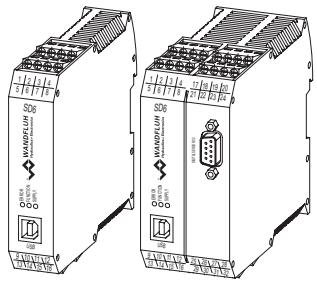
Digital Controller Module SD6

- **For position-, pressure-, pQ- and alternating control**
- **Interface: - analogue**
  - programmable
  - Profibus DP
- **Analogue or SSI sensors for the feedback value**
- **Integrated final power stage**
- **Adjustment and diagnostics via PC**
- **Signal recording**



DESCRIPTION

Digital controller module for top-hat rail installation for driving proportional valves with two solenoids. Apart from controls for pressure, volume flow or position, also pQ- and alternating controls can be implemented. The parameterisation takes place by means of the menu-controlled parameterisation and diagnostics software «PASO» of Wandfluh (USB-interface). The module is available as a basic controller and as an enhanced controller.

FUNCTION

The driving takes place through an analogue or a fieldbus interface (Profibus DP). In case of the Enhanced controller, in addition the command value (position, pressure, force, etc.) can be predefined by means of the adjustable travel profiles. As feedback value generators, it is possible to connect analogue measuring systems (in case of the Enhanced controller also digital measuring systems) directly to the controller module. The Basic controller has two analogue inputs with 10-bit resolution. The Enhanced controller in addition has two analogue inputs with 16-bit resolution.

APPLICATION

As a snap-on module, the electronics card is mainly used in the industrial field. The module can be installed on top-hat rails. Thanks to several digital inputs and outputs, it is possible to connect the controller module to a superordinate machine control system. With the Enhanced controller, solenoids can be directly driven, or also valves with integrated amplifier (e.g., DSV, servo-valves, etc.).

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CONTROLLER MODULE ENHANCED
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CONTROLLER MODULE ENHANCED
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TYPE CODE

S D6 3 ☐ 2 ☐☐ ☐ - ☐☐# ☐

Module for electrical control cubicle

Digital

Parameters to be set with PASO

Software configuration (function of card):
- Basic controller 3
- Enhanced controller 6

2-solenoid version

Supply voltage:
- 24 VDC D2
- 12 VDC D3

Digital controller module Basic:
- Analogue input 1: voltage; Analogue input 2: current 0
- Analogue input 1 and 2: both voltage 1
- Analogue input 1 and 2: both current 2

Digital controller module Enhanced:
- Analogue input 1 and 3: both voltage 4
- Analogue input 2 and 4: both current
- Analogue input 1 to 4: all voltage 5
- Analogue input 1 to 4: all current 6
- Analogue input 1 and 2: both voltage 7
  Analogue input 3 and 4: both current
- Analogue input 1 and 2: both voltage 8
  Analogue input 3 and 4: both current

Digital controller module Basic:
- Analogue input 1 und 2: 10-Bit resolution A

Digital controller module Enhanced:
- Analogue input 1 and 2: 10-Bit resolution B
  Analogue input 3 and 4: 16-Bit resolution

Option field bus:
- without field bus (with analogue input signal) A
- with Profibus DP B

Design-Index (Subject to change)

GENERAL SPECIFICATIONS

Execution	Module for electrical control cubicle, housing made of plastic
Dimensions:	
• Digital controller module Basic:	105 x 114 x 22,5 mm (see dimensions)
• Digital controller module Basic with Profibus DP:	105 x 114 x 45 mm (see dimensions)
• Digital controller module Enhanced:	105 x 114 x 45 mm (see dimensions)
Installation	for 35 mm dome rail acc. to EN 60715
Weight:	
• Digital controller module Basic / with Profibus:	130 g / 220 g
• Digital controller module Enhanced / with Profibus:	220 g / 240 g
Connections	Screw terminals, max. cable cross-section 2,5 mm^2

Working temperature: -20…+70 °C

The total current of the simultaneously driven solenoids is dependent on the ambient temperature.

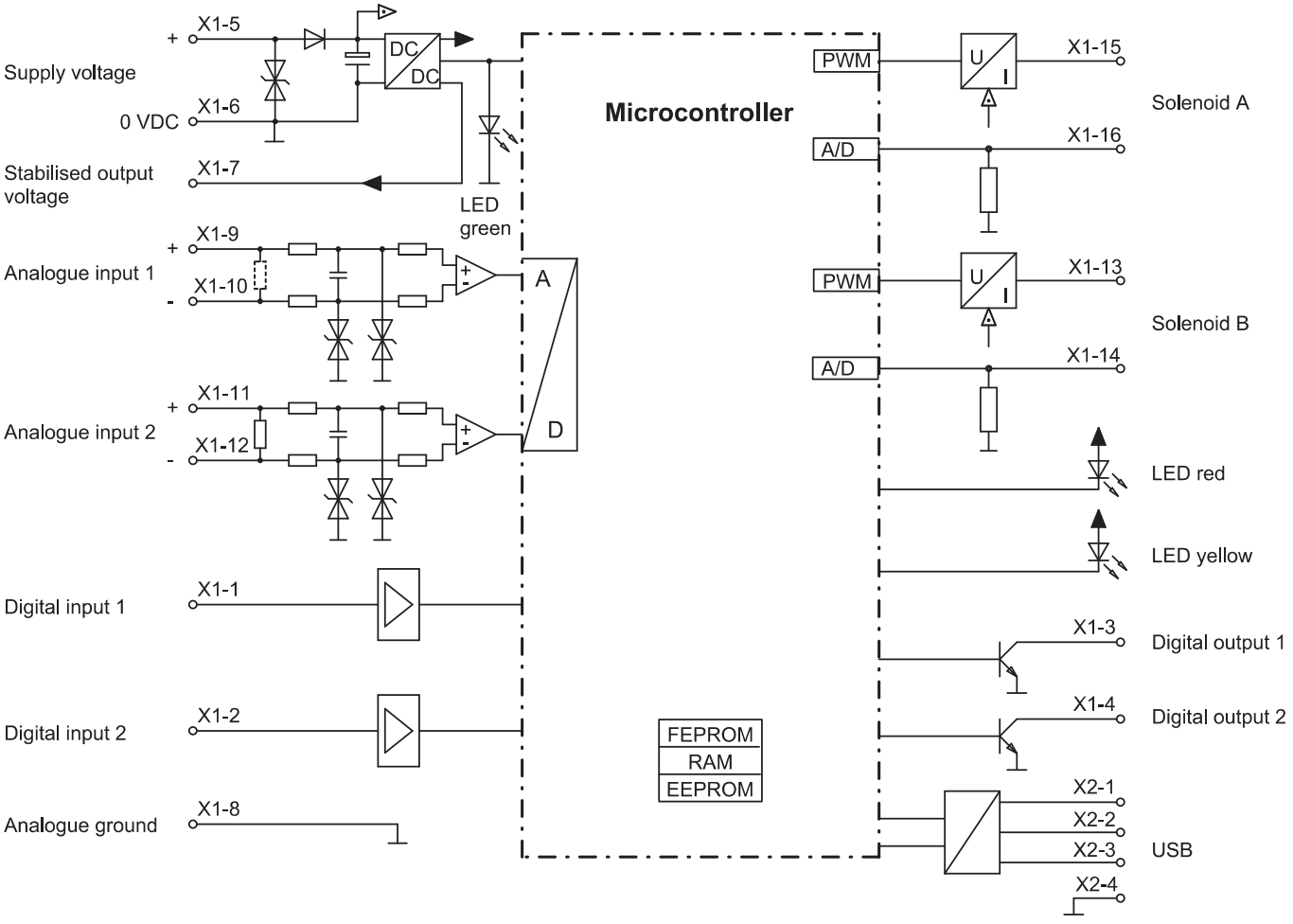
Further information can be found in the operating instructions.

Controller Module Basic with analogue interface

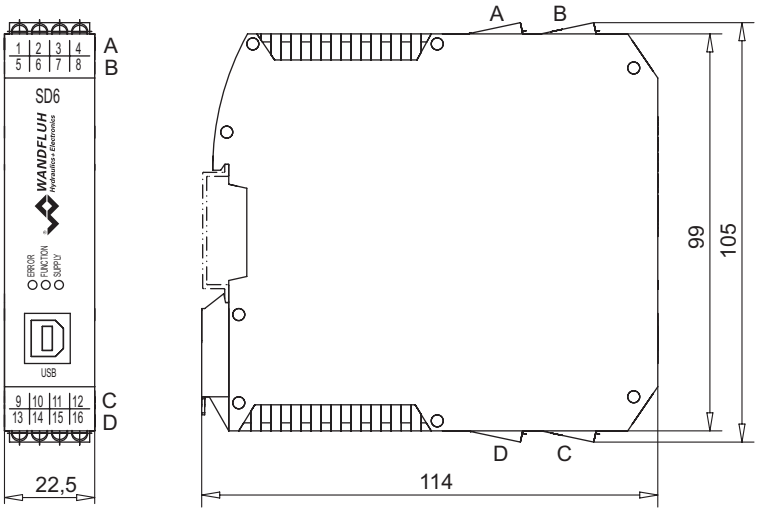
ELECTRICAL SPECIFICATIONS

Protection class	IP30 acc. to EN 60 529
Supply voltage	24 VDC or 12 VDC
Voltage range:	
• 24 VDC	21…30 V
• 12 VDC	10,5…15 V
Ripple on supply vol.	<10 %
Fuse	slow
Current consumption:	
• No-load current	approx. 40 mA
• Maximum current consumption	no-load current + 1,8 A per solenoid (with 24 VDC) no-load current + 2,3 A per solenoid (with 12 VDC)
Command and feedback 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 -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 30 mA
Solenoid current:	
• Minimum current I_{min}	Adjustable 0…950 mA Factory-preset 150 mA
• Maximum current I_{max}	Adjustable I_{min}…1,8 A (with 24 VDC) I_{min}…2,3 A (with 12 VDC) Factory-preset 700 mA
Dither	Frequency adjustable 20…500 Hz Factory-preset 100 Hz Amplitude adjustable 0…400 mA Factory-preset 100 mA
Temperature drift	<1 % at ΔT = 40 °C
Digital inputs	Switching threshold high 6…30 VDC Switching threshold low 0…1 VDC Signal active at 6…30 VDC (active high)
Digital outputs	Low-Side-Switch: U_{max} = 40 VDC I_{max} = -700 mA
Serial interface	USB (receptacle type B) for parameterisation «PASO»
EMV	
Immunity	EN 61 000-6-2
Emission	EN 61 000-6-4

BLOCK DIAGRAM

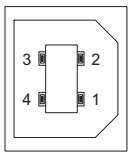


DIMENSIONS



CONNECTOR WIRING DIAGRAM / PIN ASSIGNMENT

USB interface, USB Type B X2



1 = VBUS
2 = D -
3 = D +
4 = GND

Socket USB type B

REMARK!
The parameterisation cable is not part of the scope of supply (commercially available USB-cable, plug type A to plug type B)

PIN-assignment X1

1 = Digital input 1
2 = Digital input 2
3 = Digital output 1
4 = Digital output 2
5 = Supply voltage +
6 = Supply voltage 0 VDC
7 = Stabilised output voltage
8 = Analogue ground
9 = Analogue input 1 +
10 = Analogue input 1 -
11 = Analogue input 2 +
12 = Analogue input 2 -
13 = Output solenoid B +
14 = Output solenoid B -
15 = Output solenoid A +
16 = Output solenoid A -

Configuration analogue inputs

Type description	Analogue input 1	Analogue input 2
SD6332D. **0**-AA	Voltage	Current
SD6332D. **1**-AA	Voltage	Voltage
SD6332D. **2**-AA	Current	Current

START-UP

Information regarding installation and commissioning are contained in the information leaflet supplied with the amplifier module and in the operating instructions.

