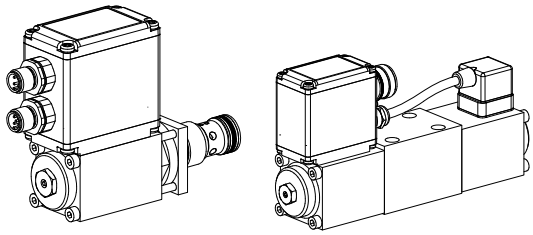
Integrated amplifier and controller electronics for proportional hydraulic valves

- **Interface: - analogue**
  - CANopen
  - Profibus DP
- **24 VDC or 12 VDC**
- **Electronic card setting via PC (RS 232)**
- **Optimisation of characteristic curve**



DESCRIPTION

Wandfluh has extended its range with a technology module and now offers proportional valves with integrated, intelligent electronics. Housing for electronics with protection class IP67 for harsh environment. Under the expression «**D**igital **S**mart **V**alve», in the smallest possible space a digital amplifier electronics system is concealed, which at the moment represents the most compact design available on the market. 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.

FUNCTION

The control connection is provided by an analogue interface or a feldbus interface (CANopen or Profibus DP). Parameter setting and diagnosis with the free-of-charge software «PASO» or via fieldbus interface. Data are stored in a non volatile memory. Even after an electric power failure settings can easily be reproduced and transmitted. These valves are available with an integrated controller as an option. As feedback signal source sensors with voltage or current output signal can be directly connected. The available controller structure has 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 a high valve-to-valve reproducibility. The hydraulic valves are implemented in systems calling for good valve-to-valve reproducibility, easy installation, comfortable operation and high precision. The integrated controller reliefs the machine control system and operates the axis (position, angle, pressure, etc.) in a closed control loop. The applications lay in the industrial- as well as in the mobile hydraulic field for the smooth control of actuators.

CONTENT

TYPE CODE

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

Type code according type liste,
(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 signal (0…+10 V factory set)	A1
With analog signal (-10…+10 V factory set))	A2
With CANopen acc. to DSP-408	C1
With Profibus	P1

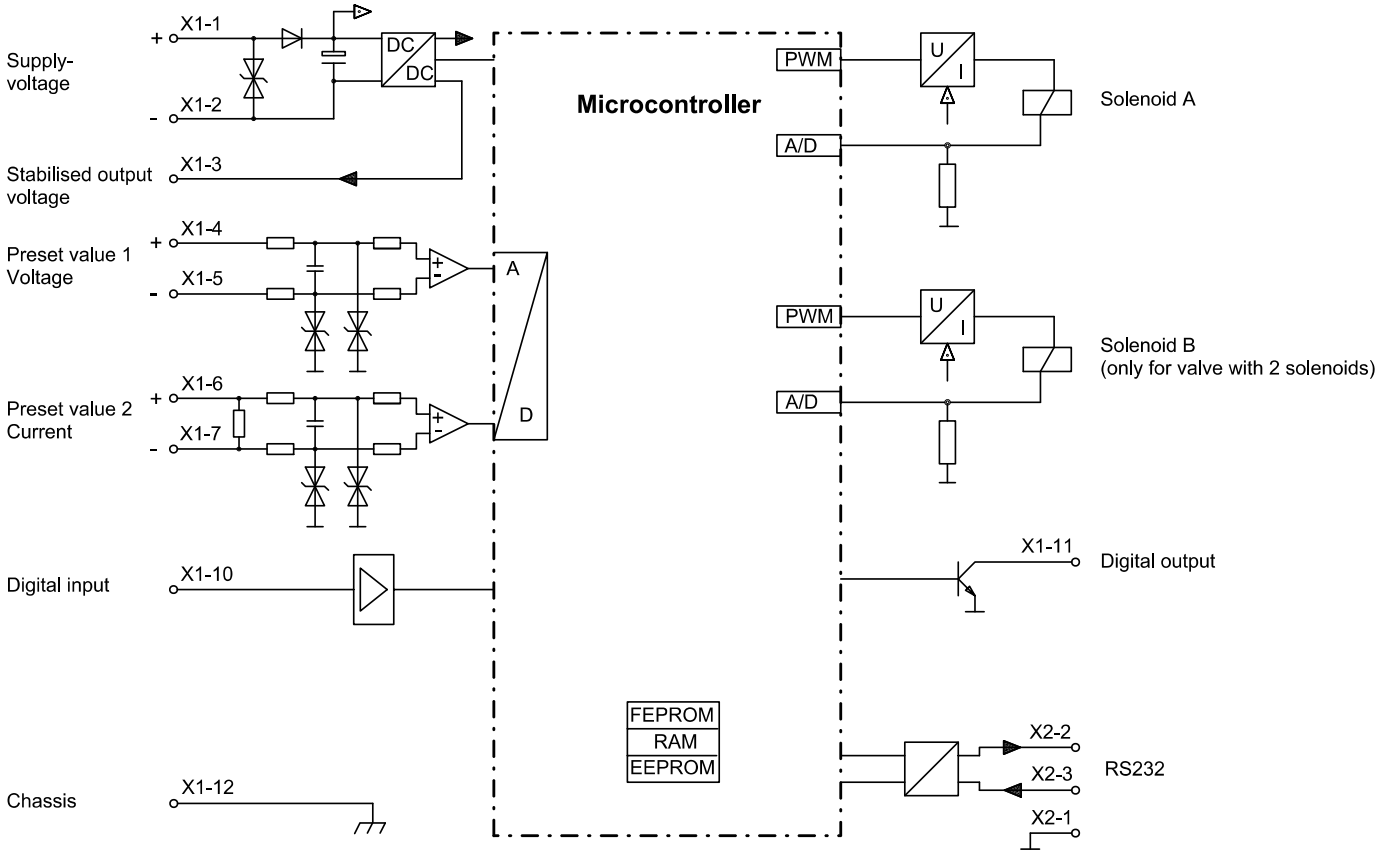
Functions:

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

Design-Index (Subject to change)

Control through analog interface with amplifier electronics

BLOCK DIAGRAM

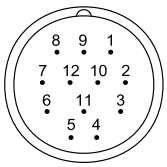


ELECTRICAL SPECIFICATIONS

Protection class	IP 67 acc. to EN 60 529 With suitable 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	ca. 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)
Preset value signal:	Selectable with software Diff. inputs not galvanically separated, for earth 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)
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 threshold high 6…30 VDC Switching threshold low 0…1 VDC
Digital output	Low-Side-Switch: U_{max} = 40 VDC I_{max} = -700 mA
Ramps adjustable	0…51 s
Temperature drift	<1 % at ΔT = 40 °C
Serial interface	RS 232 C (Receptacle RJ10) to set parameters with «PASO» under cover of electronic housing settings adjusted at factory
EMV	
Immunity	EN 61 000-6-2
Emission	EN 61 000-6-4

CONNECTOR WIRING DIAGRAM

Device receptacle (male) X1

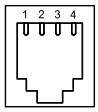


1 = Supply voltage +
2 = Supply voltage 0 VDC
3 = Stabilised output voltage
4 = Preset value voltage +
5 = Preset value voltage -
6 = Preset value current +
7 = Preset value current -
8 = Reserved for extensions
9 = Reserved for extensions
10 = Enable control (Digital input)
11 = Error signal (Digital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

Preset 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.

Serial interface RS 232 C X2 to adjust settings

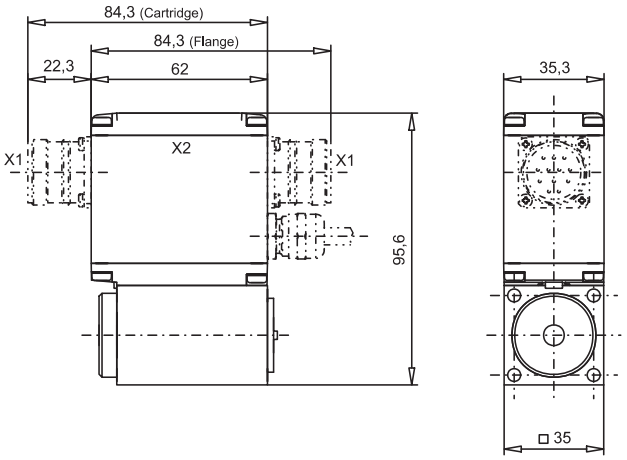


1 = GND
2 = TXD
3 = RXD
4 = not used

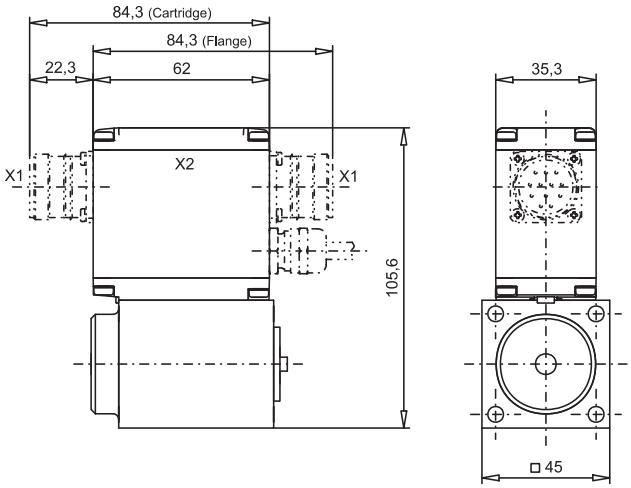
NOTE!
The cable to adjust the settings is not part of the delivery. To order the cable, look up the article no. in the chapter «Accessories» of the corresponding valve data sheet.

