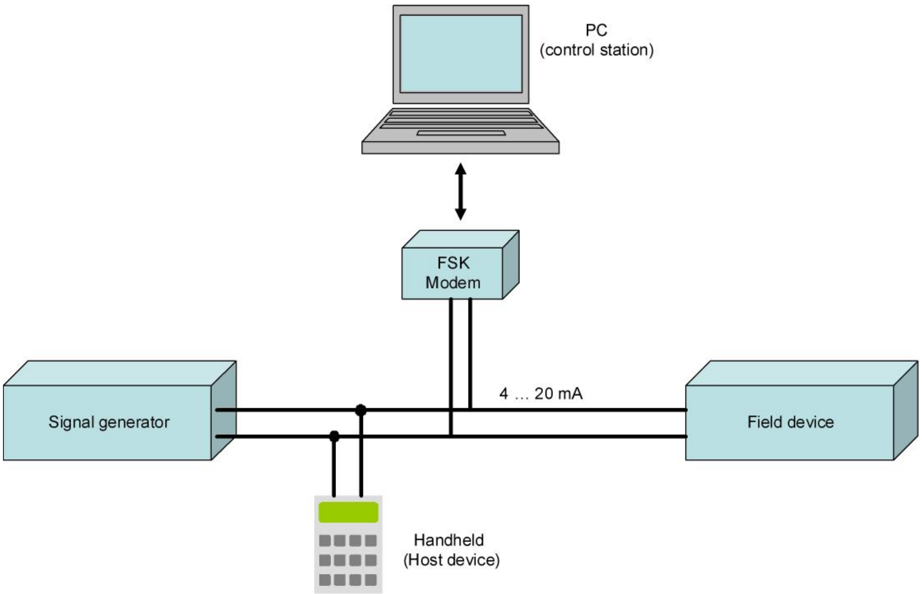
OPERATING INSTRUCTIONS

HART-7 INTERFACE



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1 HART Technologie

1.1 General

HART is a vendor independent, open fieldbus with a wide application range. Contrary to other fieldbuses it does not need a separate fieldbus line. HART devices communicate their data over the transmission lines of the 4 to 20 mA system.

This enables the field devices to be parameterized and started up in a flexible manner or to read measured and stored data (records).

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The most important performance features of the HART protocol include:

- proven in practice, simple design, easy to maintain and operate
- compatible with conventional analog instrumentation
- simultaneous analog and digital communication
- flexible data access via up to two master devices
- supports multivariable field devices
- open de-facto standard freely available to any manufacturer or user

1.2 Connecting HART devices

Devices which support the HART protocol are grouped into master (host) and slave (field) devices. Master devices include handheld terminals as well as PC-based work places (e.g. in the control room). HART slave devices, on the other hand, include sensors, transmitters and various actuators. The WANDFLUH Electronics is always a field device.

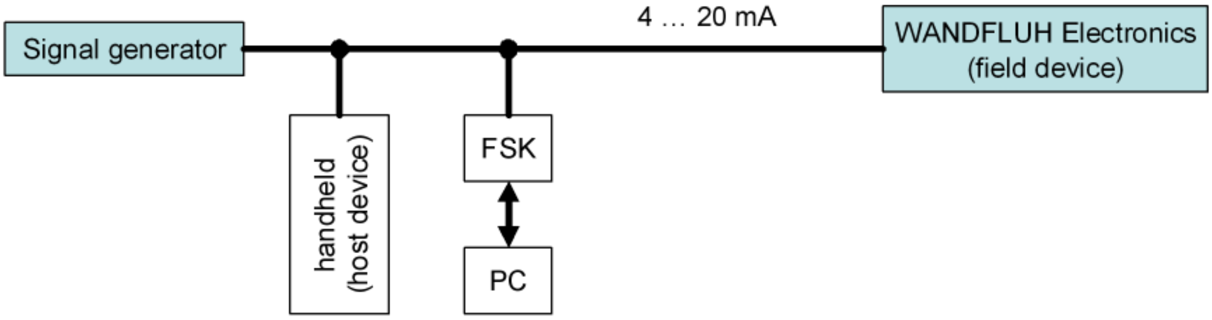
The HART data is superimposed on the 4 to 20 mA signal via a FSK modem. This enables the devices to communicate digitally using the HART protocol, while analog signal transmission takes place at the same time

Field devices and compact handheld terminals have an integrated FSK modem, whereas PC stations have a serial interface to connect the modem externally.

The following connecting variants are possible:

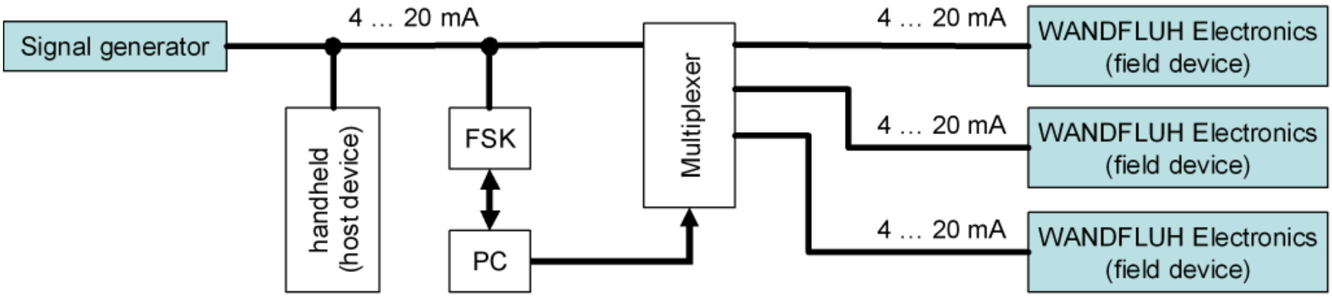
Point-to-point connection

The HART master device is connected to exactly one HART field device. This connection variant requires that the device address of the field device be always set to zero (0).



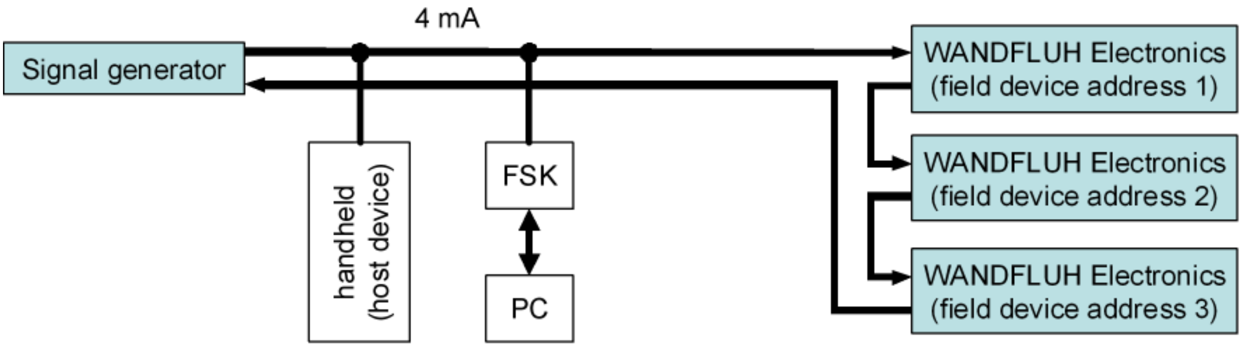
Multiplexer connection

The multiplexer system enables a large number of HART devices to be connected in a network. The user selects a particular current loop for communication via the operating program. As long as the communication takes place, the multiplexer connects the current loop to the host. The device address of all field devices must be always set to zero (0).



Multidrop operation

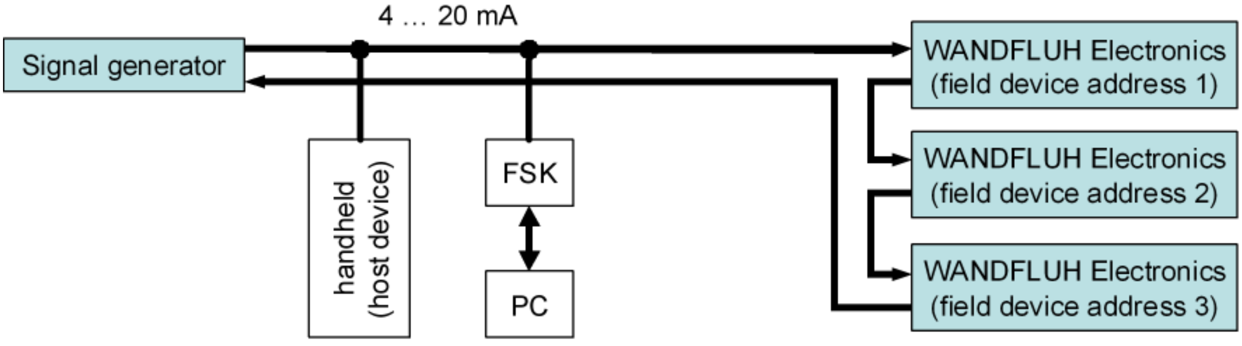
In multidrop operation, the devices exchange their data and measured values only via the HART protocol. The analog current signal serves just to energize the two-wire devices, providing a direct current of 4 mA and can not be used as an anlog signal. The host distinguishes the field devices by their preset addresses



The HART protocol specifies the total load of the current loop (including the cable resistance) to be between minimum 230 Ohm and maximum 1100 Ohm. The burden on each WANDFLUH HART device is 250 Ohm. Therefore, a maximum of four WANDFLUH HART devices can be connected (1100 Ohm / 250 Ohm = 4).

Split-Range operation

In the split-range operation, the control valves are connected in series in the current loop. Contrary to multi-drop connection, the 4 … 20 mA signal can still be used as a control signal. The host distinguishes the field devices by their preset addresses



The HART protocol specifies the total load of the current loop (including the cable resistance) to be between minimum 230 Ohm and maximum 1100 Ohm. The burden on each WANDFLUH HART device is 250 Ohm. Therefore, a maximum of four WANDFLUH HART devices can be connected (1100 Ohm / 250 Ohm = 4).

1.3 Tow-wire technique an burden impedance

The transmission of the HART signals takes place via the conventional 4 … 20 mA line. However, it is important to note that the maximum permissible burden of a HART device is fixed. The HART protocol specifies the total load of the current loop (including the cable resistance) to be between minimum 230 Ohm and maximum 1100 Ohm

The 4 .. 20 mA signal generator must be checked for its ability to provide the power required by the HART device. The process controller must be able to provide at least the load impedance of the HART device at 20 mA. The required load impedance U_B and the consumed power P_W are calculated as follows:

U_B = 20 mA x burden

$P_W = U_B \times I = I^2 \times$ burden

The burden on each WANDFLUH HART device is 250 Ohm.

1.4 EDD device description

As soon as a field device uses device-specific instructions, they must be defined in an EDD. Based on this EDD, a host device recognizes the possibilities of the connected field device. Therefore, the software of the host device must not be adaüted with any customization or extension of a field device.

The DDL allows the manufacturer to describe:

- attributes and additional information on communication data elements,
- all operating states of the device,
- all device commands and parameters,
- the menu structure, thus providing a clear representation of all operating and functional features of the device.

Having the device description of a field device and being able to interpret it, a master device is equipped with all necessary information to make use of the complete performance features of the field device.

For devices with sufficient storage capacity, the EDD can be stored direct on the field device as a DD data record.

At the moment there is only a EDD available, which is optimized and tested for the HART software "Siemens PDM". This EDD does not work with HART handheld, as they require a compiled DD, which is not offered at the moment. Also the use of other HART software (e.g. Emerson / AMS) has not been tested. Please refer to section Simatic PDM V8.x / V9.x integration 87 for a description how to integrate the EDD file into the Simatic PDM.

1.5 Requirements for host devices

Universally usable host devices must support any HART field device. These are the following features necessary:

- all commands defined in the HART protocol must be implemented and selectable as required.
- to extend the operating functions, any EDD device description can be implemented.
- the user interface provides the user with all extended communication, information and control options.

2 Communication setup

2.1 General

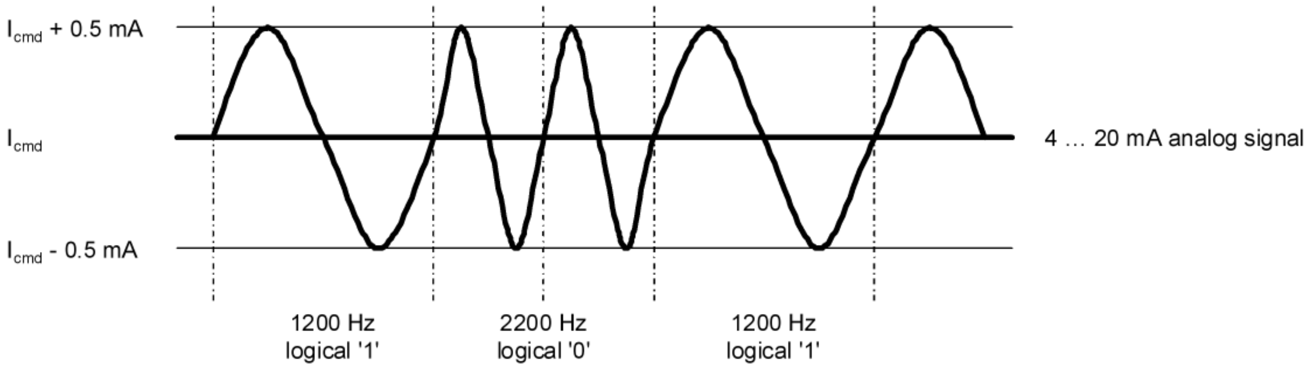
The HART protocol utilizes the OSI reference model. Therby only the layers 1, 2 and 7 are implemented.

OSI layers	HART layers
application	HART commands
presentation	
session	
transport	
network	
data link	HART protocol rules
physical layer	Bell 202

2.2 Layer 1: Physical layer

Coding

Data transmission between the masters and the field devices is physically realized by superimposing an encoded digital signal on the 4 to 20 mA current loop. Since the coding has no mean values, an analog signal transmission taking place at the same time is not affected.



To encode the bits, the FSK method (Frequency Shift Keying) based on the Bell 202 communication standard is used. Thereby, the following frequencies are used:

logical 0 = 2200 Hz

logical 1 = 1200 Hz

Each individual byte of the layer-2 telegram is transmitted as eleven-bit UART character at a data rate of 1200 bits/s..

