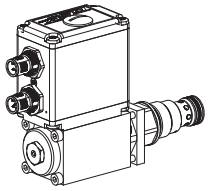
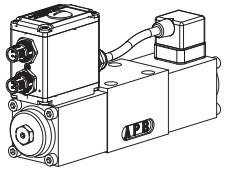
Integrated amplifier - and controller electronics for proportional hydraulic valves

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





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 standard 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, depending on the valve type, are built on to a flange solenoid or a slip-on coil.

FUNCTION

The actuation takes place via an analogue interface or a fieldbus interface (CANopen or Profibus DP). The parameterisation takes place by means of the free-of-charge parametrisation - and diagnosis software “PASO” or via the fieldbus interface. The data are stored in the non-volatile memory. Even after an electric power failure settings can easily be reproduced and transmitted. As an option, the valves are available with an integrated controller. As feedback value transmitters 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 reproducibility between valves. 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 system and operates the axis (position, angle, pressure, etc.) in a closed control loop. The applications are located in the industrial- as well as in the mobile hydraulic field for the smooth control of hydraulic actuations.

CONTENT

TYPE CODE

[ ] - [ ] [ ] [ ] # [ ]

Type designation according to type list,
(derived from basic valve type)
Example: BV**V**PM33 - 200

Standard nominal voltage U_N:

12 VDC	12
24 VDC	24

Hardware configuration:

With analog command value signal (0…+10 V factory set)	A1
With analog command value signal (-10…+10 V factory set)	A2
With analog command value signal (0…20 mA)	A3
With analog command value signal (4…20 mA)	A4
With CANopen acc. to DSP-408	C1
With Profibus DP in accordance with Fluid Power Technology	P1
With CAN J1939 (on request)	J1

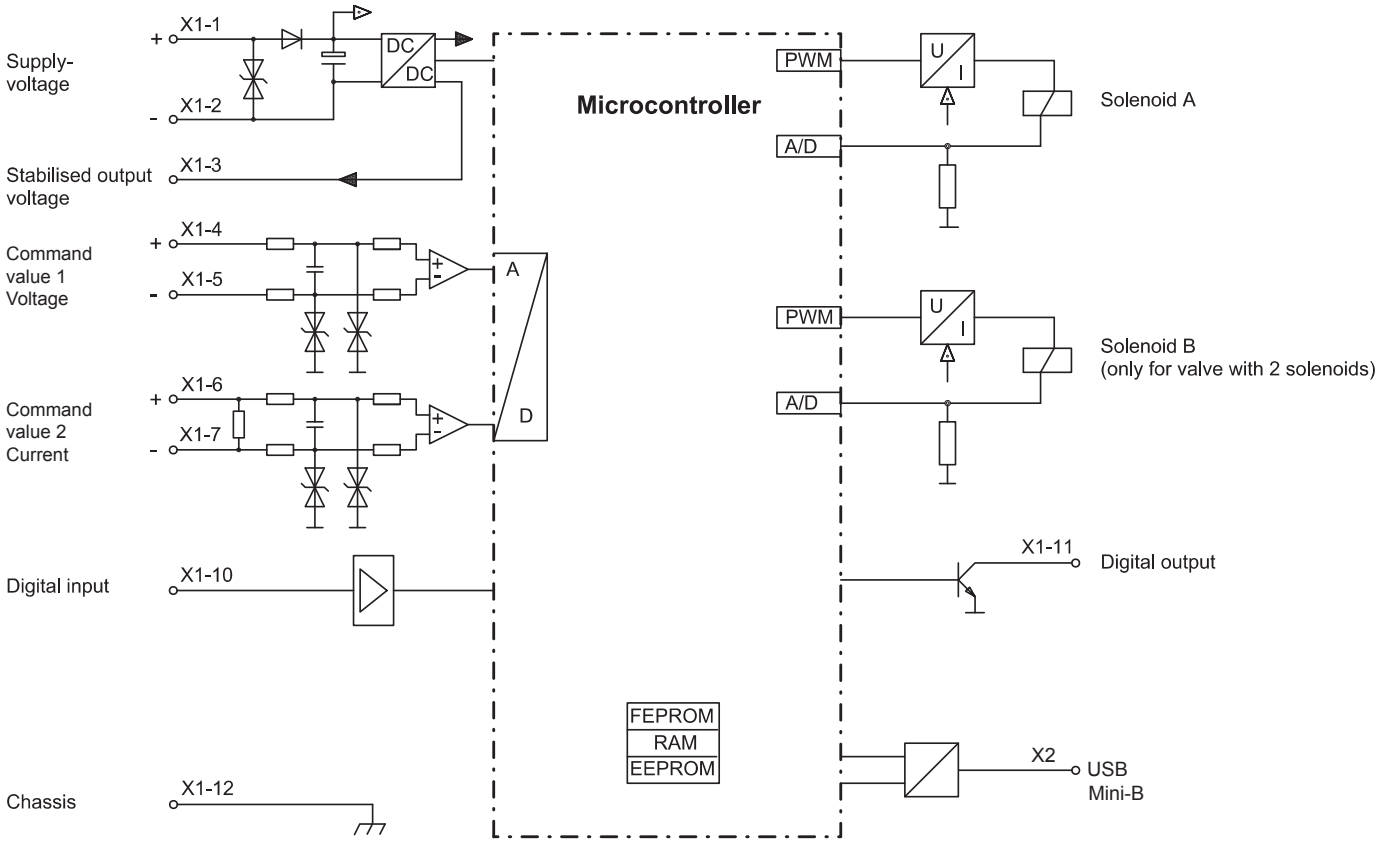
Functions:

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

Design-Index (Subject to change)

Control through analog interface with amplifier electronics

BLOCK DIAGRAM



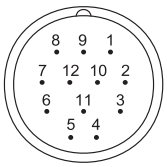
ELECTRICAL SPECIFICATIONS

Protection class	IP 67 acc. to EN 60 529 With suitable mating connector and closed electronics housing cover
Device receptacle (male)	M23, 12-poles
Mating connector	plug (female), M23, 12-poles (not incl. in delivery)
Supply voltage	24 VDC or 12 VDC
Voltage range:	
• 24 VDC	21…30 V
• 12 VDC	10,5…15 V
Ripple on supply voltage	<10 %
Fuse	slow
Current consumption:	
• No load current	approx. 40 mA
• 35 mm square size solenoid	I_{max} = 1000 mA (with version 24 VDC) I_{max} = 2000 mA (with version 12 VDC)
• 45 mm square size solenoid	I_{max} = 1200 mA (with version 24 VDC) I_{max} = 2400 mA (with version 12 VDC)
• Maximum current	I_{max} = 1534 mA (with version 24 VDC) I_{max} = 2557 mA (with version 12 VDC)
Command value signal:	Selectable with 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

Input resistance	Voltage input >18 kΩ Load for current input = 250 Ω
Stabilised output voltage	10 VDC (with version 24 VDC) 8 VDC (with version 12 VDC) max. load 10 mA
Digital inputs	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 identification)
Digital output	Low-Side-Switch: U_{max} = 40 VDC I_{max} = -700 mA
Ramps adjustable	0…500 s
Temperature drift	<1 % at ΔT = 40 °C
Parameterisation	via USB
Interface	USB (Mini-B) for parameterisation with „PASO“ under the closing screw of the housing cover factory set parameters
EMC	
Immunity	EN 61 000-6-2
Emission	EN 61 000-6-4

CONNECTOR WIRING DIAGRAM

Device receptacle (male) X1



1 = Supply voltage +
2 = Supply voltage 0 VDC
3 = Stabilised output voltage
4 = Command value voltage +
5 = Command value voltage -
6 = Command value current +
7 = Command value current -
8 = Reserved for extensions
9 = Reserved for extensions
10 = Enable control (Digital input)
11 = Error signal (Digital output)
12 = Chassis

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

The mating connector (plug female, M23, 12-poles) is not included in the delivery.

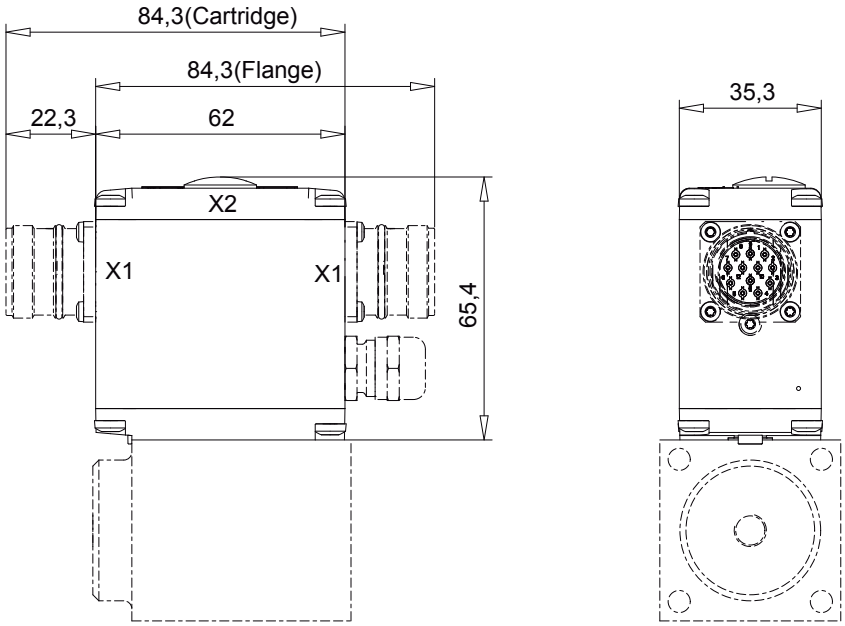
Parameterisation interface X2 (USB type Mini B) (5-pole)

NOTE!
The parameterisation cable (Plug A on Mini B) is not part of the delivery. With the corresponding article no. in the chapter „Accessories“ the parameterisation cable can be ordered.