DIMENSIONS

Housing 35 mm square size with analog interface



Housing 45 mm square size with analog interface



DESCRIPTION OF «DSV» ELECTRONICS

General description

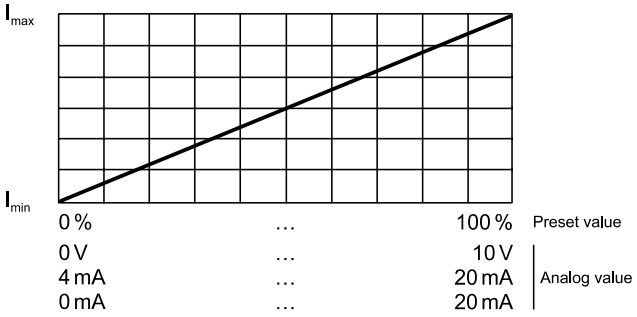
- The «**DSV**» electronics is an integral part of the valve.
- All inputs and outputs are to be contacted through the receptacle.
- Under the cover of the electronic housing a serial interface RS 232 C is located through which the adjustment of settings and diagnosis by means of the windows software «PASO-**DSV**» can be done.
- In the factory the «**DSV**» electronics will be tuned to the valve. Normally there is no need for the customer to do adjustment himself.
- **Note:**
  For adjusting the settings and for the diagnosis, a parametering cable is required (not part of the delivery). See also chapter «Accessories» of the corresponding valve data sheet.

Description of the function
Hardware configuration with analog signal

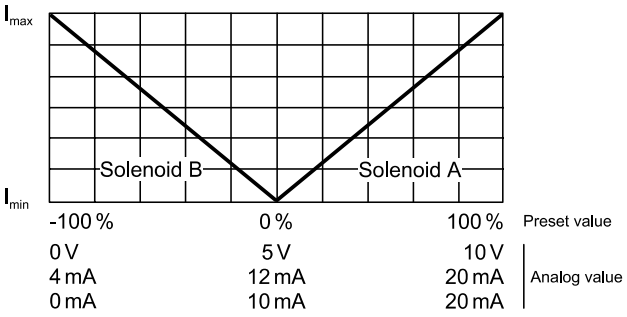
The «**DSV**» electronics serves to control the proportional valve. One (1-solenoid valve) or two (2-solenoid valve) **P**uls-**W**idth-**M**odulated current control outputs with superimposed dither signal are provided. Dither frequency and amplitude can be adjusted separately. For the 1-solenoid valve a preset value input signal 0...10 V (voltage input) or 0…20 mA respectively 4…20 mA (current input) may be applied. For the 2-solenoid valve a preset value input signal 0…10 V or 0…±10 V (voltage input) or 0…20 mA respectively 4…20 mA (current input) may be applied. In addition the «**DSV**» electronics has a digital input for the enable control and a digital output as error detection. Parameters are set by means of the set-up software «PASO-**DSV**». Altered parameters are stored in a non-volatile memory to have them available after the electronics has been switched on again.

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.

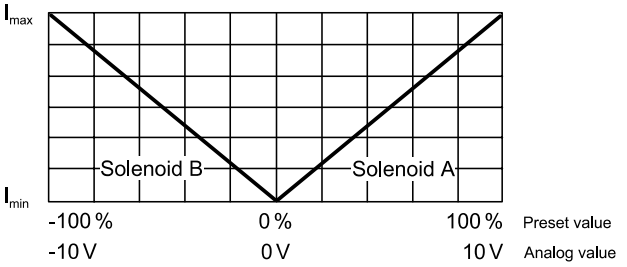
Operation mode: unipolar, 1-solenoid valve
This operation mode can only be selected for the 1-solenoid valves. The solenoid current is controlled by an unipolar (current or voltage) input signal (0...10 V, 0...20 mA and 4...20 mA correspond to 0...100 % preset value) / (0...100% preset value corresponds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



Operation mode: unipolar, 2-solenoid valve
This operation mode can only be selected for the 2-solenoid valves. With an unipolar analog input signal (voltage or current) solenoid A or B are selected depending on the size of the input signal.
The switching point from one solenoid to the other lays as a standard in the middle of the analog signal scale. (0...10 V, 0...20 mA and 4...20 mA correspond at a time to -100 %...+100 % preset value) / (-100...0 % preset value correspond to I_{max}…I_{min} solenoid B and 0...100 % preset value 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 the size of an analog input signal (voltage) solenoid A or B are selected. The switching point from one solenoid to the other is 0 V.
(-10...+10 V corrresponds to -100...+100 % preset value) / (-100...0 % preset value corresponds to I_{min}…I_{max} solenoid B and 0...100 % preset value corresponds to I_{min}…I_{max} solenoid A).



Preset value inputs
The applied analog signal is digitised by a 10-Bit A/D converter.
Note:
For the input range 4...20 mA the resolution is lower than 10-Bits. All preset value inputs are differential inputs. Differential inputs are used if the ground potential of the preset value generator does not match the ground potential of the «**DSV**» electronics.
If the differential input is used like an anlog input to ground, the minus side of the differential input must be wired to ground.

Cable break detection for the preset value input
Preset value input 2 can be monitored for cable break. If a cable break is present the solenoid current output is blocked and the output «Error» is activated. Cable break detection is effective under the following conditions:
- The input signal has to be a current signal 4…20 mA.
- The cable break detection has to be activated.

Note:
The detection of a cable break takes approx. 100 ms.
During this time the axis can make unintentional 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 settable per solenoid «Set-point value input - solenoid current output» makes an optimum (e.g. linearised) characteristic of the hydraulic system possible.

Preset value 1 (voltage signal)
Input voltage range 0…±10 V
If with the 12 VDC version the rod voltage (0…8 V) is utilised, the scaling [% / V] has to be correspondingly adapted in the «PASO-**DSV**».

Preset vale 2 (Current signal)
Input current 0..20 mA / 4...20 mA

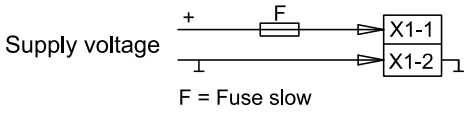
Digital input «Enable control»
Enables the «**DSV**» electronics to operate. Without the enable input there will be no solenoid current. The digital input is high active (see electrical specifications).

Digital output «Error»
This output gets active if an error is detected. The output stays active until the «**DSV**» electronics is switched off with the digital input «Enable control» and switched on again. This digital output is a «Low-side-switch» (see electric specifications).

