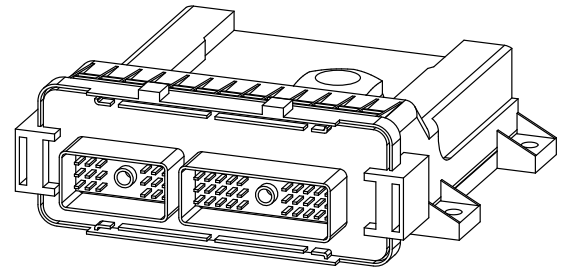# WANDFLUH
Hydraulics + Electronics

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 super-imposed 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 fieldbus.

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

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 (Basic Version)
8-solenoid version — 8 (Enhanced Version)

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 (possible only with Enhanced version)
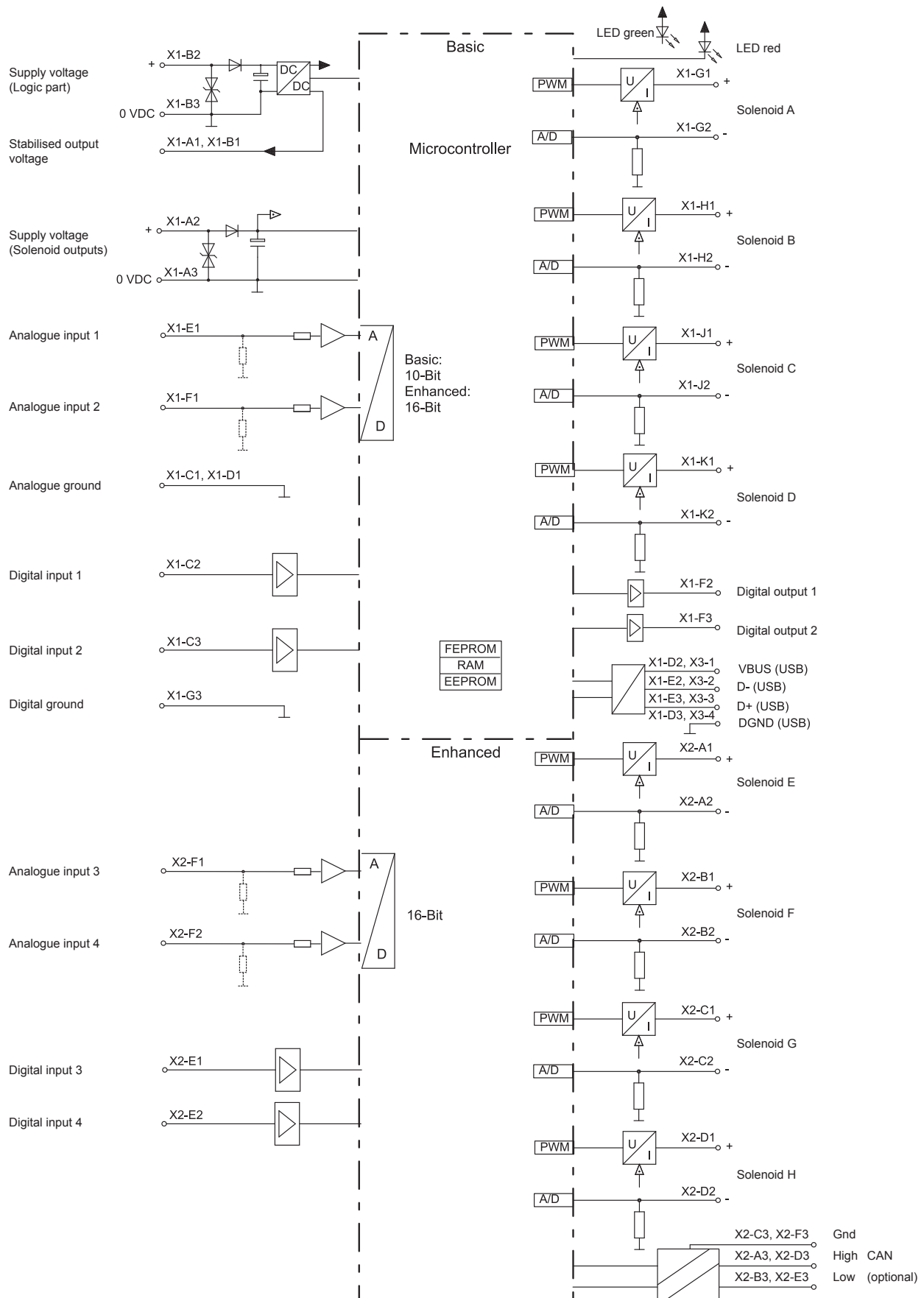
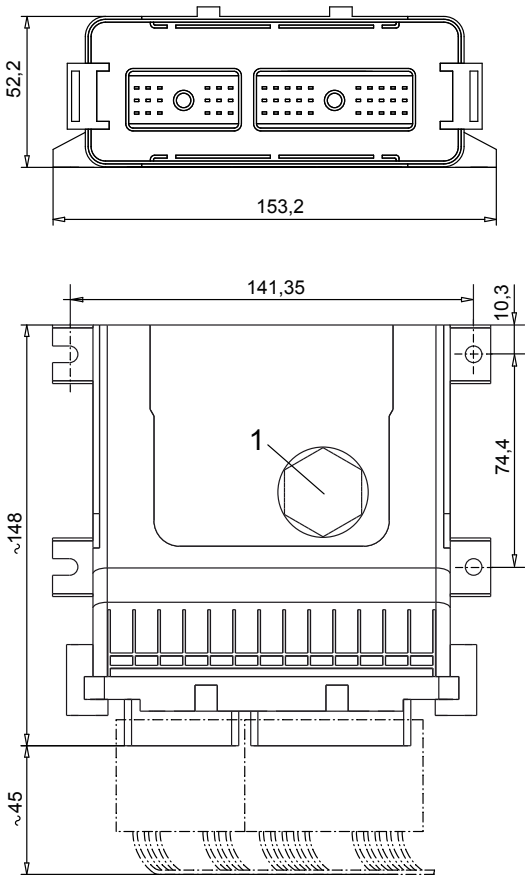Design-Index (Subject to change)

