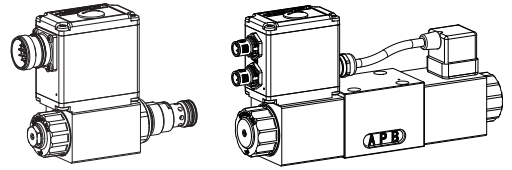## Integrated amplifier and controller electronics
for proportional hydraulic valves

- **Interface:**   - analogue
    - CANopen or J1939
    - Profibus DP
- **24 VDC or 12 VDC**
- **Electronic card setting via PC (USB)**
- **Optimisation of characteristic curve**

DSV DIGITAL SMART VALVE

Description

Wandfluh offers proportional valves with integrated, intelligent electronics. With protection class IP67 these valves are suitable for rough ambient conditions. The term "Digital Smart Valve" stands for digital amplifier or controller electronics requiring the smallest space. As a result of the compact construction, Wandfluh is in the position to also offer miniature valves of the nominal size 4 in an optimum, slender design. In addition to this, Wandfluh as the only manufacturer offers proportional screw-in cartridges M22 and M33 with integrated electronics. The electronics are mounted onto a slip-on coil.

Function

The actuation takes place via an analogue interface or a fieldbus interface (CANopen/J1939 or Profibus DP). The parameterisation takes place by means of the free-of-charge parametrisation and diagnosis software "PASO" or via the fieldbus interface.

"PASO" is a Windows program in the flow diagram style, which enables the intuitive adjustment and storing of all variable parameters. The data remain saved in case of a power failure and can also be reproduced and transferred to other DSVs.

As an option, these valves are available with an integrated controller. As feedback value generators sensors with voltage or current outputs can be directly connected. The available controller structures have been optimised for applications with hydraulic actuators.

Application

The „DSV" electronics are used by Wandfluh exclusively for proportional hydraulic valves. They are factory set and adjusted in order to guarantee the highest valve-to-valve reproducibility. The hydraulic valves have their application where a good valve-to-valve reproducibility, a simple installation, convenient operation and the highest precision are of great importance. The integrated controller reliefs the machine control and operates the axis (position, angle, pressure, etc.) in a closed control loop. The applications are in the industrial as well as in the mobile hydraulics for the smooth control of hydraulic actuations.

TYPE CODE

```
[            ] - [  ] M E [  ] [  ] - [  ] # [  ]
```

Type designation according to type list,
(derived from valve designation basic execution)

Example: BVPPM33 - 200

| Standard nominal voltage U_N: | 12 VDC | G12 |
| | 24 VDC | G24 |

Slip-on coil   Metal housing, square

Connection execution   Integrated electronics

Hardware configuration:

Analog command value signal	12-pole A1	7-pole D1	(0...+10V factory preset)
Analog command value signal	12-pole A2	7-pole D2	(-10...+10V factory preset)
Analog command value signal	12-pole A3	7-pole D3	(0...+20mA factory preset)
Analog command value signal	12-pole A4	7-pole D4	(4...+20mA factory preset)
CANopen according to DSP-408	C1		
Profibus DP acc. to Fluid Power Technology	P1		
CAN J1939 (on request)	J1		

Functions:

Amplifier	no remark
Controller with current feedback value signal (0…20 mA / 4…20 mA)	R1
Controller with voltage feedback value signal (0…10 V)	R2

Sealing material / manual override

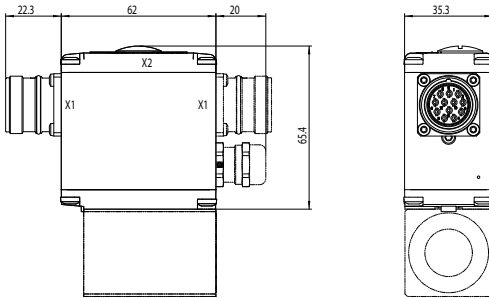Design-Index (Subject to change)

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Postfach   Fax   +41 33 672 72 12   Internet: www.wandfluh.com   *Data subject to change*   **1.13-76E** 1/10
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Electrical SPECIFICATIONS