The HART specification defines that master devices send voltage signals, while the field devices (slaves) convey their messages using load-independent currents. The current signals are converted to voltage signals at the internal resistance of the receiver (at its load)..

To ensure a reliable signal reception, the HART protocol specifies the total load of the current loop (including the cable resistance) to be between minimum 230 Ohm and maximum 1100 Ohm.

Wiring specifications

HART wiring in the field usually consists of twisted pair cables. For trouble-free transmission, the cables must have a sufficient cross section and an appropriate length. If interference signals are a problem, long lines must be shielded. The signal loop and the cable shield should be grounded at one common point only

According to the specification, the following configurations work reliably:

- for short distances, simple unshielded 0.2 mm^2 two-wire lines are sufficient.
- for distances of up to 1500 m, individually twisted 0.2 mm^2 wire pairs with a common shield over the cable should be used.
- for distances of up to 3000 m, individually twisted 0.5 mm^2 two-wire lines shielded in pairs are required.

2.3 Layer 2: Data link

Acess control

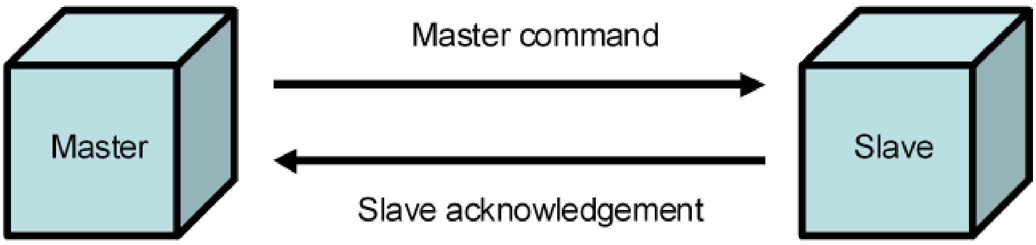
The HART protocol operates according to the master-slave method. Any activity is initiated by the master. HART accepts two masters, the primary master (usually remote service) and the secondary master (usually the host device in the field). HART field devices (slaves) never send without being requested to do so. They respond only when they have received a command message from the master. Once a transaction, (data exchange between the host device and the field device) is complete, the master will pause for a fixed time period before sending another command, allowing the other master to break in. The two masters observe a fixed time frame when taking turns communicating with the slave devices.

Communication services

The HART protocol proviedes standard and broadcast commands:

Standard commands:	Master / Slave data exchange
Broadcast command:	HART command received by all devices

The simplest form of a transaction is a master telegram which is directly followed by a response or acknowledgement telegram from the slave



When connection is established, the HART command 11 can be used to send a broadcast message to all devices to check the system configuration.

Additionally there is the optional burst communication mode. A single field device cyclically sends message telegrams with short 75-ms breaks, which can alternately be read by the primary as well as the secondary master. While usually only two transactions per second are possible, the field device can send up to four telegrams using this method.

Telegram structure

Each individual byte is send as 11-bit UART character equipped with a start, a parity and a stop bit. The follwoing picture shows the structure of an HART telegram:

preamble	SD	AD	CD	BC	status	data	parity

Preamble: The preamble consisting of three or more hexadecimal characters synchronizes the signals of the participants

Start byte (SD): The start byte indicates which participant is sending (master, slave, slave in burst mode) and whether the short frame or the long frame format is used.

Address (AD): The address contains one byte for the short frame format and five bytes for the long frame format. With both one bit is serving to distinguish the two masters and one bit to indicate burst-mode telegrams. For the addressing of the field devices, 4 bits (for the shrot frame format) resp. 38 Bits (for the long frame format) are used.

					addressing			
short (1 Byte)	master	burst	0	0	Bit 3	Bit 2	Bit 1	Bit 0

					addressing				
long (5 Byte)	master	burst	Bit 37	Bit 36	Bit 35	Bit 34	Bit 33	....	Bit 0

Command (CD): The command byte encodes the master commands of the categories universal and device specific commands. The significance of these commands depends on the definitions in the application layer 7

Byte count (BC): The byte count character indicates the message length, which is necessary since the number of data bytes per telegram can vary from 0 to 25. This is the only way to enable the recipient to clearly identify the telegram and the checksum. The number of bytes depends on the sum of the status and the data bytes.

Status: The two status bytes are included only in reply messages from slaves and contain bit-coded information. They indicate whether the received message was correct and the operational state of the field device. When the field device operates properly, both status bytes are set to logical zero.

Data: The data can be transmitted as unsigned integers, floating-point numbers or ASCII-coded character strings. The data format to be used is determined by the command byte. The number of data bytes vary from 0 to 25. The transfer takes place in big-endian format (high byte before low byte)

Parity: The checksum byte contains the longitudinal parity of all the bytes of a telegram..

Noise immunity

During operation the communication participants can be added or removed without endangering the components of the other devices or disrupting their communication. For interferences that can be coupled into the transmission lines, the HART specification demands class 3 noise immunity according to IEC 801-3 and -4. So general noise immunity requirements are met. Further protection mechanisms to detect errors in the communication are implemented in the different communication layers. On the lower levels, the UART and the longitudinal parity check reliably detect up to three corrupted bits in the transmitted telegram (Hamming distance HD = 4). Errors occurring on higher levels (e.g. HART commands that cannot be interpreted, device failures, etc) are indicated by the slave upon each transaction using the status bytes reserved for this purpose.

Transmission time and user data rate

The time required to transmit a telegram results from the bit data rate of 1200Hz and the number of bits per telegram. The length of the telegram varies depending on the message length (between 0 to 25 bytes) and the frame format (short = 1 byte, long = 5 bytes).

The following example shows the transfer of a telegram in short frame format and a message with 25 characters:

Bytes per telegram:	25 message characters (data) and 10 control characters	
Telgram size:	35 characters x 11 bits	= 385 bits
User data rate:	25 characters x 8 Bit / 385 bits	= 52 %
Time per bit:	1 / 1200 bits/s	= 0.83 ms
Transfer time:	385 x 0.83 ms	= 0.32 s
Time per user data byte:	0.32 s / 25 bytes	= 13 ms

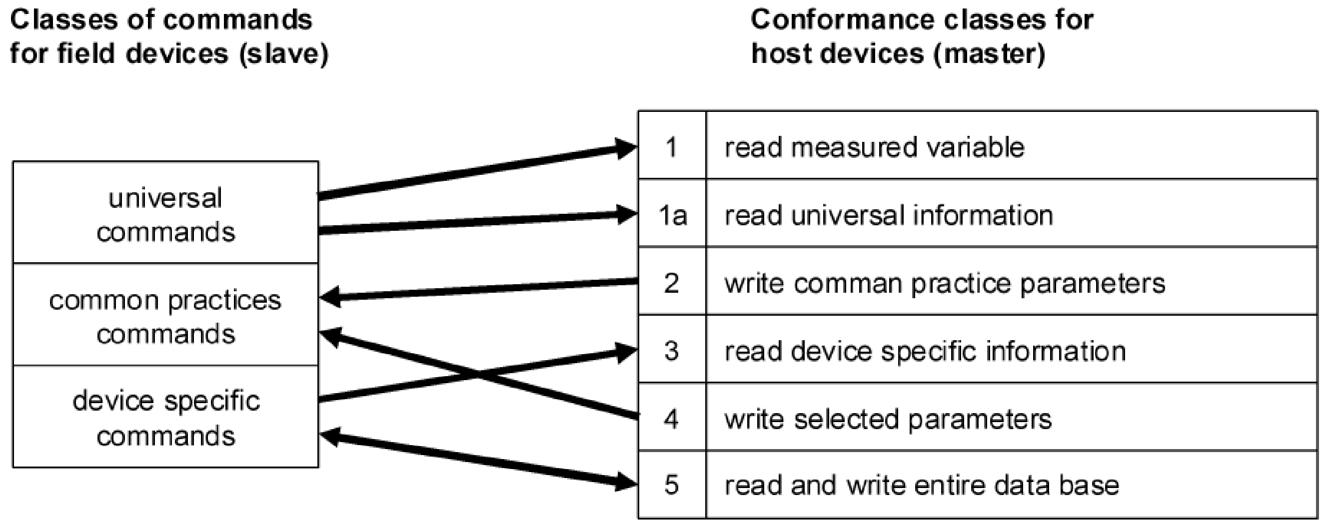
In shorter messages, the ratio between user data and control data becomes increasingly unfavorable. An average of 500 ms is accounted for per transaction (a master and a slave telegram) including additional maintenance and synchronization times. As a result, approximately two HART transactions can be carried out per second. These values show that the HART communication is not suitable for transmitting time-critical data

2.4 Layer 7: Application

Die Kommunikationsroutinen baiseren auf HART Kommandos, welche in der Anwendungschicht des HART Protokolls definiert sind. Mit Hilfe vordefinierter Kommandos erteilt on Bediengerät (Master) Befehle an on Feldgerät (Slave) oder setzt Nachrichten bzw. Daten. ab. Die Feldgeräte antworten unmittelbar mit einem Bestätigungstelegramm welches ev. angeforderte Statusmeldungen und/oder Daten enthalten.

The communication routines of HART master devices and operating programs are based on HART commands which are defined in the application layer of the HART protocol. Pre-defined commands enable the host device (master) to give instructions to a field device (slave) or send messages/data. The field devices immediately respond by sending an acknowledgement telegram which can contain requested status reports and/or the data of the field device.

The HART commands are classified according to their function into commands for host devices and for field devices



Depending on the tasks to be executed, the HART master device uses a command that can be assigned to one of the six different conformance classes. Each conformance class contains a subset of HART commands which cover a special administrative or control-related range of tasks.

Field devices interpret and process only those HART commands that are directed to them or to all participants. Each command belongs to one of three classes of commands. These classes distinguish how specific a command is:

- universal commands are understood and used by all field devices operating with the HART protocol (device designation, firmware no., etc.).
- common-practice commands are usually supported by many, but not necessarily all, HART field devices. (Read variable, set parameter, etc.).
- device-specific commands support functions that are unique to each device. These commands are defined in an according EDD device descirption

3 Product Description

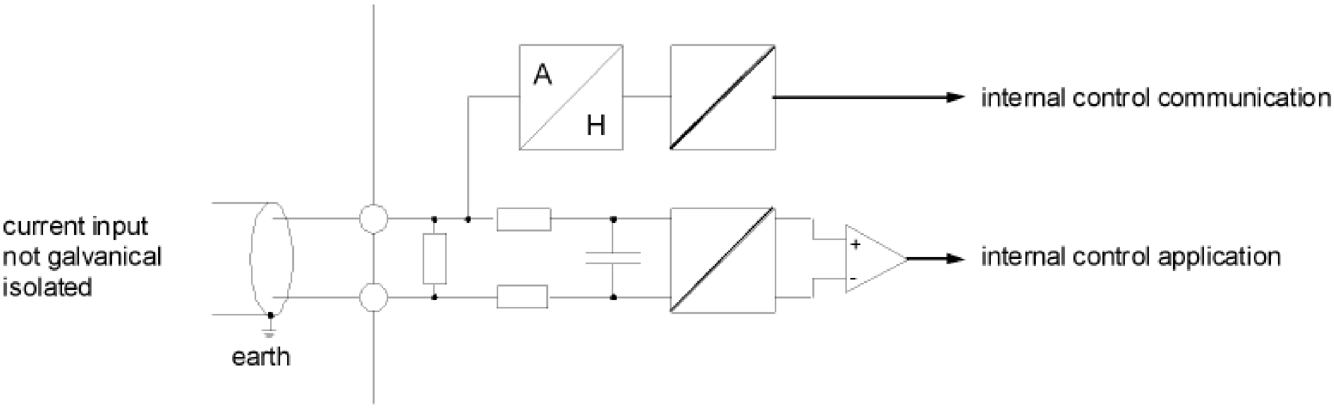
3.1 General

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

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

3.2 Technical Data

The wiring of the HART signal is done via the analog input 3 on the WANDFLUH field device. The analog input 3 a current input with galvanically isolation. The burden is 250 Ohm.



The following elements are available at analog input 3:

- the analog current signal 4 ... 20 mA is passed through the A/D converter to the internal control of the application
- through the FSK modem, the received HART signals are passed to the internal control of to communication
- the HART signals to be transmitted modulates the FSK modem on the analog current signal 4 ... 20 mA
- both internal controls (application and communication) exchange continuously the sent and received data

All WANDFLUH HART devices support the HARt protocol revision 7.

3.2.1 Transmission technology and baudrate

Data transmission of HART data takes place via the Frequency Shift Keying (FSK). On all WANDFLUH HART devices, the FSK modem is is already integrated.

The baudrate is always 1200 bits/s.