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

BLOCK DIAGRAM

Basic

LED green   LED red

Supply voltage (Logic part)
X1-B2 +
0 VDC   X1-B3
DC/DC

Stabilised output voltage
X1-A1, X1-B1

Microcontroller

PWM   U/I   X1-G1 +
Solenoid A
A/D   X1-G2 -

Supply voltage (Solenoid outputs)
X1-A2 +
0 VDC   X1-A3

PWM   U/I   X1-H1 +
Solenoid B
A/D   X1-H2 -

Analogue input 1   X1-E1
Analogue input 2   X1-F1

A
Basic: 10-Bit
Enhanced: 16-Bit
D

PWM   U/I   X1-J1 +
Solenoid C
A/D   X1-J2 -

Analogue ground   X1-C1, X1-D1

PWM   U/I   X1-K1 +
Solenoid D
A/D   X1-K2 -

Digital input 1   X1-C2

X1-F2   Digital output 1

Digital input 2   X1-C3

X1-F3   Digital output 2

FEPROM
RAM
EEPROM

X1-D2, X3-1   VBUS (USB)
X1-E2, X3-2   D- (USB)
X1-E3, X3-3   D+ (USB)
X1-D3, X3-4   DGND (USB)

Digital ground   X1-G3

Enhanced

PWM   U/I   X2-A1 +
Solenoid E
A/D   X2-A2 -

Analogue input 3   X2-F1
Analogue input 4   X2-F2

A
16-Bit
D

PWM   U/I   X2-B1 +
Solenoid F
A/D   X2-B2 -

PWM   U/I   X2-C1 +
Solenoid G
A/D   X2-C2 -

Digital input 3   X2-E1

Digital input 4   X2-E2

PWM   U/I   X2-D1 +
Solenoid H
A/D   X2-D2 -

X2-C3, X2-F3   Gnd
X2-A3, X2-D3   High   CAN
X2-B3, X2-E3   Low   (optional)

DIMENSIONS

52,2

153,2

141,35

10,3

74,4

1

~148

~45

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^2 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.
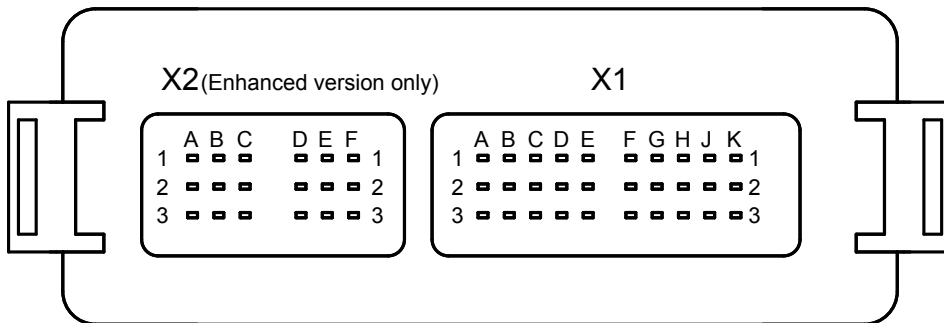
ASSEMBLY

