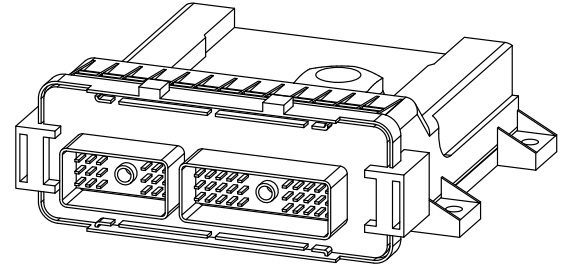


**Digital amplifier- and controller electronics MD2**

- Robust construction for mobile applications
- For 4 or 8 proportional- or switching solenoids
- Plug-in connection suitable for mobile applications
- Protection class IP67
- Adjustable via PC
- CANopen®-Connection
- Available as amplifier or controller


**DESCRIPTION**

Digital amplifier electronics, with four or eight solenoid outputs. They are characterised by a robust and compact construction. The extensive supply voltage range enables the driving of 12VDC- and 24VDC- devices. The parameterisation takes place through the menu-controlled parameterisation- and diagnostics software «PASO» of Wandfluh (USB-interface). The electronics are available as an amplifier - and as a controller function with optional CAN-interface (according to CANopen® DSP-408).

**FUNCTION**

The electronics have four, resp., eight pulse width modulated current outputs with superimposed dither signal. The solenoid outputs can also be parameterised for black/white solenoids. The two, resp. four analogue- and digital inputs as well as the two digital outputs are individually programmable. With the device, control- and closed-circuit control tasks can very easily be solved. The CAN-connection enables the reading-in of command value- and feedback value signals as well as the parameterisation directly through the field-bus.

**APPLICATION**

Screwed on to a metallic surface, the amplifier electronics are used primarily in the mobile field because of their compact construction, protection class IP67, extensive operating temperature range and the selected plug-in connection. Customer-specific requirements can easily be implemented.

**CONTENT**

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**TYPE CODE**

	M	D2	3			D8		-		#	
Mobile											
Digital											
Parameters to be set with «PASO»											
Software configuration (function of card)											
• «Basic»-amplifier				0							
• «Enhanced»-amplifier				5							
• «Basic»-controller				6							
• «Enhanced»-controller				8							
4-solenoid version			4								
8-solenoid version			8								
Supply voltage 8 ... 32 VDC											
Analogue inputs:											
• all voltage				1							
• all current				2							
• «Basic»				3							
Analogue input 1: voltage											
Analogue input 2: current											
• «Enhanced»											
Analogue input 1 and 3: both voltage											
Analogue input 2 and 4: both current											
Option field bus:											
• without field bus				A							
• with CANopen®				C							
Design-Index (Subject to change)											