3.3 Operating and Indicating elements

The WANDFLUH HART devices are not equipped with a special connection for the HART signal. The communication is done via the standard analog current input 3

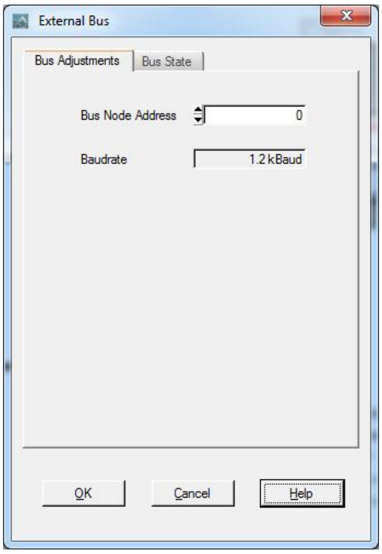
3.4 Fieldbus Settings

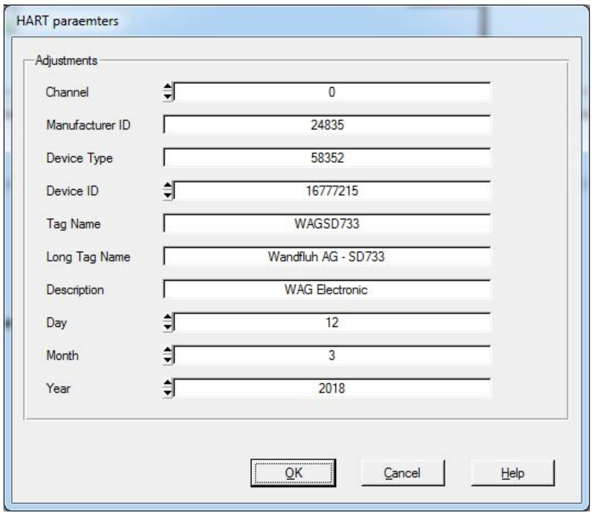
The following settings can be made via the parameterisation software PASO:

- Bus Node Address (write and read)
- Baudrate (only read)
- Manufacturer ID (only read)
- Device Type (only read)
- Device ID (write* and read)
- Tag Name (write* and read)
- Long Tag Name (write* and read)
- Description (write* and read)
- Day (write* and read)
- Month (write* and read)
- Year (write* and read)

* these parameters will be written only if they are sent directly from the window "Feldbus_Parameters"

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





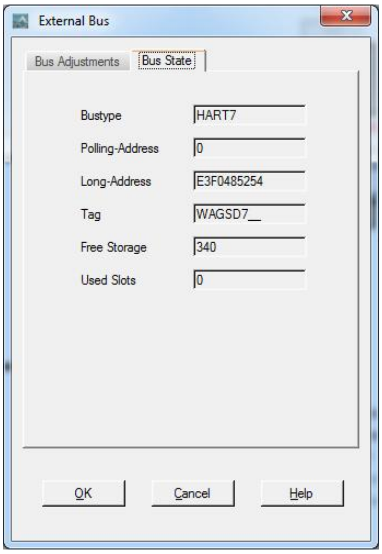
The following parameters can be set resp. will be displayed:

Field	Parameter description	Display
Bus Node Adress	With this parameter, the required node address for the HART field device can be set. The value set is saved on the HART field device in the non-volatile memory.	0 ... 15
Baudrate	The adjusted Baudrate will be displayed. The baudrate is fix set and can not be changed.	1.2 kBaud
Manufacturer ID	The official Wandfluh AG Manufacturer ID. The manufacturer ID is fix set and can not be changed.	24835
Device Type	Depending on the Wandfluh device type. Corresponds to the bits 24 ... 37 (2 bytes) of the long address (refer to "Telegram structue" 9). The Device Type is fix set and can not be changed.	SD730: tbd SD735: tbd SD733: 58352 SD736: 58353

Device ID	Corresponds to the bits 0 … 23 (3 byte) of the long address (refer to "Telegram structue" 9)	0 … 16777215
Tag Name	Unique name to identify the HART field devices	max. 8 characters
Long Tag Name	Unique name to identify the HART field devices	max. 32 characters
Descprition	Description of the HART field devices	max. 16 characters
Day	Day	1 … 31
Month	Month	1 … 12
Year	Year	1900 … 2155

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
Bustyp	The type of the connected Fieldbus	HART7
Polling-Address	Selected address on the HART field device. Corresponds to the parameter "Bus Node Address" (refer to Fieldbus Settings 13)	0 … 15
Long-Address	Selected long address on the HART field device. This consists of the Manufacturer ID, the Device Type and the Device ID	0.0.0 … 254.255.16777215
Tag	Unique name to identify the HART field devices Corresponds to the parameter "Tag Name" (refer to Fieldbus Settings 13)	e.g. WAGSD7
Free Storage	Used storage	287
Used Slots	Used entries	2

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.

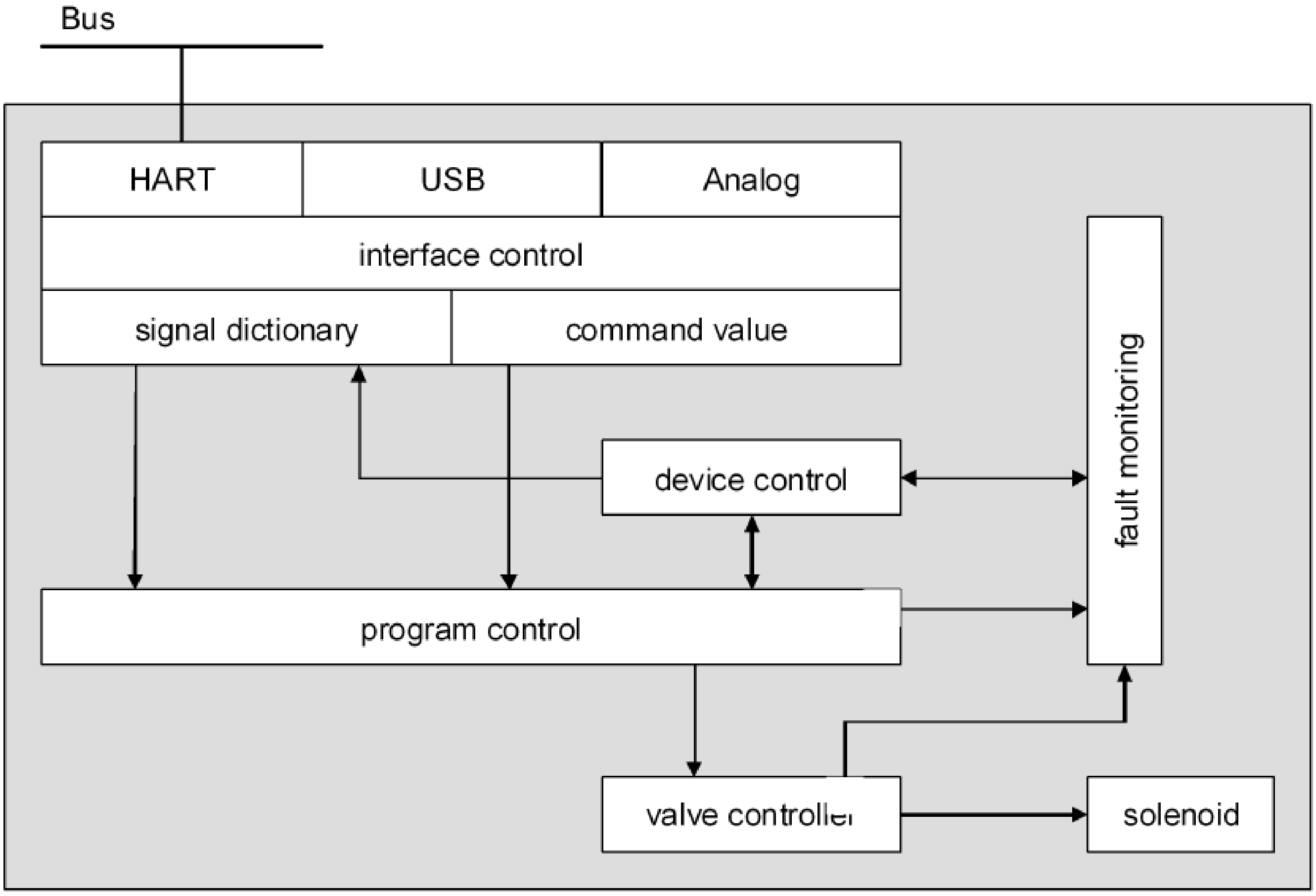
3.7 Parameterisation

The HART field device can be parameterised either through the fieldbus or through the parameterisation software PASO.

4 Description of the Function of the WANDFLUH Device Profile

The device profile explains the data and their format, which are exchanged between the host devices and the field devices. 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



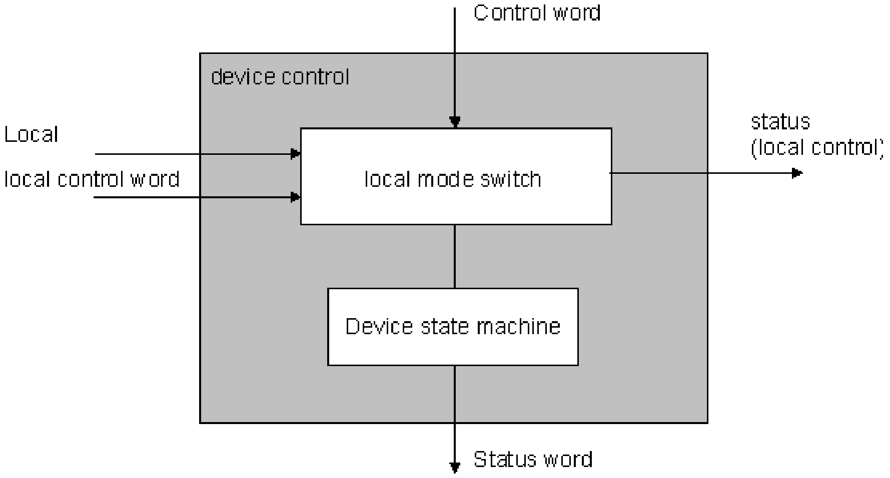
The HART field device contains the complete Hardware of the *WANDFLUH*-Electronics. This Hardware includes the interface for the Fieldbus and the interface for the parameterisation software PASO. Also included are the solenoid outputs.

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 WANDFLUH field devices.



4.2.1 Operating mode

Local mode ("local")

In the local mode, the control commands will be set direct on the device through the digital inputs. The local mode has 2 states: "Disabled" and "Enabled", switch over through the digital input. This mode can be activated as follows:

- via PASO:
  With the parameter "Operating mode = local" (window "Enable channel")
- via Fieldbus:
  With the parameter "Device local (Operating mode) = 1"

In both cases, the state of the WANDFLUH electronics must be "Init" or "Disabled" (refer to section "Device State Machine 19")

PASO mode ("Remote PASO")

In the PASO mode, the control commands will be set direct through the PASO. The PASO mode has 2 states: "Disabled" and "Enabled", switch over through the PASO command "Enable" resp. "Disable". This mode can be activated as follows:

- via PASO:
  With the parameter "Operating mode = Remote PASO". This only possible in the menu "Commands_Valve operation", "Commands_Manual operation" or "Commands_Command simulation"
- via Fieldbus:
  This mode can not be activated via the fieldbus

In both cases, the state of the WANDFLUH electronics must be "Init" or "Disabled" (refer to section "Device State Machine 19")

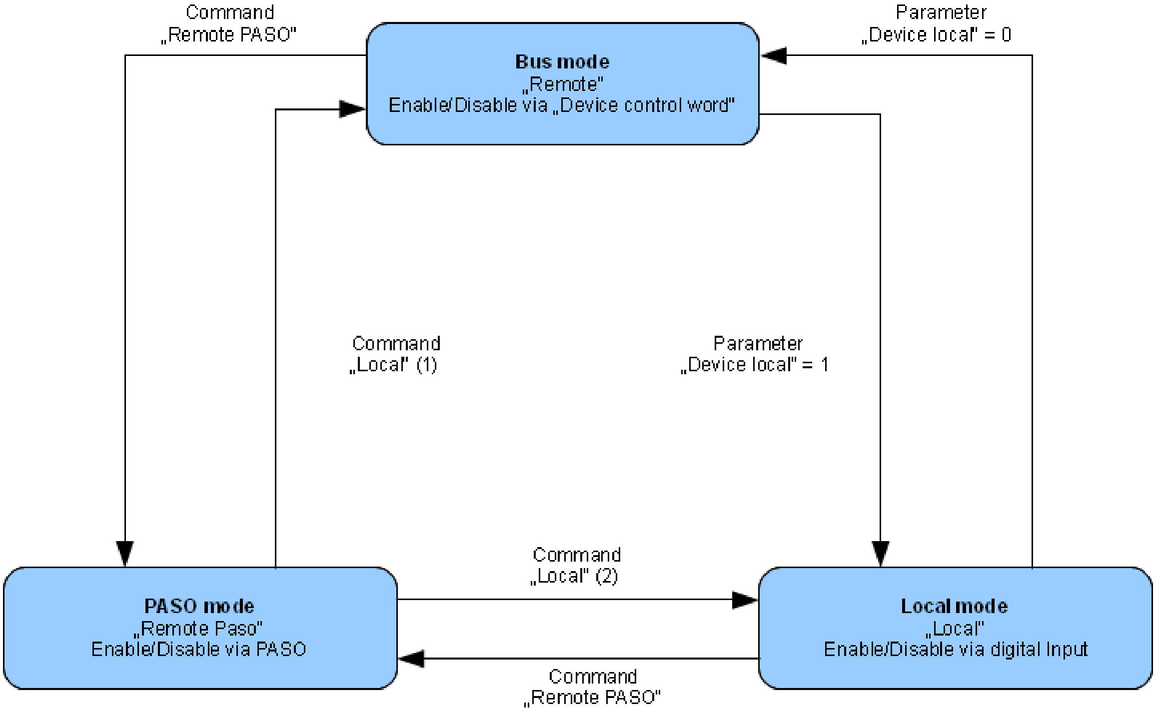
Bus mode ("Remote")

In the Bus mode, the control commands will be set through the Fieldbus. The Bus mode has several states (refer to section "Device State Machine 19"), switch over through the Bus parameter "Device control word". This mode can be activated as follows:

- via PASO:
  With the parameter "Operating mode = bus" (window "Enable channel")
- via Fieldbus:
  With the parameter "Device local (Operating mode) = 0"

In both cases, the state of the WANDFLUH electronics must be "Init" or "Disabled" (refer to section "Device State Machine 19")