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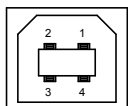
Mounting surface

View from below

2

3

0,12

74,4

87,6

5,58

6,6

0,12 A

12,45   10,2

141,35

2 Installation bores

3 Contact surface for the cooling body

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Illustrations not obligatory
Data subject to change

Data sheet no.
1.13-240E *4/10*
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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

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

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»

Free-of-charge download:
• «PASO-MD2» Parameterisation software
• Operating instructions (*.pdf)

ADDITIONAL INFORMATION

	Wandfluh-Documentation
Wandfluh electronics general	register 1.13
Accessories	register 1.13
Proportional directional valves	register 1.10
Proportional pressure valves	register 2.3
Proportional flow control valves	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.
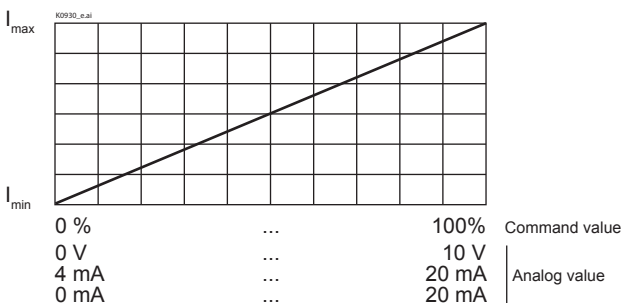
Command value generator
Per solenoid output, two linear ramps separately settable for Up and Down are available.

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.
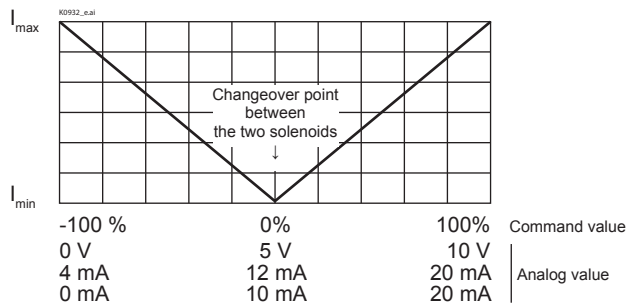
Operating mode command value unipolar (1-solenoid)
The solenoid is driven in dependence of a unipolar command value signal (voltage, current, frequency or PWM) (e.g., 0...10V correspond to 0...100 % command value, 0...100 % command value correspond to Imin...Imax solenoid driver 1).

	Command value
0 % ... 100%	
0 V ... 10 V	Analog value
4 mA ... 20 mA	
0 mA ... 20 mA	

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 Imin...Imax solenoid driver 2, 0...+100 % command value correspond to Imin...Imax solenoid driver 1).

	Command value
-100 % ... 0% ... 100%	
0 V ... 5 V ... 10 V	Analog value
4 mA ... 12 mA ... 20 mA	
0 mA ... 10 mA ... 20 mA	