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

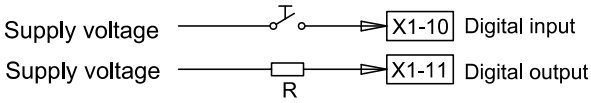
Example of connection (Analog interface with amplifier)

Connection of supply voltage



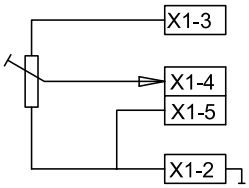
F = Fuse slow

Connection of digital inputs / outputs

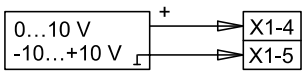


R = External load max. current 0,7 A

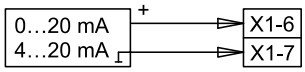
Connection of preset value from a potentiometer (not differential)



Connection with external preset value generator (differential voltage)

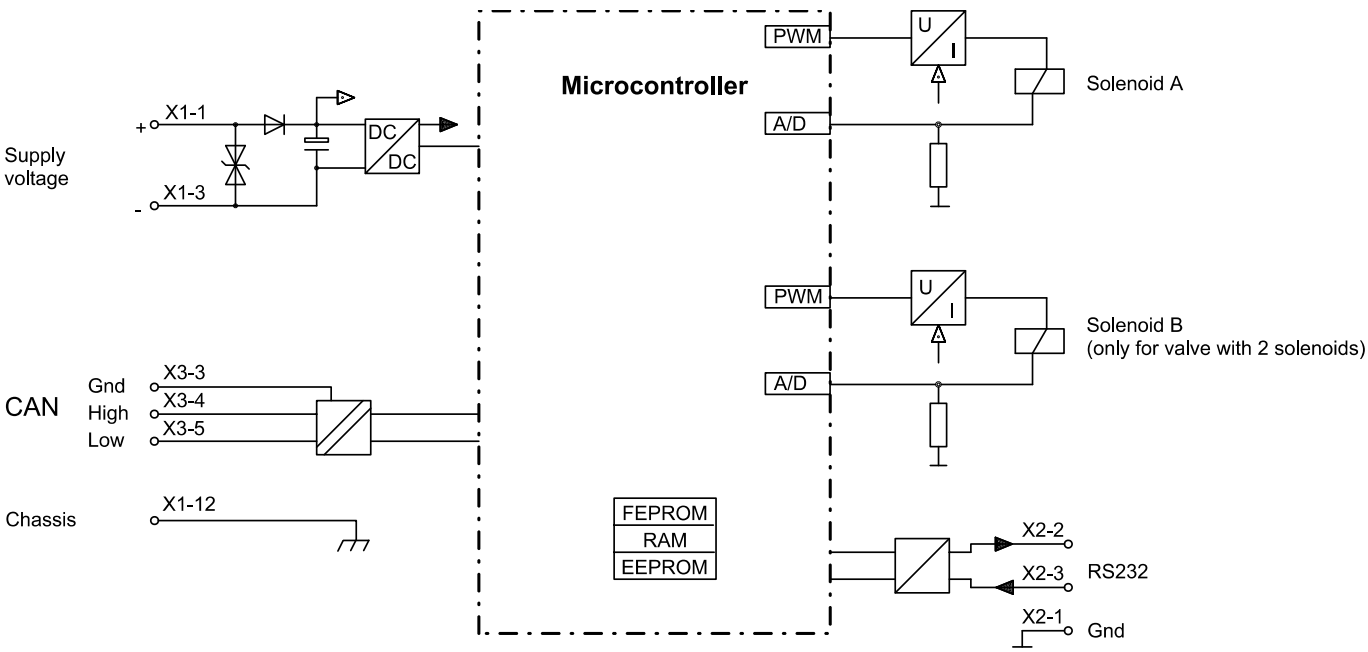


Connection with external preset value generator (differential current)



Control through CANopen interface with amplifier electronics

BLOCK DIAGRAM



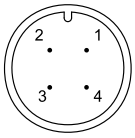
ELECTRICAL SPECIFICATIONS

Protection class	IP 67 acc. to 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)

Preset value signal	via CANopen
CANopen interface	Two wire lead acc. to ISO 11898 Differential signal transmission
Bus topology	Line
Separation of potential	CANopen to «DSV» electronics 500 VDC
Ramps adjustable	0…51 s
Temperature drift	<1 % at ΔT = 40 °C
Setting parameters	via CANopen or RS 232 C
Serial interface	RS 232 C (Receptacle RJ10) to set parameters with «PASO» under cover of electronic housing settings adjusted at factory
EMV	
Immunity	EN 61 000-6-2
Emission	EN 61 000-6-4

CONNECTOR WIRING DIAGRAM

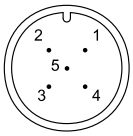
Device receptacle supply (male) X1



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

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

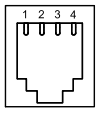
Device receptacle CANopen (male) X3



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

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

Serial interface RS 232 C X2 to adjust settings

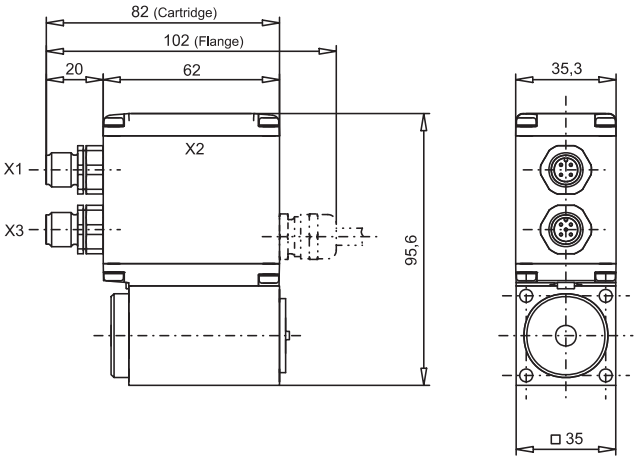


1 = GND
2 = TXD
3 = RXD
4 = not used

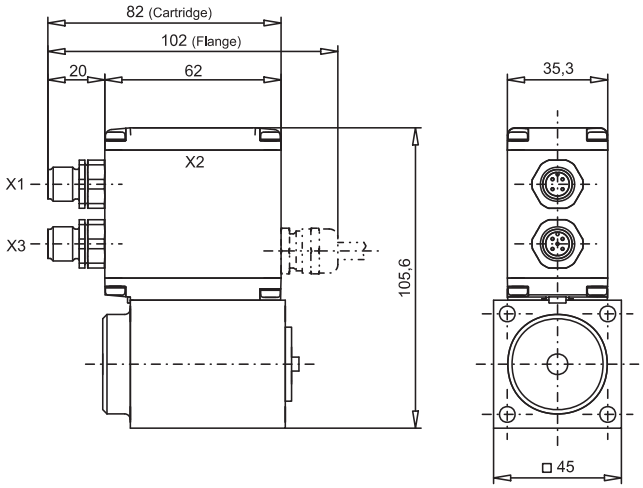
NOTE!
The cable to adjust the settings is not part of the delivery. To order the cable, look up the article no. in the chapter «Accessories» of the corresponding valve data sheet.

DIMENSIONS

Housing 35 mm square size with CANopen interface



Housing 45 mm square size with CANopen interface



DESCRIPTION OF «DSV» ELECTRONICS

General description

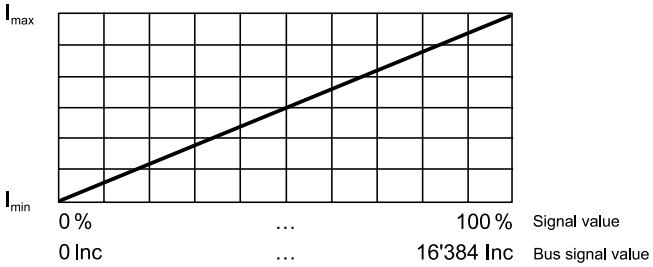
- The «**DSV**» electronics is an integral part of the valve.
- The CAN bus is to be contacted through the corresponding receptacle.
- CANopen is used as transmission protocol.
- The characteristics and functions of the «**DSV**» electronics are described through the device profile DSP-408 «Device Profile 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 cover of the electronic housing a serial interface RS 232 C is located through which the adjustment of settings and diagnosis by means of the windows software «PASO-**DSV**» can be done.
- In the factory the «**DSV**» electronics are tuned to the valve. Normally there is no need for the customer to do adjustment himself.
- **Note:**
  For adjusting the settings and diagnosis through the RS 232 C interface a parametering cable, which is not part of the delivery, is required. See also chapter «Accessories» of the corresponding valve data sheet.

Description of the function
Hardware Configuration with CANopen interface

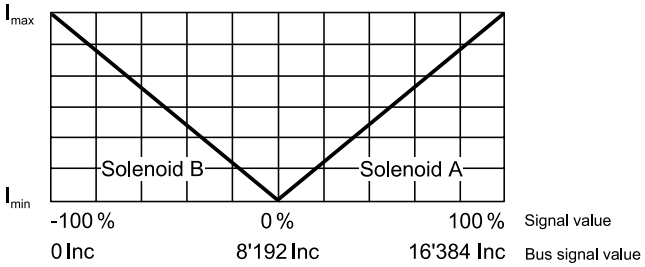
The «**DSV**» electronics serve for controlling the valve. The «**DSV**» electronics have one **P**ulse-**W**idth-**M**odulated current output with superimposed dither signal. Dither frequency and amplitude can be adjusted separately. The setting of preset values and the control of the «**DSV**» are executed through the CAN bus. In this version with a CAN interface, the «**DSV**» electronics do not have analog or digital inputs and outputs. Parameters are set by means of the set-up software «PASO-**DSV**» or by means of the CAN bus. Altered settings are stored in a non-volatile memory to have them available after the electronics has been switched on again. Operation and setting of parameters 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.