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

Free-of-charge download:
• «PASO-DSV / SD6» Parameterisation software
• Operating instructions (*.pdf)

ADDITIONAL INFORMATION

	Wandfluh documentation	
Wandfluh electronics general	register	1.13
Proportional directional valves	register	1.10
Proportional pressure valves	register	2.3
Proportional flow control valves	register	2.6

DESCRIPTION of Controller module basic «SD6» with analogue interface

Design

The controller module can be parameterised by means of the parameterisation software «PASO-DSV/SD6» through the USB-interface. In addition, the parameterisation software makes a data analysis possible. The software «PASO-DSV/SD6» is supported by Windows 2000 and Windows XP.

Description of function
Hardware configuration with analogue signal

With the controller module «SD6» different control circuits can be built-up: position -, 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 valve, resp. its solenoids are directly driven. 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 controller module «SD6» can output a digital signal.

The controller module «SD6» 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 controller module «SD6» then function corresponding to normal amplifier electronics.

In addition the controller module «SD6» is equipped with two digital inputs for the enabling, and for changing over to solenoid B (only in operating mode 5) as well as with two digital outputs, which output the conditions «Error» or «Target window reached».

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.

Signal recording
The controller module «SD6» furthermore has 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.

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.

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 ground of the external generator does not correspond to the ground from the controller module «SD6». If the differential input is to be utilised like an analogue input to ground, then the - (minus) connection of the differential input has to be connected to ground.

Cable break monitoring at the analogue inputs
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:
Until the identification of a cable break, approx. 100 ms elapse. During this time, the axis may carry out unintended movements or unintendedly modified forces!

Analogue input voltage
Input voltage range 0…±10 V
If with the version 12 VDC, the stabilised voltage (0…8 V) is utilised, then in the PASO the scaling [%/V] has to be correspondingly adapted.

Analogue input current
Input current range 0…20 mA/4…20 mA

Digital input 1 «Enable control»
Enables the controller module «SD6» in general. Without this enabling, no solenoid current is output. The digital input 1 as standard setting is high-active (refer to electrical specifications).

Digital input 2 «Solenoid B»
In the operating mode 5 «Command value unipolar (2-sol. with DigInp2)» (refer to data sheet 1.11-100, page 5), the solenoid B is active, when the digital input 2 is «active». When the digital input 2 is «inactive», then solenoid A is active.

All digital inputs are low-side switches (refer to electrical specifications).

Digital output 1 «Error»
This output becomes active, when an error is detected. An error once detected is indicated until the «SD6»-controller module is disabled through the digital input «Enable control» and enabled once again. Die Inverting the output is possible.

Digital output 2 «Target window reached»
This output becomes active, when the control difference is within the target window. Inverting the output is possible.

Ramps
Per solenoid, two linear ramps for Up and Down can be adjusted separately. The ramps are only available in the amplifier mode.

Controller modes
The following controller modes can be set:

Controller mode 3 «Pressure / flow valve open loop»
Driving of a pressure relief-, pressure control-, throttle- or volume flow control valve in open loop control circuit (without feedback value return).

Controller mode 4 «Pressure / flow valve closed loop (1-sol)»
Driving of a 1-solenoid-, pressure relief-, pressure reducing-, throttle- or volume flow control valve in closed loop control circuit (with feedback value return).

Controller mode 6 «Position open loop»
Driving of a direction control valve in open control loop circuit (without feedback value return).

Controller mode 7 «Speed control closed loop (2-sol)»
Driving of a 2-solenoid direction-, throttle- or volume flow control valve in closed loop control circuit (with feedback value return).

Controller mode 9 «Position closed loop (2-sol)»
Driving of a 2-solenoid direction control valve in closed loop control circuit (with feedback value return).

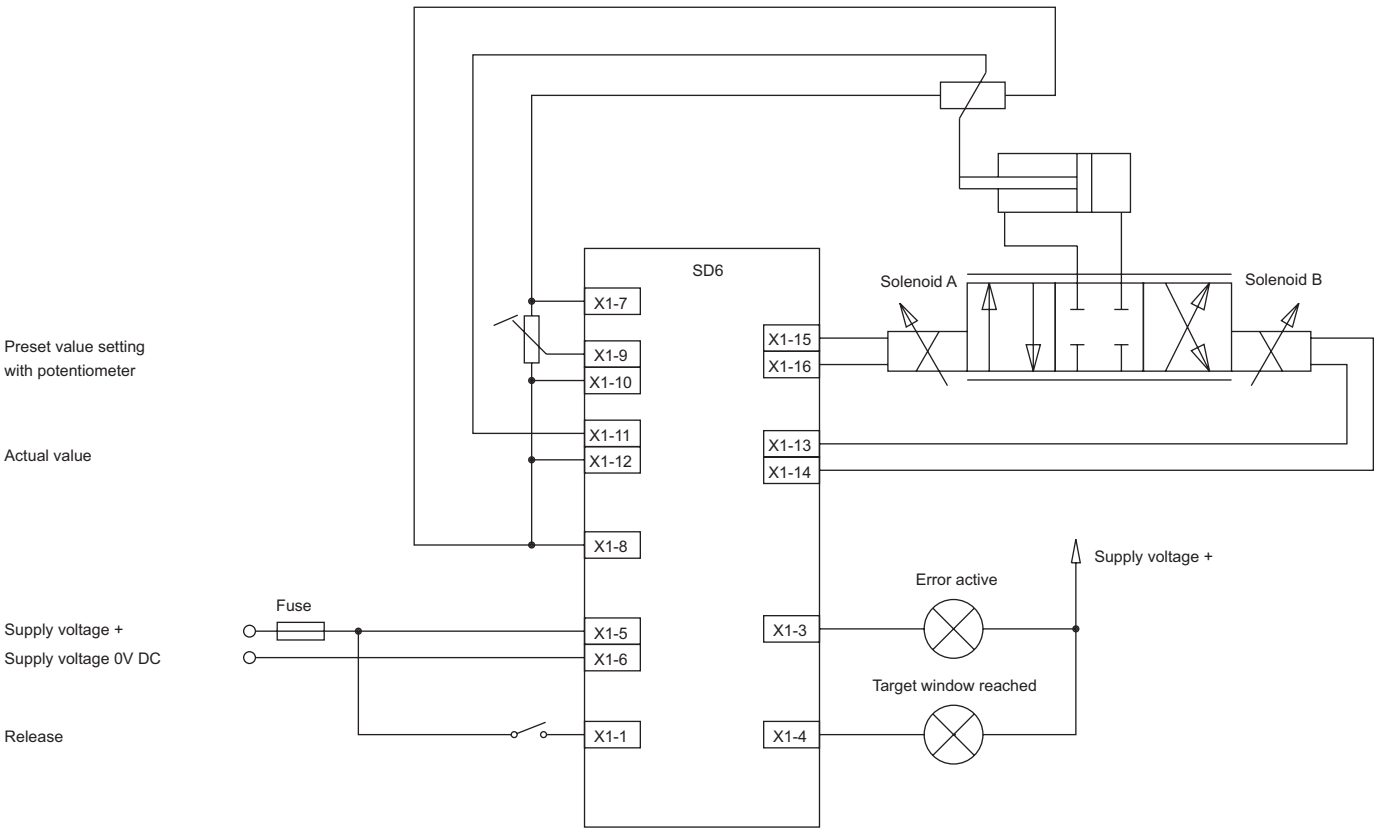
Controller mode -5 «Position closed loop (2-sol)»
Driving of two 1-solenoid throttle valves in closed loop control circuit (with feedback value return) as pressure reduction.

Controller mode -9 «pQ control (2-sol)»
Driving of a direction control valve in open loop control circuit (without feedback value return) with monitoring of a predefined pressure (with feedback value return).

Controller mode -10 «Alternating control (2-sol)»
Driving of a direction control valve in closed loop control circuit (with feedback value return) with monitoring of a predefined pressure (with feedback value return).

