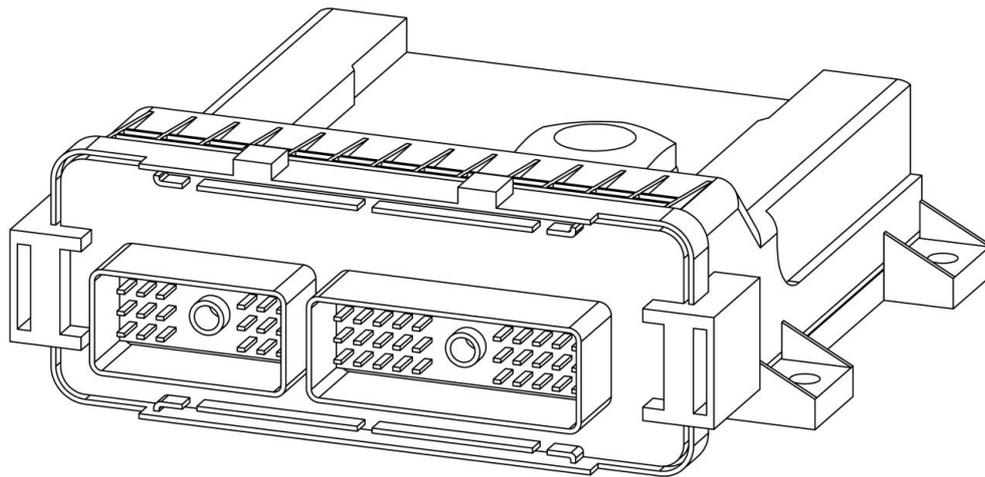


OPERATING INSTRUCTIONS

MOBILE CONTROLLER ELECTRONICS MD2



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1 General information

This operating instructions makes it possible to use the MD2-Electronics safely and according to specification. The operating instructions includes instructions which Wandfluh as the manufacturer, or its resale organisations (Wandfluh sister companies or distributors), provide to users within their duty to instruct.

For this purpose, the operating instructions mainly includes:

- information about use according to specification, installation and commissioning of the MD2-Electronics
- information about safety in dealing with control.

2 Product description

2.1 General

The MD2-Electronics is integrated in a housing from plastic, which will be screwed a metallic surface. The connections are provided by the mobile capable connector type SHS from the company CINCH.

2.2 Field of application

Screwed on to a metallic surface, the MD2-Electronics is used primarily in the mobile field because of their compact construction, protection class IP67, extensive operating temperature range and the selected plug-in connection.

2.3 Conformity

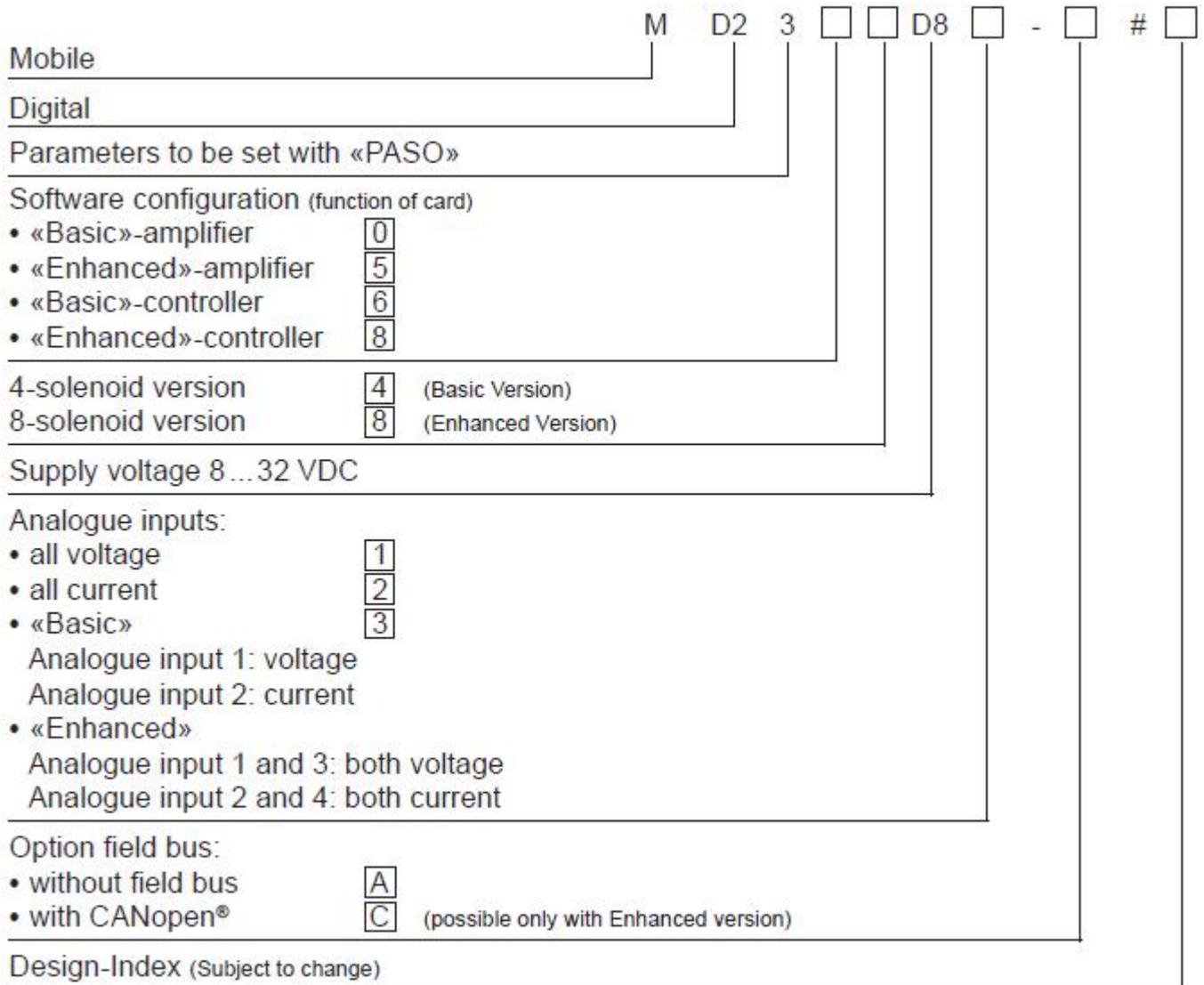
The MD2-Electronics have been developed and tested in accordance with the latest technical standards. Applied in particular was the EU Guideline 89/336/EEC (EMC Guideline) and 2004/104/EC (EMC for road vehicles).

2.4 Labelling of the product

With the PC parameterisation software PASO MD2, the following information can be directly read-off the MD2-Electronics (=electronic type code):

- Part number
- Serial number
- Software version
- Firmware version
- Card type
- Hardware configuration

2.5 Type code



2.6 Technical data

2.6.1 General specifications

Design	Housing made of plastic, resistant against salt spray and most fluids used in industrial applications.
Dimensions	153 x 57 x 147
Installations	On metallic surface, screwed on to assure heat dissipation
Weight	0.5 kg
Connections	Plug type SHS (manufacturer CINCH, www.cinch.com) (not included in the delivery, refer to Accessories ^[110] for details) 1 USB interface (connector type B)
Working temperature	-40 ... +85° C with 100% command signal (duty cycle 100%)
Protection class	IP67 acc. to EN 60 529

Further more the material specifications of the directives 2002/96/EC (RoHS) and (2000/53/EC (End of life vehicles) are achieved.

2.6.2 Electrical specifications

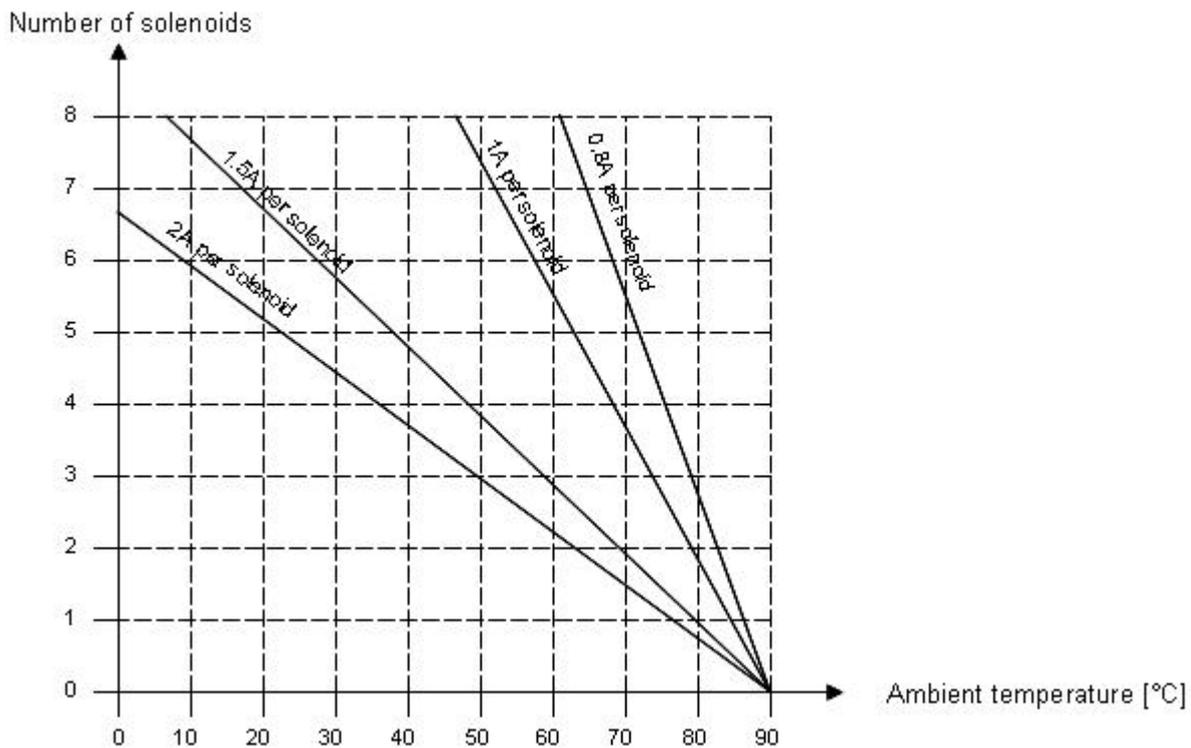
Supply voltage	for logic part: 8 ... 32 VDC for solenoid outputs: 8 ... 32 VDC
Ripple on supply voltage	< ±10 %
Fuse	Customer must integrate a slow fuse into his electrical system (refer to section " Supply voltage " ^[28]).
Temperature drift	< 1% at ΔT = 40° C
No load current	ca. 55 mA
Maximum current consumption	No load current + 2 A per solenoid
Analogue inputs	MD23..D81-A: adjustable by Software 0 ... +5 V 0 ... +10 V -10 ... +10 V MD23..D82-A: adjustable by Software 4 ... 20 mA 0 ... 20 mA Basic: Analoginput 1-2 10-Bit resolution Enhanced: Analoginput 1-4 16-Bit resolution
Input resistance	Voltage input > 18 kOhm Load for current input = 250 Ohm
Stabilised output voltage	+ 5 VDC max. load 50mA
Solenoid current	Minimal current I _{min} adjustable 0 ... 950 mA Maximal current I _{max} adjustable I _{min} ... 2 A Accumulated current limitation 10 A
Dither	Frequency adjustable 20 ... 500 Hz Amplitude adjustable 0 ... 400 mA
Digital inputs	all inputs high-active Switching threshold high 6 - 32VDC Switching threshold low 0 - 1VDC Utilisable as frequency input (frequencies 5...5000Hz) and as PWM-input (automatic frequency identification)
Digital outputs	all outputs High-Side-Switch U _{out} Supply logic I _{max} (per output) 0.5 A
LED	Green: On if the MD2-Electronics is ready. Blinking twice when the power supply of the solenoid outputs is too low. Red: On if an error occurs.
Serial interface	1 USB interface (connector type B)
EMC	
Immunity	EN 61 000-6-2
Emission	EN 61 000-6-4
Road vehicles	RL 2004/104/EC and ISO 7637-2
Vibration / shock	
Oscillation	IEC 60 068-2-6
Single shock	IEC 60 068-2-27
Continuous shock	IEC 60 068-2-29

2.6.3 Environment

Storage	Packing:	The module must be stored in the original packing
	Temperature range:	-40 ... +85° C
	Resistance to alkali and acid:	The module must be protected against alkalis and acids
In operation	Temperature range:	-40 ... +85° C
	Resistance to alkali and acid:	The module must be protected against alkalis and acids

2.6.4 Solenoid outputs and ambient temperature

The maximum number of simultaneously driven solenoid outputs is defined by the ambient temperature. This advert to the constantly driven solenoid outputs. The MD2 electronics allows to exceed the limiting number of solenoids for a short time (around 5 minutes).

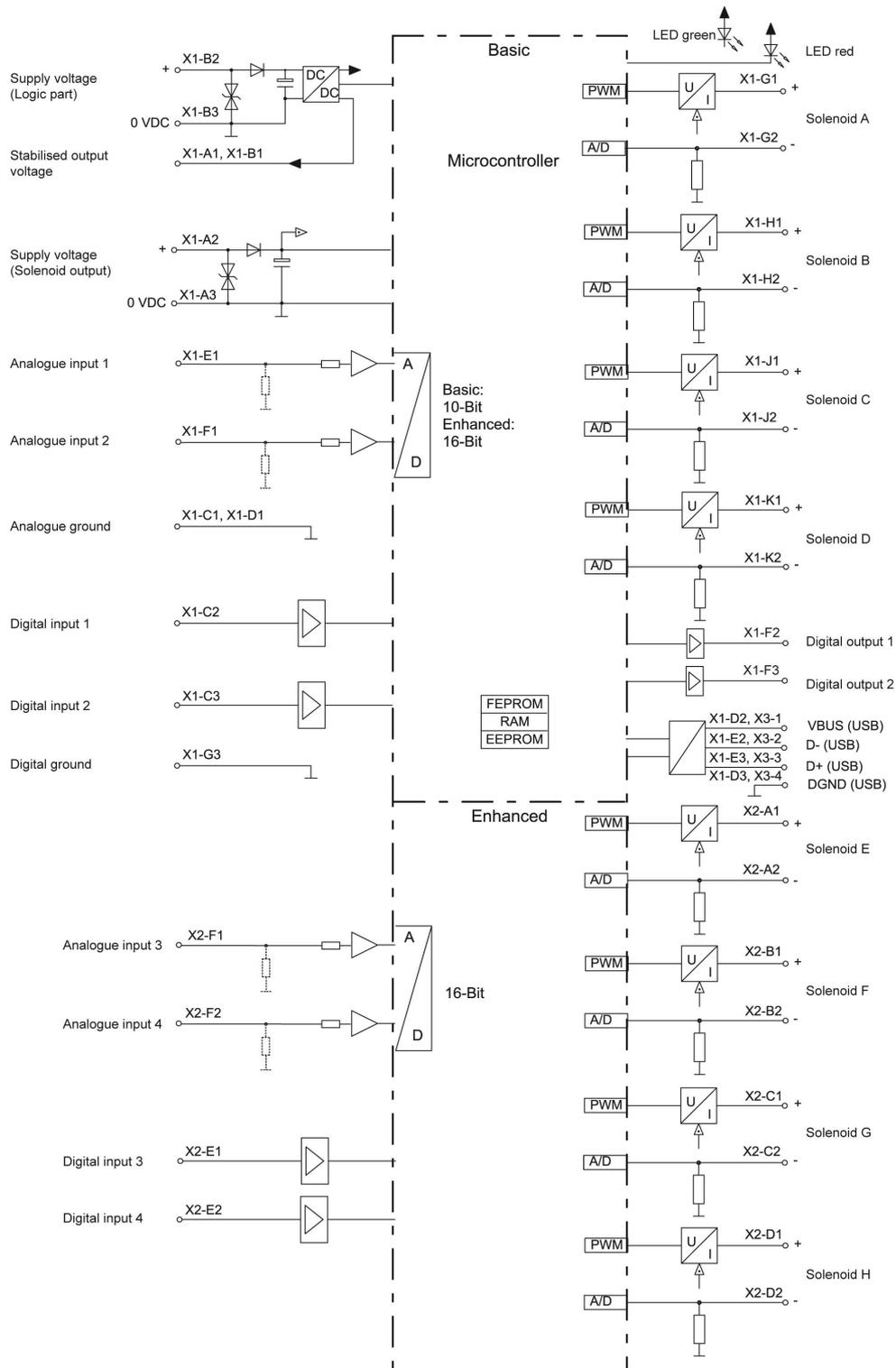


Examples:

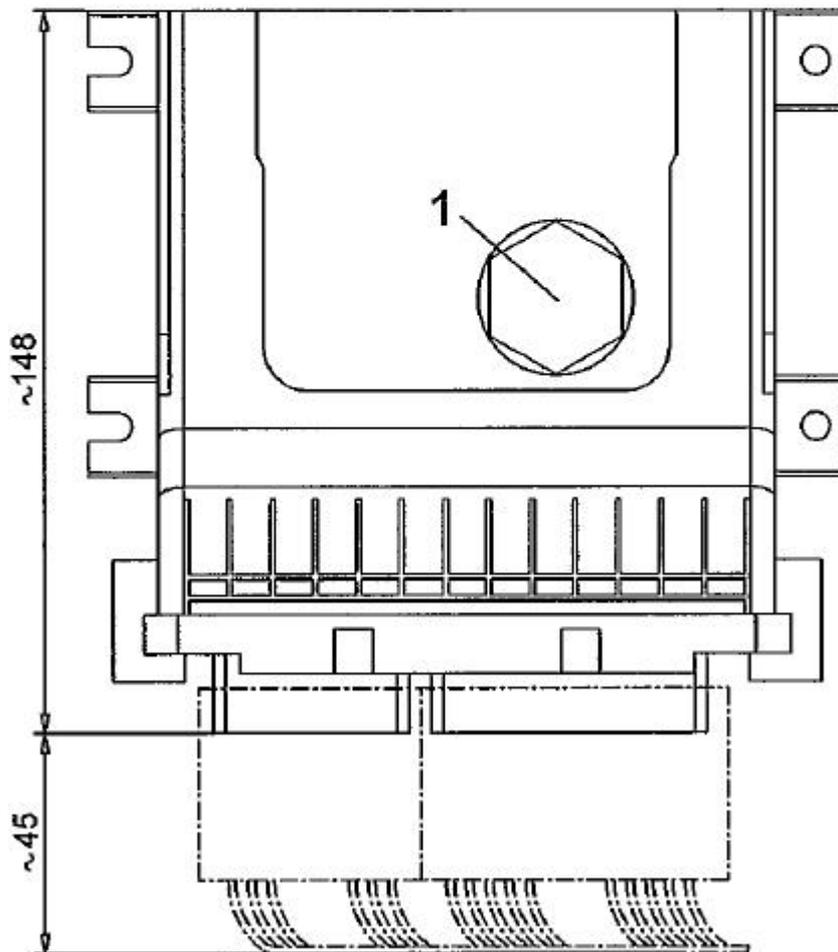
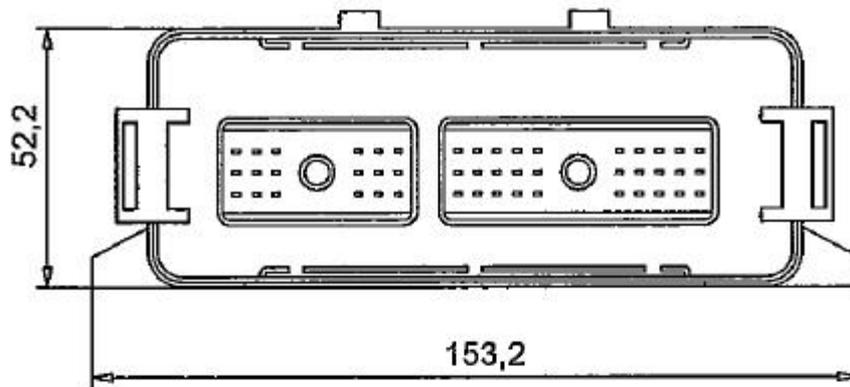
Ambient temperature:	40°C
Number of solenoids which can be constantly driven by 0.8A:	8
Number of solenoids which can be constantly driven by 1A:	8
Number of solenoids which can be constantly driven by 1.5A:	4
Number of solenoids which can be constantly driven by 2A:	3

Ambient temperature:	60°C
Number of solenoids which can be constantly driven by 0.8A:	8
Number of solenoids which can be constantly driven by 1A:	5
Number of solenoids which can be constantly driven by 1.5A:	2
Number of solenoids which can be constantly driven by 2A:	2

2.7 Block diagram



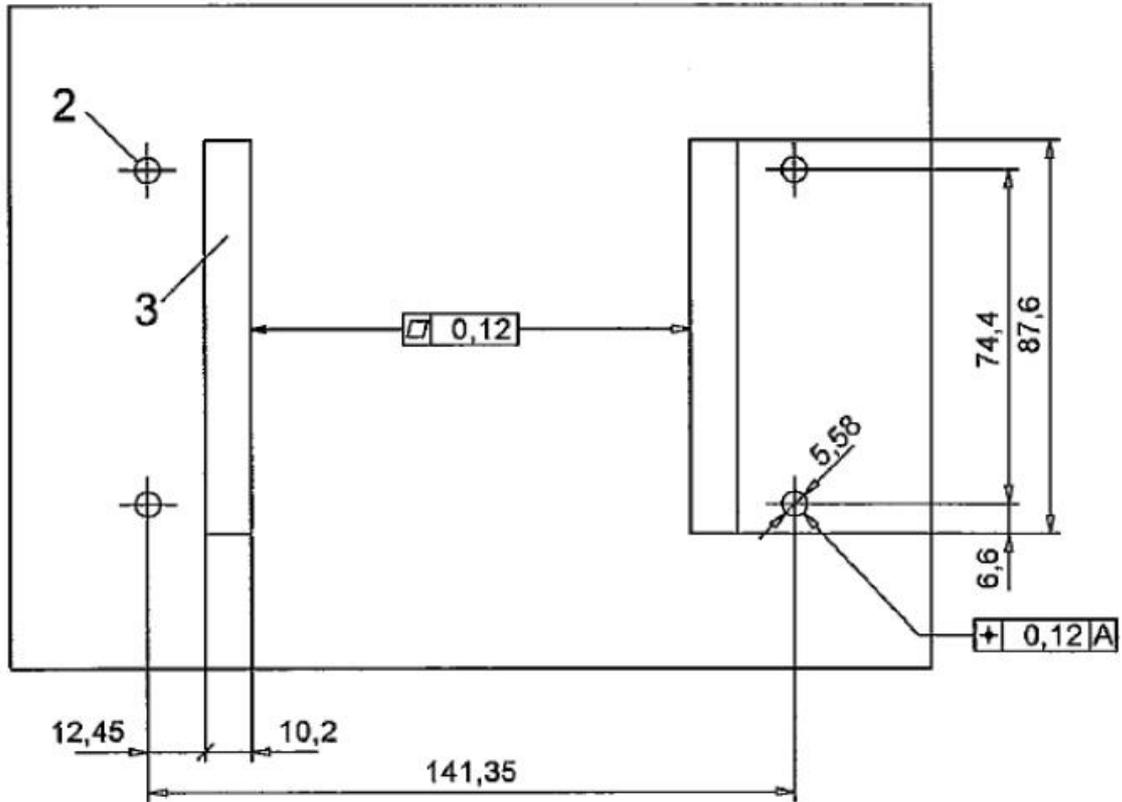
2.8 Dimensions



1: Transparent plastic screw cap for access to the USB interface. The green and red LED are visible without removing the transparent plastic screw cap.

2.9 Installation

Regarding heat abstraction the MD2 electronics has to be installed on a metallic surface.



- 2: Installing holes
- 3: Contact surface for heat sink

3 Safety rules

3.1 Installation / Commissioning / Parameterisation

- These operating instructions have to be carefully studied beforehand and the instructions are to be complied with.
- Prior to the installation, all power supply voltages and any other energy sources have to be disconnected.
- The installation/assembly must only be carried out by specialist personnel with electrical knowledge.
- Take into account precautionary measures concerning components on the module, which are subject to damage as a result of electrostatic discharge.
- Wrong manipulations by the personnel cannot be prevented by the MD2-Electronics.
- Before the switching on of the supply voltage, the fuse protection, the correct wiring and the conformity of the power supply voltage with the permissible supply voltage range have to be verified.



- **The MD2-Electronics monitors the working conditions within the electronics and within the installation. Uncontrolled movements or force changes caused by unforeseen errors of the MD2-Electronics cannot be prevented in any case.**
- **Danger for persons has to be avoided by installing an emergency stop device which cuts off the power to the system.**

4 Construction and Function

Refer to section ["Block diagram"](#) ⁽⁹⁾.

4.1 Introduction

- All inputs and outputs have to be contacted through the connector type SHS
- Under the plastic screw cap, there is a USB port. Through this port, the parameterisation and diagnosis can be made with the PC-Parameterisation software PASO MD2.
- In the factory, the MD2-Electronics are adjusted with the default values. The adjustment to the valves being used, has to be performed by the user.
- Wandfluh can create application specific parameters files in accordance to customer wish.

4.2 Description of the Function

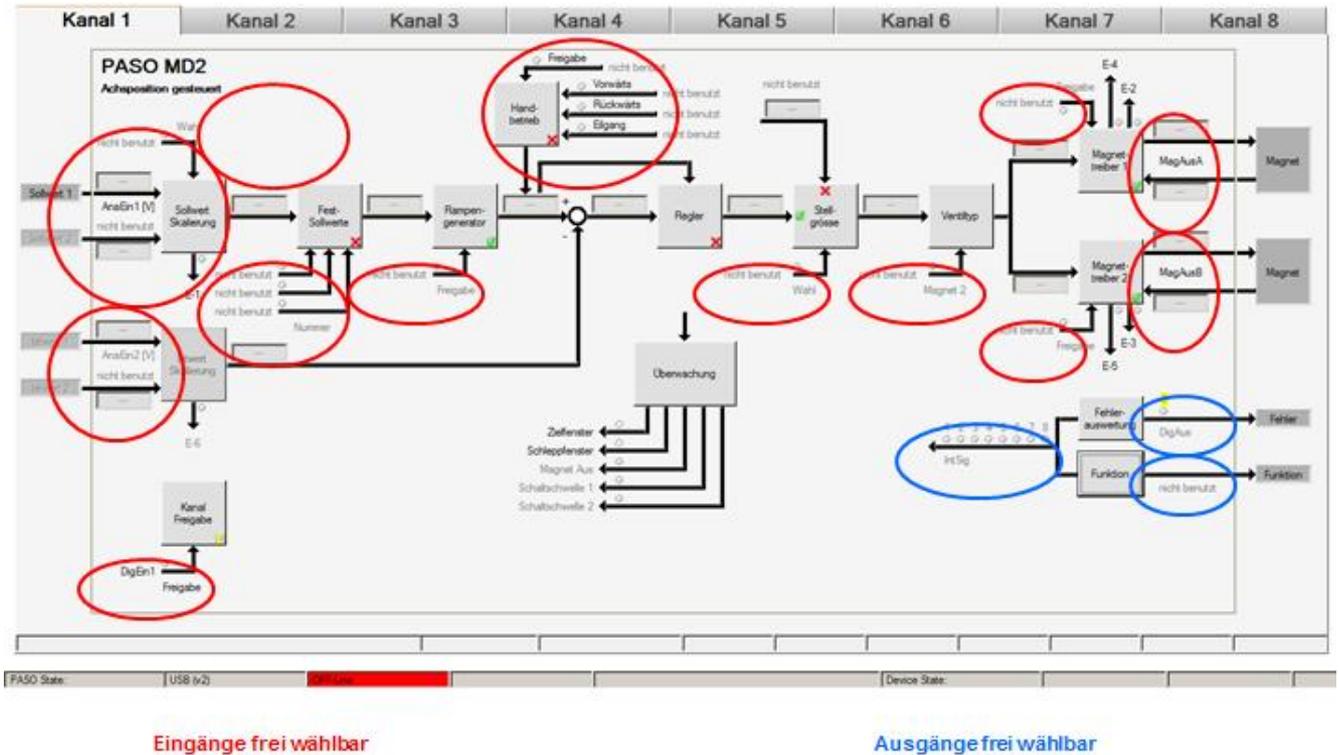
The MD2-Electronics has four (Basic controller) or eight (Enhanced controller) channels. Two (Basic controller) or four (Enhanced controller) of them can be used as closed-loop systems. The not for closed-loop system used channels can be used as open-loop channels.

Each channel has a command value input and one or two solenoid outputs. The adjustable parameters are organized in function blocks, which are displayed in PASO as small boxes. The following settings can be made per channel in these function blocks:

- | | |
|-----------------------|---|
| - Enable channel | (refer to section "Enable channel" ⁽⁴⁴⁾) |
| - Command scaling | (refer to section "Command scaling" ⁽⁴⁵⁾) |
| - Command value fixed | (refer to section "Command value fixed" ⁽⁴⁹⁾) |
| - Ramp generator | (refer to section "Ramp generator" ⁽⁵¹⁾) |
| - Manual operation | (refer to section "Manual operation" ⁽⁵³⁾ , only Enhanced version) |
| - Feedback scaling | (refer to section "Feedback scaling" ⁽⁵⁴⁾) |
| - Monitoring | (refer to section "Monitoring" ⁽⁵⁸⁾) |
| - Controller | (refer to section "Controller" ⁽⁶⁴⁾) |
| - Control value | (refer to section "Control value" ⁽⁶⁸⁾) |
| - Valve type | (refer to section "Valve type" ⁽⁷¹⁾) |
| - Solenoid driver | (refer to section "Solenoid driver" ⁽⁷²⁾) |
| - Error evaluation | (refer to section "Error evaluation" ⁽⁷⁶⁾) |
| - Function | (refer to section "Function" ⁽⁷⁷⁾) |

Each channel is independent. Only the limits by the hardware are to be considered. For example, the basic version has only four solenoid outputs. Therefore, it's not possible to operate four channels with each two solenoids. In this case the maximum is at 4 channels with 1 solenoid output per channel or 2 channels with 2 solenoid outputs per channel. The parameterisation software PASO automatically detects how many solenoids can be selected with the current settings.

