. 50000	
l/min	0 .. 500000	
m/s	0 .. 2000	
inch/s	0 .. 10000000	
1/Min	0 .. 100000	
Deg/s	0 .. 360000	

4.8.1.28 vpoc set point

Control-mode	Ind	Pnu	Datatype	Range

vpoc (open-loop)	21	21	INT16	Min .. Max Bus Interface
vprc (open-loop) vprc (closed-loop)	22	21	INT16	
dcol (open-loop)	11	21	INT32	
dsc	13	21	INT32	
dpc	12	21	INT32	
n-point	228	0	INT32	

4.8.1.29 vpoc ramp type

Ind	Pnu	Datatype	Range
21	43	INT8	0: Ramp off 3: Ramp on -1: enable ramp via dig. Input

4.8.1.30 vpoc dvg ramp acceleration time negative

Ind	Pnu	Datatype	Range
21	47	UINT16	0 .. 51000: 0 .. 51000ms

4.8.1.31 vpoc dvg ramp acceleration time positive

Ind	Pnu	Datatype	Range
21	50	UINT16	0 .. 51000: 0 .. 51000ms

4.8.1.32 vpoc dvg ramp deceleration time negative

Ind	Pnu	Datatype	Range
21	56	UINT16	0 .. 51000: 0 .. 51000ms

4.8.1.33 vpoc dvg ramp deceleration time positive

Ind	Pnu	Datatype	Range
21	59	UINT16	0 .. 51000: 0 .. 51000ms

4.8.1.34 vprc set point

Control-mode	Ind	Pnu	Datatype	Range
vpoc (open-loop)	21	21	INT16	Min .. Max Bus Interface
vprc (open-loop) vprc (closed-loop)	22	21	INT16	

dcol (open-loop)	11	21	INT32	
dsc	13	21	INT32	
dpc	12	21	INT32	
n-point	228	0	INT32	

4.8.1.35 vprc ramp type

Ind	Pnu	Datatype	Range
22	43	INT8	0: Ramp off 3: Ramp on -1: enable ramp via dig. Input

4.8.1.36 vprc dvg ramp acceleration time negative

Ind	Pnu	Datatype	Range
22	47	UINT16	0 .. 51000: 0 .. 51000ms

4.8.1.37 vprc dvg ramp acceleration time positive

Ind	Pnu	Datatype	Range
22	50	UINT16	0 .. 51000: 0 .. 51000ms

4.8.1.38 vprc dvg ramp deceleration time negative

Ind	Pnu	Datatype	Range
22	56	UINT16	0 .. 51000: 0 .. 51000ms

4.8.1.39 vprc dvg ramp deceleration time positive

Ind	Pnu	Datatype	Range
22	59	UINT16	0 .. 51000: 0 .. 51000ms

4.8.1.40 vprc actual value

Control-mode	Ind	Pnu	Datatype	Range
vprc (closed-loop)	22	144	INT16	-16384 .. 16383: refer to "Internal bus resolution 22"
dsc	13	100	INT32	Min- .. Max-Reference: refer to "Scaled parameter 22"
dpc	12	100	INT32	
n-point	228	1	INT32	

4.8.1.41 vprc control deviation

Control-mode	Ind	Pnu	Datatype	Range
vprc (closed-loop)	22	147	INT16	-16384 .. 16383: refer to "Internal bus resolution 22"

dsc	13	103	INT32	Min- .. Max-Reference: refer to "Scaled parameter 22"
dpc	12	103	INT32	
n-point	228	6	INT32	

4.8.1.42 vprc cm type

Ind	Pnu	Datatype	Range
22	150	INT8	0: off 2: Trailing window monitoring on -2: Trailing window monitoring on (raises error)

4.8.1.43 vprc cm delay time

Ind	Pnu	Datatype	Range
22	157	INT16	0 .. 100: 0 .. 100ms

4.8.1.44 vprc cm threshold

Ind	Pnu	Datatype	Range
22	160	INT16	0 .. 16384: 0 .. 100%

4.8.1.45 actual value mode

TODO!

Ind	Pnu	Datatype	Range
220	0	UINT8	1: actual value via fieldbus 2: actual value local

4.8.1.46 actual value input 16 bits

Ind	Pnu	Datatype	Range
220	1	INT16	Min .. Max Bus Interface

4.8.1.47 actual value input 32 bits

Ind	Pnu	Datatype	Range
220	2	INT32	Min .. Max Bus Interface

4.8.1.48 actual value signal type

Ind	Pnu	Datatype	Range
222	0	UINT8	0: Voltage 1: Current 2: Digital 3: Frequency 4: PWM

4.8.1.49 used analogue input for actual value

Ind	Pnu	Datatype	Range
222	1	INT8	-1: not used 0 .. [Analogue input count - 1]

4.8.1.50 used digital input for actual value

Ind	Pnu	Datatype	Range
222	2	INT8	-1: not used 0 .. [digital input count - 1]

4.8.1.51 Actual value cablebreak detection

Ind	Pnu	Datatype	Range
222	4	UINT8	0: Off 1: On

4.8.1.52 Actual value cablebreak detection lower limit

Signal-type	Range
Spannung	-10000 .. 10000: -10 .. +10V, resolution 0.001 Volts
Strom	0 .. 20000: 0 .. +20V, resolution 0.001 Amperes
Digital	0 .. 1: 0 (off), 1 (on)
Frequenz	0 .. 5000000: 0 .. 5000 Hz, resolution 0.001 Hz
PWM	0 .. 100000: 0 .. 100%, resolution 0.001 %

4.8.1.53 Actual value cablebreak detection upper limit

Signal-type	Range
Spannung	-10000 .. 10000: -10 .. +10V, resolution 0.001 Volts
Strom	0 .. 20000: 0 .. +20V, resolution 0.001 Amperes
Digital	0 .. 1: 0 (off), 1 (on)
Frequenz	0 .. 5000000: 0 .. 5000 Hz, resolution 0.001 Hz
PWM	0 .. 100000: 0 .. 100%, resolution 0.001 %

4.8.1.54 actual value min interface

Signal-type	Range
Spannung	-10000 .. 10000: -10 .. +10V, resolution 0.001 Volts
Strom	0 .. 20000: 0 .. +20V, resolution 0.001 Amperes
Digital	0 .. 1: 0 (off), 1 (on)
Frequenz	0 .. 5000000: 0 .. 5000 Hz, resolution 0.001 Hz
PWM	0 .. 100000: 0 .. 100%, resolution 0.001 %

4.8.1.55 actual value max interface

Signal-type	Range
Spannung	-10000 .. 10000: -10 .. +10V, resolution 0.001 Volts
Strom	0 .. 20000: 0 .. +20V, resolution 0.001 Amperes
Digital	0 .. 1: 0 (off), 1 (on)
Frequenz	0 .. 5000000: 0 .. 5000 Hz, resolution 0.001 Hz
PWM	0 .. 100000: 0 .. 100%, resolution 0.001 %

4.8.1.56 actual value min bus interface

Ind	Pnu	Datatype	Range
222	9	INT32	-32768 .. 32767

4.8.1.57 actual value max bus interface

Ind	Pnu	Datatype	Range
222	10	INT32	-32768 .. 32767

4.8.1.58 actual value min reference

By parameter with an unit (e.g. mm, psi, l/min, etc.), the adjusting range and the resolution depends on the selected unit. The following table shows the connection

Unit	Range	Resolution
Free unit	0 .. 15000000	1 / 1000
mm	0 .. 15000000	
Deg	0 .. 360000	
Zoll	0 .. 100000	
bar	0 .. 500000	
psi	0 .. 8000000	
kN	0 .. 1000000	
Mpa	0 .. 50000	
l/min	0 .. 500000	
m/s	0 .. 2000	
inch/s	0 .. 10000000	
1/Min	0 .. 100000	
Deg/s	0 .. 360000	

4.8.1.59 actual value max reference

By parameter with an unit (e.g. mm, psi, l/min, etc.), the adjusting range and the resolution depends on the selected unit. The following table shows the connection

Unit	Range	Resolution
Free unit	0 .. 15000000	1 / 1000
mm	0 .. 15000000	
Deg	0 .. 360000	
Zoll	0 .. 100000	
bar	0 .. 500000	
psi	0 .. 8000000	
kN	0 .. 1000000	

Unit	Range	Resolution
Mpa	0 .. 50000	
l/min	0 .. 500000	
m/s	0 .. 2000	
inch/s	0 .. 10000000	
1/Min	0 .. 100000	
Deg/s	0 .. 360000	

4.8.1.60 Channel enablement

Ind	Pnu	Datatype	Range
224	0	UINT8	0: Disabled 1: Enabled 2: External (dig. input)

4.8.1.61 used digin for channel enablement

Specifies the used dig. input for the channel - enablement, if parameter 'Channel enablement' is set to 'external'.

Ind	Pnu	Datatype	Range
224	1	INT8	-1: not used 0 .. [dig. input count - 1]

4.8.1.62 Mode of operation

Ind	Pnu	Datatype	Range
224	2	UINT8	0: Command unipolar (1-sol) 1: Command unipolar (2-sol) 2: Command bipolar (2-sol) 3: Command unipolar (2-sol with DigInp)

4.8.1.63 Used digin for solenoid B

Active digital input for the solenoid B selection if the parameter "Mode of operation = Command unipolar (2-sol with DigInp)".