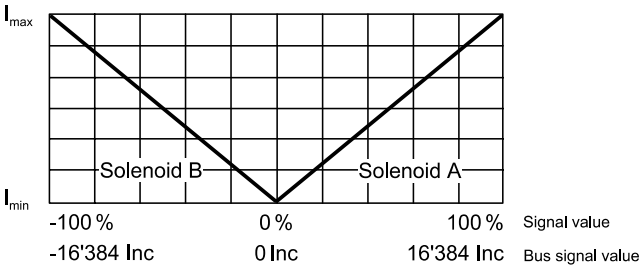
Operation mode: unipolar, 1-solenoid valve
This operation mode is selectable only for the 1-solenoid valves. Depending on an unipolar preset value from the CAN bus the solenoid will be controlled (0…+100 % CAN preset value corresponds to 0…+100 % internal preset value) (0…100 % preset value correspond 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 the size of an unipolar preset value from the CAN bus solenoid A or solenoid B will be controlled. As a standard the switching threshold between the two solenoids lays in the middle of the preset value range of the CAN preset value. (0…+100 % CAN preset value correspond to -100 %…+100 % internal preset value) (-100…0 % internal preset value correspond to I_{max}…I_{min} solenoid B and 0…100 % preset 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 the size of a bipolar preset value from the CAN bus solenoid A or solenoid B will be controlled. As a standard the switching threshold between the two solenoids lays at 0 % of the the CAN preset value. (-100 %…+100 % CAN preset value correspond to -100 %…+100 % internal preset value) (-100…0 % internal preset value correspond to I_{max}…I_{min} solenoid B and 0…100 % preset value correspond to I_{min}…I_{max} solenoid A).



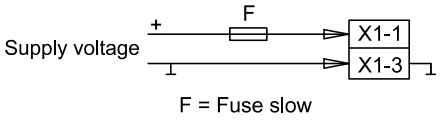
Ramps
Per solenoid two linear ramps for up and down are independently adjustable.

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).

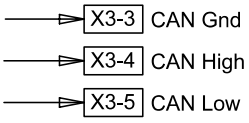
Optimisation of characteristic curve
A characteristic curve settable per solenoid «Set-point value input - solenoid current output» makes an optimum (e.g. linearised) characteristic of the hydraulic system possible.

Example of connection (CANopen interface with amplifier)

Connection of supply voltage

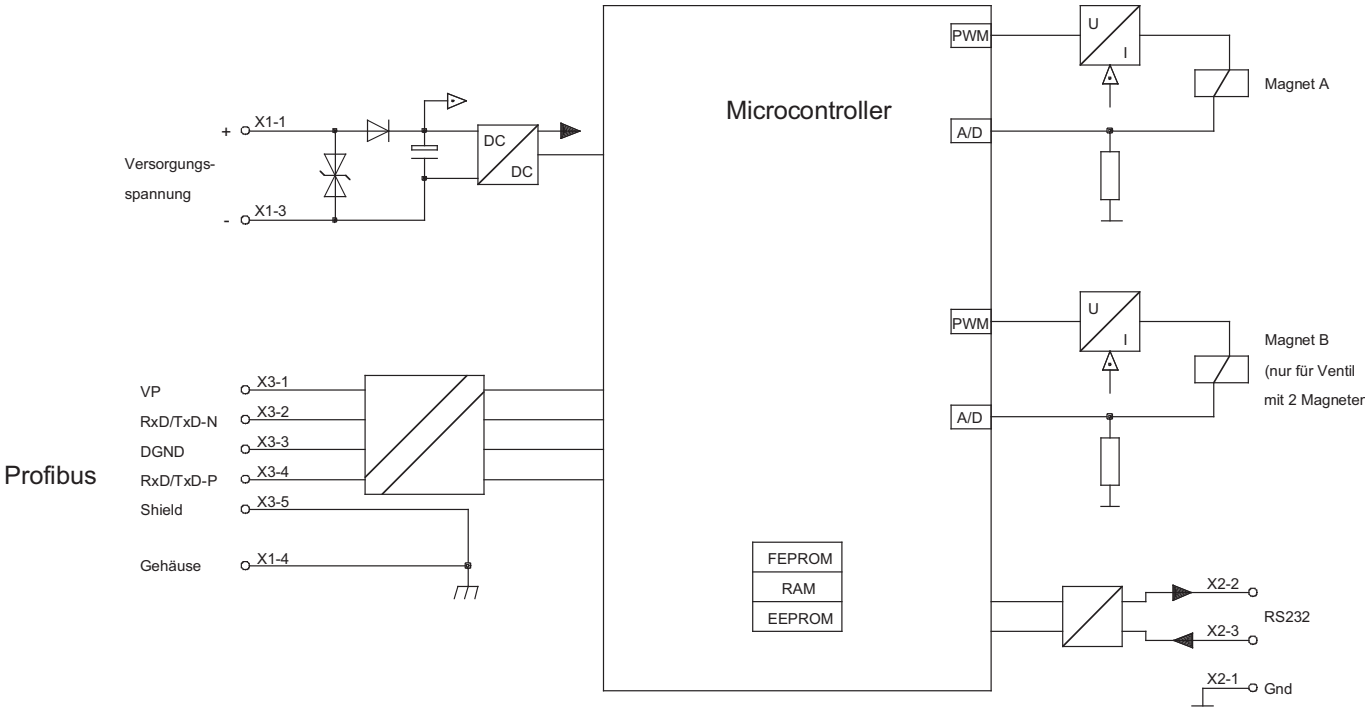


Connection CAN



Control through Profibus-interface with amplifier electronics

BLOCK DIAGRAM



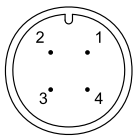
ELECTRICAL SPECIFICATIONS

Protection class	IP 67 acc. to EN 60 529 With suitable 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)

Preset value signal	via Profibus
Profibus-interface	Shielded, twisted wire Differential signal transmission
Bus topology	Line
Separation of potential	Profibus to «DSV» electronics 500 VDC
Ramps adjustable	0…51 s
Temperature drift	<1 % at $\Delta T = 40\,°C$
Setting parameters	via Profibus or RS 232 C
Serial interface	RS 232 C (Receptacle RJ10) to set parameters with «PASO» under cover of electronic housing settings adjusted at factory
EMV	
Immunity	EN 61 000-6-2
Emission	EN 61 000-6-4

CONNECTOR WIRING DIAGRAM

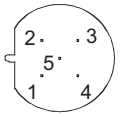
Device receptacle supply (male) X1



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.

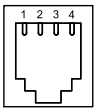
Device receptacle Profibus (female) X3



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.

Serial interface RS 232 C X2 to adjust settings

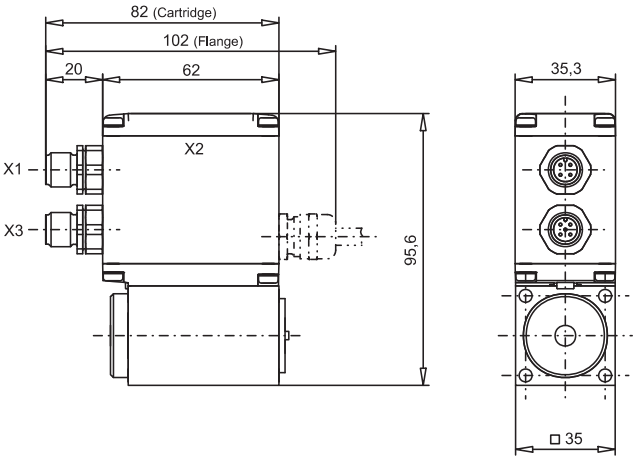


1 = GND
2 = TXD
3 = RXD
4 = not used

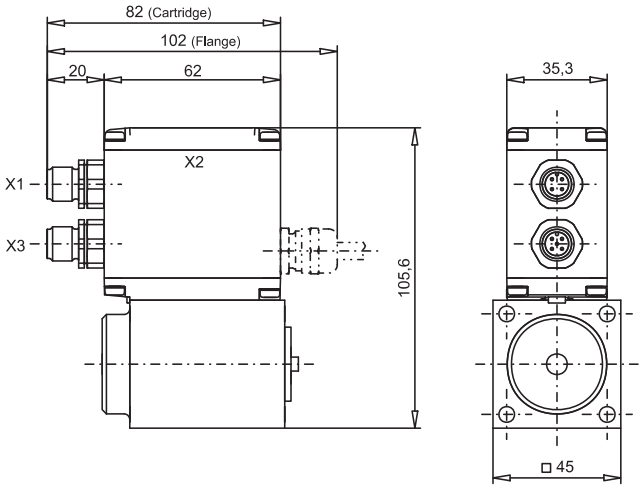
NOTE!
The cable to adjust the settings is not part of the delivery. To order the cable, look up the article no. in the chapter «Accessories» of the corresponding valve data sheet.