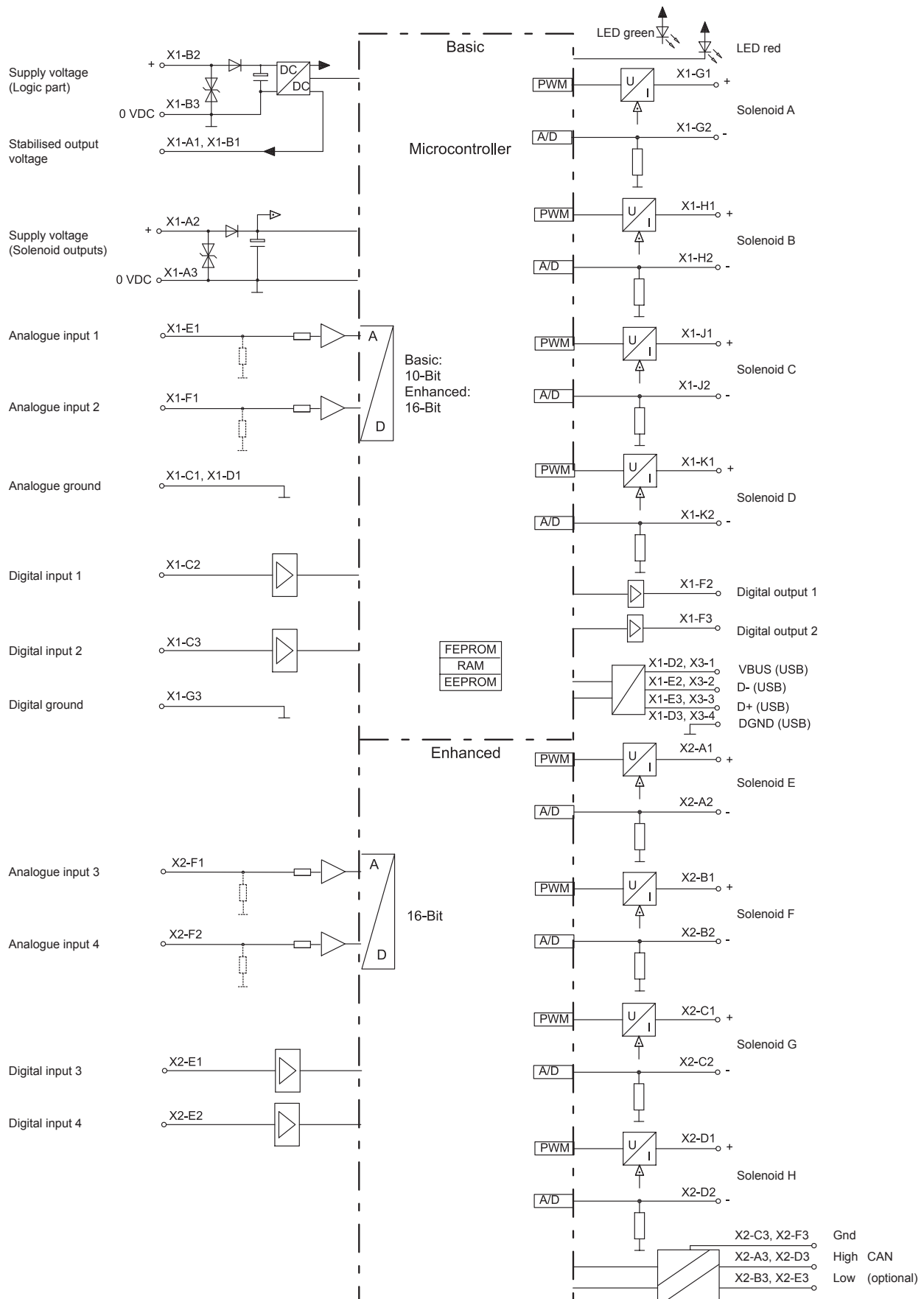
**GENERAL SPECIFICATIONS**

Execution	Housing made of plastic
Dimensions	153 x 57 x 147 (see dimensions)
Installations	On metallic surface, screwed on
Weight	0,50 kg
Device receptacle (male)	Type SHS, 30/48-poles (Manufacturer CINCH, www.cinch.com)
Mating connector	Plug (female) type SHS, 30-poles (not incl. in delivery)
Mating connector	Plug (female) type SHS, 18-poles (for MD2 «Enhanced» only, not incl. in delivery)
Working temperature	-40...+85 °C
Environmental compatibility	The material limit values from the RoHS-directive (2002/95/EC) and the ELV «end-of life vehicles directive» (2000/53/EC) are complied with.

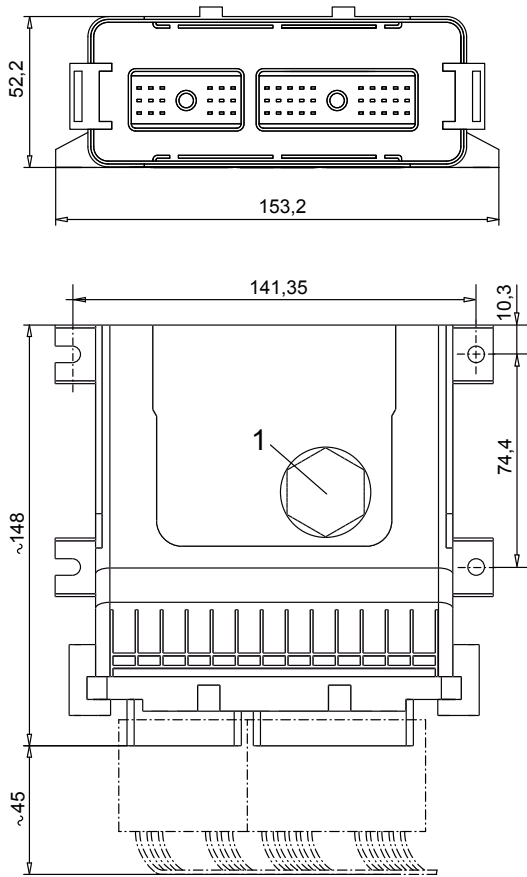
**ELECTRICAL SPECIFICATIONS**

Protection class	IP67 acc. to DIN/EN 60 529	Dither	Frequency adjustable 20...500 Hz Factory-preset 100 Hz
Supply voltage	8...32 VDC (for logic part) 8...32 VDC (for solenoid outputs)		Amplitude adjustable 0...400 mA Factory-preset 100 mA
Ripple on supply vol.	<10 %	Temperature drift	<1 % at $\Delta T = 40^\circ C$
Fuse	slow-blow	Digital inputs	Switching threshold high 6...32 VDC Switching threshold low 0...1 VDC Utilisable as frequency input (frequencies 0...5 kHz) and as PWM-input (automatic frequency identification)
Current consumption:		Digital outputs	High-Side-Switch Maximum load 500 mA per output 0...500 s
• No-load current	approx. 55 mA	Ramps adjustable	USB (receptacle type B) to set parameters with «PASO»
• Maximum current consumption	no-load current + 2 A per solenoid	Serial interface	
Analogue inputs:		LED	
• Voltage	0...+5 V/0...+10 V/-10...+10 V	Green:	– is lit, when the MD2 - electronics are ready for operation. – blinks twice, if the supply voltage is too low for the solenoid outputs.
• Current	4...20 mA/0...+20 mA	Red:	– is lit, when an error has occurred. The cause for the error can be identified by means of the «PASO»-software.
• Resolution	Basic: Analogue inputs 1 and 2: 10-Bit resolution Enhanced: Analogue inputs 1 to 4: 16 bit resolution	EMV	
• Input resistance	Voltage input > 18 k $\Omega$ Load for current input = 250 $\Omega$	• Immunity	EN 61 000-6-2
Stabilised output voltage	5 VDC max. load 50 mA	• Emission	EN 61 000-6-4
Solenoid current:		• Road vehicles	ISO 7637-2 and RL 2004/104/EC
• Minimal current $I_{min}$	Adjustable 0...950 mA Factory-preset 150 mA	Vibration/shock	
• Maximal current $I_{max}$	Adjustable: $I_{min}$ ...2 A Factory-preset 700 mA	• Oscillation	IEC 60 068-2-6
• Accumulated current limitation	10 A The number of solenoids simultaneously supplied with current and their maximum current are dependent on the ambient temperature. Further information can be found in the operating instructions.	• Single shock	IEC 60 068-2-27
CANopen® interface (optional)	Two-wire line acc. to ISO 11898 differential signal transmission	• Continuous shock	IEC 60 068-2-29
Bustopology	Line		
Voltage separation	CANopen® to MD2 500 VDC		