The assignment of the analog and digital in- and outputs can freely be made by the user. Regarding inputs it is also possible to adjust a multiple allocation. That means digital and analogue inputs can be allocated to multiple channels (refer to section ["Assignment of the inputs/outputs"](#) ⁽³²⁾). Digital in- and outputs which are set or reset by software (refer to section ["Configuration - Digital E/A"](#) ⁽⁸¹⁾) will be displayed with blue text color in the main window.



The command value can be a voltage-, a current-, a frequency- or a PWM-signal. the signals are individually adjustable.

The solenoid outputs includes a **pulse-width-modulated** current control with superimposed dither signal. These outputs can control either proportional or switching solenoids (for exceptions see section ["Controller"](#)^[64]). The current measurement can be switched on or off. The minimal and maximal solenoid currents or pulse widths can be adjusted separately. When using switching solenoids a fully adjustable power reduction function is available.

Parameters are set by means of the parameterising software PASO. Changed parameters are stored in a non-volatile memory in order to have them available after the MD2-Electronics have been switched on again. The parameterising software PASO provides to save the settings an values of the parameter in a file, which always allows to do a download or an analysis.

Some function blocks are able to generate error messages. The function block "Error evaluation" (refer to section ["Error evaluation"](#)^[76]) picks up all error messages. This function block manages the error handling of the MD2 electronics.

The process data can be displayed online (refer to section ["Analysis Show values"](#)^[92]). This helps in case of support and diagnostics.

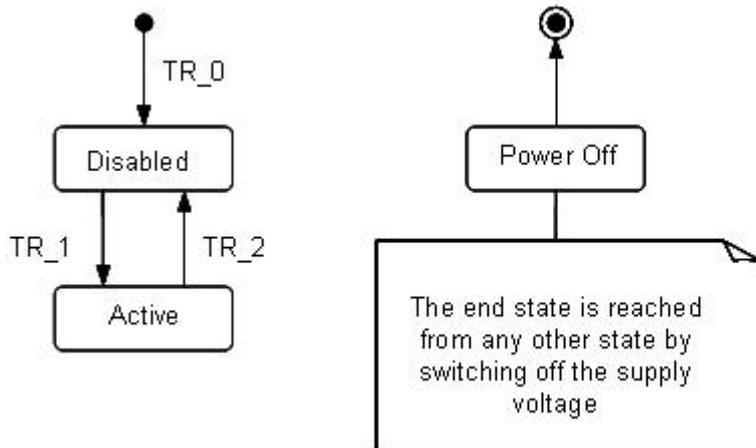
4.3 Characteristic optimisation

The MD2 electronics are provided with a possibility to optimise the characteristic "Preset value input – solenoid current output". The user is able to create a characteristic (e.g. a linearised characteristic) which matches his own application. The characteristic optimisation can be turned on or off (refer to ["Parameters Valves"](#)^[72]).

4.4 MD2 State machine

In the following, with the help of a status diagram it is described, how the start-up of the MD2-Electronics takes place and which statuses are reached when and how.

Important: Each channel has its own state machine. The states of each channel can be set separately.



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

Status	Description
Disabled	<ul style="list-style-type: none"> The assigned channel of the MD2-Electronics is disabled, no solenoid current will be active In this status, with the command "Operation mode" (refer to section "Commands_Valve operation"^[85^b]) the operating mode can be set
Active	<ul style="list-style-type: none"> The assigned channel of the MD2-Electronics is enabled The assigned channel of the MD2-Electronics can be operated according to the selected operating mode Changing the operating mode is not possible

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

Transition	Description
TR_0	Switching-on the supply voltage
TR_1	Enable This is made in the operating mode "Local" through the function "Enable Channel" (refer to section "Enable channel" ^[44^b]) and in the operating mode "Remote PASO" through the parameter "Control mode" (refer to section "Commands_Valve operation" ^[85^b]).
TR_2	Disable This is made in the operating mode "Local" through the function "Enable Channel" (refer to section "Enable channel" ^[44^b]) and in the operating mode "Remote PASO" through the parameter "Control mode" (refer to section "Commands_Valve operation" ^[85^b]).

4.5 Operating mode

The MD2-Electronics have 2 operating modes. The following table describes, what can be done in the different operating modes and how they can be activated:

Operating mode	Activating with	Description
Local	Menu point "Commands_Local Operating"	Operating via analogue and digital inputs on the MD2-Electronics
Remote PASO	Menu point "Commands_PASO Operating"	Operating direct with the PASO

The current operating mode is displayed in the status line (refer to section ["Starting of PASO MD2"](#)^[106]). For more information about the operating mode "Local" and "Remote", please refer to section ["Commands_Local Operating / PASO"](#)^[85].

4.6 Analogue inputs

- The applied analogue signals are digitised in the 10Bit A/D converter (Basic version), respectively in the 16Bit A/D converter (Enhanced version)

Attention: By the input range 4 ... 20mA, the resolution is < 10Bit!

MD2-Type	Analogue input 1	Analogue input 2	Analogue input 3	Analogue input 4
MD2304D81-A	voltage	voltage		
MD2304D82-A	current	current		
MD2358D81-A	voltage	voltage	voltage	voltage
MD2358D82-A	current	current	current	current

The assignment of the analog inputs to the corresponding channel is free to choose (refer to section ["Assignment of the inputs/outputs"](#)^[32]).

If a potentiometer is connected, a value of 10kOhm is recommended.

4.7 Cablebreak detection

The command resp. feedback value input can be detected for a cablebreak (only if Signal type = Voltage, Current, Frequency or PWM). Therefore, a lower and an upper cablebreak limit can be adjusted in the box [Command scaling](#)^[45] resp. [Feedback scaling](#)^[54]. A cablebreak is detected, if the input signal is smaller than the lower cablebreak limit or higher than the upper cablebreak limit.

If an cablebreak is detected, the internal error "E-1" (for command value) resp. "E-6 (for feedback value) is active (refer to section ["Error evaluation"](#)^[76]).

The following conditions had to be performed:

- The parameter "Signal type" must be on "Voltage", "Current", "Frequency" or "PWM" (refer to section ["Command scaling"](#)^[45] resp. ["Feedback scaling"](#)^[54])
- The parameter "Cablebreak" must be on "On" (refer to section ["Command scaling"](#)^[45] resp. ["Feedback scaling"](#)^[54])
- The parameters "Lower cablebreak limit" and "Upper cablebreak limit" must be adjusted (refer to section ["Command scaling"](#)^[45] resp. ["Feedback scaling"](#)^[54])
- An action must be assigned to the error "E-1" (refer to section ["Error evaluation"](#)^[76])



Attention: Until a cablebreak will be detected, a time delay of about 100ms will pass. During this time, the cylinder can make unintentional movements or unintentional force changes

4.8 Digital inputs

The function of the digital inputs and the assignment to the corresponding channel is free to choose (refer to section ["Assignment of the inputs/outputs"](#)^[32]).

4.9 Outputs

- **Proportional solenoid outputs A - D (Basic version) resp. A - H (Enhanced version)**

The solenoid outputs have a current output pulse-width-modulated at 1000Hz with superimposed dither. The current measurement can be switched on or off.

The assignment to the corresponding channel is free to choose (refer to section ["Assignment of the inputs/outputs"](#)^[32]).

- **Digital outputs**

The MD2-Electronics has two digital outputs. The function of the digital outputs and the assignment to the corresponding channel is free to choose (refer to section ["Assignment of the inputs/outputs"](#)^[32]) or can be set fixed on 0 or 1 with the PASO MD2 (refer to section ["Configuration Digital I/O"](#)^[32]).

4.10 Internal signals

Internal signals can be selected instead of digital inputs or outputs. They are not guided to the outside, they are processed only internally.

This allows e.g. to link a digital output to a digital input without an external connection.

4.11 controller modes

The selection of the mode of operation is made in the box ["Controller"](#)^[71].

The MD2 Basic controller provides the following controller modes:

Controller mode	Channel			
	no 1	no 2	no 3	no 4
Controller mode 1 "Spool valve open loop"	X	X	X	X
Controller mode 3 "Pressure/flow valve open loop"	X	X	X	X
Controller mode 4 "Pressure/flow valve closed loop (1-sol)"	X	X		
Controller mode -5 "Pressure control closed loop (2-sol)"	X	X		
Controller mode 6 "Position open loop"	X	X	X	X
Controller mode 9 "Position closed loop (2-sol)"	X	X		
Controller mode 7 "Speed control closed loop (2-sol)"	X	X		
Controller mode -6 "2-point controller (1-sol)"	X	X		
Controller mode -7 "2-point controller (2-sol)"	X	X		
Controller mode -8 "3-point controller (2-sol)"	X	X		

The MD2 Enhanced controller provides the following controller modes:

Reglermodi	Channel no 1	Channel no 2	Channel no 3	Channel no 4	Channel no 5	Channel no 6	Channel no 7	Channel no 8
Controller mode 1 "Spool valve open loop"	X	X	X	X	X	X	X	X
Controller mode 3 "Pressure/flow valve open loop"	X	X	X	X	X	X	X	X
Controller mode 4 "Pressure/flow valve closed loop (1-sol)"	X	X	X	X				
Controller mode -5 "Pressure control closed loop (2-sol)"	X	X	X	X	X	X	X	X
Controller mode 6 "Position open loop"	X	X	X	X				
Controller mode 9 "Position closed loop (2-sol)"	X	X	X	X				
Controller mode 7 "Speed control closed loop (2-sol)"	X	X	X	X				
Controller mode -6 "2-point controller (1-sol)"	X	X	X	X				
Controller mode -7 "2-point controller (2-sol)"	X	X	X	X				
Controller mode -8 "3-point controller (2-sol)"	X	X	X	X				

Multiple controller modes can be linked together using the function Control value (refer to section "[Control value](#)" ^[68]). Thereby it is possible to build e.g. a pQ-Controller or an Alternating control. For more details please refer to the document "Applications examples for Wandfluh Electronics cards".

- **Controller mode 1 "Spool valve open loop"**

Control of a spool valve in open loop (without feedback signal). The number of solenoids, which are activated, depends on the selected mode of operation (refer to section "[Mode of operation](#)" ^[23]).

This mode of operation corresponds to the "Device Control Mode = 1" of the fieldbus device profile Fluid Power Technology.

- **Controller mode 3 "Pressure/flow valve open loop"**

Control of a pressure relief-, pressure reducing- or flow control valve in open loop (without feedback signal). The number of solenoids, which are activated, depends on the selected mode of operation (refer to section "[Mode of operation](#)" ^[23]).

This mode of operation corresponds to the "Device Control Mode = 3" of the fieldbus device profile Fluid Power Technology.

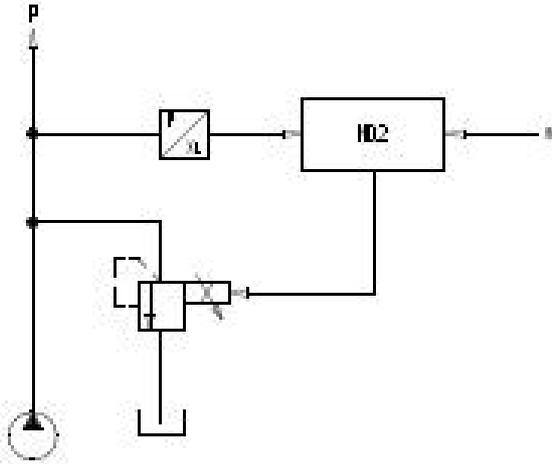
• **Controller mode 4 "Pressure/flow valve closed loop (1-sol)"**

Control of a 1-solenoid pressure relief-, pressure reducing- or flow control valve in closed loop (with feedback signal). It can only be activated one solenoid (correspond to solenoid driver 1).

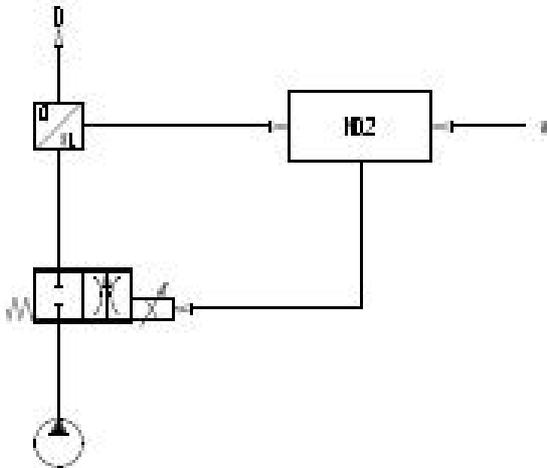
In this controller mode, the parameter "Mode of operation" has no meaning (refer to section ["Mode of Operation"](#) ²³).

This mode of operation corresponds to the "Device Control Mode = 4" of the fieldbus device profile Fluid Power Technology.

Example Application: Pressure Control: with one proportional pressure relief valve, the pressure p is held constant to the command pressure value w .



Example Application: Flow Control: with one proportional throttle valve, the flow Q is held constant to the flow command value w .

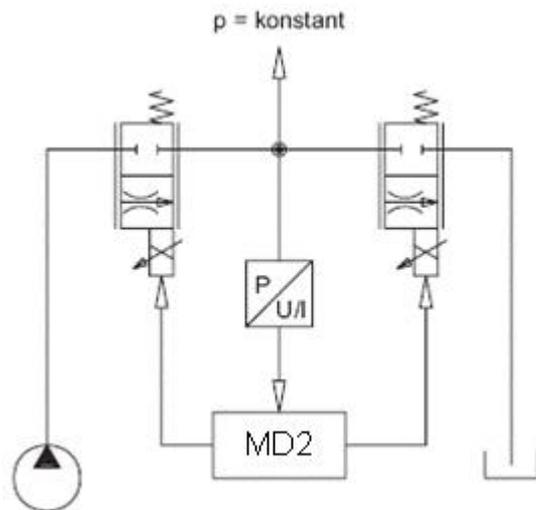


- **Controller mode –5 "Pressure control closed loop (2-sol)"**

Control of two 1-solenoid throttle valves in closed loop (with feedback signal) as a pressure reducing system. One throttle valve is the loading valve, the other throttle valve is the unloading valve. The loading valve corresponds to solenoid driver 1, the unloading valve to the solenoid driver 2.

In this controller mode, the parameter "Mode of operation" has no meaning (refer to section ["Mode of Operation"](#) ^[23]).

This controller mode is a WANDFLUH specific controller mode and does not correspond to the fieldbus device profile Fluid Power Technology.



- **Controller mode 6 "Position open loop"**

Control of a spool valve in open loop (without feedback signal).

The number of solenoids, which are activated, depends on the selected mode of operation (refer to section ["Mode of operation"](#) ^[23]).

This mode of operation corresponds to the "Device Control Mode = 6" of the fieldbus device profile Fluid Power Technology.

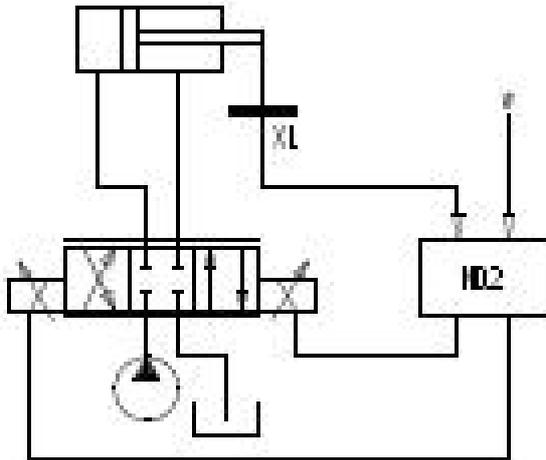
- **Controller mode 9 "Position closed loop"**

Control of a 2-solenoid spool valve in closed loop (with feedback signal). It can be activated two solenoids.

In this controller mode, the parameter "Mode of operation" has no meaning (refer to section ["Mode of Operation"](#) ²³).

This mode of operation corresponds to the "Device Control Mode = 9" of the fieldbus device profile Fluid Power Technology.

Example application: with a 4/3-proportional-spool valve, the axis position is held constant to the command position value w .



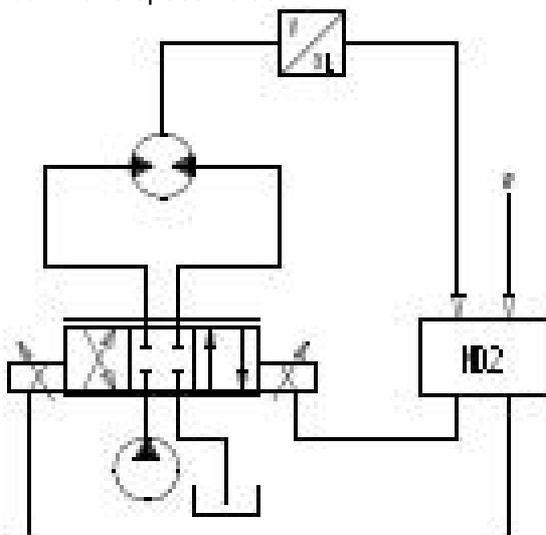
- **Controller mode 7 "Speed control closed loop (2-sol)"**

Control of a 2-solenoid pressure relief-, pressure reducing- or flow control valve in closed loop (with feedback signal). It can be activated two solenoids.

In this controller mode, the parameter "Mode of operation" has no meaning (refer to section ["Mode of Operation"](#) ²³).

This mode of operation corresponds to the "Device Control Mode = 7" of the fieldbus device profile Fluid Power Technology.

Example application: with a 4/3-proportional-spool valve the speed of a hydraulic motor is held constant to the command speed value w .

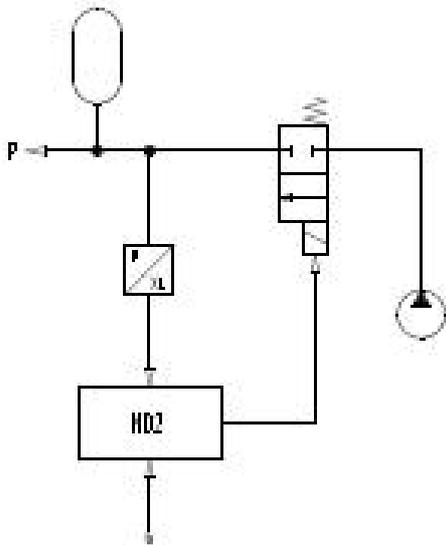


- **Controller mode –6 "2-point controller (1-sol)"**

Control of a 1-solenoid valve with a switching solenoid in closed loop (with feedback signal). It can only be activated one solenoid (correspond to solenoid driver 1).

In this controller mode, the parameter "Mode of operation" has no meaning (refer to section ["Mode of Operation"](#)²³⁾). This controller mode is a WANDFLUH specific controller mode and does not correspond to the fieldbus device profile Fluid Power Technology.

Example Application: if the pressure p falls below the command pressure value w , then the accumulator is reloaded with the 2/2 spool valve.

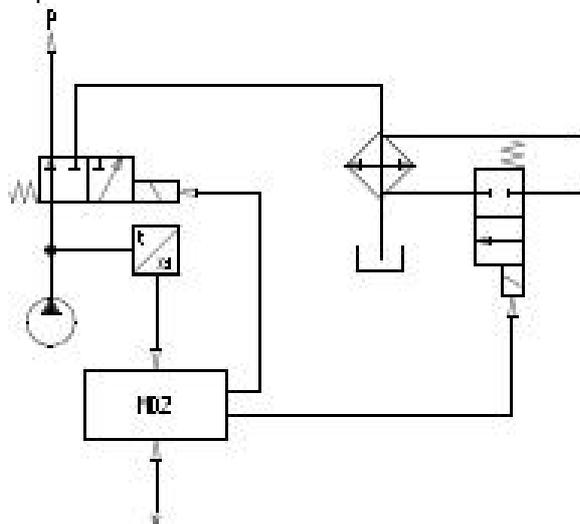


- **Controller mode –7 "2-point controller (2-sol)"**

Control of a 2-solenoid valve with switching solenoids resp. of two 1-solenoid valves with one switching solenoid each in closed loop (with feedback signal). It can be activated two solenoids.

In this controller mode, the parameter "Mode of operation" has no meaning (refer to section ["Mode of Operation"](#)²³⁾). This controller mode is a WANDFLUH specific controller mode and does not correspond to the fieldbus device profile Fluid Power Technology.

Example application: oil cooling: if the temperature of the oil exceeds the command temperature value, then the 3/2 spool valve is switched to the cooler, and simultaneously the cooling circuit is switched on with the 2/2 spool valve.



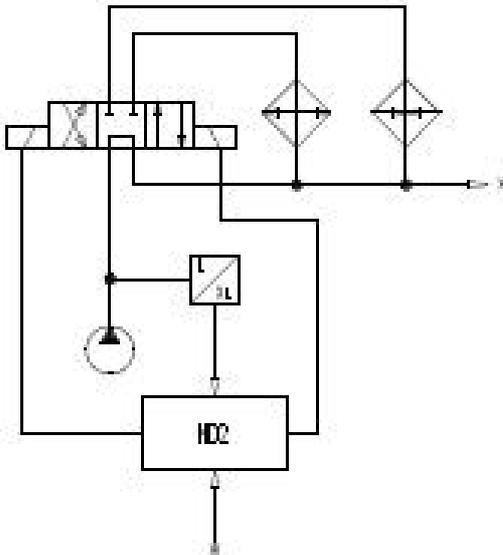
- **Controller mode –8 "3-point controller (2-sol)"**

Control of a 2-solenoid valve with switching solenoids resp. of two 1-solenoid valves with one switching solenoid each in closed loop (with feedback signal). It can be activated two solenoids.

In this controller mode, the parameter "Mode of operation" has no meaning (refer to section ["Mode of Operation"](#) ^[23]).

This controller mode is a WANDFLUH specific controller mode and does not correspond to the fieldbus device profile Fluid Power Technology.

Example application: oil temperature control: if the feedback oil temperature is equal to the command temperature value, the 4/3 spool valve remains in zero position. If the feedback oil temperature exceeds the command value, the 4/3 spool valve is switched to the cooler. If the feedback oil temperature drops below the command value, the 4/3 spool valve is switched to the heater.



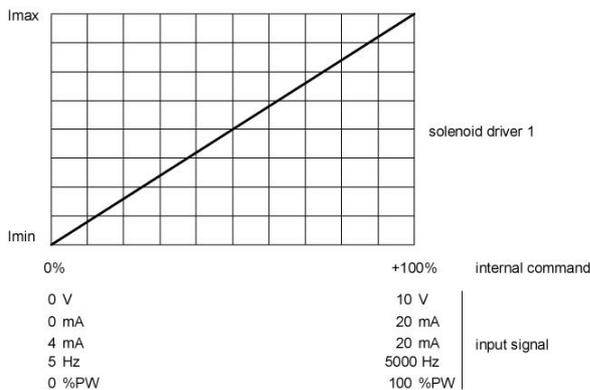
4.12 Mode of operation

The mode of operation can be set independently for each channel with the controller mode "Pressure/flow valve open loop" and "Position open loop". For all other controller modes, the mode of operation has no influence.

- **Mode of operation "Command unipolar (1-sol)"**

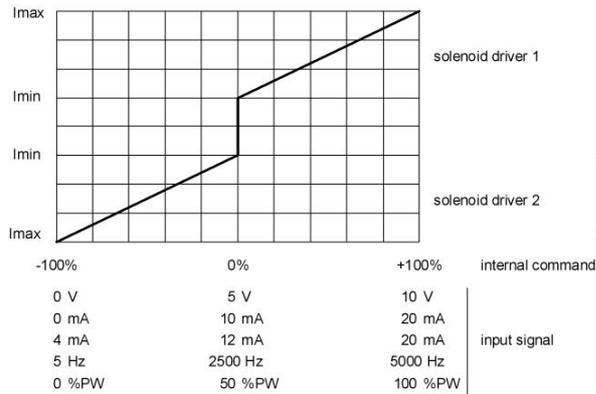
This Mode of operation is only possible, if the valve type is set to "Standard 2-solenoid" (refer to section ["Valve type"](#) ^[71]).

With an input signal 0 ... 100% an internal command from 0 ... 100% is generated.

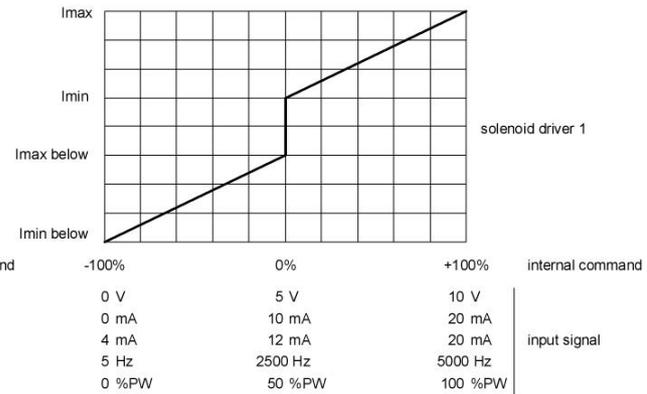


- **Mode of operation "Command unipolar (2-sol)"**

With an input signal 0 ... 100% an internal command from -100 ... +100% is generated.



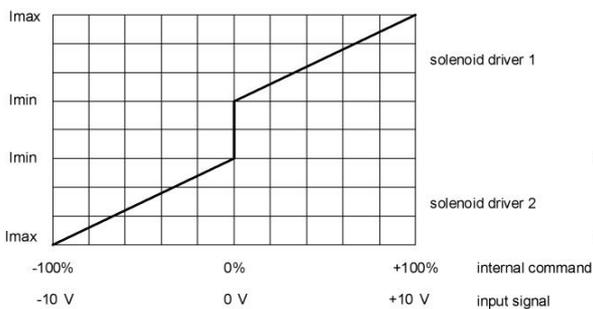
Valve type = Standard 2-solenoid



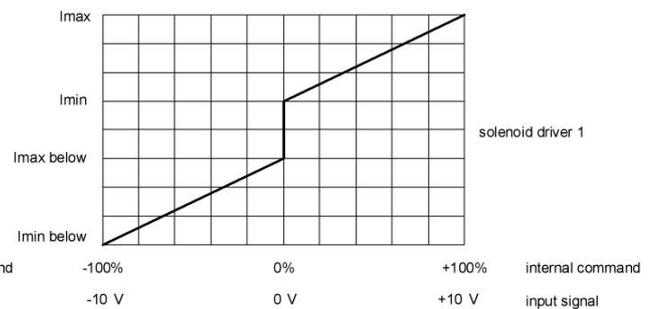
Valve type = 4/3-Wege 1-solenoid

- **Mode of operation "Command bipolar (2-sol)"**

With an input signal -100 ... 100% an internal command from -100 ... +100% is generated.



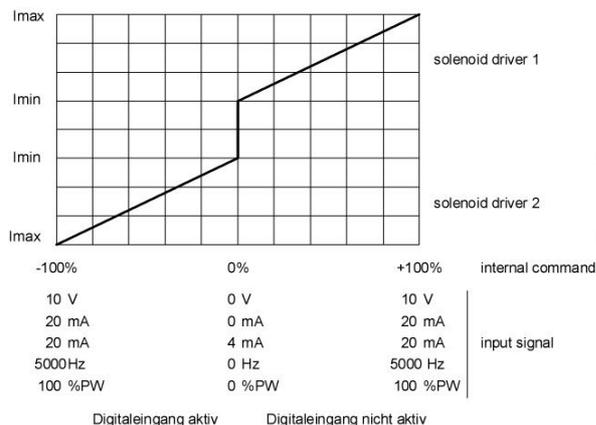
Valve type = Standard 2-solenoid



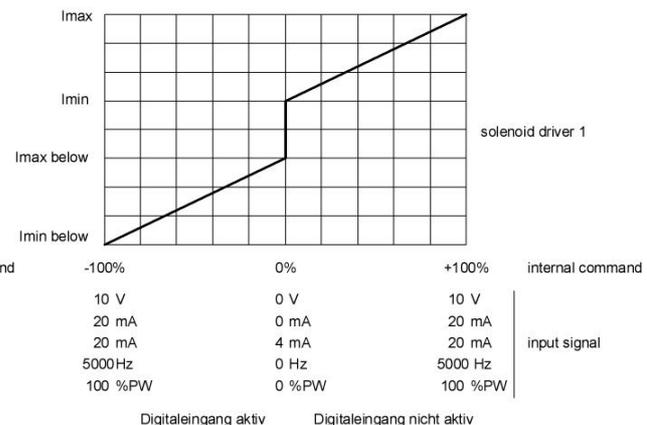
Valve type = 4/3-Wege 1-solenoid

- **Mode of operation "Command unipolar (2-sol mit DigInp)"**

With an input signal 0 ... +100% an internal command from 0 ... +100% (digital input not active) resp. 0 ... -100% (digital input active) is generated.



Valve type = Standard 2-solenoid



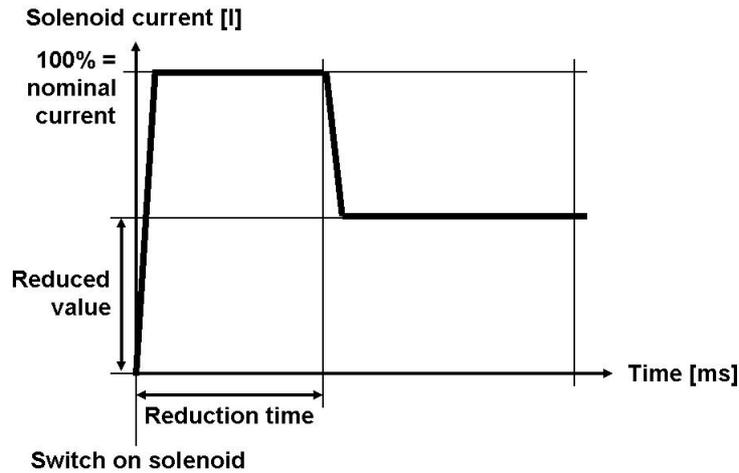
Valve type = 4/3-Wege 1-solenoid

The selection of the mode of operation is made in the box ["Valve type"](#) 

4.13 Power reduction

The power reduction can be switched on with solenoid type "Switching solenoid without current measuring".