DIMENSIONS

Housing 35 mm square size with Profibus interface



Housing 45 mm square size with Profibus interface



DESCRIPTION OF «DSV» ELECTRONICS

General description

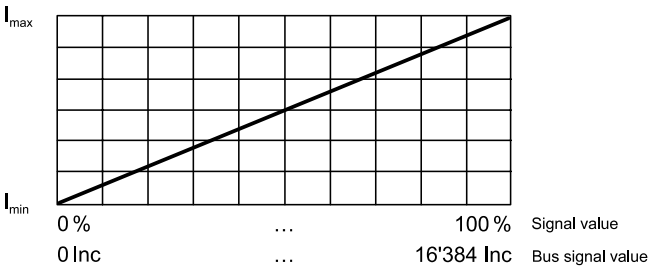
- The «**DSV**» electronics is an integral part of the valve.
- The Profibus is to be contacted through the corresponding receptacle.
- Profibus DP is used as transmission protocol.
- The characteristics and functions of the «**DSV**» electronics are described through the device profile DSP-408 «Device 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 cover of the electronic housing a serial interface RS 232 C is located through which the adjustment of settings and diagnosis by means of the windows software «PASO-**DSV**» can be done.
- In the factory the «**DSV**» electronics are tuned to the valve. Normally there is no need for the customer to do adjustment himself.
- **Note:**
  For adjusting the settings and diagnosis through the RS 232 C interface a parametering cable, which is not part of the delivery, is required. See also chapter «Accessories» of the corresponding valve data sheet.

Description of the function
Hardware Configuration with Profibus interface

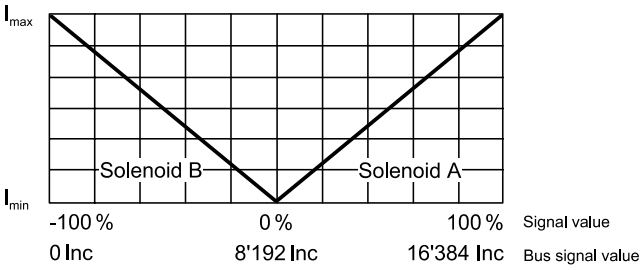
The «**DSV**» electronics serve for controlling the valve. The «**DSV**» electronics have one **P**ulse-**W**idth-**M**odulated current output with superimposed dither signal. Dither frequency and amplitude can be adjusted separately. The setting of preset values and the control of the «**DSV**» are executed through the Profibus. In this version with a Profibus interface, the «**DSV**» electronics do not have analog or digital inputs and outputs. Parameters are set by means of the set-up software «PASO-**DSV**» or by means of the Profibus. Altered settings are stored in a non-volatile memory to have them available after the electronics has been switched on again. Operation and setting of parameters 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.

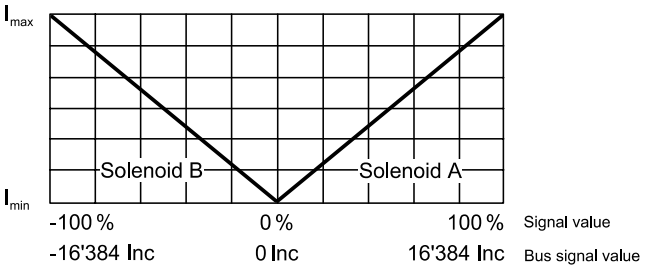
Operation mode: unipolar, 1-solenoid valve
This operation mode is selectable only for the 1-solenoid valves. Depending on an unipolar preset value from the Profibus the solenoid will be controlled (0…+100 % Profibus preset value corresponds to 0…+100 % internal preset value) (0…100 % preset value correspond 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 the size of an unipolar preset value from the Profibus solenoid A or solenoid B will be controlled. As a standard the switching threshold between the two solenoids lays in the middle of the preset value range of the Profibus preset value. (0…+100 % Profibus preset value correspond to -100 %…+100 % internal preset value) (-100…0 % internal preset value correspond to I_{max}…I_{min} solenoid B and 0…100 % preset 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 the size of a bipolar preset value from the Profibus preset value solenoid A or solenoid B will be controlled. As a standard the switching threshold between the two solenoids lays at 0 % of the the Profibus preset value preset value. (-100 %…+100 % CAN preset value correspond to -100 %…+100 % internal preset value) (-100…0 % internal preset value correspond to I_{max}…I_{min} solenoid B and 0…100 % preset value correspond to I_{min}…I_{max} solenoid A).



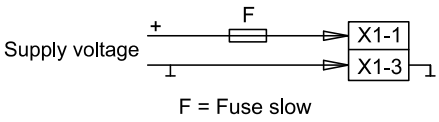
Ramps
Per solenoid two linear ramps for up and down are independently adjustable.

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).

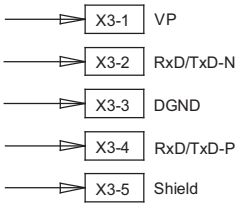
Optimisation of characteristic curve
A characteristic curve settable per solenoid «Set-point value input - solenoid current output» makes an optimum (e.g. linearised) characteristic of the hydraulic system possible.

Example of connection (Profibus preset value interface with amplifier)

Connection of supply voltage

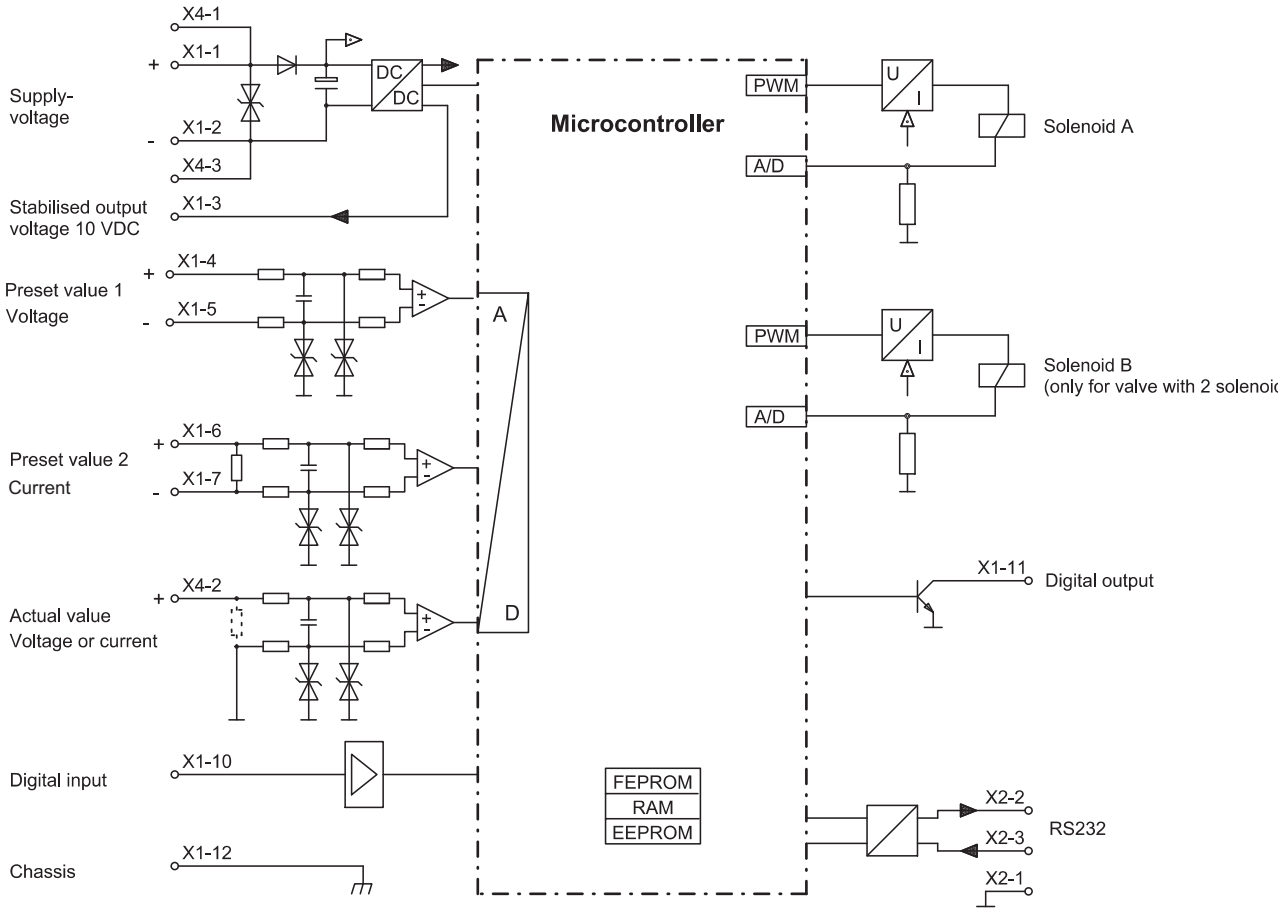


Connection Profibus



Control through analog interface with controller electronics

BLOCK DIAGRAM



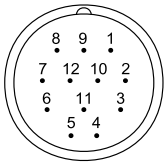
ELECTRICAL SPECIFICATIONS

Protection class	IP 67 acc. to EN 60 529 With suitable 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	ca. 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)
Preset value signal:	Selectable with software Diff. inputs not galvanically separated, for earth 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)