**BLOCK DIAGRAM**



**DIMENSIONS**



**ACCESSORIES**

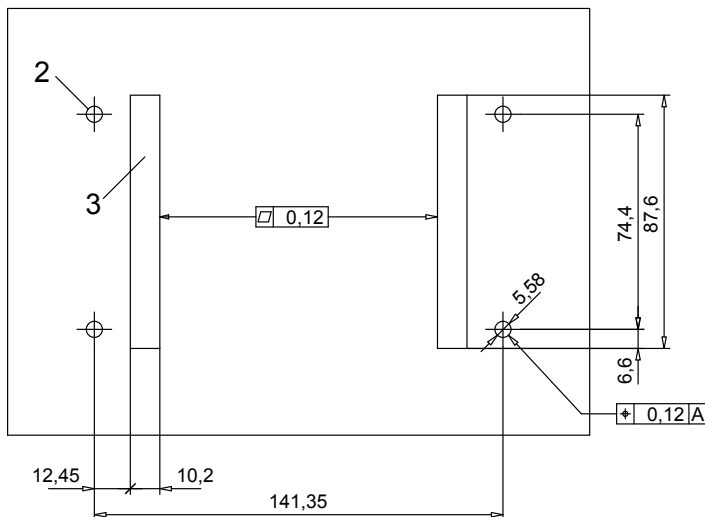
- Parameterisation software Refer to commissioning
- Connection-Set for MD2 «Basic» Wandfluh No 727.9900
  - 1 pce mating connector 30-poles
  - 50 pce crimp terminals
  - 30 pce cavity filler plugs
- Connection-Set for MD2 «Enhanced» Wandfluh No 727.9901
  - 1 pce mating connector 30-poles
  - 1 pce mating connector 18-poles
  - 80 pce crimp terminals
  - 50 pce cavity filler plugs
- Mating connector Plug (female) type SHS 30-poles Cinch No 581 01 30 029
- Mating connector Plug (female) type SHS 18-poles Cinch No 581 01 18 023
- Crimp terminal 0,8–1,0 mm<sup>2</sup> Cinch No 425 00 00 873
- Cavity filler plug Cinch No 581 00 00 011
- Tool (to open mating connector) Cinch No 599 11 11 628 Wandfluh No 983.0950
- Tool (Hand crimp tool for crimp terminals) Cinch No 599 11 11 616
- Tool (Removal tool for crimp terminals) Cinch No 581 01 18 920

1 Transparent screw-on cap for the access to the USB - interface. The green and the red LEDs are visible without having to remove the screw-on cap.

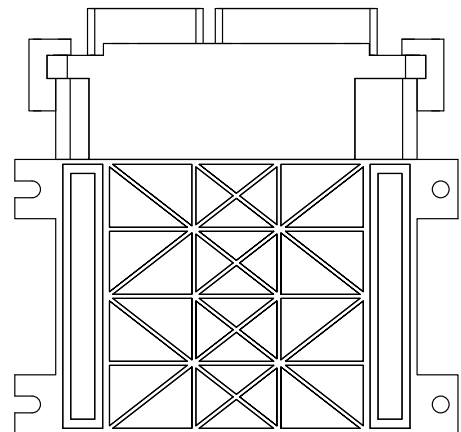
**ASSEMBLY**

For conducting the heat away, the MD2-electronics have to be installed on a metallic surface.

Mounting surface

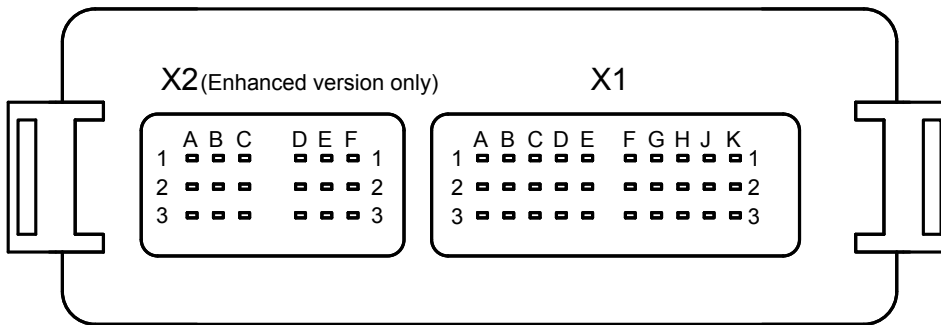


View from below

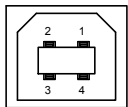


2 Installation bores

3 Contact surface for the cooling body

**CONNECTOR WIRING DIAGRAM / PIN ASSIGNMENT**

**DEVICE PLUG (X2; ONLY FOR ENHANCED VERSION)**

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

**USB-interface (X3, underneath the screw cover)**


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

Socket USB type B


**Remark!**

The parameterisation cable is not part of the scope of supply (commercially available USB-cable, plug type A to plug type B)

**START-UP**

Information regarding installation and commissioning are contained in the information leaflet supplied with the amplifier module and in the operating instructions.