CONNECTION EXAMPLE «SD6»-Controller module with analogue interface

Position control (Command value and feedback value 10-bit, 16-bit not possible in case of «SD6»-Controller module Basic)

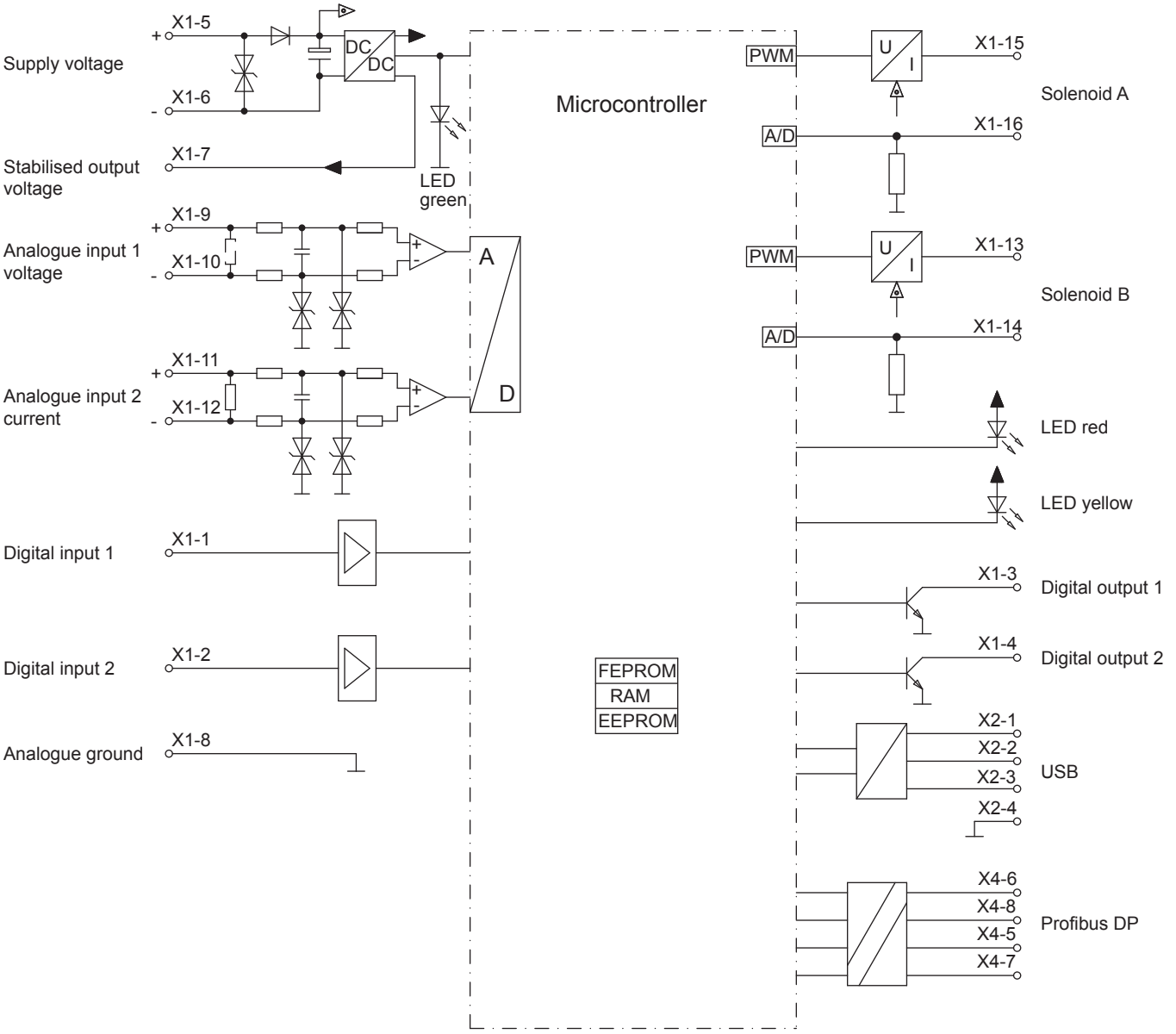


Controller module Basic with Profibus interface

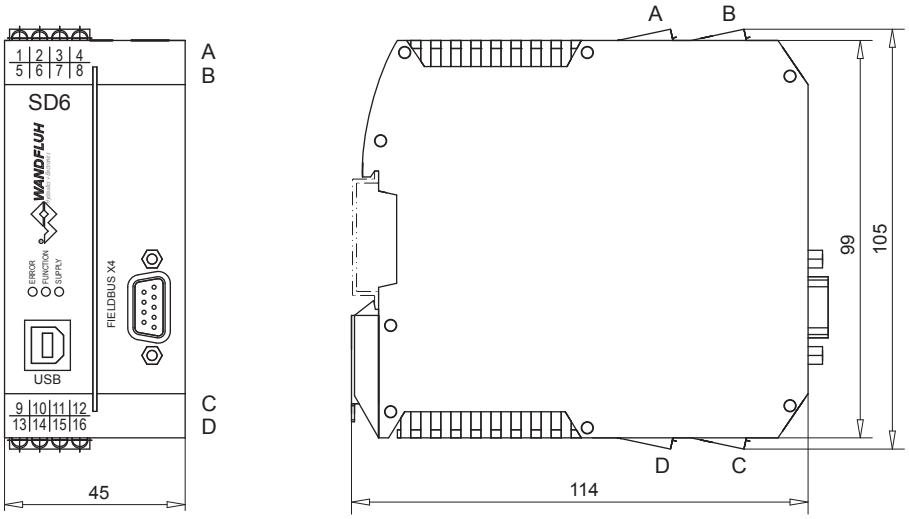
ELECTRICAL SPECIFICATIONS

Protection class	IP 30 acc. to EN 60 529
Device receptacle	
Profibus (female)	DSUB, 9-poles
Mating connector	Plug (male) DSUB, 9-poles
Supply voltage	24 VDC or 12 VDC
Voltage range:	
• 24 VDC	21…30 V
• 12 VDC	10,5…15 V
Ripple on supply vol.	<10 %
Fuse	slow
Current consumption:	
• No-load current	approx. 50 mA
• Maximum current consumption	no-load current + 1,8 A per solenoid (with 24 VDC) no-load current + 2,3 A per solenoid (with 12 VDC)
Command and feedback 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 -10…+10 V (not with analogue input 2)
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 30 mA
Profibus interface	D-Sub plug-in connector DSUB 9-poles, female on front plate, differential signal transmission
Bus topology	Line
Potential separation	Profibus to «SD6»-electronics 500 VDC
Solenoid current:	
• Minimum current I_{min}	Adjustable 0…950 mA Factory-preset 150 mA
• Maximum current I_{max}	Adjustable I_{min}…1,8 A (with 24 VDC) I_{min}…2,3 A (with 12 VDC) Factory-preset 700 mA
Dither	Frequency adjustable 20…500 Hz Factory-preset 100 Hz Amplitude adjustable 0…400 mA Factory-preset 100 mA
Temperature drift	<1 % at ΔT = 40 °C
Digital inputs	Switching threshold high 6…30 VDC Switching threshold low 0…1 VDC Signal active at 6…30 VDC (active high)
Digital outputs	Low-Side-Switch: U_{max} = 40 VDC I_{max} = -700 mA
Serial interface	USB (receptacle type B) for parameterisation «PASO»
EMV	
Immunity	EN 61 000-6-2
Emission	EN 61 000-6-4

BLOCK DIAGRAM

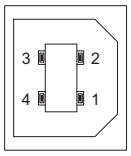


DIMENSIONS



CONNECTOR WIRING DIAGRAM / PIN ASSIGNMENT

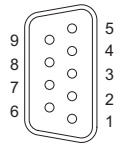
USB-interface, USB Type B X2



1 = VBUS
2 = D -
3 = D +
4 = GND

REMARK!
The parameterisation cable is not part of the scope of supply (commercially available USB-cable, plug type A to plug type B).

Device receptacle Profibus DP (female) X4

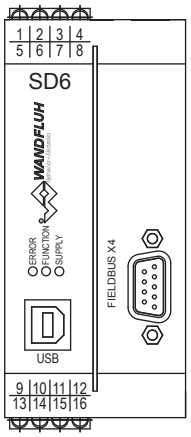


PROFIBUS

1 = Reserved
2 = Reserved
3 = RxD/TxD-P
4 = Reserved
5 = DGND
6 = VP
7 = Reserved
8 = RxD/TxD-N
9 = Reserved

The mating connector (plug male, DSUB, 9-poles) is not included in the delivery.

PIN-assignment X1



1 = Digital input 1
2 = Digital input 2
3 = Digital output 1
4 = Digital output 2
5 = Supply Analogue input +
6 = Supply voltage 0 VDC
7 = Stabilised output voltage
8 = Analogue ground
9 = Analogue input 1 +
10 = Analogue input 1 -
11 = Analogue input 2 +
12 = Analogue input 2 -
13 = Output solenoid B +
14 = Output solenoid B -
15 = Output solenoid A +
16 = Output solenoid A -

Configuration analogue inputs

Type description	Analogue input 1	Analogue input 2
SD6332D. **0**-AB	voltage	current
SD6332D. **1**-AB	voltage	voltage (0...10 V only)
SD6332D. **2**-AB	current	current

START-UP

Information regarding installation and commissioning are contained in the information leaflet supplied with the amplifier module and in the operating instructions.

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

Free-of-charge download:
• «PASO-DSV/SD6» Parameterisation software
• Operating instructions (*.pdf)
• GSD-file «WAGOB8E.gsd»

ADDITIONAL INFORMATION

	Wandfluh documentation	
Wandfluh electronics general	register	1.13
Proportional directional valves	register	1.10
Proportional pressure valves	register	2.3
Proportional flow control valves	register	2.6

DESCRIPTION of Controller module basic «SD6» with Profibus DP-interface

Design

The controller module can be parameterised by means of the parameterisation software «PASO-DSV/SD6» through the USB-interface. In addition, the parameterisation software makes a data analysis possible. The software «PASO-DSV/SD6» is supported by Windows 2000 and Windows XP.

Description of function
Hardware configuration with analogue signal

With the controller module «SD6» different control circuits can be built-up: position -, 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 valve, resp. its solenoids are directly driven. The command value is brought to the controller as an electric signal or through the Profibus DP; 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 controller module «SD6» can output a digital signal.

The controller module «SD6» 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 controller module «SD6» then function corresponding to normal amplifier electronics.

In addition the controller module «SD6» is equipped with two digital inputs for the enabling, and for changing over to solenoid B (only in operating mode 5) as well as with two digital outputs, which output the conditions «Error» or «Target window reached».

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.

Signal recording
The controller module «SD6» furthermore has 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.

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.

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 ground of the external generator does not correspond to the ground from the controller module «SD6». If the differential input is to be utilised like an analogue input to ground, then the - (minus) connection of the differential input has to be connected to ground.

Cable break monitoring at the analogue inputs
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:
Until the identification of a cable break approx. 100 ms elapse. During this time, the axis may carry out unintended movements or unintendedly modified forces!

Analogue input voltage
Input voltage range 0…±10 V, analogue input 2: 0...10 V.
If with the version 12 VDC, the stabilised voltage (0…8 V) is utilised, then in the PASO the scaling [%/V] has to be correspondingly adapted.

Analogue input current
Input current range 0…20 mA/4…20 mA

Digital input 1 «Enable control»
Enables the controller module «SD6» in general. Without this enabling, no solenoid current is output. The digital input 1 as standard setting is high-active (refer to electrical specifications).

Digital input 2 «Solenoid B»
In the operating mode 5 «Command value unipolar (2-sol. with DigInp2)» (refer to data sheet 1.11-100, page 5), the solenoid B is active, when the digital input 2 is «active». When the digital input 2 is «inactive», then solenoid A is active.

All digital inputs are low-side switches (refer to electrical specifications).
The digital inputs 1-2 can only be utilised with local device control (db.local=1).

Digital output 1 «Error»
This output becomes active, when an error is detected. An error once detected is indicated until the «SD6»-controller module is disabled through the digital input «Enable control» and enabled once again. Inverting the output is possible.

Digital output 2 «Target window reached»
This output becomes active, when the control difference is within the target window. Inverting the output is possible.