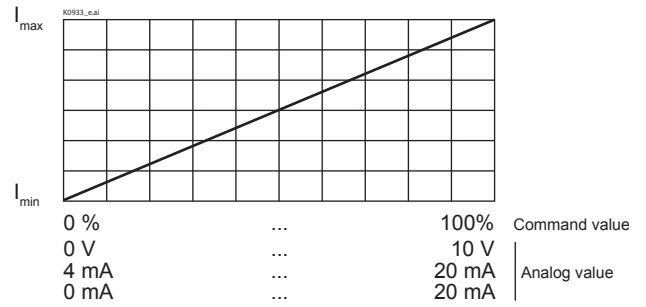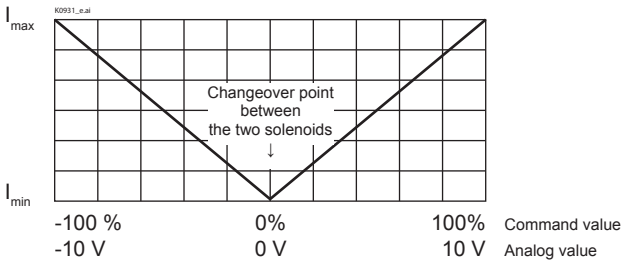#### Operating mode command value bipolar (2-solenoids)
In dependence of a bipolar command value signal (voltage), according to the signal level, one of the two solenoids is driven. The changeover point between the two solenoids as standard is at 0V (e.g., -10...+10V correspond to -100...+100 % command value, -100...0 % command value correspond to Imin...Imax solenoid driver 2, 0...+100 % command value correspond to Imin...Imax 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 Imin...Imax solenoid driver 1 or 2).
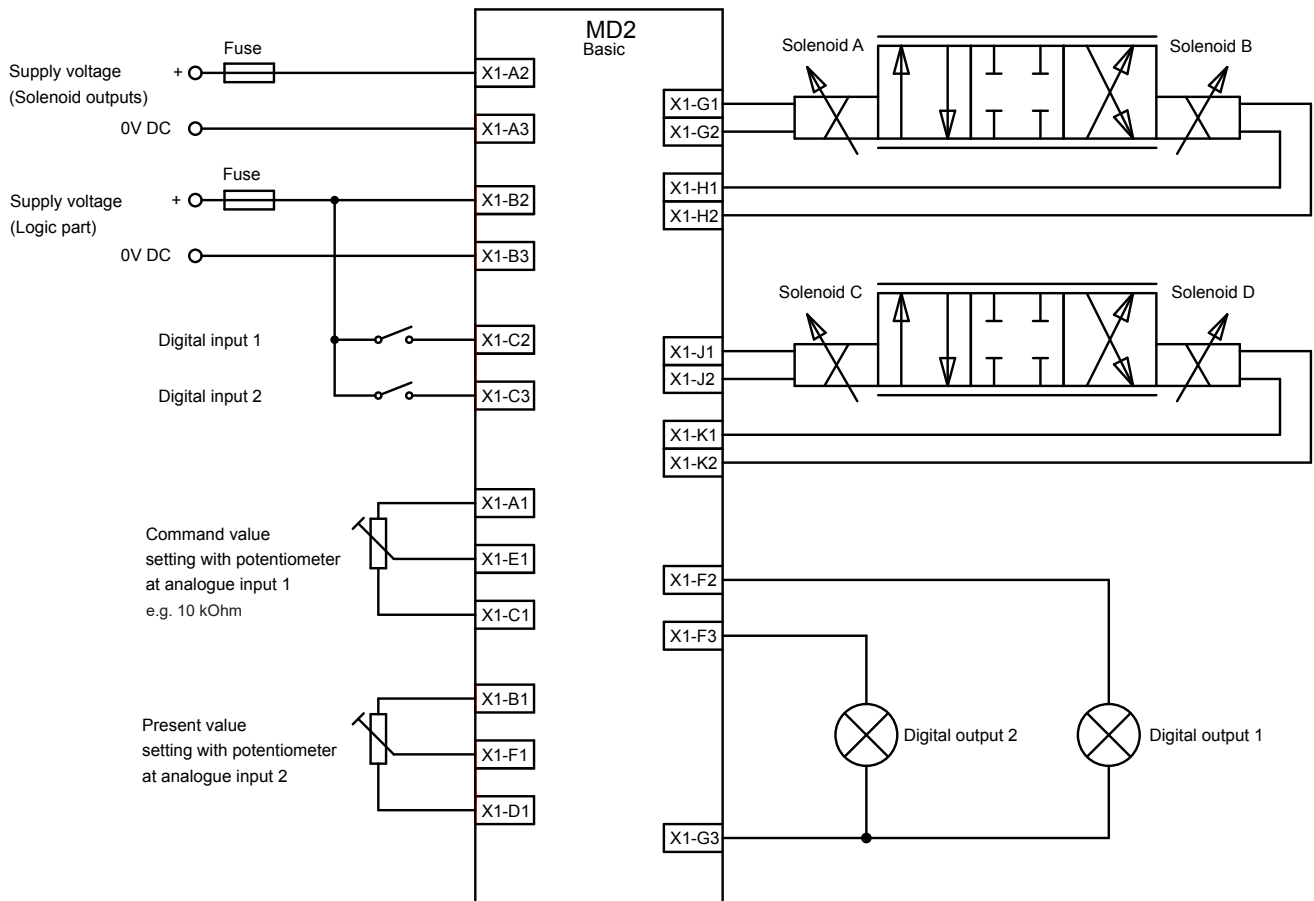
Solenoid drivers

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 (Imin) and the maximum (Imax) 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.