Actual 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
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 threshold high 6…30 VDC Switching threshold low 0…1 VDC
Digital output	Low-Side-Switch: U_{max} = 40 VDC I_{max} = -700 mA
Ramps adjustable	0…51 s
Temperature drift	<1 % at ΔT = 40 °C
Serial interface	RS 232 C (Receptacle RJ10) to set parameters with «PASO» under cover of electronic housing settings adjusted at factory
EMV	
Immunity	EN 61 000-6-2
Emission	EN 61 000-6-4

CONNECTOR WIRING DIAGRAM

Device receptacle (male) X1

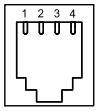


1 = Supply voltage +
2 = Supply voltage 0 VDC
3 = Stabilised output voltage
4 = Preset value voltage +
5 = Preset value voltage -
6 = Preset value current +
7 = Preset value current -
8 = Reserved for extensions
9 = Reserved for extensions
10 = Enable control (Digital input)
11 = Error signal (Digital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

Preset 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.

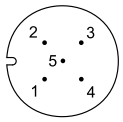
Serial interface RS 232 C X2 to adjust settings



1 = GND
2 = TXD
3 = RXD
4 = not used

Feedback signal interface

Device receptacle Sensor (female) X4



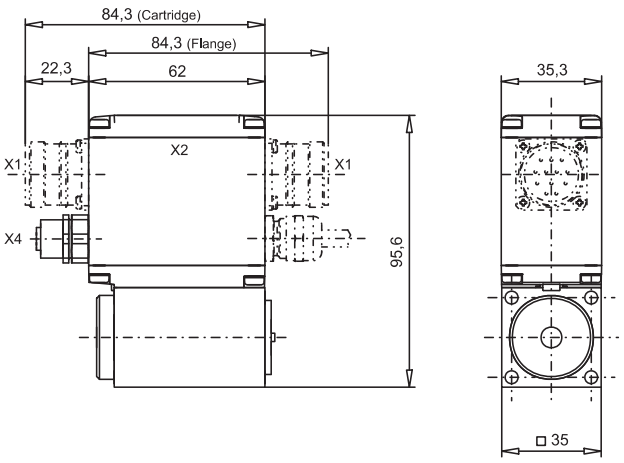
1 = Supply voltage (output) +
2 = Feedback signal +
3 = Supply voltage 0 VDC
4 = not connected
5 = not connected

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

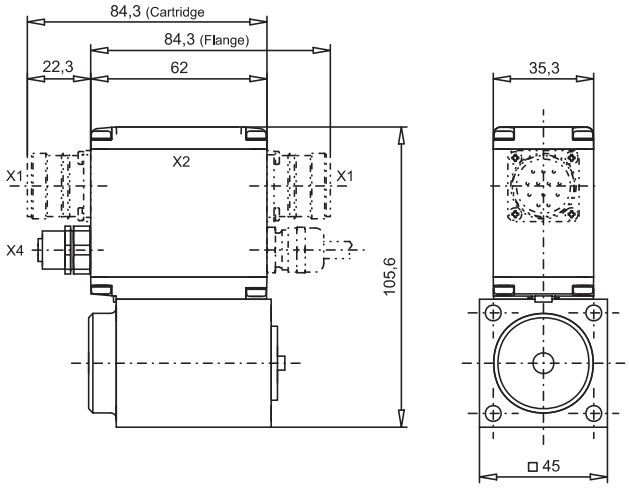
NOTE!
The cable to adjust the settings is not part of the delivery. To order the cable, look up the article no. in the chapter «Accessories» of the corresponding valve data sheet.

DIMENSIONS

Housing 35 mm square size with analog interface



Housing 45 mm square size with analog interface



DESCRIPTION OF «DSV» ELECTRONICS

General description

- The «**DSV**» electronics is an integral part of the valve.
- All inputs and outputs are to be contacted through the receptacle.
- Under the cover of the electronic housing a serial interface RS 232 C is located through which the adjustment of settings and diagnosis by means of the windows software «PASO-DSV» can be done.
- Ex works, the «**DSV**» - electronics are adjusted to the valve, so that the user only still has to carry out the corresponding controller adjustments.
- **Note:**
  For adjusting the settings and diagnosis through the RS 232 C interface a parametering cable, which is not part of the delivery, is required. See also chapter «Accessories» of the corresponding valve data sheet.

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 set-point value is brought to the controller as an electric signal; a sensor records the effective actual value, and this signal is also brought to the controller. In correspondence with the control difference (set-point value - actual value), a control signal (solenoid current) is output to the valve. By means of the scaling of set-point value and actual value, all further inputs can be made in the required, resp. selectable physical unit (e.g., bar or mm, etc.). Once the set-point 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 set-point 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 are equipped with 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.

Modified parameters can be saved in a non-volatile memory, so that they are available again following 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 set-point value, actual 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 10-bit A/D-converter.
Attention:
When selecting the range 4...20 mA, the resolution is <10-bit! All analogue inputs are executed as differential inputs. Differential inputs are utilised, when the potential of the mass of the external transmitters does not correspond to the mass from the **«DSV»**-electronics card. If the differential input is to be utilised like an analogue input to mass, then the - (minus) connection if the differential input has to be connected to mass.

Cable Break Monitoring at the Analogue Input
The analogue input 2 can be monitored for cable breaks. If a cable break is detected, the solenoid output is blocked and the output «Error» is activated. For the monitoring to be effective, the following conditions have to be fulfilled:
- The input signal has to be a current signal of 4...20.
- The cable break monitoring has to be activated.

Attention:
Up until the identification of a cable break approx. 100 ms elapse. During this time, the axis may carry out unintended movements!

Set Value 1 (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.

Set Value 2 (Current Signal)
Input current range 0...20 mA / 4...20 mA

Actual value (voltage or current)
Input range 0...+10V 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 characteristic electrical values).

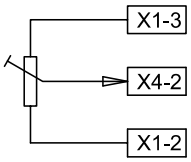
Digital Output «Error»
This output becomes active, when an error is detected. Once detected, an error is indicated until the **«DSV»**-electronics are blocked through the digital input «Enable control system » and then enabled once more. The digital output is a Lowside Switch (refer to characteristic electrical values).

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).

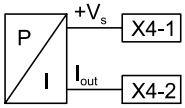
Example of connection (Analog interface with controller)