Additional information can be found on our website:  
 «[www.wandfluh.com](http://www.wandfluh.com)»

Free-of-charge download:

- «PASO-MD2» Parameterisation software
- Operating instructions (\*.pdf)

**DEVICE PLUG (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 = Digital ground  
 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

**ADDITIONAL INFORMATION**

Wandfluh electronics general Accessories

Proportional directional valves  
 Proportional pressure valves  
 Proportional flow control valves

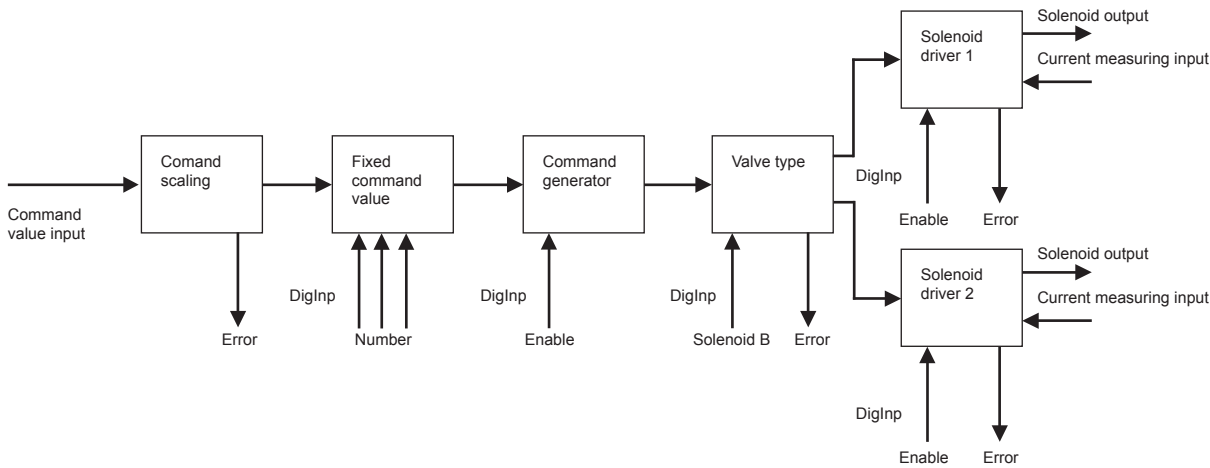
Wandfluh-Dokumentation  
 register 1.13  
 register 1.13  
 register 1.10  
 register 2.3  
 register 2.6

## Description of the «MD2»-amplifier electronics

### DESIGN

The mobile electronics can be parameterised by means of the parameterisation software «PASO MD2» through the USB-interface. In addition, the parameterisation software makes a data analysis possible. The software «PASO MD2» is supported by Windows 2000, Windows XP, Windows Vista and Windows 7.

### DESCRIPTION OF FUNCTION



### MD2 AMPLIFIER

#### Command value scaling

The command value can be applied as a voltage -, current -, digital -, frequency - or PWM-signal. For each command value the input utilised can be selected. The scaling takes place through the parameters «Interface» and «Reference». Furthermore each command value can be monitored for cable break (excepting the voltage - and digital signal). For each command value a dead band can be set.

#### Fixed command values

There are 7 fixed command values available, which can be selected through 3 digital inputs.

#### Command value generator

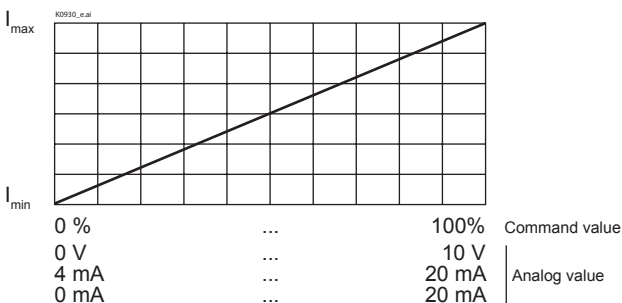
Per solenoid output, two linear ramps separately settable for Up and Down are available.

#### Valve type

Here the operating mode is set, when in open-loop controller mode. In addition it can be selected, whether proportional - or switching solenoids are to be driven.

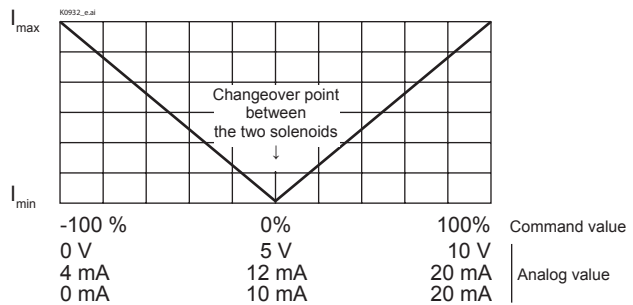
#### Operating mode command value unipolar (1-solenoid)

The solenoid is driven in dependence of a unipolar command value signal (voltage, current, frequency or PWM) (e.g., 0...10V correspond to 0...100 % command value, 0...100 % command value correspond to I<sub>min</sub>...I<sub>max</sub> solenoid driver 1).