Once the solenoid has switch on, the full solenoid current (= nominal current of the solenoid) passes through during the adjusted time (Parameter "Reduction time"). Thereafter, the current is limited to the reduced value (Parameter "Reduced value"). The reduced value refers to the nominal current of the solenoid (100% = nominal current, 50% = half nominal current).

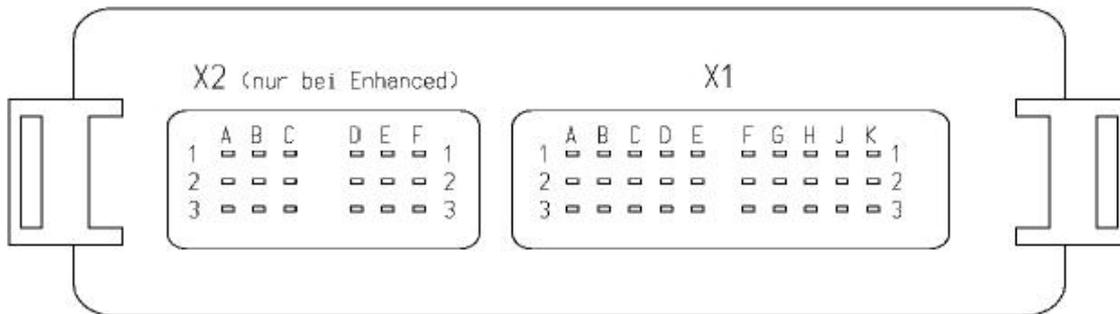


5 Operating and indicating elements

5.1 General

- All inputs and outputs have to be contacted through the connector type SHS
- Under the plastic screw cap, there is a USB port. Through this port, the parameterisation and diagnosis can be made with the PC-Parameterisation software PASO MD2
- The green and red LED are visible without removing the plastic screw cap

5.2 Connector view



Device plus X2
(only Enhanced-Verstärker)

A1 = Output solenoid E +
 A2 = Output solenoid E -
 A3 = Reserved
 B1 = Output solenoid F +
 B2 = Output solenoid F -
 B3 = Reserved
 C1 = Output solenoid G +
 C2 = Output solenoid G -
 C3 = Reserved
 D1 = Output solenoid H +
 D2 = Output solenoid H -
 D3 = Reserved
 E1 = Digital input 3
 E2 = Digital input 4
 E3 = Reserved
 F1 = Analogue input 3
 F2 = Analogue input 4
 F3 = Reserved

Device plus X1

A1 = Stabilised output voltage
 A2 = Supply voltage + (Solenoid outputs)
 A3 = Supply voltage 0 VDC (Solenoid outputs)
 B1 = Stabilised output voltage
 B2 = Supply voltage + (Logic part)
 B3 = Supply voltage 0 VDC (Logic part)
 C1 = Analogue ground
 C2 = Digital input 1
 C3 = Digital input 2
 D1 = Analogue ground
 D2 = VBUS (USB)
 D3 = GND (USB)
 E1 = Analogue input 1
 E2 = D- (USB)
 E3 = D+ (USB)
 F1 = Analogue input 2
 F2 = Digital output 1
 F3 = Digital output 2
 G1 = Output solenoid A +
 G2 = Output solenoid A -
 G3 = Reserved
 H1 = Output solenoid B +
 H2 = Output solenoid B -
 H3 = Reserved
 J1 = Output solenoid C +
 J2 = Output solenoid C -
 J3 = Reserved
 K1 = Output solenoid D +
 K2 = Output solenoid D -
 K3 = Reserved

The mating connectors are not included in the delivery.
 Refer to [Accessories](#) for additional information.

5.3 Control elements

5.3.1 LED

Under the transparent plastic screw cap are two LED's which are visible without removing the transparent plastic screw cap.

The SUPPLY-LED (Green) shows the operating state of the MD2-Electronics. The LED is on if the MD2-Electronics is ready.

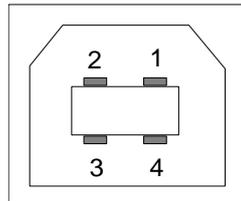
The SUPPLY-LED is blinking twice when the supply voltage of the solenoid outputs is too low (refer to Section ["Analysis Diagnostics"](#)^[97]).

The ERROR-LED (red) is on if an error occurs (refer to section ["System does not work"](#)^[101]). The error cause can be read out by PASO-Software.

5.3.2 USB-interface

The USB-interface is placed under the transparent plastic screw cap. It allows the parameterisation and the analysis of the MD2-electronics by PASO software. The connection to the PC is realised by standard USB-cables (USB Type A connector PC-side, USB Type B connector MD2-side).

View of the USB-interface:



Connector USB Type B

X2-1 = VBUS
X2-2 = D-
X2-3 = D+
X2-4 = GND

Hint: The USB-cable is not included.

6 Commissioning

Please refer to section "[Safety rules](#)" ^[12].

6.1 Connection instructions

The contact assignment of the following description refers to section "[Operating and Indicating elements](#)" ^[26] and to section "[Connection examples](#)" ^[30].

For an **installation / connection appropriate for EMC**, the following points absolutely have to be observed:

- Solenoid- and signal cables must not be laid parallel to high voltage cables.

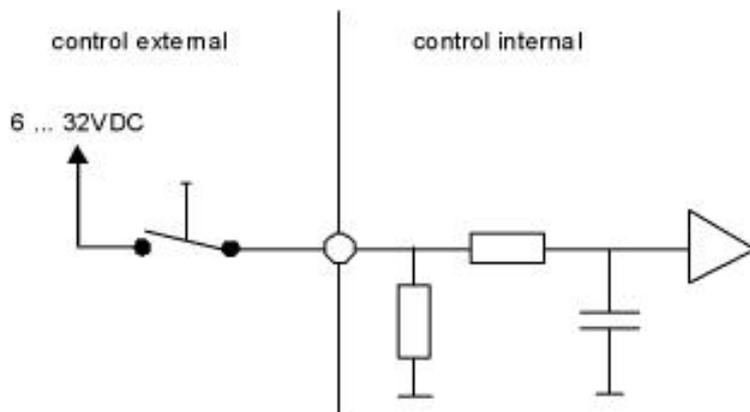
To deduce the heat, the MD2-Electronics must be mounted on a smooth metallic surface!

6.1.1 Supply voltage

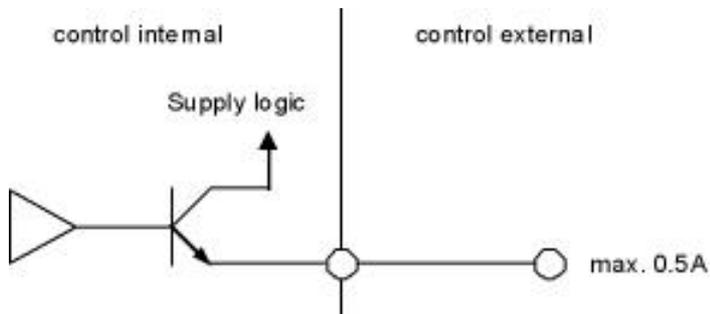
- For the dimensioning of the power supply, the maximum current demand of the solenoids has to be increased by the no load current from the MD2-Electronics (refer to section "[Electrical specifications](#)" ^[7]).
- The limit values of the supply voltage and its residual ripple indispensably have to be complied with (refer to section "[Electrical specifications](#)" ^[7]).
- The MD2-Electronics have to be protected with a slow acting fuse

6.1.2 Digital inputs and outputs

- The digital inputs are active-high and not galvanically separated
- For activation, they have to be connected to a voltage between 6 ... 32VDC (e.g. power supply)

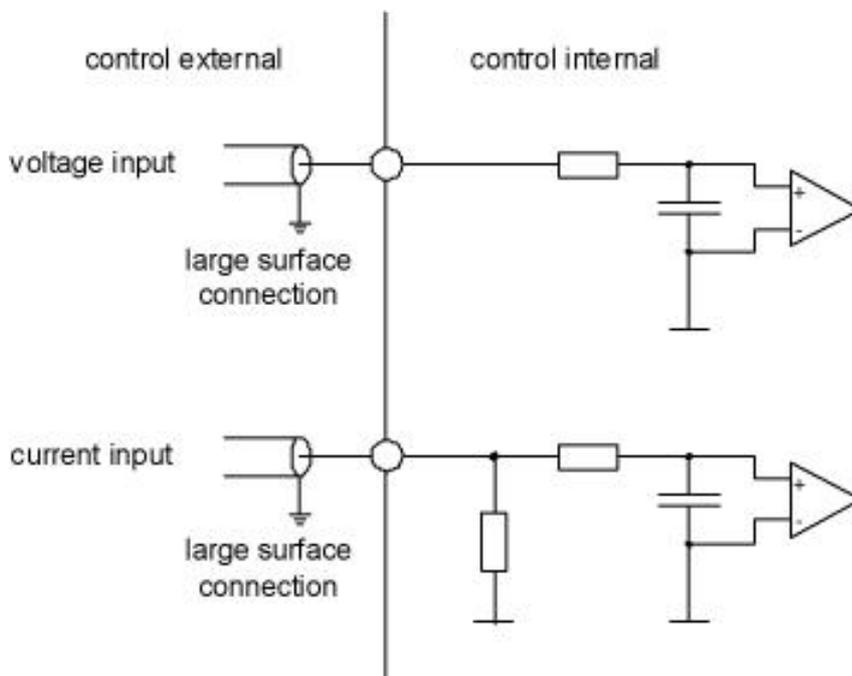


- The digital outputs are "High-Side Switch" outputs.



6.1.3 Analogue inputs

- The basic amplifier has 2 analog inputs with 10Bit resolution
- The enhanced amplifier has 4 analog input with 16bit resolution
- If a potentiometer is connected, a value of 10kOhm is recommended



6.1.4 Solenoid outputs

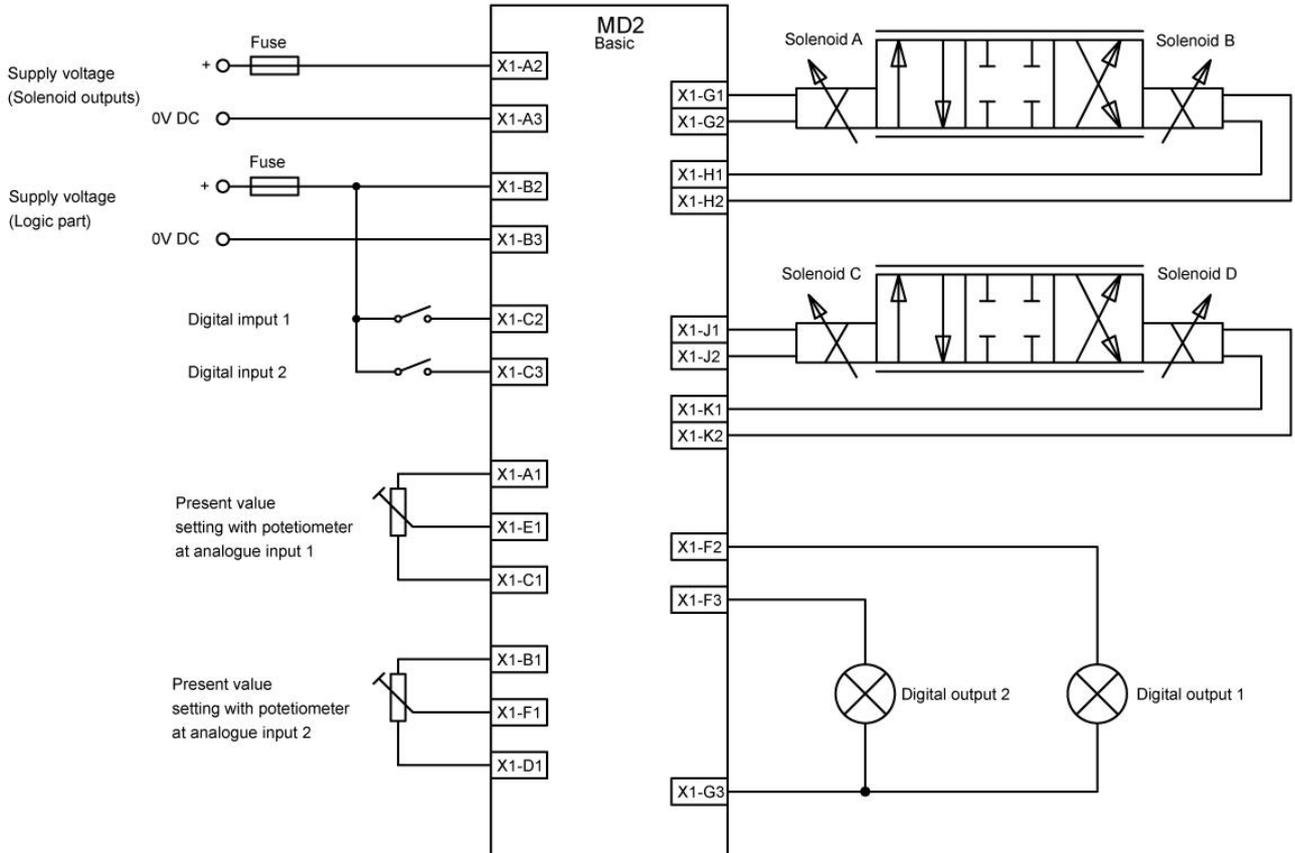
- The solenoid outputs are able to measure the solenoid current. This is necessary for controlling the solenoid current if the parameter "Solenoid type" is set to "Proportional solenoid with current measurement" (refer to section ["Valve type"](#)^[71]). In this case, the negative pole of the solenoid has to be connected to the appropriate negative pole of the solenoid output (for example "Output solenoid A -", refer to section ["Connector view"](#)^[26]).
- If the parameter "Solenoid type" is set to "Proportional solenoid without current measurement" or "Switching solenoid without current measurement" a current measurement is not necessary (refer to section ["Valve type"](#)^[71]). The negative pole of the solenoid can be connected directly to the 0VDC of the Supply Voltage (Solenoid Outputs).

6.2 Connection examples

The contact assignment of the following description refers to section ["Operating and Indicating elements"](#)²⁶.

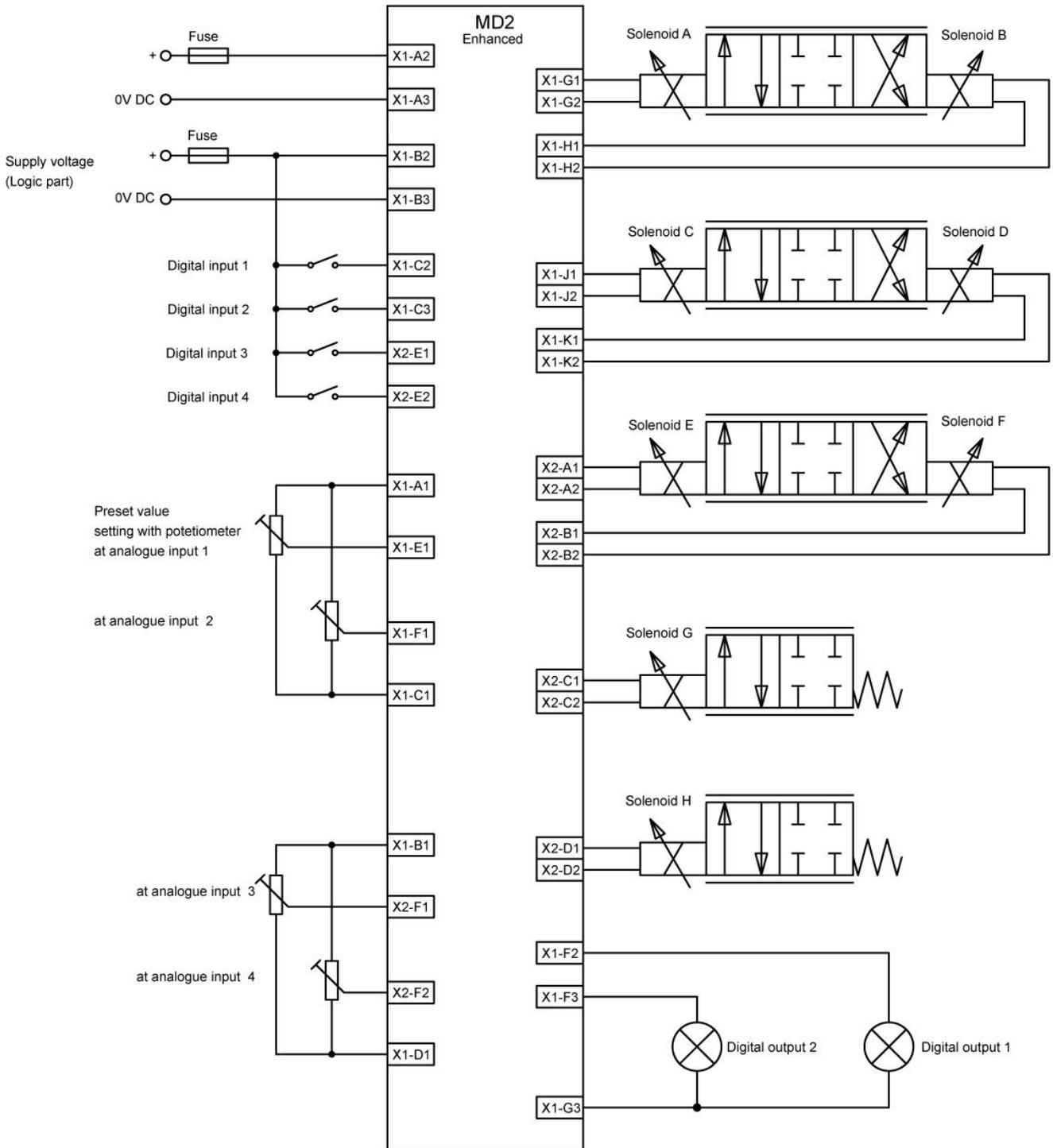
6.2.1 Basic Amplifier

All analogue inputs voltage



6.2.2 Enhanced Amplifier

All analogue inputs voltage



7 Settings

Please refer to section "[Safety rules](#)" ¹².

7.1 Introduction

- The system- and parameter settings can be made via the PC-Parameterisation software PASO MD2. The graphic view in PASO MD2 eases the handling.
- For information about the operation via the PC-Parameterisation software PASO MD2 please refer to section "[PASO MD2 Installation and Operation](#)" ¹⁰².
- Depending on the connected MD2-Electronics, certain settings may be blocked.

7.2 Assignment of the inputs/outputs

The allocation of inputs and outputs is not fixed. The user can choose itself which input and output is assigned to which function. The following selection is available:

Values in italic letters are only valid for the Enhanced version

Digital inputs	DigInp1	
	DigInp2	
	<i>DigInp3</i>	
	<i>DigInp4</i>	
	IntSig1	
	IntSig2	
	IntSig3	
	IntSig4	
	IntSig5	
	IntSig6	
	IntSig7	
	IntSig8	
	not used	
	Digital outputs	DigOut1
		DigOut2
		IntSig1
IntSig2		
IntSig3		
IntSig4		
IntSig5		
IntSig6		
IntSig7		
IntSig8		
not used		
Analog inputs	Analnp1	
	Analnp2	
	<i>Analnp3</i>	
	<i>Analnp4</i>	
	not used	
Solenoid outputs	SolOutA	
	SolOutB	
	SolOutC	
	SolOutD	
	<i>SolOutE</i>	
	<i>SolOutF</i>	
	<i>SolOutG</i>	
	<i>SolOutH</i>	
	not used	

The selection "not used" means that no input or output will be assigned.

The selection "IntSig1 ... IntSig8" means internal signals. This allows e.g. to link a digital output to a digital input without an external connection.

With the digital inputs, digital outputs, internal signals and analog inputs, a double allocation is allowed. For example, DigInp1 can be used for enable channel 1 and channel 2 at the same time. Inputs and outputs with a double allocation will be displayed with a yellow background.

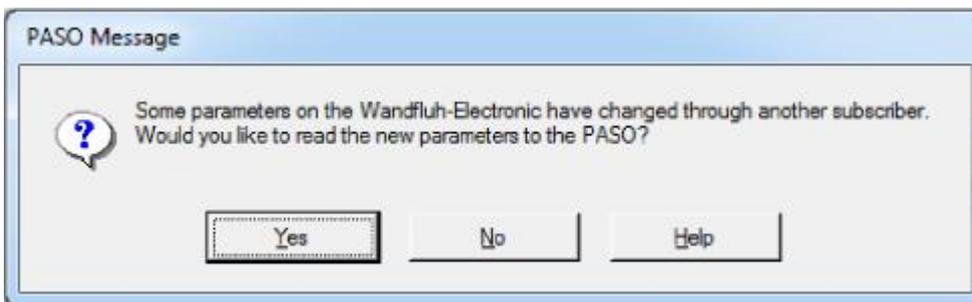
With the solenoid outputs, a double allocation is not allowed. If the selected solenoid outputs is already occupied, an error message appears.

Digital in- and outputs and internal signals which are set or reset by software (refer to section ["Configuration - Digital E/A"](#)⁽⁸¹⁾) will be displayed with blue text color in the main window.

7.3 Parameter inconsistency

The parameter settings can be made via the PC-Parameterisation software PASO MD2 or via the fieldbus (only if the MD2-Electronics has the fieldbus option). In any case, the current parameter values will be displayed in the PASO

If a parameter value will be changed through the fieldbus, this new value does not correspond with the displayed value in the PASO. In this case, the following message appears:



If the answer is "Yes", then the parameters will be read-in from the MD2-Electronics. Possible open parameter windows in the PASO will be closed automatically. If a parameter value will be changed through the manual operation terminal after the read-in of the new parameters, this message will appear again.

If the answer is "No", then the displayed parameter values in the PASO do not correspond to the current parameter value on the MD2-Electronics. This will be displayed in the status line in the field "Parameter inconsistency" (refer to section "Starting of PASO DSV/MD2"). If a parameter value will be changed through the manual operation terminal again, no further message will be appear in the PASO. But it's always possible to change also parameter values through the PASO.

7.4 Tips for the first commissioning

- Connect the power supply, leave the MD2-Electronics still switched-off
- Switch-off the hydraulic drive (hydraulics switched-off)
- Carefully check the connections
- Switch-on the power supply
- Establish communication with PASO (connect PC and axis controller with a standard USB cable and start PASO)
- Configure the MD2-Electronics specific to the installation. In doing so, the following sequence should be observed:
 1. Select the controller mode in the box "[Controller](#)" ^[64]
 2. Select the mode of operation and the solenoid type in the box "[Valve type](#)" ^[71]
 3. Make the corresponding settings in the box "[Command Scaling](#)" ^[45]
 4. Make the corresponding settings in the box "[Feedback Scaling](#)" ^[54]
 5. Make the corresponding settings in the box "[Fixed Command values](#)" ^[49]
 6. Make the corresponding settings in the box "[Ramp generator](#)" ^[51]
 7. Make the corresponding settings in the box "[Windows](#)" ^[58]
 8. Make the corresponding settings in the box "[Controller](#)" ^[64]
 9. Make the corresponding settings in the box "[Solenoid driver](#)" ^[72]
- Switch-on the hydraulic drive (hydraulics switched-on)

7.5 Scaling

The MD2-Controller has the possibility to display the command and feedback value with a selectable unit (e.g. mm or bar). For it, both signals must be scaled. This is made with the parameters in the box "[Command scaling](#)" ^[45] resp "[Feedback scaling](#)" ^[54].

In the following section you will find a detailed description about these parameters.

The scaling is defined by two points. These points are called scaling points (SP) in the following. A scaling point consists of an interface and a reference value. The interface value corresponds to the real signal value (e.g. in V or mA), the reference value corresponds to the real measured quantity (e.g. mm or bar). In the following examples, the measured quantity is a distance in mm.

It is advisable to select the two scaling points as far apart from one another as possible. Attention has to be paid, that Min. Reference always has to be smaller than Max. Reference.

The scaling depends on the selected controller mode:

2

This example shows an inversion of the input signal

Scaling point 1:	Min. Reference (fixed set)	=	-100% with mode of operation "Command unipolar (2-sol)" 0% for all other mode of operations
	Min. Interface	=	10V or 20mA
Scaling point 2:	Max. Reference (fixed set)	=	100% (fixed set)
	Max. Interface	=	0V or 0mA

3

This example shows a level adaption of the input signal

Scaling point 1:	Min. Reference (fixed set)	=	-100% with mode of operation "Command unipolar (2-sol)" 0% for all other mode of operations
	Min. Interface	=	2V or 4mA
Scaling point 2:	Max. Reference (fixed set)	=	100% (fixed set)
	Max. Interface	=	8V or 16mA

Controller mode = Closed Loop:

Command scaling:

With the command scaling, the desired working range can be adjusted. This may be less than the maximum possible working area.

1. Example:

The command value is a voltage signal (0 ... 10V). With 0V the position 0mm and with 10V the position 100mm should be approached.

Scaling point 1:	Min. Reference	=	0mm
	Min. Interface	=	0V
Scaling point 2:	Max. Reference	=	100mm
	Max. Interface	=	10V

2. Example

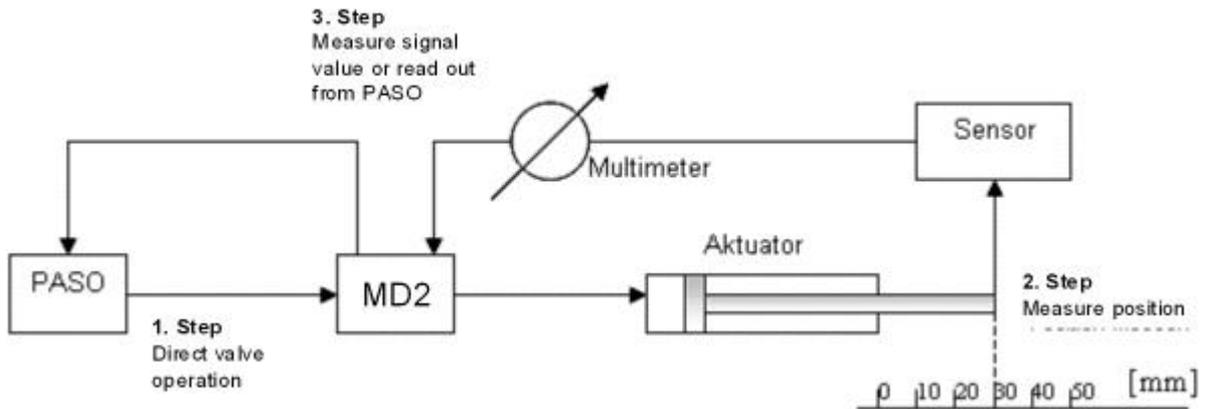
The command value is a current signal (4 ... 20mA). With 4mA the position 0mm and with 20mA the position 80mm should be approached.

Scaling point 1:	Min. Reference	=	0mm
	Min. Interface	=	4mA
Scaling point 2:	Max. Reference	=	80mm
	Max. Interface	=	20mA

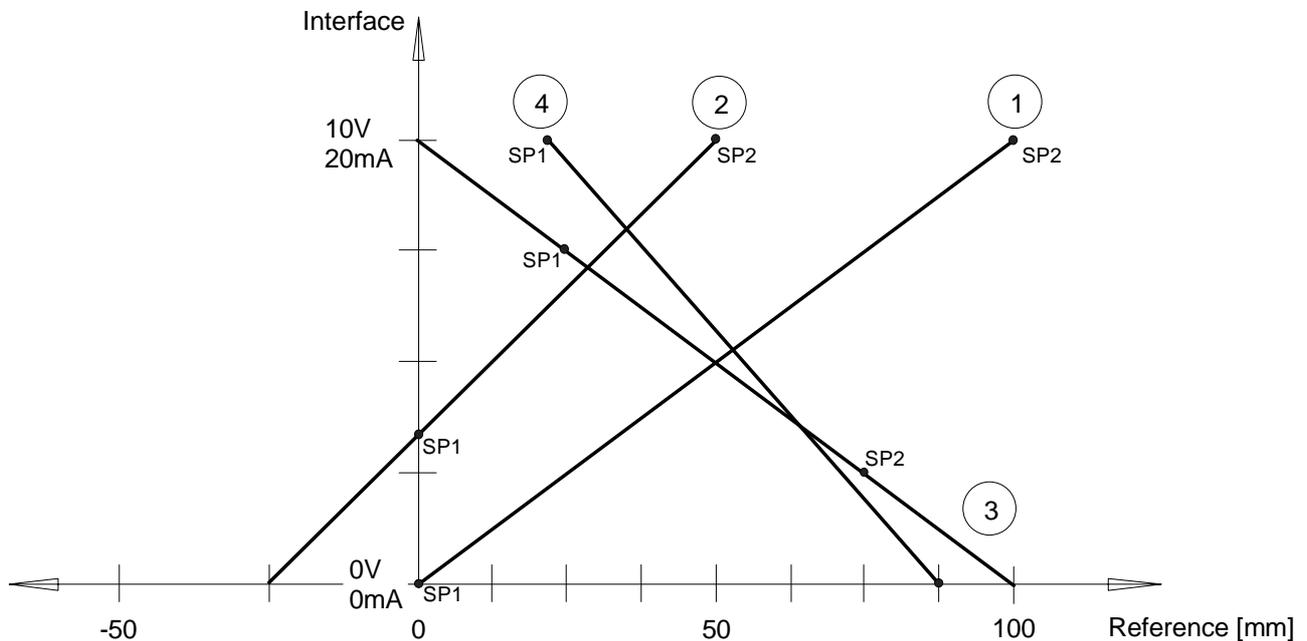
Feedback scaling:

With the feedback scaling, the maximum possible working area can be adjusted.