Protection class	IP 67 acc. to EN 60 529 With suitable mating connector and closed electronics housing cover	Input resistance	Voltage input >18 kΩ Load for current input = 250 Ω
Device receptacle (male) Analog interface	M23, 12-pole or Connector DIN EN175201 - 804, 7-pole	Command value signal CANopen/J1939 interface	via CANopen / J1939 Two wire lead acc. to ISO 11898 Differential signal transmission
Device receptacle (male) Supply Fieldbus interface	M12, 4-pole	Command value signal Profibus	via Profibus Shielded, twisted wire Differential signal transmission
Mating connector (female)	Plug M23, 12-pole or Plug DIN EN175201 - 804, 7-pole or Plug M12, 4-pole (not incl. in delivery)	Feedback value signal: (controller only) • Type R1 • Type R2	Differential input not galvanically separated, for earth potential difference up to 1,5 V 4…+20 mA / 0…+20 mA 0…+10 V / -10…+10 V Resolution ±12 bit
Device receptacle (female) Sensor (controller only)	M12, 5-pole		
Mating connector (male) Sensor (controller only)	M12, 5-pole (not incl. in delivery)	Bustopologie Fieldbus interface	Line
Device receptacle (male) CANopen / J1939	M12, 5-pole (according to DRP 303-1)	Separation of potential Fieldbus interface	CANopen / Profibus to DSV 500 VDC
Mating connector (female) CANopen / J1939	Plug M12, 5-pole (not incl. in delivery)	Digital inputs (analog interface only with M23 connector, 12-pole)	Switching level high 6…30 VDC Switching level low 0…1 VDC Utilisable as frequency input (frequencies 0...5 kHz) and as PWM-input (automatic frequency recognition)
Device receptacle (female) Profibus	M12, 5-pole, B coded (according to IEC 947-5-2)		
Mating connector (male) Profibus	Plug M12, 5-pole, B coded (not incl. in delivery)	Digital output (analog interface only with M23 connector, 12-pole)	Low-Side-Switch: U_{max} = 40 VDC I_{max} = -700 mA
Voltage range: • 24 VDC • 12 VDC	 21…30 VDC 10,5…15 VDC	Ramps adjustable	0…500 s
Ripple on supply voltage	<10 %	Temperature drift	<1 % at ∆T = 40 °C
Fuse	Low	Parameterisation	via USB or CANopen / J1939 (CANopen / J1939
Stabilised output voltage	10 VDC (with version 24 VDC) 8 VDC (with version 12 VDC) max. load 10 mA	only)	or Profibus (Profibus only)
Current consumption: • No load current • 35 mm square size solenoid • 45 mm square size solenoid • Maximum current	 approx. 40 mA I_{max} = 1000 mA (with version 24 VDC) I_{max} = 2000 mA (with version 12 VDC) I_{max} = 1200 mA (with version 24 VDC) I_{max} = 2400 mA (with version 12 VDC) I_{max} = 1534 mA (with version 24 VDC) I_{max} = 2557 mA (with version 12 VDC)	Interface EMC Immunity Emission	USB (Mini B) for parameterisation with «PASO» under the closing screw of the housing cover factory preset EN 61 000-6-2 EN 61 000-6-4
Command value signal: Analog interface	Input voltage/current and signal range are adjustable by software. Diff. inputs not galvanically separated, for ground potential differences up to 1,5 V 4…+20 mA / 0…+20 mA 0…+10 V (1- or 2-solenoid valve) -10…+10 V (only 2-solenoid valve) Resolution +/-12 bit		

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CH-3714 Frutigen   *Edition 21 20*
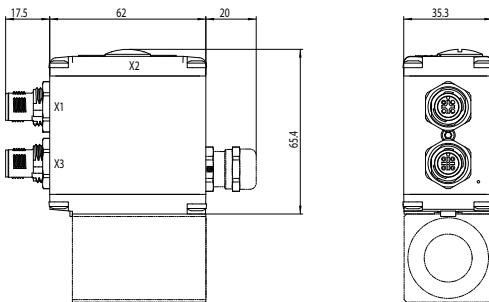
DIMENSIONS
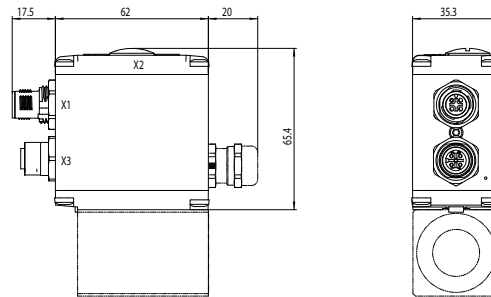
Amplifier with analog interface, plug 12-pole