ACCESSORIES

Cable to adjust the settings through interface USB
(from plug type A to Mini B, 3 m)
article no. 219.2896

DIMENSIONS



Flange solenoid or slip-on coil possible

DESCRIPTION OF „DSV“ ELECTRONICS

General description

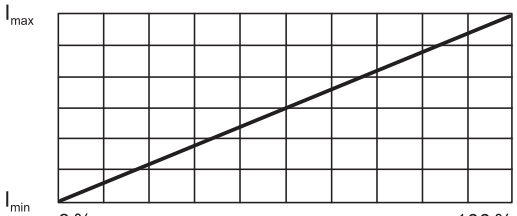
- The „**DSV**“ electronics is an integral part of the valve.
- All inputs and outputs are to be contacted via the device receptacle.
- Under the closing screw of the housing cover there is a USB - interface, through which with the menu-controlled Windows program „PASO-DSV“ the parameterisation and diagnostics 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.

Description of the function
Hardware configuration with analog signal

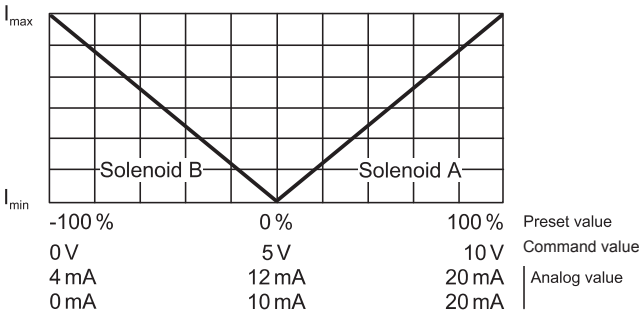
The „DSV“ electronics serve to actuate the valve.
The “DSV”- electronics has one (in case of 1-solenoid valves) and two (in case of 2-solenoid valves) Pulse Width Modulated current outputs with superimposed dither signal, whereby dither frequency and dither level can be adjusted separately. In the case of 1-solenoid valves, the command value can be applied in the range of 0…10 V (voltage input) or 0…20 mA, resp., 4…20 mA (current input). In the case of 2-solenoid valves, the command value can be applied in the range 0…10 V, resp., 0… ±10 V (voltage input) or 0…20 mA, resp.,4…20 mA (current input). Furthermore the „DSV“ - electronics have a digital input for the enable as well as a digital output for the error identification. The parameterisation takes place by means of the parameterisation software „PASO-DSV“. Changed parameters are stored in a non-volatile memory, so that they are available again after a renewed switching-on of the control system.

The following operation modes depend on the valve type and are selected in the factory accordingly. If required, the operation mode can be changed by the user.

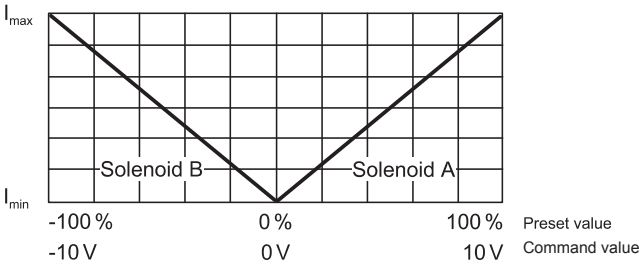
Operation mode: unipolar, 1-solenoid valve
This operation mode can only be selected for the 1-solenoid valves. Depending on an unipolar analog input (voltage or current) the solenoid is actuated. (0...10 V, 0...20 mA, 4...20 mA correspond to 0...100 % command value signal) / (0...100 % command value signal correspond to I_{min} … I_{max} solenoid).



Operation mode: unipolar, 2-solenoid valve
This operation mode can only be selected for the 2-solenoid valves. Depending on an unipolar analog input (voltage or current), according to the signal level solenoid A or B are actuated.
The switching point between the two solenoids as a standard is at the middle of the range of values of the analogue signal. (0...10 V, 0...20 mA and 4...20 mA correspond to -100 %...+100 % command value signal) / (-100...0 % command value signal correspond to I_{max}…I_{min} solenoid B, and 0...100 % command value signal correspond to I_{min}…I_{max} solenoid A).



Operation mode: bipolar, 2-solenoid valve
This operation mode can only be selected for the 2-solenoid valves. Depending on an bipolar analog input (voltage), according to the signal level solenoid A or B are actuated. The switching point between the two solenoids as a standard is at 0 V. (-10...+10 V corrrespond to -100...+100 % command value signal) / (-100...0 % command value signal correspond to I_{min}…I_{max} solenoid B and 0...100 % command value signal correspond to I_{min}…I_{max} solenoid A).



Command value inputs
The applied analog signal is digitised by a 13-Bit (+/-12 Bit) A/D converter.

Note:
When the range 4…20 mA is selected, the resolution is <12-Bit! All command value inputs are executed as differential inputs.
Differential inputs are utilised, when the potential of the ground of the external command value generator does not match the ground of the „DSV“ - electronics. If the digital input is to be utilised like an analogue input against ground, the - (minus) connection of the differential input is to be connected to ground.

Cable rupture safety on the analogue input
The command value input can be monitored for a cable break. If a cable break is detected, the solenoid output is disabled and the output „Error“ is activated. In order that the monitoring is effective, the following conditions have to be fulfilled:
• The levels have to be parameterised.
• The cable break monitoring has to be activated.

Note:
It takes approx. 100 ms for a cable break to be detected. During this time the axis can make unintended movements.

Error Detection
In case of an error, the solenoids are optionally blocked or supplied with a fixed current (providing the error leaves a current supply possible).

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.

Command value (voltage signal)
Input voltage range 0…±10 V / 0...+10 V
If with the 12 VDC version the rod voltage (0…8 V) is utilised, the scaling (min./max. Interface) has to be correspondingly adapted in the „PASO-**DSV**“.

Command value (current signal)
Input current range 0..20 mA / 4...20 mA

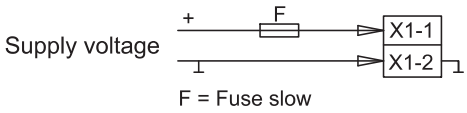
Digital input „Enable control“
Enables the „**DSV**“ electronics in general. Without this enabling no solenoid current is output. The digital input is high-active (see Electrical specifications).

Digital output „Error“
This output becomes active, when an error is detected. Once it is detected, an error is displayed until the „DSV“ - electronics are blocked via the digital input „Enable control system“ and then enabled again.
The digital output is a low-side switch (refer to Electrical specifications).

Ramps
Per solenoid two linear ramps for up and down are independently adjustable.

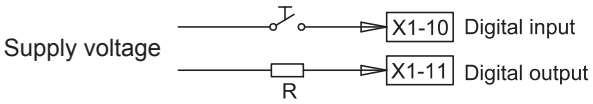
Example of connection (Analog interface with amplifier)

Connection of the supply voltage



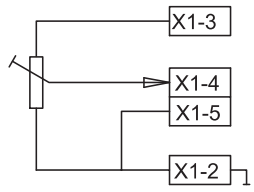
F = Fuse slow

Connection of the digital inputs / outputs

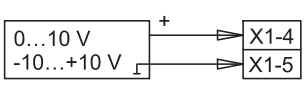


R = Consumer resistance for a max. current 0,7 A

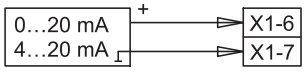
Connection command value with potentiometer (not differential)
e.g. 10 kOhm



Connection with external command value generator (voltage differential)

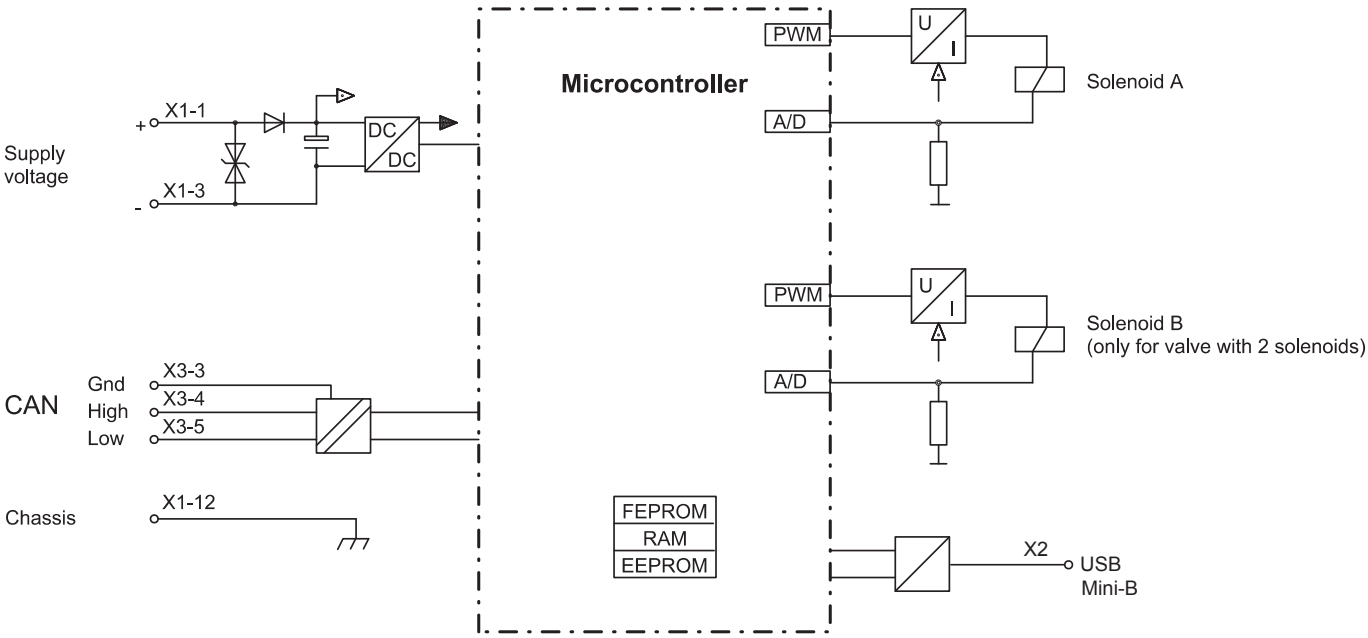


Connection with external command value generator (current differential)