1. Go to a small position (e.g. inside endpoint) by using direct valve operation (refer to section "[Commands Valve operation](#)"^[85]).
2. Measure the position (→ Min. Reference value).
3. Measure the signal value of the feedback sensor or read out this value via PASO (→ Min. Interface value).
4. Go to a large position (e.g. outside endpoint) by using direct valve operation (refer to section "[Commands Valve operation](#)"^[85]).
5. Measure the position (→ Max. Reference value).
6. Measure the signal value of the feedback sensor or read out this value via PASO (→ Max. Interface value).



The following illustration shows various examples for the scaling (SP = scaling points).



1

Scaling point 1: Min. Reference = 0mm
 Min. Interface = 0V or 0mA

Scaling point 2: Max. Reference = 100mm
 Max. Interface = 10V or 20mA

2

This example shows, that with positive interface values also negative reference values can be achieved.

Scaling point 1: Min. Reference = 0mm
 Min. Interface = 03.33V or 6.67mA

Scaling point 2: Max. Reference = 50mm
 Max. Interface = 10V or 20mA

3

This example shows, that the scaling points do not necessarily have to be the end points.

Scaling point 1: Min. Reference = 25mm
 Min. Interface = 7.5V or 15mA

Scaling point 2: Max. Reference = 75mm
 Max. Interface = 2.5V or 5mA

4

This example shows, that depending on the scaling 0mm are never reached.

Scaling point 1: Min. Reference = 25mm
 Min. Interface = 10V or 20mA

Scaling point 2: Max. Reference = 87.5mm
 Max. Interface = 0V or 0mA

7.6 Inputs/outputs according to Wandfluh standard

The allocation of inputs and outputs is not fixed. The user can choose itself which input and output is assigned to which function (refer to section ["Assignment of the inputs/outputs"](#)^[32]).

However, Wandfluh has defined a default mapping, with which all the basic functions of the card can be selected. The following table shows the corresponding settings:

Input/Output	Basic Controller	Enhanced Controller
Digital input 1	Enable channel - Dig. input ^[44] (Channel 1)	Enable channel - Dig. input ^[44] (Channel 1)
Digital input 2		Enable channel - Dig. input ^[44] (Channel 2)
Digital input 3		
Digital input 4		
Analog input 1	Command scaling - Used analog input ^[45] (Channel 1)	Command scaling - Used analog input ^[45] (Channel 1)
Analog input 2	Feedback scaling - Used analog input ^[54] (Channel 1)	Feedback scaling - Used analog input ^[54] (Channel 1)
		Command scaling - Used analog input ^[45] (Channel 2)
		Feedback scaling - Used analog input ^[54] (Channel 2)
Digital output 1	Error evaluation - Dig. output ^[76] (all Channels)	Error evaluation - Dig. output ^[76] (all Channels)
Solenoid output A	Solenoid driver 1 - Solenoid output ^[72] (Channel 1)	Solenoid driver 1 - Solenoid output ^[72] (Channel 1)
Solenoid output B	Solenoid driver 2 - Solenoid output ^[72] (Channel 1)	Solenoid driver 2 - Solenoid output ^[72] (Channel 1)
Solenoid output C		Solenoid driver 1 - Solenoid output ^[72] (Channel 2)
Solenoid output D		Solenoid driver 2 - Solenoid output ^[72] (Channel 2)

This setting can be rechanged at any time (refer to section ["Assignment of the inputs/outputs"](#)^[32]).

7.7 Default setting of the parameters

The MD2-Electronic will be delivered with the following default settings:

Parameter	Basic Controller	Enhanced Controller
Digital input 1 - 2	X	X
Digital input 3 - 4		X
Digital output 1 - 2	X	X
Internal signals 1 - 8	X	X
Auto Reset	no	no
Filter type Analnp1 - Analnp2	no filter	no filter
Smoothing factor Analnp1 - Analnp2	8	8
Filter type Analnp3 - Analnp4		no filter
Smoothing factor Analnp3 - Analnp4		8
	Channel 1 - 4	Channel 1 - 8
Enable channel	off	off
Dig. input enable channel	not used	not used
Channel name	Channel 1 - 4	Channel 1 - 8
Signal type command	Voltage	Voltage
Used analog input command	not used	not used
Used digital input command	not used	not used
Cablebreak detection	no	no
Lower cablebreak limit command	0.5 V	0.5 V
Upper cablebreak limit command	9.5 V	9.5 V
Deadband function command	off	off
Deadband threshold command	0.0 %	0.0 %
Min Interface command	0.000 V	0.000 V
Max Interface command	10.000 V	10.000 V
Min Reference command	0.0 %	0.0 %
Max Reference command	100.0 %	100.0 %
Function command 2	not used	not used
Dig. input command 2	not used	not used
Enable fixed command values	off	off
Wahl 1 fixed command values	not used	not used
Wahl 2 fixed command values	not used	not used
Wahl 3 fixed command values		not used
Fixed command value 1 - 3	0.0 %	0.0 %
Fixed command value 4 - 7		0.0 %
Enable ramp	on	on
Dig. input enable ramp	not used	not used
Ramp up positive / negative	0.0 s	0.0 s
Ramp down positive / negative	0.0 s	0.0 s
Type Monitoring switching threshold 1	off	off
Selection Monitoring switching threshold 1	Command value	Command value
Function Monitoring switching threshold 1	< (less than)	< (less than)
Threshold Monitoring switching threshold 1	100.0 %	100.0 %

Delay time Monitoring switching threshold 1	50 ms	50 ms
Type Monitoring switching threshold 2	off	off
Selection Monitoring switching threshold 2	Command value	Command value
Function Monitoring switching threshold 2	< (less than)	< (less than)
Threshold Monitoring switching threshold 2	100.0 %	100.0 %
Delay time Monitoring switching threshold 2	50 ms	50 ms
Function Control value	primary	primary
Source Control value	not used	not used
Dig. input Control value	not used	not used
Mode of operation	Command unipolar (2-sol)	Command unipolar (2-sol)
Digital input solenoid B	not used	DigInp2
Solenoid type	Proportional solenoid with current measuring	Proportional solenoid with current measuring
Error evaluation	1111111	1111111
Digital output error	not used	not used
Error action	Solenoid 1+2 off	Solenoid 1+2 off
Function "Solenoid 1 active"	not used	not used
Function "Solenoid 2 atkiv"	not used	not used
Function "Target window active"	not used	not used
Function "Ready signale"	not used	not used
Function "Trailing window"	not used	not used
Function "Command 2 active"	not used	not used
Solenoid output 1	not used	not used
Solenoid output 2	not used	not used
	Channel 1 - 2	Channel 1 - 4
Speed + / -	100.000 mm/s	100.000 mm/s
Acceleration + / -	100.000 mm/s	100.000 mm/s
Deceleration + / -	100.00 mm/s	100.00 mm/s
Signal type feedback	Voltage	Voltage
Used Analog input feedback	not used	not used
Used Digital input feedback	not used	not used
Used Sensor input feedback		not used
Cablebreak detection feedback	no	no
Lower cablebreaklimit feedback	0.5 V	0.5 V
Upper cablebreaklimit feedback	9.5 V	9.5 V
Min Interface feedback	0.000 V	0.000 V
Max Interface feedback	10.000 V	10.000 V
Min Reference feedback	0.00 mm	0.00 mm
Max Reference feedback	100.00 mm	100.00 mm
Function feedback 2		not used
Dig. input feedback 2		not used
Target window type	on	on
Target window threshold	10.000 mm	10.000 mm
Target window delay time	50 ms	50 ms
Trailing window type	on without error	on without error

Trailing window threshold	10.000 mm	10.000 mm
Trailing window delay time	50 ms	50 ms
Solenoid-Off window type	off	off
Solenoid-Off window threshold	10.000 mm	10.000 mm
Solenoid-Off window delay time	50 ms	50 ms
Controller mode	Position open-loop	Position open-loop
Displayed unit	mm	mm
Free unit	"empty"	"empty"
Command feed forward	0	0
Velocity feed forward	0	0
I-Type	on	on
Control deviation scaling	no	no
Control deviation for 100% control value	100.000 mm	100.000 mm
I-Term, if control deviation > I-Window	set to 0	set to 0
P-Ampl.. positive / negative	5.0	5.0
I-Time positive / negative	0.100 s	0.100 s
I-Window outside positive / negative	5.000 mm	5.000 mm
I-Window inside positive / negative	0.000 mm	0.000 mm
I-Reduction timet positive / negative	0.100 s	0.100 s
D-Time positive / negative	0.000 s	0.000 s
D-Ampl. positive / negative	0.0	0.0
Threshold 1	5.000 mm	5.000 mm
Threshold 2	2.000 mm	2.000 mm
Threshold 3	-2.000 mm	-2.000 mm
Threshold 4	-5.000 mm	-5.000 mm
Speed slow speed		10 mm/s
Speed fast speed		100 mm/s
Dig. input manual operation Enable		not used
Dig. input manual operation forward		not used
Dig. input manual operation backward		not used
Dig. input manual operation fast speed		not used
	Solenoid A - D	Solenoid A - H
Enable solenoid output	off	off
Dig. input enable solenoid output	not used	not used
Error solenoid output	no	no
Inversion	no	no
Characteristic optimisation	off	off
Solenoid immer active	no	no
Imin	150 mA	150 mA
Imax	700 mA	700 mA
Dither function	on	on
Dither frequency	100 Hz	100 Hz
Dither level	100 mA	100 mA
Switching on threshold	60.0 %	60.0 %
Switching off threshold	40.0 %	40.0 %

Reduction time	0 ms	0 ms
Reduced value	100.0 %	100.0 %

In the section "[Parameter - Setting](#)"^[44] and "[Configuration - Menu](#)"^[81] there is a description of all the parameters.

With the menu "[Configuration - Default setting](#)"^[84], these values will be loaded on the connected MD2-Electronics and read to the PC

7.8 Parameters setting

By clicking with the left mouse button on the corresponding box in the channel window, the parameter values of MD2-Elektronik can be set.

7.8.1 Enable channel

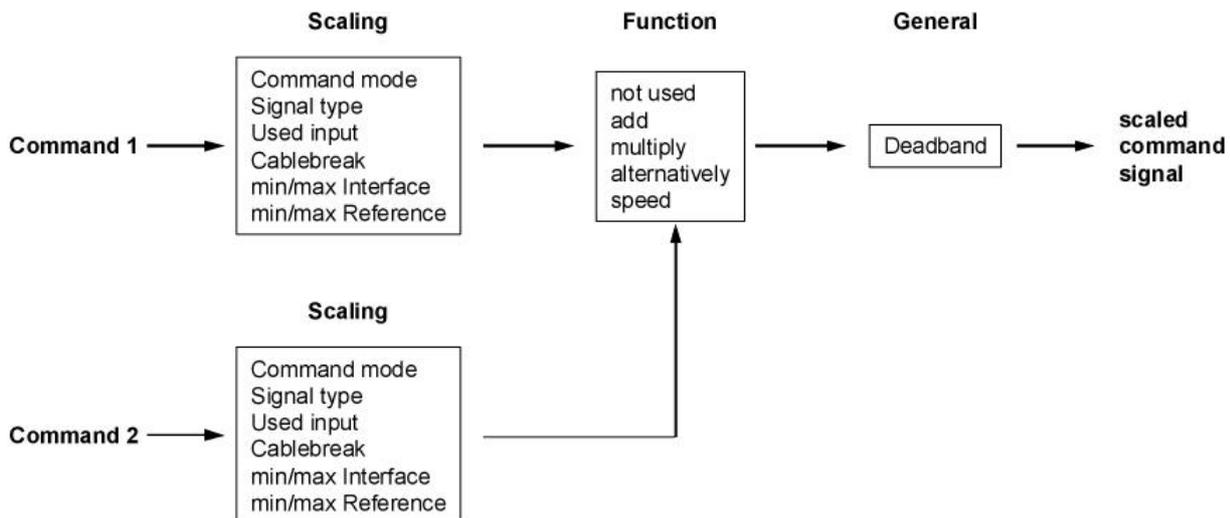
In this window, all settings specific to the channel release will be made.

Field	Parameter description	Range / Step
Operating mode (Device local)	Select the desired command value source (only valid for MD2 with Fieldbus Interface).	bus local
Enable	<p>Enable channel.</p> <p>With the selection "off", the corresponding channel is disabled and no solenoid current will be active (refer to section "MD2 State machine"¹⁵).</p> <p>With the selection "on", the corresponding channel is enabled and the solenoid current will be operated according to the selected operating mode (refer to section "MD2 State machine"¹⁵).</p> <p>With the selection "external", the enable of the channel is made through a high-signal on a digital input (input active = enable).</p> <p>With the selection "external inverted", the enable of the channel is made through a low-signal on a digital input (input not active = enable).</p> <p>The digital input for "external" resp. "external inverted" can be selected with the parameter "Dig. input".</p>	off on external external inverted
Dig. input	<p>Active digital input for the enable if the parameter "enable = external".</p> <p>Aktiver Digitaleingang für die Freigabe, sofern der Parameter "Freigabe = extern" ist. Otherwise, this setting has no effect. In choosing "not used", no digital input will be assigned to the enable function.</p>	refer to section "Assignment of the inputs/outputs" ³²

7.8.2 Command value scaling

In this window, the adjustments and scaling values of the command value signal will be adjusted. For a detailed description about the scaling please refer to section ["Scaling"](#) ^[34].

There are two command value inputs available. Each input can be scaled independently. How the second input is merged with the first input can be selected with the parameter "Function". If necessary, a deadband can be set on the resulting command value.



Command 1 and Command 2

The tab Command 2 is only active if the parameter "Function" is set to "add", "multiply", "alternatively" or "speed"

Field	Parameter description	Range / Step
Command value mode (Device Local)	Select the desired command value source (only valid for MD2 with Fieldbus Interface).	local bus
Signal type	Select the desired command value signal type. If the parameter "Mode of operation" is set to "Command value bipolar (2-sol)", only the selection "Voltage" is possible (refer to section "Valve type" ^[71]).	Voltage Current Digital Frequency PWM
Used analog input	Select the desired used analog input. This control is only active, if the parameter "Signal type" is set to "Voltage" or "Current". In choosing "not used", no analog input will be assigned.	refer to section "Assignment of the inputs/outputs" ^[32]
Used digital input	Select the desired used digital input. This control is only active, if the parameter "Signal type" is set to "Digital", "Frequency" or "PWM". In choosing "not used", no digital input will be assigned.	refer to section "Assignment of the inputs/outputs" ^[32]
Function (only adjustable on command 1)	The function of the command 2 can be selected: Command 2 is not active. Only command 1 is available The value from command 2 is added to the value from command 1. A negative value on command 2 leads to a subtraction..	not used add multiply

	<p>The value from command 1 is multiply with the value from command 2. A negative value on command 2 leads to a division.</p> <p>It will either work with command 1 or command 2. Switching between the two command value is done with the digital input from parameter "Dig. input".</p> <p>With the value from command 2 the speed can be adjusted. The adjustment range is always 0 ... value from parameter "speed +" resp. "Speed -" (refer to section Ramp generator ⁵¹).</p>	<p>alternatively</p> <p>Speed</p>
Dig. input (only adjustable on command 1)	<p>The desired digital inputs for switching between command 1 / command 2 can be select. This control is only active, if the parameter "Function" is set to "alternatively".</p>	refer to section "Assignment of the inputs/outputs" ³²

The following adjustments can only be made if the parameter "Signal type" is set to "Voltage", "Current", Frequency" or "PWM".

Field	Parameter description	Range / Step
Cablebreak detection	Switch on/off the cablebreak detection of the input signal (refer to section "Cablebreak detection" ¹⁶).	no yes
Lower cablebreak limit	<p>Command value < Lower cablebreak limit = cablebreak active</p> <p>Signal type = Voltage</p> <p>Signal type = Current</p> <p>Signal type = Frequency</p> <p>Signal type = PWM</p> <p>The adjusted value must be less than the value of the Upper cablebreak limit. By changing the parameter "Signal type", this value will be set to the default value (see table below).</p>	<p>0 ... 10V 0.2V</p> <p>0 ... 20mA 0.3mA</p> <p>5 ... 5000Hz 0.2Hz</p> <p>0 ... 100%PW 0.2%PW</p>
Upper cablebreak limit	<p>Command value > Upper cablebreak limit = cablebreak active</p> <p>Signal type = Voltage</p> <p>Signal type = Current</p> <p>Signal type = Frequency</p> <p>Signal type = PWM</p> <p>The adjusted value must be greater than the value of the Lower cablebreak limit. By changing the parameter "Signal type", this value will be set to the default value (see table below).</p>	<p>0 ... 10V 0.2V</p> <p>0 ... 20mA 0.3mA</p> <p>5 ... 5000Hz 0.2Hz</p> <p>0 ... 100%PW 0.2%PW</p>

The following adjustments can only be made if the parameter "Signal type" is set to "Voltage", "Current", Frequency" or "PWM".

Field	Parameter description	Range / Step
Min Interface	<p>Indicates the input signal value for "Min Reference".</p> <p>Signal type = Voltage (Mode of operation ²³ = 3)</p>	-10 ... 10V

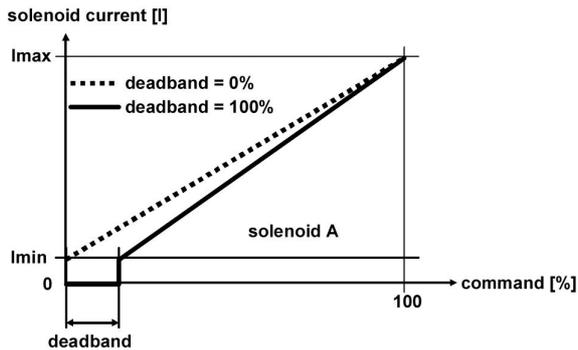
	Signal type = Voltage (Mode of operation ^[23] = 1, 2 or 4) Signal type = Current Signal type = Frequency Signal type = PWM By changing the parameter "Signal type", this value will be set to the default value (see table below).	0.2V 0 ... 10V 0.2V 0 ... 20mA 0.3mA 5 ... 5000Hz 0.2Hz 0 ... 100%PW 0.2%PW
Max Interface	Indicates the input signal value for "Max Reference". Signal type = Voltage (Mode of operation ^[23] = 3) Signal type = Voltage (Mode of operation ^[23] = 1, 2 or 4) Signal type = Current Signal type = Frequency Signal type = PWM By changing the parameter "Signal type", this value will be set to the default value (see table below).	-10 ... 10V 0.2V 0 ... 10V 0.2V 0 ... 20mA 0.3mA 5 ... 5000Hz 0.2Hz 0 ... 100%PW 0.2%PW
Min Reference	Indicates the absolute command value at "Min Interface". The min reference command value has to be smaller than the max reference command value.	Dependent on unit
Max Reference	Indicates the absolute command value at "Max Interface". The max reference command value has to be larger than the min reference command value.	Dependent on unit

General

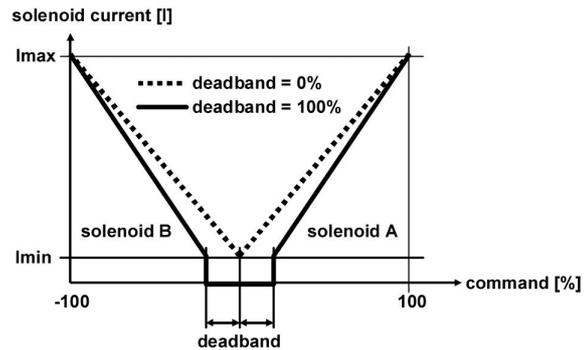
These adjustments apply to the command value after merging command 1 and command 2.

The following adjustments can only be made if the parameter "Controller mode" is set to "Pressure/flow valve open loop" or "Position open loop".

Deadband function	Switch on/off the deadband function	off on
Deadband	Command value < Deadband = 0 mA solenoid current Command value >=Deadband = Imin..Imax solenoid current	0 ... 100% 0.1%



1-solenoid version



2-solenoid version

Default values for scaling parameters

	Signal type			
	Voltage	Current	Frequency	PWM
Lower cablebreak limit	0.5 V	0.5 mA	10 Hz	10 %PW
Upper cablebreak limit	10 V	20 mA	5000 Hz	100 %PW
Min Interface	0 V	0 mA	5 Hz	5 %PW
Max Interface	10 V	20 mA	5000 Hz	95 %PW
Min Reference	0.00 mm	0.00 mm	0.00 mm	0.00 mm
Max Reference	100.00 mm	100.00 mm	100.00 mm	100.00 mm

7.8.3 Command value fixed

In this window, all settings specific to the command values fixed will be made. Command values fixed can be used in place of the external command value. They serve to pretend of predefined, fixed set command values.

Values in italic letters are only valid for the enhanced version.

Field	Parameter description	Range / Step
Enable	Enable command values fixed. With the selection "off", the command value fixed function is switched off, that means the input command value is 1:1 redirected to the output. With the selection "on", the command value fixed function is switched on, that means the output value is dependent on the digital inputs.	off on
Selection 1	Active digital input for command value fixed 1, if the parameter "enable = 1". Otherwise, this setting has no effect. In choosing "not used", no digital input will be assigned to the command value fixed 1.	refer to section " Assignment of the inputs/outputs " ³²
Selection 2	Active digital input for command value fixed 2, if the parameter "enable = 1". Otherwise, this setting has no effect. In choosing "not used", no digital input will be assigned to the command value fixed 2 - 3. If "Selection 1 = not used", the control "Selection 2" is disabled.	refer to section " Assignment of the inputs/outputs " ³²
Selection 3	<i>Active digital input for command value fixed 4, if the parameter "enable = 1". Otherwise, this setting has no effect. In choosing "not used", no digital input will be assigned to the command value fixed 4 - 7. If "Selection 1 = not used" and "Selection 2 = not used", the control "Selection 2" is disabled.</i>	refer to section " Assignment of the inputs/outputs " ³²

The following description is only valid, if a controller mode = open loop is active.

Fixed command value 1	Value for the fixed command value 1. The adjusted %-value correspond to the adjusted solenoid current range (0% = 0mA, 0.1% = Imin, 100% = Imax). A positive value will activate solenoid driver 1, a negative value will activate solenoid driver 2 Can only be adjusted if "Selection 1" is not set to "not used".	0 ... 100% for 1 solenoid -100 ... +100% for 2 solenoid 0.1%
Fixed command value 2 Fixed command value 3	Value for the fixed command value 2 - 3. The adjusted %-value correspond to the adjusted solenoid current range (0% = 0mA, 0.1% = Imin, 100% = Imax). A positive value will activate solenoid driver 1, a negative value will activate solenoid driver 2 Can only be adjusted if "Selection 1" and "Selection 2" are not set to "not used".	0 ... 100% for 1 solenoid -100 ... +100% for 2 solenoid 0.1%
Fixed command value 4 Fixed command value 5 Fixed command value 6 Fixed command value 7	Value for the fixed command value 4 - 7. The adjusted %-value correspond to the adjusted solenoid current range (0% = 0mA, 0.1% = Imin, 100% = Imax). A positive value will activate solenoid driver 1, a negative value will activate solenoid driver 2 Can only be adjusted if "Selection 1", "Selection 2" and "Selection 3" are not set to "not used".	0 ... 100% for 1 solenoid -100 ... +100% for 2 solenoid 0.1%

The following description is only valid, if a controller mode = closed loop is active.

Fixed command value 1	Value for the fixed command value 1. The adjusted value must be between the value from "Min reference" and "Max reference" from the command value (refer to section "Command scaling" ^[45]). Can only be adjusted if "Selection 1" is not set to "not used".	Min reference ... Max reference from command value
Fixed command value 2 Fixed command value 3	Value for the fixed command value 2 - 3. The adjusted value must be between the value from "Min reference" and "Max reference" from the command value (refer to section "Command scaling" ^[45]). Can only be adjusted if "Selection 1" is not set to "not used".	Min reference ... Max reference from command value
Fixed command value 4 Fixed command value 5 Fixed command value 6 Fixed command value 7	Value for the fixed command value 4 - 7. The adjusted value must be between the value from "Min reference" and "Max reference" from the command value (refer to section "Command scaling" ^[45]). Can only be adjusted if "Selection 1" is not set to "not used". "Selection 3" are not set to "not used".	Min reference ... Max reference from command value

7.8.4 Ramp generator

In this window, all adjustments according to the command value change (the increase speed of the command value) will be made.

The following description is only valid, if a controller mode = open loop is active.

Field	Parameter description	Range / Step
Enable	Enable ramp function. With the selection "off", the ramp function is switched off, that means the input command value is redirected to the output without a delay. With the selection "on", the ramp function is switched on, that means the input command value is redirected to the output with a delay. With the selection "external", the enable of the channel is made through a high-signal on a digital input (input active = enable). With the selection "external inverted", the enable of the channel is made through a low-signal on a digital input (input not active = enable). The digital input for "external" resp. "external inverted" can be selected with the parameter "Dig. input".	off on external external inverted
Dig. input	Active digital input for the enable if the parameter "enable = external". Otherwise, this setting has no effect. In choosing "not used", no digital input will be assigned to the enable function.	refer to section "Assignment of the inputs/outputs" ³²⁾
Rampe up positive	The set ramp time refer to a command value jump from 0% to 100% for the solenoid from the solenoid driver 1.	0 ... 500s 0.05s
Rampe down positive	The set ramp time refer to a command value jump from 0% to 100% for the solenoid from the solenoid driver 1.	0 ... 500s 0.05s
Rampe up negative	The set ramp time refer to a command value jump from 0% to 100% for the solenoid from the solenoid driver 2.	0 ... 500s 0.05s
Rampe down negative	The set ramp time refer to a command value jump from 0% to 100% for the solenoid from the solenoid driver 2.	0 ... 500s 0.05s

The following description is only valid, if a controller mode = closed loop is active

Field	Parameter description	Range / Step
Speed	This is a command value delay. After a command value jump the new command value is run-up to over a ramp (depending on the adjusted acceleration, speed and deceleration). This corresponds to a certain travel speed. To achieve an optimal control behavior, this setting must be adapted to the hydraulic system. With this an overshoot can be reduced.	
Speed +	Desired speed for a positive command value jump	0 ... 15000 * Step size depends on the scaling
Speed -	Desired speed for a negative command value jump	0 ... 15000 * Step size depends on the scaling
Acceleration +	Desired acceleration for a positive command value jump	0 ... 15000 * Step size depends on the scaling
Acceleration -	Desired acceleration for a negative command value jump	0 ... 15000 * Step size depends on the scaling
Deceleration +	Desired deceleration for a positive command value jump	0 ... 15000 * Step size depends on the scaling
Deceleration -	Desired deceleration for a negative command value jump	0 ... 15000 * Step size depends on the scaling

* depending on the adjusted command value scaling values, the maximum value can be lower

7.8.5 Manual operation

In this window, all settings specific to the manual operation will be made. With the manual operation, the command value can be changed over a defined speed. This command value change is operated through digital inputs.

Field	Parameter description	Range / Step
Enable	<p>Enable manual operation.</p> <p>With the selection "off", the manual operation is switched off, that means the external command value is redirected to the output.</p> <p>With the selection "on", the manual operation is switched on, that means the external command value is not redirected to the output.</p> <p>With the selection "external", the enable of the channel is made through a high-signal on a digital input (input active = enable).</p> <p>With the selection "external inverted", the enable of the channel is made through a low-signal on a digital input (input not active = enable).</p> <p>The digital input for "external" resp. "external inverted" can be selected with the parameter "Dig. input".</p>	<p>off</p> <p>on</p> <p>external</p> <p>external inverted</p>
Dig. input	Active digital input for the enable if the parameter "enable = external". Otherwise, this setting has no effect. In choosing "not used", no digital input will be assigned to the enable function.	refer to section "Assignment of the inputs/outputs" ³²⁾
Forward	Active digital input for the the function "manual operation forward". If this input is active, the command value will become a higher value. If this input is not active, the command value will stay at the current level. This control is only active, if the "Operating mode" is set to "Local" (refer to section "Enable Channel" ⁴⁴⁾).	refer to section "Assignment of the inputs/outputs" ³²⁾
Backward	Active digital input for the the function "manual operation backward". If this input is active, the command value will become a lower value. If this input is not active, the command value will stay at the current level. This control is only active, if the "Operating mode" is set to "Local" (refer to section "Enable Channel" ⁴⁴⁾).	refer to section "Assignment of the inputs/outputs" ³²⁾
Fast speed	Active digital input for the the function "manual operation fast speed". If this input is active, the change of the command value is done with the fast speed. If this input is not active, the change of the command value is done with the slow speed. This control is only active, if the "Operating mode" is set to "Local" (refer to section "Enable Channel" ⁴⁴⁾).	refer to section "Assignment of the inputs/outputs" ³²⁾
Slow speed	Slow speed. This speed is active, if the input "Fast speed" is not active.	0 ... 15000 * Step size depends on the scaling
Fast speed	Fast speed. This speed is active, if the input "Fast speed" is active.	0 ... 15000 * Step size depends on the scaling

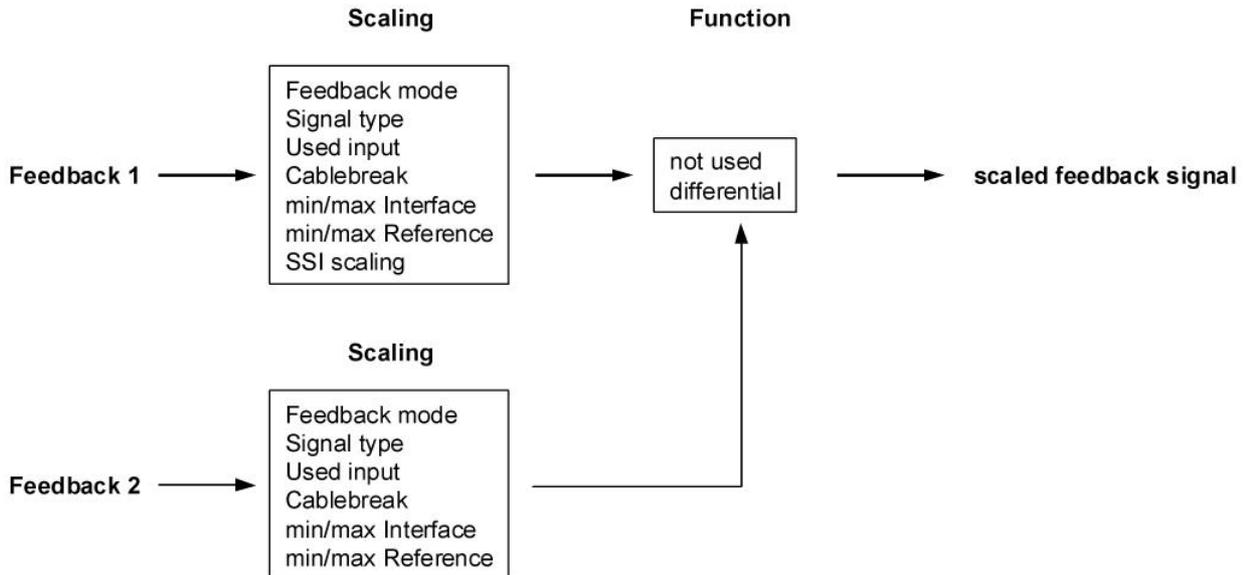
* depending on the adjusted command value scaling values, the maximum value can be lower

7.8.6 Feedback value scaling

The following description is only valid, if the parameter "Controller mode" is not set to "Pressure/flow valve open loop" or "Position open loop".

