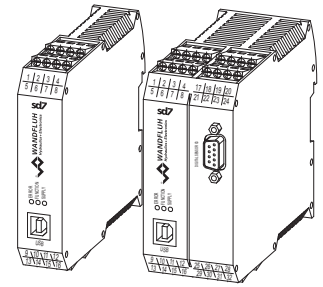


**Digital Controller Module SD7**

- For position, pressure and volume flow controls
- Interface:
  - analogue
  - CANopen / J1939
  - Profibus DP
  - HART
- Analogue or SSI sensors for the feedback signal
- Integrated final power stage
- Adjustment via PC
- For snapping on to dome rail
- Also available as amplifier module (see data sheet 1.13-101)



**DESCRIPTION**

Digital controller module for installation on dome rail for driving proportional or switching valves with one or two solenoids. Regulation of pressure, volume flow or position can be realized. The parameterisation takes place by means of menu-controlled parameterisation- and diagnostics software «PASO» from Wandfluh (USB-interface). The electronics are optionally available with different field bus interfaces.

**FUNCTION**

The controller module has two Pulse-Width-Modulated current outputs with superimposed dither signal. The analog and digital inputs as well as the digital outputs are individually programmable. With the Enhanced controller, the command value (position, pressure, force, etc.) can also be specified by means of freely adjustable travel profiles. The fieldbus connection enables reading the command value signal respectively the feedback value signal as well as the parameterisation directly via the fieldbus.

**APPLICATION**

As snap-on module, the controller module is mainly utilised in the industrial field. The module can be mounted on dome rails. Thanks to numerous digital inputs and outputs, the controller module can be connected to a higher-level machine control. Alternatively, the Enhanced controller can be used to control valves with integrated controllers (e.g. DSV, servo valves, etc.) via the analog output.

**GENERAL SPECIFICATIONS**

Execution	Module for control cubicle, housing made of plastic
Installation	on 35 mm dome rail according to EN 60715
Weight	
• Basic controller analog	130 g
• Basic controller fieldbus	220 g
• Enhanced controller analog	220 g
• Enhanced controller fieldbus	240 g
Connections	Screw terminals, max. cable cross-section 2,5 mm <sup>2</sup>
Working temperature	-20...+70 °C

Further information can be found in the Operating instructions.

**COMMISSIONING**

Information regarding installation and commissioning are contained in the information leaflet supplied with the controller module and in the operating instructions. Further information can be found on our website: [www.wandfluh.com](http://www.wandfluh.com)

- Free-of-charge download:
- «PASO» Parameterisation software
  - Operating instructions (.pdf)
  - Device description data: (EDS file «WAGSD7C1.eds»)  
(GSD file «SD7-0B8E.gsd»)

**ADDITIONAL INFORMATION**

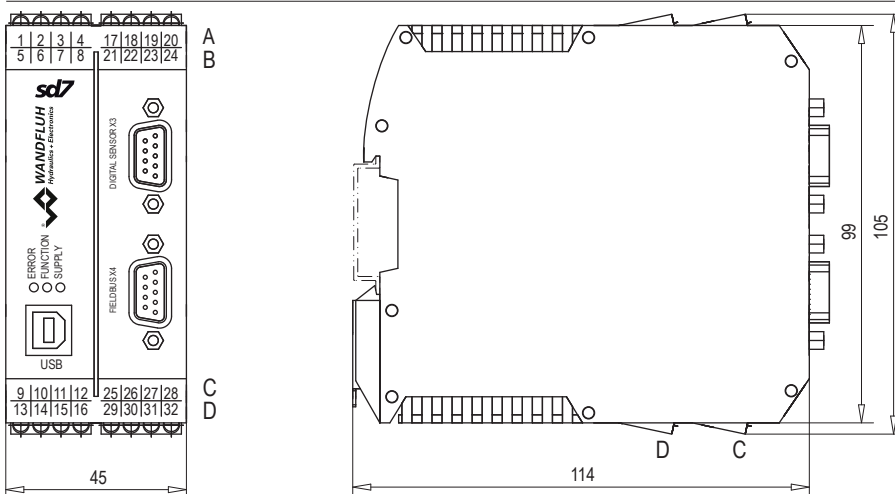
Wandfluh electronics general	Wandfluh documentation
Proportional spool valves	Register 1.13
Proportional pressure valves	Register 1.10
Proportional flow valves	Register 2.3
	Register 2.6