Connection of the voltage - or current actual value with potentiometer

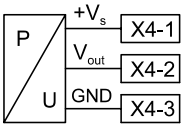


Connection of the voltage - or current actual value of a pressure sensor

2-conductor

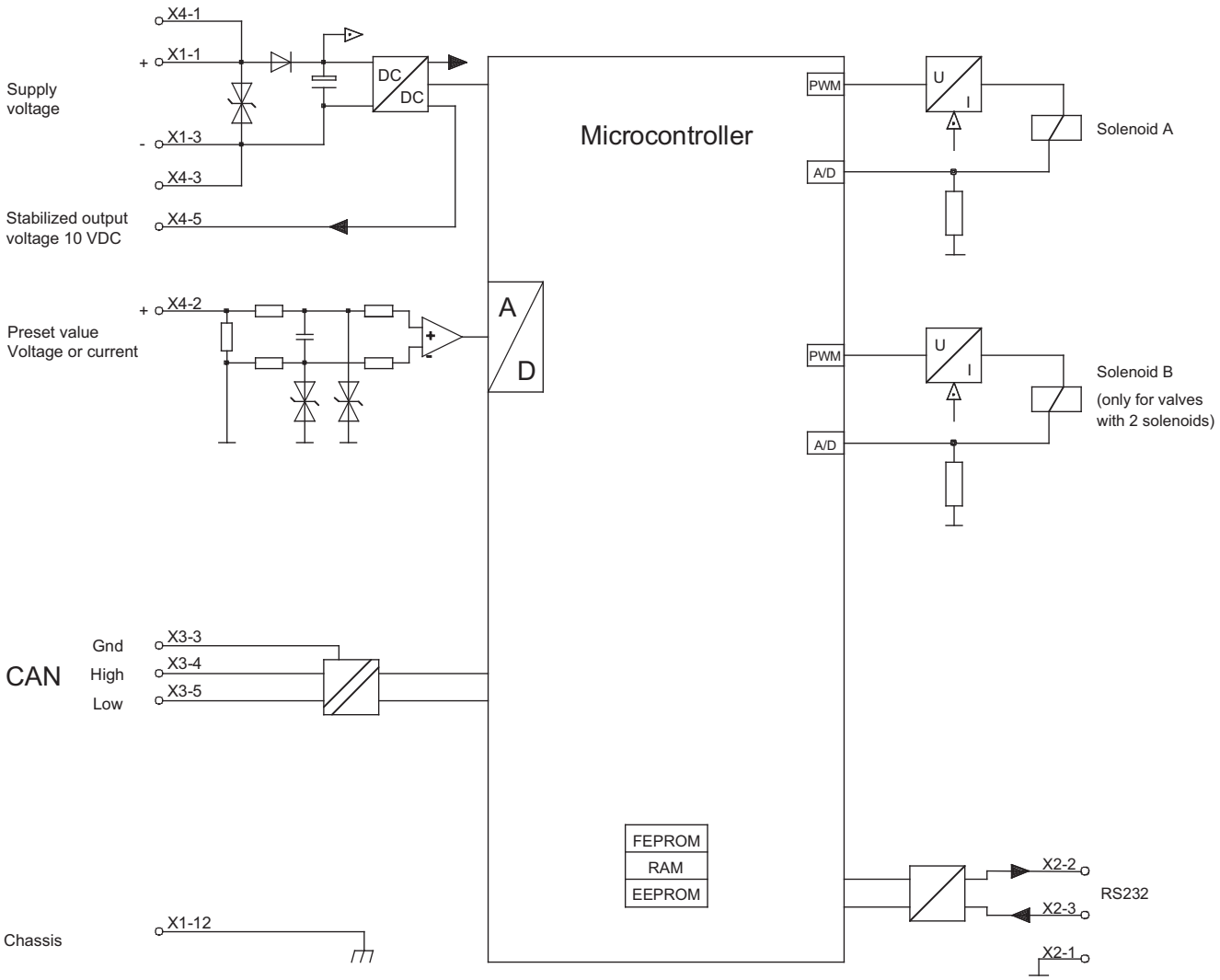


3-conductor



Control through CANopen interface with controller electronics

BLOCK DIAGRAM



ELECTRICAL SPECIFICATIONS

Protection class	IP 67 acc. to EN 60 529 With suitable 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	ca. 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)
Preset value signal:	via CANopen
CANopen interface	Two-wire circuit acc.to ISO 11898 Differential signal transmission
Bus topology	Line
Separation of potential	CANopen to «DSV» electronics 500 VDC
Actual 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
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…51 s
Temperature drift	<1 % at ΔT = 40 °C
Serial interface	RS 232 C (Receptacle RJ10) to set parameters with «PASO» under cover of electronic housing settings adjusted at factory
EMV	
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

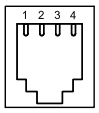
The mating connector (Plug female, M12, 4-poles) is not included in the delivery.

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.

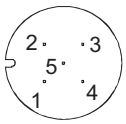
Serial interface RS 232 C X2 to adjust settings



1 = GND
2 = TXD
3 = RXD
4 = not used

Feedback signal interface

Device receptacle sensor (female) X4



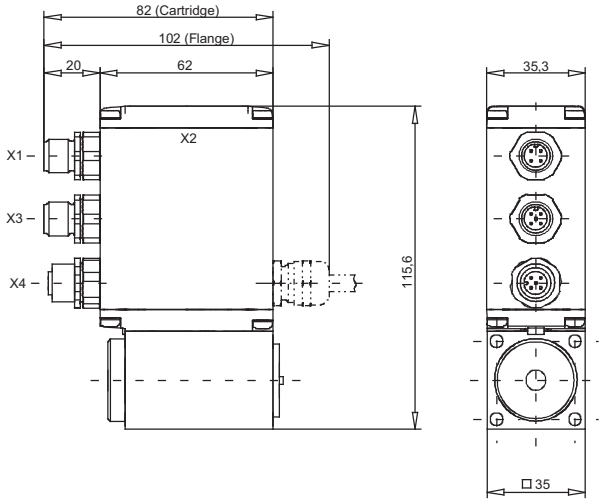
SENSOR
1 = Supply voltage (output) +
2 = Feedback signal +
3 = Supply voltage 0 VDC
4 = not connected
5 = stab. output voltage

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

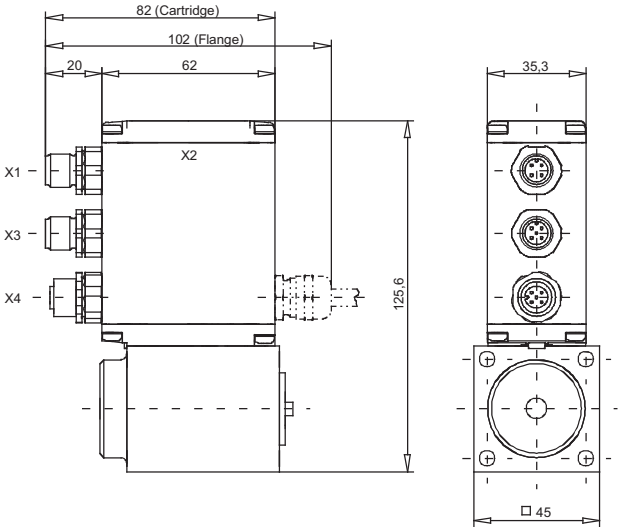
NOTE!
The cable to adjust the settings is not part of the delivery. To order the cable, look up the article no. in the chapter «Accessories» of the corresponding valve data sheet.

DIMENSIONS

Housing 35 mm square size with CANopen interface



Housing 45 mm square size with CANopen interface



DESCRIPTION OF «DSV» ELECTRONICS

General description

- The «**DSV**» electronics is an integral part of the valve.
- The CAN bus is to be contacted through the corresponding 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 cover of the electronic housing a serial interface RS 232 C is located through which the adjustment of settings and diagnosis by means of the windows software «PASO-DSV» can be done.
- Ex works, the «**DSV**» - electronics are adjusted to the valve, so that the user only still has to carry out the corresponding controller adjustments.
- **Note:**
  For adjusting the settings and diagnosis through the RS 232 C interface a parametering cable, which is not part of the delivery, is required. See also chapter «Accessories» of the corresponding valve data sheet.

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 set-point value is predefined and brought to the controller by CANopen; a sensor records the effective actual value, and this signal is also brought to the controller. In correspondence with the control difference (set-point value – actual value), a control signal (solenoid current) is output to the valve. By means of the scaling of set-point value and actual 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 set-point 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.

Modified parameters can be saved in a non-volatile memory, so that they are available again following 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 set-point value, actual 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 10-bit A/D-converter.
Attention:
When selecting the range 4...20 mA, the resolution is <10-bit! All analogue inputs are executed as differential inputs. Differential inputs are utilised, when the potential of the mass of the external transmitters does not correspond to the mass from the **«DSV»**-electronics card. If the differential input is to be utilised like an analogue input to mass, then the - (minus) connection if the differential input has to be connected to mass.

Cable Break Monitoring at the Analogue Input
The analogue input 2 can be monitored for cable breaks. If a cable break is detected, the solenoid output is blocked and the output «Error» is activated. For the monitoring to be effective, the following conditions have to be fulfilled:
- The input signal has to be a current signal of 4...20.
- The cable break monitoring has to be activated.

Attention:
Up until the identification of a cable break approx. 100 ms elapse. During this time, the axis may carry out unintended movements!

Preset value
Predefined by CANopen

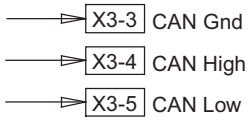
Set Value voltage or current
Input voltage range 0...±10 V or 0...20 mA/4...20mA

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).