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

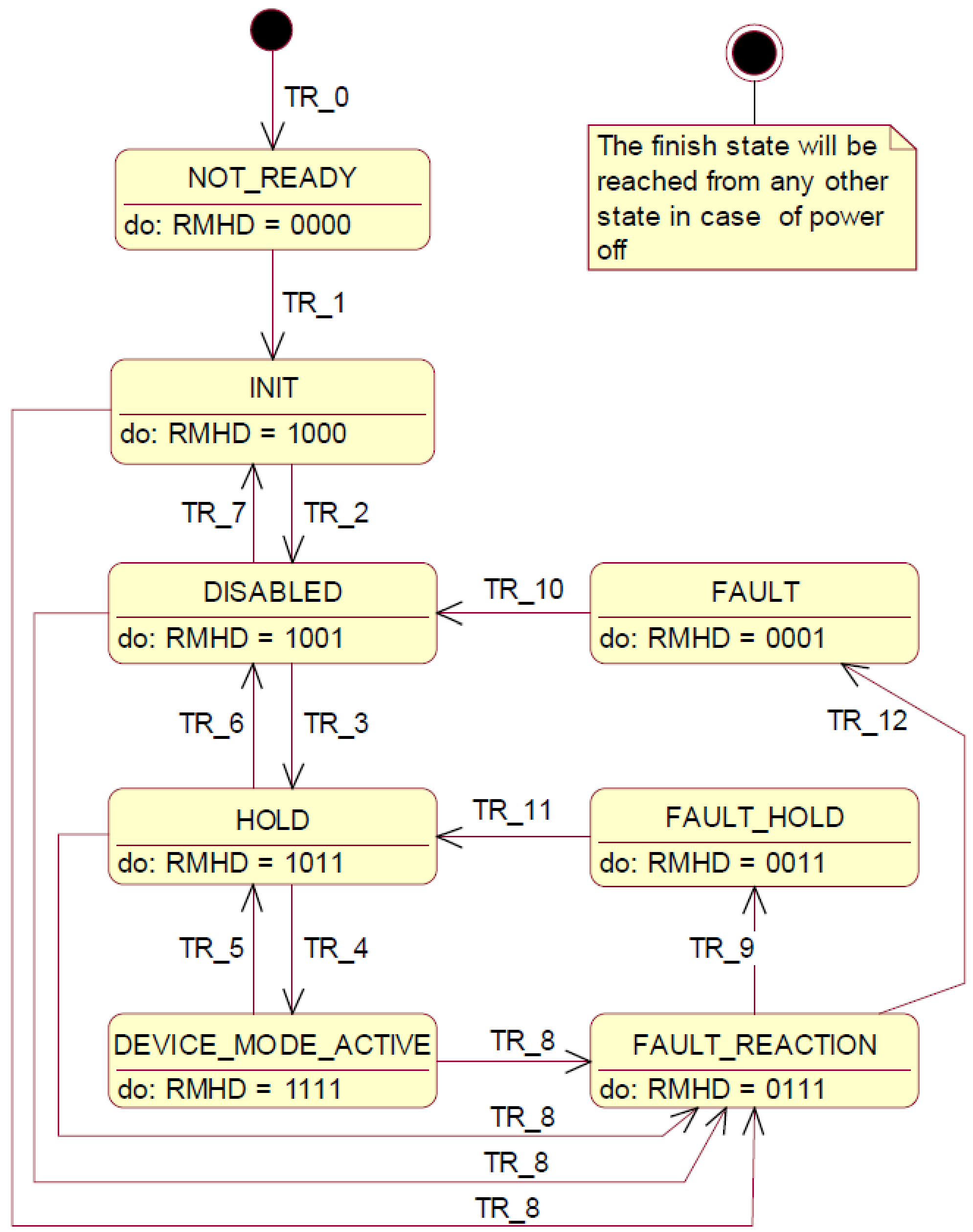
- In state "Remote PASO" sending of parameter "Device local" through fieldbus also possible

4.2.2 Device state machine

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

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

State	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 • The device configuration can be set (e.g. device mode, device control mode, scaling, etc.) • It's possible to activate the "PASO remote" mode
HOLD	• Device parameters can be set • The last present command value or the "HOLD command value" is maintained active • The device configuration can not be set
DEVICE_MODE_ACTIVE	• Device parameters can be set • The device functions are enabled • The device configuration can not be set
FAULT_HOLD	• This state is not present on the WANDFLUH Electronics
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 • It is just a transition state, it will automatically exit



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:

Transition	Description	Controlwort Bit							
		7	6	5	4	3 R	2 M	1 H	0 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	X	X	X	X	1
TR_3	Bit "Hold enable" active	X	X	X	X	X	X	1	1
TR_4	Bit "Device mode active enable" active	X	X	X	X	X	1	1	1
TR_5	Bit "Device mode active enable " not active	X	X	X	X	X	0	X	X
TR_6	Bit "Hold enable" not active	X	X	X	X	X	0	0	X
TR_7	Bit "Disable" not active	X	X	X	X	X	0	0	0
TR_8	Error present	Internal transition							
TR_9	Is not present on the WANDFLUH Electronics								
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	X	X	X	0	X	0	X
		==>							
		X	X	X	X	1	X	0	X
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	X	X	X	0	X	1	X
		==>							
		X	X	X	X	1	X	1	X
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 can be set through the fieldbus to the following operating modes; in doing so, one differentiates between the Control mode and the Device mode:

Control mode	Description
Local operating mode	The WANDFLUH-Electronic is operated through the local possibilities such as e.g. the digital inputs and outputs or PASO. **This control mode is active after switch on the WANDFLUH-Electronic.**
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 and controller.**
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 and 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-sol((-5)	Wandfluh - specific. Like vprc (4), but for 2 solenoids. **This control mode is only selectable with controller.**
2-Point controller 1-sol. (-6)	Wandfluh – specific. 2-point controller for 1 solenoid. **This control mode is only selectable with controller.**
2-Point controller 2-sol. (-7)	Wandfluh – specific. 2-point controller for 2 solenoid. **This control mode is only selectable with controller.**
3-Point controller 2-sol. (-8)	Wandfluh – specific. 3-point controller for 1 solenoid. **This control mode is only selectable with controller.**

Device mode	Description
Command 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.
Command value setting locally	The set-point value setting for the CANopen-Slave takes place locally.

The HART field device can be parameterised through the HART bus, corresponding to parameters are available.

4.4 HART Command Transfer

The HART host device knows automatically, which byte must be written with which value for a certain command by including the WANDFLUH EDD device description file.

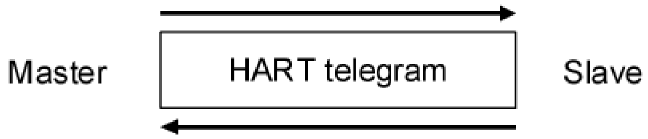
A description of all from the WANDFLUH HART field device supports universal commands is located in the section "Universal commands 28".

A description of all from the WANDFLUH HART field device supports device specific commands is located in the section "Device specific command 35".

In the following section is a brief description anyway, which bytes are set with the various commands.

4.4.1 Telegram structure

To any request from the master (host device), there is a response from the slave (field device).



In the section Telegram structure 9 there is a description about the whole HART transfer availble. For the transfer of the HART commands, only bytes CD, BC, Status and Data are used.

CD	BC	status	data

CD (command): The command byte encodes the master commands of the categories universal and device specific commands.

With the universal commands, the command number is written direct on the command description (refer to section "Universal commands 28").

With the device specific commands, the command number depends on the data type of the parameter and if the parameter is write or read. The following table shows the relationship:

data type	number of bytes	command number	
		read	write
INT8	1 byte	128	129
UINT8	1 byte	128	129
INT16	2 bytes	130	131
UINT16	2 bytes	130	131
INT32	4 bytes	132	133
UINT32	4 bytes	132	133
FLOAT	4 bytes	132	133

A description of all from the WANDFLUH HART field device supports universal commands is located in the section "Universal commands 28".

A description of all from the WANDFLUH HART field device supports device specific commands is located in the section "Device specific command 35".

BC (Byte count): The byte count character indicates the message length. The number of bytes depends on the sum of the status and the data bytes.

Status: The two status bytes are included only in reply messages (transfer field device => host device).

The first byte includes an error code, the second byte a device status (bit coded)

The following table shows the possible error codes:

status byte 1	Description
0	no error active
5	wrong byte count
6	device specific error

The following table shows the possible device status:

status byte 2	Description
0x01 (Bit 0)	PV out of limits
0x02 (Bit 1)	Non PV out of limits
0x04 (Bit 2)	PV analog output saturated
0x08 (Bit 3)	PV analog output fixed
0x10 (Bit 4)	more status available
0x20 (Bit 5)	cold start
0x40 (Bit 6)	configuration changed
0x80 (Bit 7)	device malfunction

Data: The data can be transmitted as unsigned integers, floating-point numbers or ASCII-coded character strings. The data format to be used is determined by the command byte. The number of data bytes vary from 0 to 25. The transfer takes place in big-endian format (high byte before low byte)

With the universal commands, the byte order is written direct on the command description (refer to section "Universal commands 28").

With the device specific commands, the byte order is as follows:

Request Master => Slave with parameter read

data byte 1	data byte 2	data byte 3
IND	PNU	instance number

Response Slave => Master with parameter read

data byte 1	data byte 2	data byte 3	Datenbytes 4 … 25
IND	PNU	instance number	data value

Request Master => Slave with parameter write

data byte 1	data byte 2	data byte 3	Datenbytes 4 … 25
IND	PNU	instance number	data value

Response Slave => Master with parameter write

data byte 1	data byte 2	data byte 3	Datenbytes 4 … 25
IND	PNU	instance number	data value

IND and PNU correspond to the description of the certain parameter (refer to section "Universal commands 28").

The instance number corresponds to the channel number of the WANDFLUH field device.

Example 1:

Write the paramter "Imin solenoid 1" with the value 450mA.

- data type = UINT16 => number of bytes = 2 => command = 131 = 0x83
- IND = 250 = 0xFA
- PNU = 6 = 0x06
- instance number = channel 1 => 0 = 0x00
- value = 450 = 0x01C2

Request Master => Slave:

data byte 1	data byte 2	data byte 3	data bytes 4 … 25	
IND	PNU	instance number	data value	
0xFA	0x06	0x00	0x01	0xC2

Response Slave => Master:

status byte 1	status byte 2	Description
0	0	no error active

data byte 1	data byte 2	data byte 3	Datenbytes 4 … 25	
IND	PNU	instance number	data value	
0xFA	0x06	0x00	0x01	0xC2

Example 2:

Read the parameter "Fixed command value 3" (supposition: fixed command value 3 is set to 80% = 0x50).

- data type = INT32 => number of bytes = 4 => command = 132 = 0x84
- IND = 238 = 0xEE
- PNU = 8 = 0x08
- instance number = channel 1 => 0 = 0x00

Request Master => Slave:

data byte 1	data byte 2	data byte 3
IND	PNU	instance number
0xEE	0x08	0x00

Response Slave => Master:

status byte 1	status byte 2	Description
0	0	kein Fehler vorhanden

data byte 1	data byte 2	data byte 3	Datenbytes 4 … 25	
IND	PNU	instance number	data value	
0xEE	0x08	0x00	0x50	0x00

4.5 Scaled parameter

For parameter with a unit (e.g. mm, psi, l/min, etc.), the adjusting range is always 0 ... 15000000 and the resolution is 1 / 1000.

4.6 Interface

By setting the interface parameters, the adjusting range and the resolution depends on the selected signal type. The following table shows the connection

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

4.7 Solenoid current

By setting the solenoid current parameters, the adjusting range and the resolution depends on the selected solenoid type. The following table shows the connection

<table>
<tr><th rowspan="2">Solenoid type</th><th colspan="3">Range</th></tr>
<tr><th>DSV</th><th>MD2</th><th>SD6</th></tr>
<tr><td>current measured</td><td>0 .. 16384: 0 .. 1534mA at 24V
0 .. 16384: 0 .. 2557mA at 12V</td><td>0 .. 16384: 0 .. 2112mA</td><td>0 .. 16384: 0 .. 1877mA at 24V
0 .. 16384: 0 .. 2346mA at 12V</td></tr>
<tr><td>current not measured</td><td colspan="3">0 .. 16384: 0 .. 100% Duty-Cycle</td></tr>
</table>

4.8 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.

5 Parameter description

In the following section, all parameters, which can be adjusted via the HART bus will be descripted.

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

5.1 Universal commands

Command	Description
0	Command 0: Read Transmitter Unique Identifier 28
1	Command 1: Read Primary Variable 29
2	Command 2: Read Loop Current and Percent of Range 29
3	Command 3: Read Dynamic Variables And Loop Current 29
6	Command 6: Write Polling Address 30
7	Command 7: Read Loop Configuratioin 30
8	Command 8: Read Dynamic Variable Classifications 30
9	Command 9: Read Device Variables with Status 30
11	Command 11: Read Unique Identifier Asssociated With Tag 31
12	Command 12: Read Message 31
13	Command 13: Read Tag, Descriptor, Date 31
14	Command 14: Read Primary Variable Transducer Information 32
15	Command 15: Read Device Information 32
16	Command 16: Read Final Assembly Number 33
17	Command 17: Write Message 33
18	Command 18: Write Tag, Descriptor, Date 33
19	Command 19: Write Final Assembly Number 33
20	Command 20: Read Long Tag 33
21	Command 21: Read Unique Identifier Associated With Long Tag 34
22	Command 22: Write Long Tag 34
38	Command 38: Reset Configuration Changed Flag 34
48	Command 48: Read Additional Device Status 34

5.1.1 Command 0: Read Transmitter Unique Identifier

Command	0
Data bytes write	none
Data bytes read	0: Device Type Code for Expansion 1 - 2: Expanded Device Type 3: Minimum numbers of Request Preambles 4: HART Protocol Major Revision Number 5: Device Revision Level 6: Software Revision Level 7: Hardware Revision Level 8: Flags, non defined at this time

Command	0
	9 - 11: Device Identification 12: Minimum numbers of Response Preambles 13: Maximum Number of Device Variables 14 - 15: Configuration Change Counter 16: Extended Field Device Status 17 - 18: Manufacturer Identification Code 19 - 20: Private Label Distributor Code 21: Device Profile
Status bytes read	refer to section "Telegram structure 23"

5.1.2 Command 1: Read Primary Variable

Command	1
Data bytes write	none
Data bytes read	0: Actual value in unit (closed loop) / 0 (open loop), Unit Code 1 … 4: Actual value in unit (closed loop) / 0 (open loop), IEEE 754
Status bytes read	refer to section "Telegram structure 23"

5.1.3 Command 2: Read Loop Current and Percent of Range

Command	2
Data bytes write	none
Data bytes read	0 … 3: Analog Output Current mA, IEEE 754 4 … 7: Percent of Range, IEEE 754
Status bytes read	refer to section "Telegram structure 23"

5.1.4 Command 3: Read Dynamic Variables And Loop Current

Command	3
Data bytes write	none
Data bytes read	0 … 3: Analog output in mA, IEEE 754 4: Actual value in unit (closed loop) / 0.0 (open loop), Unit Code 5 … 8: Actual value in unit (closed loop) / 0 (open loop), IEEE 754 9: Analog comand value in unit, Unit Code 10 … 13: Analog comand value in unit, IEEE 754 14: Command value after rampe generator in unit, Unit Code 15 … 18: Command value after rampe generator in unit, IEEE 754 19: Control deviation in unit (closed loop) / 0.0 (open loop), Unit Code 20 … 23: Control deviation in unit (closed loop) / 0.0 (open loop), IEEE 754
Status bytes read	refer to section "Telegram structure 23"