Control through CANopen interface with amplifier electronics

BLOCK DIAGRAM



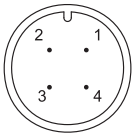
ELECTRICAL SPECIFICATIONS

Protection class	IP 67 acc. to mating EN 60 529 With suitable connector and closed electronics housing cover
Device receptacle supply (male)	M12, 4-poles
Mating connector	plug (female), M12, 4-poles (not incl. in delivery)
Device receptacle CANopen (male)	M12, 5-poles (acc. to DRP 303-1)
Mating connector	plug (female), M12, 5-poles (not incl. in delivery)
Supply voltage	24 VDC or 12 VDC
Voltage range:	
• 24 VDC	21…30 V
• 12 VDC	10,5…15 V
Ripple on supply voltage	<10 %
Fuse	slow
Current consumption:	
• No load current	50 mA
• 35 mm square size solenoid	I_{max} = 1000 mA (with version 24 VDC) I_{max} = 2000 mA (with version 12 VDC)
• 45 mm square size solenoid	I_{max} = 1200 mA (with version 24 VDC) I_{max} = 2400 mA (with version 12 VDC)
• Maximum current	I_{max} = 1534 mA (with version 24 VDC) I_{max} = 2557 mA (with version 12 VDC)

Command value signal	via CANopen
CANopen interface	Two wire lead acc. to ISO 11898 Differential signal transmission
Bus topology	Line
Separation of potential	CANopen against „DSV“ electronics 500 VDC
Ramps adjustable	0…500 s
Temperature drift	<1 % at ΔT = 40 °C
Parameterisation	via CANopen or USB
Interface	USB (Mini B) for parameterisation with „PASO“ under the closing screw of the housing cover factory set parameters
EMC	
Immunity	EN 61 000-6-2
Emission	EN 61 000-6-4

CONNECTOR WIRING DIAGRAM

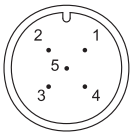
Device receptacle supply (male) X1



MAIN
1 = Supply voltage +
2 = Reserved for extensions
3 = Supply voltage 0 VDC
4 = Chassis

The mating connector (plug female, M12, 4-poles) is not included in the delivery.

Device receptacle CANopen (male) X3



CAN
1 = Not connected
2 = Not connected
3 = CAN Gnd
4 = CAN High
5 = CAN Low

The mating connector (plug female, M12, 5-poles) is not included in the delivery.

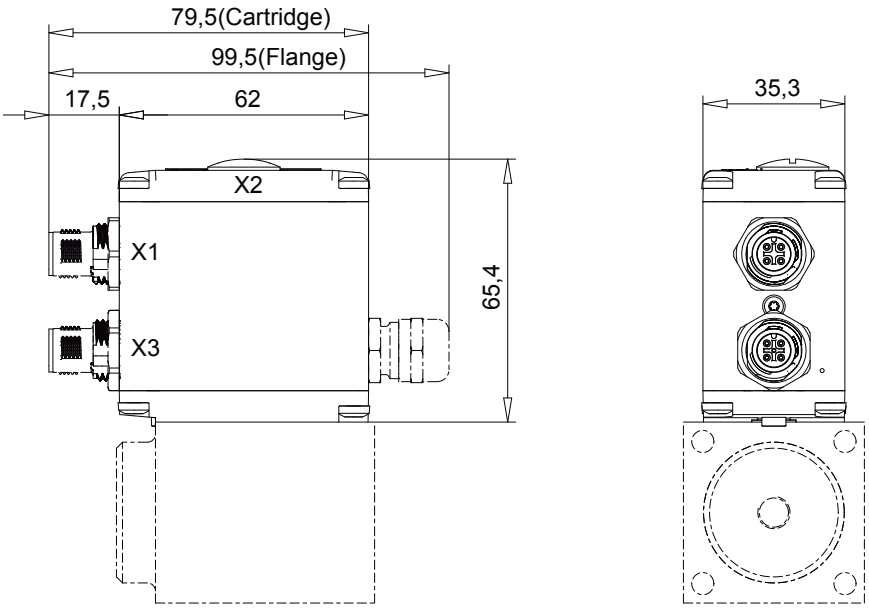
Parameterisation interface X2 (USB type Mini B) (5-pole)

NOTE!
The parameterisation cable (Plug A on Mini B) is not part of the delivery. With the corresponding article no. in the chapter „Accessories“ the parameterisation cable can be ordered.

ACCESSORIES

Cable to adjust the settings through interface USB
(from plug type A to Mini B, 3 m)
article no. 219.2896

DIMENSIONS



Flange solenoid or slip-on coil possible

DESCRIPTION OF THE „DSV“ ELECTRONICS

General description

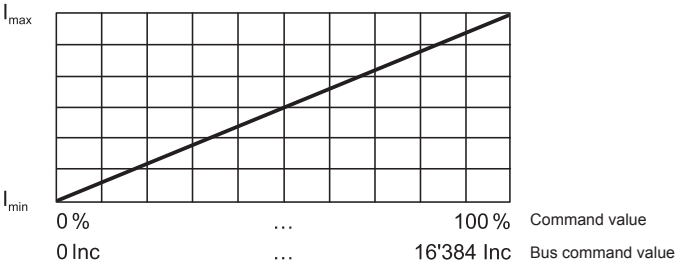
- The „**DSV**“ electronics is an integral part of the valve.
- The CAN bus is to be contacted through the corresponding device receptacle.
- CANopen is used as transmission protocol.
- The characteristics and functions of the „**DSV**“ electronics are described through the device profile DSP-408 „Device Profile Fluid Power Technology“. A detailed description can be found on our website (see set-up instructions).
- With CANopen DSP-408, the „**DSV**“ electronics is controlled and parameters are set.
- Under the closing screw of the housing cover there is a USB - interface of the type Mini-B (5-pole), through which with the menu-controlled Windows program „PASO-DSV“ 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.

Description of the function
Hardware Configuration with CANopen interface

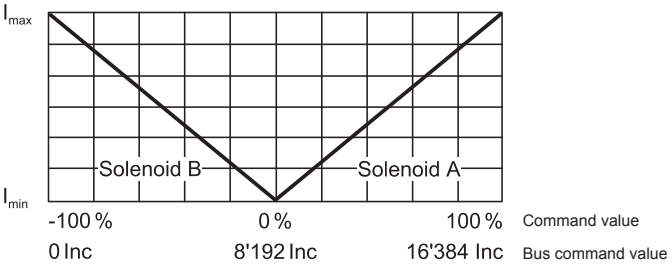
The „DSV“ electronics serve to actuate the valve. The “DSV”- electronics has a **P**ulse **W**idth **M**odulated current output with superimposed dither signal, whereby dither frequency and dither level can be adjusted separately. The command value and the control of the „DSV“ - electronics are predefined through the CAN-bus. In this version with a CAN interface, the “DSV” electronics do not have analog or digital inputs or outputs. The parameterisation takes place via the parameterisation software „PASO-DSV“ or via the CAN bus. Changed parameters are stored in a non-volatile memory, so that they are available again after a renewed switching-on of the control system. Operation and parameterisation for „**DSV**“ valves with CAN bus are described in detail in the operation manual „CANopen protocol with device profile to CiA DSP-408“.

The following operation modes depend on the valve type and are selected in the factory accordingly. If required, the operation mode can be changed by the user.

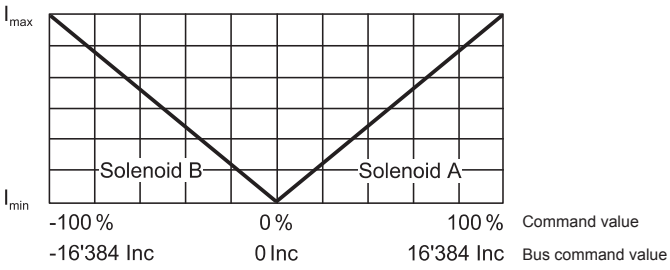
Operation mode: unipolar, 1-solenoid valve
This operation mode is selectable only for the 1-solenoid valves. Depending on an unipolar command value via the CAN bus the solenoid will be actuated. (0…+100 % CAN command value corresponds to 0…+100 % internal command value) (0…100 % command value correspond to I_{min} … I_{max} solenoid).



Operation mode: unipolar, 2-solenoid valve
This operation mode is selectable only for the 2-solenoid valves. Depending on an unipolar command value via the CAN bus, solenoid A or solenoid B will be actuated. The switching point between the two solenoids as a standard is at the middle of the range of values of the CAN command value. (0…+100 % CAN command value correspond to -100 %…+100 % internal command value) (-100…0 % internal command value correspond to I_{max}…I_{min} solenoid B and 0…100 % command value correspond to I_{min}…I_{max} solenoid A).



Operation mode: bipolar, 2-solenoid valve
This operation mode is selectable only for the 2-solenoid valves. Depending on a bipolar command value via the CAN bus solenoid A or solenoid B will be actuated. The switching point between the two solenoids as a standard is at 0 % the CAN command value. (-100 %…+100 % CAN command value correspond to -100 %…+100 % internal command value) (-100…0 % internal command value correspond to I_{max}…I_{min} solenoid B and 0…100 % command value correspond to I_{min}…I_{max} solenoid A).



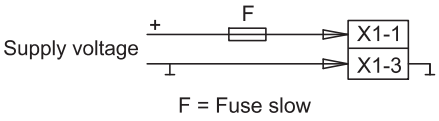
Ramps
Per solenoid two linear ramps for up and down are independently adjustable.

Error Detection
In case of an error, the solenoids are optionally blocked or supplied with a fixed current (providing the error leaves a current supply possible).

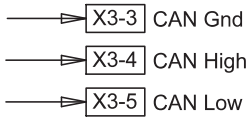
Optimisation of characteristic curve
A characteristic curve adjustable per solenoid „Command value input - solenoid current output“ enables an optimised (e.g., linearised) characteristic of the hydraulic system.