#### Operating mode command value unipolar (2-solenoids)

Depending on the signal level (voltage, current, frequency or PWM), one of the two solenoids is driven in dependence of a unipolar command value signal. The switching point between the two solenoids, as standard, is at the centre of the values range of the command value signal (e.g., 0...10V correspond to -100...+100 % command value, -100...0 % command value correspond to I<sub>min</sub>...I<sub>max</sub> solenoid driver 2, 0...+100 % command value correspond to I<sub>min</sub>...I<sub>max</sub> solenoid driver 1).



#### Operating mode command value bipolar (2-solenoids)

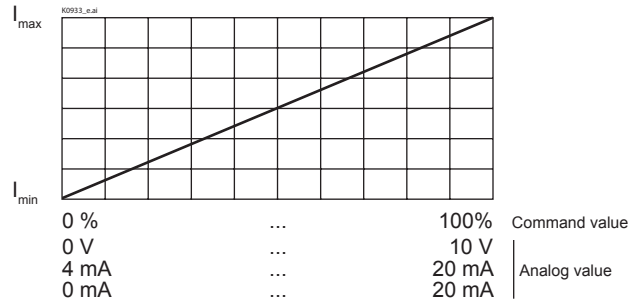
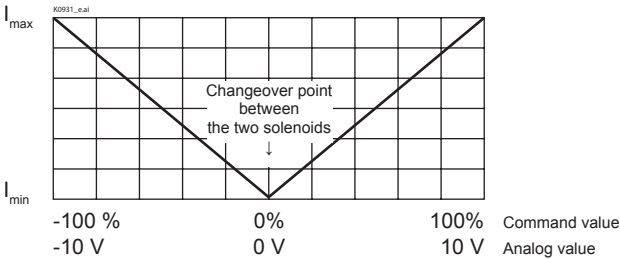
In dependence of a bipolar command value signal (voltage), according to the signal level, one of the two solenoids is driven. The changeover point between the two solenoids as standard is at 0V (e.g., -10...+10V correspond to -100...+100 % command value, -100...0 % command value correspond to I<sub>min</sub>...I<sub>max</sub> solenoid driver 2, 0...+100 % command value correspond to I<sub>min</sub>...I<sub>max</sub> solenoid driver 1).

**Operating mode command value unipolar (2-solenoids with DigIn)**

In dependence of a unipolar command signal (voltage, current, frequency or PWM) the solenoid is driven by the solenoid driver 1, if the selected digital input is «not activated», resp. the solenoid is driven by the solenoid driver 2, if the selected digital input is «activated» (e.g., 0...10V correspond to 0...100 % command value, 0...100 % command value correspond to  $I_{min}$ ... $I_{max}$  solenoid driver 1 or 2).

