Solenoid coil acc. to VDE 0580
- With integrated amplifier electronics PD2
- Protection class IP 67

**DESCRIPTION**
Solenoid coil with integrated amplifier electronics. Protection class is IP67. The electronics are fix mounted on the solenoid coil. The construction corresponds to standard VDE 0580. The steel housing is zinc nickel coated.

**FUNCTION**
The electronics has a Pulse-Width-Modulated current output. The solenoid output can also be parameterised for switching solenoids. The parameterisation is carried out directly on the device by means of push-buttons and display, or by means of the parameterisation and diagnostics software „PASO“ of Wandfluh.

**APPLICATION**
Due to its water spray resistant execution, the solenoid coil is suitable for most diverse applications. It can be used on all proportional valves with 19 mm, 23 mm resp. 31 mm armature tube diameters. Easy connecting enables assembly and commissioning with conventional tools. All settings can be carried out easily and quickly.

**TYPE CODE**

<table>
<thead>
<tr>
<th>M</th>
<th>P</th>
<th>-</th>
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<th>1</th>
<th>-</th>
<th>#</th>
</tr>
</thead>
</table>

- **Metal housing square**
- **Integrated amplifier electronics**
- **Coil execution**
  - Square 35 mm: S35/19x50
  - Square 60 mm: S60/31x72
  - Square 45 mm: S45/23x50
  - Square 60 mm: A60/31x72
- **Connection cable**
  - waway from the solenoid
- **1-solenoid execution**
  - Nominal voltage $U_n$
    - 12 VDC
    - 24 VDC
- **Analogue input**
  - voltage/current (0...5 V factory preset)
- **CANopen acc. to DSP-408 with J1939**
  - on request
- **Design index** (subject to change)

* only for proportional spool valve NG10

**GENERAL SPECIFICATIONS**
- **Connections**
  - Connection cable: 5 x 0,34 mm². Exterior coating PVC length = 1,5 m via connection «Digital input» requires the Wandfluh USB adapter PD2
- **Dimensions**
  - See drawing page 3
- **Ambient temperature**
  - -20...+85°C

**SAFE OPERATION**

**Caution:** To avoid overheating the coil may only be energised when mounted on an armature tube and valve.

**Note:** For maximum power development the coil has to be installed in its preferred direction. A reversed installation can lead to lower hydraulic values.
Amplifier with analogue interface

**ELECTRICAL SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection class</td>
<td>IP67 acc. to EN 60 529</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>8…32 V</td>
</tr>
<tr>
<td>Residual ripple</td>
<td>&lt; +/-5 %</td>
</tr>
<tr>
<td>Fuse</td>
<td>low</td>
</tr>
<tr>
<td>No-load current</td>
<td>approx. 20 mA</td>
</tr>
<tr>
<td>Max. current consumption</td>
<td>No-load current + 2.5 A per solenoid</td>
</tr>
<tr>
<td>Analogue input</td>
<td>1 input non-differential</td>
</tr>
<tr>
<td>Voltage / current</td>
<td>(switchable by means of parameter)</td>
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<tr>
<td>Resolution</td>
<td>10-Bit</td>
</tr>
<tr>
<td>Input resistance</td>
<td>Voltage input &gt;100 kΩ</td>
</tr>
<tr>
<td></td>
<td>(Input current &lt; 5 mA)</td>
</tr>
<tr>
<td>Stabilised output</td>
<td>5 VDC</td>
</tr>
<tr>
<td>voltage</td>
<td>max. load 20 mA</td>
</tr>
<tr>
<td>Solenoid current:</td>
<td>• Minimal current $I_{\text{min}}$ Adjustable 0…$I_{\text{min}}$ mA</td>
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<tr>
<td></td>
<td>• Maximal current $I_{\text{max}}$ Adjustable $I_{\text{max}}$…2450 mA</td>
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<tr>
<td></td>
<td>MP35/19x50-..-12, Factory setting 1360 mA</td>
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<td></td>
<td>MP35/19x50-..-24, Factory setting 680 mA</td>
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<td>MP45/23x50-..-12, Factory setting 1490 mA</td>
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</table>

**BLOCK DIAGRAM**

- +VCC
- GND
- Stabilised output
- Analogue input Voltage or current
- Digital input
- Adapter USB-PD2
- Push-buttons
- Internal supply
- Microcontroller
- Supply
- PWM
- AD
- 7 segment display
- Internal supply
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**Solenoids**

**START-UP**
Information regarding installation and commissioning are contained in the information leaflet supplied with the amplifier electronics and in the operating instructions.

Additional information can be found on our website: «www.wandfluh.com»

Free-of-charge download:
- «PASO-PD2» Parameterisation software
- Operating instruction (*.pdf)

**ADDITIONAL INFORMATION**
- Wandfluh documentation-
  register 1.13
- Proportional spool valve
  register 1.10
- Proportional pressure valves
  register 2.3
- Proportional flow control valves
  register 2.6

**ACCESSORIES**
USB-adapter PD2
Article no. 726.9900
incl. USB-cable type A-B, 1,8 m
(for parameterisation via PASO)

**PARAMETER SETTINGS**
The PD2 electronics have push-buttons and a 7 segment display which enable setting the most important parameters. In addition, the digital input can be used as a communication interface, through which, by means of the parameterisation software „PASO-PD2“, the complete parameterisation and diagnostics can be carried out. For this, the Wandfluh USB-PD2 adapter is required. (not included in the delivery)

Attention: During the communication, the digital input cannot be used.

**FUNCTION DESCRIPTION**
Solenoids

**PD2-AMPLIFIER WITH ANALOGUE INTERFACE**

**Command value scaling**
The command value can be applied as a voltage, current, digital, frequency or PWM signal. The scaling takes place via the parameter "Interface". Furthermore, the command value can be monitored for a cable break. A dead band can also be set.