Ind	Pnu	Datatype	Range
224	3	INT8	-1: not used 0 .. [dig. input count - 1]

4.8.1.64 Solenoid type

Ind	Pnu	Datatype	Range
224	4	UINT8	0: Proportional solenoid without current measurement 1: Proportional solenoid with current measurement 2: Switching solenoid without current measurement

4.8.1.65 Error handling mask

The errors can be selected, which lead to activate the selected digital output in the active state.

Ind	Pnu	Datatype	Range
224	5	UINT16	1: Cablebreak command signal 2: Short circuit solenoid driver 1 4: Short circuit solenoid driver 2 8: Cablebreak solenoid driver 1 16: Cable break solenoid driver 2 32: Cablebreak actual value signal 64: Trailing window error 128 J1939-bus error (J1939 only) 256: LVDT trailing window error (LVDT only)

4.8.1.66 Error handling reaction

Ind	Pnu	Datatype	Range
224	6	UINT8	0: Solenoid 1+2 off 1: Solenoid 1 on 2: Solenoid 2 on 3: Solenoid 1+2 on

4.8.1.67 Error handling used digout

If a selected error is active, this digital output will be activated. In choosing "not used", no digital output will be assigned to the error.

Ind	Pnu	Datatype	Range
224	7	UINT8	-1: not used 0 .. [dig. output count - 1]

4.8.1.68 Function handling mask

Digital output can be activated, when a certain function is running. Several functions can be set at the same time.

Ind	Pnu	Datatype	Range
224	8	UINT8	1: Solenoid 1 active 2: Solenoid 2 active 4: Channel is ready (no error) 8: Temperature Derating active 16: LVDT outside trailing window (LVDT-only)

4.8.1.69 Function handling used digout

Active digital output for the function. In choosing "not used", no digital output will be assigned to the function.

Ind	Pnu	Datatype	Range
224	9	UINT8	-1: not used 0 .. [dig. output count - 1]

4.8.1.70 Valve type

Ind	Pnu	Datatype	Range
224	10	UINT8	0: Standard 2-Solenoid 1: 4/3-way 1-solenoid

4.8.1.71 Used digin for ramp enable

Ind	Pnu	Datatype	Range
225	0	UINT8	-1: not used 0 .. [dig. input count - 1]

4.8.1.72 n-point controller set point

Control-mode	Ind	Pnu	Datatype	Range
vpoc (open-loop)	21	21	INT16	Min .. Max Bus Interface
vprc (open-loop) vprc (closed-loop)	22	21	INT16	
dcol (open-loop)	11	21	INT32	
dsc	13	21	INT32	
dpc	12	21	INT32	
n-point	228	0	INT32	

4.8.1.73 n-point controller actual value

Control-mode	Ind	Pnu	Datatype	Range
vprc (closed-loop)	22	144	INT16	-16384 .. 16383: refer to "Internal bus resolution 22"
dsc	13	100	INT32	Min- .. Max-Reference: refer to "Scaled parameter 22"
dpc	12	100	INT32	
n-point	228	1	INT32	

4.8.1.74 n-point controller threshold value 1

By parameter with an unit (e.g. mm, psi, l/min, etc.), the adjusting range and the resolution depends on the selected unit. The following table shows the connection

Unit	Range	Resolution
Free unit	0 .. 15000000	1 / 1000
mm	0 .. 15000000	
Deg	0 .. 360000	
Zoll	0 .. 100000	
bar	0 .. 500000	
psi	0 .. 8000000	
kN	0 .. 1000000	
Mpa	0 .. 50000	
l/min	0 .. 500000	
m/s	0 .. 2000	
inch/s	0 .. 10000000	
1/Min	0 .. 100000	
Deg/s	0 .. 360000	

4.8.1.75 n-point controller threshold value 2

By parameter with an unit (e.g. mm, psi, l/min, etc.), the adjusting range and the resolution depends on the selected unit. The following table shows the connection

Unit	Range	Resolution
Free unit	0 .. 15000000	1 / 1000
mm	0 .. 15000000	
Deg	0 .. 360000	
Zoll	0 .. 100000	
bar	0 .. 500000	
psi	0 .. 8000000	
kN	0 .. 1000000	
Mpa	0 .. 50000	
l/min	0 .. 500000	
m/s	0 .. 2000	
inch/s	0 .. 10000000	
1/Min	0 .. 100000	
Deg/s	0 .. 360000	

4.8.1.76 n-point controller threshold value 3

By parameter with an unit (e.g. mm, psi, l/min, etc.), the adjusting range and the resolution depends on the selected unit. The following table shows the connection

Unit	Range	Resolution
Free unit	0 .. 15000000	1 / 1000
mm	0 .. 15000000	
Deg	0 .. 360000	
Zoll	0 .. 100000	
bar	0 .. 500000	
psi	0 .. 8000000	
kN	0 .. 1000000	
Mpa	0 .. 50000	
l/min	0 .. 500000	
m/s	0 .. 2000	
inch/s	0 .. 10000000	
1/Min	0 .. 100000	
Deg/s	0 .. 360000	

4.8.1.77 n-point controller threshold value 4

By parameter with an unit (e.g. mm, psi, l/min, etc.), the adjusting range and the resolution depends on the selected unit. The following table shows the connection

Unit	Range	Resolution
Free unit	0 .. 15000000	1 / 1000
mm	0 .. 15000000	
Deg	0 .. 360000	
Zoll	0 .. 100000	
bar	0 .. 500000	
psi	0 .. 8000000	
kN	0 .. 1000000	
Mpa	0 .. 50000	
l/min	0 .. 500000	
m/s	0 .. 2000	
inch/s	0 .. 10000000	

Unit	Range	Resolution
1/Min	0 .. 100000	
Deg/s	0 .. 360000	

4.8.1.78 n-point control deviation

Control-mode	Ind	Pnu	Datatype	Range
vprc (closed-loop)	22	147	INT16	-16384 .. 16383: refer to "Internal bus resolution 22"
dsc	13	103	INT32	Min- .. Max-Reference: refer to "Scaled parameter 22"
dpc	12	103	INT32	
n-point	228	6	INT32	

4.8.1.79 n-point cm type

Ind	Pnu	Datatype	Range
228	7	INT8	0: off 2: Trailing window monitoring on -2: Trailing window monitoring on (raises error)

4.8.1.80 n-point cm delay time

Ind	Pnu	Datatype	Range
228	8	UINT16	0 .. 100: 0 .. 100ms

4.8.1.81 n-point cm threshold

By parameter with an unit (e.g. mm, psi, l/min, etc.), the adjusting range and the resolution depends on the selected unit. The following table shows the connection

Unit	Range	Resolution
Free unit	0 .. 15000000	1 / 1000
mm	0 .. 15000000	
Deg	0 .. 360000	
Zoll	0 .. 100000	
bar	0 .. 500000	
psi	0 .. 8000000	
kN	0 .. 1000000	
Mpa	0 .. 50000	
l/min	0 .. 500000	
m/s	0 .. 2000	
inch/s	0 .. 10000000	
1/Min	0 .. 100000	
Deg/s	0 .. 360000	

4.8.1.82 demand value signal type

Ind	Pnu	Datatype	Range
232	0	UINT8	0: Voltage 1: Current 2: Digital 3: Frequency 4: PWM

4.8.1.83 used analogue input for demand value

Ind	Pnu	Datatype	Range
232	1	INT8	-1: not used 0 .. [Analogue input count - 1]

4.8.1.84 used digital input for demand value

Ind	Pnu	Datatype	Range
232	2	INT8	-1: not used 0 .. [digital input count - 1]

4.8.1.85 demand value cablebreak detection

Ind	Pnu	Datatype	Range
232	4	UINT8	0: Off 1: On

4.8.1.86 demand value cablebreak detection lower limit

Signal-type	Range
Spannung	-10000 .. 10000: -10 .. +10V, resolution 0.001 Volts
Strom	0 .. 20000: 0 .. +20V, resolution 0.001 Amperes
Digital	0 .. 1: 0 (off), 1 (on)
Frequenz	0 .. 5000000: 0 .. 5000 Hz, resolution 0.001 Hz
PWM	0 .. 100000: 0 .. 100%, resolution 0.001 %

4.8.1.87 demand value cablebreak detection upper limit

Signal-type	Range
Spannung	-10000 .. 10000: -10 .. +10V, resolution 0.001 Volts
Strom	0 .. 20000: 0 .. +20V, resolution 0.001 Amperes
Digital	0 .. 1: 0 (off), 1 (on)
Frequenz	0 .. 5000000: 0 .. 5000 Hz, resolution 0.001 Hz
PWM	0 .. 100000: 0 .. 100%, resolution 0.001 %

4.8.1.88 demand value min interface

Signal-type	Range
Spannung	-10000 .. 10000: -10 .. +10V, resolution 0.001 Volts
Strom	0 .. 20000: 0 .. +20V, resolution 0.001 Amperes
Digital	0 .. 1: 0 (off), 1 (on)
Frequenz	0 .. 5000000: 0 .. 5000 Hz, resolution 0.001 Hz
PWM	0 .. 100000: 0 .. 100%, resolution 0.001 %