5.1.5 Command 6: Write Polling Address

Command	6
Data bytes write	0: Polling Adresse from the device 1: Loop Current Mode
Data bytes read	0: Polling Adresse from the device 1: Loop Current Mode
Status bytes read	refer to section "Telegram structure 23"

5.1.6 Command 7: Read Loop Configuratioin

Command	7
Data bytes write	none
Data bytes read	0: Polling Adresse from the device 1: Loop Current Mode
Status bytes read	refer to section "Telegram structure 23"

5.1.7 Command 8: Read Dynamic Variable Classifications

Command	8
Data bytes write	none
Data bytes read	0: Primary Variable Classification 1: Secondary Variable Classification 2: Tertiary Variable Classification 3: Quaternary Variable Classification
Status bytes read	refer to section "Telegram structure 23"

5.1.8 Command 9: Read Device Variables with Status

Command	9
Data bytes write	0: Slot 0: Device Variable Code 1: Slot 1: Device Variable Code 2: Slot 2: Device Variable Code 3: Slot 3: Device Variable Code 4: Slot 4: Device Variable Code 5: Slot 5: Device Variable Code 6: Slot 6: Device Variable Code 7: Slot 7: Device Variable Code
Data bytes read	0: Extended Field Device Status 1: Slot 0: Device Variable Code 2: Slot 0: Device Variable Classification 3: Slot 0: Units Code 4 - 7: Slot 0: Device Variable Value 8: Slot 0: Device Variable Stauts 9 - 16: dito for Slot 1 17 - 24: dito for Slot 2 25 - 32: dito for Slot 3 33 - 40: dito for Slot 4

Command	9
	41 - 48: dito for Slot 5 49 - 56: dito for Slot 6 57 - 64: dito for Slot 7 65 - 68: Slot 0 data time stamp
Status bytes read	refer to section "Telegram structure 23"

5.1.9 Command 11: Read Unique Identifier Asssociated With Tag

Command	11
Data bytes write	0 … 5: Tag, ASCII coded
Data bytes read	0: Device Type Code for Expansion 1 - 2: Expanded Device Type 3: Minimum numbers of Request Preambles 4: HART Protocol Major Revision Number 5: Device Revision Level 6: Software Revision Level 7: Hardware Revision Level 8: Flags, non defined at this time 9 - 11: Device Identification 12: Minimum numbers of Response Preambles 13: Maximum Number of Device Variables 14 - 15: Configuration Change Counter 16: Extended Field Device Status 17 - 18: Manufacturer Identification Code 19 - 20: Private Label Distributor Code 21: Devie Profile
Status bytes read	refer to section "Telegram structure 23""

5.1.10 Command 12: Read Message

Command	12
Data bytes write	none
Data bytes read	0 … 23: Message, ASCII coded
Status bytes read	refer to section "Telegram structure 23""

5.1.11 Command 13: Read Tag, Descriptor, Date

Command	13
Data bytes write	none
Data bytes read	0 … 5: Tag, ASCII coded

Command	13
	6 … 17: Description, ASCII coded 18 … 20: Date (day, month, year)
Status bytes read	refer to section "Telegram structure 23""

5.1.12 Command 14: Read Primary Variable Transducer Information

Command	14
Data bytes write	none
Data bytes read	0 … 2: Transducer Serial Number MSB, 24-Bit UINT 3: Transducer Limits/Min Span Units 4 … 7: Upper Transducer Limit, IEEE 754 8 … 11: Lower Transducer Limit, IEEE 754 12 … 15: Minimum Span, IEEE 754
Status bytes read	refer to section "Telegram structure 23"

5.1.13 Command 15: Read Device Information

Command	15
Data bytes write	none
Data bytes read	0: Alarm Select Code 1: Primary Variable Transfer Function Code 2: Primary Variable Range Values Units Code 3 … 6: Primary Variable Upper Range Value, IEEE 754 7 … 10: Primary Variable Lower Range Value, IEEE 754, immer 0 11 … 14: Primary Variable Damping Value, IEEE 754, Einheit in s 15: Write Protect Code 16: Reserved (must be 250 "not used") 17: Primary Variable Channel Flags
Status bytes read	refer to section "Telegram structure 23""
Bemerkungen	Alarm Selection Code : 1 (Low) PV Transfer Function Code : 0 (Linear) PV Upper Range Value : max. actual value (closed loop) / 0.0 (open loop) PV Lower Range Value : min. actual value (closed loop) / 0.0 (open loop) PV Damping Value : 0.0 Write Protect Code : 251 (not impemented) Private Lable Distributor) : Manufacturer ID

5.1.14 Command 16: Read Final Assembly Number

Command	16
Data bytes write	none
Data bytes read	0 … 2: Final Assembly Number
Status bytes read	refer to section "Telegram structure 23""

5.1.15 Command 17: Write Message

Command	17
Data bytes write	0 … 23: Message, ASCII coded
Data bytes read	0 … 23: Message, ASCII coded
Status bytes read	refer to section "Telegram structure 23"

5.1.16 Command 18: Write Tag, Descriptor, Date

Command	18
Data bytes write	0 … 5: Tag, ASCII coded 6 … 17: Description, ASCII coded 18 … 20: Date (day, month, year)
Data bytes read	0 … 5: Tag, ASCII coded 6 … 17: Description, ASCII coded 18 … 20: Date (day, month, year)
Status bytes read	refer to section "Telegram structure 23"

5.1.17 Command 19: Write Final Assembly Number

Command	16
Data bytes write	0 … 2: Final Assembly Number
Data bytes read	0 … 2: Final Assembly Number
Status bytes read	refer to section "Telegram structure 23"

5.1.18 Command 20: Read Long Tag

Command	20
Data bytes write	none
Data bytes read	0 … 31: Long Tag, ASCII coded
Status bytes read	refer to section "Telegram structure 23"

5.1.19 Command 21: Read Unique Identifier Associated With Long Tag

Command	21
Data bytes write	0 … 31: Long Tag, ASCII coded
Data bytes read	0: Device Type Code for Expansion 1 - 2: Expanded Device Type 3: Minimum numbers of Request Preambles 4: HART Protocol Major Revision Number 5: Device Revision Level 6: Software Revision Level 7: Hardware Revision Level 8: Flags, non defined at this time 9 - 11: Device Identification 12: Minimum numbers of Response Preambles 13: Maximum Number of Device Variables 14 - 15: Configuration Change Counter 16: Extended Field Device Status 17 - 18: Manufacturer Identification Code 19 - 20: Private Label Distributor Code 21: Devie Profile
Status bytes read	refer to section "Telegram structure 23"

5.1.20 Command 22: Write Long Tag

Command	22
Data bytes write	0 … 31: Long Tag, ASCII coded
Data bytes read	0 … 31: Long Tag, ASCII coded
Status bytes read	refer to section "Telegram structure 23"

5.1.21 Command 38: Reset Configuration Changed Flag

Command	38
Data bytes write	0 … 1: Configuration Change Counter
Data bytes read	0 … 1: Configuration Change Counter
Status bytes read	refer to section "Telegram structure 23"

5.1.22 Command 48: Read Additional Device Status

Command	48
Data bytes write	0 - 5: Device Specific Status 6: Extended Device Status 7: Device Operating Mode 8: Standardized Status 0 9: Standardized Status 1

Command	48
	10: Analog Channel Saturated 11: Standardized Status 2 12: Standardized Status 3 13: Analog Channel Fixed 14 - 24: Device Specific Status
Data bytes read	0 - 5: Device Specific Status 6: Extended Device Status 7: Device Operating Mode 8: Standardized Status 0 9: Standardized Status 1 10: Analog Channel Saturated 11: Standardized Status 2 12: Standardized Status 3 13: Analog Channel Fixed 14 - 24: Device Specific Status
Status bytes read	refer to section "Telegram structure 23""

5.2 Device specific commands

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
0	37	Device control word 43		UINT16	-32768	32767
0	38	Device status word 43		UINT16		
0	39	Device mode 44		UINT8	1	2
0	40	Device control mode 44		INT8	-128	127
0	41	Device local 44		UINT8	0	1
0	50	Capability 45		UINT32		
0	52	Reset Default 80		INT32	-2147483648	2147483647
0	55	Device Temperature 45		INT16		

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
11	21	dcol Command value 45	dcol	INT32	-2147483648	2147483647
11	42	dcol Ramp type 45	dcol	INT8	-128	127
11	46	dcol Ramp A down 46	dcol	UINT16	0	51000
11	49	dcol Ramp A up 46	dcol	UINT16	0	51000
11	55	dcol Ramp B down 46	dcol	UINT16	0	51000
11	58	dcol Ramp B up 46	dcol	UINT16	0	51000

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
12	21	dpc Command value 46	dpc	INT32	-2147483648	2147483647
12	100	dpc Actual value 46	dpc	INT32		
12	103	dpc Control deviation 46	dpc	INT32		
12	140	dpc Trailing window type 47	dpc	INT8	-2	2
12	147	dpc Trailing window Delay time 47	dpc	INT16	0	100
12	150	dpc Trailing window Threshold 47	dpc	INT32	0	2147483647

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
13	21	dsc Command value 47	dsc	INT32	-2147483648	2147483647
13	100	dsc Actual value 47	dsc	INT32		
13	103	dsc Control deviation 48	dsc	INT32		
13	112	dsc Trailing window type 48	dsc	INT8	-2	2
13	119	dsc Trailing window Delay time 48	dsc	INT16	0	100
13	122	dsc Trailing window Threshold 48	dsc	INT32	0	2147483647

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
21	21	vpoc Command value 48	vpoc	INT16	-32768	32767
21	43	vpoc Ramp type 48	vpoc	INT8	-128	127
21	47	vpoc Ramp A down 49	vpoc	UINT16	0	51000
21	50	vpoc Ramp A up 49	vpoc	UINT16	0	51000
21	56	vpoc Ramp B down 49	vpoc	UINT16	0	51000
21	59	vpoc Ramp B up 49	vpoc	UINT16	0	51000

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
22	21	vprc Command value 49	vprc (open-loop) vprc (closed-loop)	INT16	-32768	32767
22	43	vprc Ramp type 49	vprc (open-loop)	INT8	-128	127
22	47	vprc Ramp A down 49	vprc (open-loop)	UINT16	0	51000
22	50	vprc Ramp A up 50	vprc (open-loop)	UINT16	0	51000
22	56	vprc Ramp B down 50	vprc (open-loop)	UINT16	0	51000
22	59	vprc Ramp B up 50	vprc (open-loop)	UINT16	0	51000
22	144	vprc Actual value 50	vprc (closed-loop)	INT16		
22	147	vprc Control deviation 50	vprc (closed-loop)	INT16		
22	150	vprc Trailing window type 50	vprc (closed-loop)	INT8	-2	2
22	157	vprc Trailing window Delay time 50	vprc (closed-loop)	INT16	0	100
22	160	vprc Trailing window Threshold 50	vprc (closed-loop)	INT16	0	16384

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
220	0	Actual value Mode 51	n-point Controller vprc (closed-loop) dpc dsc	UINT8	1	2
220	1	Actual value Input 16 Bit 51	n-point Controller vprc (closed-loop) dpc dsc	INT16	-32768	32767
220	2	Actual value Input 32 Bit 51	n-point Controller vprc (closed-loop) dpc dsc	INT32	-2147483648	2147483647

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
222	0	Signal type Actual value 51	n-point Controller vprc (closed-loop)	UINT8	0	4

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
			dpc dsc			
222	1	Analog Input for Actual value 51	n-point Controller vprc (closed-loop) dpc dsc	INT8	-1	AnzAnaEin-1
222	2	Digital Input for Actual value 51	n-point Controller vprc (closed-loop) dpc dsc	INT8	-1	AnzDigEin-1
222	4	Cablebreak detection Actual value 51	n-point Controller vprc (closed-loop) dpc dsc	UINT8	0	1
222	5	Lower Cablebreak limit Actual value 51	n-point Controller vprc (closed-loop) dpc dsc	INT32	0	2147483647
222	6	Upper Cablebreak limit Actual value 51	n-point Controller vprc (closed-loop) dpc dsc	INT32	0	2147483647
222	7	Min. Interface Actual value 52	n-point Controller vprc (closed-loop) dpc dsc	INT32	-2147483648	2147483647
222	8	Max. Interface Actual value 52	n-point Controller vprc (closed-loop) dpc dsc	INT32	-2147483648	2147483647
222	9	Min. Interface Actual value via Fieldbus 52	n-point Controller vprc (closed-loop) dpc dsc	INT32	-32768	32767
222	10	Max. Interface Actual value via Fieldbus 52	n-point Controller vprc (closed-loop) dpc dsc	INT32	-32768	32767
222	11	Min. Reference Actual value 52	n-point Controller vprc (closed-loop) dpc dsc	INT32	0	2147483647
222	12	Max. Reference Actual value 52	n-point Controller vprc (closed-loop) dpc dsc	INT32	0	2147483647

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
224	0	Channel Enable 52		UINT8	0	2
224	1	Digital Input for Channel Enable 52		INT8	-1	AnzDigEin-1
224	2	Mode of operation 52	vprc (open-loop) dcol vpoc	UINT8	0	3
224	3	Digital Input for solenoid B 53	vprc (open-loop) dcol	INT8	-1	AnzDigEin-1

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
			vpoc			
224	4	Solenoid type 53		UINT8	0	2
224	5	Error handling mask 53		UINT16	0	65535
224	6	Error handling reaction 53		UINT8	0	3
224	7	Error handling digital output 53		UINT8	-1	0
224	8	Function handling mask 53		UINT8	0	255
224	9	Function handling digital output 54		UINT8	-1	0
224	10	Valve type 54		UINT8	0	1

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
225	0	Digital Input for Ramp Enable 54	vprc (open-loop) dcol vpoc	UINT8	-1	AnzDigEin-1

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
228	0	n-point Controller Command value 54	n-point Controller	INT32	-2147483648	2147483647
228	1	n-point Controller Actual value 54	n-point Controller	INT32		
228	2	Threshold 1 for n-point Controller 55	n-point Controller	INT32	-2147483648	2147483647
228	3	Threshold 2 for n-point Controller 55	n-point Controller	INT32	-2147483648	2147483647
228	4	Threshold 3 for n-point Controller 55	n-point Controller	INT32	-2147483648	2147483647
228	5	Threshold 4 for n-point Controller 55	n-point Controller	INT32	-2147483648	2147483647
228	6	n-point Controller Control deviation 55	n-point Controller	INT32		
228	7	n-point Controller Trailing window type 55	n-point Controller	INT8	-2	2
228	8	n-point Controller Trailing window Delay time 55	n-point Controller	UINT16	0	100
228	9	n-point Controller Trailing window Threshold 55	n-point Controller	INT32	0	2147483647