-100 %	0%	100%	Command value
-10 V	0 V	10 V	Analog value

0 %	...	100%	Command value
0 V	...	10 V	
4 mA	...	20 mA	Analog value
0 mA	...	20 mA	

Changing over between the two solenoids
by means of the selected digital input

CONNECTION EXAMPLE:

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

Wandfluh AG   Tel.   +41 33 672 72 72   E-mail: sales@wandfluh.com   *Illustrations not obligatory*   Data sheet no.
Postfach   Fax +41 33 672 72 12   Internet: www.wandfluh.com   *Data subject to change*   **1.13-240E** 7/10
CH-3714 Frutigen   Edition 11 15

CONNECTION EXAMPLE:

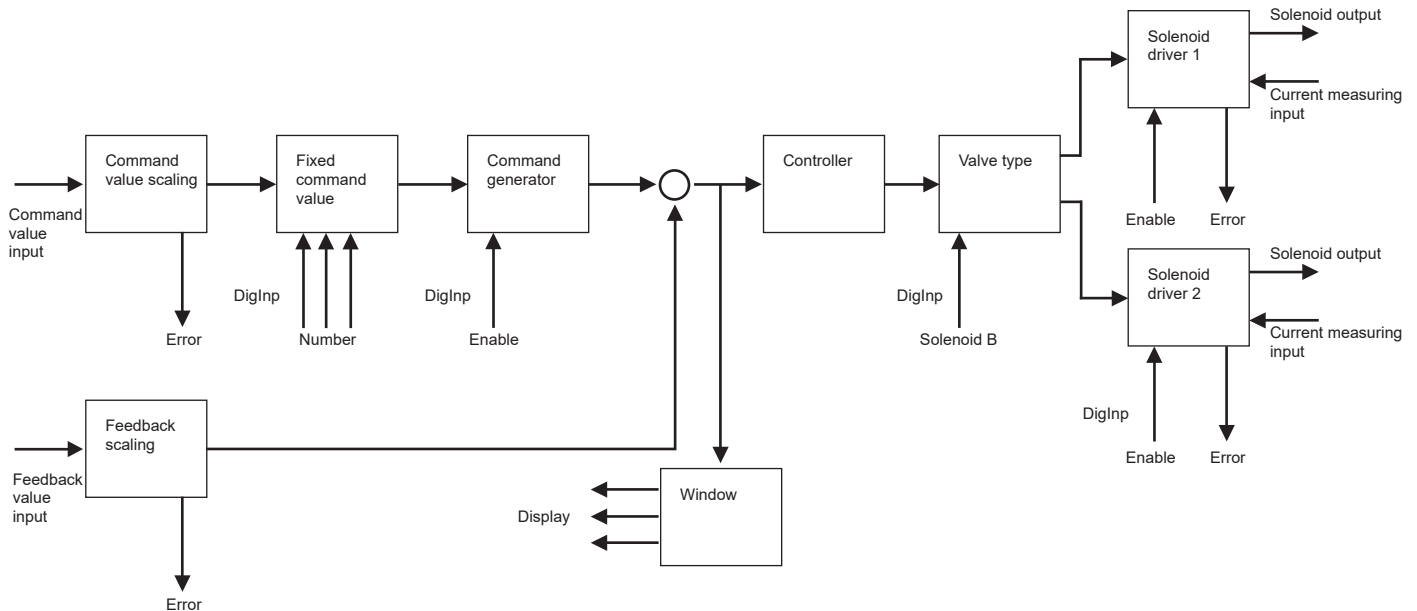**Amplifier module: MD2 Enhanced** (all analogue inputs voltage):

Wandfluh AG   *Tel. +41 33 672 72 72*   *E-mail: sales@wandfluh.com*   *Illustrations not obligatory*   *Data sheet no.*
Postfach   *Fax +41 33 672 72 12*   *Internet: www.wandfluh.com*   *Data subject to change*   ***1.13-240E*** *8/10*
CH-3714 Frutigen   *Edition 11 15*