In this window, the adjustments and scaling values of the feedback value signal will be adjusted. For a detailed description about the scaling please refer to section ["Scaling"](#)³⁴.

There are two feedback value inputs available. Each input can be scaled independently. How the second input is merged with the first input can be selected with the parameter "Function".



Feedback value 1 and Feedback value 2

The tab Feedback value 2 is only active if the parameter "Function" is set to "differential".

Field	Parameter description	Range / Step
Feedback value mode (Device Local)	Select the desired feedback value source (only valid for MD2 with Fieldbus Interface).	local bus
Signal type	Select the desired feedback value signal type	Voltage Current Frequency PWM
Used analog input	Select the desired used analog input. This control is only active, if the parameter "Signal type" is set to "Voltage" or "Current". In choosing "not used", no analog input will be assigned.	refer to section "Assignment of the inputs/outputs" ³²
Used digital input	Select the desired used digital input. This control is only active, if the parameter "Signal type" is set to "Frequency" or "PWM". In choosing "not used", no digital input will be assigned.	refer to section "Assignment of the inputs/outputs" ³²
Function (only adjustable on feedback value 1)	The function of the feedback value 2 can be selected: Feedback value 2 is not active. Only feedback value 1 is available The value from the feedback value 2 is subtracted from the value from the feedback value 1. Thus, for example the differential pressure can be read.	not used differential

The following adjustments can only be made if the parameter "Signal type" is set to "Voltage", "Current", "Frequency" or "PWM".

Field	Parameter description	Range / Step
Cablebreak detection	Switch on/off the cablebreak detection of the input signal (refer to section " Cablebreak detection " ¹⁶).	no yes
Lower cablebreak limit	Feedback value < Lower cablebreak limit = cablebreak active Signal type = Voltage Signal type = Current Signal type = Frequency Signal type = PWM The adjusted value must be less than the value of the Upper cablebreak limit. By changing the parameter "Signal type", this value will be set to the default value (see table below).	0 ... 10V 0.2V 0 ... 20mA 0.3mA 5 ... 5000Hz 0.2Hz 0 ... 100%PW 0.2%PW
Upper cablebreak limit	Feedback value > Upper cablebreak limit = cablebreak active Signal type = Voltage Signal type = Current Signal type = Frequency Signal type = PWM The adjusted value must be greater than the value of the Lower cablebreak limit. By changing the parameter "Signal type", this value will be set to the default value (see table below).	0 ... 10V 0.2V 0 ... 20mA 0.3mA 5 ... 5000Hz 0.2Hz 0 ... 100%PW 0.2%PW

The following adjustments can only be made if the parameter "Signal type" is set to "Voltage", "Current", "Frequency" or "PWM".

Field	Parameter description	Range / Step
Min Interface	Indicates the input signal value for "Min Reference". Signal type = Voltage Signal type = Current Signal type = Frequency Signal type = PWM By changing the parameter "Signal type", this value will be set to the default value (see table below).	-10 ... 10V 0.2V 0 ... 20mA 0.3mA 5 ... 5000Hz 0.2Hz 0 ... 100%PW 0.2%PW
Max Interface	Indicates the input signal value for "Max Reference". Signal type = Voltage Signal type = Current Signal type = Frequency Signal type = PWM By changing the parameter "Signal type", this value will be set to the default value (see table below).	-10 ... 10V 0.2V 0 ... 20mA 0.3mA 5 ... 5000Hz 0.2Hz 0 ... 100%PW 0.2%PW
Min Reference	Indicates the absolute feedback measured value at "Min Interface". The min reference feedback value has to be smaller than the max reference feedback value.	Dependent on unit
Max Reference	Indicates the absolute feedback measured value at "Max Interface". The max reference feedback value has to be larger than the min reference feedback value.	Dependent on unit

Default values for scaling parameters

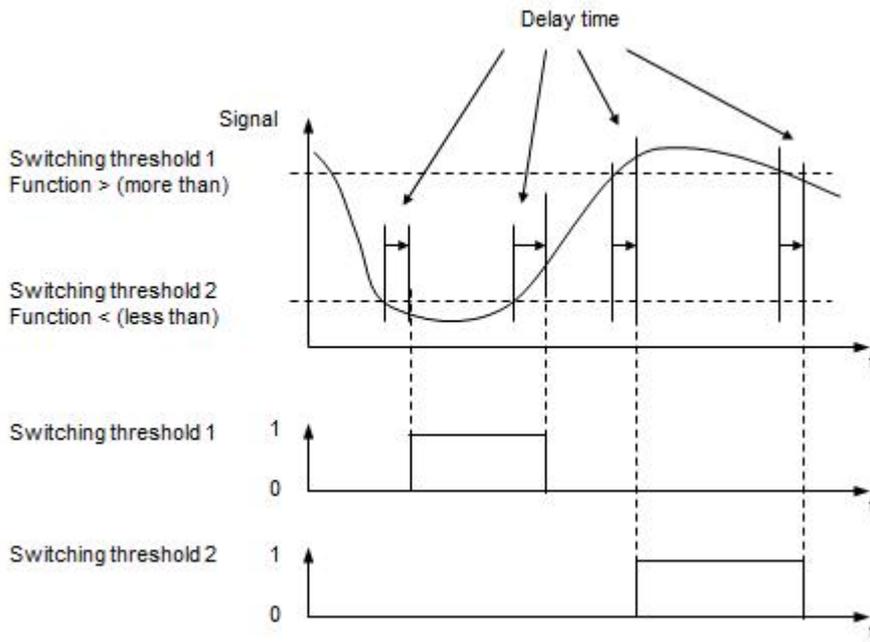
	Signal type			
	Voltage	Current	Frequency	PWM
Lower cablebreak limit	0.5 V	0.5 mA	10 Hz	10 %PW
Upper cablebreak limit	10 V	20 mA	5000 Hz	100 %PW
Min Interface	0 V	0 mA	5 Hz	5 %PW
Max Interface	10 V	20 mA	5000 Hz	95 %PW
Min Reference	0.00 mm	0.00 mm	0.00 mm	0.00 mm
Max Reference	100.00 mm	100.00 mm	100.00 mm	100.00 mm

7.8.7 Monitoring

The following description is only valid, if the parameter "Controller mode" is not set to "Pressure/flow valve open loop" or "Position open loop".

Feld	Parameter Beschreibung	Bereich / Schrittweite
Target window Type	Switch on/off the target window function. HINT: This signal can be routed to a digital output (refer to section " Function " ^[77]).	off on
Target window threshold	Defines the target window.	Adapted to unit
Target window delay time	Delay time when falling below and exceeding the target window threshold.	0 ... 10 0ms 1ms
Trailing window Type	Signals	
	Two independent switching thresholds can be monitored. In both, the same settings are possible:	
	Type	Switch on/off the switching threshold monitoring No monitoring of the switching threshold If the selected signal is smaller or higher (refer to "Function") than the adjusted threshold, the error E-12 will be set. This signal can be routed to a digital output (refer to section " Error evaluation " ^[76]). If the selected signal is smaller or higher (refer to "Function") than the adjusted threshold, the state "Switching threshold x" will be set. The state can be routed to a digital output (refer to section " Function " ^[77]).
Selection	Selection of the the monitored signal	Command value

		Feedback value
Function	Selection of condition that leads to the activation Signal < adjusted threshold value = active Signal > adjusted threshold value = active	< (less than) > (more than)
Threshold	Defines the value by which the selected signal is compared	Adapted to unit
Delay time	Delay time when exceeding or falling of the switching threshold	0 ... 10000ms 1ms

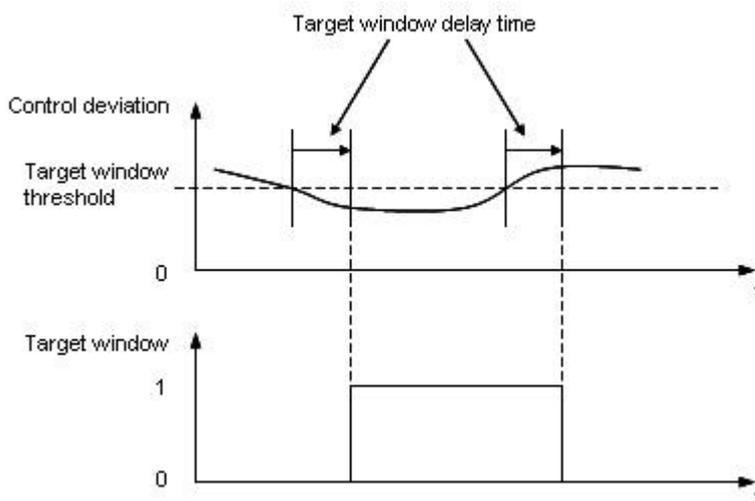


Windows

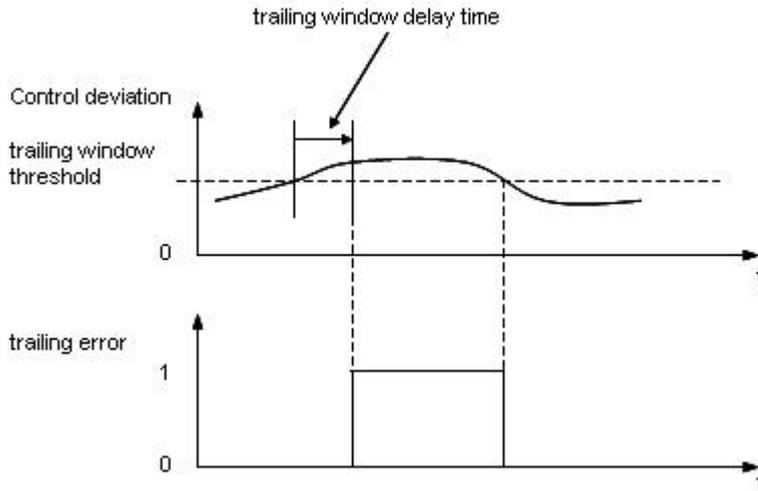
The following description is only valid, if the parameter "Controller mode" is not set to "Pressure/flow valve open loop" or "Position open loop".

Feld	Parameter Beschreibung	Bereich / Schrittweite
Target window Type	Switch on/off the target window function. HINT: This signal can be routed to a digital output (refer to section " Function " ^[77]).	off on
Target window threshold	Defines the target window.	Adapted to unit
Target window delay time	Delay time when falling below and exceeding the target window threshold.	0 ... 100ms 1ms
Trailing window Type	Switch on/off the trailing window function A trailing error will not be detected A trailing error will be detected and the error E-7 will be set during an active trailing error. This signal can be routed to a digital output (refer to section " Error evaluation " ^[76]).	off on with error
Trailing window threshold	Defines the trailing window.	Adapted to unit
Trailing window delay time	Delay time when falling below and exceeding the target window threshold.	0 ... 100ms 1ms
Solenoid-Off window Type	Switch on/off the target window function	off on
Solenoid-Off window threshold	Defines the target window. If the control difference is within this window, the solenoid outputs are switched off.	Adapted to unit
Solenoid-Off window delay time	Delay time when falling below and exceeding the target window threshold.	0 ... 100ms 1ms

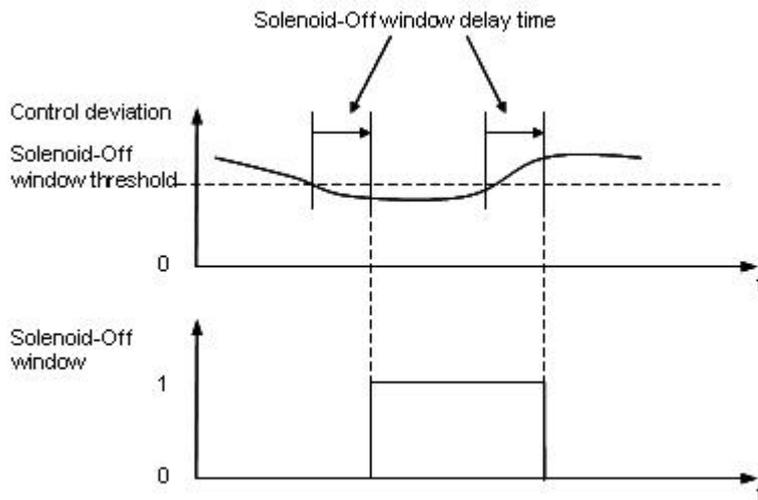
Target window:



Trailing window::

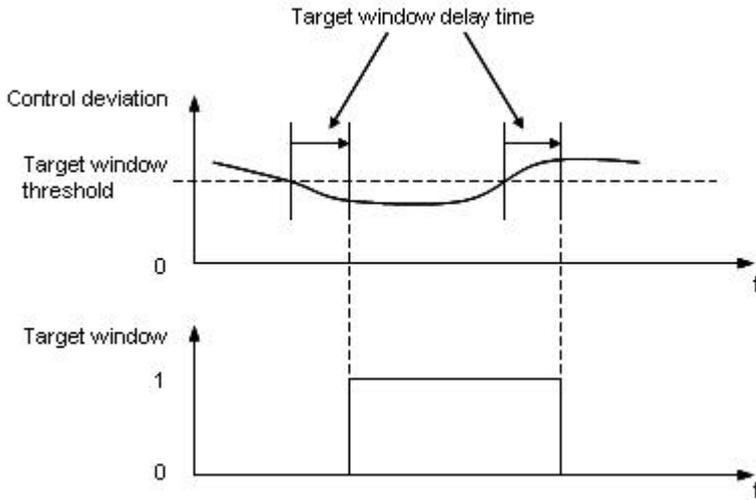


Solenoid-Off window::

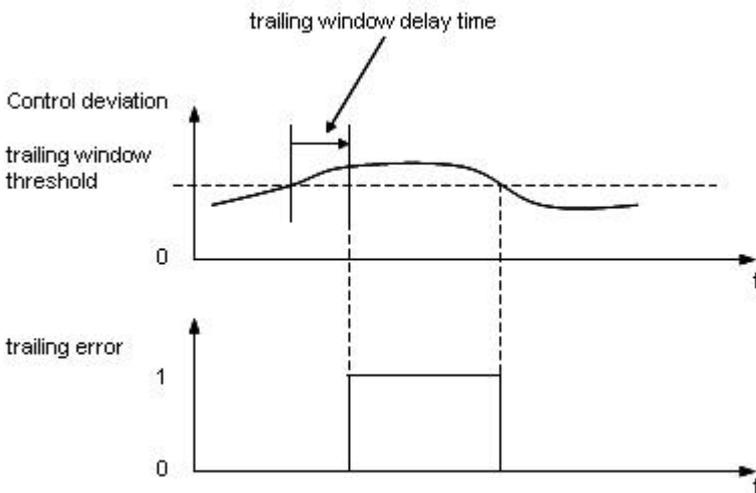


Trailing window threshold	Defines the trailing window.	Adapted to unit
Trailing window delay time	Delay time when falling below and exceeding the target window threshold.	0 ... 10 0ms 1ms
Solenoid-Off window Type	Switch on/off the target window function	off on
Solenoid-Off window threshold	Defines the target window. If the control difference is within this window, the solenoid outputs are switched off.	Adapted to unit
Solenoid-Off window delay time	Delay time when falling below and exceeding the target window threshold.	0 ... 10 0ms 1ms

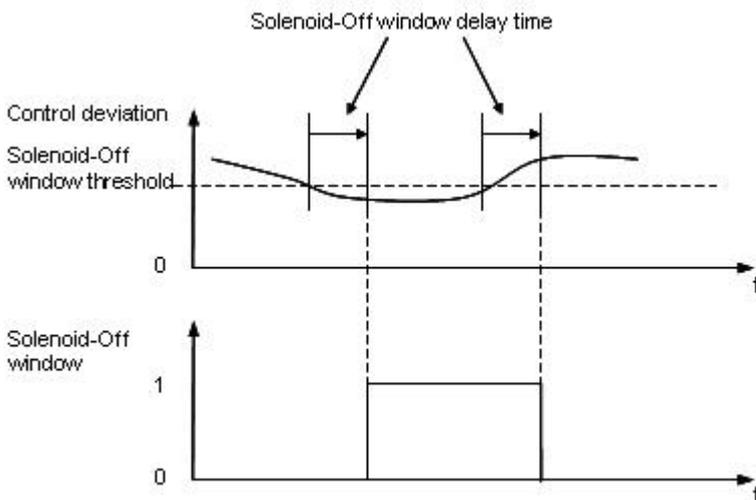
Target window:



Trailing window:



Solenoid-Off window:



7.8.8 Controller

In this window all settings concerning the controller are made. The controller is split-up into two independent blocks for positive and negative control difference. With this, asymmetrical characteristics of the hydraulic system can be compensated for.

General:

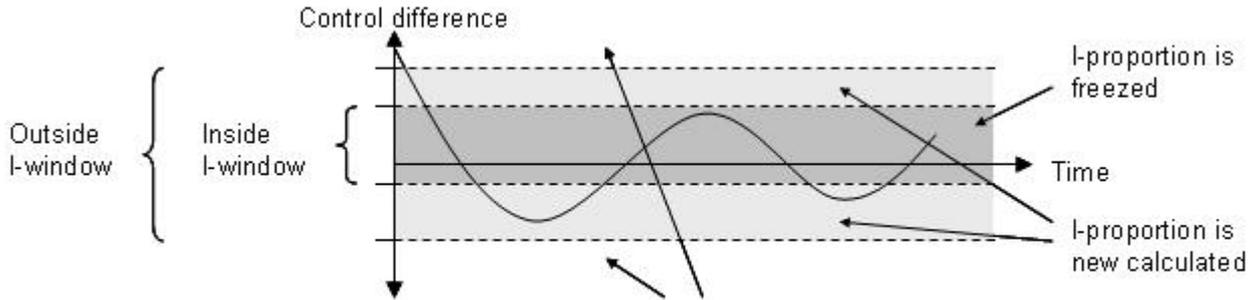
Field	Parameter description	Range / Step
Controller mode	<p>Select the desired controller mode (refer to section "Controller mode" ⁽¹⁷⁾).</p> <p>Depending on the selected controller mode, may be other parameters are automatically adapted.</p> <p>On channel 3 - 4 (Basic controller) resp. 5 - 8 (Enhanced controller), only controller mode "Spool valve open loop", "Pressure/flow valve open loop" and "Position open loop" can be selected.</p> <p>Multiple controller modes can be linked together using the function Control value (refer to section "Control value" ⁽⁶⁸⁾). Thereby it is possible to build e.g. a pQ-Controller or an Alternating control. For more details please refer to the document "Applications examples for Wandfluh Electronics cards".</p>	Spool valve open loop = 1 Pressure/flow valve open loop = 3 Pressure/flow valve closed loop (1-sol) = 4 Pressure control closed loop (2-sol) = -5 Position open loop = 6 Position closed loop (2-sol) = 9 Speed control closed loop (2-sol) = 7 2-point controller (1-sol) = -6 2-point controller (2-sol) = -7 3-point controller (2-sol) = -8
Displayed unit	<p>In this field the required unit can be selected.</p> <p>Controller mode 4 and -5: Controller mode 6 and 9: Controller mode 7: Controller mode -6, -7 and -8:</p> <p>All controller modes:</p>	bar, psi, kN, MPa mm, Grad, Zoll l/min, mm/s, 1/Min, Zoll/s, Grad/s bar, psi, kN, MPa, mm, Grad, Zoll, l/min, mm/s, 1/Min, Zoll/s, Grad/s Eigene Einheit
Free unit	<p>If with "Display unit" the type "Own unit" was selected, then an own unit can be entered in this field.</p>	Min. number of characters: 1 Max. number of characters: 5
Command feed forward	<p>The command value is multiplied with this factor and added to the correcting variable of the controller. If this factor is 0, no command value proportion is added to the correcting variable</p>	0 ... 10 0.1
Velocity feed forward	<p>The change of the command value (the increase speed of the command value) is multiplied with this factor and added to the correcting variable of the controller. If this factor is 0, no command value addition is added to the correcting variable</p>	0 ... 10 0.1

PID controller:

The following adjustments can only be made if the parameter "Controller mode" is set to "Pressure/flow valve closed loop (1-sol)", "Pressure control closed loop (2-sol)", "Position closed loop (2-sol)" or "Speed control closed loop (2-sol)".

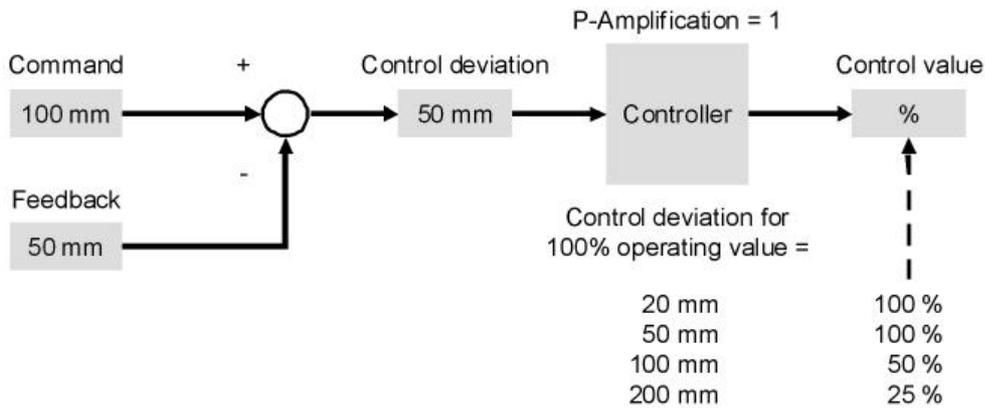
Field	Parameter description	Range / Step
I-Type	Set on/off the calculation of the I-term This parameter can only be set if the parameter "Controller mode" is set to "Position closed loop (2-sol)". In any other case it is set to on.	off on
I-term, if control deviation > I-window outside	I-term is set to 0 if control deviation is outside the outside I-window. I-term is held if control deviation is outside the outside I-window.	set to 0 leave value
I-term, if control value is not active	This parameter is only used if there is a selection of the used control value (refer to section "Control value" (68)). I-term is set to 0 if the control value from the current channel is not active I-term is held if the control value from the current channel is not active	set to 0 leave value
Symmetrical setting	If this function is activated, the setting changes of a controller block are also transferred to the other controller block.	
Control deviation scaling	Set on/off the function "Control deviation for 100% operating value". If the control deviation scaling is switch off, the operating value is 100% if the control deviation corresponds to the feedback value from 10V resp. 20mA.	off on
Control deviation for 100% control value	If the control deviation corresponds to this value, the operating value (controller output) is 100% (with a P-Amplification from 1, refer to the picture below). This allows to match optimally the influence of the PID controller parameters to the desired range. Can only be set if the parameter "Control deviation scaling" is set to "on"	Adapted to unit
P-Ampl. positive	P-amplification factor for positive control difference.	0 ... 25 0.1
I-Time positive	Reaction time for the integrator. If the time is set to 0s, the integrator is switched off.	0 ... 10s 0.01s
I-window outside positive	Defines the outside I-window. If the control difference is within this window, the I-term is calculated with the set I-time positive.	Adapted to unit
I-window inside positive	Defines the inside I-window. If the control difference is within this window, the I-term is frozen.	Adapted to unit
D-Ampl. positive	D-amplification factor for positive control difference.	0 ... 10
D-Time positive	Defines the inside I-window. If the control difference is within this window, the I-term is frozen.	0 ... 10s 0.1s
P-Ampl. positive	P-amplification factor for positive control difference.	0 ... 25 0.1
I-Time positive	Reaction time for the integrator. If the time is set to 0s, the integrator is switched off.	0 ... 10s 0.01s
I-window outside positive	Defines the outside I-window. If the control difference is within this window, the I-term is calculated with the set I-time positive.	Adapted to unit
I-window inside positive	Defines the inside I-window. If the control difference is within this window, the I-term is frozen.	Adapted to unit
D-Ampl. positive	D-amplification factor for positive control difference.	0 ... 10
D-Time positive	Defines the inside I-window. If the control difference is within this window, the I-term is frozen.	0 ... 10s 0.1s

Example with outside and inside I-window

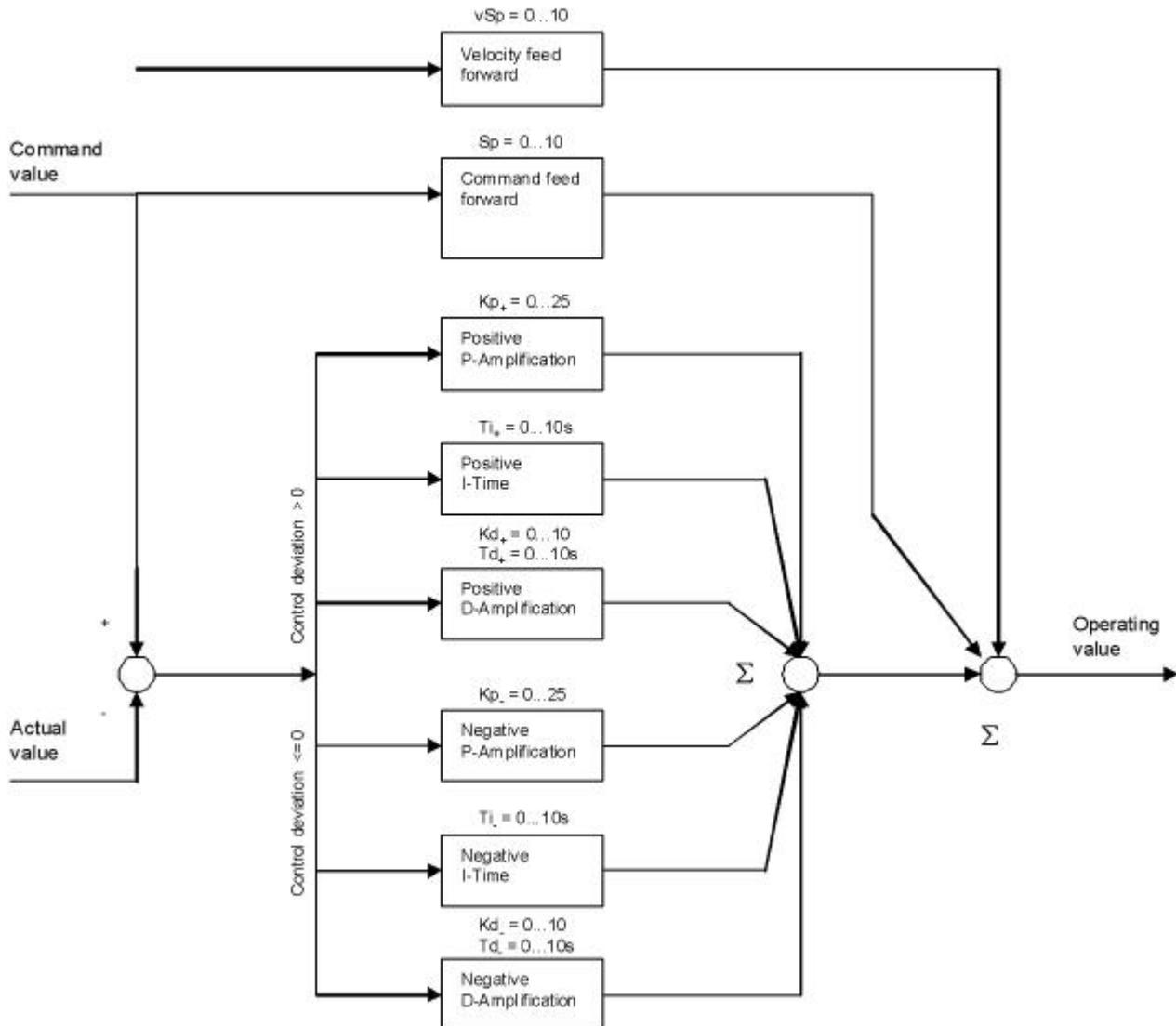


"I-proportion, if control deviation > I-window outside" = "set to 0": I-proportion is set to 0.
 "I-proportion, if control deviation > I-window outside" = "leave value": I-proportion is held.