**Fixed command value**
There is 1 fixed command value available, which can be selected via the digital input. This function has to be configured before in PASO.

**Ramp generator**
Two linear ramps for up and down are available which can be adjusted separately.

**Valve type**
Adjustment possibilities: switching solenoid or proportional solenoid.

**Mode of operation „Command value unipolar/bipolar (1-Sol)**
Dependent on a command value signal (voltage, current, digital, frequency or PWM), the solenoid is driven (e.g. 0….10V correspond to 0…100 % command value, 0….+100 % command value correspond to Imin….Imax solenoid driver)

![Command value vs. analogue value graph](image)

**Signal recording**
Furthermore, the „PD2“ amplifier electronics have a signal recording function. This, by means of PASO, enables the recording of various system signals, such as command value, solenoid current, etc., which can be represented on a common time axis.

**Solenoid driver**
A Pulse-Width-Modulated current output is available. A dither signal is superimposed, whereby the dither frequency and the dither level are separately adjustable. The minimum (Imin) and maximum (Imax) current can be adjusted. The solenoid output can also be configured as switching solenoid output. In this case, a power reduction can be adjusted.

**Optimisation of characteristic curve**
An adjustable characteristic curve „Command value input – solenoid current output“ enables an optimised (e.g. linearised) characteristic of the hydraulic system.

**Channel enabling**
As per factory setting, the device is enabled („on“). This „enable channel“ can be set to „on“, „off“ or „external“ (digital input) via PASO or via menu item.

**Hints:**
Digital input: if not wired, the state of the digital input is not defined
Analogue input: if not wired, the voltage input will read 1.11 V constantly.

**CONNECTION EXAMPLES**

**Supply voltage**
Supply voltage

- Supply voltage
- F = Fuse slow
- Brown: grey

**Digital input as function input**
USB/PASO

- 0…1 VDC
- 6…32 VDC
- White

**Analogue input with potentiometer**

- 0…10 VDC
- 0…20 mA
- Yellow: green: grey

**Analogue input current with external current source**

- 0…20 mA
- 4…20 mA
- Green: grey

**Analogue input voltage with external voltage source**

- 0…10 VDC
- +10 VDC
- Green: grey

**Digital input as USB interface**

- PC PASO
- USB - Adapter
- ON: TX: RX:
- USB type B
- Screw Terminal
Amplifier with CANopen interface

**ELECTRICAL SPECIFICATIONS**

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**Solenoid current:**

- Minimal current $I_{\text{min}}$: Adjustable 0...$I_{\text{min}}$ mA
- Maximal current $I_{\text{max}}$: Adjustable $I_{\text{min}}$...2450 mA

**Supply Voltages:**

- MP35/19x50...-12, Factory setting 1360 mA
- MP35/19x50...-24, Factory setting 680 mA
- MP45/23x50...-12, Factory setting 1490 mA
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- MPS60/31x72...-24, Factory setting 1140 mA
- MPA60/31x72...-12, Factory setting 1140 mA
- MPA60/31x72...-24, Factory setting 1140 mA

**Dither:**
- Frequency adjustable 4...500 Hz
- Factory setting 80 Hz

**Temperature drift:**
- <1% at $\Delta T = 40^\circ$C

**Digital inputs:**
- 1 input high-active, no pull-up/down
- Switching threshold high 6...32 VDC
- Switching threshold low 0...1 VDC

**USB interface:**
- Input (automatic frequency recognition)
- Via digital input

**EMV:**
- Immunity EN 61 000-6-2
- Emission EN 61 000-6-4

**Block Diagram**
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Attention: During the communication, the digital input cannot be used.

**FUNCTION DESCRIPTION**
**PD2-AMPLIFIER WITH CANopen INTERFACE**

**Command value scaling**
The command value can be applied as a CAN-bus, digital, frequency or PWM signal. The scaling takes place via the parameter „Interface“.

**Fixed command value**
There is 1 fixed command value available, which can be selected via the digital input. This function has to be configured before in PASO.

**Ramp generator**
Two linear ramps for up and down are available which can be adjusted separately.

**Valve type**
Adjustment possibilities: switching solenoid or proportional solenoid.

**Mode of operation „Command value unipolar/bipolar (1-Sol)***
Dependent on a command value signal (CAN-bus, digital, frequency or PWM), the solenoid is driven (e.g. 0...16383 CAN-command correspond to 0...100 % command value, 0...+100 % command value correspond to Imin...Imax solenoid driver)

**Signal recording**
Furthermore, the „PD2“ amplifier electronics have a signal recording function. This, by means of PASO, enables the recording of various system signals, such as command value, solenoid current, etc., which can be represented on a common time axis.

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An adjustable characteristic curve „Command value input – solenoid current output“ enables an optimised (e.g. linearised) characteristic of the hydraulic system.

**Channel enabling**
As per factory setting, the device can be enabled via CAN-bus. This „enable channel“ can be set to „bus“, „on“, „off“ or „external“ (digital input) via PASO or via menu item.

**Hint:**
Digital input if not wired, the state of the digital input is not defined.

**CONNECTION EXAMPLES**

**Supply voltage**

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<th>Supply voltage</th>
<th>CAN connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown</td>
<td>CAN-Low</td>
</tr>
<tr>
<td>Gray</td>
<td>CAN-High</td>
</tr>
<tr>
<td>0...1 VDC</td>
<td>K1-2 green</td>
</tr>
<tr>
<td>6...32 VDC</td>
<td>K1-4 yellow</td>
</tr>
</tbody>
</table>

**Digital input as function input**

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<td>USB/PASO</td>
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<tr>
<td>0...1 VDC</td>
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**Digital input as USB interface**

![Diagram of connection examples]