Ramps
Per solenoid, two linear ramps for Up and Down can be adjusted separately. The ramps are only available in the amplifier mode.

Controller modes
The following controller modes can be set:

Controller mode 3 «Pressure / flow valve open loop»
Driving of a pressure relief-, pressure control-, throttle- or volume flow control valve in open loop control circuit (without feedback value return).

Controller mode 4 «Pressure / flow valve closed loop (1-sol)»
Driving of a 1-solenoid-, pressure relief-, pressure reducing-, throttle- or volume flow control valve in closed loop control circuit (with feedback value return).

Controller mode 6 «Position open loop»
Driving of a direction control valve in open control loop circuit (without feedback value return).

Controller mode 7 «Speed control closed loop (2-sol)»
Driving of a 2-solenoid direction-, throttle- or volume flow control valve in closed loop control circuit (with feedback value return).

Controller mode 9 «Position closed loop (2-sol)»
Driving of a 2-solenoid direction control valve in closed loop control circuit (with feedback value return).

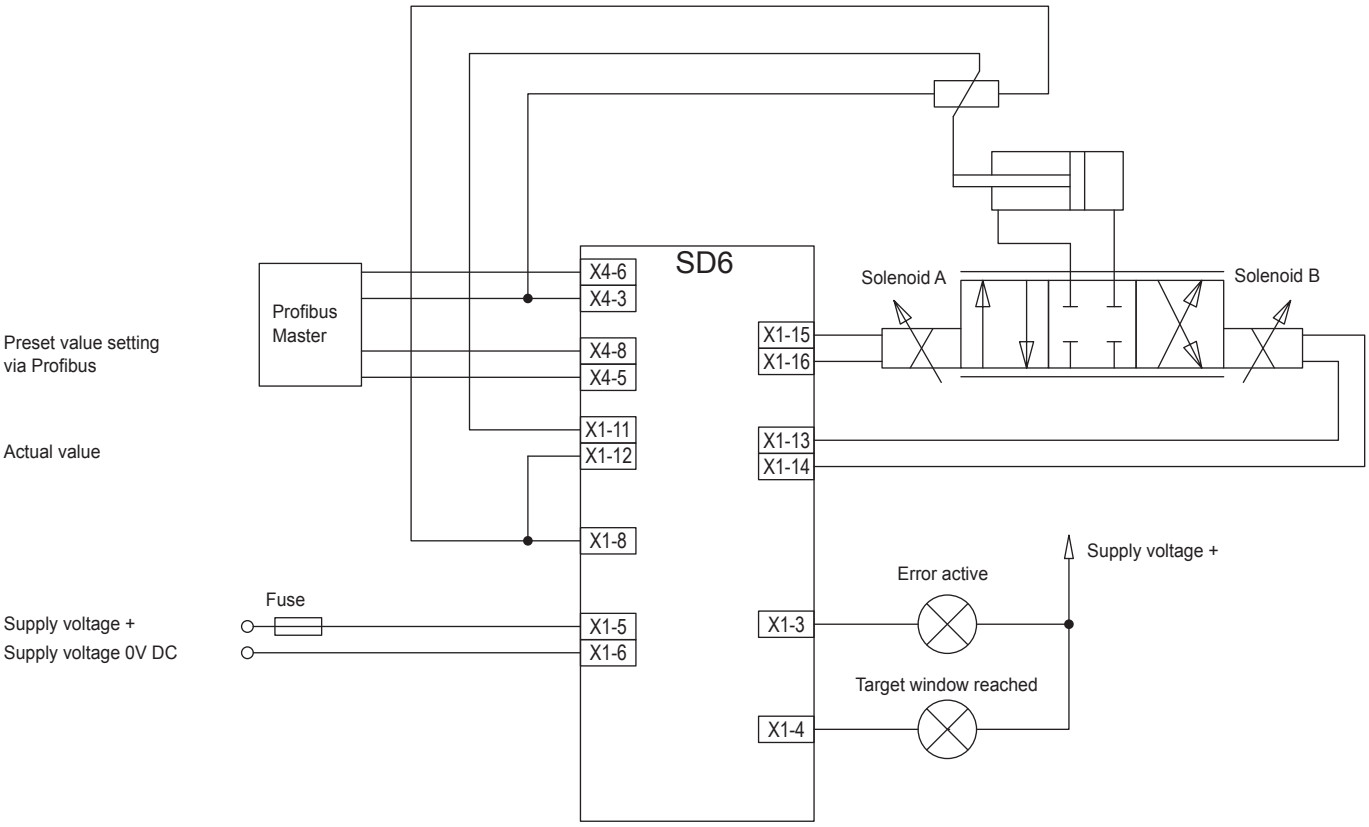
Controller mode -5 «Position closed loop (2-sol)»
Driving of two 1-solenoid throttle valves in closed loop control circuit (with feedback value return) as pressure reduction.

Controller mode -9 «pQ control (2-sol)»
Driving of a direction control valve in open loop control circuit (without feedback value return) with monitoring of a predefined pressure (with feedback value return).

Controller mode -10 «Alternating control (2-sol)»
Driving of a direction control valve in closed loop control circuit (with feedback value return) with monitoring of a predefined pressure (with feedback value return).

CONNECTION EXAMPLE («SD6»-Controller module Basic with Profibus DP-interface)

Position control (Command value and feedback value 10-bit, 16-bit not possible in case of «SD6»-Controller module Basic)



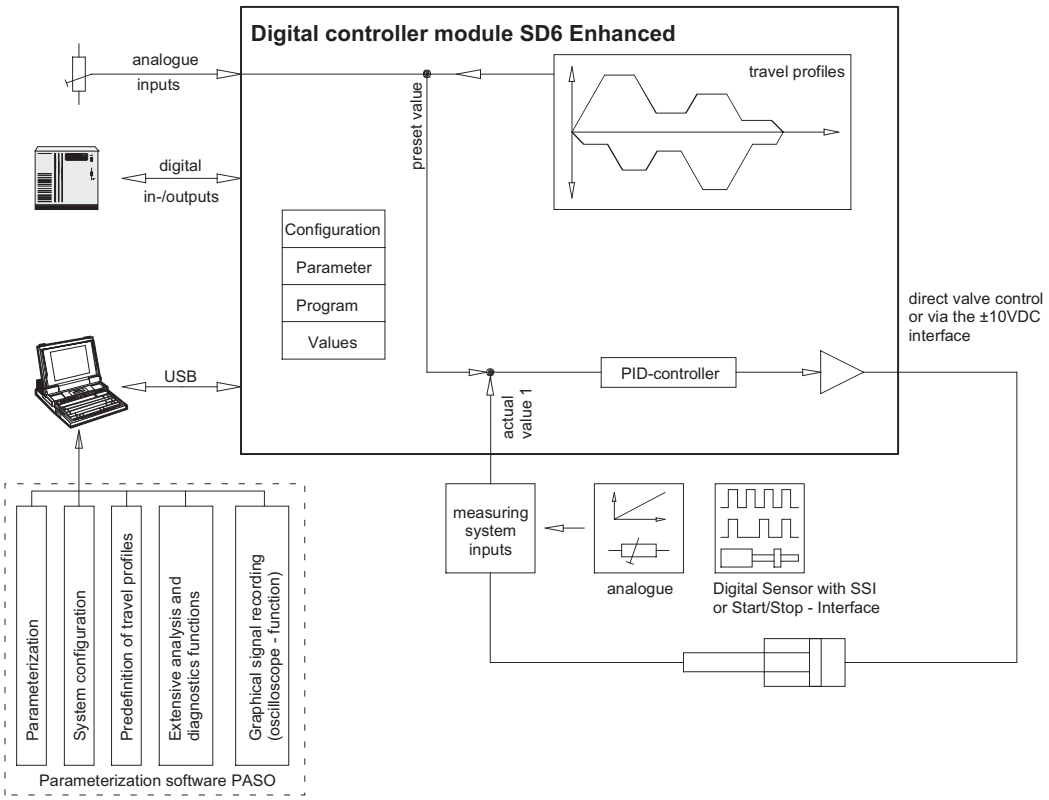
Controller Module Enhanced with analogue interface

ELECTRICAL SPECIFICATIONS

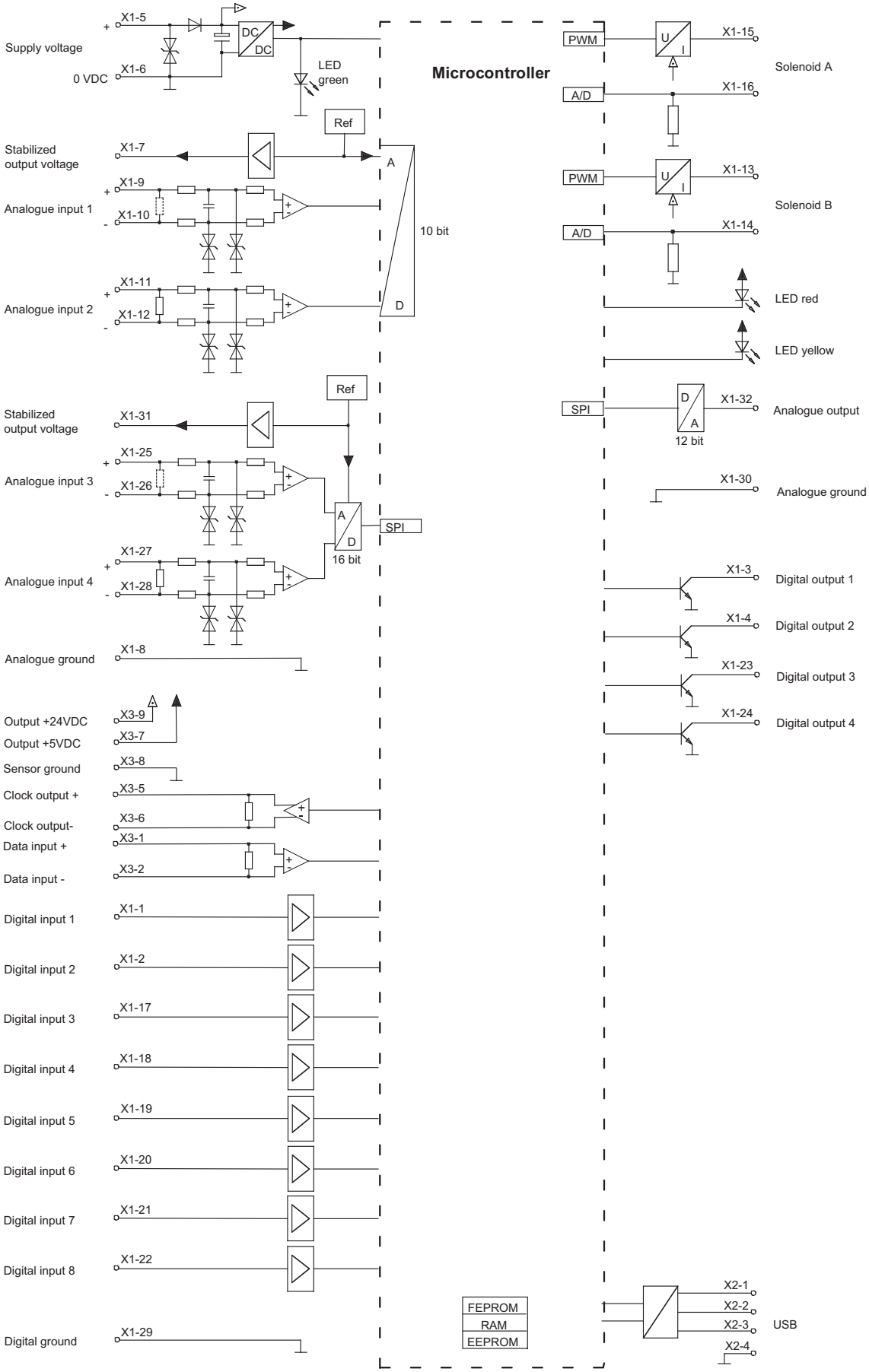
Protection class	IP 30 acc. to EN 60 529
Device receptacle	
Sensor (female)	DSUB, 9-poles
Mating connector	Plug (male) DSUB, 9-poles
Supply voltage	24 VDC or 12 VDC
Voltage range:	
• 24 VDC	21…30 V
• 12 VDC	10,5…15 V
Ripple on supply vol.	<10 %
Fuse	slow
Current consumption:	
• No-load current	approx. 60 mA
• Maximum current consumption	no-load current + 1,8 A per solenoid (with 24 VDC) no-load current + 2,3 A per solenoid (with 12 VDC)
Command and feedback 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 -10…+10 V
Analogue inputs:	
• 1 and 2	10-bit-resolution
• 3 and 4	16-bit-resolution
Input resistance	Voltage input >18 kΩ Load for current input = 250 Ω