Example for control deviation scaling:



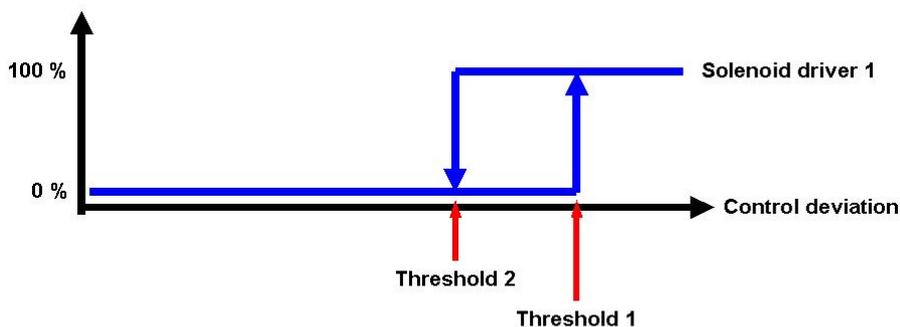
Blockdiagramm des Reglers:


n-point controller:

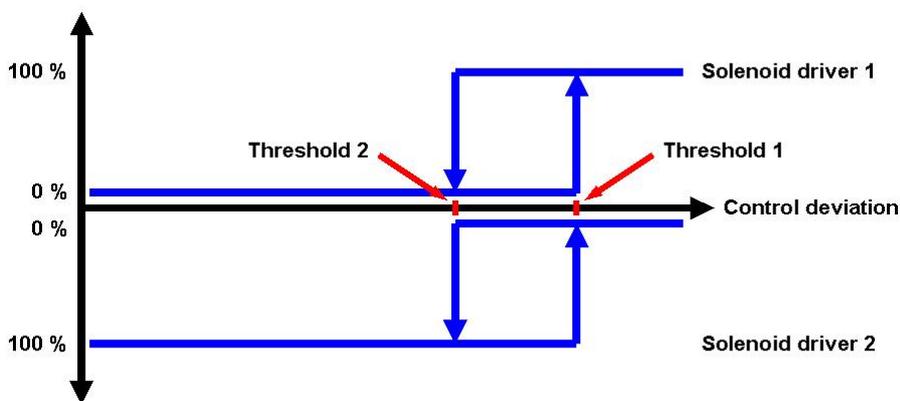
The following adjustments can only be made if the parameter "Controller mode" is set to "2-point controller (1-sol)", "2-point controller (2-sol)" or "3-point controller (2-sol)".

Field	Parameter description	Range / Step
Threshold 1	Value for threshold 1 (see below picture)	Adapted to unit
Threshold 2	Value for threshold 2 (see below picture)	Adapted to unit
Threshold 3	Value for threshold 3 (see below picture) This parameter can only be set if the parameter "Controller mode" ist set to "3-point controller (2-sol)"	Adapted to unit
Threshold 4	Value for threshold 4 (see below picture) This parameter can only be set if the parameter "Controller mode" ist set to "3-point controller (2-sol)"	Adapted to unit

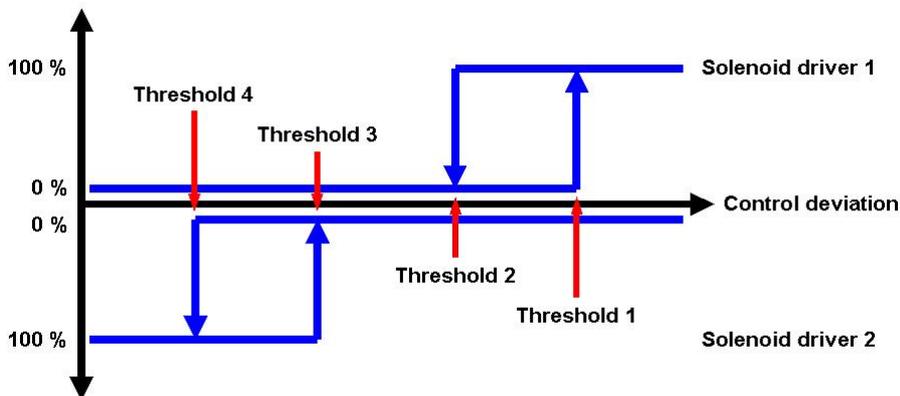
2-point controller (1-sol)



2-point controller (2-sol)



3-point controller (2-sol)


7.8.9 Control value

In this window, the selection can be made which control value will be reused

Field	Parameter description	Range / Step
Function	The control value from the current channel is used	primary
	The control value from the channel selected with the parameter "Source" is used	secondary

	<p>With the digital input selected with the parameter "Dig. input" the selection can be made, if the control value from the current channel (digital input not active) or the control value from the channel selected with the parameter "Source" (digital input active) is used. The changeover takes place independent of the device status (Disabled or Active, refer to section "SD7 State machine").</p> <p>With the digital input selected with the parameter "Dig. input" the selection can be made, if the control value from the current channel (digital input active) or the control value from the channel selected with the parameter "Source" (digital input not active) is used. The changeover takes place independent of the device status (Disabled or Active, refer to section "SD7 State machine").</p> <p>With the digital input selected with the parameter "Dig. input" the selection can be made, if the control value from the current channel (digital input not active) or the control value from the channel selected with the parameter "Source" (digital input active) is used. The changeover takes place only in the status "Disabled" (refer to section "SD7 State machine").</p> <p>With the digital input selected with the parameter "Dig. input" the selection can be made, if the control value from the current channel (digital input active) or the control value from the channel selected with the parameter "Source" (digital input not active) is used. The changeover takes place only in the status "Disabled" (refer to section "SD7 State machine").</p> <p>The control value from the current channel and the control value from the channel selected with the parameter "Source" are compared. The lower value is used. With this, it is possible to build e.g. a pQ-Controller or an Alternating control. For more details please refer to the document "Applications examples for Wandfluh Electronics cards".</p> <p>Mit dieser Funktion kann z.B. ein pQ-Regler oder eine Ablösende Regelung aufgebaut werden. Mehr Details dazu finden sie im Dokument "Anwendungsbeispiele zu Wandfluh Elektronik Karten"</p> <p>The control value from the current channel and the control value from the channel selected with the parameter "Source" are compared. The higher value is used.</p> <p>The control value from the channel selected with the parameter "Source" is added to the control value from the current channel (refer to table below).</p> <p>The control value from the channel selected with the parameter "Source" is added as an absolute value to the control value from the current channel (refer to table below).</p>	<p>alternatively</p> <p>alternatively inverted</p> <p>alternatively (only Disabled)</p> <p>alternatively inverted (only Disabled)</p> <p>minimum bildner</p> <p>maximum bildner</p> <p>offset</p> <p>offset bidirectional</p>
Source	Selection of the channel, from which the control value is used. Is only active if the parameter "Source" is not	Channel x not used

	set to "primary". In choosing "not used", no channel will be assigned.	
Dig. input	Active digital input for the selection of the control value source, unless the parameter "Function" is set to "alternatively" or "alternatively inverted". Otherwise this setting has no effect. In choosing "not used", no digital input will be assigned.	refer to section "Assignment of the inputs/outputs" ³²

Function "offset"

Control value 1	Control value 2	Resulting control value
+50%	+10%	60%
+50%	-10%	40%
-50%	+10%	-40%
-50%	-10%	-60%

Function "offset bidirectional"

Control value 1	Control value 2	Resulting control value
+50%	+10%	60%
+50%	-10%	40%
-50%	+10%	-60%
-50%	-10%	-40%

7.8.10 Valve type

In this window, all settings specific to the valves will be made

Field	Parameter description	Range / Step
Solenoid type	Select the desired solenoid type If the parameter "Controller mode" is set to "2-point controller (1-sol)", "2-point controller (2-sol)" or "3-point controller (2-sol)", the solenoid type can be only set to "Switching solenoid without current measurement".	Proportional solenoid without current measurement Proportional solenoid with current measurement Switching solenoid without current measurement
Valve type	Valve type of the connected valve Standard valve with one or two solenoids 4/3-way valve (2-solenoid function) with only one solenoid	Standard 2-solenoid 4/3-way 1-solenoid

The following adjustments can only be made if the parameter "Controller mode" is set to "Pressure/flow valve open loop" or "Position open loop".

Field	Parameter description	Range / Step
Mode of operation	Select the desired mode of operation (refer to section " Mode of operation " 23). The signal type can be changed automatically it depends on the selected mode of operation.	Command unipolar (1-sol) Command unipolar (2-sol) Command bipolar (2-sol) Command unipolar (2-sol with DigInp)
Magnet B	Active digital input for the solenoid B selection if the parameter "Mode of operation = Command unipolar (2-sol with DigInp)". Otherwise, this setting has no effect. In choosing "not used", no digital input will be assigned to the solenoid B selection.	refer to section " Assignment of the inputs/outputs " 32

7.8.11 Solenoid driver

In this window, all settings specific to the solenoids will be made

Field	Parameter description	Range / Step
Solenoid output	Select the desired solenoid output for the current channel. In choosing "not used", no solenoid output will be assigned to the current channel.	refer to section " Assignment of the inputs/outputs " ³²
Enable	<p>Solenoid enable</p> <p>With the selection "off", the selected solenoid output is disabled and no solenoid current will be active.</p> <p>With the selection "on", the selected solenoid output is enabled and the solenoid current will be operated according to the selected operating mode.</p> <p>With the selection "external", the enable of the channel is made through a high-signal on a digital input (input active = enable).</p> <p>With the selection "external inverted", the enable of the channel is made through a low-signal on a digital input (input not active = enable).</p> <p>The digital input for "external" resp. "external inverted" can be selected with the parameter "Dig. input".</p>	<p>off</p> <p>on</p> <p>external</p> <p>external inverted</p>
Dig. input	<p>Active digital input for the enable if the parameter "enable = external".</p> <p>Otherwise, this setting has no effect. In choosing "not used", no digital input will be assigned to the enable function..</p>	refer to section " Assignment of the inputs/outputs " ³²
Inversion	<p>Inversion of the solenoid output</p> <p>0% command = I_{min}, 100% command = I_{max}</p> <p>0% command = I_{max}, 100% command = I_{min}</p>	<p>no</p> <p>yes</p>
Solenoid always active	<p>The behavior of the non-active solenoid can be set.</p> <p>With the selection "no", the current of the non-active solenoid is set to 0.</p> <p>With the selection "yes", the current of the non-active solenoid is set to I_{min} (with parameter "Inversion" = no) resp. to I_{max} (with parameter "Inversion" = yes).</p>	<p>no</p> <p>yes</p>
Characteristic optimisation	Switch on/off the characteristic optimisation (refer to section " Characteristic optimisation " ¹⁴)	<p>off</p> <p>on</p>

The following adjustments can only be made if the parameter "Solenoid type" is set to "Proportional solenoid":

Field	Parameter description	Range / Step
Cablebreak detection	Switch on/off the cablebreak detection on the solenoid output. This parameter can only be set with a solenoid type "Proportional solenoid with current measurement" (refer to section " Valve type " ^[71])	no yes
Imin	Set minimum solenoid current A. (= solenoid current by 0% command value) With a solenoid type "... without current measurement" (refer to section " Valve type " ^[71]), this parameter can be set from 0 ... 100% duty cycle Using the menu Commands - Valve operation ^[85] the Imin can be adjusted very easily. With a valve type "4/3-way 1-solenoid" (refer to section " Valve type " ^[71]), this parameter corresponds to the solenoid current by 0% command value.	0 ... 950mA 3mA I _{max} below < I _{min} < I _{max}
I _{max}	Set maximum solenoid current A. (= solenoid current by 100% command value) For the max. current refer to section " Electrical specifications " ^[7] . With a solenoid type "... without current measurement" (refer to section " Valve type " ^[71]), this parameter can be set from 0 ... 100% duty cycle Using the menu Commands - Valve operation ^[85] the I _{max} can be adjusted very easily. With a valve type "4/3-way 1-solenoid" (refer to section " Valve type " ^[71]), this parameter corresponds to the solenoid current by 100% command value.	I _{min} ... max. current 3mA I _{min} < I _{max}
I _{min} below	Is only active with a valve type "4/3-way 1-solenoid" (refer to section " Valve type " ^[71]). This parameter corresponds to the solenoid current by -0.1% command value.	0 ... 950mA 3mA I _{min} below < I _{max} below
I _{max} below	Is only active with a valve type "4/3-way 1-solenoid" (refer to section " Valve type " ^[71]). This parameter corresponds to the solenoid current by -100% command value.	I _{min} below ... max. current 3mA I _{min} below < I _{max} below < I _{min}
Dither function	Switch on/off the dither function	off on
Dither frequency	The dither frequency can be set in steps..	2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 25, 30, 35, 40, 45, 50, 55, 60, 70, 80, 100, 125, 165, 250, 500Hz
Dither level	Level of the superimposed dither signal With a solenoid type "... without current measurement" (refer to section " Valve type " ^[71]), this parameter can be set from 0 ... 100% duty cycle	0 ... 399mA 2mA

The following adjustments can only be made if the parameter "Solenoid type" is set to "Switching solenoid":

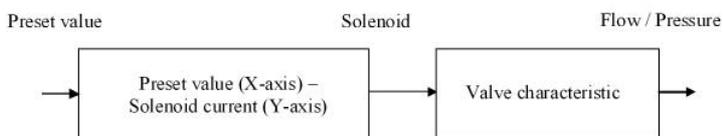
Field	Parameter description	Range / Step
Switching on threshold	Command value > Switching on threshold = solenoid output active	0 ... 100%
Switching off threshold	Command value > Switching off threshold = solenoid output not active	0 ... 100%
Reduction time	After this time the PWM output will be reduced to the value which is set by parameter "reduction value" (refer to section " Power reduction " ^[25]).	0...2000ms
Reduced value	The PWM output will be reduced to this value after the time which is set by parameter "reduction time" (refer to section " Power reduction " ^[25]).	0...100%

Characteristic optimisation:

This menu enables the optimisation of the solenoid current adjustment of DSV-Electronics. A graphic is shown which represents the characteristic "Preset value (X-axis) – Solenoid current (Y-axis)". The graphic consists of 11 points, the first and the last point (100%) are preset.

Index	X-Axis value	Y-Axis value
0	0	0
10	100	100

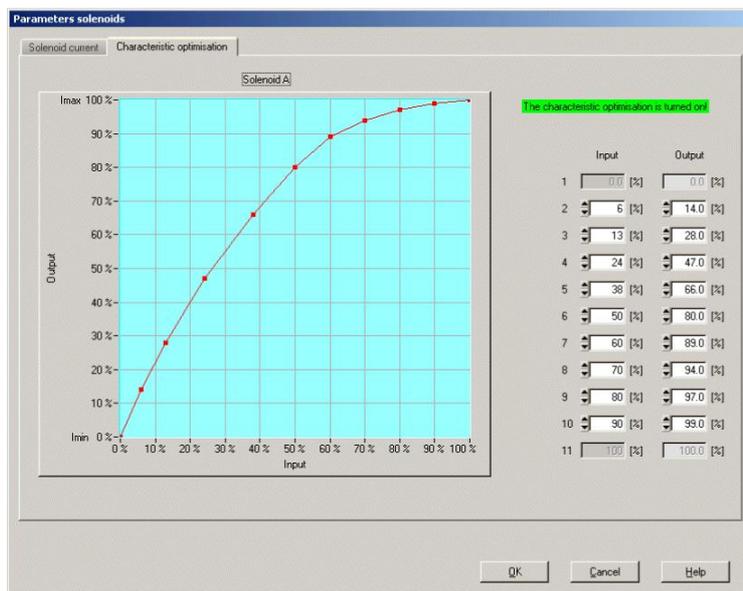
The other graphic points can be adjusted either by tracking with the mouse or by entering the value at the numeric inputs. The resolution of the X-values is in %, those of the Y-values in 0.1 %. The X-values cannot be falling.



At shipping ex work (default settings) the preset value is transmitted proportionally to the solenoid current (default characteristic). In this case the characteristic "Preset value (X-axis – Solenoid current (Y-axis))" is linear. The same behaviour occurs at any time when the characteristic optimisation is turned off.

By modifying the default linear characteristic "Preset value (X-axis) – Solenoid current (Y-axis)" e.g. a progressive valve characteristic "Current - Flow/Pressure" can be compensated in such a way that a linear relation between preset value and Flow / Pressure is realised. The characteristic "Preset value (X-axis) – Solenoid current (Y-axis)" in this case should be adjusted in the "opposite progressive" direction (refer to the example characteristic below).

Additionally the characteristic optimisation must be turned on. This will be shown in the PASO-Status line (refer to section ["Starting of PASO MD2"](#) ^[106]).



The solenoid current values are in the range Imin (0%) up to Imax (100%). Imin and Imax are adjusted in the menu "Solenoid current". At an input value which is between two graphic points, the solenoid current is interpolated. If two or more preset values overlap, at the corresponding Preset value the highest current value is calculated.

In the case of an error in the characteristic values, the characteristic optimisation is automatically turned off.

7.8.12 Error evaluation

In this window, all settings specific to the error evaluation will be made.

Solenoid 1 = selected solenoid output from the solenoid driver 1 (refere to section ["Solenoid driver"](#)⁷²)
 Solenoid 2 = selected solenoid output from the solenoid driver 2 (refere to section ["Solenoid driver"](#)⁷²)

Field	Parameter description	Range / Step
Selection	The errors can be selected, which lead to activate the selected digital output in the active state E-1 = Cablebreak from Command scaling ⁴⁵ E-6 = Cablebreak from Feedback scaling ⁵⁴ E-2 = Short circuit from Solenoid driver 1 ⁷² E-3 = Short circuit from Solenoid driver 2 ⁷² E-4 = Cablebreak Solenoid driver 1 ⁷² E-5 = Cablebreak Solenoid driver 2 ⁷² E-7 = Trailing error Windows ⁵⁸ E-8 = J1939 Error (only with MD2-Elektronics with J1939E-11 = Device error * E-9 E-11	
Dig. 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.	refer to section "Assignment of the inputs/outputs" ³²
Error handling	The desired error handling with a cablebreak error can be set. With the error "Short circuit from Solenoid driver 1" and "Short circuit from Solenoid driver 2", the error handling is fixed set to "Solenoid 1+2 off"	Solenoid 1+2 off Solenoid 1 on Solenoid 2 on Solenoid 1+2 on

* Device error:

In this selection, all errors are brought together who are not dependent on the channel (= device error). These are:

- Power supply fault
- Fieldbus error

** on

The solenoid is activated with 2/3 from the range $I_{min} .. I_{max}$ ($I_{min} + 2/3 \times (I_{max} - I_{min})$)

Example:

$$I_{min} = 100\text{mA}, I_{max} = 700\text{mA} \Rightarrow 100 + 2/3 \times (700 - 100) = 500\text{mA}$$

On the right side of each selection, the current status of the corresponding error is displayed (only in On-Line mode).

An active error is indicated as follows:

- the button "Diagnostics" is red
- the corresponding current state of the error is red
- in the status line per channel the text "Error" is displayed (instead of "Ready")
- the box "Error evaluation" has a red frame
- in the main window a red point appears for the corresponding error

With the button "Diagnostics", a complete description of all present errors will be displayed (only in On-Line mode, refer to section ["Analysis Diagnostics"](#)⁹⁷).

7.8.13 Function

Digital outputs can be activated, when a certain function is running. Several functions can be set at the same time. If a function should not be evaluated, the corresponding digital output can be set to "not used".

Solenoid 1 = selected solenoid output from the solenoid driver 1 (refer to section ["Solenoid driver"](#) ⁽⁷²⁾)

Solenoid 2 = selected solenoid output from the solenoid driver 2 (refer to section ["Solenoid driver"](#) ⁽⁷²⁾)

Field	Parameter description	Range / Step
Selection	<p>The functions can be selected, which lead to activating the selected digital output. Each function can be assigned to a separate digital output.</p> <p>Solenoid 1 active The solenoid output 1 is active (the analysis value 9 is not 0, refer to section "Analysis Show values" ⁽⁹²⁾)</p> <p>Solenoid 2 active The solenoid output 1 is active (the analysis value 9 is not 0, refer to section "Analysis Show values" ⁽⁹²⁾)</p> <p>Target window active The control deviation is inside the adjusted target window threshold (refer to section "Windows" ⁽⁵⁸⁾)</p> <p>Ready signal No error is present</p> <p>Trailing window The control deviation is inside the adjusted trailing window threshold (refer to section "Windows" ⁽⁵⁸⁾)</p> <p>Command value 2 active In the function with two command values, the activation of the second command value is displayed here (refer to section "Command scaling" ⁽⁴⁵⁾)</p> <p>Switching threshold 1 active The selected signal is exceeding or falling of the adusted threshold (refer to section "Windows" ⁽⁵⁸⁾)</p> <p>Switching threshold 2 active The selected signal is exceeding or falling of the adusted threshold (refer to section "Windows" ⁽⁵⁸⁾)</p> <p>Control value 2 active Insted of the control value from the current channel, the control value from the channel selected with the parameter "Source" is used</p>	<p>refer to section "Assignment of the inputs/outputs" ⁽³²⁾</p>

On the right side of each selection, the current status of the selected output is displayed (only in On-Line mode).

7.9 File-Menu

Contained in the File menu are the menu points, which concern the file handling and the printing of the parameters. In the "On Line"-mode, some of these menu points are blocked.

7.9.1 New

This menu point is active only in the "Off Line"-mode.

With this command, a new file can be opened. Near it, all parameters are set to default values. A question will be displayed, if the current configuration will be retain or not.

If "Yes" will be selected, the current configuration will not be changed.

If "No" will be selected, a selection window will be displayed. In this window, the following configuration can be selected.

Function	<ul style="list-style-type: none">• Basic Amplifier• Enhanced Amplifier• Basic Controller• Enhanced Controller
Analogoutputs	<ul style="list-style-type: none">• Input 1 voltage or current• Input 2 voltage or current• Input 2 current only if Function = Enhanced Amplifier or Enhanced Controller• Input 3 voltage or current• Input 4 voltage or current
Fieldbus	<ul style="list-style-type: none">• without Fieldbus• with CANopen• with J1939

The modified configuration only affects the "Off Line"-mode. By switching to "On Line"-mode the configuration of the connected SD7-electronics will be read in.

In both cases, the following question will be displayed:

"Should the inputs / outputs set according to the Wandfluh standard or to "not used"?"

If "not used" will be selected, the inputs / outputs are assigned itself to the corresponding functions (refer to section ["Assignment of the inputs/outputs"](#)³²⁾).

If "Wandfluh standard" will be selected, the assignment of all inputs / outputs will be adjusted corresponding to the Wandfluh specification (refer to section ["Inputs/outputs according to Wandfluh standard"](#)³⁹⁾). This setting can be rechanged at any time (refer to section ["Assignment of the inputs/outputs"](#)³²⁾). With the function "Basic Amplifier", the question appears if the mode of operation 4 (solenoid single) should be enabled. If "Yes" will be selected, the assignment of the inputs / outputs will be adapted accordingly.

7.9.2 Open...

This menu point is only active in the "Off Line"-mode.

With this command, an existing file from a storage medium is opened. First the file selection window appears. In this window the required file can now be selected and opened with "OK". If the configuration of the selected file does not correspond to the current configuration of the PASO MD2, a message will be displayed and the current configuration from the PASO MD2 will change automatically over to the new configuration of the selected file.

The read parameter values will be checked in the case of a limiting value excess. If one or more parameter values are outside the tolerance, a message will be displayed and the parameter value will be set to the default value (refer to section "[Limiting value error](#)"^[108]). The parameter values can now be edited and changed as required under the corresponding menu points.

Wandfluh can create application specific parameters files in accordance to customer wish.

7.9.3 Save

With this command, the parameters are saved on a data storage medium. All parameter values of all input windows are saved under the current file name. If no file name has been defined yet, then first the file selection window appears (refer to section "[File Save as...](#)"^[79]).

7.9.4 Save as...

With this command, the parameters are saved on a data storage medium. All parameter values of all input windows are saved under the file name entered.

First the file selection window appears. In this window the desired file name can now be entered. If the file name is entered without an extension, then the extension ".par" is automatically assigned to it. After actuating the key "Save", the file information window appears (refer to section "[File-Info](#)"^[79]). In this window the required entries can now be made. With the key "Save", the file is then finally saved under the selected file name. With the key "Cancel", one changes back to the file window.

7.9.5 Print

With this command, the current parameters are printed in ASCII text format. The File_Print window is opened. In this window one can now select, whether the printing process is to be to a printer or to a file.

If the output is to be to a printer, then the Windows printer selection window is opened.. **In this window, please do not select "Print to File"**. If you do, a new program start might possibly be required and you could lose any data not yet saved.

If the output is to be to a file, then the file selection window appears. In this window the desired file name can now be entered. If the file name is entered without an extension, then automatically the extension ".txt" is assigned to it.

7.9.6 File-Info

With this command, the file information of an existing file is displayed. The file information consists of the following parts:

Date, time Date, time of saving.
File name: The file name, under which the file has been saved.
Valve type: The valve type of the connected MD2-Electronics at the moment of saving. If no MD2-Electronics are connected, then this indication remains empty. In case of saving during "On Line Operation", this indication is updated.
Operator: The name of the originating person.
Remarks: Possibility to enter remarks concerning the file.

When the File_Info window appears during the execution of the command "[File Save as...](#)"^[79], then the corresponding entries can be made in the various fields (with the exception of "Date", "Time", "File name" and "Card type", which cannot be edited). When the File_Info window appears during the execution of the command "[File File-Info](#)"^[79], then the various fields cannot be edited.

7.9.7 Activate Off Line / Activate On Line

Off Line

With this command, the connection with the MD2-Electronics is interrupted. All menu points, which call for a communication with the MD2-Electronics, are blocked. The PASO MD2 software now runs in the "Off Line mode". The loading, saving and the editing of parameter files is possible in this mode.

On Line

With this command, the connection with the MD2-Electronics is established. The communication with the MD2-Electronics is briefly tested. If the connection works, then the user has the option of taking over the parameters from the MD2-Electronics or of transferring the parameters to the MD2-Electronics. During the transfer of the parameters, the user has the possibility of aborting the operation.

Before parameters are transferred to the MD2-Electronics, a verification is carried out as to whether the configuration of the MD2-Electronics supports the parameter values. The configuration corresponds here to the number of the solenoids. If the configuration of the connected MD2-Electronics do not match with the current configuration of the PASO MD2, a message will be displayed and the current configuration from the PASO MD2 will change automatically over to the new configuration.

If the parameters have been taken over by the MD2-Electronics, then they will be checked in the case of a limiting value excess. If one or more parameter values are outside the tolerance, a message will be displayed and the parameter value will be set to the default value (refer to section "[Limiting value error](#)"^[108]). The PASO MD2 will stay in the "Off Line"-mode. For going On Line in this case, the parameter must be transferred to the MD2-Electronics. If the transfer was successful and the limiting value check was also successful, then the software subsequently runs in the "On Line"-mode. The loading of parameter files is not possible in this mode.

The current mode will be displayed in the status line.

7.9.8 MD2 datarecord info

This menu point is only active in the "On Line"-mode.

Under this menu the current data set information of the connected MD2-Electronics appears. The data correspond to the last change to the MD2-Electronics data carried out.

7.9.9 Exit

With this command, the PASO MD2 is terminated. If parameter data have been changed and have not yet been saved, then the question appears, as to whether these data should be saved. This is referring only to the save in file. On the MD2-Electronics, the parameter will be saved automatically by clicking on the button "OK" in the corresponding windows (refer to section "[Store parameter](#)"^[108]).

7.10 Configuration-Menu

In this window, the settings of the function of the MD2-Electronics will be made.

7.10.1 Digital I/O

With this command the digital inputs and outputs of the connected MD2-Electronics are activated, not activated or enabled.

Field	Parameter description	Range / Step
Digital inputs	Set digital input by software	1
	Reset digital input by software	0
	Activate external digital input	X
Digital outputs	Set digital output with software	1
	Reset digital output with software	0
	The digital output is set in case of the selected function	X
	The digital output is set inverted in case of the selected function	!X
Internal signals	Set internal signal by software	1
	Reset internal signal by software	0
	Internal signal is set in case of the selected function	X

Digital in- and outputs which are set or reset by software will be displayed with blue text color in the main window

7.10.2 Binary operations

In this window, digital signals can be logically linked (a digital output or internal signal is set in dependence on one or two digital inputs or internal signals).

Field	Parameter description	Range / Step
Output Inv	Output, to which the result of the logical operation is outputted. In choosing "not used", the function is switched off By selecting "Inv", the selected output can be inverted	refer to section " Assignment of the inputs/outputs " ³²⁾
Input 1 Inv	First operand of the logically operation. In choosing "not used", no input will be assigned to the first operand. By selecting "Inv", the selected input can be inverted	refer to section " Assignment of the inputs/outputs " ³²⁾
Input 2 Inv	Second operand of the logically operation. In choosing "not used", no input will be assigned to the second operand. By selecting "Inv", the selected input can be inverted	refer to section " Assignment of the inputs/outputs " ³²⁾
Function	Desired logical operation (refer to truth tables ⁸¹⁾): Link two signals with AND Link two signals with OR Link two signals with EXCLUSIV OR INVERT one signal In choosing "not used", the function is switched off	AND OR XOR NOT

The following truth tables shows all possible operation the state of the output in dependence of the operands

AND

Output	Operand 1	Operand 2
not active	not active	not active
not active	active	not active

not active	not active	active
active	active	active

Output Inv	Operand 1	Operand 2
active	not active	not active
active	active	not active
active	not active	active
not active	active	active

OR

Output	Operand 1	Operand 2
not active	not active	not active
active	active	not active
active	not active	active
active	active	active

Output Inv	Operand 1	Operand 2
active	not active	not active
not active	active	not active
not active	not active	active
not active	active	active

XOR

Output	Operand 1	Operand 2
not active	not active	not active
active	active	not active
active	not active	active
not active	active	active

Output Inv	Operand 1	Operand 2
active	not active	not active
not active	active	not active
not active	not active	active
active	active	active

NOT

Output	Operand 1
active	not active
not active	active

7.10.3 Filter for analog inputs

In this window the adjustments for the filter of the analog inputs can be set.

Field	Parameter description	Range / Step
Filter type	The filtering of the corresponds analog input can be switch on or off (refer to section " Analog inputs [16]"): No filtering on the analog input is active The analog input is filterd with the function "exponential smoothing"	no filter Exponential smoothing
Smoothing factor	Determines the speed / response time of the filter	8

Field	Parameter description	Range / Step
	- high value = high degree of filtering, but long response time (the reading of the analog input is delayed)	16
	- small value = low degree of filtering, but fast response time	32
		64

The two parameters can be set separately for each existing analog input.

7.10.4 General errors

In this menu the handling of general errors can be set.

