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 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.

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- ELECTRICAL SPECIFICATIONS
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- DESCRIPTION AMPLIFIER
- DESCRIPTION CONTROLLER

**TYPE CODE**

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<tr>
<th>Mobile</th>
<th>Digital</th>
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<tr>
<td>Parameters to be set with «PASO»</td>
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<tr>
<td>Software configuration (function of card)</td>
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<tr>
<td>«Basic»-amplifier</td>
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<tr>
<td>«Enhanced»-amplifier</td>
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<tr>
<td>«Basic»-controller</td>
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<tr>
<td>«Enhanced»-controller</td>
<td></td>
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<tr>
<td>4-solenoid version</td>
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<tr>
<td>8-solenoid version</td>
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<tr>
<td>Supply voltage 8 ... 32 VDC</td>
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<tr>
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<tr>
<td>all voltage</td>
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<tr>
<td>all current</td>
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<tr>
<td>Analogue input 1: voltage</td>
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<td>Analogue input 2: current</td>
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<td>«Enhanced»</td>
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<tr>
<td>Analogue input 1 and 3: both voltage</td>
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<td>Analogue input 2 and 4: both current</td>
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<tr>
<td>Option field bus:</td>
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<tr>
<td>without field bus</td>
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<tr>
<td>with CANopen®</td>
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<tr>
<td>(possible only with Enhanced version)</td>
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**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**

**BLOCK DIAGRAM**

**DIMENSIONS / ASSEMBLY / ACCESSORIES**

**CONNECTOR WIRING DIAGRAM**

**START-UP**

**ADDITIONAL INFORMATION**

**DESCRIPTION AMPLIFIER**

**DESCRIPTION CONTROLLER**
ELECTRICAL SPECIFICATIONS

Protection class: IP67 acc. to DIN/EN 60 529
Supplied voltage: 8...32 VDC (for logic part) 8...32 VDC (for solenoid outputs)
Ripple on supply vol.: <10%
Fuse: slow-blow
Current consumption:
• No-load current: approx. 55 mA
• Maximum current consumption: no-load current + 2 A per solenoid

Analog inputs:
• Voltage: 0...+5 V/0...+10 V/-10...+10 V
• Current: 4...20 mA/0...+20 mA
• Resolution: Basic: Analogue inputs 1 and 2: 10-Bit resolution
Enhanced: Analogue inputs 1 to 4: 16 bit resolution

Digital inputs:
• Factory-preset 100 Hz
• Temperature drift <1 % at ∆T = 40°C

Digital outputs:
• High-Side-Switch
• Maximum load 500 mA per output

Ramps adjustable 0...500 s

Serial interface: USB (receptacle type B)
to set parameters with «PASO»

Protection class: IP67 acc. to DIN / EN 60 529
Supply voltage: 8...32 VDC (for logic part) 8...32 VDC (for solenoid outputs)
Stabilised output voltage: 5 VDC max. load 50 mA
Multiple current: Adjustable 0...950 mA Factory-preset 150 mA
Maximal current I_{max}: Adjustable: I_{min}...2 A Factory-preset 700 mA
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.

EMV
• Immunity: EN 61 000-6-2
• Emission: EN 61 000-6-4
• Road vehicles: ISO 7637-2 and RL 2004/104/EC
• Vibration/shock:
• Oscillation: IEC 60 068-2-6
• Single shock: IEC 60 068-2-27
• Continuous shock: IEC 60 068-2-29

CANopen® interface:
Two-wire line acc. to ISO 11898 differential signal transmission
Bustopology: Line
Voltage separation: CANopen® to MD2 500 VDC
DIMENSIONS

ACCESSORIES

- Parameterisation software: Refer to commissioning
- Connection-Set for MD2 «Basic»:
  - 1 pce mating connector 30-poles
  - 50 pce crimp terminals
  - 30 pce cavity filler plugs
- Connection-Set for MD2 «Enhanced»:
  - 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 mm²
  - 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

ASSEMBLY

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

Mounting surface

View from below

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.
**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 = Digital input 2
- 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>

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

**ADDITIONAL INFORMATION**

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<th>Component</th>
<th>Reference</th>
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<td>Wandfluh electronics general register</td>
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</tr>
<tr>
<td>Accessories register</td>
<td>1.13</td>
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<tr>
<td>Proportional directional valves</td>
<td>1.10</td>
</tr>
<tr>
<td>Proportional pressure valves</td>
<td>2.3</td>
</tr>
<tr>
<td>Proportional flow control valves</td>
<td>2.6</td>
</tr>
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</table>

**CONNECTOR WIRING DIAGRAM / PIN ASSIGNMENT**

![Diagram](image)
Design 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

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).

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.

CONNECTION EXAMPLE:

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

**CONNECTION EXAMPLE:**

- **Supply voltage (Solenoid outputs)**
  - +
  - Fuse
  - X1-A2
  - X1-A3
  - 0V DC
  - +
  - Fuse
  - X1-B2
  - X1-B3

- **Supply voltage (Logic part)**
  - +
  - Fuse
  - X1-C2
  - X1-C3
  - X1-C1
  - X1-F2
  - X1-F3
  - X1-G1
  - X1-J1
  - X1-G2
  - X1-J2
  - X1-H1
  - X1-K1
  - X1-H2
  - X1-K2
  - X1-A1

- **Digital input 1**
  - X1-A1
  - X1-E1
  - X1-F1
  - X1-C1
  - at analogue input 1
  - E.g. 10 kOhm

- **Digital input 2**
  - X1-B1
  - X2-F1
  - X2-F2
  - X1-D1
  - at analogue input 3
  - E.g. 10 kOhm

- **Digital input 3**
  - X2-A1
  - X2-A2
  - X2-B1
  - X2-B2
  - X2-C1
  - X2-C2
  - at analogue input 4

- **Digital input 4**
  - X2-E1
  - X2-E2
  - X1-B1

- **Command value setting with potentiometer**
  - at analogue input 2
  - E.g. 10 kOhm

- **Digital output 1**
  - X1-G1
  - X1-G2
  - X1-H1
  - X1-H2

- **Digital output 2**
  - X1-F1
  - X1-F3

- **Digital output 3**
  - X2-A1
  - X2-A2
  - X2-B1
  - X2-B2

- **Digital output 4**
  - X2-C1
  - X2-C2

- **Supply voltage (Logic part)**
  - +
  - Fuse
  - X1-B2
  - X1-B3

- **Supply voltage (Solenoid outputs)**
  - +
  - Fuse
  - X1-A2
  - X1-A3
  - 0V DC
  - +
  - Fuse
  - X1-B2
  - X1-B3
**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**

**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 -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.