Measuring system input	D-Sub plug-in connector 9-pole female on front plate in accordance with RS422-standard selectable by means of software Absolute via Start / Stop Absolute via SSI (1...32 bit, gray or binary)
Analogue output:	Output voltage ± 10 V max. output current ± 3 mA
Stabilised output voltage	10 VDC (with version 24 VDC) 8 VDC (with version 12 VDC) max. load 30 mA
Solenoid current:	
• Minimum current I_{min}	Adjustable 0…950 mA Factory-preset 150 mA
• Maximum current I_{max}	Adjustable I_{min}…1,8A (with 24 VDC) I_{min}…2,3A (with 12 VDC) Factory-preset 700 mA
Dither	Frequency adjustable 20…500 Hz Factory-preset 100 Hz Amplitude adjustable 0…400 mA Factory-preset 100 mA
Temperature drift	<1 % at ΔT = 40 °C
Digital inputs	Switching threshold high 6…30 VDC Switching threshold low 0…1 VDC Signal active at 6…30 VDC (active high)
Digital outputs	Low-Side-Switch: U_{max} = 40 VDC I_{max} = -700 mA
Serial interface	USB (receptacle type B) for parameterisation «PASO»
EMV	
Immunity	EN 61 000-6-2
Emission	EN 61 000-6-4

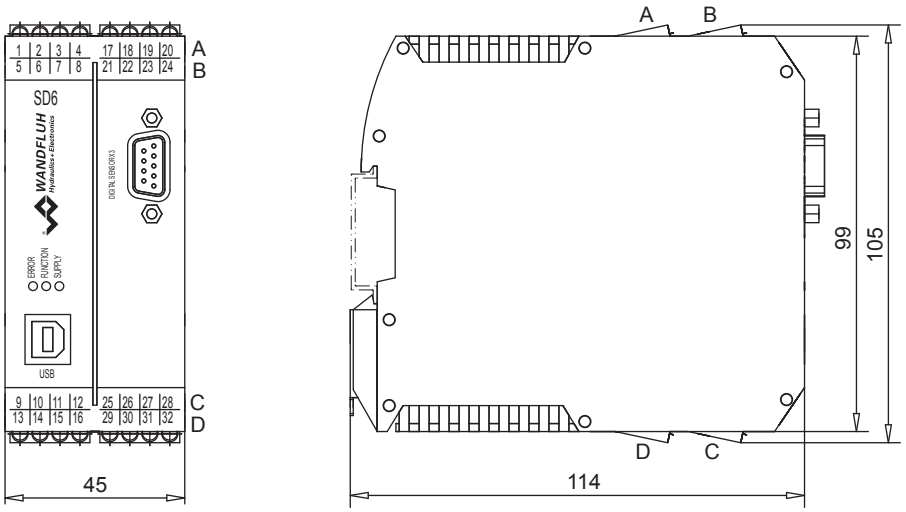
FUNCTION DIAGRAM



BLOCK DIAGRAM

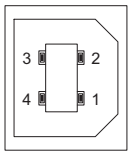


DIMENSIONS



CONNECTOR WIRING DIAGRAM / PIN ASSIGNMENT

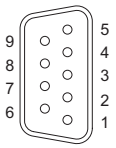
USB-interface, USB Type B X2



1 = VBUS
2 = D -
3 = D +
4 = GND

REMARK!
The parameterisation cable is not part of the scope of supply (commercially available USB-cable, plug type A to plug type B)

Device receptacle Sensor (female) X3



1 = Digital input +
2 = Digital input -
3 = Reserved
4 = Reserved
5 = Clock output +
6 = Clock output -
7 = Output +5VDC
8 = Sensor ground
9 = Output +24VDC

The mating connector (plug male, DSUB, 9-poles) is not included in the delivery.

START-UP

Information regarding installation and commissioning are contained in the information leaflet supplied with the amplifier module and in the operating instructions.

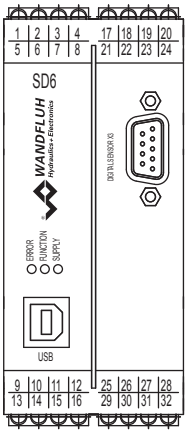
Additional information can be found on our website:
«www.wandfluh.com»

Free-of-charge download:
• «PASO-DSV / SD6» Parameterisation software
• Operating instructions (*.pdf)

ADDITIONAL INFORMATION

	Wandfluh documentation	
Wandfluh electronics general	register	1.13
Proportional directional valves	register	1.10
Proportional pressure valves	register	2.3
Proportional flow control valves	register	2.6

PIN-assignment X1



1 = Digital input 1
2 = Digital input 2
3 = Digital output 1
4 = Digital output 2
5 = Supply Analogue input +
6 = Supply voltage 0 VDC
7 = Stabilised output voltage
8 = Analogue ground
9 = Analogue input 1 +
10 = Analogue input 1 -
11 = Analogue input 2 +
12 = Analogue input 2 -
13 = Output solenoid B +
14 = Output solenoid B -
15 = Output solenoid A +
16 = Output solenoid A -
17 = Digital input 3
18 = Digital input 4
19 = Digital input 5
20 = Digital input 6
21 = Digital input 7
22 = Digital input 8
23 = Digital output 3
24 = Digital output 4
25 = Analogue input 3 +
26 = Analogue input 3 -
27 = Analogue input 4 +
28 = Analogue input 4 -
29 = Digital ground
30 = Analogue ground
31 = Stabilised output voltage
32 = Analogue output

Configuration analogue inputs

Type description	Analogue input			
	No. 1	No. 2	No. 3	No. 4
SD6362D. **4**-BA	voltage	current	voltage	current
SD6362D. **5**-BA	voltage	voltage	voltage	voltage
SD6362D. **6**-BA	current	current	current	current

DESCRIPTION of «SD6»-Controller module Enhanced with analogue interface

Design

The controller module can be parameterised by means of the parameterisation software «PASO-DSV / SD6» through the USB-interface. In addition, the parameterisation software makes a data analysis possible. The software «PASO-DSV / SD6» is supported by Windows 2000 and Windows XP.

Description of function
Hardware configuration with analogue signal

With the controller module «SD6» different control circuits can be built-up: position -, 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 valve, resp. its solenoids are directly driven. Through the analogue output it is also possible to drive a valve with integrated amplifier (e.g. DSV). The command value is brought to the controller as an electric signal, or internally by means of freely adjustable travelling profiles; an analogue or digital 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 controller module «SD6» can output a digital signal.

The controller module «SD6» Enhanced has an adjustable travelling speed, if the command value is preset in an analogue manner. 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 controller module «SD6» then function corresponding to normal amplifier electronics.

Furthermore the controller module «SD6» is equipped with digital inputs for the enabling, for controlling the manual operation and for the profile generator as well as digital outputs, which output the conditions «Error» or «Target window reached».

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.

signal recording
The controller module «SD6» furthermore has 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.

The manual operating mode makes available commands such as Forwards, Backwards, Rapid Speed and Creep Speed. With this it is possible to put the connected hydraulics into operation without a superordinate control system.

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.

Analogue inputs
The applied analogue signal is digitalised at the analogue inputs 1 and 2 with 10-bits, and at the analogue inputs 3 and 4 with 16-bits.

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 ground of the external generator does not correspond to the ground from the controller module «SD6». If the differential input is to be utilised like an analogue input to ground, then the - (minus) connection of the differential input has to be connected to ground.

Cable break monitoring at the analogue inputs
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:
Until the identification of a cable break approx. 100 ms elapse. During this time, the axis may carry out unintended movements or unintendedly modified forces!

Analogue input voltage
Input voltage range 0…±10 V
If with the version 12 VDC, the stabilised voltage (0…8 V) is utilised, then in the PASO the scaling [% / V] has to be correspondingly adapted.

Analogue input current
Input current range 0…20 mA / 4…20 mA

Analogue output
The analogue output is converted with a 12-Bit D/A converter. This provides the possibility of outputting different signals, such as, e.g., command - or feedback values as analogue value.

Digital input 1 «Enable control»
Enables the controller module «SD6» in general. Without this enabling, no solenoid current is output. The digital input 1 as standard setting is high-active (refer to electrical specifications).

Digital input 2 «Solenoid B» or «Automatic - / Manual operation»
In the operating mode 5 «Command value unipolar (2 - solenoid with DigOn2)» (refer to data sheet 1.11-100 / page 5), the solenoid B is active, when the digital input 2 is «active». When the digital input 2 is «inactive», the solenoid A is active. For changing over, the digital controller module SD6 has to be blocked by means of the digital input 1.