Feld	Parameter Beschreibung	Bereich / Schrittweite
Auto reset	If the supply voltage rises above 8VDC after a supply error appeared, the MD2 electronics has to be disabled and re-enabled to acknowledge the supply error.	no
	If the supply voltage rises above 8VDC after a supply error appeared, the MD2 electronics acknowledges the supply error automatically.	yes

7.10.5 Default setting

This menu point is only active in the "On Line"-mode and in the MD2-state "Disabled" (refer to section ["MD2 State machine"](#) ¹⁵).

With this command, the default settings made in the factory will be loaded on the connected MD2-Electronics and read to the PC. After successfully read in, the question appears, if the values should be stored on the MD2-Electronics or not.

If "Yes" will be selected, the values will be stored in the way that they are available after the MD2-Electronics will be switched on again (non-volatile memory).

If "No" will be selected, the values are running at the moment, but after the MD2-Electronics will be switched on again, the before current values will be active again.

7.10.6 Interface

If a Wandfluh-device with USB interface is connected, by this command the USB parameters will be displayed otherwise an error message will be displayed.

7.10.7 Language

In this window, the language can be selected, with which the PASO MD2 will be inscribed. This setting is automatically saved in the file "konfig.kon" and taken over with a new start.

Field	Parameter description	Range / Step
Language	Field, from which the desired language can be selected.	deutsch english français

7.11 Commands-Menu

In the Commands menu, direct control commands can be transmitted to the MD2-Electronics.

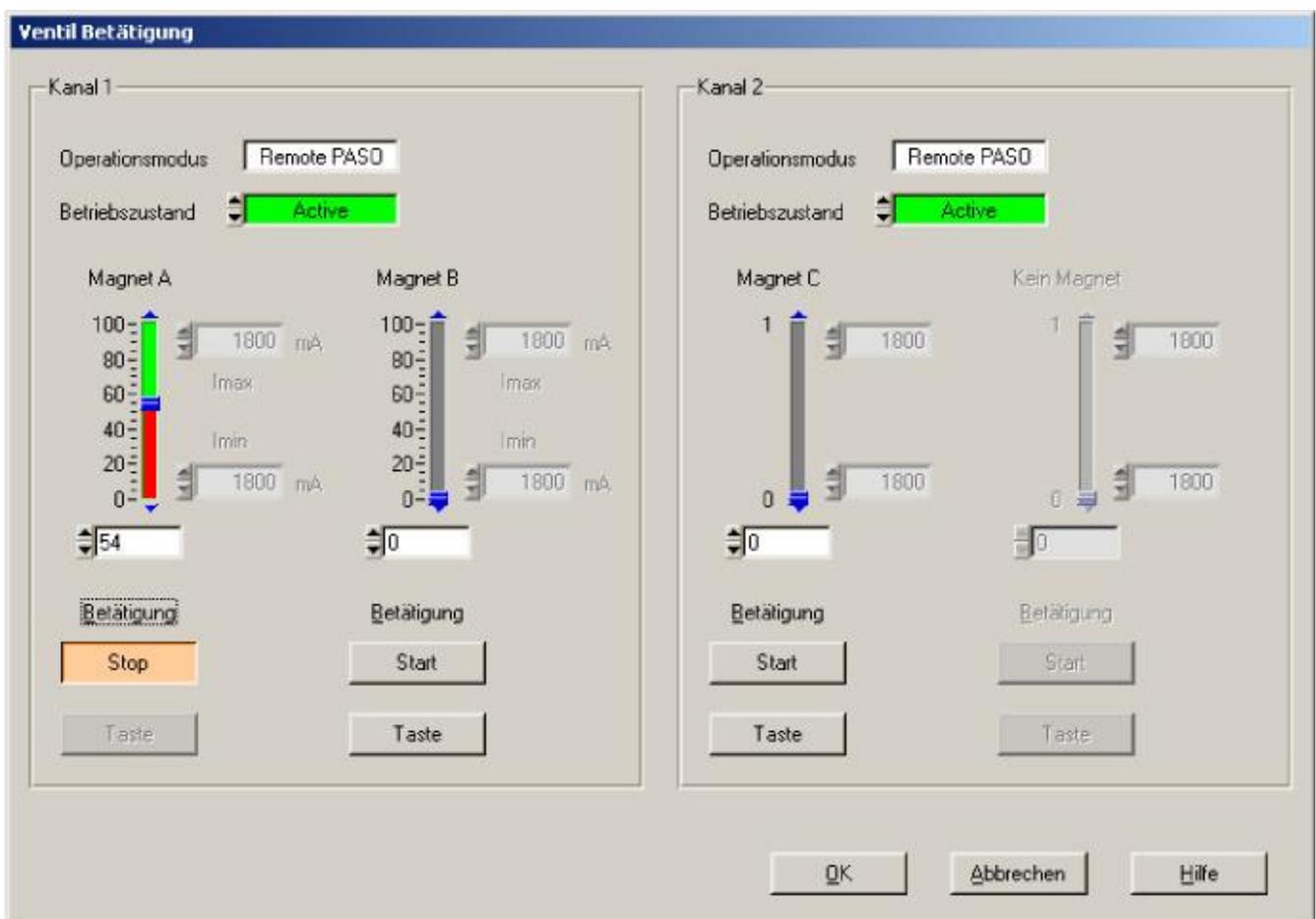
7.11.1 Valve operation

This menu point is only active in the "On Line"-mode.

In this window, the valve can be directly actuated via the elements available in the window.

It is possible to hold open also the window "Analysis - Signal recording" at the same time. These can be made with the selection of the menu item "Analysis - Signal recording" in the menu bar. Thus, the impact of the direct valve operation can be directly analyzed. If two windows are open, the window "Analysis - Signal recording" must be closed first before even the window "Valve operation" can be closed.

The following window appears:



- The number of the shown channels is equal to the number of channels that can be operated (refer to section ["Description of the Function"](#) ^[13])
- The number of solenoids per channel corresponds to the selected mode of operation (refer to section ["Valve type"](#) ^[71])
- The solenoid name (for example "solenoid A") corresponds to the selected solenoid output (refer to section ["Solenoid driver"](#) ^[72])
- In the field "Operation mode" the current operation mode of the channel will be displayed
- In the field "Control mode" the current control mode of the channel will be displayed

Field	Parameter description	Range / Step size
Operation mode	Select the desired operating mode (refer to section "Operating mode" ⁽¹⁶⁾). This adjustment can only be made if the field "Control mode" is set to "Disabled".	Local Remote PASO
Control mode	Select the desired control mode (refer to section "MD2 State machine" ⁽¹⁵⁾). This adjustment can only be made if the field "Operation mode" is set to "Remote PASO".	Disabled Active
Operation	With this button, the adjusted current can be sent to the solenoid or the solenoid can be set to 0 current. This button can only be operated if the field "Operation mode" is set to "Remote PASO" and the field "Control mode" is set to "Active".	Start / Stop
Solenoid x	The desired solenoid current can be adjusted either with the slider or in the numeric field. With a proportional solenoid, the adjustment from 0...100% refers to a solenoid current from Imin...Imax. With a switching solenoid, the solenoid can be switched off or on with 0 / 1. The adjusted current will be sent to the solenoid only if the button "Operation - Start" is activated (label of the button is "Stop")	0...100% (Imin...Imax) 0 / 1
Imin / Imax	The value of the parameter Imin / Imax from the corresponding solenoid driver can be changed (refer to section "Solenoid driver" ⁽⁷²⁾). If the window is closed with the key "OK", the changed values from Imin / Imax will be take over. If the window is closed with the key "Cancel", the changed values from Imin / Imax will be reset to the original values.	

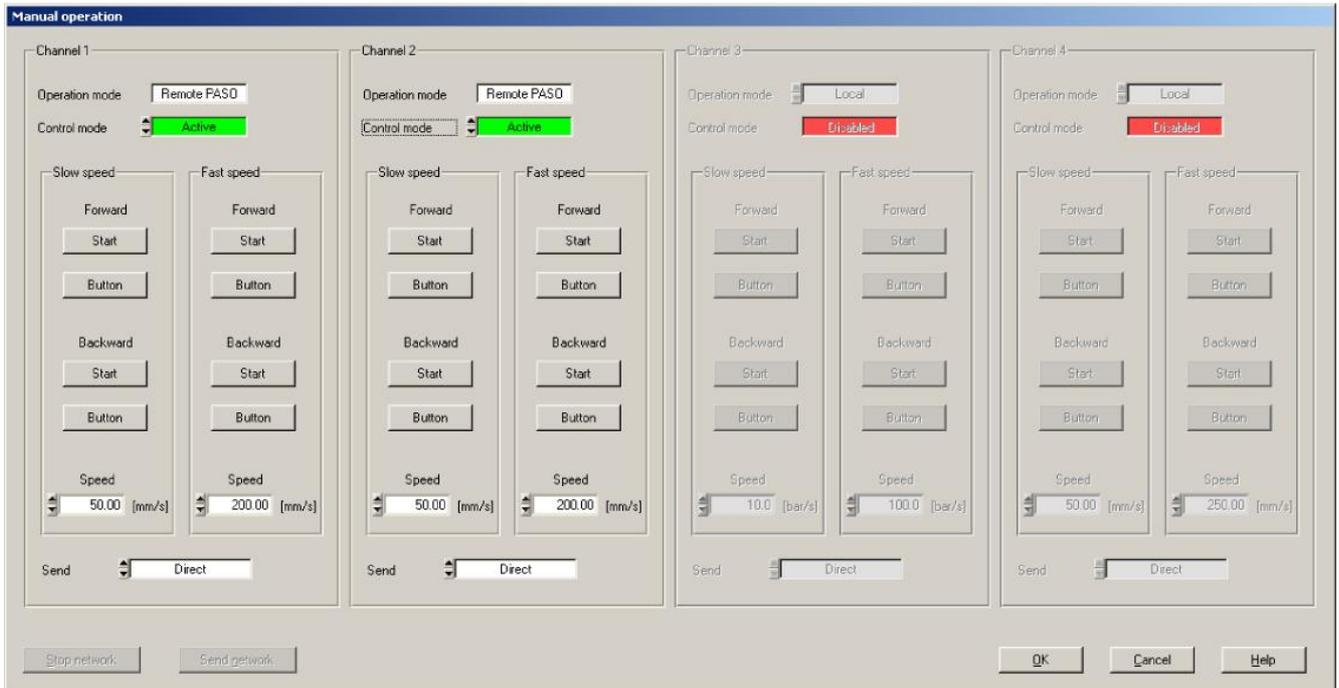
7.11.2 Manual operation

This menu point is only active in the "On Line"-mode.

In this window, the channels can be directly actuated in the manual operation via the elements available in the window.

It is possible to hold open also the window "Analysis - Signal recording" at the same time. These can be made with the selection of the menu item "Analysis - Signal recording" in the menu bar. Thus, the impact of the manual operation can be directly analyzed. If two windows are open, the window "Analysis - Signal recording" must be closed first before even the window "Manual operation" can be closed.

The following window appears:



- The number of the shown channels is equal to the number of channels that can be operated in the manual operation
- The number of active channels corresponds to the number of channels, for which a closed loop control mode is selected and for which the manual operation is enabled (refer to section "[Manul operation](#)" ⁵³)
- In the field "Operation mode" the current operation mode of the channel will be displayed
- In the field "Control mode" the current control mode of the channel will be displayed

Field	Parameter description	Range / Step size
Operation mode	Select the desired operating mode (refer to section "Operating mode" ⁽¹⁶⁾) This adjustment can only be made if the field "Control mode" is set to "Disabled".	Local Remote PASO
Control mode	Select the desired control mode (refer to section "MD2 State machine" ⁽¹⁵⁾) This adjustment can only be made if the field "Operation mode" is set to "Remote PASO".	Disabled Active
Slow speed Fast speed	Selection, if the manual mode should operate in slow speed or fast speed	
Start	By actuating this button, the manual operation is switched on forward or backward and switched off by actuating again. This button can only be operated if the field "Operation mode" is set to "Remote PASO" and the field "Control mode" is set to "Active".	Start / Stop
Button	As long as the left mouse button is pushed, the manual operation is switched on forward or backward. If the left mouse button is released or the mouse cursor moves outside of the button, it will switched off. This button can only be operated if the field "Operation mode" is set to "Remote PASO" and the field "Control mode" is set to "Active".	
Speed	Slow reps. fast speed. This value corresponds to the parameter "Slow speed" resp. "Fast speed" (refer tot section "Manual operation" ⁽⁵³⁾). If the window is closed with the key "OK", the changed values for the speed will be take over. If the window is closed with the key "Cancel", the changed values for the speed will be reset to the original values.	0 ... 15000 Step size depends on the scaling
Send	Selection of how the operation should be sent: Direct: Each activation of the keys "Start", "Stop" oder "Button" is sent immediately to the MD2-Electronics Channel network: Each activation of the keys "Start", "Stop" oder "Button" is not sent before the key "Send network" is actuating.	Direct Channel network
Send network	The preselected activation of the keys "Start", "Stop" oder "Button" is sent to the MD2-Electronics. This key can only be operated if at least on one channel the send is set to "Channel network".	
Stop network	All channels where the send is set to "Channel network" will be stopped. This key can only be operated if at least on one channel the send is set to "Channel network".	

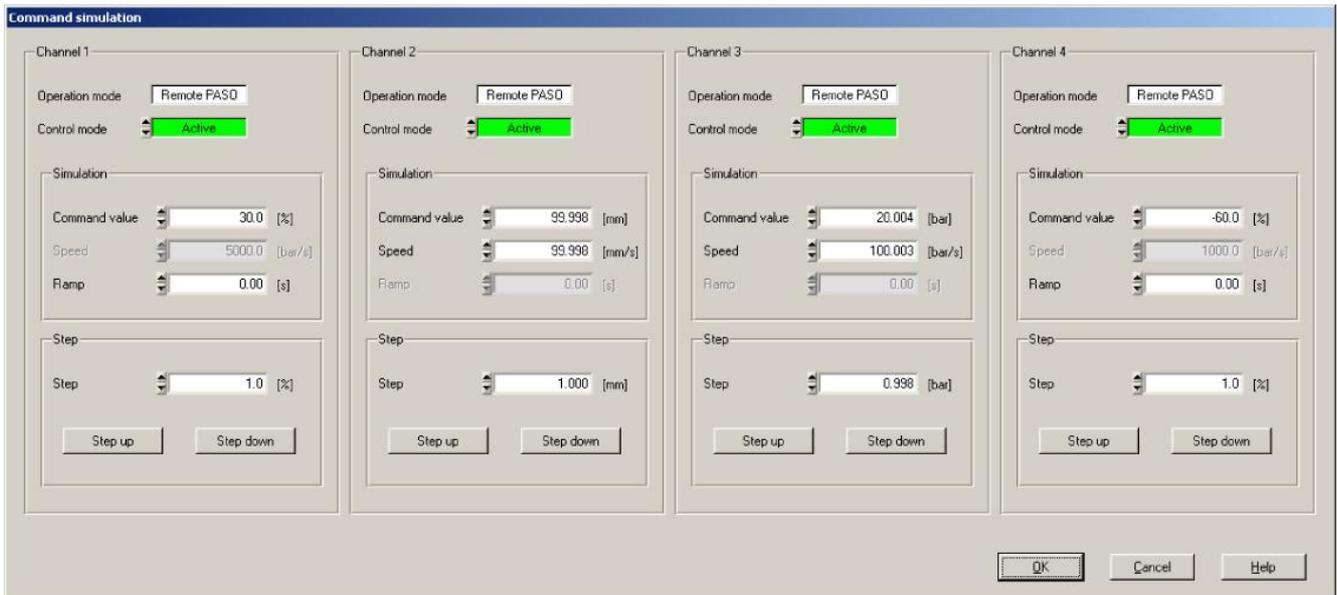
7.11.3 Command simulation

This menu point is only active in the "On Line"-mode.

In this window a command value can be set directly for each active axis.

It is possible to hold open also the window "Analysis - Signal recording" at the same time. These can be made with the selection of the menu item "Analysis - Signal recording" in the menu bar. Thus, the impact of the command simulation can be directly analyzed. If two windows are open, the window "Analysis - Signal recording" must be closed first before even the window "Command simulation" can be closed.

The following window appears:



- The number of the shown channels is equal to the number of active channels (refer to section ["Function description"](#) ⁽¹³⁾)
- In the field "Operation mode" the current operation mode of the channel will be displayed
- In the field "Control mode" the current control mode of the channel will be displayed

Field	Parameter description	Range / Step size
Operation mode	Select the desired operating mode (refer to section " Operating mode " ^[16]) This adjustment can only be made if the field "Control mode" is set to "Disabled".	Local Remote PASO
Control mode	Select the desired control mode (refer to section " MD2 State machine " ^[15]) This adjustment can only be made if the field "Operation mode" is set to "Remote PASO".	Disabled Active
Command value	Desired value of the command value. The setting depends on the selected control mode: Open-Loop control mode: The adjusted %-value refer to the adjusted solenoid current range (0 ... 100% = I _{min} ... I _{max}). A positive %-value will activate the solenoid A, a negative %-value will activate the solenoid B (0% = I _{min} A). Closed-Loop control mode: Desired value of the command value. The value can be adjusted in the selected unit.	-100% ... 100% 0.1% Adapted to unit
Speed	After a command value jump the new command value is run-up to over a linear ramp (depending on the speed set). On the actuator this corresponds to a certain travel speed. This parameter can only be set with a closed loop control mode.	0 ... 2000 Step size depends on the scaling
Ramp	After a command value jump, the new command value is approached via a linear ramp. The adjusted ramp time refer to a command value jump from 0% to 100% resp. from 100% to 0%. This parameter can only be set with a closed loop control mode.	0 ... 500s 0.05s
Step	With this value the command value will be added by clicking on the button "Step up" resp. will be subtracted by clicking on the button "Step down".	Adaped to command value
Step up	The command value will be added with the value from "Step"	
Step down	The command value will be subtracted with the value from "Step"	

7.12 Fieldbus-Menu

If the MD2-Electronics have a fieldbus, with this menu point the necessary bus node adjustments can be made. Also bus states will be displayed here.

If the MD2-Electronics have no fieldbus, the message "The connected MD2-Electronics don't provide an external bus port" will appear.

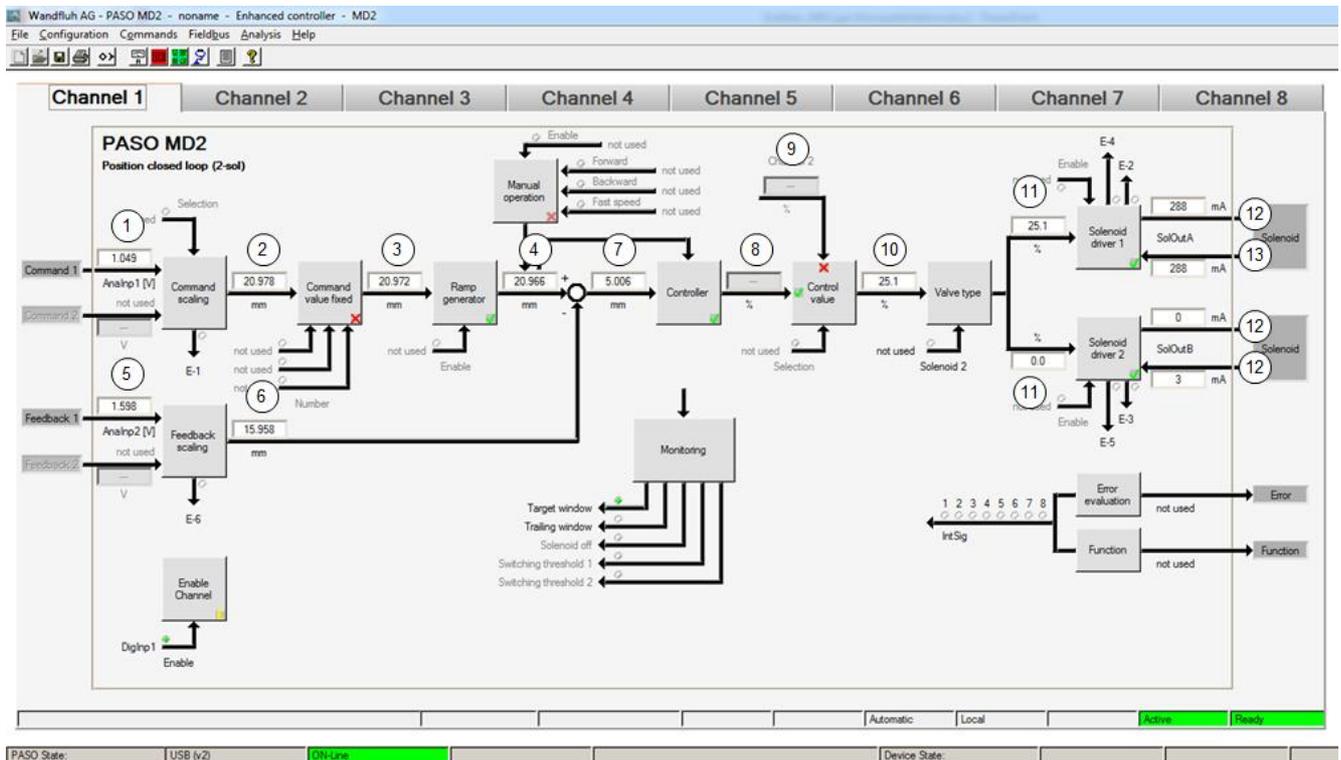
For more information about the possibilities for the MD2-Electronics with fieldbus, please refer to the document "Operating Instructions MD2 CANopen - Protocol with Device Profile in accordance with CiA DSP 408".

7.13 Analysis-Menu

In the Analysis menu, measured values and possible errors on the MD2-Electronics can be displayed on-line.

7.13.1 Show values

With this command, the online data-values of the selected channel can be switched on / off.



1 Input command value resp. command value 2

Actual command value. Is shown in V, mA, % or Hz, depending on the selected signal type (refer to section "[Command scaling](#)"^[45^b]).

2 Output value command scaling

Command value scaled to Min./Max. reference (refer to section "[Command scaling](#)"^[45^b]) and selected unit (refer to section "[Controller](#)"^[64^b]).

3 Output value command values fixes

Command value scaled to Min./Max. reference (refer to section "[Command scaling](#)"^[45^b]) and selected unit (refer to section "[Controller](#)"^[64^b]). If fixed command values are selected this value can differ to field 2.

4 Output value ramp generator

Command value scaled to Min./Max. reference (refer to section "[Command scaling](#)"^[45^b]) and selected unit (refer to section "[Controller](#)"^[64^b]). If a ramp is running this value can differ to field 3.

5 Input feedback value resp. feedback value 2

Actual Feedback value. Is shown in V, mA, % or Hz, depending on the selected signal type (refer to section "[Feedback scaling](#)"^[54^b]).

6 Output value feedback scaling

Feedback value scaled to Min./Max. reference (refer to section "[Feedback scaling](#)"^[54^b]) and selected unit (refer to section "[Controller](#)"^[64^b]).

7 Control deviation

Control deviation (Difference between field 4 - field 6) scaled to Min./Max. reference (refer to section "[Feedback scaling](#)"^[54^b]) and selected unit (refer to section "[Controller](#)"^[64^b]).

8 Output value controller

Command value scaled to -100...+100%. This value corresponds with the control deviation from field 7 charged with the controller adjustments (refer to section "[Controller](#)"^[64^b]) and scaled to -100...+100%.

9 Control value 2

Control value from the channel selected with the parameter "Source"

10 Output value control value

Depending on the selected function, the value from field 8 or from field 9 is shown

11 Input value solenoid driver 1 resp. solenoid driver 2

Command value scaled to 0...100%.

If the value in field 10 is -100...0% a command value is given to solenoid driver 2. The command value for solenoid driver 1 is 0.

If the value in field 10 is 0...100% a command value of is given to solenoid driver 1. The command value for solenoid driver 2 is 0.

12 Command solenoid current solenoid driver 1 resp. solenoid driver 2

Output solenoid current. It is shown in mA if solenoid type is "Proportional solenoid with current measurement". If solenoid type is "Proportional solenoid without current measurement" or "Switching solenoid without current measurement" the value is shown in % (refer to section ["Valve type"](#))^[71].

13 Actual solenoid current solenoid driver 1 resp. solenoid driver 2

Measured solenoid current. It is only shown if solenoid type is "Proportional solenoid with current measurement" (refer to section ["Valve type"](#))^[71].

7.13.2 Values window

This menu point is only active in the "On Line" - mode.

With this command, all relevant data of the connected MD2-Electronics are read-in and displayed. The values are continuously updated (on-line).

Field	Description	Unit
Supply voltage logic part	Supply voltage for the logical part of the MD2-Electronics .	V
Supply voltage solenoid outputs	Supply voltage for the solenoid outputs of the MD2-Electronics.	V
Temperature	Actual MD2 temperature.	°C
Digital inputs	Logical statuses of the digital input: <ul style="list-style-type: none"> • If the input is set • If the input is not set 	1 0
Digital outputs	Logical statuses of the digital output: <ul style="list-style-type: none"> • If the outputs are set • If the outputs are not set 	1 0
Internal signals	Logical status of the internal signals: <ul style="list-style-type: none"> • If the signal is set • If the signal is not set 	1 0

7.13.3 Signal Recording

In this menu, various signals of the connected MD2-Electronics can be recorded and analysed.

The selection of the data to be recorded takes place in the menu "Signal assignment", which is selected through the button "Signal assignment". In the "Offline - mode" it is not possible to record signals, it is possible, however, to process the recording parameters (menu "Signal assignment").

With the selection "Start - single", it is possible to record up to 250 measuring values per measuring channel (maximum 4 channels). The maximum recording duration of the recording can be derived from the scanning rate set multiplied with the number of the measuring values. The scanning rate is a minimum of 4ms. Because the first measured value is recorded at the point in time zero (start), the last measurement is situated one scanning step before the end of the measuring duration.

With the selection "Scroll - continuous", it is possible to record up to 20000 measuring values per measuring channel (maximum 4 channels). Displayed will be always the last 250 measuring values. All previous measured values can be displayed using a scroll bar. The scanning rate is a minimum of 12ms. With a small scanning rate, may the PC can not read in the measured values fast enough. In this case, a message appears and the recording is finished.

The recording parameters (signal type, scanning rate, etc.) together with the parameters are saved on the card

and when saving to a file they are saved on the hard-disk.

The recorded measuring values are **not** saved with the parameters. However, there is the possibility of exporting the recorded measuring values (button "Export").

With the help of the time cursor, the measuring values are displayed for every point in time.

When changing the mode "On-Line / Off-Line" and when terminating the PASO, the recorded measuring values are lost.

Field	Parameter description
Signal display	Switching-on the fields makes the recorded curve of the respective channel visible.
Time cursor	Positioning the time cursor over the input field time [s] or with the help of the slider control underneath the graphics.
Signal assignment	Opens the menu Signal Assignment ⁹⁶
New	Any recorder data are deleted and the card is ready for a new recording.
Start / Stop (single)	<p>Start A new recording is started. As soon as the trigger is actuated (or with "Trigger condition - start directly" immediately), the recording runs (apparent by the blinking of the field "Recording") and the measuring data are transmitted. If there are already measuring data in the memory, then the recording continues as from this point. Once the maximum number of measuring values (= 250) has been read-in, the possible remaining recording data are transmitted (the curves continue to be updated). During the transmission, it is already possible to analyse the curves ("Signal display", "Auto-scaling").</p> <p>Stop Stops the transmission and the recording. As from this point it is possible to record once again by a renewed actuation of Start.</p> <p>Once the maximum number of measuring values has been read-in or if "Scroll" was pressed, the Start button is dimmed.</p>
Scroll / Stop (continuous)	<p>Scroll A new recording is started. As soon as the trigger is actuated (or with "Trigger condition - start directly" immediately), the recording runs (apparent by the blinking of the field "Recording") and the measuring data are transmitted. If there are already measuring data in the memory, then the recording continues as from this point. As long as the buttons "Stop" or "New" are not pressed, the measuring values are read in. If the data memory on the SD7-Electronics is full or the maximum number of measuring value (= 20000) has been read-in, a message appears and the recording is stopped. During the transmission, it is already possible to analyse the curves ("Signal display", "Auto-scaling").</p> <p>Stop Stops the transmission and the recording. As from this point it is possible to record once again by a renewed actuation of Start.</p> <p>If "Start!" was pressed, the Scroll button is dimmed.</p>
Export	<p>By the actuation of this button the recorded data are saved on the hard-disk. The format used is a text format with tabulators as separators, so that it is easily possible to import the values into a different program (e.g. Excel). The decimal marker of the numbers can be selected: Decimal point or comma.</p>
Auto-scaling	<p>With this button, the curves are displayed in the graphics in an optimum manner. The optimisation is only carried out for the inserted curves. The values "Scaling/Div" and "Offset" of the corresponding channels ("Signal assignment" ⁹⁶"), are adapted for this purpose. The auto-scaling is also operative during a recording.</p>
Close	With this button, one leaves the signal recording menu. Any recording data are kept and these are displayed once more by a renewed selection of the menu.

Menu Signal Assignment

This menu is opened by the actuation of the button "Signal Assignment" in the Signal Recording window.

Field	Parameter description
Range "Signal selection"	In this menu, the selection which signals should be recorded can be made
Signal	The desired signals can be activated / not activated
Recording signal	The desired signal for recording can be selected (refer to " Show values " ⁹² " and " Values window " ⁹³)
Supplementary	For the following recording signals, the supplementary selection is active: - all channel depending signals desired channel - digital input desired digital input - digital output desired digital output - internal signal desired internal signal
Scale / Div	Vertical value for one step in the signal recording window
Offset	Offset value for the signal display in the signal recording window. If offset value = 0 the 0 - line from the signal value is in the middle of the signal recording window
Range "Trigger"	In this range the condition for the Trigger signal are made
Condition	Start condition for starting the recording: - negative slope: Signal level must change from higher than level value to smaller than level value - positive slope: Signal level must change from smaller than level value to higher than level value - pos/neg slope: Signal level must change from higher than level value to smaller than level value or from smaller than level value to higher than level value - start directly: by operating the "Start" button, the recording is started directly
Signal	Signal, on which triggering takes place
Level	Value for the start condition
Range "Sample time"	In this Range the recording time can be set
Sample time	Scanning rate for the recording (0.004 ... 60s, a multiple of 4ms). After this time interval, a new measurement is made. The value from the recording time will be adapted accordingly
Recording time	Desired recording period (1 ... 15000s). The value from the sample time will be adapted accordingly
OK	If changes have been made, then any possible recording data (together with the graphics) are deleted
Cancel	Any possible changes are cancelled again

The display parameters "Scaling/Div" and "Offset" are saved on the card together with the parameters.