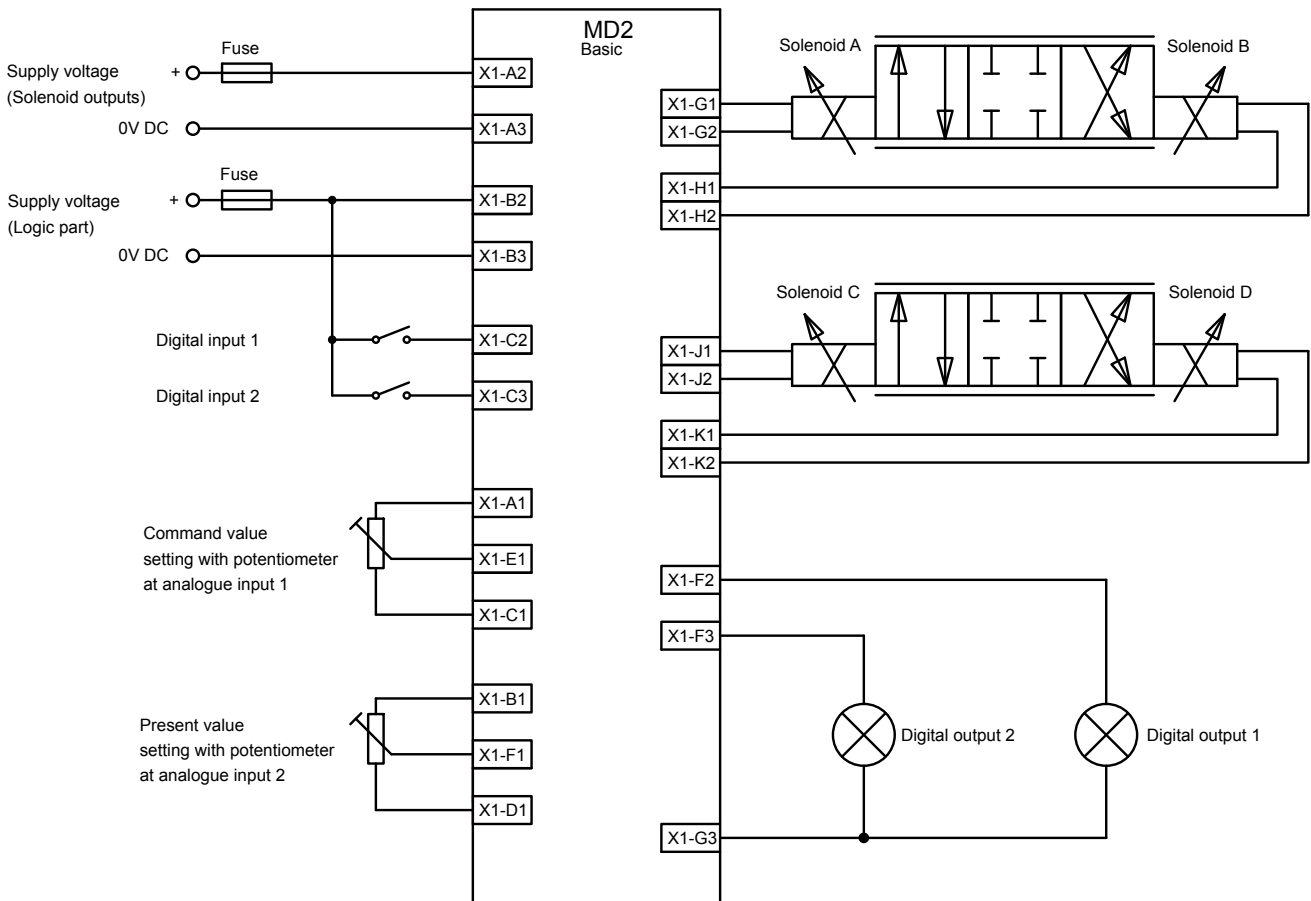
**Solenoid drivers**

Four (in case of the basic version) or eight (in case of the enhanced version) pulse width modulated current outputs are available. A dither signal is superimposed on the output, whereby the dither frequency and the dither level are separately adjustable. For each output the minimum ( $I_{min}$ ) and the maximum ( $I_{max}$ ) current can be separately set. The solenoid outputs are also configurable as switching outputs. In doing so, a power reduction can be separately set for each output.



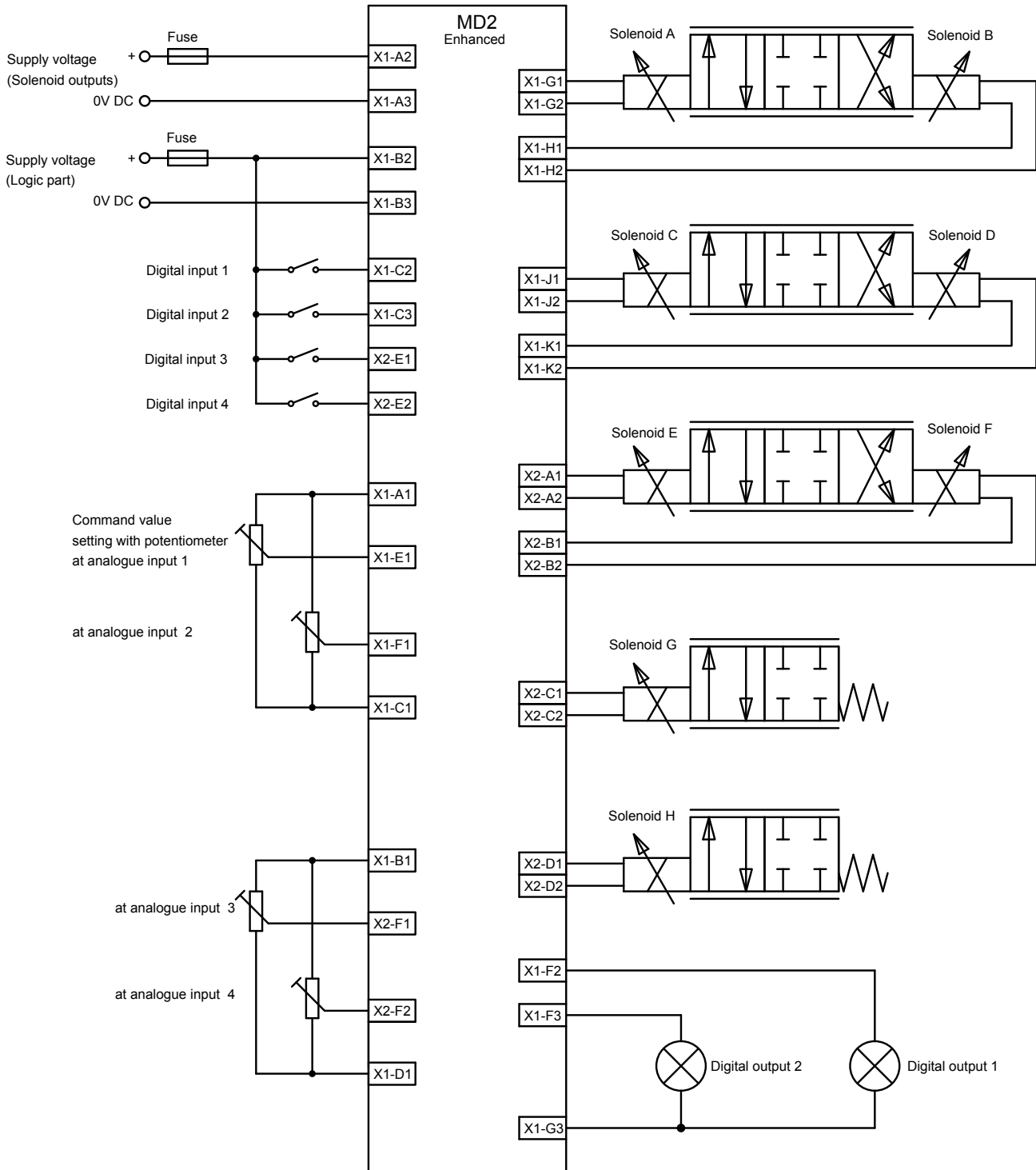
**CONNECTION EXAMPLE:**

Amplifier module: MD2 Basic (all analogue inputs voltage):