4.8.1.89 demand value max interface

Signal-type	Range
Spannung	-10000 .. 10000: -10 .. +10V, resolution 0.001 Volts
Strom	0 .. 20000: 0 .. +20V, resolution 0.001 Amperes
Digital	0 .. 1: 0 (off), 1 (on)
Frequenz	0 .. 5000000: 0 .. 5000 Hz, resolution 0.001 Hz
PWM	0 .. 100000: 0 .. 100%, resolution 0.001 %

4.8.1.90 demand value min bus interface

Ind	Pnu	Datatype	Range
232	9	INT32	-32768 .. 32767

4.8.1.91 demand value max bus interface

Ind	Pnu	Datatype	Range
232	10	INT32	-32768 .. 32767

4.8.1.92 demand value min reference

By parameter with an unit (e.g. mm, psi, l/min, etc.), the adjusting range and the resolution depends on the selected unit. The following table shows the connection

Unit	Range	Resolution
Free unit	0 .. 15000000	1 / 1000
mm	0 .. 15000000	
Deg	0 .. 360000	
Zoll	0 .. 100000	
bar	0 .. 500000	
psi	0 .. 8000000	
kN	0 .. 1000000	
Mpa	0 .. 50000	
l/min	0 .. 500000	
m/s	0 .. 2000	
inch/s	0 .. 10000000	
1/Min	0 .. 100000	
Deg/s	0 .. 360000	

4.8.1.93 demand value max reference

By parameter with an unit (e.g. mm, psi, l/min, etc.), the adjusting range and the resolution depends on the selected unit. The following table shows the connection

Unit	Range	Resolution
Free unit	0 .. 15000000	1 / 1000
mm	0 .. 15000000	
Deg	0 .. 360000	
Zoll	0 .. 100000	
bar	0 .. 500000	
psi	0 .. 8000000	
kN	0 .. 1000000	
Mpa	0 .. 50000	
l/min	0 .. 500000	
m/s	0 .. 2000	
inch/s	0 .. 10000000	
1/Min	0 .. 100000	
Deg/s	0 .. 360000	

4.8.1.94 demand value deadband enable

Ind	Pnu	Datatype	Range
232	13	UINT8	0: off 1: on

4.8.1.95 demand value deadband

Ind	Pnu	Datatype	Range
232	14	INT16	0 .. 16384: 0 .. 100%

4.8.1.96 fixed command values enable

Fixed command values function on/off

Ind	Pnu	Datatype	Value	Description
238	0	UINT8	0	Fixed command values not active
			1	Fixed command values active

Fixed command values digital input x

Ind	Pnu	Datatype	Value	Description
238	1	UINT8	x [RO]	Count of dig. inputs used for fixed command values
	2 .. 2+x	UINT8	-1	Not used
			0 .. 3*	Number of the dig. input (* count is device specific)

Fixed command values 1 .. x

Ind	Pnu	Datatype	Value	Description
238	5	UINT8	x [RO]	Count of Fixed command values

	6 .. 6+x	INT32		Open-Loop: -16384 .. 16384: -100 .. 100% Closed-Loop: refer to "Scaled parameter"

4.8.1.97 Dig. input count for fixed command values

Fixed command values function on/off

Ind	Pnu	Datatype	Value	Description
238	0	UINT8	0	Fixed command values not active
			1	Fixed command values active

Fixed command values digital input x

Ind	Pnu	Datatype	Value	Description
238	1	UINT8	x [RO]	Count of dig. inputs used for fixed command values
	2 .. 2+x	UINT8	-1	Not used
			0 .. 3*	Number of the dig. input (* count is device specific)

Fixed command values 1 .. x

Ind	Pnu	Datatype	Value	Description
238	5	UINT8	x [RO]	Count of Fixed command values
	6 .. 6+x	INT32		Open-Loop: -16384 .. 16384: -100 .. 100% Closed-Loop: refer to "Scaled parameter"

4.8.1.98 fixed command values used digin 1

Fixed command values function on/off

Ind	Pnu	Datatype	Value	Description
238	0	UINT8	0	Fixed command values not active
			1	Fixed command values active

Fixed command values digital input x

Ind	Pnu	Datatype	Value	Description
238	1	UINT8	x [RO]	Count of dig. inputs used for fixed command values
	2 .. 2+x	UINT8	-1	Not used
			0 .. 3*	Number of the dig. input (* count is device specific)

Fixed command values 1 .. x

Ind	Pnu	Datatype	Value	Description
238	5	UINT8	x [RO]	Count of Fixed command values
	6 .. 6+x	INT32		Open-Loop: -16384 .. 16384: -100 .. 100% Closed-Loop: refer to "Scaled parameter"

4.8.1.99 fixed command values used digin 2

Fixed command values function on/off

Ind	Pnu	Datatype	Value	Description
238	0	UINT8	0	Fixed command values not active
			1	Fixed command values active

Fixed command values digital input x

Ind	Pnu	Datatype	Value	Description
238	1	UINT8	x [RO]	Count of dig. inputs used for fixed command values
	2 .. 2+x	UINT8	-1	Not used
			0 .. 3*	Number of the dig. input (* count is device specific)

Fixed command values 1 .. x

Ind	Pnu	Datatype	Value	Description
238	5	UINT8	x [RO]	Count of Fixed command values
	6 .. 6+x	INT32		Open-Loop: -16384 .. 16384: -100 .. 100% Closed-Loop: refer to "Scaled parameter"

4.8.1.100 fixed command values used digin 3

Fixed command values function on/off

Ind	Pnu	Datatype	Value	Description
238	0	UINT8	0	Fixed command values not active
			1	Fixed command values active

Fixed command values digital input x

Ind	Pnu	Datatype	Value	Description
238	1	UINT8	x [RO]	Count of dig. inputs used for fixed command values
	2 .. 2+x	UINT8	-1	Not used
			0 .. 3*	Number of the dig. input (* count is device specific)

Fixed command values 1 .. x

Ind	Pnu	Datatype	Value	Description
238	5	UINT8	x [RO]	Count of Fixed command values
	6 .. 6+x	INT32		Open-Loop: -16384 .. 16384: -100 .. 100% Closed-Loop: refer to "Scaled parameter"

4.8.1.101 fixed command values count

Fixed command values function on/off

Ind	Pnu	Datatype	Value	Description
238	0	UINT8	0	Fixed command values not active
			1	Fixed command values active

Fixed command values digital input x

Ind	Pnu	Datatype	Value	Description
238	1	UINT8	x [RO]	Count of dig. inputs used for fixed command values
	2 .. 2+x	UINT8	-1	Not used
			0 .. 3*	Number of the dig. input (* count is device specific)

Fixed command values 1 .. x

Ind	Pnu	Datatype	Value	Description
238	5	UINT8	x [RO]	Count of Fixed command values
	6 .. 6+x	INT32		Open-Loop: -16384 .. 16384: -100 .. 100% Closed-Loop: refer to "Scaled parameter"

4.8.1.102 fixed command value 1

Fixed command values function on/off

Ind	Pnu	Datatype	Value	Description
238	0	UINT8	0	Fixed command values not active
			1	Fixed command values active

Fixed command values digital input x

Ind	Pnu	Datatype	Value	Description
238	1	UINT8	x [RO]	Count of dig. inputs used for fixed command values
	2 .. 2+x	UINT8	-1	Not used
			0 .. 3*	Number of the dig. input (* count is device specific)

Fixed command values 1 .. x

Ind	Pnu	Datatype	Value	Description
238	5	UINT8	x [RO]	Count of Fixed command values
	6 .. 6+x	INT32		Open-Loop: -16384 .. 16384: -100 .. 100% Closed-Loop: refer to "Scaled parameter"

4.8.1.103 fixed command value 2

Fixed command values function on/off

Ind	Pnu	Datatype	Value	Description
238	0	UINT8	0	Fixed command values not active
			1	Fixed command values active

Fixed command values digital input x

Ind	Pnu	Datatype	Value	Description
238	1	UINT8	x [RO]	Count of dig. inputs used for fixed command values
	2 .. 2+x	UINT8	-1	Not used
			0 .. 3*	Number of the dig. input (* count is device specific)

Fixed command values 1 .. x

Ind	Pnu	Datatype	Value	Description
238	5	UINT8	x [RO]	Count of Fixed command values
	6 .. 6+x	INT32		Open-Loop: -16384 .. 16384: -100 .. 100% Closed-Loop: refer to "Scaled parameter"

4.8.1.104 fixed command value 3

Fixed command values function on/off

Ind	Pnu	Datatype	Value	Description
238	0	UINT8	0	Fixed command values not active
			1	Fixed command values active

Fixed command values digital input x

Ind	Pnu	Datatype	Value	Description
238	1	UINT8	x [RO]	Count of dig. inputs used for fixed command values
	2 .. 2+x	UINT8	-1	Not used
			0 .. 3*	Number of the dig. input (* count is device specific)

Fixed command values 1 .. x

Ind	Pnu	Datatype	Value	Description
238	5	UINT8	x [RO]	Count of Fixed command values
	6 .. 6+x	INT32		Open-Loop: -16384 .. 16384: -100 .. 100% Closed-Loop: refer to "Scaled parameter"

4.8.1.105 fixed command value 4

Fixed command values function on/off

Ind	Pnu	Datatype	Value	Description
238	0	UINT8	0	Fixed command values not active
			1	Fixed command values active