7.13.4 Diagnostics

With this command, possibly present errors on the connected MD2-Electronics are indicated. The error is read in once. A complete description of the error will be displayed.

An active error is indicated as follows:

- on the SD7-Electronics, the red LED flashes (refer to "Blink code")
- in the status line per channel the text "Error" is displayed (instead of "Ready")
- in the main window a red point appears for the corresponding error
- the box "[Error evaluation](#)" has a red frame
- the button "Diagnostics" in the box "[Error evaluation](#)" is red
- in the box "[Error evaluation](#)" the corresponding current state of the error is red

The reaction to an existing error can be set in the box "Error evaluation" set (refer to section "[Error evaluation](#)")

Diagnostics:	Error	Error remedy
Power supply fault	If the supplied voltage < 6VDC. In the general status line it will be displayed if this error is present (State: Error) or not (State: Ready).	Disable and reenale the control.
Cable break command value input	This error is only detected, if the parameter "cablebreak" is set to "yes" and the command value is smaller than the lower cable break limit or higher than the upper cable break limit. In the status line of the corresponding channel it will be displayed if this error is present (State: Error) or not (State: Ready).	Disable and reenale the corresponding channel.
Cable break feedback value input	This error is only detected, if the parameter "cablebreak" is set to "yes" and the feedback value is smaller than the lower cable break limit or higher than the upper cable break limit. In the status line of the corresponding channel it will be displayed if this error is present (State: Error) or not (State: Ready).	Disable and reenale the corresponding channel.
Short circuit solenoid output	There is a short circuit on the solenoid output In the status line of the corresponding channel it will be displayed if this error is present (State: Error) or not (State: Ready).	Disable and reenale the corresponding channel.
Cable break solenoid output	There is a cable break on the solenoid output In the status line of the corresponding channel it will be displayed if this error is present (State: Error) or not (State: Ready).	Disable and reenale the corresponding channel.
Trailing error	The control deviation is higher than the threshold value from the trailing window (refer to section Windows). In the status line of the corresponding channel it will be displayed if this error is present (State: Error) or not (State: Ready).	

7.13.5 Temperature statistics

With this command the temperature history of the MD2-Electronics is displayed.

All statistic values are saved once per hour in the MD2 non-volatile memory. If the MD2 is operated for less than one hour, the values of the last operation period are not saved.

At the opening of the window, the current statistic values are read from the memory and displayed. While the window is open, the displayed values are not continuously updated.

Field	Description	Unit
Min. temperature value	Shows the deepest ever measured internal MD2 temperature. Is updated continuously in the background, however only once per hour saved in memory.	°C
Max. temperature value	Shows the highest ever measured internal MD2 temperature. Is updated continuously in the background, however only once per hour saved in memory..	°C
Temperature classes	Shows the frequency of the measured internal MD2 temperatures, distributed over 6 temperature classes. Every hour the current temperature is measured and the corresponding temperature counter is increased with one step and subsequently saved in memory, together with the minimal and maximal temperature. If one of the counters reached the highest value of 65535, the counters will not be updated furthermore.	

7.13.6 Operating hours

With this command the operating hours of the MD2-Electronics is displayed.

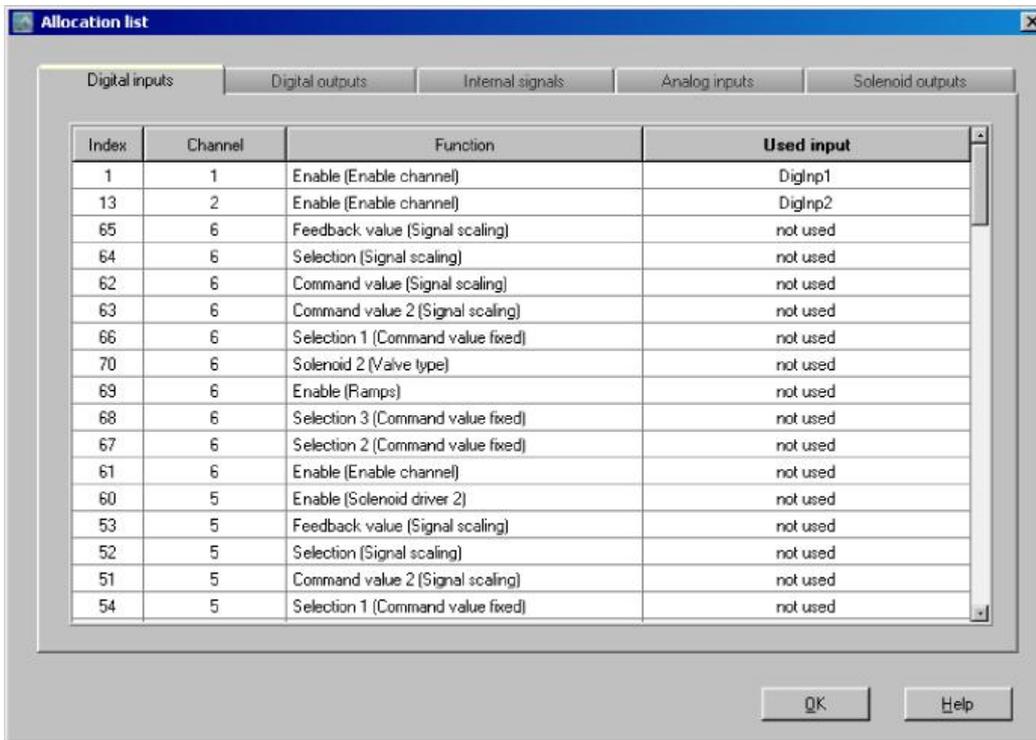
This value is saved once per hour in the MD2 non-volatile memory. If the MD2 is operated for less than one hour, the value of the last operation period is not saved.

At the opening of the window, the current value are read from the memory and displayed. While the window is open, the displayed value is not continuously updated.

Field	Description	Unit
Operating hours	Every hour the operating hours counter is increased with one step and subsequently saved in memory. If the counter reached the highest value of 65535, the counter will not be updated furthermore.	

7.13.7 Allocation list

With this command, the current allocation list of all inputs and outputs can be displayed.



Index	Channel	Function	Used input
1	1	Enable (Enable channel)	DigInp1
13	2	Enable (Enable channel)	DigInp2
65	6	Feedback value (Signal scaling)	not used
64	6	Selection (Signal scaling)	not used
62	6	Command value (Signal scaling)	not used
63	6	Command value 2 (Signal scaling)	not used
66	6	Selection 1 (Command value fixed)	not used
70	6	Solenoid 2 (Valve type)	not used
69	6	Enable (Ramps)	not used
68	6	Selection 3 (Command value fixed)	not used
67	6	Selection 2 (Command value fixed)	not used
61	6	Enable (Enable channel)	not used
60	5	Enable (Solenoid driver 2)	not used
53	5	Feedback value (Signal scaling)	not used
52	5	Selection (Signal scaling)	not used
51	5	Command value 2 (Signal scaling)	not used
54	5	Selection 1 (Command value fixed)	not used

The display of the allocation list can be divided in digital inputs, analog inputs, digital outputs and solenoid outputs. The display can be individually sorted. Inputs and outputs which are doubly occupied, have a yellow background (refer to section ["Assignment of the inputs/outputs"](#)^[32]).

7.14 Help-Menu

7.14.1 Description of the function

A general information about the function of the MD2-Electronics will be displayed.

7.14.2 Contents

The list of contents of the PASO MD2-Help will be displayed. By clicking on the desired subject, the corresponding help text will be displayed.

7.14.3 Card Identification

Here the current version of the hardware and the software from the connected MD2-Electronics will be read and displayed. They can not be changed.

Part number: Corresponds to the Wandfluh part number
 Serial number: The serial number has the following structure: YYDDXXXXX
 YY: Production year
 DDD: Production day (different for each card type)
 XXXX: Continuous number (different for each card type)

Software version: Corresponds to the installed software version on the connected SD7-Electronics. This information should be always applied when a request to Wandfluh is made.

Firmware version: Corresponds to the installed firmware version on the connected SD7-Electronics. This

information should be always applied when a request to Wandfluh is made.

Card type: Corresponds to the Wandfluh type code

Device configuration: This includes all relevant information about the existing hardware and software components. This information should be always applied when a request to Wandfluh is made.

Using the "Save" button, these values can be stored in a file. By some questions to the Wandfluh AG, this file can be sent via eMail to sales@wandfluh.com for an analysis.

7.14.4 WANDFLUH on the Web

A link to the [WANDFLUH home page](#).

7.14.5 Info

Information about PASO MD2 and its version.

8 System does not work

In this section, the generally possible errors and the procedures for eliminating them are listed and explained.

8.1 Procedure

The following check list can be used to help, if a problem is arised.

Question:	Action:	Possible errors and causes
State: Error	Analysis_Diagnostics Power supply error	<ul style="list-style-type: none"> The supplied voltage is under 6VDC. The error is also displayed if a supplied voltage interruption occurred ($t > 250\text{ms}$). Is the supplied power sufficient? Is the AC voltage too high (refer to section "Electrical specifications"^{[7^b])}? When the error is cleared, disable the controller for a short period and re-enable.
	Analysis_Diagnostics Cable break command value input	<ul style="list-style-type: none"> The command value is either smaller than the lower cable break limit or higher than the upper cable break limit. Check the command value signal connections between the command value encoder and MD2-Electronics. If the cablebreak detection is not desired, switch off the cablebreak detection (refer to section "Command scaling"^{[45^b)}). When the error is cleared, disable the corresponding channel for a short period and re-enable.
	Analysis_Diagnostics Cable break feedback value input	<ul style="list-style-type: none"> The feedback value is either smaller than the lower cable break limit or higher than the upper cable break limit. Check the feedback value signal connections between the command value encoder and MD2-Electronics. If the cablebreak detection is not desired, switch off the cablebreak detection (refer to section "Feedback scaling"^{[54^b)}). When the error is cleared, disable the corresponding channel for a short period and re-enable.
	Analysis_Diagnostics Short circuit solenoid output	<ul style="list-style-type: none"> There is a short circuit on the solenoid output. When the error is cleared, disable the corresponding channel for a short period and re-enable.
	Analysis_Diagnostics Cable break solenoid output	<ul style="list-style-type: none"> There is a cable break on the solenoid output. When the error is cleared, disable the corresponding channel for a short period and re-enable.
	Analysis_Diganostics Trailing error	<ul style="list-style-type: none"> The control deviation is higher than the threshold value from the trailing window (refer to section "Windows"^{[58^b)}), If the trailing error function is not desired, switch off the detection with the parameter "Trailing window type = off" (refer to section "Windows"^{[58^b)}). When the error is cleared, disable the corresponding channel for a short period and re-enable.

9 PASO MD2 Installation and Operation

The parameterisation software PASO MD2 serves for the parameterising and diagnosing of all Electronic cards MD2 of the WANDFLUH AG company. The software provides a user interface, through which by means of a keyboard or a mouse all adjustments and settings can easily be carried out. The communication with the digital card takes place through a USB-interface.

The parameterisation software PASO MD2 can only be utilised in connection with a MD2-Electronics of the WANDFLUH AG company.

9.1 System presupposition

A description of the different PASO versions is located in the file "history.pdf". This file is located in the directory where the PASO will be installed.

In order to be able to correctly utilise the PASO, an IBM-compatible PC with the following requirements has to be available:

- Processor Pentium 4/M, min. 256MB RAM (recommended 1GB RAM)
- Free harddisk storage space of minimum 30MB
- Operating system Windows 2000, Windows XP, Windows Vista, Window 7 or higher
- Standard VGA or higher graphics card, min resolution 1425 x 800
- At least one USB interface (USB 1.1 or USB 2.0)
- USB cable type A => B, male/male

9.2 Installation

The PASO software can be downloaded via the Internet free of charge (www.wandfluh.com/Download => PASO MD200 => Download Program files) or on request delivered on an installation-CD.

The installation of the PASO is then carried out by executing the file "setupPasoMD2.exe". An installation program takes over the complete installation of PASO. To them, the Windows Installer must be installed. This is normally a part of the Windows Environment. If not, please download it from the Microsoft Website.

If there is already a version of the PASO software installed on the PC, one can select if the existing version should be overwritten or removed.

The helpfiles are included in the setup and are installed automatically.

9.3 Connection to the Wandfluh card

The connection between the PC, on which the parameterisation software PASO MD2 is installed, and the MD2-Electronics takes place through the USB interface. To do this, a USB cable type A => B, male/male has to be connected with the desired USB port on the PC and with the USB socket on the MD2-Electronics.

During the installation of the parameterisation software PASO MD2, the used USB driver for the MD2-Electronics will be installed automatically. A new installation of this driver is possible. In the directory, where the parameterisation software PASO MD2 is installed, there is a sub directory "USB_Driver". In this sub directory, there is a file "PreInstaller.exe". With executing this file, the installation of the USB driver is possible.

If the USB driver for the MD2-Electronics is installed correctly, it must be shown in the Windows Devicemanager in the "USB-Controller" as "Wandfluh AG - MD2" while a MD2-Electronics is connected to the PC.

Hint:

The USB driver is not Windows certificated. Therefore a Windows warning message appears during installation with Windows XP. Please click "install" to continue installation. The PC will not be damaged. The same warning message appears by connecting a MD2-Electronics to the PC the first time. In this case please click "install". Both warning messages appear only with Windows XP. They do not appear with Windows 2000.

9.4 Mode "Off Line" and "On Line"

The parameterisation software PASO MD2 runs in one of two modes:

- In the **"Off Line"-mode**, the processing of the parameter files is possible. This has no influence in a possible connected Wandfluh-Electronics. The communication with the Wandfluh-Electronics is not active. A connection is allowed, but not necessary.

All menu points and keys, which involve an action in connection with the communication, are then blocked.

- In the **"On Line"-mode**, there is active communication with the Wandfluh-Electronics. Every change becomes immediately effective in the Wandfluh-Electronics. In this mode, the loading and processing of files is not possible. Only the saving of the currently active parameters to a file is possible.

There is permanent communication between the PASO MD2 and the connected Wandfluh-Electronics.

Because of that, it is not allowed to disconnect the connection to the Wandfluh-Electronics or to switch off the Wandfluh-Electronics in the "On Line"-mode.

The change between the two modes takes place through the menu point "File_Activate On Line / Activate Off Line". Near it, it's possible to select if the parameters should be read from the Wandfluh-Electronics (UPLOAD PARAMETERS, data flow Wandfluh-Electronics => PASO) or if the parameters should be send to the Wandfluh-Electronics (DOWNLOAD PARAMETERS, data flow PASO => Wandfluh-Electronics).

In case of an interference in the communication, the controlling of the Wandfluh-Electronics is not assured anymore. An error message follows and the PASO MD2 software automatically changes over to the "Off Line"-mode (refer to section ["Communication interruption"](#)^[104]).

9.5 Communication start up

When the parameterisation software PASO MD2 is started up, a check takes place, as to whether a communication with the Wandfluh-Electronics is possible. If no communication can be established, an error message appears (refer to section ["Communication interruption"](#)^[104]). If a communication with the connected card is possible, a check will be made, whether the current configuration of the PASO MD2 corresponds to the configuration of the connected Wandfluh-Electronics. If yes, the parameters will be transferred from the Wandfluh-Electronics to the PASO MD2. If no, a message will be displayed and the current configuration from the PASO MD2 will change automatically over to the new configuration and the parameters will be transferred from the Wandfluh-Electronics to the PASO MD2.

If several Wandfluh-Electronic devices are connected via the USB-Interface, the following window appears:



Here, the desired device for the communication start up can be selected.

9.6 Communication interruption

If no communication is possible during the start up or the interruption of the communication occurs during the operation of the parameterisation software PASO MD2, then an error message appears and the PASO MD2 software is set to the "Off Line"-mode. All menu points and keys, which involve an action in connection with the communication, are now blocked. In order to re-establish a communication, the menu point "File_Activate On Line" has to be selected.

Possible reasons for a communication interruption are:

- No Wandfluh-Electronics are connected
- The connected Wandfluh-Electronics are not switched on
- The USB driver is not correct installed (refer to section "[Connection to the Wandfluh card](#)"⁽¹⁰²⁾)
- The connection cable is defect or not plugged in

9.7 Program description

9.7.1 Description of the keys

TAB	Transfer to the next input element
SHIFT-TAB	Transfer to the previous input element
ENTER	Execution of the active input element or conclusion of an input.
ESC	Abort, undoing of an action. In many cases corresponds to the key "Cancel".
F1	Activate the key "Help"

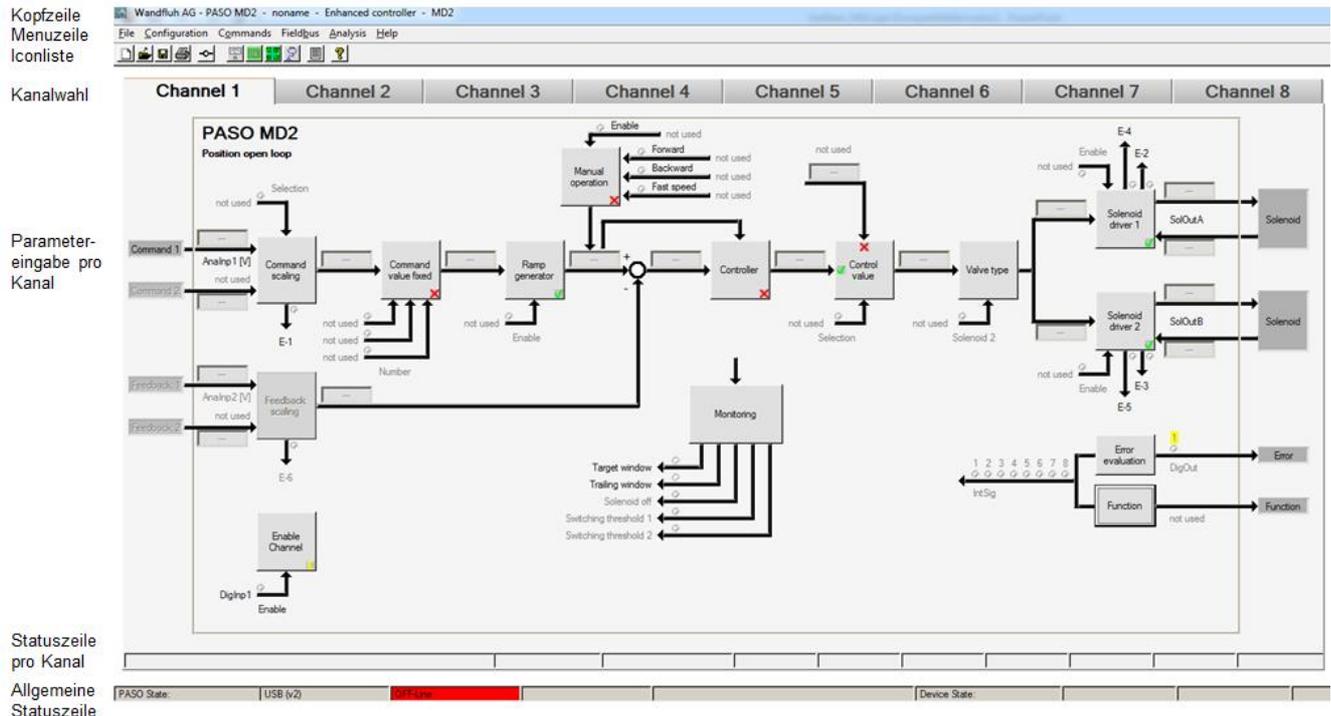
9.7.2 Input elements

Key	<p>A key executes the action, with which it is inscribed.</p> <p>Actuation of a key through the keyboard:</p> <ul style="list-style-type: none"> • Push the key TAB, until the key becomes active. • Push the key ENTER. The action is now carried out. • Push the key ALT and the underlined letter of the key inscription: The action is carried out immediately. <p>Actuation of a key with the mouse:</p> <ul style="list-style-type: none"> • Click on the corresponding key. The action is now carried out.
Switch	<p>By means of a switch, a selection between two possibilities is possible. A switch is either switched on or - off.</p> <p>Actuation of a switch through the keyboard:</p> <ul style="list-style-type: none"> • Push the keys UP or HOME to switch on the switch. • Push the keys DOWN or END to switch off the switch. • Push the SPACE key for changing over (switching over). <p>Actuation of a switch with the mouse:</p> <ul style="list-style-type: none"> • Click on the switch for changing over (switching over).
Input field	<p>The input fields enable the entering of numbers or text. All applicable keys of the keyboard are allowed, including the keys HOME, END, LEFT, RIGHT. In certain cases when taking it over, the input is checked and if necessary an error message is issued.</p> <p>Actuation of an input field through the keyboard:</p> <ul style="list-style-type: none"> • Push the key ENTER or TAB to finish with the input field. • In the case of input fields with ARROW keys UP and DOWN: Actuation of the UP-/DOWN - keys for the step by step changing of the values. <p>Actuation of an input field with the mouse:</p> <ul style="list-style-type: none"> • Click within the input field, in order to position the cursor in it. • In the case of input fields with ARROW keys UP and DOWN: Click on the corresponding arrow for the step by step changing of the values.
Selection field	<p>The selection fields enable the selection from various possibilities.</p> <p>Actuation of a selection field through the keyboard:</p> <ul style="list-style-type: none"> • Push the SPACE key to open all selection possibilities. With the help of the keys UP, DOWN, HOME, END, make the required selection. Subsequently push the ENTER key to confirm the required selection, or else the ESC key to undo the selection. • Push the key UP to cyclically select the previous selection. • Push the key DOWN to cyclically select the next selection. • Push the key HOME to select the first item of the selection list. • Push the key END to select the last item of the selection list. <p>Actuation of a selection field with the mouse:</p> <ul style="list-style-type: none"> • Click inside the selection field so that all selection possibilities are displayed and then click on the required selection.

9.8 Starting of PASO MD2

Following the successful installation, the parameterisation software PASO MD2 can be started by double-clicking on the PASO MD2 - icon. Certain settings of the PASO MD2 software, e.g., the selected interface port, are saved in the file "konfig.kon". When PASO MD2 is started for the first time, the configuration values in this file are set to standard values. During the course of running the program, these values can be corrected.

After the start-up, the Start window appears:



During the start-up, the parameterisation software PASO MD2 checks, whether a Wandfluh-Electronics device is connected. If no communication can be established, an error message appears (refer to section ["Communication interruption"](#)^[104]) and the "Off Line"-mode will become active. All menu points and keys, which involve an action in connection with the communication, are then blocked. All other functions of the parameterisation software PASO MD2 can be utilised without any limitation.

If the communication works without any interference, the software PASO MD2 checks, whether the current configuration of the PASO MD2 corresponds with the configuration of the connected digital controller card. If no, a message will be displayed and the current configuration from the PASO MD2 will change automatically over to the new configuration.

Subsequently the parameters are loaded from the card and subsequently a verification of the Wandfluh-Electronics values takes place. If one or several parameters are outside the corresponding tolerance, they are replaced with standard values and a message is issued (refer so section ["Limiting value error"](#)^[105]). The changed parameters can be either sent directly to the connected Wandfluh-Electronics or the communication start-up can be terminated (the "Off-Line"-mode will become active). In the latter case the user has the possibility to correct the parameters in "Off-Line"-mode. The communication is resumed again via the menu point "File_Activate On Line". Subsequently the user has to select the option "Reprogram the Wandfluh-Electronics", in order for the corrected values to be made active on the Wandfluh-Electronics.

The parameter input can be made with clicking with the left mouse key on the corresponding box in the channel window. A input window will appear where all the desired values can be entered.

The menu points in the menu line can be selected in the following manner:

- by clicking on them with the mouse
- by actuating the key "ALT" and the underlined letter of the required menu point

- if a menu point has been selected, then by means of the keys "←" and "→" one can change to the next menu point and with the keys "↑" and "↓" one can change to the next sub-menu point within the menu selection field.
- by clicking on the corresponding icon in the icon list

In the header line of the window, the name of the current file is always displayed. If no existing file has been loaded or if the data have not been saved to a file, then this line reads "noname".

The following states will be displayed in the general status line:

- 1st field: Selected interface ("USB")
- 2nd field: Current mode ("On Line" or "Off Line", refer to section ["Mode "Off Line" and "On Line" | 103](#))

The following states will be displayed in the channel status line:

- 3rd field: Operating mode ("Remote PASO" or "Local", refer to section ["Operating mode" | 16](#))
- 5th field: MD2 state ("Disabled" or "Active", refer to section ["MD2 State machine" | 15](#))
- 6th field: Error state (Ready or Error, refer to section ["Analysis Diagnostic" | 97](#))

9.9 Store parameter

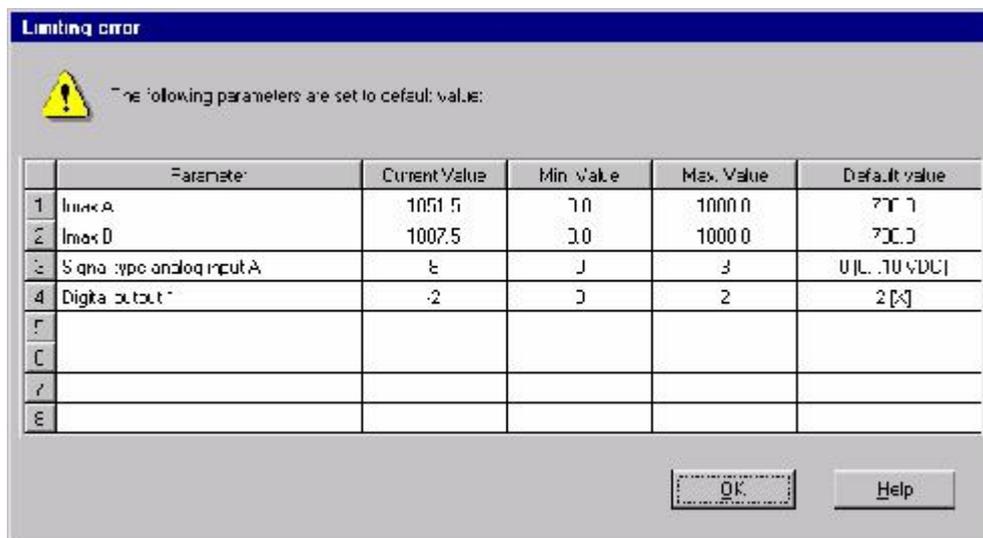
Each new input value is immediately transferred to the connected Wandfluh-Electronics after the completion of the input field (either by pushing the key ENTER or by activating another input field).

If the window is closed with the key "OK", the values are stored in the Wandfluh-Electronics so that they are available after the Wandfluh-Electronics are switched on again (non-volatile memory).

If the window is closed with the key "Cancel", the previous current values are active again. All inputs made in the current window are cancelled.

9.10 Limiting value error

Each incoming parameter (either transferred via the serial interface or loaded from a file) is checked against the limiting value. If a parameter is smaller or bigger than its limiting value (= limiting value error), it is set automatically to the default value and the following window appears:



Parameter: Name of the parameter with the limiting value error
 Current value: Current value of the parameter
 Min. value: Minimum allowed value of the parameter
 Max. value: Maximum allowed value of the parameter
 Default value: Default value of the parameter

After pressing the key "OK", the current value is overwritten by the default value.

Normally, a limiting value error does not happen. However, in the following cases it can happen:

- loading a file, in which parameter values have been changed from outside
- reading parameter values from a Wandfluh-Electronics device with another configuration than the current configuration in the PASO (only if the Wandfluh-Electronics were changed while in the "On Line"-mode)
- if the transmission of the parameter values is wrong

9.11 Description of Commands

The description of the individual commands and parameters is contained in section "[Settings](#)" ¹³.

10 Disposal

- The MD2-Electronics have to be disposed of in accordance with the generally applicable regulations of that country, in which it is being used.
- Electronics components are recycled by companies specialised in this field.

11 Accessories

- Parameterisation software refer to [Commissioning](#) ²⁸
- Connection-Set for MD2 "Basic"
Wandfluh Art. No. 727.9900
 - 1 pce mating connector 30-poles
 - 50 pce crimp terminals
 - 30 pce cavity filler plugs
- Connection-Set für MD2 "Enhanced"
Wandfluh Art. No. 727.9901
 - 1 pce mating connector 30-poles
 - 1 pce mating connector 18-poles
 - 80 pce crimp terminals
 - 50 pce cavity filler plugs
- Mating connector Plug (female) Typ SHS 30-poles
Cinch Art. No. 581 01 30 029
- Mating connector Plug (female) Typ SHS 18-poles
Cinch Art. No. 581 01 18 023
- Crimp terminal 0.8-1.0mm²
Cinch Art. No. 425 00 00 873
- Cavity filler plug Cinch Art. No. 581 00 00 011
- Tool Cinch Art. No. 599 11 11 628
(to open mating connector) Wandfluh Art. No. 983.0950
- Tool Cinch Art.No. 599 11 11 616
(hand crimp tool for crimp terminals)
- Tool Cinch Art. No. 581 01 18 920
(removal tool for crimp terminals)

12 Additional information

You can find additional information in the following Wandfluh documentations:

Wandfluh-Electronics general	Documentation A	Register	1.13
Accessories	Documentation A	Register	1.13
Proportional directional control valves	Documentation A	Register	1.10
Proportional pressure control valves	Documentation A	Register	2.3
Proportional flow control valves	Documentation A	Register	2.6