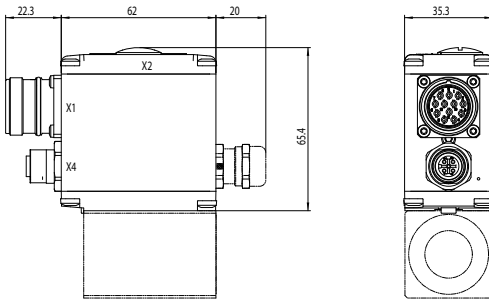Amplifier with analog interface, plug 7-pole
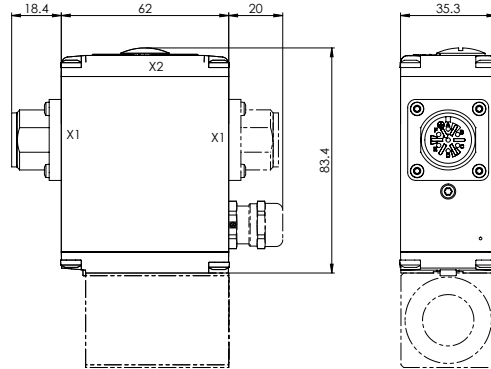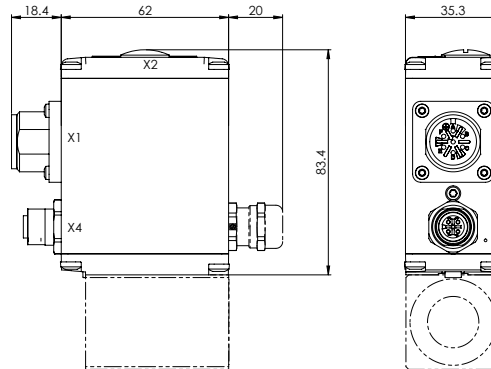
Amplifier with CANopen / J1939 interface
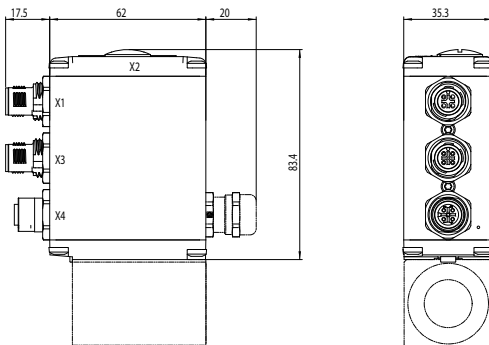
Amplifier with Profibus interface

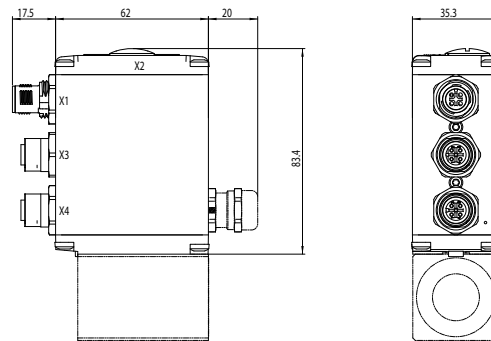Controller with analog interface, plug 12-pole

Controller with analog interface, plug 7-pole

Controller with CANopen / J1939 interface

Controller with Profibus interface

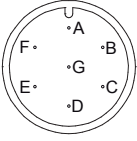|			
Wandfluh AG	Tel. +41 33 672 72 72	E-mail: sales@wandfluh.com	*Illustrations not obligatory*	Data sheet no.
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CH-3714 Frutigen				Edition 21 20

CONNECTOR WIRING DIAGRAM

X1	Analog interface (Main)
Device receptacle	M23, 12 pole male
	1 = Supply voltage +
	2 = Supply voltage 0 VDC
	3 = Stabilised output voltage
	4 = Command value signal voltage +
	5 = Command value signal voltage -
	6 = Command value signal current +
	7 = Command value signal current -
	8 = Reserved for extentions
	9 = Reserved for extentions
	10 = Enable signal (Digital input)
	11 = Error signal (Digital output)
	12 = Chassis

Command value signal voltage (PIN 4/5) resp. current (PIN 6/7) are selected with parameterisation and diagnostics software PASO.

X1	Fieldbus interface (Main)
Device receptacle	M12, 4 pole male
	1 = Supply voltage +
	2 = Reserved for extentions
	3 = Supply voltage 0 VDC
	4 = Chassis

X2	Parameterisation interface
USB, Mini B	Under the screw plug of the housing cover
	Factory set

X1	Analog interface (Main) Connector DIN EN 175201 - 804
Device receptacle	7 pole male
	A = Supply voltage +
	B = Supply voltage 0 VDC
	C = Not connected
	D = Command value signal +
	E = Command value signal -
	F = Not connected
	G = Chassis

Command value signal: current (D3/D4) or voltage (D1/D2) to specify when placing the order

X3	Profibus interface according to IEC 947-5-2
Device receptacle	M12, 5 pole female B-coded
	1 = VP
	2 = RxD / TxD - N
	3 = DGND
	4 = RxD / TxD - P
	5 = Shield

X3	CANopen interface according to DRP 303-1
Device receptacle	M12, 5 pole male
	1 = Not connected
	2 = Not connected
	3 = CAN Gnd
	4 = CAN High
	5 = CAN Low

X4 (controller only)	Feedback value interface (sensor)
Device receptacle	M12, 5 pole female
	1 = Supply voltage (output) +
	2 = Feedback value signal +
	3 = Supply voltage 0 VDC
	4 = Not connected
	5 = Stabilised output voltage

Feedback value signal: current (R1) or voltage (R2) to specify when placing the order