Example of connection (CANopen interface with amplifier)

Connection of supply voltage

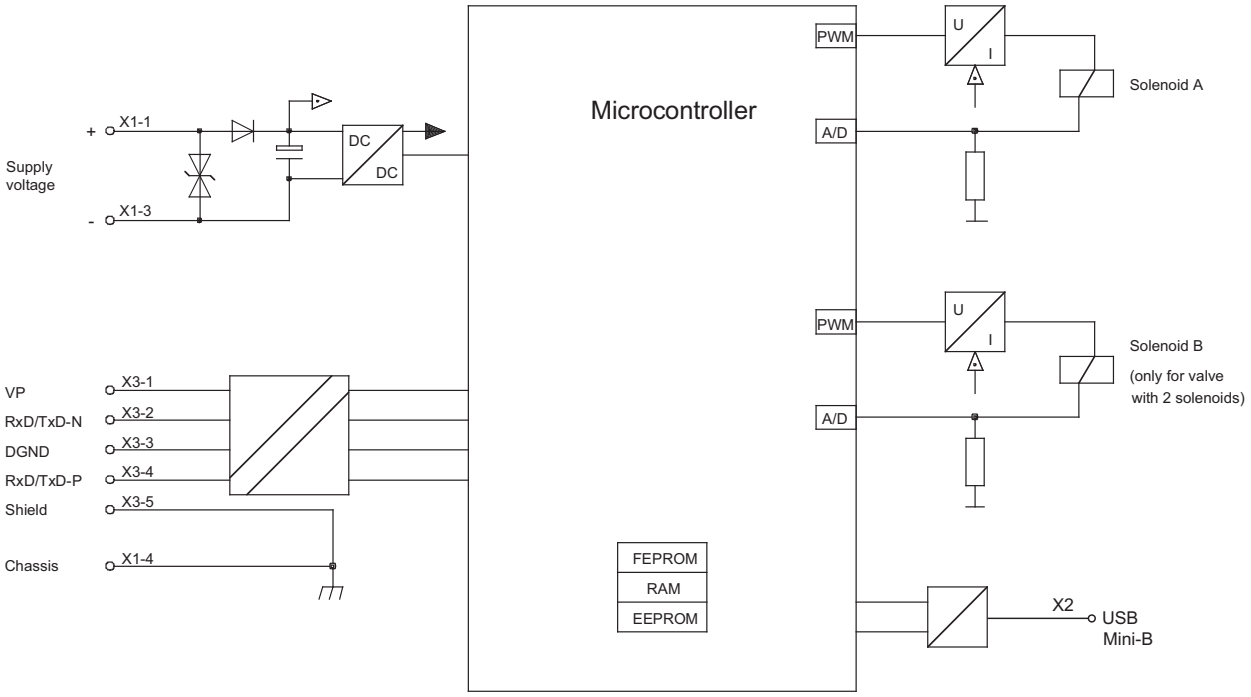


Connection CAN



Control through Profibus-interface with amplifier electronics

BLOCK DIAGRAM



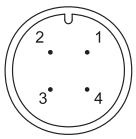
ELECTRICAL SPECIFICATIONS

Protection class	IP 67 acc. to EN 60 529 With suitable mating connector and closed electronics housing cover
Device receptacle supply (male)	M12, 4-poles
Mating connector	plug (female), M12, 4-poles (not incl. in delivery)
Device receptacle Profibus (female)	M12, 5-poles, B-coded (acc. to IEC 947-5-2)
Mating connector	plug (male), M12, 5-poles, B-coded (not incl. in delivery)
Supply voltage	24 VDC or 12 VDC
Voltage range:	
• 24 VDC	21…30 V
• 12 VDC	10,5…15 V
Ripple on supply voltage	<10 %
Fuse	slow
Current consumption:	
• No load current	50 mA
• 35 mm square size solenoid	I_{max} = 1000 mA (with version 24 VDC) I_{max} = 2000 mA (with version 12 VDC)
• 45 mm square size solenoid	I_{max} = 1200 mA (with version 24 VDC) I_{max} = 2400 mA (with version 12 VDC)
• Maximum current	I_{max} = 1534 mA (with version 24 VDC) I_{max} = 2557 mA (with version 12 VDC)

Command value signal	via Profibus
Profibus-interface	Shielded, twisted wire Differential signal transmission
Bus topology	Line
Separation of potential	Profibus against „DSV“ electronics 500 VDC
Ramps adjustable	0…500 s
Temperature drift	<1 % at ∆T = 40 °C
Parameterisation	via Profibus or USB
Interface	USB (Mini B) for parameterisation with „PASO“ under the closing screw of the housing cover factory set parameters
EMC	
Immunity	EN 61 000-6-2
Emission	EN 61 000-6-4

CONNECTOR WIRING DIAGRAM

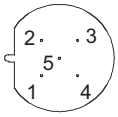
Device receptacle supply (male) X1



MAIN
1 = Supply voltage +
2 = Reserved for extensions
3 = Supply voltage 0 VDC
4 = Chassis

The mating connector (plug female, M12, 4-poles) is not included in the delivery.

Device receptacle Profibus (female) X3



PROFIBUS
1 = VP
2 = RxD / TxD - N
3 = DGND
4 = RxD / TxD - P
5 = Shield

The mating connector (plug male, M12, 5-poles, B-coded) is not included in the delivery.

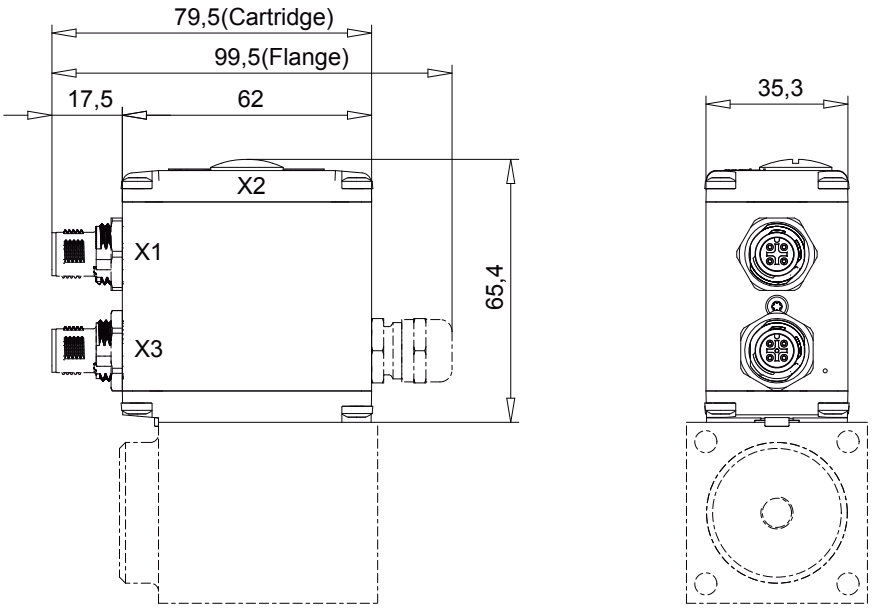
Parameterisation interface X2 (USB type Mini-B) (5-pole)

NOTE!
The parameterisation cable (Plug A on Mini B) is not part of the delivery. With the corresponding article no. in the chapter „Accessories“ the parameterisation cable can be ordered.

ACCESSORIES

Cable to adjust the settings through interface USB
(from plug type A to Mini B, 3 m)
article no. 219.2896

DIMENSIONS



Flange solenoid or slip-on coil possible

DESCRIPTION OF THE „DSV“ ELECTRONICS

General description

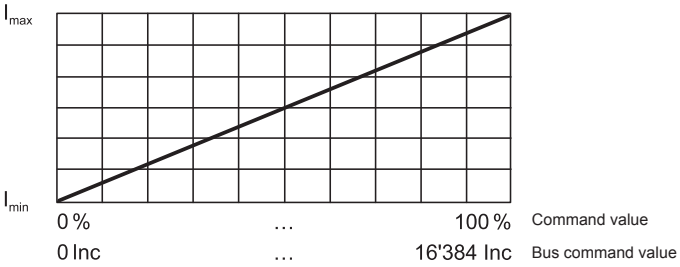
- The „**DSV**“ electronics is an integral part of the valve.
- The Profibus is to be contacted through the corresponding device receptacle.
- Profibus DP is used as transmission protocol.
- The characteristics and functions of the „**DSV**“ electronics are described through the device profile DSP-408 „Device Profile Fluid Power Technology“. A detailed description can be found on our website (see set-up instructions).
- With Profibus DP, the „**DSV**“ electronics is controlled and parameters are set.
- Under the closing screw of the housing cover there is a X2 USB - interface of the type Mini B (5-pole), through which with the menu-controlled Windows program „PASO-DSV“ 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.

Description of the function
Hardware Configuration with Profibus interface

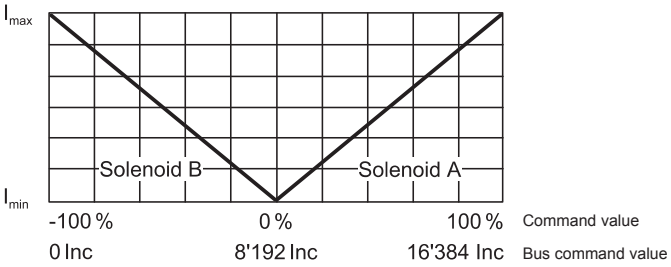
The „DSV“ electronics serve to actuate the valve. The „DSV“- electronics has a Pulse Width Modulated current output with superimposed dither signal, whereby dither frequency and dither level can be adjusted separately. The command value and the control of the „DSV“ - electronics are predefined through Profibus. In this version with a Profibusinterface, the „DSV“ electronics do not have analog or digital inputs or outputs. The parameterisation takes place via the parameterisation software „PASO-DSV“ or via the Profibus. Changed parameters are stored in a non-volatile memory, so that they are available again after a renewed switching-on of the control system. Operation and parameterisation for „**DSV**“ valves with Profibus are described in detail in the operation manual.

The following operation modes depend on the valve type and are selected in the factory accordingly. If required, the operation mode can be changed by the user.

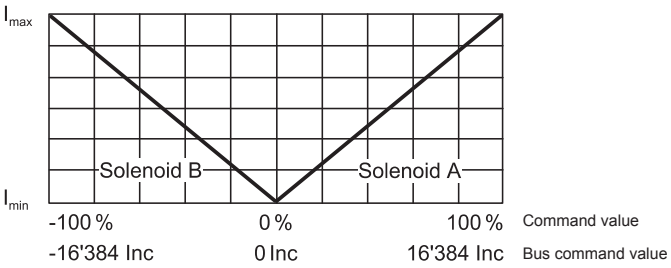
Operation mode: unipolar, 1-solenoid valve
This operation mode is selectable only for the 1-solenoid valves. Depending on an unipolar command value via Profibus, the solenoid is actuated. (0…+100 % Profibus command value corresponds to 0…+100 % internal command value) (0…100 % command value correspond to I_{min} … I_{max} solenoid).