**CONNECTION EXAMPLE:**

Amplifier module: MD2 Enhanced (all analogue inputs voltage):



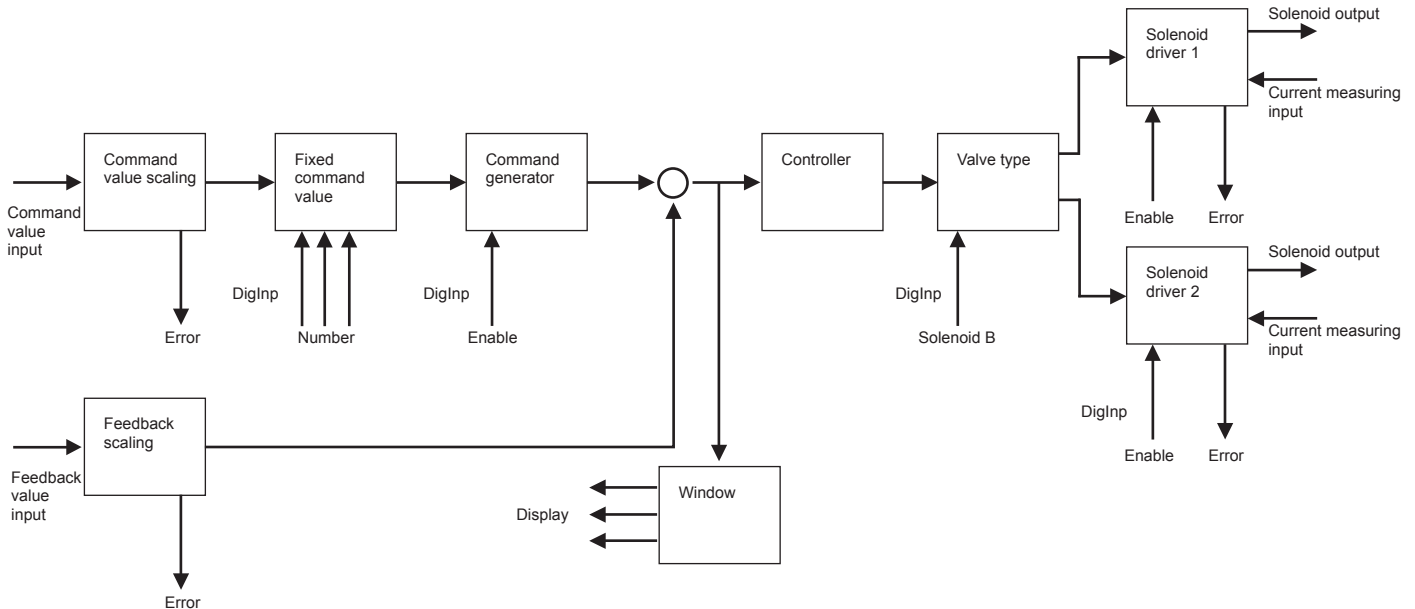


## Description of the amplifier – and controller electronics «MD2»

### DESIGN

The mobile electronics can be parameterised by means of the parameterisation software «PASO MD2» through the USB-interface. In addition, the parameterisation software makes a data analysis possible, with integrated graphic signal recording. The software «PASO MD2» is supported by Windows 2000, Windows XP, Windows Vista and Windows 7.

### DESCRIPTION OF FUNCTION



### MD2 CONTROLLER

#### Command value scaling

The command value can be applied as a voltage -, current -, digital -, frequency - or PWM-signal. For each command value the input utilised can be selected. The scaling takes place through the parameters «Interface» and «Reference». Furthermore each command value can be monitored for cable break (excepting the voltage - and digital signal). In the version with CAN-connection, the command value can also be digitally transmitted.

#### Fixed command values

There are 7 fixed command values available, which can be selected through 3 digital inputs.

#### Command value generator

In the open-loop controller modes, two linear ramps separately settable for Up and Down are available per solenoid output.

In the closed-loop controller modes, a positive and a negative travelling speed are available.

#### Feedback value scaling

The feedback value can be applied as a voltage -, current -, frequency - or PWM-signal. For each feedback signal the input utilised can be selected. The scaling takes place through the parameters «Interface» and «Reference». Furthermore each command value can be monitored for cable break (excepting the voltage signal). In the version with CAN-connection, the feedback value can be read-in by a sensor with CAN interface.

#### Windows

Available are a target -, contouring error - and solenoid-off window. In each window the threshold and the delay time can be adjusted.

#### Controller

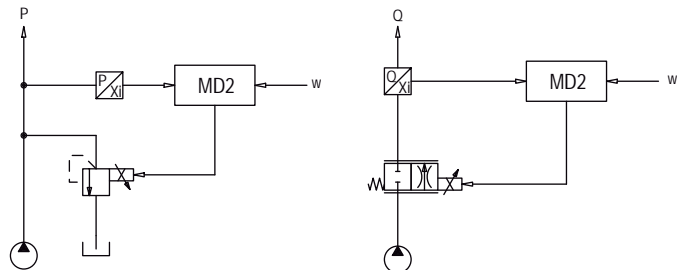
Two (for the Basic version) or four (for the Enhanced version) controller circuits are available. The following controller modes can be selected:

#### Controller mode 3 «Pressure/volume flow valve control»

Driving of a pressure relief -, pressure control -, throttle - or flow control valve in the open control circuit (without feedback value return). The number of solenoids that are driven is dependent on the selected operating mode.