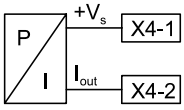
Example of connection (CANopen interface with controller)

Connection CANopen

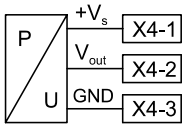


Connection of the voltage - or current actual value of a pressure sensor

2-conductor

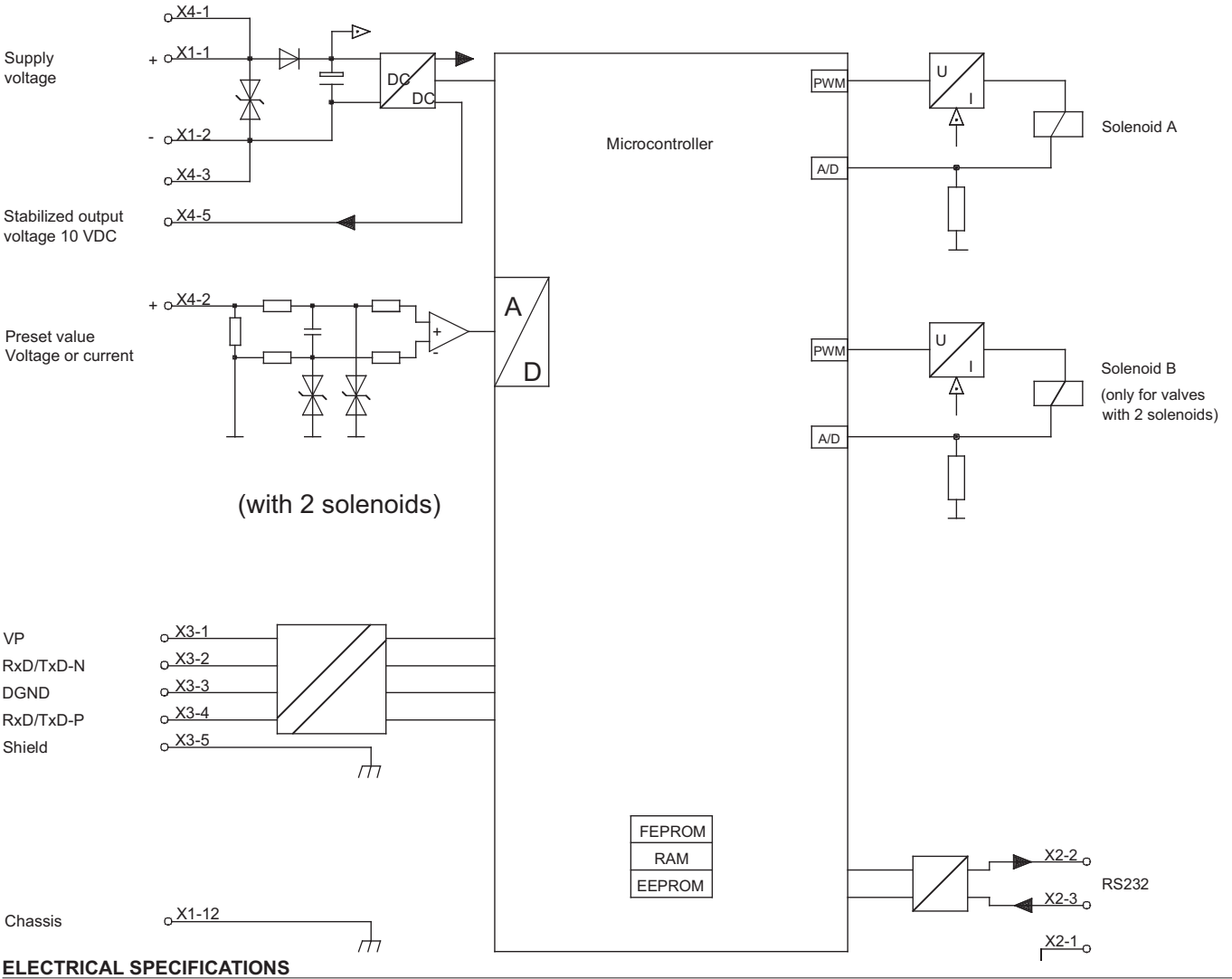


3-conductor



Control through Profibus interface with controller electronics

BLOCK DIAGRAM

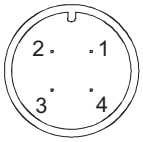


ELECTRICAL SPECIFICATIONS

Protection class	IP 67 acc. to EN 60 529 With suitable 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	ca. 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)
Preset value signal:	via Profibus
Profibus interface	Shielded, twisted wire Differential signal transmission
Bus topology	Line
Separation of potential	Profibus to «DSV» electronics 500 VDC
Actual 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
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…51 s
Temperature drift	<1 % at ΔT = 40 °C
Serial interface	RS 232 C (Receptacle RJ10) to set parameters with «PASO» under cover of electronic housing settings adjusted at factory
EMV	
Immunity	EN 61 000-6-2
Emission	EN 61 000-6-4

CONNECTOR WIRING DIAGRAM

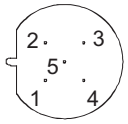
Device receptacle supply (male) X1



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.

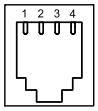
Device receptacle Profibus (female) X3



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.

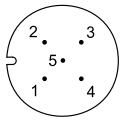
Serial interface RS 232 C X2 to adjust settings



1 = GND
2 = TXD
3 = RXD
4 = not used

Feedback signal interface

Device receptacle sensor (female) X4



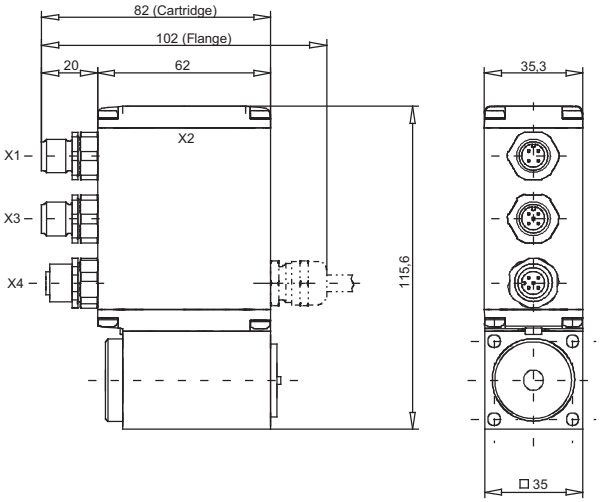
SENSOR
1 = Supply voltage (output) +
2 = Feedback signal +
3 = Supply voltage 0 VDC
4 = not connected
5 = stab. output voltage

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

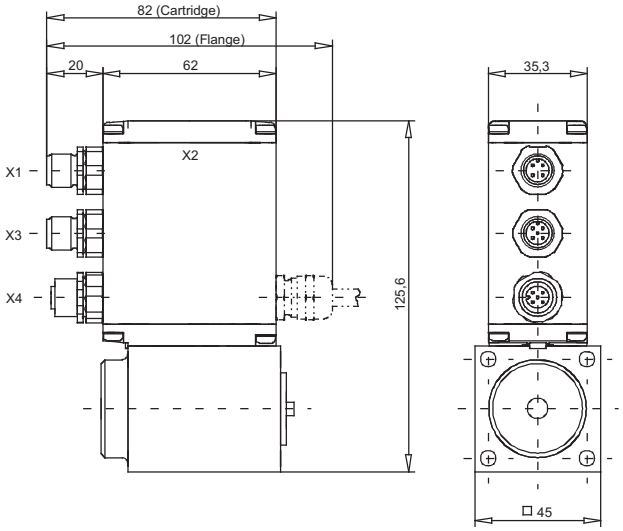
NOTE!
The cable to adjust the settings is not part of the delivery. To order the cable, look up the article no. in the chapter «Accessories» of the corresponding valve data sheet.

DIMENSIONS

Housing 35 mm square size with Profibus DP interface



Housing 45 mm square size with Profibus DP interface



DESCRIPTION OF «DSV» ELECTRONICS

General description

- The «**DSV**» electronics is an integral part of the valve.
- The Profibus is to be contacted through the corresponding receptacle.
- Profibus 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 the «**DSV**» electronics is controlled and parameters are set.
- Under the cover of the electronic housing a serial interface RS 232 C is located through which the adjustment of settings and diagnosis by means of the windows software «PASO-DSV» can be done.
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Functional characteristics
Hardware configuration with Profibus DP interface

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Predefined by Profibus

Set Value voltage or current
Input voltage range 0...±10 V or 0...20 mA/4...20mA

Ramps
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Error Detection
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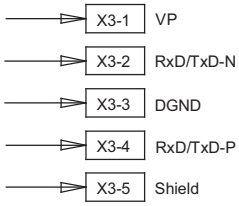
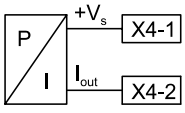
Example of connection (Profibus interface with controller)

Connection Profibus



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

2-conductor



3-conductor