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
232	0	Signal type Command value 56		UINT8	0	4
232	1	Analog Input for Command value 56		INT8	-1	3
232	2	Digital Input for Command value 56		INT8	-1	1
232	4	Cablebreak detection Command value 56		UINT8	0	1
232	5	Lower Cablebreak limit Command value 56		INT32	0	2147483647
232	6	Upper Cablebreak limit Command value 56		INT32	0	2147483647
232	7	Min. Interface Command value 56		INT32	-2147483648	2147483647
232	8	Max. Interface Actual value 56		INT32	-2147483648	2147483647
232	9	Min. Interface Command value via Fieldbus 56		INT32	-32768	32767
232	10	Max. Interface Command value via Fieldbus 57		INT32	-32768	32767
232	11	Min. Reference Command value 57	n-point Controller vprc (closed-loop) dpc dsc	INT32	0	2147483647
232	12	Max. Reference Command value 57	n-point Controller vprc (closed-loop) dpc dsc	INT32	0	2147483647
232	13	Deadband function for Command value 57	vprc (open-loop) dcol vpoc	UINT8	0	1

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
232	14	Deadband Command value 57	vprc (open-loop) dcol vpoc	INT16	0	16384

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
238	0	Fixed command value function 57		INT8	0	1
238	1	number of digital inputs for Fixed command values 58		INT8		
238	2	Fixed command values digital Input 1 58		INT8	-1	AnzDigEin-1
238	3	Fixed command values digital Input 2 58		INT8	-1	AnzDigEin-1
238	4	Fixed command values digital Input 3 59		INT8	-1	AnzDigEin-1
238	5	Number of Fixed command values 59		INT8		
238	6	Fixed command value 1 60		INT32	-2147483648	2147483647
238	7	Fixed command value 2 60		INT32	-2147483648	2147483647
238	8	Fixed command value 3 61		INT32	-2147483648	2147483647
238	9	Fixed command value 4 61		INT32	-2147483648	2147483647
238	10	Fixed command value 5 62		INT32	-2147483648	2147483647
238	11	Fixed command value 6 62		INT32	-2147483648	2147483647
238	12	Fixed command value 7 62		INT32	-2147483648	2147483647

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
240	0	Pos. Speed Command value 63	n-point Controller vprc (closed-loop) dpc dsc	INT32	0	2147483647
240	1	Neg. Speed Command value 63	n-point Controller vprc (closed-loop) dpc dsc	INT32	0	2147483647
240	2	Target window type 63	n-point Controller vprc (closed-loop) dpc dsc	INT8	0	2
240	3	Target window Delay time 63	n-point Controller vprc (closed-loop) dpc dsc	INT16	0	100
240	4	Target window Threshold 63	n-point Controller vprc (closed-loop) dpc dsc	INT32	0	2147483647
240	5	Solenoid Off window type 63	n-point Controller vprc (closed-loop) dpc dsc	INT8	0	2
240	6	Solenoid Off window Delay time 64	n-point Controller vprc (closed-loop) dpc dsc	INT8	0	100
240	7	Solenoid Off window Threshold 64	n-point Controller vprc (closed-loop)	INT32	0	2147483647

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
			dpc dsc			
240	8	Displayed unit 64	n-point Controller vprc (closed-loop) dpc dsc	INT8	0	12
240	9	Command value Feed forward 64	n-point Controller vprc (closed-loop) dpc dsc	INT16	0	10000
240	10	Speed Feed forward 64	n-point Controller vprc (closed-loop) dpc dsc	INT16	0	10000
240	11	Integrator function 64	n-point Controller vprc (closed-loop) dpc dsc	INT8	0	1
240	12	I-reduction if outside I-window 64	n-point Controller vprc (closed-loop) dpc dsc	INT8	0	2
240	13	P-Ampl. positive 64	n-point Controller vprc (closed-loop) dpc dsc	INT16	0	25000
240	14	P-Ampl. negative 65	n-point Controller vprc (closed-loop) dpc dsc	INT16	0	25000
240	15	I-time positive 65	n-point Controller vprc (closed-loop) dpc dsc	INT16	0	10000
240	16	I-time negative 65	n-point Controller vprc (closed-loop) dpc dsc	INT16	0	10000
240	17	I-window positive 65	n-point Controller vprc (closed-loop) dpc dsc	INT32	0	2147483647
240	18	I-window negative 65	n-point Controller vprc (closed-loop) dpc dsc	INT32	0	2147483647
240	19	Inside I-window positive 65	n-point Controller vprc (closed-loop) dpc dsc	INT32	0	2147483647
240	20	Inside I-window negative 65	n-point Controller vprc (closed-loop) dpc dsc	INT32	0	2147483647
240	21	D-time positive 65	n-point Controller vprc (closed-loop)	INT16	0	10000

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
			dpc dsc			
240	22	D-time negative 65	n-point Controller vprc (closed-loop) dpc dsc	INT16	0	10000
240	23	D-Ampl. positive 65	n-point Controller vprc (closed-loop) dpc dsc	INT16	0	10000
240	24	D-Ampl. negative 66	n-point Controller vprc (closed-loop) dpc dsc	INT16	0	10000

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
245	0	Used Analog output 66		INT8	-1	AnzAnaAus-1
245	1	Signal type Analog output 66		INT8	0	3
245	2	min Interface Analog output 66		INT32	-2147483648	2147483647
245	3	max Interface Analog output 66		INT32	-2147483648	2147483647
245	4	min Reference Analog output 66		INT32	0	2147483647
245	5	max Reference Analog output 66		INT32	0	2147483647

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
250	0	Used Solenoid output 1 66		INT8	-1	AnzMagAus-1
250	1	Enable solenoid 1 66		UINT8	0	2
250	2	Digital Input for Enable solenoid 1 67		UINT8	0	AnzDigEin-1
250	3	Inversion solenoid 1 67		UINT8	0	1
250	4	Imin always active solenoid 1 67		UINT8	0	1
250	5	Cablebreak detection solenoid 1 67		UINT8	0	1
250	6	Imin solenoid 1 67		INT16	0	16384
250	7	Imax solenoid 1 67		INT16	0	16384
250	8	Dither function solenoid 1 67		UINT8	0	1
250	9	Dither Frequency solenoid 1 67		INT16	2	250
250	10	Dither Level solenoid 1 67		INT16	0	16384
250	11	Switching On threshold solenoid 1 68		INT16	0	16384
250	12	Switching Off threshold solenoid 1 68		INT16	0	16384
250	13	Reduction time solenoid 1 68		UINT16	0	10000
250	14	Reduced value solenoid 1 68		INT16	0	16384
250	15	Lower Imin (S1578) solenoid 1 68		INT16	0	16384
250	16	Lower Imax (S1578) solenoid 1 68		INT16	0	16384

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
251	0	Characteristic optimisation solenoid 1 68		INT8	0	1
251	1	Characteristic optimisation Number of points solenoid 1 68		INT8		

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
251	2	Characteristic optimisation solenoid 1 point 1 69		INT32	-2147483648	2147483647
251	3	Characteristic optimisation solenoid 1 point 2 69		INT32	-2147483648	2147483647
251	4	Characteristic optimisation solenoid 1 point 3 70		INT32	-2147483648	2147483647
251	5	Characteristic optimisation solenoid 1 point 4 70		INT32	-2147483648	2147483647
251	6	Characteristic optimisation solenoid 1 point 5 71		INT32	-2147483648	2147483647
251	7	Characteristic optimisation solenoid 1 point 6 71		INT32	-2147483648	2147483647
251	8	Characteristic optimisation solenoid 1 point 7 72		INT32	-2147483648	2147483647
251	9	Characteristic optimisation solenoid 1 point 8 72		INT32	-2147483648	2147483647
251	10	Characteristic optimisation solenoid 1 point 9 73		INT32	-2147483648	2147483647

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
252	0	Used Solenoid output 2 73		INT8	-1	AnzMagAus-1
252	1	Enable solenoid 2 73		UINT8	0	2
252	2	Digital Input for Enable solenoid 2 73		UINT8	0	AnzDigEin-1
252	3	Inversion solenoid 2 73		UINT8	0	1
252	4	Imin always active solenoid 2 74		UINT8	0	1
252	5	Cablebreak detection solenoid 2 74		UINT8	0	1
252	6	Imin solenoid 2 74		INT16	0	16384
252	7	Imax solenoid 2 74		INT16	0	16384
252	8	Dither function solenoid 2 74		UINT8	0	1
252	9	Dither Frequency solenoid 2 74		INT16	2	250
252	10	Dither Level solenoid 2 74		INT16	0	16384
252	11	Switching On threshold solenoid 2 74		INT16	0	16384
252	12	Switching Off threshold solenoid 2 74		INT16	0	16384
252	13	Reduction time solenoid 2 75		UINT16	0	10000
252	14	Reduced value solenoid 2 75		INT16	0	16384
252	15	Lower Imin (S1578) solenoid 2 75		INT16	0	16384
252	16	Lower Imax (S1578) solenoid 2 75		INT16	0	16384

Ind	Pnu	Desription	Controller mode	Datatype	min value	max value
253	0	Characteristic optimisation solenoid 2 75		INT8	0	1
253	1	Characteristic optimisation Number of points solenoid 2 75		INT8		
253	2	Characteristic optimisation solenoid 2 point 1 76		INT32	-2147483648	2147483647
253	3	Characteristic optimisation solenoid 2 point 2 76		INT32	-2147483648	2147483647
253	4	Characteristic optimisation solenoid 2 point 3 77		INT32	-2147483648	2147483647
253	5	Characteristic optimisation solenoid 2 point 4 77		INT32	-2147483648	2147483647
253	6	Characteristic optimisation solenoid 2 point 5 78		INT32	-2147483648	2147483647
253	7	Characteristic optimisation solenoid 2 point 6 78		INT32	-2147483648	2147483647
253	8	Characteristic optimisation solenoid 2 point 7 79		INT32	-2147483648	2147483647
253	9	Characteristic optimisation solenoid 2 point 8 79		INT32	-2147483648	2147483647
253	10	Characteristic optimisation solenoid 2 point 9 80		INT32	-2147483648	2147483647

5.2.1 Device control word

IND	PNU	Data type	Range
0	37	UINT16	siehe folgende Description

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 19.	
1	Hold enable (H)		
2	Device mode active (M)		
3	Reset fault (R)	Resets an error/fault	
4	Reserviert		
5	Reserviert		
6	Reserviert		
7	Reserviert		
8	Reserviert		
9	Forward	Manual mode	Moves the axis forward
10	Backward	Manual mode	Moves the axis backward
	Force_setpoint	Profile Position mode	The transmitted motion profile values will be take over immediately
11	Reserviert		
12	Reserviert		
13	Fast speed	Manual mode	Fast speed will be active
	New_setpoint	Profile Position mode	Send new motion profile values to the DP-Slave controller
	Start	Profile generator	Run the selected profile
14	Stop	Profile generator	Stop the active profile
15	Single sequence	Profile generator	Profile is executed in single sequences

5.2.2 Device status word

IND	PNU	Data type	Range
0	38	UINT16	siehe folgende Description

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 19.	
1	Hold enable (H)		
2	Device mode active (M)		
3	Ready (R)		
4	Local control	Is active, if the WANDFLUH Electronics is operated locally	
5	Reserved		
6	Reserved		
7	Reserved		
8	Reserved		
9	Ramp running	The command value ramp is active (open-loop modes only)	
10	Reserved		
11	Trailing window active	The trailing window error is active (closed-loop modes only)	
12	Target window reached	The target window is reached (closed-loop modes only)	
13	Setpoint-_acknlowdege	Profile Position Mode	New motion profiles values are take over from the DP-Slave controller
14	Reserved		
15	Manufacturer-specific		

5.2.3 Device mode

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

5.2.4 Device control mode

Ind	Pnu	Datatype	Range
0	40	INT8	1: Spool position control open loop (vpoc) 3: Pressure control valve open loop (vprc) 4: Pressure control 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 Controller) -7: 2-point controller 2-sol (n-point Controller) -8: 3-point controller 2-sol (n-point Controller)

5.2.5 Device local

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

5.2.6 Capability

Ind	Pnu	Datatype	Range
0	50	UINT32	Bit 0..13 = reserved Bit 14 = n-point Controller 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)

5.2.7 Device temperature

Actual, internal temperature on the WANDFLUH-Electronic in °C (only, if the WANDFLUH-Electronic has a temperature sensor).

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

5.2.8 dcol Command value

Control-mode	Ind	Pnu	Data type	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	

5.2.9 dcol Ramp type

Ind	Pnu	Datatype	Range
11	42	INT8	0: off 3: on -1: external (via digital input)

5.2.10 dcol Rampe A ab

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

5.2.11 dcol Rampe A auf

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

5.2.12 dcol Rampe B ab

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

5.2.13 dcol Rampe B auf

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

5.2.14 dpc Command value

Control-mode	Ind	Pnu	Data type	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	

5.2.15 dpc Actual value

Control-mode	Ind	Pnu	Data type	Range
vprc (closed-loop)	22	144	INT16	-16384 .. 16383: refer to "Internal bus resolution 27"
dsc	13	100	INT32	Min- .. Max-Reference: refer to "Scaled parameter 27"
dpc	12	100	INT32	
n-point	228	1	INT32	

5.2.16 dpc Control deviation

Control-mode	Ind	Pnu	Data type	Range

vprc (closed-loop)	22	147	INT16	-16384 .. 16383: refer to "Internal bus resolution 27"
dsc	13	103	INT32	Min- .. Max-Reference: refer to "Scaled parameter 27"
dpc	12	103	INT32	
n-point	228	6	INT32	

5.2.17 dpc Trailing window type

Ind	Pnu	Datatype	Range
12	140	INT8	0: off 2: on without error -2: on with error

5.2.18 dpc Trailing window Delay time

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

5.2.19 dpc Trailing window Threshold

For parameter with a unit (e.g. mm, psi, l/min, etc.), the adjusting range is always 0 ... 15000000 and the resolution is 1 / 1000.