Operation mode: unipolar, 2-solenoid valve
This operation mode is selectable only for the 2-solenoid valves. Depending on an unipolar command value via Profibus, according to the command value solenoid A or B are actuated. The switching point between the two solenoids as a standard is at the middle of the range of values of the Profibus command value. (0…+100 % Profibus command value correspond to -100 %…+100 % internal command value) (-100…0 % internal command value correspond to I_{max}…I_{min} solenoid B and 0…100 % command value correspond to I_{min}…I_{max} solenoid A).



Operation mode: bipolar, 2-solenoid valve
This operation mode is selectable only for the 2-solenoid valves. Depending on a bipolar command value via Profibus, according to the command value solenoid A or B are actuated. The switching point between the two solenoids as a standard is at 0 % of the Profibus command value. (-100 %…+100 % CAN command value correspond to -100 %…+100 % internal command value) (-100…0 % internal command value correspond to I_{max}…I_{min} solenoid B and 0…100 % command value correspond to I_{min}…I_{max} solenoid A).



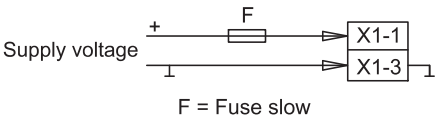
Ramps
Per solenoid two linear ramps for up and down are independently adjustable.

Error Detection
In case of an error, the solenoids are optionally blocked or supplied with a fixed current (providing the error leaves a current supply possible).

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.

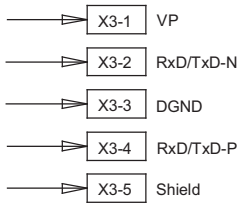
Example of connection (Profibus interface with amplifier)

Connection of supply voltage



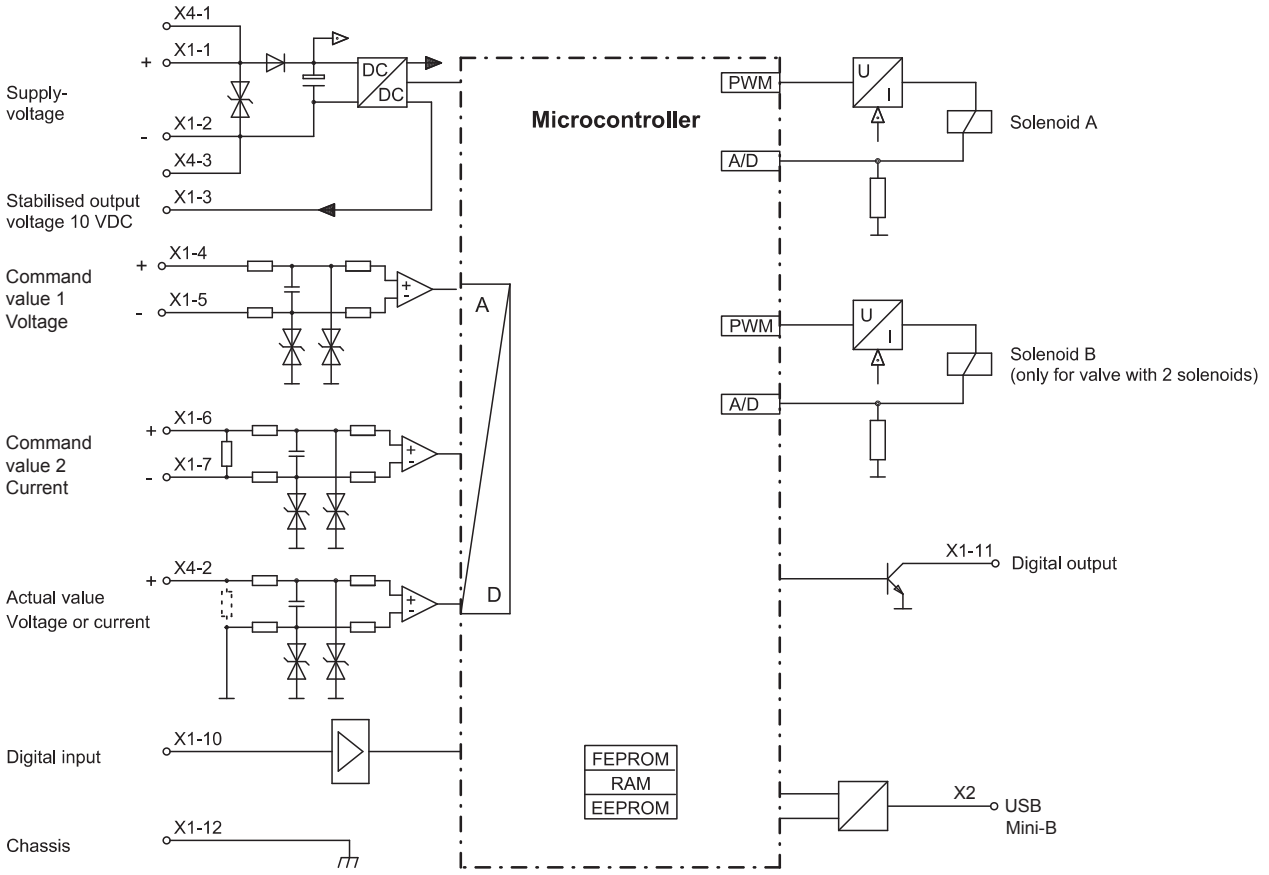
F = Fuse slow

Connection Profibus



Control through analog interface with controller electronics

BLOCK DIAGRAM



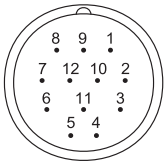
ELECTRICAL SPECIFICATIONS

Protection class	IP 67 acc. to EN 60 529 with suitable mating connector and closed electronics housing cover
Device receptacle (male)	M23, 12-poles
Mating connector	plug (female), M23, 12-poles (not incl. in delivery)
Device receptacle sensor (female)	M12, 5-poles
Mating connector	plug (male), M12, 5-poles (not incl. in delivery)
Supply voltage	24 VDC or 12 VDC
Voltage range:	
• 24 VDC	21…30 V
• 12 VDC	10,5…15 V
Ripple on supply voltage	<10 %
Fuse	slow
Current consumption:	
• No load current	approx. 40 mA
• 35 mm square size solenoid	I_{max} = 1000 mA (with version 24 VDC) I_{max} = 2000 mA (with version 12 VDC)
• 45 mm square size solenoid	I_{max} = 1200 mA (with version 24 VDC) I_{max} = 2400 mA (with version 12 VDC)
• Maximum current	I_{max} = 1534 mA (with version 24 VDC) I_{max} = 2557 mA (with version 12 VDC)
Command value signal:	Selectable with 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

Feedback value signal:	Diff. inputs not galvanically separated, for earth potential differences up to 1,5 V
• Type R1	4…+20 mA / 0…+20 mA
• Type R2	0…+10 V / -10…+10 V
Input resistance	Voltage input >18 kΩ Load for current input = 250 Ω
Stabilised output voltage	10 VDC (with version 24 VDC) 8 VDC (with version 12 VDC) max. load 10 mA
Digital inputs	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 identification)
Digital output	Low-Side-Switch: U_{max} = 40 VDC I_{max} = -700 mA
Ramps adjustable	0…500 s
Temperature drift	<1 % at ΔT = 40 °C
Parameterisation	via USB
Interface	USB (Mini B) for parameterisation with „PASO“ under the closing screw of the housing cover factory set parameters
EMC	
Immunity	EN 61 000-6-2
Emission	EN 61 000-6-4

CONNECTOR WIRING DIAGRAM

Device receptacle (male) X1



1 = Supply voltage +
2 = Supply voltage 0 VDC
3 = Stabilised output voltage
4 = Preset value voltage +
5 = Preset value voltage -
6 = Preset value current +
7 = Preset value current -
8 = Reserved for extensions
9 = Reserved for extensions
10 = Enable control (Digital input)
11 = Error signal (Digital output)
12 = Chassis

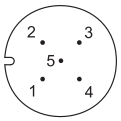
Command value voltage (PIN 4/5) resp. current (PIN 6/7) are selected with set-up and diagnosis software.

The mating connector (plug female, M23, 12-poles) is not included in the delivery.

Parameterisation interface X2 (USB type Mini-B) (5-pole)

Feedback signal interface

Device receptacle Sensor (female) X4



1 = Supply voltage (output) +
2 = Feedback signal +
3 = Supply voltage 0 VDC
4 = Not connected
5 = Stabilized output voltage

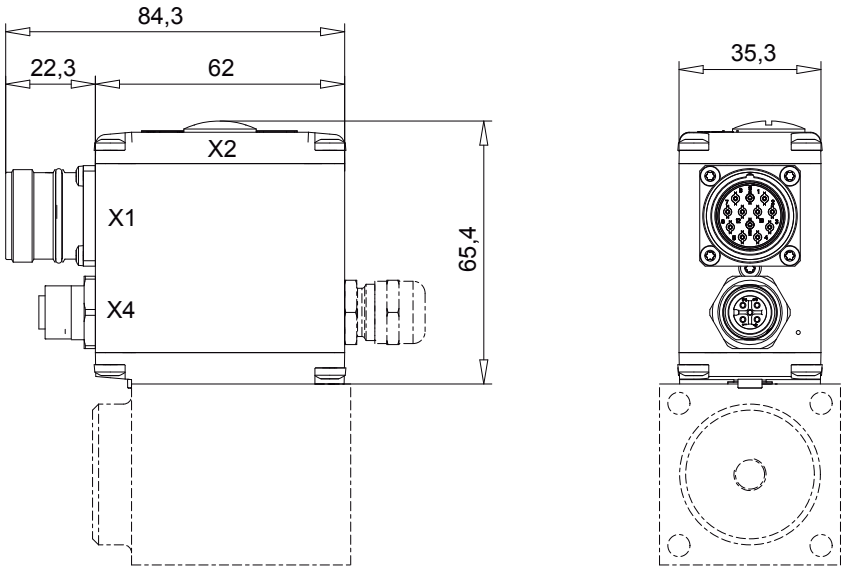
The mating connector (plug male, M12, 5-poles) is not included in the delivery.

NOTE!
The parameterisation cable (Plug A on Mini-B) is not part of the delivery. With the corresponding article no. in the chapter „Accessories“ the parameterisation cable can be ordered.