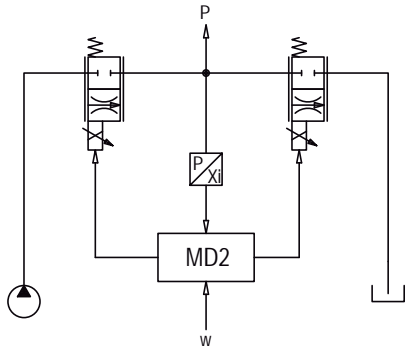
#### Controller mode 4 «Pressure/volume flow valve control (1-solenoid)»

Driving of a 1-solenoid pressure relief -, pressure control -, throttle - or flow control valve in the closed control circuit (with feedback value return). With it, only one solenoid can be driven (corresponds to the solenoid driver 1).



#### Controller mode -5 «Pressure control (2-solenoids)»

Driving of two 1-solenoid throttle valves in the closed control circuit (with feedback value return) as pressure reduction. In doing so, one of the throttle valves serves as the charge - and the other one as the discharge valve. The charge valve corresponds to the solenoid driver 1, the discharge valve to the solenoid driver 2 (graphics on the following page).

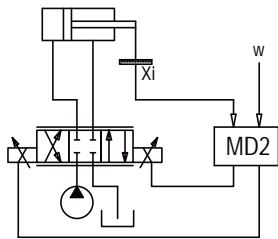


**Controller mode 6 «Axis position controlled»**

Driving of a directional control valve in the open control circuit (without feedback value return). The number of solenoids that are driven is dependent on the selected operating mode.

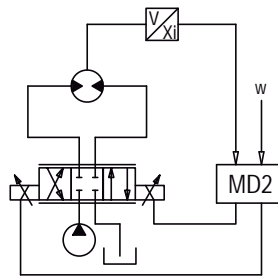
**Controller mode 9 «Axis position controlled»**

Driving of a 2-solenoid directional control valve in the closed control circuit (with feedback value return). With it, two solenoids can be driven.



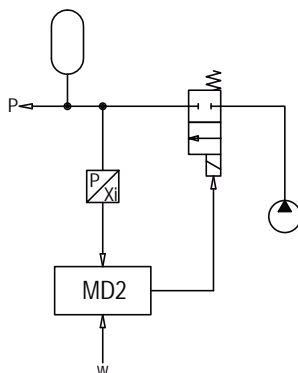
**Controller mode 7 «Speed control (2-solenoids)»**

Controlling of a 2-solenoid directional -, throttle - or flow control valve in the closed control circuit (with feedback value return). With it, two solenoids can be driven.



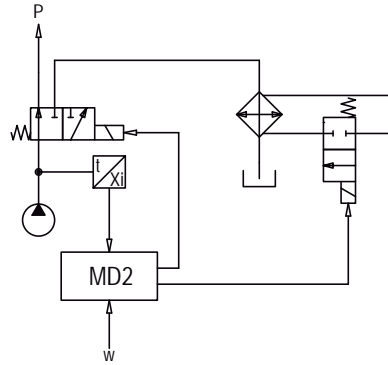
**Controller mode -6 «2-Point controller (1-solenoid)»**

Driving of a 1-solenoid valve with switching solenoid in the closed control circuit (with feedback value return). With it, only one solenoid can be driven (corresponds to the solenoid driver 1).



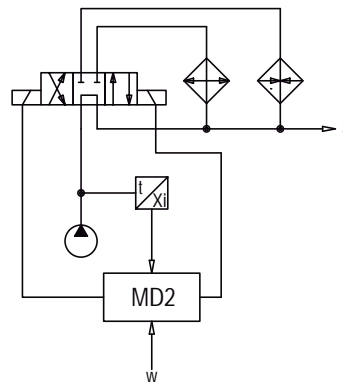
**Controller mode -7 «2-Point controller (2-solenoids)»**

Driving of a 2-solenoid valve with switching solenoid, resp. of two 1-solenoid valves with switching solenoid in the closed control circuit (with feedback value return). With it, two solenoids can be driven.



**Controller mode -8 «3-Point controller (2-solenoids)»**

Driving of a 2-solenoid valve with switching solenoid, resp., of two 1-solenoid valves with switching solenoid in the closed control circuit (with feedback value return). With it, two solenoids can be driven.



**Valve type**

Here the operating mode is set when in open-loop controller mode. In addition it can be selected, whether proportional - or switching solenoids are to be driven. A detailed description of the operating modes can be found in the section «Description of the MD2-amplifier electronics», page 6.

**Solenoid drivers**

Four (in the basic version) or eight (in the enhanced version) pulse width modulated current outputs are available. A dither signal is superimposed on the output, whereby the dither frequency and the dither level are separately adjustable. For each output the minimum ( $I_{min}$ ) and the maximum ( $I_{max}$ ) current can be separately set. The solenoid outputs are also configurable as switching outputs. In doing so, for each output a power reduction can be separately set.