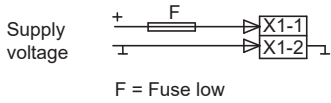**Note!** The mating connector is not included in the delivery
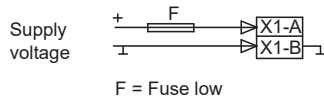
BLOCK DIAGRAM
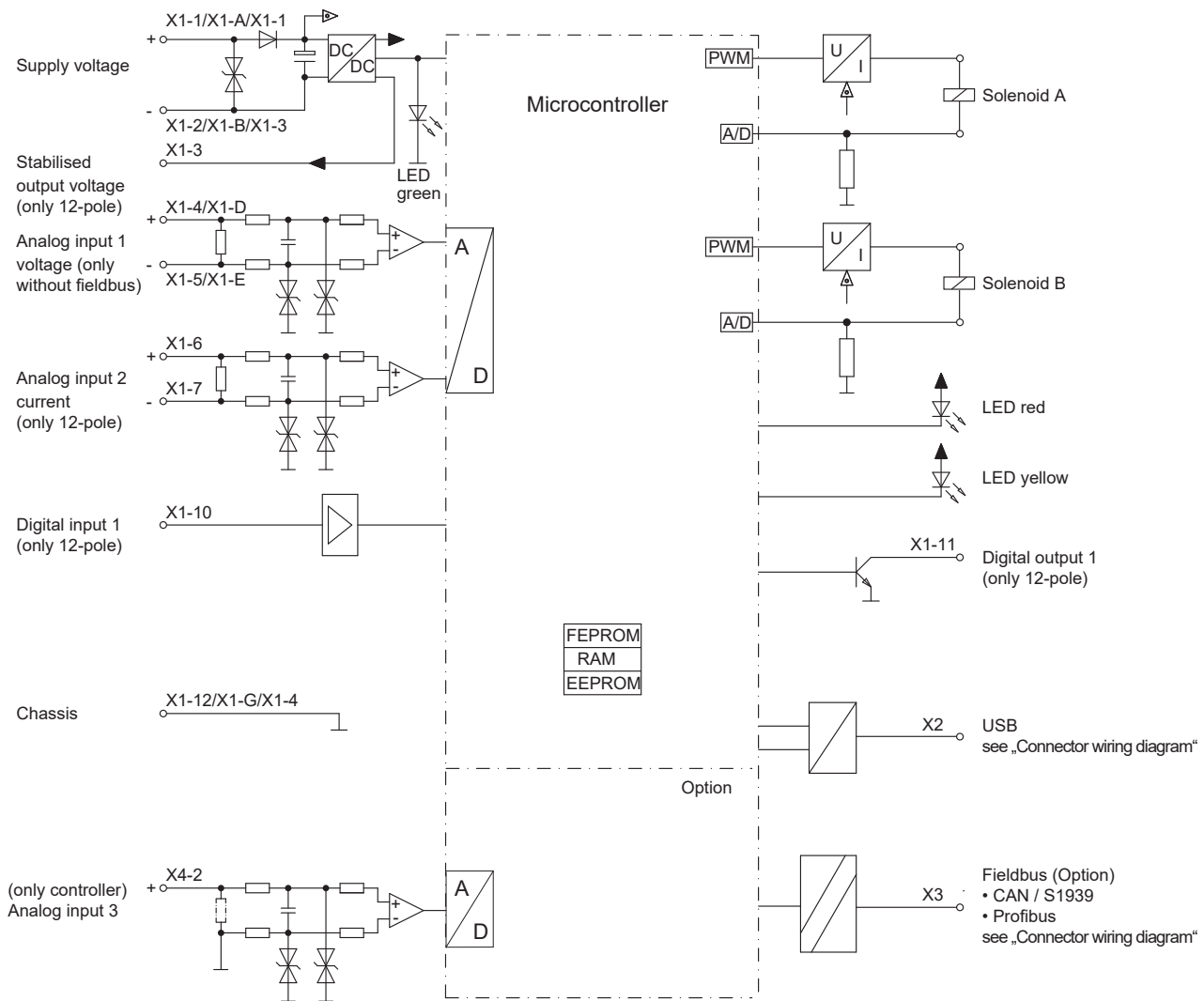
Configuration analog inputs

Type designation	Analog input 1	Analog input 2	Analog input 3
..A1..	Voltage	Current	
..A2..	Voltage	Current	
..A3..	Voltage	Current	
..A4..	Voltage	Current	
..D1..	Voltage	--	
..D2..	Voltage	--	
..D3..	Current	--	
..D4..	Current	--	
..C1..	--	--	
..P1..	--	--	
..J1..	--	--	
..R1..			Current
..R2..			Voltage