ACCESSORIES

Cable to adjust the settings through interface USB
(from plug type A to Mini B, 3 m)
article no. 219.2896

DIMENSIONS



Flange solenoid or slip-on coil possible

DESCRIPTION OF THE „DSV“ ELECTRONICS

General description

- The „**DSV**“ electronics is an integral part of the valve.
- All inputs and outputs are to be contacted through the device receptacle.
- Under the closing screw of the housing cover there is a X2 USB - interface of the type Mini B (5-pole), through which with the menu-controlled Windows program „PASO-DSV“ the parameterisation and diagnostics can be carried out.
- At the factory the „DSV“- electronics are adapted to the valve, so that the user only still has to carry out the corresponding controller adjustments.

Functional characteristics Hardware configuration with analogue signal

With the „**DSV**“ - electronics different control circuits can be built-up; positional -, speed -, pressure - or volume flow controllers. They can optionally be adjusted in the form of a controller mode. Additionally an amplifier part is integrated, with which the built-on solenoid is directly actuated. The command value is brought to the controller as an electric signal; a sensor records the effective feedback value, and this signal is also brought to the controller. In correspondence with the control difference (command value - feedback value), a control signal (solenoid current) is output to the valve. By means of the scaling of command value and feedback value, all further inputs can be made in the required, resp. selectable physical unit (e.g., bar or mm, etc.). Once the command value has been reached, the „**DSV**“ - electronics can output a digital signal (optionally as an „Error“ or „Target window reached“ - signal).
The „**DSV**“ - controller has a command value generator, with which the up - and down ramp of the internal set-point value can be preset. The controller is designed as a PID - controller. Because of this, the control characteristics can be correspondingly adjusted, resp. adapted to the control circuit. Furthermore it is also possible to switch the control system off completely for testing - and adjustment purposes. The „**DSV**“ -electronics then function corresponding to normal amplifier electronics.

In addition the „**DSV**“ - electronics have a digital input for the enabling, as well as with a digital output, which optionally can be parameterised as an „Error“ or „Target window reached“ - output.

Changed parameters can be stored in a non-volatile memory, so that they are available again after a renewed switching-on of the control system.

The „**DSV**“ - electronics furthermore have a signal recording function. This, by means of PASO, makes possible a recording of various system signals, such as command value, feedback value, control difference, solenoid currents, etc., which can graphically be depicted on a common time axis.

Analogue Inputs
The analogue signal present is digitalised in the 13 bit (+/-12 bit) A/D-converter.
Note:
When the range 4…20 mA is selected, the resolution is <12-Bit! All analog inputs are executed as differential inputs. Differential inputs are utilised, when the potential of the ground of the external generator does not match the ground of the „DSV“ - electronics. If the digital input is to be utilised like an analogue input against ground, the - (minus) connection of the differential input is to be connected to ground.

Cable rupture safety on the analogue input
The analogue input can be monitored for a cable break. If a cable break is detected, the solenoid output is disabled and the output „Error“ is activated. In order that the monitoring is effective, the following conditions have to be fulfilled:
• The levels have to be parameterised.
• The cable break monitoring has to be activated.

Note:
It takes approx. 100 ms for a cable break to be detected. During this time the axis can make unintended movements.

Command value (Voltage Signal)
Input voltage range 0...±10 V / 0...+10 V
If in case of the version 12 VDC the bar voltage (0...8 V) is utilised, in the PASO-**„DSV“** the scaling [%V] has to be correspondingly adapted.

Command value (Current Signal)
Input current range 0...20 mA / 4...20 mA

Feedback value (voltage or current)
Input range 0...+10 V or 0...20 mA / 4...20 mA

Digital Input „Enable Control System“
Enables the „DSV“ - electronics in general. Without this enabling, no solenoid current is output. The digital input is high-active (refer to Electrical specifications).

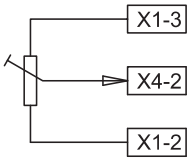
Digital Output „Error“
This output becomes active, when an error is detected. Once it is detected, an error is displayed until the „DSV“ - electronics are blocked via the digital input „Enable control system“ and then enabled again. The digital output is a low-side switch (refer to Electrical specifications).

Ramps
Per solenoid, two linear ramps can be separately set for up and down.

Error Detection
In case of an error, the solenoids are optionally blocked or supplied with a fixed current (providing the error leaves a current supply possible).

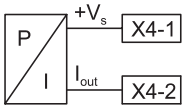
Example of connection (Analog interface with controller)

Connection of the voltage - or current feedback value with potentiometer
e.g. 10 kOhm

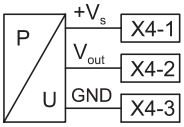


Connection of the voltage - or current feedback value of a pressure sensor

2-conductor

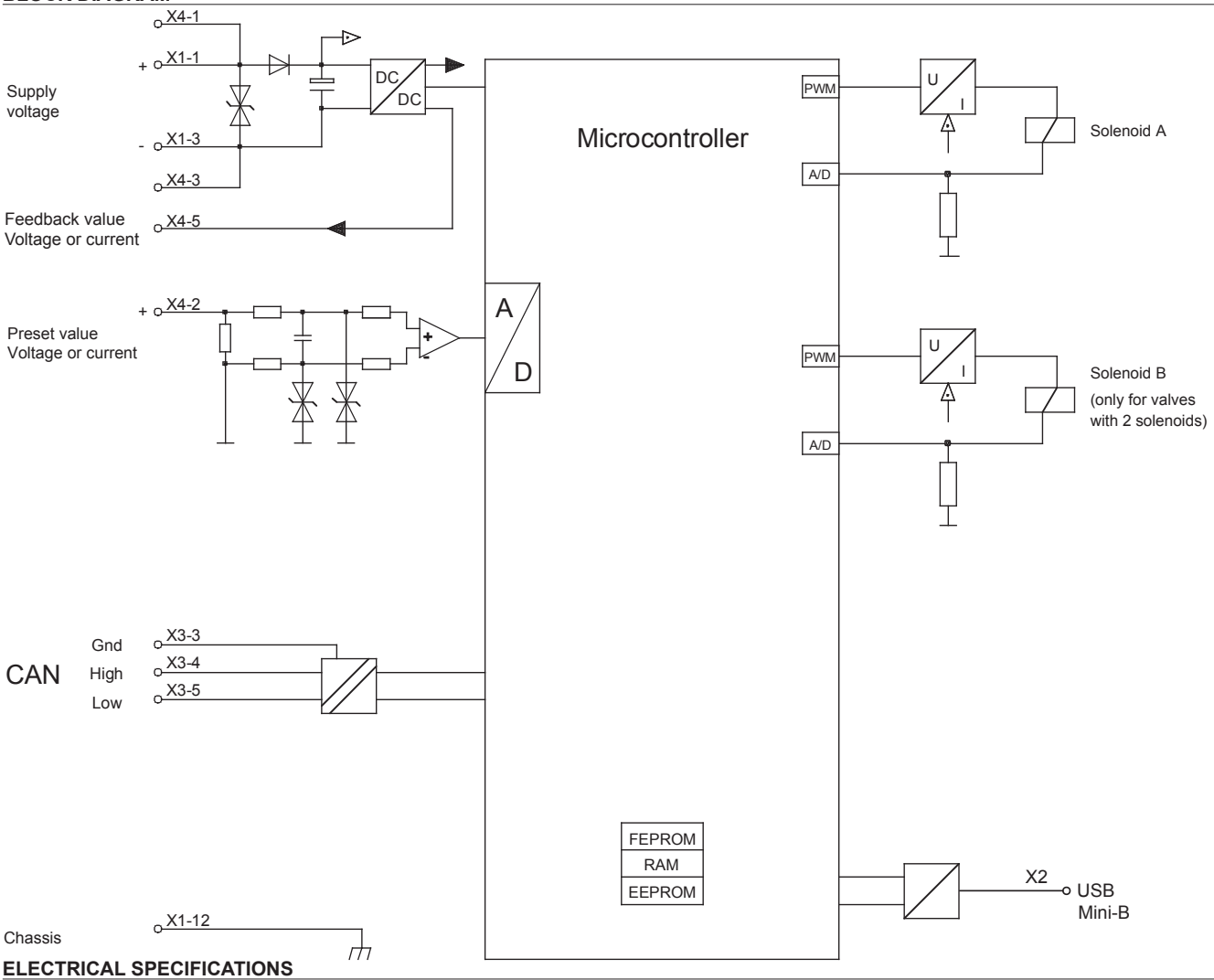


3-conductor



Control through CANopen interface with controller electronics

BLOCK DIAGRAM



ELECTRICAL SPECIFICATIONS

Protection class	IP 67 acc. to EN 60 529 With suitable mating connector and closed electronics housing cover
Device receptacle supply (male)	M12, 4-poles
Mating connector	plug (female), M12, 4-poles (not incl. in delivery)
Device receptacle CANopen (male)	M12, 5-poles (acc. to DRP 303-1)
Mating connector	plug (female), M12, 5-poles (not incl. in delivery)
Device receptacle sensor (female)	M12, 5-poles
Mating connector	plug (male), M12, 5-poles (not incl. in delivery)
Supply voltage	24 VDC or 12 VDC
Voltage range:	
• 24 VDC	21…30 V
• 12 VDC	10,5…15 V
Ripple on supply voltage	<10 %
Fuse	slow
Current consumption:	
• No load current	approx. 40 mA
• 35 mm square size solenoid	I_{max} = 1000 mA (with version 24 VDC) I_{max} = 2000 mA (with version 12 VDC)
• 45 mm square size solenoid	I_{max} = 1200 mA (with version 24 VDC) I_{max} = 2400 mA (with version 12 VDC)
• Maximum current	I_{max} = 1534 mA (with version 24 VDC) I_{max} = 2557 mA (with version 12 VDC)
Command value signal:	via CANopen
CANopen interface	Two-wire circuit acc.to ISO 11898 Differential signal transmission
Bus topology	Line
Separation of potential	CANopen against „DSV“ electronics 500 VDC
Feedback value signal:	Diff. inputs not galvanically separated, for ground potential differences up to 1,5 V
• Type R1	4…+20 mA / 0…+20 mA
• Type R2	0…+10 V / -10…+10 V Resolution +/-12bit
Input resistance	Voltage input >18 kΩ Load for current input = 250 Ω
Stabilised output voltage	10 VDC (with version 24 VDC) 8 VDC (with version 12 VDC) max. load 10 mA
Ramps adjustable	0…500 s
Temperature drift	<1 % at ΔT = 40 °C
Parameterisation	via CANopen or USB
Interface	USB (Mini B) for parameteristion with „PASO“ under the closing screw of the housing cover factory set parameters
EMC Immunity	EN 61 000-6-2
Emission	EN 61 000-6-4

CONNECTOR WIRING DIAGRAM

Device receptacle supply (male) X1

MAIN
1 = Supply voltage +
2 = Reserved for extensions
3 = Supply voltage 0 VDC
4 = Chassis

The mating connector (plug female, M12, 4-poles) is not included in the delivery.