Fixed command values digital input x

Ind	Pnu	Datatype	Value	Description
238	1	UINT8	x [RO]	Count of dig. inputs used for fixed command values
	2 .. 2+x	UINT8	-1	Not used
			0 .. 3*	Number of the dig. input (* count is device specific)

Fixed command values 1 .. x

Ind	Pnu	Datatype	Value	Description
238	5	UINT8	x [RO]	Count of Fixed command values
	6 .. 6+x	INT32		Open-Loop: -16384 .. 16384: -100 .. 100% Closed-Loop: refer to "Scaled parameter"

4.8.1.106 fixed command value 5

Fixed command values function on/off

Ind	Pnu	Datatype	Value	Description
238	0	UINT8	0	Fixed command values not active
			1	Fixed command values active

Fixed command values digital input x

Ind	Pnu	Datatype	Value	Description
238	1	UINT8	x [RO]	Count of dig. inputs used for fixed command values
	2 .. 2+x	UINT8	-1	Not used
			0 .. 3*	Number of the dig. input (* count is device specific)

Fixed command values 1 .. x

Ind	Pnu	Datatype	Value	Description
238	5	UINT8	x [RO]	Count of Fixed command values
	6 .. 6+x	INT32		Open-Loop: -16384 .. 16384: -100 .. 100% Closed-Loop: refer to "Scaled parameter"

4.8.1.107 fixed command value 6

Fixed command values function on/off

Ind	Pnu	Datatype	Value	Description
238	0	UINT8	0	Fixed command values not active
			1	Fixed command values active

Fixed command values digital input x

Ind	Pnu	Datatype	Value	Description
238	1	UINT8	x [RO]	Count of dig. inputs used for fixed command values
	2 .. 2+x	UINT8	-1	Not used
			0 .. 3*	Number of the dig. input (* count is device specific)

Fixed command values 1 .. x

Ind	Pnu	Datatype	Value	Description
238	5	UINT8	x [RO]	Count of Fixed command values
	6 .. 6+x	INT32		Open-Loop: -16384 .. 16384: -100 .. 100% Closed-Loop: refer to "Scaled parameter"

4.8.1.108 fixed command value 7

Fixed command values function on/off

Ind	Pnu	Datatype	Value	Description
238	0	UINT8	0	Fixed command values not active
			1	Fixed command values active

Fixed command values digital input x

Ind	Pnu	Datatype	Value	Description
238	1	UINT8	x [RO]	Count of dig. inputs used for fixed command values
	2 .. 2+x	UINT8	-1	Not used
			0 .. 3*	Number of the dig. input (* count is device specific)

Fixed command values 1 .. x

Ind	Pnu	Datatype	Value	Description
238	5	UINT8	x [RO]	Count of Fixed command values
	6 .. 6+x	INT32		Open-Loop: -16384 .. 16384: -100 .. 100% Closed-Loop: refer to "Scaled parameter"

4.8.1.109 demand value positive velocity

By parameter with an unit (e.g. mm, psi, l/min, etc.), the adjusting range and the resolution depends on the selected unit. The following table shows the connection

Unit	Range	Resolution
Free unit	0 .. 15000000	1 / 1000
mm	0 .. 15000000	
Deg	0 .. 360000	
Zoll	0 .. 100000	
bar	0 .. 500000	
psi	0 .. 8000000	
kN	0 .. 1000000	
Mpa	0 .. 50000	
l/min	0 .. 500000	
m/s	0 .. 2000	
inch/s	0 .. 10000000	
1/Min	0 .. 100000	
Deg/s	0 .. 360000	

4.8.1.110 demand value negative velocity

By parameter with an unit (e.g. mm, psi, l/min, etc.), the adjusting range and the resolution depends on the selected unit. The following table shows the connection

Unit	Range	Resolution
Free unit	0 .. 15000000	1 / 1000
mm	0 .. 15000000	
Deg	0 .. 360000	
Zoll	0 .. 100000	
bar	0 .. 500000	
psi	0 .. 8000000	
kN	0 .. 1000000	
Mpa	0 .. 50000	
l/min	0 .. 500000	
m/s	0 .. 2000	
inch/s	0 .. 10000000	
1/Min	0 .. 100000	
Deg/s	0 .. 360000	

4.8.1.111 target window enable

Ind	Pnu	Datatype	Range
240	2	INT8	0: off 2: on

4.8.1.112 target window delay time

Ind	Pnu	Datatype	Range
240	3	INT16	0 .. 100: 0 .. 100ms

4.8.1.113 target window threshold

By parameter with an unit (e.g. mm, psi, l/min, etc.), the adjusting range and the resolution depends on the selected unit. The following table shows the connection

Unit	Range	Resolution
Free unit	0 .. 15000000	1 / 1000
mm	0 .. 15000000	
Deg	0 .. 360000	
Zoll	0 .. 100000	
bar	0 .. 500000	
psi	0 .. 8000000	
kN	0 .. 1000000	
Mpa	0 .. 50000	
l/min	0 .. 500000	
m/s	0 .. 2000	
inch/s	0 .. 10000000	
1/Min	0 .. 100000	
Deg/s	0 .. 360000	

4.8.1.114 solenoid-off window enable

Ind	Pnu	Datatype	Range
240	5	INT8	0: off 2: on

4.8.1.115 solenoid-off window delay time

Ind	Pnu	Datatype	Range
240	6	INT8	0 .. 100: 0 .. 100ms

4.8.1.116 solenoid-off threshold

By parameter with an unit (e.g. mm, psi, l/min, etc.), the adjusting range and the resolution depends on the selected unit. The following table shows the connection

Unit	Range	Resolution
Free unit	0 .. 15000000	1 / 1000
mm	0 .. 15000000	
Deg	0 .. 360000	
Zoll	0 .. 100000	
bar	0 .. 500000	
psi	0 .. 8000000	
kN	0 .. 1000000	
Mpa	0 .. 50000	
l/min	0 .. 500000	
m/s	0 .. 2000	
inch/s	0 .. 10000000	
1/Min	0 .. 100000	
Deg/s	0 .. 360000	

4.8.1.117 Displayed unit

Ind	Pnu	Datatype	Range
240	8	INT8	0: Free unit 1: mm 2: Deg 3: Inch 4: bar 5: psi 6: kN 7: MPa 8: l/min 9: m/s 10: Inch/s 11: 1/Min 12: Deg/s

4.8.1.118 command feed forward

Ind	Pnu	Datatype	Range
240	9	INT16	0 .. 10000: 0 .. 10, resolution 0.001

4.8.1.119 velocity feed forward

Ind	Pnu	Datatype	Range
240	10	INT16	0 .. 10000: 0 .. 10, resolution 0.001

4.8.1.120 Integrator enable

Ind	Pnu	Datatype	Range
240	11	INT8	0: off 1: on

4.8.1.121 reduction of I-part if outside I-windows

Ind	Pnu	Datatype	Range
240	12	INT8	0: reset to 0 1: unchanged 2: reduction over time

4.8.1.122 Kp positive

Ind	Pnu	Datatype	Range
240	13	INT16	0 .. 25000: 0 .. 25, resolution 0.001

4.8.1.123 Kp negative

Ind	Pnu	Datatype	Range
240	14	INT16	0 .. 25000: 0 .. 25, resolution 0.001

4.8.1.124 Ti positive

Ind	Pnu	Datatype	Range
240	15	INT16	0 .. 10000: 0 .. 10s, resolution 0.001s

4.8.1.125 Ti negative

Ind	Pnu	Datatype	Range
240	16	INT16	0 .. 10000: 0 .. 10s, resolution 0.001s

4.8.1.126 I window positive

By parameter with an unit (e.g. mm, psi, l/min, etc.), the adjusting range and the resolution depends on the selected unit. The following table shows the connection

Unit	Range	Resolution
Free unit	0 .. 15000000	1 / 1000
mm	0 .. 15000000	
Deg	0 .. 360000	
Zoll	0 .. 100000	
bar	0 .. 500000	
psi	0 .. 8000000	
kN	0 .. 1000000	
Mpa	0 .. 50000	
l/min	0 .. 500000	
m/s	0 .. 2000	
inch/s	0 .. 10000000	
1/Min	0 .. 100000	
Deg/s	0 .. 360000	

4.8.1.127 I window negative

By parameter with an unit (e.g. mm, psi, l/min, etc.), the adjusting range and the resolution depends on the selected unit. The following table shows the connection

Unit	Range	Resolution
Free unit	0 .. 15000000	1 / 1000
mm	0 .. 15000000	
Deg	0 .. 360000	
Zoll	0 .. 100000	
bar	0 .. 500000	
psi	0 .. 8000000	
kN	0 .. 1000000	
Mpa	0 .. 50000	
l/min	0 .. 500000	
m/s	0 .. 2000	
inch/s	0 .. 10000000	
1/Min	0 .. 100000	
Deg/s	0 .. 360000	

4.8.1.128 I inner window positive

By parameter with an unit (e.g. mm, psi, l/min, etc.), the adjusting range and the resolution depends on the selected unit. The following table shows the connection