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EXAMPLE OF CONNECTION

Connection of the supply voltage

with 12-pole connector

Supply voltage — + — F — X1-1 / X1-2

F = Fuse low

with 7-pole connector

Supply voltage — + — F — X1-A / X1-B

F = Fuse low

with fieldbus interface

Supply voltage — + — F — X1-1 / X1-3

F = Fuse low
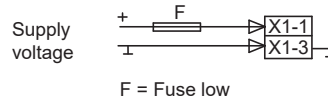
Connection of the digital inputs / outputs (only with 12-pole connector)
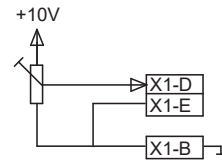
Supply voltage — X1-10 Digital input / X1-11 Digital output
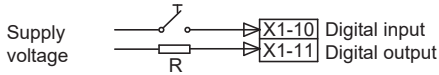
R = Consumer resistance for max. current 0,7 A

Connection command value with potentiometer (not differential)

with 12-pole connector
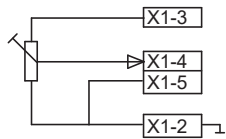
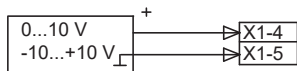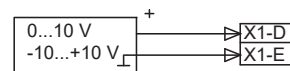X1-3 / X1-4 / X1-5 / X1-2

with 7-pole connector

+10V — X1-D / X1-E / X1-B

Connection with external command value generator (voltage differential)*

with 12-pole connector

0...10 V / -10...+10 V — + — X1-4 / X1-5

with 7-pole connector

0...10 V / -10...+10 V — + — X1-D / X1-E
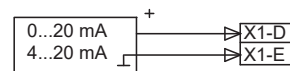
Connection with external command value generator (voltage differential)*

with 12-pole connector

0...20 mA / 4...20 mA — + — X1-6 / X1-7

with 7-pole connector

0...20 mA / 4...20 mA — + — X1-D / X1-E
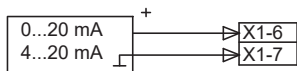
* Ground potential difference between 0V-GND of the external command value generator and 0V-GND of the DSV electronics max. 1.5V.
If required, connect the negative input X1-5 or X1-7 with 0V X1-2.

Connection CANopen J1939

X3-3 CAN GND
X3-4 CAN High
X3-5 CAN Low

Connection Profibus

X3-1 VP
X3-2 RxD / TxD - N
X3-3 DGND
X3-4 RxD / TxD - P
X3-5 Shield
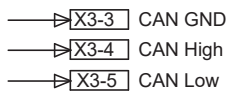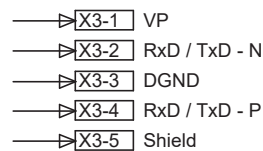
Connection voltage or current feedback value of a pressure sensor

2 conductor

P / I — +V$_s$ X4-1 / I$_{out}$ X4-2

3 conductor

P / U — +V$_s$ X4-1 / V$_{out}$ X4-2 / GND X4-3

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CH-3714 Frutigen — Edition 21 20
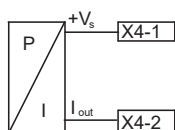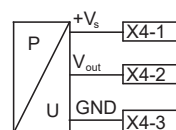
Amplifier electronics

CONSTRUCTION

General

- The „DSV" electronics is an integral part of the valve.
- All inputs and outputs are to be contacted via the device receptacle.
- Under the closing screw of the housing cover there is a USB - interface, through which with the menu-controlled Windows program „PASO" the parameterisation and diagnostics can be carried out.
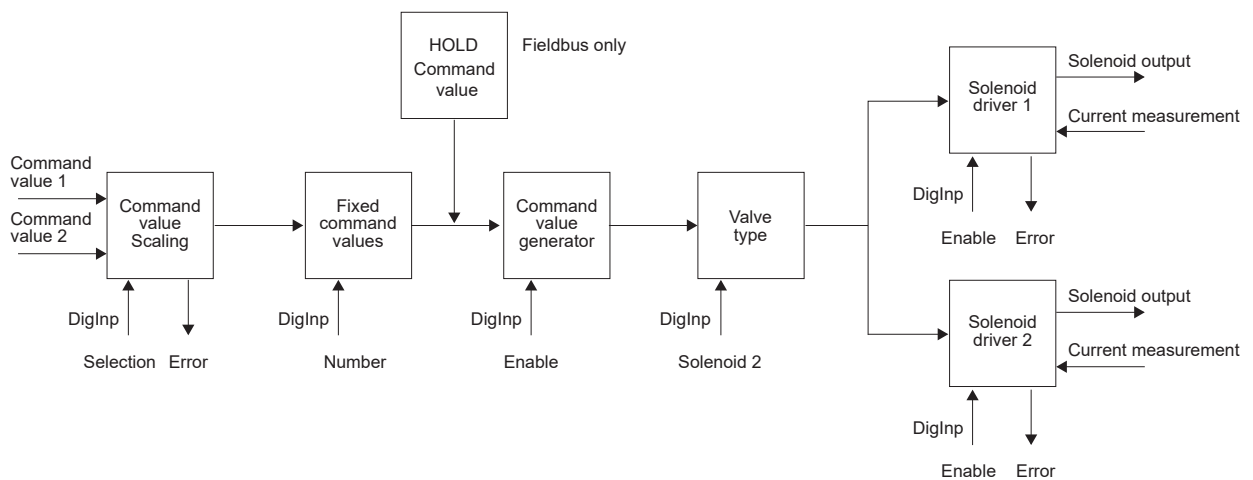- At the factory the "DSV" electronics are adapted to the valve, so that, as a rule, no intervention of the user is necessary.