Device receptacle CANopen (male) X3

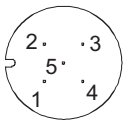
CAN
1 = Not connected
2 = Not connected
3 = CAN Gnd
4 = CAN High
5 = CAN Low

The mating connector (plug female, M12, 5-poles) is not included in the delivery.

Parameterisation interface X2 (USB type Mini-B) (5-pole)

Feedback signal interface

Device receptacle sensor (female) X4



SENSOR
1 = Supply voltage (output) +
2 = Feedback signal +
3 = Supply voltage 0 VDC
4 = Not connected
5 = Stab. output voltage

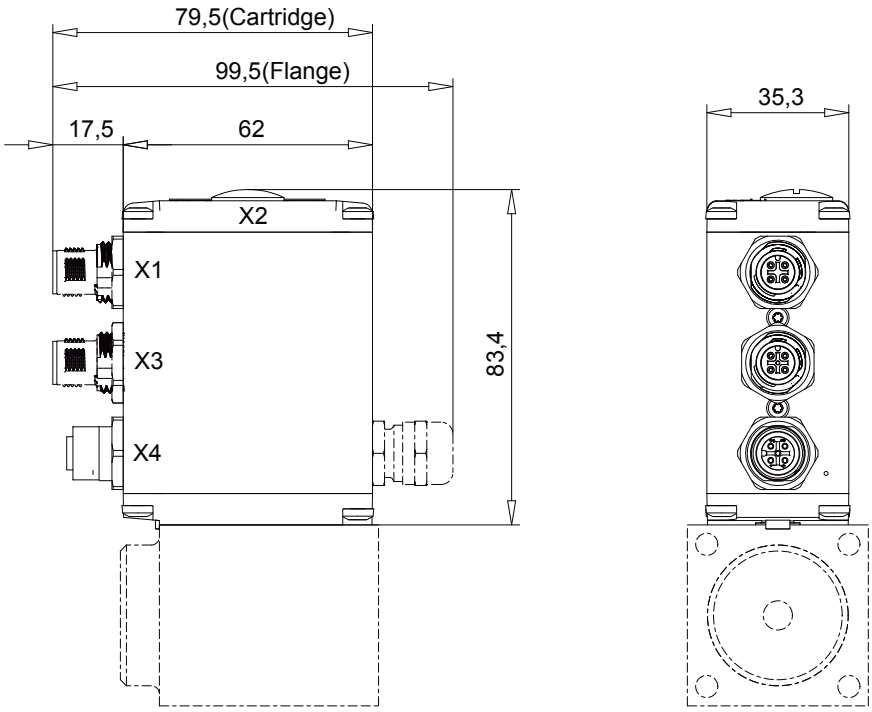
The mating connector (plug male, M12, 5-poles) is not included in the delivery.

NOTE!
The parameterisation cable (plug A on Mini B) is not part of the delivery. With the corresponding article no. in the chapter „Accessories“ the parameterisation cable can be ordered.

ACCESSORIES

Cable to adjust the settings through interface USB
(from plug type A to Mini B, 3 m)
article no. 219.2896

DIMENSIONS



Flange solenoid or slip-on coil possible

DESCRIPTION OF THE „DSV“ ELECTRONICS

General description

- The „**DSV**“ electronics is an integral part of the valve.
- The CAN bus is to be contacted through the corresponding device receptacle.
- CANopen 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 CANopen DSP-408, the „**DSV**“ electronics is controlled and parameters are set.
- Under the closing screw of the housing cover there is a X2 USB - interface of the type Mini-B (5-pole), through which with the menu-controlled Windows program „PASO-DSV“ the parameterisation and diagnostics can be carried out.
- The „DSV“ electronics serve to actuate the valve.

At the factory the „DSV“ - electronics are adapted to the valve, so that the user only still has to carry out the corresponding controller adjustments.

Functional characteristics
Hardware configuration with CANopen interface

With the „**DSV**“ - electronics different control circuits can be built-up; positional -, speed -, pressure, or volume flow controllers. They can optionally be adjusted in the form of a controller mode. Additionally an amplifier part is integrated, with which the built-on solenoid is directly actuated. The command value is predefined and brought to the controller by CANopen; a sensor records the effective feedback value, and this signal is also brought to the controller. In correspondence with the control difference (command value – feedback value), a control signal (solenoid current) is output to the valve. By means of the scaling of command value and feedback value, all further inputs can be made in the required, resp. selectable physical unit (e.g., bar or mm, etc.).
The „**DSV**“-controller has a command value generator, with which the up- and down ramp of the internal command value can be preset. The controller is designed as a PID-controller. Because of this, the control characteristics can be correspondingly adjusted, resp. adapted to the control circuit. Furthermore it is also possible to switch the control system off completely for testing and adjustment purposes. The „**DSV**“-electronics then function corresponding to normal amplifier electronics.

Changed parameters can be stored in a non-volatile memory, so that they are available again after a renewed switching-on of the control system.

The „**DSV**“ - electronics furthermore have a signal recording function. This, by means of PASO, makes possible a recording of various system signals, such as command value, feedback value, control difference, solenoid currents, etc., which can graphically be depicted on a common time axis.

Analogue Inputs
The analogue signal present is digitalised in the 13 bit (+/-12 bit) A/D-converter.
Note:
When the range 4…20 mA is selected, the resolution is <12-Bit! All analog inputs are executed as differential inputs. Differential inputs are utilised, when the potential of the ground of the external generator does not match the ground of the „DSV“ - electronics. If the digital input is to be utilised like an analogue input against ground, the - (minus) connection of the differential input is to be connected to ground.

Cable rupture safety on the analogue input
The analogue input can be monitored for a cable break. If a cable break is detected, the solenoid output is disabled and the output „Error“ is activated. In order that the monitoring is effective, the following conditions have to be fulfilled:
- The levels have to be parameterised.
- The cable break monitoring has to be activated.

Note:
It takes approx. 100 ms for a cable break to be detected. During this time the axis can make unintended movements.
Attention:
Up until the identification of a cable break approx. 100 ms elapse. During this time, the axis may carry out unintended movements!

Command value
Predefined by CANopen

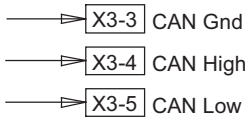
Feedback value (voltage or current)
Input range 0…±10 V / 0…+10 V or 0…20 mA/4…20 mA

Ramps
Per solenoid, two linear ramps can be separately set for up and down.

Error Detection
In case of an error, the solenoids are optionally blocked or supplied with a fixed current (providing the error leaves a current supply possible).

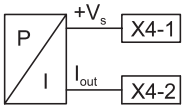
Example of connection (CANopen interface with controller)