Unit	Range	Resolution
Free unit	0 .. 15000000	1 / 1000
mm	0 .. 15000000	
Deg	0 .. 360000	
Zoll	0 .. 100000	
bar	0 .. 500000	
psi	0 .. 8000000	
kN	0 .. 1000000	
Mpa	0 .. 50000	
l/min	0 .. 500000	
m/s	0 .. 2000	
inch/s	0 .. 10000000	
1/Min	0 .. 100000	
Deg/s	0 .. 360000	

4.8.1.129 I inner window negative

By parameter with an unit (e.g. mm, psi, l/min, etc.), the adjusting range and the resolution depends on the selected unit. The following table shows the connection

Unit	Range	Resolution
Free unit	0 .. 15000000	1 / 1000
mm	0 .. 15000000	
Deg	0 .. 360000	
Zoll	0 .. 100000	
bar	0 .. 500000	
psi	0 .. 8000000	
kN	0 .. 1000000	
Mpa	0 .. 50000	
l/min	0 .. 500000	
m/s	0 .. 2000	
inch/s	0 .. 10000000	
1/Min	0 .. 100000	
Deg/s	0 .. 360000	

4.8.1.130 D time positive

Ind	Pnu	Datatype	Range
240	21	INT16	0 .. 10000: 0 .. 10s, resolution 0.001s

4.8.1.131 D time negative

Ind	Pnu	Datatype	Range
240	22	INT16	0 .. 10000: 0 .. 10s, resolution 0.001s

4.8.1.132 D value positive

Ind	Pnu	Datatype	Range
240	23	INT16	0 .. 10000: 0 .. 10, resolution 0.001

4.8.1.133 D value negativ

Ind	Pnu	Datatype	Range
240	24	INT16	0 .. 10000: 0 .. 10, resolution 0.001

4.8.1.134 used solenoid driver 1

Ind	Pnu	Datatype	Range
250	0	INT8	-1: not used 0 .. [solenoid driver count - 1]

4.8.1.135 solenoid 1 enable

Ind	Pnu	Datatype	Range
250	1	UINT8	0: off 1: on 2: external (dig. input)

4.8.1.136 solenoid 1 enable used digin

Ind	Pnu	Datatype	Range
250	2	UINT8	-1: not used 0 .. [dig. input count - 1]

4.8.1.137 solenoid 1 inversion

Ind	Pnu	Datatype	Range
250	3	UINT8	0: no inversion 1: inversion of solenoid current

4.8.1.138 Imin always active solenoid 1

Ind	Pnu	Datatype	Range
250	4	UINT8	0: normal 1: Imin always active

4.8.1.139 solenoid 1 cablebreak detection

Ind	Pnu	Datatype	Range
250	5	UINT8	0: off 1: on

4.8.1.140 solenoid 1 Imin

Solenoid-type	Range		
	DSV	MD2	SD6
current measured	0 .. 16384: 0 .. 1534mA at 24V 0 .. 16384: 0 .. 2557mA at 12V	0 .. 16384: 0 .. 2112mA	0 .. 16384: 0 .. 1877mA at 24V 0 .. 16384: 0 .. 2346mA at 12V
current not measured	0 .. 16384: 0 .. 100% Duty-Cycle		

4.8.1.141 solenoid 1 Imax

Solenoid-type	Range		
	DSV	MD2	SD6
current measured	0 .. 16384: 0 .. 1534mA at 24V 0 .. 16384: 0 .. 2557mA at 12V	0 .. 16384: 0 .. 2112mA	0 .. 16384: 0 .. 1877mA at 24V 0 .. 16384: 0 .. 2346mA at 12V
current not measured	0 .. 16384: 0 .. 100% Duty-Cycle		

4.8.1.142 solenoid 1 dither function

Ind	Pnu	Datatype	Range
250	8	UINT8	0: off 1: on

4.8.1.143 solenoid 1 dither period

Ind	Pnu	Datatype	Range
250	9	INT16	2 .. 250: 500 .. 4Hz

4.8.1.144 solenoid 1 dither amplitude

Solenoid-type	Range		
	DSV	MD2	SD6
current measured	0 .. 16384: 0 .. 1534mA at 24V 0 .. 16384: 0 .. 2557mA at 12V	0 .. 16384: 0 .. 2112mA	0 .. 16384: 0 .. 1877mA at 24V 0 .. 16384: 0 .. 2346mA at 12V
current not measured	0 .. 16384: 0 .. 100% Duty-Cycle		

4.8.1.145 solenoid 1 switch on threshold

Ind	Pnu	Datatype	Range
250	11	INT16	0 .. 16384: 0 .. 100%

4.8.1.146 solenoid 1 switch off threshold

Ind	Pnu	Datatype	Range
250	12	INT16	0 .. 16384: 0 .. 100%

4.8.1.147 solenoid 1 switch reduction time

Ind	Pnu	Datatype	Range
250	13	UINT16	0 .. 10000: 0 .. 10s, resolution 0.001s

4.8.1.148 solenoid 1 switch reduction value

Ind	Pnu	Datatype	Range
250	14	INT16	0 .. 16384: 0 .. 100%

4.8.1.149 solenoid 1 lower I-min (S1578)

Solenoid-type	Range		
	DSV	MD2	SD6
current measured	0 .. 16384: 0 .. 1534mA at 24V 0 .. 16384: 0 .. 2557mA at 12V	0 .. 16384: 0 .. 2112mA	0 .. 16384: 0 .. 1877mA at 24V 0 .. 16384: 0 .. 2346mA at 12V
current not measured	0 .. 16384: 0 .. 100% Duty-Cycle		

4.8.1.150 solenoid 1 lower I-max (S1578)

Solenoid-type	Range		
	DSV	MD2	SD6
current measured	0 .. 16384: 0 .. 1534mA at 24V 0 .. 16384: 0 .. 2557mA at 12V	0 .. 16384: 0 .. 2112mA	0 .. 16384: 0 .. 1877mA at 24V 0 .. 16384: 0 .. 2346mA at 12V
current not measured	0 .. 16384: 0 .. 100% Duty-Cycle		

4.8.1.151 solenoid 1 characteristic optimisation enable

Ind	Pnu	Datatype	Range
251	0	INT8	0: off 1: on

4.8.1.152 solenoid 1 characteristic optimisation point count

Ind	Pnu	Datatype	Range
251	1	INT8	9 [RO]

4.8.1.153 solenoid 1 characteristic optimisation point 1

Characteristic optimisation on/off

Ind	Pnu	Datatype	Value	Description
251	0	UINT8	0	Characteristic optimisation sol-1 off
			1	Characteristic optimisation sol-1 on
253	0	UINT8	0	Characteristic optimisation sol-2 off
			1	Characteristic optimisation sol-1 on

Characteristic optimisation values

Ind	Pnu	Datatype	Value	Description
251	1	UINT8	9 [RO]	Characteristic optimisation point count sol-1
	2 .. 10	UINT32		Characteristic optimisation points (see below
253	1	UINT8	9 [RO]	Characteristic optimisation point count sol-2
	2 .. 10	UINT32		Characteristic optimisation points (see below).

Coding of one characteristic optimisation point as 32-bit integer value:

Solenoid-current output Y-axis (High - Word)		Solenoid-current input X-axis (Low - Word)	
Value	Description	Value	Description
0 .. 16384	0 .. 100% solenoid current	0 .. 16384	0 .. 100% command - solenoid current

4.8.1.154 solenoid 1 characteristic optimisation point 2

Characteristic optimisation on/off

Ind	Pnu	Datatype	Value	Description
251	0	UINT8	0	Characteristic optimisation sol-1 off
			1	Characteristic optimisation sol-1 on
253	0	UINT8	0	Characteristic optimisation sol-2 off
			1	Characteristic optimisation sol-1 on

Characteristic optimisation values

Ind	Pnu	Datatype	Value	Description
251	1	UINT8	9 [RO]	Characteristic optimisation point count sol-1
	2 .. 10	UINT32		Characteristic optimisation points (see below
253	1	UINT8	9 [RO]	Characteristic optimisation point count sol-2
	2 .. 10	UINT32		Characteristic optimisation points (see below).

Coding of one characteristic optimisation point as 32-bit integer value:

Solenoid-current output Y-axis (High - Word)		Solenoid-current input X-axis (Low - Word)	
Value	Description	Value	Description

0 .. 16384	0 .. 100% solenoid current	0 .. 16384	0 .. 100% command - solenoid current

4.8.1.155 solenoid 1 characteristic optimisation point 3

Characteristic optimisation on/off

Ind	Pnu	Datatype	Value	Description
251	0	UINT8	0	Characteristic optimisation sol-1 off
			1	Characteristic optimisation sol-1 on
253	0	UINT8	0	Characteristic optimisation sol-2 off
			1	Characteristic optimisation sol-1 on

Characteristic optimisation values

Ind	Pnu	Datatype	Value	Description
251	1	UINT8	9 [RO]	Characteristic optimisation point count sol-1
	2 .. 10	UINT32		Characteristic optimisation points (see below
253	1	UINT8	9 [RO]	Characteristic optimisation point count sol-2
	2 .. 10	UINT32		Characteristic optimisation points (see below).