In all «closed-loop» - controller modes, with digital input 2 it is possible to changeover between automatic - and manual operation.

Digital input 3 «Manual forwards» or «Profile / Sequence»
In the manual operating mode, the digital input 3 issues the command 3 Forwards. In the automatic operating mode, the digital input 3 changes over between Profile and Sequence.

Digital input 4 «Manual reverse» or «Start»
In the manual operating mode, the digital input 4 issues the command Reverse. In the automatic operating mode, the digital input 4 issues the command Start for the profile generator.

Digital Input 5 «Rapid Speed / Creep Speed» or «Stop»
In the manual operating mode, the digital input 5 changes over between Rapid speed and Creep speed. In the automatic operating mode, the digital input 5 issues the command Stop for the profile generator.

Digital Inputs 6...8 «Profile Selection»
In the automatic operating mode, with the digital inputs 6...8 it is possible to select the travelling profile. In the manual operating mode, the digital inputs 6...8 have no function.

All digital inputs are low-side switches (refer to electrical specifications).

Digital Output 1 «Error»
This output becomes active, when an error is detected. An error once detected is indicated until the «SD6»-controller module is disabled through the digital input «Enable control» and enabled once again. Inverting the output is possible.

Digital Output 2 «Target Window Reached»
This output becomes active, when the control difference is within the target window. Inverting the output is possible.

Digital Output 3 «Trailing Error»
This output becomes active, when the contouring error is outside the trailing error window. Inverting the output is possible.

Digital Output 4 «Profile End»
This output becomes active, when the travelling profile has been finished. Inverting the output is possible

Controller modes
The following controller modes can be set:

Controller mode 3 «Pressure / flow valve open loop»
Driving of a pressure relief-, pressure control-, throttle- or volume flow control valve in open loop control circuit (without feedback value return).

Controller mode 4 «Pressure / flow valve closed loop (1-sol)»
Driving of a 1-solenoid-, pressure relief-, pressure reducing-, throttle- or volume flow control valve in closed loop control circuit (with feedback value return).

Controller mode 6 «Position open loop»
Driving of a direction control valve in open control loop circuit (without feedback value return).

Controller mode 7 «Speed control closed loop (2-sol)»
Driving of a 2-solenoid direction-, throttle- or volume flow control valve in closed loop control circuit (with feedback value return).

Controller mode 9 «Position closed loop (2-sol)»
Driving of a 2-solenoid direction control valve in closed loop control circuit (with feedback value return).

Controller mode -5 «Position closed loop (2-sol)»
Driving of two 1-solenoid throttle valves in closed loop control circuit (with feedback value return) as pressure reduction.

Controller mode -9 «pQ control (2-sol)»
Driving of a direction control valve in open loop control circuit (without feedback value return) with monitoring of a predefined pressure (with feedback value return).

Controller mode -10 «Alternating control (2-sol)»
Driving of a direction control valve in closed loop control circuit (with feedback value return) with monitoring of a predefined pressure (with feedback value return).

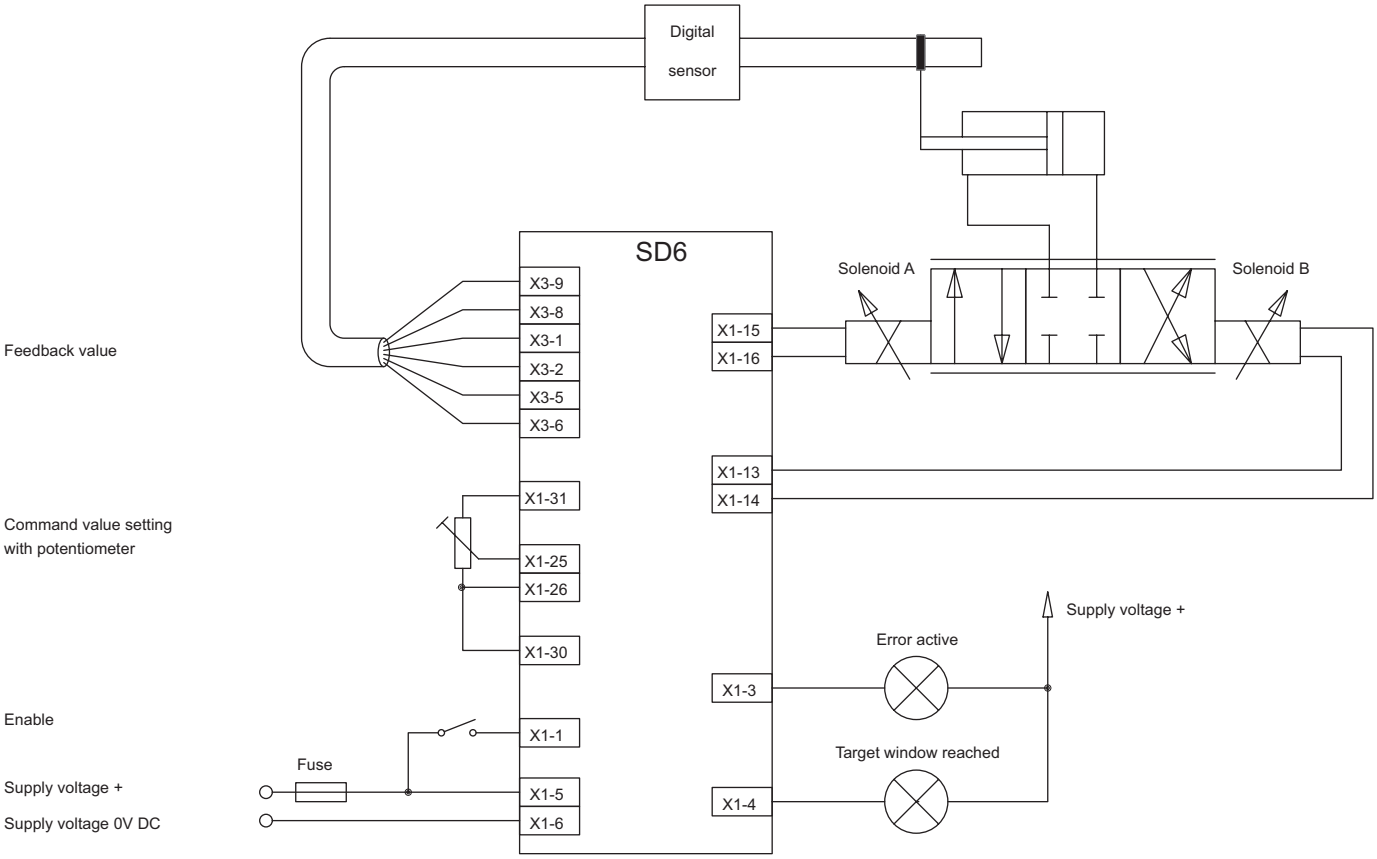
Travel profiles
The «SD6» controller module Enhanced is in a position to save and to run through complete travel profiles, which have been preset by the user. A travel profile is a sequence of individual profiles (sequences). Each sequence consists of the following data:
- command position (sequence target or endposition)
- speed (travelling speed)
- acceleration (acceleration for reaching the travelling speed)
- deceleration (deceleration, departing from the travelling speed)
- stop time (waiting time after reaching the end position of the sequence)
- function «sequence reached» (setting a digital output when reaching the end position of the sequence)

A travel profile as a minimum consists of 1 - and as a maximum of 100 sequences. As a maximum there are 7 travel profiles possible. A travel profile can be run through either completely or else step by step (sequence by sequence).
In the travel profile generator, the travel profiles can be defined and graphically displayed. With this, a good overview is assured, because all inputs are immediately graphically visible.

Ramps
Per solenoid, two linear ramps for Up and Down can be adjusted separately. The ramps are only available in the amplifier mode.

CONNECTION EXAMPLE («SD6»-Controller module Enhanced)