Connection CANopen

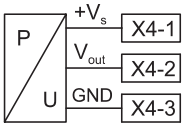


Connection of the voltage - or current feedback value of a pressure sensor

2-conductor

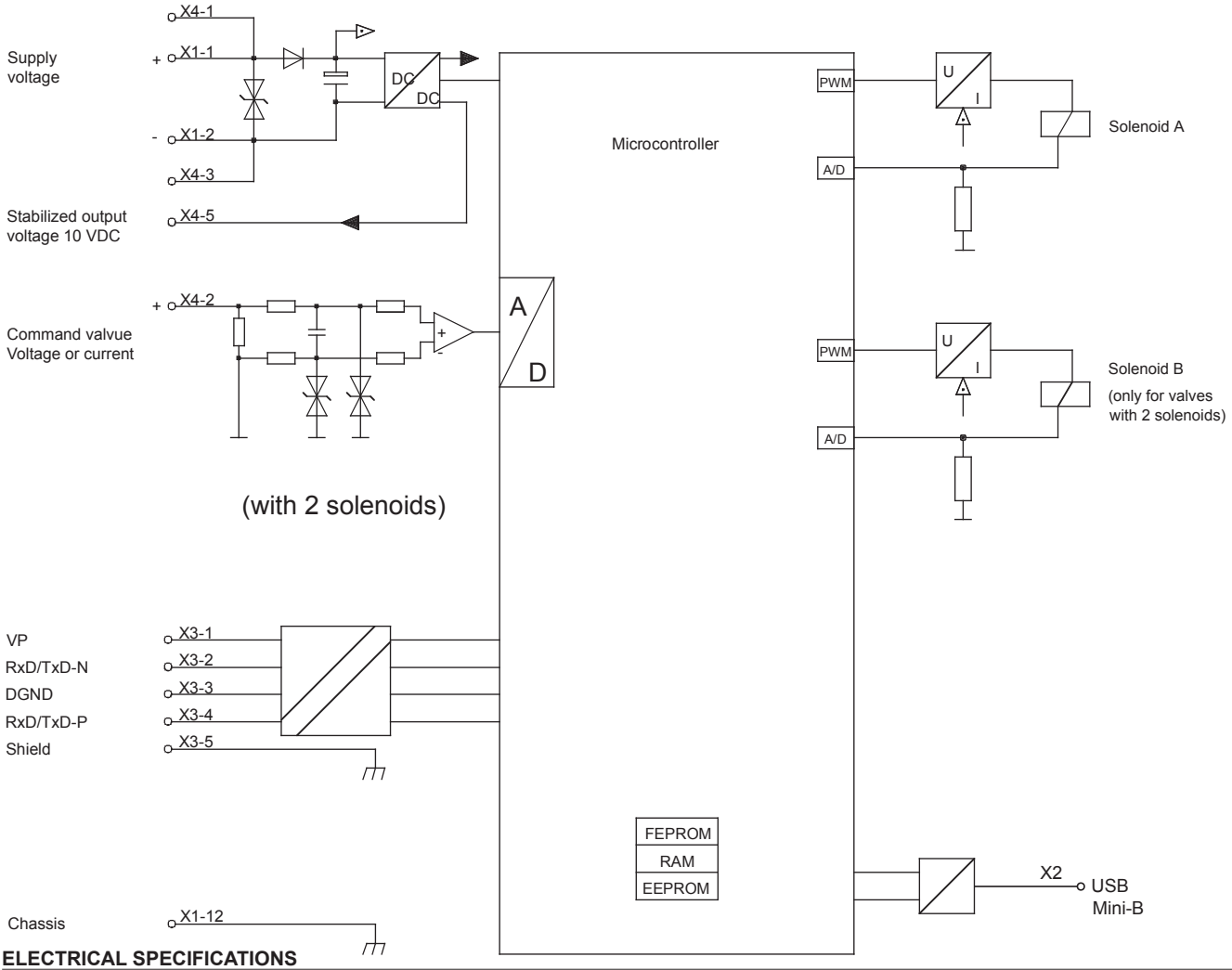


3-conductor



Control through Profibus interface with controller electronics

BLOCK DIAGRAM

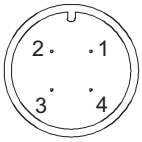


ELECTRICAL SPECIFICATIONS

Protection class	IP 67 acc. to EN 60 529 With suitable mating connector and closed electronics housing cover
Device receptacle supply (male)	M12, 4-poles
Mating connector	plug (female), M12, 4-poles (not incl. in delivery)
Device receptacle Profibus (female)	M12, 5-poles, B-coded (acc. to IEC 947-5-2)
Mating connector	plug (male), M12, 5-poles, B-coded (not incl. in delivery)
Device receptacle sensor (female)	M12, 5-poles
Mating connector	plug (male), M12, 5-poles (not incl. in delivery)
Supply voltage	24 VDC or 12 VDC
Voltage range:	
• 24 VDC	21…30 V
• 12 VDC	10,5…15 V
Ripple on supply voltage	<10 %
Fuse	slow
Current consumption:	
• No load current	approx. 40 mA
• 35 mm square size solenoid	I_{max} = 1000 mA (with version 24 VDC) I_{max} = 2000 mA (with version 12 VDC)
• 45 mm square size solenoid	I_{max} = 1200 mA (with version 24 VDC) I_{max} = 2400 mA (with version 12 VDC)
• Maximum current	I_{max} = 1534 mA (with version 24 VDC) I_{max} = 2557 mA (with version 12 VDC)
Command value signal:	via Profibus
Profibus interface	Shielded, twisted wire Differential signal transmission
Bus topology	Line
Separation of potential	Profibus against „DSV“ electronics 500 VDC
Feedback value signal:	Diff. inputs not galvanically separated, for ground potential differences up to 1,5 V
• Type R1	4…+20 mA / 0…+20 mA
• Type R2	0…+10 V / 0… +10 V Resolution: +/-12 bit
Input resistance	Voltage input >18 kΩ Load for current input = 250 Ω
Stabilised output voltage	10 VDC (with version 24 VDC) 8 VDC (with version 12 VDC) max. load 10 mA
Ramps adjustable	0…500 s
Temperature drift	<1 % at ΔT = 40 °C
Parameterisation	via Profibus or USB
Interface	USB (Mini B) for parameterisation with „PASO“ under the closing screw of the housing cover factory set parameters
EMC Immunity	EN 61 000-6-2
Emission	EN 61 000-6-4

CONNECTOR WIRING DIAGRAM

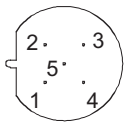
Device receptacle supply (male) X1



MAIN
1 = Supply voltage +
2 = reserved for extensions
3 = Supply voltage 0 VDC
4 = Chassis

The mating connector (plug female, M12, 4-poles) is not included in the delivery.

Device receptacle Profibus (female) X3



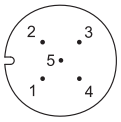
PROFIBUS
1 = VP
2 = RXD/TXD -N
3 = DGND
4 = RXD/TXD-P
5 = Shield

The mating connector (plug male, M12, 5-poles, B-coded) is not included in the delivery.

Parameterisaton interface X2 (USB type Mini-B) (5-pole)

Feedback signal interface

Device receptacle sensor (female) X4



SENSOR
1 = Supply voltage (output) +
2 = Feedback signal +
3 = Supply voltage 0 VDC
4 = not connected
5 = stab. output voltage

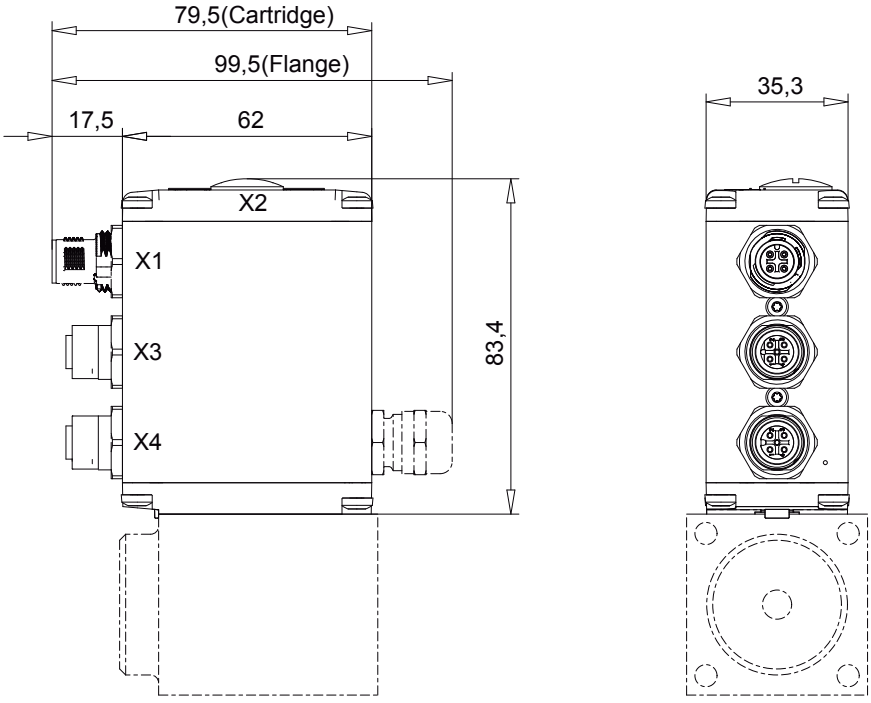
The mating connector (plug male, M12, 5-poles) is not included in the delivery.

NOTE!
The parameterisation cable (Plug A on Mini B) is not part of the delivery. With the corresponding article no. in the chapter „Accessories“ the parameterisation cable can be ordered.

ACCESSORIES

Cable to adjust the settings through interface USB
(from plug type A to Mini B, 3 m)
article no. 219.2896

DIMENSIONS



Flange solenoid or slip-on coil possible

DESCRIPTION OF THE „DSV“ ELECTRONICS

General description

- The „**DSV**“ electronics is an integral part of the valve.
- The Profibus is to be contacted through the corresponding device receptacle.
- 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 Profibus DP the „**DSV**“ electronics is controlled and parameters are set.
- Under the closing screw of the housing cover there is a X2 USB - interface of the type Mini-B (5-pole), through which with the menu-controlled Windows program „PASO-DSV“ the parameterisation and diagnostics can be carried out.
- At the factory the „DSV“- electronics are adapted to the valve, so that the user only still has to carry out the corresponding controller adjustments.

Functional characteristics
Hardware configuration with Profibus DP interface

With the „**DSV**“ - electronics different control circuits can be built-up; positional -, speed -, pressure, or volume flow controllers. They can optionally be adjusted in the form of a controller mode. Additionally an amplifier part is integrated, with which the built-on solenoid is directly actuated. The command value is predefined and brought to the controller by the Profibus; a sensor records the effective actual value, and this signal is also brought to the controller. In correspondence with the control difference (command value – feedback value), a control signal (solenoid current) is output to the valve. By means of the scaling of command value and feedback value, all further inputs can be made in the required, resp. selectable physical unit (e.g., bar or mm, etc.).
The „**DSV**“-controller has a command value generator, with which the up- and down ramp of the internal command value can be preset. The controller is designed as a PID-controller. Because of this, the control characteristics can be correspondingly adjusted, resp. adapted to the control circuit. Furthermore it is also possible to switch the control system off completely for testing and adjustment purposes. The „**DSV**“-electronics then function corresponding to normal amplifier electronics.

Changed parameters can be stored in a non-volatile memory, so that they are available again after a renewed switching-on of the control system.

The „**DSV**“ - electronics furthermore have a signal recording function. This by means of PASO makes possible a recording of various system signals, such as command value, feedback value, control difference, solenoid currents, etc., which can graphically be depicted on a common time axis.

Analogue Inputs
The analogue signal present is digitalised in the 13 bit (+/-12 bit) A/D-converter.
Note:
When the range 4…20 mA is selected, the resolution is <12-Bit! All analog inputs are executed as differential inputs. Differential inputs are utilised, when the potential of the ground of the external generator does not match the ground of the „DSV“ - electronics. If the digital input is to be utilised like an analogue input against ground, the - (minus) connection of the differential input is to be connected to ground.

Cable rupture safety on the analogue input
The analogue input can be monitored for a cable break. If a cable break is detected, the solenoid output is disabled and the output „Error“ is activated. In order that the monitoring is effective, the following conditions have to be fulfilled:
- The levels have to be parameterised.
- The cable break monitoring has to be activated.

Note:
It takes approx. 100 ms for a cable break to be detected. During this time the axis can make unintended movements.

Command value
Predefined by Profibus

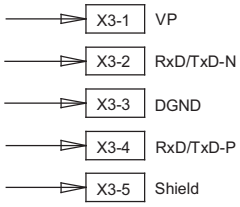
Feedback value (voltage or current)
Input voltage range 0…±10 V / 0...+10 V or 0…20 mA / 4…20 mA

Ramps
Per solenoid, two linear ramps can be separately set for up and down.

Error Detection
In case of an error, the solenoids are optionally blocked or supplied with a fixed current (providing the error leaves a current supply possible).

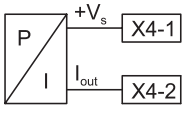
Example of connection (Profibus interface with controller)

Connection Profibus



Connection of the voltage - or current feedback value of a pressure sensor

2-conductor



3-conductor