Coding of one characteristic optimisation point as 32-bit integer value:

Solenoid-current output Y-axis (High - Word)		Solenoid-current input X-axis (Low - Word)	
Value	Description	Value	Description
0 .. 16384	0 .. 100% solenoid current	0 .. 16384	0 .. 100% command - solenoid current

4.8.1.156 solenoid 1 characteristic optimisation point 4

Characteristic optimisation on/off

Ind	Pnu	Datatype	Value	Description
251	0	UINT8	0	Characteristic optimisation sol-1 off
			1	Characteristic optimisation sol-1 on
253	0	UINT8	0	Characteristic optimisation sol-2 off
			1	Characteristic optimisation sol-1 on

Characteristic optimisation values

Ind	Pnu	Datatype	Value	Description
251	1	UINT8	9 [RO]	Characteristic optimisation point count sol-1
	2 .. 10	UINT32		Characteristic optimisation points (see below
253	1	UINT8	9 [RO]	Characteristic optimisation point count sol-2
	2 .. 10	UINT32		Characteristic optimisation points (see below).

Coding of one characteristic optimisation point as 32-bit integer value:

Solenoid-current output Y-axis (High - Word)		Solenoid-current input X-axis (Low - Word)	
Value	**Description**	**Value**	**Description**
0 .. 16384	0 .. 100% solenoid current	0 .. 16384	0 .. 100% command - solenoid current

4.8.1.157 solenoid 1 characteristic optimisation point 5

Characteristic optimisation on/off

Ind	Pnu	Datatype	Value	Description
251	0	UINT8	0	Characteristic optimisation sol-1 off
			1	Characteristic optimisation sol-1 on
253	0	UINT8	0	Characteristic optimisation sol-2 off
			1	Characteristic optimisation sol-1 on

Characteristic optimisation values

Ind	Pnu	Datatype	Value	Description
251	1	UINT8	9 [RO]	Characteristic optimisation point count sol-1
	2 .. 10	UINT32		Characteristic optimisation points (see below
253	1	UINT8	9 [RO]	Characteristic optimisation point count sol-2
	2 .. 10	UINT32		Characteristic optimisation points (see below).

Coding of one characteristic optimisation point as 32-bit integer value:

Solenoid-current output Y-axis (High - Word)		Solenoid-current input X-axis (Low - Word)	
Value	**Description**	**Value**	**Description**
0 .. 16384	0 .. 100% solenoid current	0 .. 16384	0 .. 100% command - solenoid current

4.8.1.158 solenoid 1 characteristic optimisation point 6

Characteristic optimisation on/off

Ind	Pnu	Datatype	Value	Description
251	0	UINT8	0	Characteristic optimisation sol-1 off
			1	Characteristic optimisation sol-1 on
253	0	UINT8	0	Characteristic optimisation sol-2 off
			1	Characteristic optimisation sol-1 on

Characteristic optimisation values

Ind	Pnu	Datatype	Value	Description
251	1	UINT8	9 [RO]	Characteristic optimisation point count sol-1

	2 .. 10	UINT32		Characteristic optimisation points (see below
253	1	UINT8	9 [RO]	Characteristic optimisation point count sol-2
	2 .. 10	UINT32		Characteristic optimisation points (see below).

Coding of one characteristic optimisation point as 32-bit integer value:

Solenoid-current output Y-axis (High - Word)		Solenoid-current input X-axis (Low - Word)	
Value	**Description**	**Value**	**Description**
0 .. 16384	0 .. 100% solenoid current	0 .. 16384	0 .. 100% command - solenoid current

4.8.1.159 solenoid 1 characteristic optimisation point 7

Characteristic optimisation on/off

Ind	Pnu	Datatype	Value	Description
251	0	UINT8	0	Characteristic optimisation sol-1 off
			1	Characteristic optimisation sol-1 on
253	0	UINT8	0	Characteristic optimisation sol-2 off
			1	Characteristic optimisation sol-1 on

Characteristic optimisation values

Ind	Pnu	Datatype	Value	Description
251	1	UINT8	9 [RO]	Characteristic optimisation point count sol-1
	2 .. 10	UINT32		Characteristic optimisation points (see below
253	1	UINT8	9 [RO]	Characteristic optimisation point count sol-2
	2 .. 10	UINT32		Characteristic optimisation points (see below).

Coding of one characteristic optimisation point as 32-bit integer value:

Solenoid-current output Y-axis (High - Word)		Solenoid-current input X-axis (Low - Word)	
Value	**Description**	**Value**	**Description**
0 .. 16384	0 .. 100% solenoid current	0 .. 16384	0 .. 100% command - solenoid current

4.8.1.160 solenoid 1 characteristic optimisation point 8

Characteristic optimisation on/off

Ind	Pnu	Datatype	Value	Description
251	0	UINT8	0	Characteristic optimisation sol-1 off
			1	Characteristic optimisation sol-1 on
253	0	UINT8	0	Characteristic optimisation sol-2 off
			1	Characteristic optimisation sol-1 on

Characteristic optimisation values

Ind	Pnu	Datatype	Value	Description
251	1	UINT8	9 [RO]	Characteristic optimisation point count sol-1
	2 .. 10	UINT32		Characteristic optimisation points (see below
253	1	UINT8	9 [RO]	Characteristic optimisation point count sol-2
	2 .. 10	UINT32		Characteristic optimisation points (see below).

Coding of one characteristic optimisation point as 32-bit integer value:

Solenoid-current output Y-axis (High - Word)		Solenoid-current input X-axis (Low - Word)	
Value	Description	Value	Description
0 .. 16384	0 .. 100% solenoid current	0 .. 16384	0 .. 100% command - solenoid current

4.8.1.161 solenoid 1 characteristic optimisation point 9

Characteristic optimisation on/off

Ind	Pnu	Datatype	Value	Description
251	0	UINT8	0	Characteristic optimisation sol-1 off
			1	Characteristic optimisation sol-1 on
253	0	UINT8	0	Characteristic optimisation sol-2 off
			1	Characteristic optimisation sol-1 on

Characteristic optimisation values

Ind	Pnu	Datatype	Value	Description
251	1	UINT8	9 [RO]	Characteristic optimisation point count sol-1
	2 .. 10	UINT32		Characteristic optimisation points (see below
253	1	UINT8	9 [RO]	Characteristic optimisation point count sol-2
	2 .. 10	UINT32		Characteristic optimisation points (see below).

Coding of one characteristic optimisation point as 32-bit integer value:

Solenoid-current output Y-axis (High - Word)		Solenoid-current input X-axis (Low - Word)	
Value	Description	Value	Description
0 .. 16384	0 .. 100% solenoid current	0 .. 16384	0 .. 100% command - solenoid current

4.8.1.162 used solenoid driver 2

Ind	Pnu	Datatype	Range
252	0	INT8	-1: not used 0 .. [solenoid driver count - 1]

4.8.1.163 solenoid 2 enable

Ind	Pnu	Datatype	Range
252	1	UINT8	0: off 1: on 2: external (dig. input)

4.8.1.164 solenoid 2 enable used digin

Ind	Pnu	Datatype	Range
252	2	UINT8	-1: not used 0 .. [dig. input count - 1]

4.8.1.165 solenoid 2 inversion

Ind	Pnu	Datatype	Range
252	3	UINT8	0: no inversion 1: inversion of solenoid current

4.8.1.166 Imin always active solenoid 2

Ind	Pnu	Datatype	Range
252	4	UINT8	0: normal 1: Imin always active

4.8.1.167 solenoid 2 cablebreak detection

Ind	Pnu	Datatype	Range
252	5	UINT8	0: off 1: on

4.8.1.168 solenoid 2 Imin

Solenoid-type	Range		
	DSV	MD2	SD6
current measured	0 .. 16384: 0 .. 1534mA at 24V 0 .. 16384: 0 .. 2557mA at 12V	0 .. 16384: 0 .. 2112mA	0 .. 16384: 0 .. 1877mA at 24V 0 .. 16384: 0 .. 2346mA at 12V
current not measured	0 .. 16384: 0 .. 100% Duty-Cycle		

4.8.1.169 solenoid 2 Imax

Solenoid-type	Range		
	DSV	MD2	SD6
current measured	0 .. 16384: 0 .. 1534mA at 24V 0 .. 16384: 0 .. 2557mA at 12V	0 .. 16384: 0 .. 2112mA	0 .. 16384: 0 .. 1877mA at 24V 0 .. 16384: 0 .. 2346mA at 12V

current not measured	0 .. 16384: 0 .. 100% Duty-Cycle

4.8.1.170 solenoid 2 dither function

Ind	Pnu	Datatype	Range
252	8	UINT8	0: off 1: on

4.8.1.171 solenoid 2 dither period

Ind	Pnu	Datatype	Range
252	9	INT16	2 .. 250: 500 .. 4Hz

4.8.1.172 solenoid 2 dither amplitude

Solenoid-type	Range		
	DSV	MD2	SD6
current measured	0 .. 16384: 0 .. 1534mA at 24V 0 .. 16384: 0 .. 2557mA at 12V	0 .. 16384: 0 .. 2112mA	0 .. 16384: 0 .. 1877mA at 24V 0 .. 16384: 0 .. 2346mA at 12V
current not measured	0 .. 16384: 0 .. 100% Duty-Cycle		