Fieldbus

- The „DSV" electronics is an integral part of the valve.
- The fieldbus is to be contacted through the corresponding device receptacle.
- CAN open resp. Profibus DP is used as transmission protocol.
- The characteristics and functions of the „DSV" electronics are described through the device profile DSP-408 „Device Profile Fluid Power Technology". A detailed description can be found on our website (see Set-up instructions).
- With the fieldbus the „DSV" electronics can be controlled and parameterised.
- The utilisation of J1939 has to be jointly specified by the customer and Wandfluh.

DESCRIPTION OF THE FUNCTION

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Command value scaling

The command value can be applied as a voltage, current or digital signal, or via fieldbus For every command value, the input utilised can be selected. The scaling takes place via the parameters „Interface" and „Reference". Furthermore every command value can be monitored for a cable break (except for digital signal). For every command value a dead band can also be set. Optionally one can operate with two command values. The characteristic of these command values can be adjusted.

Fixed command values

• One fixed command value is available, which can be selected via a digital input (only DSV electronics with analog interface and 12-pole connector).

Command value generator

For each solenoid output two linear ramps for up and down are available which can be adjusted separately.

## HOLD command value (fieldbus option only)

If via Profibus DP the device is put into the "HOLD" condition, the respective command value is activated.

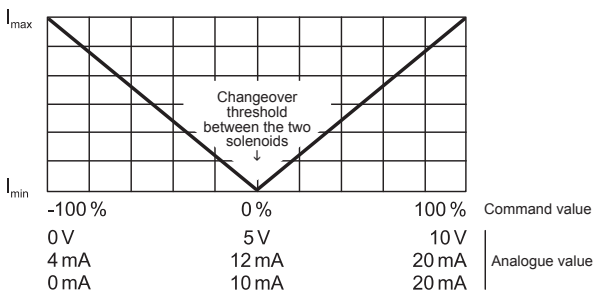## Valve type

Here the mode of operation mode is set.

Mode of operation „Command value unipolar (1-sol)"

Dependent on a unipolar command value (voltage, current), the solenoid is driven (e.g. 0...10V correspond to 0...100 % command value, 0...100 % command value correspond to Imin...Imax solenoid driver 1).

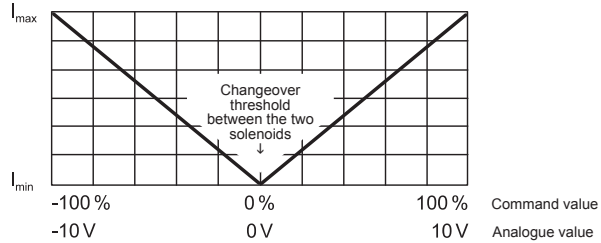|			
0 %	…	100 %	Command value
0 V	…	10 V	
4 mA	…	20 mA	Analogue value
0 mA	…	20 mA	
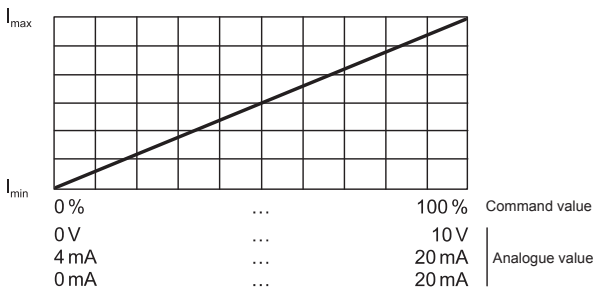
Mode of operation „Command value unipolar (2-sol)"

Dependent on a unipolar command value signal (voltage, current), according to the signal level one of the two solenoids is driven. The switching threshold between the two solenoids as standard is in the middle 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).

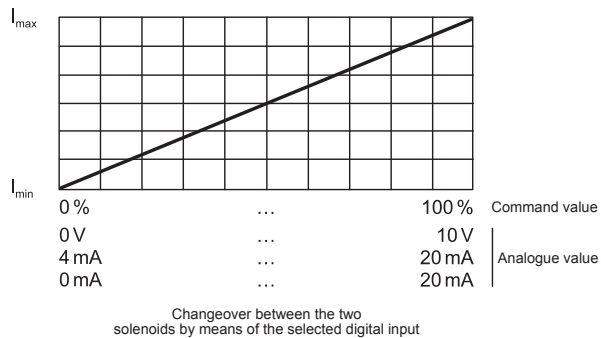|			
-100 %	0 %	100 %	Command value
0 V	5 V	10 V	
4 mA	12 mA	20 mA	Analogue value
0 mA	10 mA	20 mA	

Mode of operation „Command value bipolar (2-sol)"

Dependent on a bipolar command value signal (voltage), according to the signal level one of the two solenoids is driven. The switching threshold 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).