5.2.20 dsc Command value

Control-mode	Ind	Pnu	Data type	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	

5.2.21 dsc Actual value

Control-mode	Ind	Pnu	Data type	Range
vprc (closed-loop)	22	144	INT16	-16384 .. 16383: refer to "Internal bus resolution 27"
dsc	13	100	INT32	Min- .. Max-Reference: refer to "Scaled parameter 27"
dpc	12	100	INT32	
n-point	228	1	INT32	

5.2.22 dsc Control deviation

Control-mode	Ind	Pnu	Data type	Range
vprc (closed-loop)	22	147	INT16	-16384 .. 16383: refer to "Internal bus resolution 27"
dsc	13	103	INT32	Min- .. Max-Reference: refer to "Scaled parameter 27"
dpc	12	103	INT32	
n-point	228	6	INT32	

5.2.23 dsc Trailing window type

Ind	Pnu	Datatype	Range
13	112	INT8	0: off 2: on without error -2: on with error

5.2.24 dsc Trailing window Delay time

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

5.2.25 dsc Trailing window Threshold

For parameter with a unit (e.g. mm, psi, l/min, etc.), the adjusting range is always 0 ... 15000000 and the resolution is 1 / 1000.

5.2.26 vpoc Command value

Control-mode	Ind	Pnu	Data type	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	

5.2.27 vpoc Ramp type

Ind	Pnu	Datatype	Range
21	43	INT8	0: Rampe off 3: Rampe on -1: Rampe on via digital Input

5.2.28 vpoc Ramp A down

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

5.2.29 vpoc Ramp A up

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

5.2.30 vpoc Ramp B down

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

5.2.31 vpoc Ramp B up

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

5.2.32 vprc Command value

Control-mode	Ind	Pnu	Data type	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	

5.2.33 vprc Ramp type

Ind	Pnu	Datatype	Range
22	43	INT8	0: Rampe off 3: Rampe on -1: Rampe on via digital Input

5.2.34 vprc Ramp A down

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

5.2.35 vprc Ramp A up

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

5.2.36 vprc Ramp B down

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

5.2.37 vprc Ramp B up

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

5.2.38 vprc Actual value

Control-mode	Ind	Pnu	Data type	Range
vprc (closed-loop)	22	144	INT16	-16384 .. 16383: refer to "Internal bus resolution 27"
dsc	13	100	INT32	Min- .. Max-Reference: refer to "Scaled parameter 27"
dpc	12	100	INT32	
n-point	228	1	INT32	

5.2.39 vprc Control deviation

Control-mode	Ind	Pnu	Data type	Range
vprc (closed-loop)	22	147	INT16	-16384 .. 16383: refer to "Internal bus resolution 27"
dsc	13	103	INT32	Min- .. Max-Reference: refer to "Scaled parameter 27"
dpc	12	103	INT32	
n-point	228	6	INT32	

5.2.40 vprc Trailing window t

Ind	Pnu	Datatype	Range
22	150	INT8	0: off 2: on without error -2: on with error

5.2.41 vprc Trailing window Delay time

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

5.2.42 vprc Trailing window Threshold

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

5.2.43 Actual value Mode

Ind	Pnu	Datatype	Range
220	0	UINT8	1: Actual value via Fieldbus 2: Actual value local

5.2.44 Actual value Input 16 Bit

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

5.2.45 Actual value Input 32 Bit

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

5.2.46 Signal type Actual value

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

5.2.47 Analog Input for Actual value

Ind	Pnu	Datatype	Range
222	1	INT8	-1: not used 0 .. [number of analog inputs - 1]

5.2.48 Digital Input for Actual value

Ind	Pnu	Datatype	Range
222	2	INT8	-1: not used 0 .. [number of digital inputs - 1]

5.2.49 Cablebreak detection Actual value

Ind	Pnu	Datatype	Range
222	4	UINT8	0: off 1: on

5.2.50 Lower Cablebreak limit Actual value

Ind	Pnu	Datatype	Range
222	5	INT32	refer to section "Skalierbare Parameter" 27

5.2.51 Upper Cablebreak limit Actual value

Ind	Pnu	Datatype	Range
222	6	INT32	refer to section "Skalierbare Parameter" 27

5.2.52 Min. Interface Actual value

Ind	Pnu	Datatype	Range
222	7	INT32	refer to section "Skalierbare Parameter" 27

5.2.53 Max. Interface Actual value

Ind	Pnu	Datatype	Range
222	8	INT32	refer to section "Skalierbare Parameter" 27

5.2.54 Min. Interface Actual value via Fieldbus

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

5.2.55 Max. Interface Actual value via Fieldbus

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

5.2.56 Min. Reference Actual value

Ind	Pnu	Datatype	Range
222	11	INT32	refer to section "Skalierbare Parameter" 27

5.2.57 Max. Reference Actual value

Ind	Pnu	Datatype	Range
222	12	INT32	refer to section "Skalierbare Parameter" 27

5.2.58 Channel Enable

Ind	Pnu	Datatype	Range
224	0	UINT8	0: Enable off 1: Enable on 2: external (digital Input)

5.2.59 Digital Input for Channel Enable

Spezifiziert den digital Input for die Kanalfreigabe, wenn Parameter 'Kanal Freigabe' auf 'extern' steht.

Ind	Pnu	Datatype	Range
224	1	INT8	-1: not used 0 .. [number of digital inputs - 1]

5.2.60 Mode of operation

Ind	Pnu	Datatype	Range
224	2	UINT8	0: Command value unipolar (1-Mag) 1: Command value unipolar (2-Mag) 2: Command value bipolar (2-Mag) 3: Command value unipolar (2-Mag with DigEin)

5.2.61 Digital Input for solenoid

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 .. [number of digital inputs - 1]

5.2.62 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

5.2.63 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)

5.2.64 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

5.2.65 Error handling digital output

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 .. [number of digital outputs - 1]

5.2.66 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)

5.2.67 Function handling digital output

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 .. [number of digital outputs - 1]

5.2.68 Valve type

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

5.2.69 Digital Input for Ramp Enable

Ind	Pnu	Datatype	Range
225	0	UINT8	-1: not used 0 .. [number of digital inputs - 1]

5.2.70 n-point Controller Command value

<table>
<tr><th>Control-mode</th><th>Ind</th><th>Pnu</th><th>Data type</th><th>Range</th></tr>
<tr><td>vpoc (open-loop)</td><td>21</td><td>21</td><td>INT16</td><td rowspan="6">Min .. Max Bus Interface</td></tr>
<tr><td>vprc (open-loop)
vprc (closed-loop)</td><td>22</td><td>21</td><td>INT16</td></tr>
<tr><td>dcol (open-loop)</td><td>11</td><td>21</td><td>INT32</td></tr>
<tr><td>dsc</td><td>13</td><td>21</td><td>INT32</td></tr>
<tr><td>dpc</td><td>12</td><td>21</td><td>INT32</td></tr>
<tr><td>n-point</td><td>228</td><td>0</td><td>INT32</td></tr>
</table>

5.2.71 n-point Controller Actual value

<table>
<tr><th>Control-mode</th><th>Ind</th><th>Pnu</th><th>Data type</th><th>Range</th></tr>
<tr><td>vprc (closed-loop)</td><td>22</td><td>144</td><td>INT16</td><td>-16384 .. 16383: refer to "Internal bus resolution 27"</td></tr>
<tr><td>dsc</td><td>13</td><td>100</td><td>INT32</td><td rowspan="2">Min- .. Max-Reference: refer to "Scaled parameter 27"</td></tr>
<tr><td>dpc</td><td>12</td><td>100</td><td>INT32</td></tr>
</table>

n-point	228	1	INT32	

5.2.72 Threshold 1 for n-point Controller

Ind	Pnu	Datatype	Range
228	2	INT32	refer to section "Skalierbare Parameter" 27

5.2.73 Threshold 2 for n-point Controller

Ind	Pnu	Datatype	Range
228	3	INT32	refer to section "Skalierbare Parameter" 27

5.2.74 Threshold 3 for n-point Controller

Ind	Pnu	Datatype	Range
228	4	INT32	refer to section "Skalierbare Parameter" 27

5.2.75 Threshold 4 for n-point Controller

Ind	Pnu	Datatype	Range
228	5	INT32	refer to section "Skalierbare Parameter" 27

5.2.76 n-point Controller Control deviation

Control-mode	Ind	Pnu	Data type	Range
vprc (closed-loop)	22	147	INT16	-16384 .. 16383: refer to "Internal bus resolution 27"
dsc	13	103	INT32	Min- .. Max-Reference: refer to "Scaled parameter 27"
dpc	12	103	INT32	
n-point	228	6	INT32	

5.2.77 n-point Controller Trailing window type

Ind	Pnu	Datatype	Range
228	7	INT8	0: off 2: Schleppfenster type on -2: Schleppfenster type on (löst Fehler off)

5.2.78 n-point Controller Trailing window Delay time

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

5.2.79 n-point Controller Trailing window Threshold

Ind	Pnu	Datatype	Range
228	9	INT32	refer to section "Skalierbare Parameter" 27

5.2.80 Signal type Command value

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

5.2.81 Analog Input for Command value

Ind	Pnu	Datatype	Range
232	1	INT8	-1: not used 0 .. [number of analog inputs - 1]

5.2.82 Digital Input for Command value

Ind	Pnu	Datatype	Range
232	2	INT8	-1: not used 0 .. [number of digital inputs - 1]

5.2.83 Cablebreak detection Command value

Ind	Pnu	Datatype	Range
232	4	UINT8	0: off 1: on

5.2.84 Lower Cablebreak limit Command value

Ind	Pnu	Datatype	Range
232	5	INT32	refer to section "Interface" 27

5.2.85 Upper Cablebreak limit Command value

Ind	Pnu	Datatype	Range
232	6	INT32	refer to section "Interface" 27

5.2.86 Min. Interface Command value

Ind	Pnu	Datatype	Range
232	7	INT32	refer to section "Interface" 27

5.2.87 Max. Interface Actual value

Ind	Pnu	Datatype	Range
232	8	INT32	refer to section "Interface" 27

5.2.88 Min. Interface Command value via Fieldbus

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

5.2.89 Max. Interface Command value via Fieldbus

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

5.2.90 Min. Reference Command value

Ind	Pnu	Datatype	Range
232	11	INT32	refer to section "Skalierbare Parameter" 27

5.2.91 Max. Reference Command value

Ind	Pnu	Datatype	Range
232	12	INT32	refer to section "Skalierbare Parameter" 27

5.2.92 Deadband function for Command value

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

5.2.93 Deadband Command value

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

5.2.94 Fixed command value function

Fixed command values function on/off

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

Fixed command values digital input x

Ind	Pnu	Data type	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	Data type	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 27"

5.2.95 Number of digital inputs for Fixed command values

Fixed command values function on/off

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

Fixed command values digital input x

Ind	Pnu	Data type	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	Data type	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 27"

5.2.96 Fixed command values digital Input 1

Fixed command values function on/off

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

Fixed command values digital input x

Ind	Pnu	Data type	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	Data type	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 27"

5.2.97 Fixed command values digital Input 2

Fixed command values function on/off

Ind	Pnu	Data type	Value	Description
238	0	UINT8	0	Fixed command values not active

Ind	Pnu	Data type	Value	Description
			1	Fixed command values active

Fixed command values digital input x

Ind	Pnu	Data type	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	Data type	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 27"

5.2.98 Fixed command values digital Input 3

Fixed command values function on/off

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

Fixed command values digital input x

Ind	Pnu	Data type	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	Data type	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 27"

5.2.99 Number of Fixed command values

Fixed command values function on/off

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

Fixed command values digital input x

Ind	Pnu	Data type	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	Data type	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 27"

5.2.100 Fixed command value 1

Fixed command values function on/off

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

Fixed command values digital input x

Ind	Pnu	Data type	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	Data type	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 27"

5.2.101 Fixed command value 2

Fixed command values function on/off

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

Fixed command values digital input x

Ind	Pnu	Data type	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	Data type	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 27"

5.2.102 Fixed command value 3

Fixed command values function on/off

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

Fixed command values digital input x

Ind	Pnu	Data type	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	Data type	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 27"

5.2.103 Fixed command value 4

Fixed command values function on/off

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

Fixed command values digital input x

Ind	Pnu	Data type	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	Data type	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 27"

5.2.104 Fixed command value 5

Fixed command values function on/off

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

Fixed command values digital input x

Ind	Pnu	Data type	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	Data type	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 27"

5.2.105 Fixed command value 6

Fixed command values function on/off

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

Fixed command values digital input x

Ind	Pnu	Data type	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	Data type	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 27"

5.2.106 Fixed command value 7

Fixed command values function on/off

Ind	Pnu	Data type	Value	Description
238	0	UINT8	0	Fixed command values not active

Ind	Pnu	Data type	Value	Description
			1	Fixed command values active

Fixed command values digital input x

Ind	Pnu	Data type	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	Data type	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 27"

5.2.107 Pos. Speed Command value

Ind	Pnu	Datatype	Range
240	0	INT32	refer to section "Skalierbare Parameter" 27

5.2.108 Neg. Speed Command value

Ind	Pnu	Datatype	Range
240	1	INT32	refer to section "Skalierbare Parameter" 27

5.2.109 Target window type

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

5.2.110 Target window Delay time

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

5.2.111 Target window Threshold

Ind	Pnu	Datatype	Range
240	4	INT32	refer to section "Skalierbare Parameter" 27

5.2.112 Solenoid Off window type

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

5.2.113 Solenoid Off window Delay time

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

5.2.114 Solenoid Off window Threshold

Ind	Pnu	Datatype	Range
240	7	INT32	refer to section "Skalierbare Parameter" 27

5.2.115 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: Grad/s

5.2.116 Command value Feed forward

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

5.2.117 Speed Feed forward

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

5.2.118 Integrator function

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

5.2.119 I-reduction if outside I-window

Ind	Pnu	Datatype	Range
240	12	INT8	0: set to 0 1: leave value 2: reduce

5.2.120 P-Ampl. positive

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

5.2.121 P-Ampl. negative

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

5.2.122 I-time positive

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

5.2.123 I-time negative

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

5.2.124 I-window positive

Ind	Pnu	Datatype	Range
240	17	INT32	refer to section "Skalierbare Parameter" 27

5.2.125 I-window negative

Ind	Pnu	Datatype	Range
240	18	INT32	refer to section "Skalierbare Parameter" 27

5.2.126 Inside I-window positive

Ind	Pnu	Datatype	Range
240	19	INT32	refer to section "Skalierbare Parameter" 27

5.2.127 Inside I-window negative

Ind	Pnu	Datatype	Range
240	20	INT32	refer to section "Skalierbare Parameter" 27

5.2.128 D-time positive

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

5.2.129 D-time negative

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

5.2.130 D-Ampl. positive

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

5.2.131 D-Ampl. negative

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

5.2.132 Used analogoutput

Ind	Pnu	Datatype	Range
245	0	INT8	-1: not used 0 .. [number of analog outputs - 1]