4.8.1.173 solenoid 2 switch on threshold

Ind	Pnu	Datatype	Range
252	11	INT16	0 .. 16384: 0 .. 100%

4.8.1.174 solenoid 2 switch off threshold

Ind	Pnu	Datatype	Range
252	12	INT16	0 .. 16384: 0 .. 100%

4.8.1.175 solenoid 2 switch reduction time

Ind	Pnu	Datatype	Range
252	13	UINT16	0 .. 10000: 0 .. 10s, resolution 0.001s

4.8.1.176 solenoid 2 switch reduction value

Ind	Pnu	Datatype	Range
252	14	INT16	0 .. 16384: 0 .. 100%

4.8.1.177 solenoid 2 lower I-min (S1578)

Solenoid-type	Range		
	DSV	MD2	SD6

current measured	0 .. 16384: 0 .. 1534mA at 24V 0 .. 16384: 0 .. 2557mA at 12V	0 .. 16384: 0 .. 2112mA	0 .. 16384: 0 .. 1877mA at 24V 0 .. 16384: 0 .. 2346mA at 12V
current not measured	0 .. 16384: 0 .. 100% Duty-Cycle		

4.8.1.178 solenoid 2 lower I-max (S1578)

Solenoid-type	Range		
	DSV	MD2	SD6
current measured	0 .. 16384: 0 .. 1534mA at 24V 0 .. 16384: 0 .. 2557mA at 12V	0 .. 16384: 0 .. 2112mA	0 .. 16384: 0 .. 1877mA at 24V 0 .. 16384: 0 .. 2346mA at 12V
current not measured	0 .. 16384: 0 .. 100% Duty-Cycle		

4.8.1.179 solenoid 2 characteristic optimisation enable

Ind	Pnu	Datatype	Range
253	0	INT8	0: off 1: on

4.8.1.180 solenoid 2 characteristic optimisation point count

Ind	Pnu	Datatype	Range
253	1	INT8	9 [RO]

4.8.1.181 solenoid 2 characteristic optimisation point 1

Characteristic optimisation on/off

Ind	Pnu	Datatype	Value	Description
251	0	UINT8	0	Characteristic optimisation sol-1 off
			1	Characteristic optimisation sol-1 on
253	0	UINT8	0	Characteristic optimisation sol-2 off
			1	Characteristic optimisation sol-1 on

Characteristic optimisation values

Ind	Pnu	Datatype	Value	Description
251	1	UINT8	9 [RO]	Characteristic optimisation point count sol-1
	2 .. 10	UINT32		Characteristic optimisation points (see below
253	1	UINT8	9 [RO]	Characteristic optimisation point count sol-2
	2 .. 10	UINT32		Characteristic optimisation points (see below).

Coding of one characteristic optimisation point as 32-bit integer value:

Solenoid-current output Y-axis (High - Word)	Solenoid-current input X-axis (Low - Word)

Value	Description	Value	Description
0 .. 16384	0 .. 100% solenoid current	0 .. 16384	0 .. 100% command - solenoid current

4.8.1.182 solenoid 2 characteristic optimisation point 2

Characteristic optimisation on/off

Ind	Pnu	Datatype	Value	Description
251	0	UINT8	0	Characteristic optimisation sol-1 off
			1	Characteristic optimisation sol-1 on
253	0	UINT8	0	Characteristic optimisation sol-2 off
			1	Characteristic optimisation sol-1 on

Characteristic optimisation values

Ind	Pnu	Datatype	Value	Description
251	1	UINT8	9 [RO]	Characteristic optimisation point count sol-1
	2 .. 10	UINT32		Characteristic optimisation points (see below
253	1	UINT8	9 [RO]	Characteristic optimisation point count sol-2
	2 .. 10	UINT32		Characteristic optimisation points (see below).

Coding of one characteristic optimisation point as 32-bit integer value:

Solenoid-current output Y-axis (High - Word)		Solenoid-current input X-axis (Low - Word)	
Value	Description	Value	Description
0 .. 16384	0 .. 100% solenoid current	0 .. 16384	0 .. 100% command - solenoid current

4.8.1.183 solenoid 2 characteristic optimisation point 3

Characteristic optimisation on/off

Ind	Pnu	Datatype	Value	Description
251	0	UINT8	0	Characteristic optimisation sol-1 off
			1	Characteristic optimisation sol-1 on
253	0	UINT8	0	Characteristic optimisation sol-2 off
			1	Characteristic optimisation sol-1 on

Characteristic optimisation values

Ind	Pnu	Datatype	Value	Description
251	1	UINT8	9 [RO]	Characteristic optimisation point count sol-1
	2 .. 10	UINT32		Characteristic optimisation points (see below
253	1	UINT8	9 [RO]	Characteristic optimisation point count sol-2
	2 .. 10	UINT32		Characteristic optimisation points (see below).

Coding of one characteristic optimisation point as 32-bit integer value:

Solenoid-current output Y-axis (High - Word)		Solenoid-current input X-axis (Low - Word)	
Value	**Description**	**Value**	**Description**
0 .. 16384	0 .. 100% solenoid current	0 .. 16384	0 .. 100% command - solenoid current

4.8.1.184 solenoid 2 characteristic optimisation point 4

Characteristic optimisation on/off

Ind	Pnu	Datatype	Value	Description
251	0	UINT8	0	Characteristic optimisation sol-1 off
			1	Characteristic optimisation sol-1 on
253	0	UINT8	0	Characteristic optimisation sol-2 off
			1	Characteristic optimisation sol-1 on

Characteristic optimisation values

Ind	Pnu	Datatype	Value	Description
251	1	UINT8	9 [RO]	Characteristic optimisation point count sol-1
	2 .. 10	UINT32		Characteristic optimisation points (see below
253	1	UINT8	9 [RO]	Characteristic optimisation point count sol-2
	2 .. 10	UINT32		Characteristic optimisation points (see below).

Coding of one characteristic optimisation point as 32-bit integer value:

Solenoid-current output Y-axis (High - Word)		Solenoid-current input X-axis (Low - Word)	
Value	**Description**	**Value**	**Description**
0 .. 16384	0 .. 100% solenoid current	0 .. 16384	0 .. 100% command - solenoid current

4.8.1.185 solenoid 2 characteristic optimisation point 5

Characteristic optimisation on/off

Ind	Pnu	Datatype	Value	Description
251	0	UINT8	0	Characteristic optimisation sol-1 off
			1	Characteristic optimisation sol-1 on
253	0	UINT8	0	Characteristic optimisation sol-2 off
			1	Characteristic optimisation sol-1 on

Characteristic optimisation values

Ind	Pnu	Datatype	Value	Description

251	1	UINT8	9 [RO]	Characteristic optimisation point count sol-1
	2 .. 10	UINT32		Characteristic optimisation points (see below
253	1	UINT8	9 [RO]	Characteristic optimisation point count sol-2
	2 .. 10	UINT32		Characteristic optimisation points (see below).

Coding of one characteristic optimisation point as 32-bit integer value:

Solenoid-current output Y-axis (High - Word)		Solenoid-current input X-axis (Low - Word)	
Value	**Description**	**Value**	**Description**
0 .. 16384	0 .. 100% solenoid current	0 .. 16384	0 .. 100% command - solenoid current

4.8.1.186 solenoid 2 characteristic optimisation point 6

Characteristic optimisation on/off

Ind	Pnu	Datatype	Value	Description
251	0	UINT8	0	Characteristic optimisation sol-1 off
			1	Characteristic optimisation sol-1 on
253	0	UINT8	0	Characteristic optimisation sol-2 off
			1	Characteristic optimisation sol-1 on

Characteristic optimisation values

Ind	Pnu	Datatype	Value	Description
251	1	UINT8	9 [RO]	Characteristic optimisation point count sol-1
	2 .. 10	UINT32		Characteristic optimisation points (see below
253	1	UINT8	9 [RO]	Characteristic optimisation point count sol-2
	2 .. 10	UINT32		Characteristic optimisation points (see below).

Coding of one characteristic optimisation point as 32-bit integer value:

Solenoid-current output Y-axis (High - Word)		Solenoid-current input X-axis (Low - Word)	
Value	**Description**	**Value**	**Description**
0 .. 16384	0 .. 100% solenoid current	0 .. 16384	0 .. 100% command - solenoid current

4.8.1.187 solenoid 2 characteristic optimisation point 7

Characteristic optimisation on/off

Ind	Pnu	Datatype	Value	Description
251	0	UINT8	0	Characteristic optimisation sol-1 off
			1	Characteristic optimisation sol-1 on
253	0	UINT8	0	Characteristic optimisation sol-2 off
			1	Characteristic optimisation sol-1 on

Characteristic optimisation values

Ind	Pnu	Datatype	Value	Description
251	1	UINT8	9 [RO]	Characteristic optimisation point count sol-1
	2 .. 10	UINT32		Characteristic optimisation points (see below
253	1	UINT8	9 [RO]	Characteristic optimisation point count sol-2
	2 .. 10	UINT32		Characteristic optimisation points (see below).

Coding of one characteristic optimisation point as 32-bit integer value:

Solenoid-current output Y-axis (High - Word)		Solenoid-current input X-axis (Low - Word)	
Value	Description	Value	Description
0 .. 16384	0 .. 100% solenoid current	0 .. 16384	0 .. 100% command - solenoid current

4.8.1.188 solenoid 2 characteristic optimisation point 8

Characteristic optimisation on/off

Ind	Pnu	Datatype	Value	Description
251	0	UINT8	0	Characteristic optimisation sol-1 off
			1	Characteristic optimisation sol-1 on
253	0	UINT8	0	Characteristic optimisation sol-2 off
			1	Characteristic optimisation sol-1 on

Characteristic optimisation values

Ind	Pnu	Datatype	Value	Description
251	1	UINT8	9 [RO]	Characteristic optimisation point count sol-1
	2 .. 10	UINT32		Characteristic optimisation points (see below
253	1	UINT8	9 [RO]	Characteristic optimisation point count sol-2
	2 .. 10	UINT32		Characteristic optimisation points (see below).