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

Mode of operation „Command value unipolar (2-sol with DigInp)"

Dependent on a unipolar command value signal (voltage, current), the solenoid is driven by solenoid driver 1, when the selected digital input is „not activated", resp. the solenoid by the solenoid driver 2, when 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).

0 %	…	100 %	Command value
0 V	…	10 V	
4 mA	…	20 mA	Analogue value
0 mA	…	20 mA	

Changeover between the two
solenoids by means of the selected digital input

Signal recording

The DSV electronics has a signal recording function. This, by means of PASO, enables the recording of various system signals, such as command value, solenoid currents, etc., which can be represented on a common time axis.

Solenoid driver

Two Pulse-Width-Modulated current outputs are available. To each output, a dither signal is superimposed, whereas dither frequency and dither level can be adjusted separately. For each output, the minimum (Imin) and maximum (Imax) current can be adjusted separately. The solenoid outputs can also be configured as switching outputs. Therewith for each output a power reduction can be adjusted separately.

Optimisation of characteristic curve

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

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CH-3714 Frutigen   *Edition 21 20*

Controller electronics

CONSTRUCTION

General

- The „DSV" electronics is an integral part of the valve.
- All inputs and outputs are to be contacted via the device receptacle.
- Under the closing screw of the housing cover there is a USB - interface, through which with the menu-controlled Windows program „PASO" the parameterisation and diagnostics can be carried out.
- At the factory the "DSV" electronics are adapted to the valve, so that, as a rule, no intervention of the user is necessary.

Fieldbus

- The fieldbus is to be contacted through the corresponding device receptacle.
- CANopen resp. Profibus DP is used as transmission protocol.
- The characteristics and functions of the „DSV" electronics are described through the device profile DSP-408 „Device Profile Fluid Power Technology". A detailed description can be found on our website (see set-up instructions).
- Via the fieldbus, the DSV electronics can be controlled and parameterised.
- The utilisation of J1939 has to be jointly specified by the customer and Wandfluh.

DESCRIPTION OF THE FUNCTION
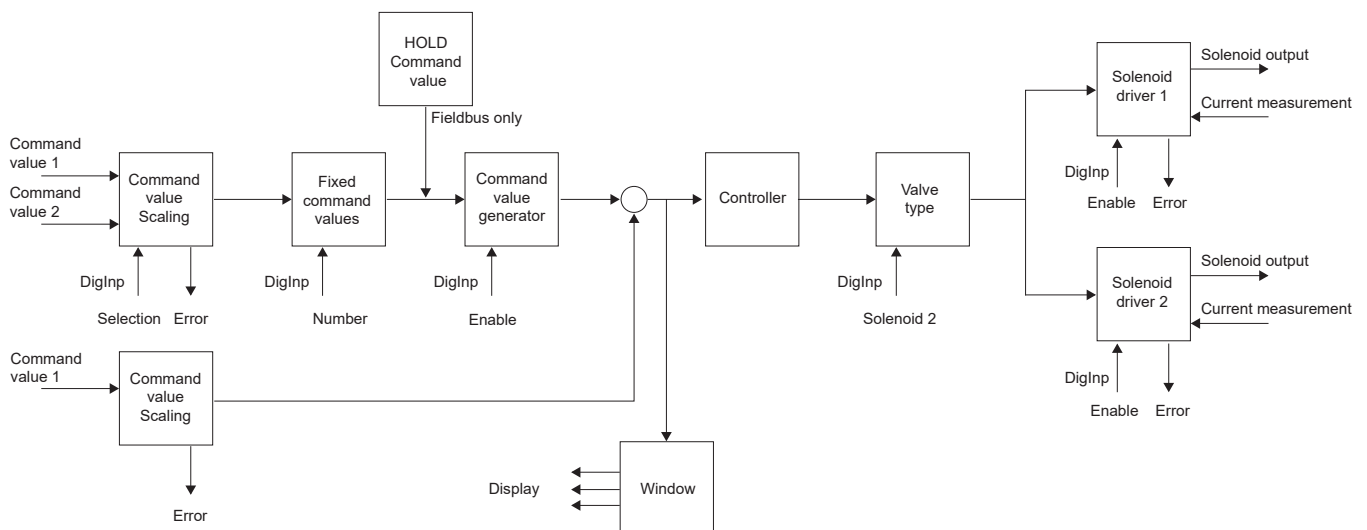
Command value scaling
The command value can be applied via the fieldbus or as a voltage, current, digital, frequency or PWM signal. For every command value, the input utilised can be selected. The scaling takes place via the parameters „Interface" and „Reference". Furthermore every command value can be monitored for a cable break (except for digital signal). For every command value a dead band can also be set. Optionally one can operate with two command values. The characteristic of these command values can be adjusted.