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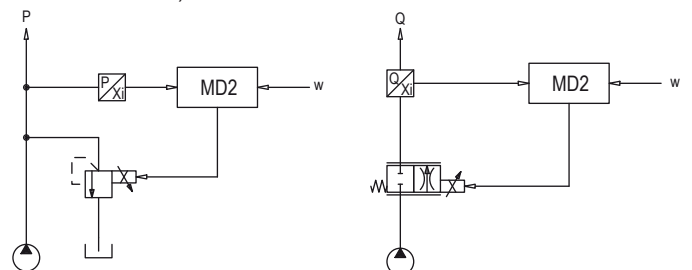Two (for the Basic version) or four (for the Enhanced version) controller circuits are available. The following controller modes can be selected:

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.
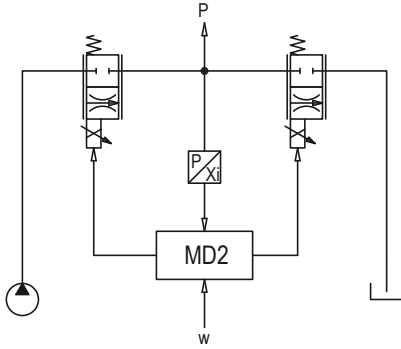
Controller mode 4 «Pressure / volume flow valve control (1-solenoid)»
Driving of a 1-solenoid pressure relief -, pressure control -, throttle - or flow control valve in the closed control circuit (with feedback value return). With it, only one solenoid can be driven (corresponds to the solenoid driver 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).

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Illustrations not obligatory
Data subject to change

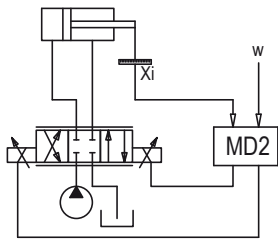Data sheet no.
1.13-240E 9/10
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Controller mode 6 «Axis position controlled»
Driving of a directional control valve in the open control circuit (without feedback value return). The number of solenoids that are driven is dependent on the selected operating mode.
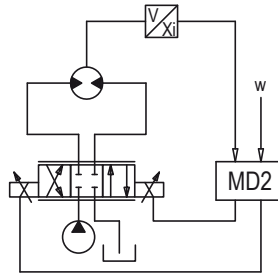
Controller mode 9 «Axis position controlled»
Driving of a 2-solenoid directional control valve in the closed control circuit (with feedback value return). With it, two solenoids can be driven.
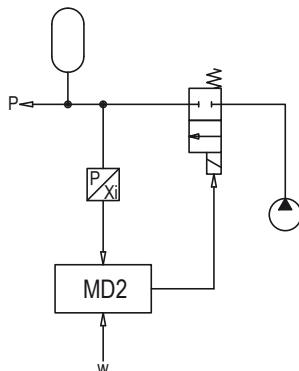

Controller mode 7 «Speed control (2-solenoids)»
Controlling of a 2-solenoid directional -, throttle - or flow control valve in the closed control circuit (with feedback value return). With it, two solenoids can be driven.
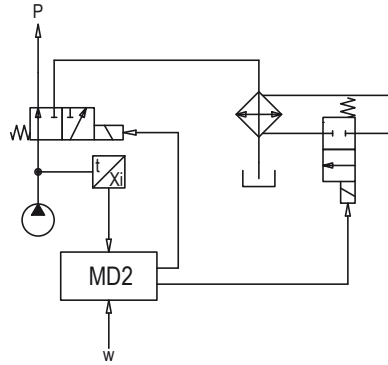

Controller mode -6 «2-Point controller (1-solenoid)»
Driving of a 1-solenoid valve with switching solenoid in the closed control circuit (with feedback value return). With it, only one solenoid can be driven (corresponds to the solenoid driver 1).
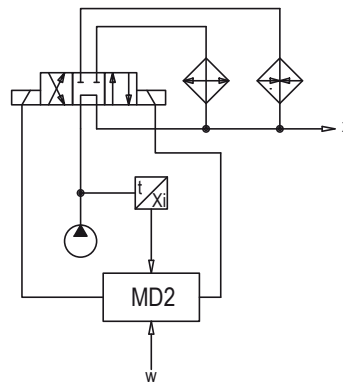

Controller mode -7 «2-Point controller (2-solenoids)»
Driving of a 2-solenoid valve with switching solenoid, resp. of two 1-solenoid valves with switching solenoid in the closed control circuit (with feedback value return). With it, two solenoids can be driven.

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 (Imin) and the maximum (Imax) 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.