Position control with a digital sensor and 16-bit command value preset

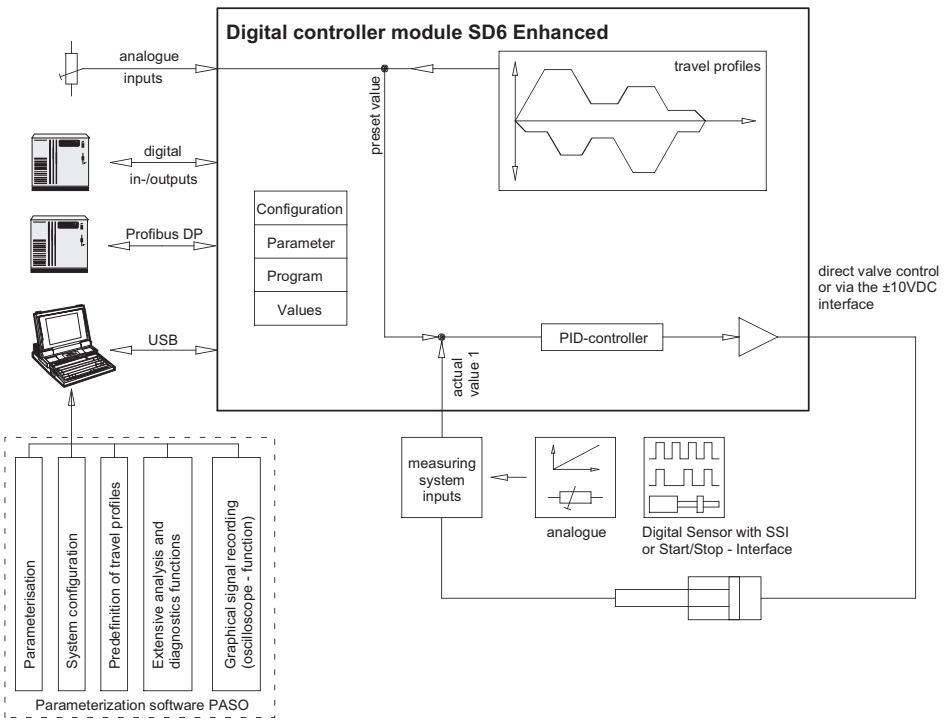


Controller Module Enhanced with Profibus interface

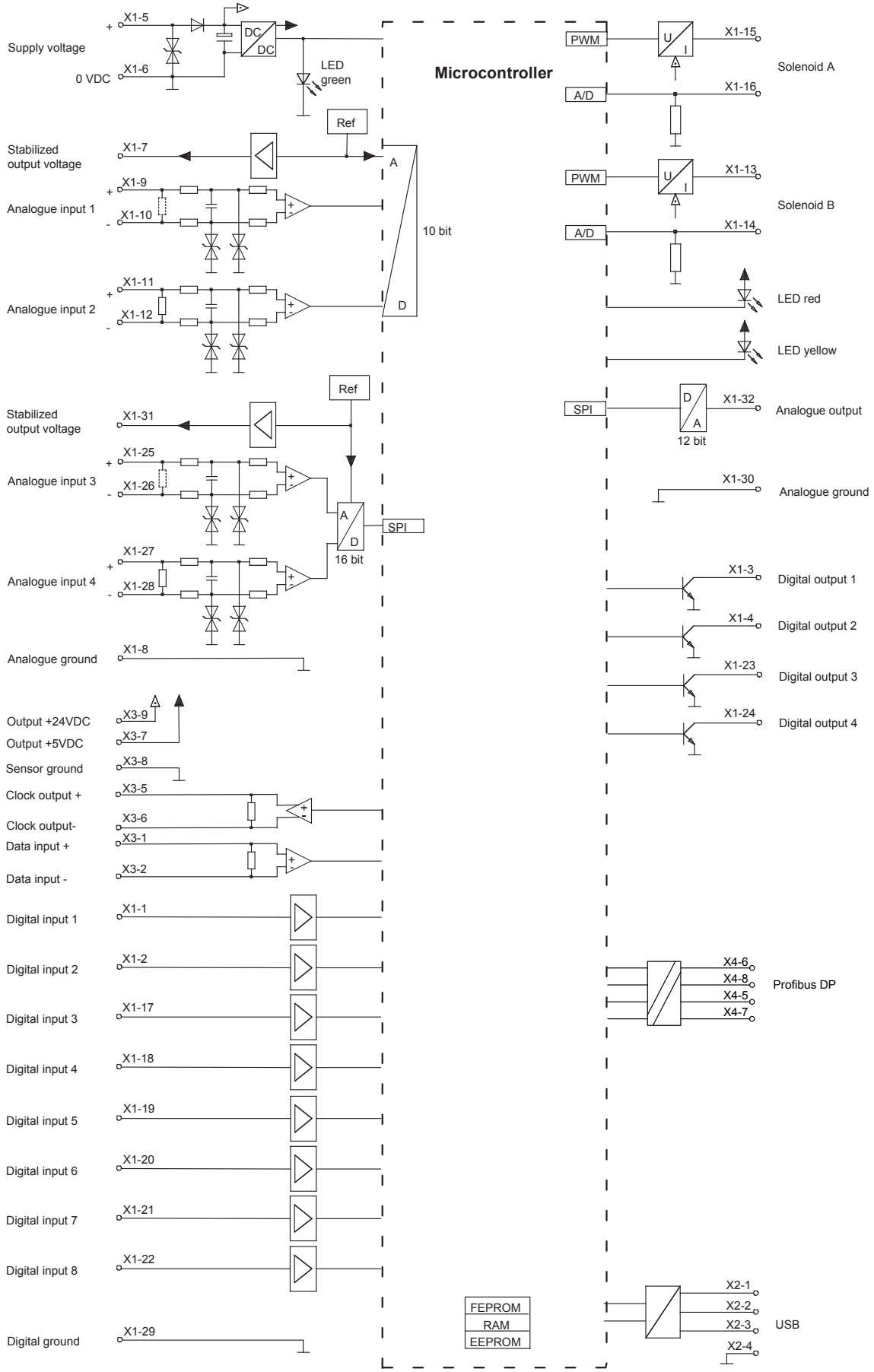
ELECTRICAL SPECIFICATIONS

Protection class	IP 30 acc. to EN 60 529
Device receptacle	
Sensor (female)	DSUB, 9-poles
Mating connector	Plug (male) DSUB, 9-poles
Device receptacle	
Profibus (female)	DSUB, 9-poles
Mating connector	Plug (male) DSUB, 9-poles
Supply voltage	24 VDC or 12 VDC
Voltage range:	
• 24 VDC	21…30 V
• 12 VDC	10,5…15 V
Ripple on supply vol.	<10 %
Fuse	slow
Current consumption:	
• No-load current	approx. 70 mA
• Maximum current consumption	no-load current + 1,8 A per solenoid (with 24 VDC) no-load current + 2,3 A per solenoid (with 12 VDC)
Command and feedback 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 -10…+10 V (not with analogue input 2)
Analogue inputs	
• 1 and 2	10-bit-resolution
• 3 and 4	16-bit-resolution
Input resistance	Voltage input >18 kΩ Load for current input = 250 Ω
Measuring system input	D-Sub plug-in connector 9-pole female on front plate in accordance with RS422-standard selectable by means of software Absolute via Start / Stop Absolute via SSI (1...32 bit, gray or binary)
Profibus interface	D-Sub-Plug-in coupling 9-poles, female on front plate, differential signal transmission
Bus topology	Line
Potential separation	Profibus to «SD6»-electronics 500 VDC
Analogue output:	Output voltage ± 10 V max. output current ± 3 mA
Stabilised output voltage	10 VDC (with version 24 VDC) 8 VDC (with version 12 VDC) max. load 30 mA
Solenoid current:	
• Minimum current I_{min}	Adjustable 0…950 mA Factory-preset 150 mA
• Maximum current I_{max}	Adjustable I_{min}…1,8A (with 24 VDC) I_{min}…2,3A (with 12 VDC) Factory-preset 700 mA
Dither	Frequency adjustable 20…500 Hz Factory-preset 100 Hz Amplitude adjustable 0…400 mA Factory-preset 100 mA
Temperature drift	<1 % at ΔT = 40 °C
Digital inputs	Switching threshold high 6…30 VDC Switching threshold low 0…1 VDC Signal active at 6…30 VDC (active high)
Digital outputs	Low-Side-Switch: U_{max} = 40 VDC I_{max} = -700 mA
Serial interface	USB (receptacle type B) for parameterisation «PASO»
EMV	
Immunity	EN 61 000-6-2
Emission	EN 61 000-6-4

FUNCTION DIAGRAM

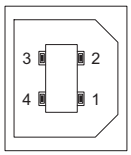


BLOCK DIAGRAM



CONNECTOR WIRING DIAGRAM / PIN ASSIGNMENT

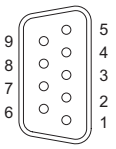
USB-interface, USB Type B X2



1 = VBUS
2 = D -
3 = D +
4 = GND

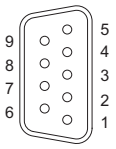
Remark!
The parameterisation cable is not part of the scope of supply (commercially available USB-cable, plug type A to plug type B)

Device receptacle Sensor (female) X3



1 = Digital input +
2 = Digital input -
3 = Reserved
4 = Reserved
5 = Clock output +
6 = Clock output -
7 = Output +5VDC
8 = Sensor ground
9 = Output +24VDC

Device receptacle Profibus DP (female) X4

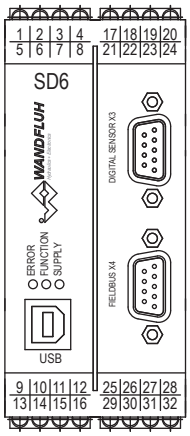


PROFIBUS

1 = Reserved
2 = Reserved
3 = RxD/TxD-P
4 = Reserved
5 = DGND
6 = VP
7 = Reserved
8 = RxD/TxD-N
9 = Reserved

The mating connector (plug male DSUB, 9-pole) is not included in the delivery.

PIN-assignment X1



1 = Digital input 1
2 = Digital input 2
3 = Digital output 1
4 = Digital output 2
5 = Supply Analogue input +
6 = Supply voltage 0 VDC
7 = Stabilised output voltage
8 = Analogue ground
9 = Analogue input 1 +
10 = Analogue input 1 -
11 = Analogue input 2 +
12 = Analogue input 2 -
13 = Output solenoid B +
14 = Output solenoid B -
15 = Output solenoid A +
16 = Output solenoid A -
17 = Digital input 3
18 = Digital input 4
19 = Digital input 5
20 = Digital input 6
21 = Digital input 7
22 = Digital input 8
23 = Digital output 3
24 = Digital output 4
25 = Analogue input 3 +
26 = Analogue input 3 -
27 = Analogue input 4 +
28 = Analogue input 4 -
29 = Digital ground
30 = Analogue ground
31 = Stabilised output voltage
32 = Analogue output

START-UP

Information regarding installation and commissioning are contained in the information leaflet supplied with the amplifier module and in the operating instructions.

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

Free-of-charge download:
• «PASO-DSV/SD6» Parameterisation software
• Operating instructions (*.pdf)
• GSD-file «WAGOB8E.gsd»

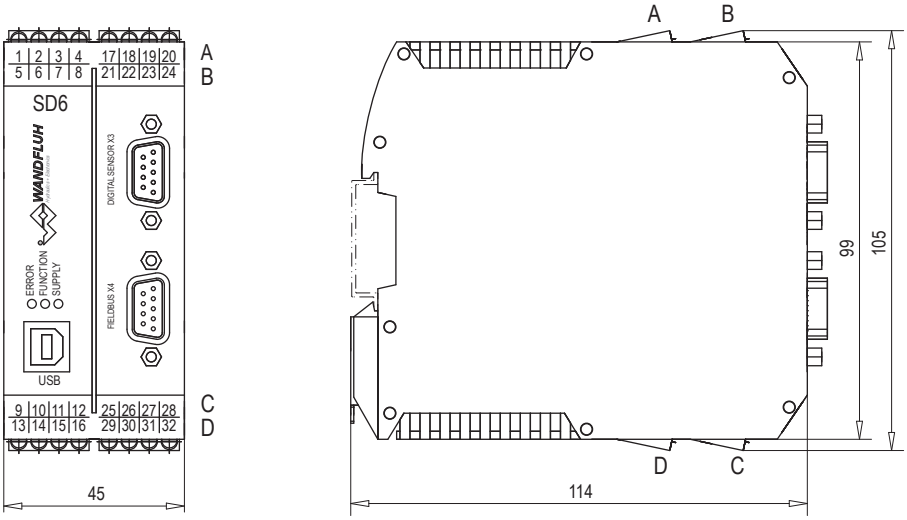
ADDITIONAL INFORMATION

	Wandfluh documentation	
Wandfluh electronics general	register	1.13
Proportional directional valves	register	1.10
Proportional pressure valves	register	2.3
Proportional flow control valves	register	2.6

Configuration analogue inputs

Type description	Analogue input			
	No. 1	No. 2	No. 3	No. 4
SD6362D. **4**-BB	voltage	current	voltage	current
SD6362D. **5**-BB	voltage	voltage (0...10 V only)	voltage	voltage
SD6362D. **6**-BB	current	current	current	current

DIMENSIONS


1 2 3 4 17 18 19 20
5 6 7 8 21 22 23 24
A
B
SD6
WANDFLUH
DIGITAL SENSOR X3
FIELDBUS X4
ERROR
FUNCTION
SUPPLY
USB
9 10 11 12 25 26 27 28
13 14 15 16 29 30 31 32
C
D
45
A
B
99
105
D
C
114

DESCRIPTION of «SD6»-Controller module Enhanced with Profibus DP interface

Design

The controller module can be parameterised by means of the parameterisation software «PASO-DSV / SD6» through the USB-interface. In addition, the parameterisation software makes a data analysis possible. The software «PASO-DSV / SD6» is supported by Windows 2000 and Windows XP.