Fixed command values
One fixed command value is available, which can be selected via a digital input (only DSV electronics with analog interface and 12-pole connector).

Command value generator
With the Open-Loop-Controller modes, for each solenoid output two linear ramps for up and down are available which can be adjusted separately. With the Cloded-Loop-Controller modes, a positive and a negative traversing speed is available.

HOLD command value (fieldbus option only)
If via Profibus DP the device is put into the "HOLD" condition, the respective command value is activated.

Feedback value scaling
The feedback value can be applied as voltage, current, frequency or PWM signal. For the feedback value, the input utilised can be selected. The scaling takes place via the parameters „Interface" and „Reference". Furthermore the feedback value can be monitored for a cable break.

Windows
A target, tracking error and magnetic stop window are available. The threshold and delay time can be set for each window.
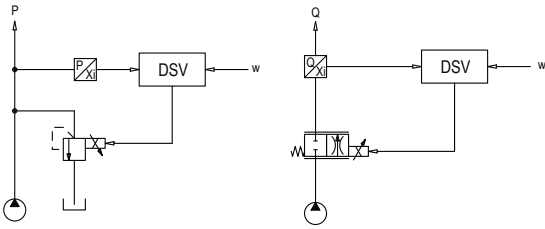
Controller
The DSV controller module has a controller circuit. This is built up as PID controller. The following controller modes can be selected:

Controler mode Pressure/flow valve control
Control of a pressure relief, pressure reducing, throttle or flow control valve in open control circuit (without feedback value signal). The number of solenoids that can be controlled depends on the selected operating mode.

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Controler mode Pressure/flow valve control (1-Sol)»

Actuation of one solenoid pressure relief, pressure reducing, throttle, or flow control valve in closed-loop control circuit (with feedback value signal). Only one solenoid can be controlled with it (corresponds to the magnet driver 1).

Controller mode „Pressure control (2-Sol)"

Control of two 1 solenoid throttle valves in closed position Control loop (with feedback value signal) as pressure reducing control. The one throttle valve serves as a loading valve and the other as a unloading valve. The loading valve corresponds to the solenoid driver 1, the unloading valve corresponds to the solenoid driver 2.
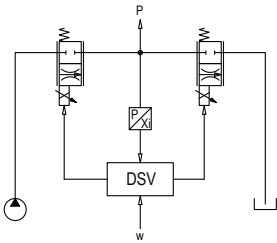

Controller mode „Axis position controlled"

Control of a spool valve in the open control circuit (without feedback value signal). The number of solenoids to be controlled depends on the selected operating mode.
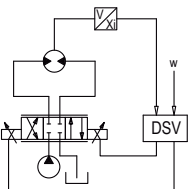
Control mode „Axis position controlled (2-Sol)"

Control of a two solenoid spool valve in closed position control loop (with feedback value signal). Two solenoids can be used with it.
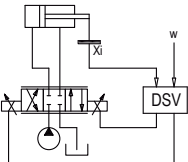
Controller mode „Speed control (2-Sol)"

Control of a two solenoid spool, throttle, or flow control valve in closed control loop (with feedback value signal). Two solenoid can be used with it.
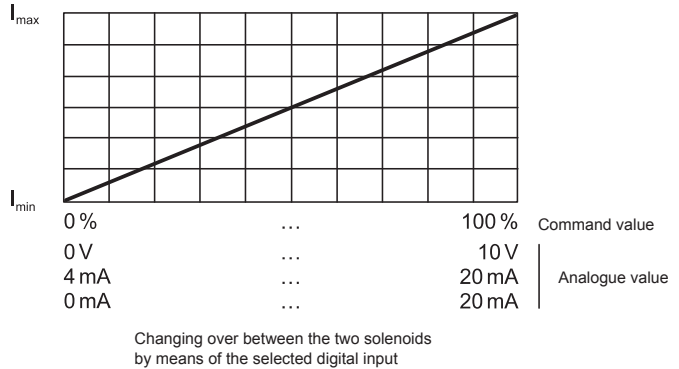

Valve type

The operating mode is set here for the open loop controller modes. It is also possible to select whether proportional or switching solenoids are to be controlled.

Solenoid driver

Two Pulse-Width-Modulated current outputs are available. To each output, a dither signal is superimposed, whereas dither frequency and dither level can be adjusted separately. For each output, the minimum (I_{min}) and maximum (I_{max}) current can be adjusted separately. The solenoid outputs can also be configured as switching outputs. Therewith for each output a power reduction can be adjusted separately.

0 %	…	100 %	Command value
0 V	…	10 V	
4 mA	…	20 mA	Analogue value
0 mA	…	20 mA	

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

Signal recording

The DSV controller module has a signal recording function. This, by means of PASO, enables the recording of various system signals, such as command value, solenoid currents, etc., which can be represented on a common time axis.

Optimisation of characteristic curve

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