Coding of one characteristic optimisation point as 32-bit integer value:

Solenoid-current output Y-axis (High - Word)		Solenoid-current input X-axis (Low - Word)	
Value	Description	Value	Description
0 .. 16384	0 .. 100% solenoid current	0 .. 16384	0 .. 100% command - solenoid current

4.8.1.189 solenoid 2 characteristic optimisation point 9

Characteristic optimisation on/off

Ind	Pnu	Datatype	Value	Description

251	0	UINT8	0	Characteristic optimisation sol-1 off
			1	Characteristic optimisation sol-1 on
253	0	UINT8	0	Characteristic optimisation sol-2 off
			1	Characteristic optimisation sol-1 on

Characteristic optimisation values

Ind	Pnu	Datatype	Value	Description
251	1	UINT8	9 [RO]	Characteristic optimisation point count sol-1
	2 .. 10	UINT32		Characteristic optimisation points (see below
253	1	UINT8	9 [RO]	Characteristic optimisation point count sol-2
	2 .. 10	UINT32		Characteristic optimisation points (see below).

Coding of one characteristic optimisation point as 32-bit integer value:

Solenoid-current output Y-axis (High - Word)		Solenoid-current input X-axis (Low - Word)	
Value	Description	Value	Description
0 .. 16384	0 .. 100% solenoid current	0 .. 16384	0 .. 100% command - solenoid current

5 Commissioning

For a support during the commissioning of a DP-Slave controller card, the parameterisation software PASO can be connected to the DP-Slave controller card. PASO offers the possibility to display some process value like preset value, solenoid current, device state (state machine) etc. Also the setting of the node adress and a PROFIBUS-DP diagnostic can be made via the PASO (refer to section "Fieldbus Settings 6").

5.1 Step by step instructions for the first commissioning

For the first commissioning, the following steps should be observed:

5.1.1 Test the hydraulic system

1. Switch off the hydraulic system
2. Switch off the fieldbus master
3. Switch on the *WANDFLUH*-Electronics
4. In the PASO window "Fieldbus_Info" in the section "Bus State" the following statement will be displayed: WD-Status = Baud_Search and DP-status = Wait_Prm (refer to section "Fieldbus Settings 6")
5. In the PASO status line, the statements "Local" and "Init" will be displayed
6. Switch on the hydraulic system
7. Set the control of the device to PASO with the PASO Menu "Commands_PASO Control". In the PASO status line, the statements "Remote PASO" and "Init" will be displayed
8. Enable the device with the PASO Menu "Commands_Enable". In the PASO status line, the statements "Remote PASO" and "Active" will be displayed
9. With the PASO Menu "Commands_Valve operation", the solenoids can be operated directly.

IMPORTANT: The hydraulic moves in an open loop system! Be sure, that the hydraulic system can move free.

10. In the PASO window "Parameters_Valves", the parameters for the minimum (Imin) and maximum (Imax) current and the dither signal (frequency and level) can be set
11. Disable the device with the PASO Menu "Commands_Disable". In the PASO status line, the statements "Remote PASO" and "Disabled" will be displayed
12. Set the control of the device to Local with the PASO Menu "Commands_Local Control". In the PASO status line, the statements "Remote" and "Init" will be displayed

5.1.2 Connect the measuring system (only controller)

1. Connect the measuring system to the corresponding input of the *WANDFLUH*-Electronics
2. In the PASO window "Configuration_Control mode", the adjustments for the desired control mode can be made
3. In the PASO window "Configuration_Signal scaling", the adjustments for the feedback value signal can be made

5.1.3 Adjust the mode of operation (only amplifier)

1. In the PASO window "Configuration_Mode of operation", the adjustments for the desired mode of operation can be made

5.1.4 Test the fieldbus

1. Load the GSD-Datei in the filedbus master and select the desired telegram type (refer to section „Presupposition and information for the Fieldbus master 76")

2. Adjust the node adress and the telegram type (refer to section "Presupposition for the DP-Slave controller card 76")
3. Switch on the fieldbus master
4. In the PASO window „Fieldbus_Info“ in the section „Bus State“ the following statement will be displayed: WD-Status = DP_Control and DP-Status = Data-Exchange (refer to section "Fieldbus Diagnostics 7")

5.1.5 Test the control via the fieldbus

1. Set the following parameter in the declared order with the PKW-services (refer to section "Cyclical parameter data exchange (PKW) 19")
2. Set the parameter "Device local" to "Control operation via BUS (0)" (refer to section "Device local")
3. With the parameter „Device control mode“).
4. For the release of the *WANDFLUH*-Electronics, the 3 bits "Disable (D)", "Hold enable (H)" and "Device mode active (M)" from the control word (refer to section "Control Word") must be set to logical 1. The DP-Slave controller is now in the state "ACTIVE".
5. With the PKW-services (refer to section "Cyclical parameter data exchange (PKW) 19") resp. the PZD-services (refer to section "Cyclical process data exchange (PZD) 17") a preset value can now be set via the fieldbus.

5.2 Presupposition for the DP-Slave controller card

For the commissioning of a DP-Slave controller card, the following presupposition must be cleared:

- **What is the node adresse from the DP-Slave controller card?**
  The node address can be set via the parameterisation software PASO in the menu item "Fieldbus_Info" (refer to section "Fieldbus Settings 6").

- **What is the device control mode for the DP-Slave controller card?**
  The device control mode can be set via the parameter "ControlMode". This selection is important for the for the function range of the DP-Slave controller card.

  IMPORTANT: This parameter can only be changed if the *WANDFLUH*-Electronics is in the state "INIT" or "DISABLE"

  (refer to section "State machine 12")

- **Telegram**
  If the mode of operation is selected, the corresponding telegram must be selected. This adjustment can only be made if the *WANDFLUH*-Electronics is separated from the Profibus.

5.3 Presupposition and information for the Fieldbus master

Presupposition and information for the Fieldbus master

For the commissioning of a Fieldbus master, the following presupposition must be cleared:

- **Node adress**
  What is the node address from the DP-Slave?

- **Telegram**
  The master must be adjusted to the same type of telegram as the *WANDFLUH*-Electronics.

- **GSD-file**
  The GSD-file "WAGxxx.gsd" must be present on the Master side. If not, this file must be copied into the project tool of the Master.

- **Data exchange (consistent / inconsistent)**
  For the programing of the data exchange (consistent / inconsistent) in the appliation program of the master, the following rules are valid:

  - PKW-part
    ? consistent data transfer (consistent for the whole length)

  - PZD-part
    ? consistent data transfer (consistent for the whole length)

5.4 Delivery state

The *WANDFLUH*-Electronics is delivered with the following basic configuration:

Device	Adress	Telegram type
WANDFLUH-Electronics Amplifier	6	3
WANDFLUH-Electronics Controller	6	1

5.5 Parameterisation

The parameters of the DP-Slave controller card can be read or changed trough the PROFIBUS-DP or through PASO.

After switch-on the DP-Slave controller card, it can be parameterised by sending parameter via PKW (refer to section "Cyclical parameter data exchange (PKW) 19"). If the changed parameters should be also present after a switch-Off and switch-on, they must be stored before the switch-Off. This can be made with the parameter "Store Parameter".

5.6 Setting the preset value via Fieldbus

In the standard version of the DP-Slave controller card, the preset value can be set locally or via the Fieldbus (refer to section "Program Control 16"). The switch over is made with the parameter " DeviceMode".

After each power on, the following commissioning sequence is necessary:

1. The DP-Slave controller card is now in the state "INIT"
2. In this state, the device control mode can be set with the parameter "ControlMode" and the device mode can be set with the parameter "DeviceMode"
3. For the release of the DP-Slave controller card, the 3 bits D, H and M from the control word (refer to section "State machine 12") must be set to logical 1. The DP-Slave controller card is now in the state "ACTIVE". Now, a preset value can be set.

   Note: If the DP-Slave controller card is used locally (refer to section "Local control"), the start signal (digital input 1) must be set additionally

5.7 Start after an error

- If the device detects an error, the release will be take away internal and the bit "Ready" from the status word will be set to 0. Via the parameter "Error Code" or via the menu item "Diagnostic" in the PASO, an error description can be displayed.

- For restarting the DP-Slave controller card, the bit "Reset Fault" in the control word must be set once to logical 1. Therefore, the error will be reset.
- If the error is reset, the bit "Ready" from status word will be set to 1.
- For the release of the DP-Slave controller card, the 3 bit D, H and M from the control word must be set again to logical 1

6 Diagnostic and error detection

A diagnostic about the Fieldbus is always possible via the parameterisation software PASO. This will be made via the menu item "Fieldbus_Info". The following values will be displayed:

- Node adress
- Baudrate
- Telegram type
- Bus type
- ID-number
- WD-state
- DP-state
- TG-state

A detailed description of the diagnostic function you will find in the section "Fieldbus Diagnostics 7".