Description of Function
Hardware-Configuration with Analogue Signal

With the controller module «SD6» different control circuits can be built-up: position -, 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 valve, resp. its solenoids are directly driven. Through the analogue output it is also possible to drive a valve with integrated amplifier (e.g. DSV). The command value is applied by means of an electric signal or through the Profibus DP and brought to the controller internally by means of freely adjustable travelling profiles; an analogue or digital 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 controller module «SD6» can output a digital signal.

The controller module «SD6» Enhanced has an adjustable travelling speed, if the command value is preset in an analogue manner. 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 controller module «SD6» then function corresponding to normal amplifier electronics.

Furthermore the controller module «SD6» is equipped with digital inputs for the enabling, for controlling the manual operation and for the profile generator as well as digital outputs, which output the conditions «Error» or «Target window reached».

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.

Signal recording
The controller module «SD6» furthermore has 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.

The manual operating mode makes available commands such as Forwards, Backwards, Rapid Speed and Creep Speed. With this it is possible to put the connected hydraulics into operation without a superordinate control system.

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.

Analogue inputs
The applied analogue signal is digitalised at the analogue inputs 1 and 2 with 10-bits, and at the analogue inputs 3 and 4 with 16-bits.

Attention:
When selecting the range 4...20 mA, the resolution is <10-bit! All command value inputs are executed as differential inputs. Differential inputs are utilised, when the potential of the ground of the external command generator does not correspond to the ground from the controller module «SD6». If the differential input is to be utilised like an analogue input to ground, then the - (minus) connection of the differential input has to be connected to ground.

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:
Until the identification of a cable break approx. 100 ms elapse. During this time, the axis may carry out unintended movements or unintendedly modified forces!

Analogue input voltage
Input voltage range 0…±10 V, analogue input 2: 0...10 V.
If with the version 12 VDC, the stabilised voltage (0…8 V) is utilised, then in the PASO the scaling [% / V] has to be correspondingly adapted.

Analogue input current
Input current range 0…20 mA / 4…20 mA

Analogue output
The analogue output is converted with a 12-Bit D/A converter. This provides the possibility of outputting different signals, such as, e.g., command - or feedback values as analogue value.

Digital input 1 «Enable control»
Enables the controller module «SD6» in general. Without this enabling, no solenoid current is output. The digital input 1 as standard setting is high-active (refer to electrical specifications).

Digital input 2 «Solenoid B» or «Automatic - / Manual operation»
In the operating mode 5 «Command value unipolar (2 - solenoid with DigOn2)» (refer to data sheet 1.11-100 / page 5), the solenoid B is active, when the digital input 2 is «active». When the digital input 2 is «inactive», the solenoid A is active. For changing over, the digital controller module SD6 has to be blocked by means of the digital input 1.

In all «closed-loop» - controller modes, with digital input 2 it is possible to changeover between automatic - and manual operation.

Digital Input 3 «Manual forwards» or «Profile / Sequence»
In the manual operating mode, the digital input 3 issues the command 3 Forwards. In the automatic operating mode, the digital input 3 changes over between Profile and Sequence.

Digital Input 4 «Manual reverse» or «Start»
In the manual operating mode, the digital input 4 issues the command Reverse. In the automatic operating mode, the digital input 4 issues the command Start for the profile generator.

Digital Input 5 «Rapid Speed / Creep Speed» or «Stop»
In the manual operating mode, the digital input 5 changes over between Rapid speed and Creep speed. In the automatic operating mode, the digital input 5 issues the command Stop for the profile generator.

Digital Inputs 6...8 «Profile Selection»
In the automatic operating mode, with the digital inputs 6...8 it is possible to select the travelling profile. In the manual operating mode, the digital inputs 6...8 have no function.

All digital inputs are low-side switches (refer to electric specifications).
The digital inputs 1-2 can only be utilised with local device control (db.local=1).

Digital Output 1 «Error»
This output becomes active, when an error is detected. An error once detected is indicated until the «SD6»-controller module is disabled through the digital input «Enable control» and enabled once again.
Inverting the output is possible.

Digital Output 2 «Target Window Reached»
This output becomes active, when the control difference is within the target window.

Digital Output 3 «Trailing Error»
This output becomes active, when the contouring error is outside the trailing error window.
Inverting the output is possible.

Digital Output 4 «Profile End»
This output becomes active, when the travelling profile has been finished. Inverting the output is possible.

Travel profiles
The «SD6» controller module Enhanced is in a position to save and to run through complete travel profiles, which have been preset by the user. A travel profile is a sequence of individual profiles (sequences). Each sequence consists of the following data:
- command position (sequence target or endposition)
- speed (travelling speed)
- acceleration (acceleration for reaching the travelling speed)
- deceleration (deceleration, departing from the travelling speed)
- stop time (waiting time after reaching the end position of the sequence)
- function «sequence reached» (setting a digital output when reaching the end position of the sequence)

A travel profile as a minimum consists of 1 - and as a maximum of 100 sequences. As a maximum there are 7 travel profiles possible.
A travel profile can be run through either completely or else step by step (sequence by sequence).
In the travel profile generator, the travel profiles can be defined and graphically displayed. With this, a good overview is assured, because all inputs are immediately graphically visible.

Ramps
Per solenoid, two linear ramps for Up and Down can be adjusted separately. The ramps are only available in the amplifier mode.

Controller modes
The following controller modes can be set:

Controller mode 3 «Pressure / flow valve open loop»
Driving of a pressure relief-, pressure control-, throttle- or volume flow control valve in open loop control circuit (without feedback value return).

Controller mode 4 «Pressure / flow valve closed loop (1-sol)»
Driving of a 1-solenoid-, pressure relief-, pressure reducing-, throttle- or volume flow control valve in closed loop control circuit (with feedback value return).

Controller mode 6 «Position open loop»
Driving of a direction control valve in open control loop circuit (without feedback value return).

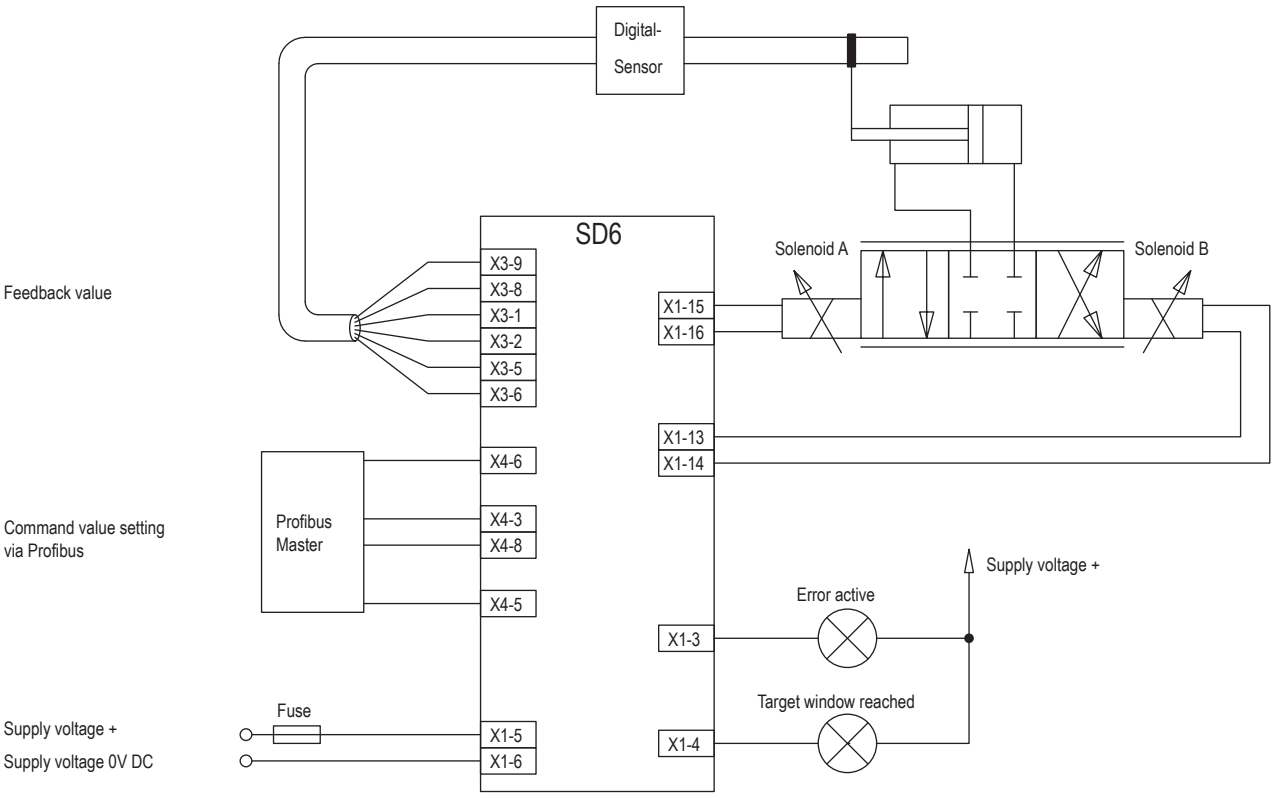
Controller mode 7 «Speed control closed loop (2-sol)»
Driving of a 2-solenoid direction-, throttle- or volume flow control valve in closed loop control circuit (with feedback value return).

Controller mode 9 «Position closed loop (2-sol)»
Driving of a 2-solenoid direction control valve in closed loop control circuit (with feedback value return).

Controller mode -5 «Position closed loop (2-sol)»
Driving of two 1-solenoid throttle valves in closed loop control circuit (with feedback value return) as pressure reduction.

Controller mode -9 «pQ control (2-sol)»
Driving of a direction control valve in open loop control circuit (without feedback value return) with monitoring of a predefined pressure (with feedback value return).

Controller mode -10 «Alternating control (2-sol)»
Driving of a direction control valve in closed loop control circuit (with feedback value return) with monitoring of a predefined pressure (with feedback value return).

CONNECTION EXAMPLE («SD6»-Controller module Enhanced with Profibus DP interface)

Position control with a digital sensor and 16-bit command value preset