5.2.133 Signal type Analog output

Ind	Pnu	Datatype	Range
245	1	INT8	0 = Control value 1 = Command value 2 = Actual value 3 = Control deviation

5.2.134 min Interface Analog output

Ind	Pnu	Datatype	Range
245	2	INT32	Voltage input: -10000 .. 10000: -10 .. +10V, Resolution 0.001 V Current input: 0 … 20000:0 … +20mA, Resolution 1 mA

5.2.135 max Interface Analog output

Ind	Pnu	Datatype	Range
245	3	INT32	Voltage input: -10000 .. 10000: -10 .. +10V, Resolution 0.001 V Current input: 0 … 20000:0 … +20mA, Resolution 1 mA

5.2.136 min Reference Analog output

Ind	Pnu	Datatype	Range
245	4	INT32	-16384 .. 16384: -100 .. 100%

5.2.137 max Reference Analog output

Ind	Pnu	Datatype	Range
245	5	INT32	-16384 .. 16384: -100 .. 100%

5.2.138 Used Solenoid output

Ind	Pnu	Datatype	Range
250	0	INT8	-1: not used 0 .. [number of solenoid outputs - 1]

5.2.139 Enable solenoid 1

Ind	Pnu	Datatype	Range
250	1	UINT8	0: off 1: on 2: external (digital Input)

5.2.140 Digital Input for Enable solenoid 1

Ind	Pnu	Datatype	Range
250	2	UINT8	-1: not used 0 .. [number of digital inputs - 1]

5.2.141 Inversion solenoid 1

Ind	Pnu	Datatype	Range
250	3	UINT8	0: no 1: yes

5.2.142 Imin always active solenoid 1

Ind	Pnu	Datatype	Range
250	4	UINT8	0: no 1: yes

5.2.143 Cablebreak detection solenoid 1

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

5.2.144 Imin solenoid 1

Ind	Pnu	Datatype	Range
250	6	INT16	refer to section "Magnetstrom" 27

5.2.145 Imax solenoid 1

Ind	Pnu	Datatype	Range
250	7	INT16	refer to section "Magnetstrom" 27

5.2.146 Dither function solenoid 1

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

5.2.147 Dither Frequency solenoid 1

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

5.2.148 Dither Level solenoid 1

Ind	Pnu	Datatype	Range
250	10	INT16	refer to section "Magnetstrom" 27

5.2.149 Switching On threshold solenoid 1

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

5.2.150 Switching Off threshold solenoid 1

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

5.2.151 Reduction time solenoid 1

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

5.2.152 Reduced value solenoid 1

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

5.2.153 Lower Imin (S1578) solenoid 1

Ind	Pnu	Datatype	Range
250	15	INT16	refer to section "Magnetstrom" 27

5.2.154 Lower Imax (S1578) solenoid 1

Ind	Pnu	Datatype	Range
250	16	INT16	refer to section "Magnetstrom" 27

5.2.155 Characteristic optimisation solenoid 1

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

5.2.156 Characteristic optimisation Number of points solenoid 1

Ind	Pnu	Datatype	Range
251	1	INT8	9 [RO]

5.2.157 Characteristic optimisation solenoid 1 point 1

Characteristic optimisation on/off

Ind	Pnu	Data type	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	Data type	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

5.2.158 Characteristic optimisation solenoid 1 point 2

Characteristic optimisation on/off

Ind	Pnu	Data type	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	Data type	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

5.2.159 Characteristic optimisation solenoid 1 point 3

Characteristic optimisation on/off

Ind	Pnu	Data type	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	Data type	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

5.2.160 Characteristic optimisation solenoid 1 point 4

Characteristic optimisation on/off

Ind	Pnu	Data type	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	Data type	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

5.2.161 Characteristic optimisation solenoid 1 point 5

Characteristic optimisation on/off

Ind	Pnu	Data type	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	Data type	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

5.2.162 Characteristic optimisation solenoid 1 point 6

Characteristic optimisation on/off

Ind	Pnu	Data type	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	Data type	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

5.2.163 Characteristic optimisation solenoid 1 point 7

Characteristic optimisation on/off

Ind	Pnu	Data type	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	Data type	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

5.2.164 Characteristic optimisation solenoid 1 point 8

Characteristic optimisation on/off

Ind	Pnu	Data type	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	Data type	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

5.2.165 Characteristic optimisation solenoid 1 point 9

Characteristic optimisation on/off

Ind	Pnu	Data type	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	Data type	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

5.2.166 Used Solenoid output 2

Ind	Pnu	Datatype	Range
252	0	INT8	-1: not used 0 .. [number of solenoid outputs - 1]

5.2.167 Enable solenoid 2

Ind	Pnu	Datatype	Range
252	1	UINT8	0: off 1: on 2: external (digital Input)

5.2.168 Digital Input for Enable solenoid 2

Ind	Pnu	Datatype	Range
252	2	UINT8	-1: not used 0 .. [number of digital inputs - 1]

5.2.169 Inversion solenoid 2

Ind	Pnu	Datatype	Range
252	3	UINT8	0: no 1: yes

5.2.170 Imin always active solenoid 2

Ind	Pnu	Datatype	Range
252	4	UINT8	0: no 1: yes

5.2.171 Cablebreak detection solenoid 2

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

5.2.172 Imin solenoid 2

Ind	Pnu	Datatype	Range
252	6	INT16	refer to section "Magnetstrom" 27

5.2.173 Imax solenoid 2

Ind	Pnu	Datatype	Range
252	7	INT16	refer to section "Magnetstrom" 27

5.2.174 Dither function solenoid 2

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

5.2.175 Dither Frequency solenoid 2

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

5.2.176 Dither Level solenoid 2

Ind	Pnu	Datatype	Range
252	10	INT16	refer to section "Magnetstrom" 27

5.2.177 Switching On threshold solenoid 2

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

5.2.178 Switching Off threshold solenoid 2

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

5.2.179 Reduction time solenoid 2

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

5.2.180 Reduced value solenoid 2

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

5.2.181 Lower Imin (S1578) solenoid 2

Ind	Pnu	Datatype	Range
252	15	INT16	refer to section "Magnetstrom" 27

5.2.182 Lower Imin (S1578) solenoid 2

Ind	Pnu	Datatype	Range
252	16	INT16	refer to section "Magnetstrom" 27

5.2.183 Lower Imin (S1578) solenoid 2

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

5.2.184 Lower Imin (S1578) solenoid 2

Ind	Pnu	Datatype	Range
253	1	INT8	9 [RO]

5.2.185 Characteristic optimisation solenoid 2 point 1

Characteristic optimisation on/off

Ind	Pnu	Data type	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	Data type	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

5.2.186 Characteristic optimisation solenoid 2 point 2

Characteristic optimisation on/off

Ind	Pnu	Data type	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	Data type	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

5.2.187 Characteristic optimisation solenoid 2 point 3

Characteristic optimisation on/off

Ind	Pnu	Data type	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	Data type	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

5.2.188 Characteristic optimisation solenoid 2 point 4

Characteristic optimisation on/off

Ind	Pnu	Data type	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	Data type	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

5.2.189 Characteristic optimisation solenoid 2 point 5

Characteristic optimisation on/off

Ind	Pnu	Data type	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	Data type	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

5.2.190 Characteristic optimisation solenoid 2 point 6

Characteristic optimisation on/off

Ind	Pnu	Data type	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	Data type	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

5.2.191 Characteristic optimisation solenoid 2 point 7

Characteristic optimisation on/off

Ind	Pnu	Data type	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	Data type	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

5.2.192 Characteristic optimisation solenoid 2 point 8

Characteristic optimisation on/off

Ind	Pnu	Data type	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	Data type	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

5.2.193 Characteristic optimisation solenoid 2 point 9

Characteristic optimisation on/off

Ind	Pnu	Data type	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	Data type	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

5.2.194 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

6 Commissioning

For a support during the commissioning of a HART field device, the parameterisation software PASO can be connected to the HART field device. 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 HART diagnostic can be made via the PASO (refer to section "Fieldbus Settings 14").

6.1 Step by step instructions for the first commissioning

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

6.1.1 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 status line, the statements "Local" and "Init" will be displayed
5. Switch on the hydraulic system
6. 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.
7. In the PASO window "Solenoid Driver", the parameters for the minimum (Imin) and maximum (Imax) current and the dither signal (frequency and level) can be set

6.1.2 Parameterise the HART field device

1. Select the desired controller mode in the PASO with "Controller" (only for controller)
2. Select the desired mode of operation (only for amplifier) and valve type in the PASO with "Valve type"
3. Adjust the desired command value scaling in the PASO with "Command scaling"
   If the command value should be set via the fieldbus, the parameter "Command value mode" must be set tot "Bus"
4. Adjust the desired feedback value scaling in the PASO with "Feedback scaling"
   If the feedback value should be set via the fieldbus, the parameter "Feedback value mode" must be set tot "Bus"
5. Adjust the desired adjustments for the solenoid outputin the PASO with "Solenoid driver 1" and "Solenoid driver 1"
6. Adjust the desired adjustments for the enabling in the PASO with "Enable Channel"
   If the enable of the channel should be set via the fieldbus, the parameter "Operating mode" must be set tot "Bus"

6.1.3 Test the fieldbus

1. Load and install the EDD-File in the HART host device master.
2. Adjust the node adress on the WANDFLUH-Electronrics
3. Switch on the HART host device
4. In the PASO-window "Fieldbus_Feldbus-Info" in the section "Bus State" the following statement will be displyed:

Bustype:	HART7
Polling-Adress:	Node address from the HART field device
Long-Adress	Long address from the HART field device
Tag:	Tag name of the HART field device
Status:	OK

6.1.4 Test the control via the fieldbus

Set the following parameters in the given order using the HART command transfer (refer to "HART Command Transfer 23"):

1. Set the parameter "Device local“ to "Control word via fieldbus (0)" (refer to "Device local 44“).
2. Select with the parameter "Device mode“ the desired device mod (refer to "Device mode 44“).
3. Select with the parameter "Device control mode“ the desired device control mode (refer to "Device control mode 44“).
4. For the release of the WANDFLUH-Electronics, the three bits "Disable (D)", "Hold enable (H)" and "Device mode active (M)" from the control word (refer to "Device control word 43") must be set to logical 1. The HART field device is now in the state "ACTIVE".
5. Now a command value can be set using the HART command transfer (refer to "HART Command Transfer 23"):

6.2 Presupposition for the DP-Slave controller card

For the commissioning of a HART field device, the following presupposition must be cleared:

- **What is the node adresse from the HART field device?**
  The node address can be set via the parameterisation software PASO in the menu item "Fieldbus_Info" (refer to section "Fieldbus Settings 13").

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

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

  (refer to section "State machine 19")

6.3 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 HART field device?

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

6.4 Delivery state

The HART field device is delivered with the following basic configuration:

Device	Address	Baudrate
WANDFLUH-Electronics Amplifier	0	1.2 kBaud
WANDFLUH-Electronis Controller	0	1.2 kBaud

The HART-parameter are set to the follwing values:

- Manufacturer ID: 24835
- Device Type: SD730: tbd / SD735: tbd / SD733: 58352 / SD736: 58353
- Device ID: Year (2 digits) plus continuous number of the serial number (5 digits)
- Tag Name: WAGSD7xx
- Long Tag Name: Wandfluh AG - SD73xx
- Description: WAG Electronic
- Day: Day of testing
- Month: Month of testing
- Year: Year of testing

6.5 Parameterisation

The parameters of the HART field device can be read or changed trough the HART or through PASO.

After switch-on the HART field device, it can be parameterised by sending parameter via HART Command Transfer (refer to section "HART Command Transfer 23"). The modified parameters are automatically written in the non-volatile memory after 2s.

6.6 Setting the command value via Fieldbus

In the standard version of the HART field device, the preset value can be set locally or via the Fieldbus (refer to section "Product Description 22"). The switch over is made with the parameter "Device mode 44".

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

1. The HART field device 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 HART field device, the 3 bits D, H and M from the control word (refer to section "Device state machine 19") must be set to logical 1. The HART field device is now in the state "ACTIVE". Now, a preset value can be set.

6.7 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 HART field device, 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 HART field device, the 3 bits D, H and M from the control word (refer to section "Device state machine 19") must be set to logical 1. The HART field device is now in the state "ACTIVE". Now, a preset value can be set.

7 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
- Bus type
- Polling Adresse
- Long Adresse
- Tag
- Status

A detailed description of the diagnostic function you will find in the section "Fieldbus Diagnostics 14".

8 Simatic PDM V8.x / V9.x integration

The following steps must be completed to integrate a Wandfluh AG HART EDD file into Simatic PDM V8.x / V9.x.

Simatic configuration files

- edit the following file:
  `C:\ProgramData\Siemens\Automation\SIMATIC_PDM\EDD_WorkingDir\edd_catalog\catalogdata\manufacturer.csv`
- add the following line to the end of the file:
  `Wandfluh AG;;;;;WANDFLUH;0x6103;`
- edit the following file:
  `C:\ProgramData\Siemens\Automation\SIMATIC_PDM\EDD_WorkingDir\edd_catalog\DEVICE\SI__DEV01.cfg`
- add the following lines to the end of the file:

```
MANUFACTURER 0x6103 = WANDFLUH
     DEVICE_TYPE 0xE3F0 = _SD733
     DEVICE_TYPE 0xE3F1 = _SD736
```

Integrate the EDD file

- open the Device integration Manager
- in the menu select “File” => ”Read device description from compressed source…”
- select the EDD zip file.
- set a checkmark at Devices => Actuators => Hydraulic => Wandfluh AG => SD73x
- in the menu select “Catalog” => ”Integration”
- the EDD file is now integrated and can be assigned to devices in Simatic PDM