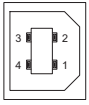
**TYPE CODE**

	S	D7	3		2			-		#	
Control cubicle											
Digital											
Adjustable with PASO											
Software configuration (function of card):											
• Basic controller											
• Enhanced controller											
2-solenoid version											
Supply voltage:											
24 VDC											
12 VDC											
Basic controller:											
• Analog input 1: voltage											
2: current											
• Analog input 1 and 2: both voltage											
• Analog input 1 and 2: both current											
Analog input 3: always current (with HART only)											
Enhanced controller:											
• Analog input 1 and 3: both voltage											
Analog input 2 and 4: both current											
• Analog input 1 to 4: all voltage											
• Analog input 1 to 4: all current											
• Analog input 1 and 2: both voltage											
Analog input 3 and 4: both current											
• Analog input 1 and 2: both current											
Analog input 3 and 4: both voltage											
Basic controller without HART											
• Analog input 1 and 2: 10-bit resolution											
Basic controller with HART											
• Analog input 1 and 2: 10-bit resolution											
• Analog input 3: 16-bit resolution											
Enhanced controller											
• Analog input 1 and 2: 10-bit resolution											
• Analog input 3 and 4: 16-bit resolution											
Option fieldbus:											
• without fieldbus											
• with Profibus DP											
• with CANopen											
• with J1939											
• with HART											
Design-index (Subject to change)											

**ELECTRICAL SPECIFICATIONS**

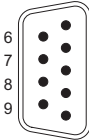
Protection class	IP 30 according to EN 60 529	Fieldbus (option)	
Supply voltage	24 VDC or 12 VDC	• Device receptacle	DSUB, 9-pole, CANopen, J1939, Profibus
Voltage range:		• Screw terminals	HART
• 24 VDC	21...30 V	• Bus topology	Line, differential signal transmission
• 12 VDC	10,5...15 V	• Potential separation	500 VDC
Residual ripple	<10 %		
Fuse	Low		
Current consumption:		Solenoid current:	
• No-load current	approx. 40 mA	• Minimal current $I_{min}$	Adjustable 0...950 mA Factory setting 150 mA
• Maximum current consumption	No-load current + 1,8 A per solenoid (with 24 VDC) Consumption no-load current + 2,3 A per solenoid (with 12 VDC)	• Maximal current $I_{max}$	Adjustable $I_{min}...1,8 A$ (with 24 VDC) $I_{min}...2,3 A$ (with 12 VDC) Factory setting 700 mA
Command value signal:	Selectable by means of software Input 1 and 2 and 4 (option): Differential input not galvanically separated, for ground potential difference up to 1,5 V 4...+20 mA/0...+20 mA 0...+10 V (1- or 2-solenoid version) -10...+10 V (2-solenoid version only) Input 3 (option): Galvanically separated for HART signal	• Accumulated current limitation	The accumulated current of the simultaneously controlled solenoids depends on the ambient temperature. Further information can be found in the Operating instructions. Frequency adjustable 2...500 Hz Factory setting 100 Hz Level adjustable 0...400 mA Factory setting 100 mA
Resolution	10-bit (for analog inputs 1 and 2) 16-bit (for analog inputs 3 and 4)	Dither	Temperature drift <1 % at $\Delta T = 40 ^\circ C$
Input resistance	Voltage input >18 k $\Omega$	Digital inputs	Switching threshold high 6...30 VDC Switching threshold low 0...1 VDC Digital input 5 – 7 can be used as frequency input (frequencies 0...5 kHz) and as PWM input (automatic frequency recognition)
Measuring system input	Load for current input = 250 $\Omega$ DSUB plug coupling 9-pole (female) to front panel according to RS422 standard selectable by software - Absolutely via Start/Stop - Absolutely via SSI (1... 32 bit, gray or binary)	Digital outputs	Low-Side-Switch: $U_{max} = 40 VDC$ $I_{max} = -700 mA$ 0...500 s
Analog output	Enhanced controller: Voltage output $\pm 10 VDC$ Max. output current $\pm 3 mA$ Enhanced controller with HART: Current output 0...20 mA Max. output voltage 12 VDC	Ramps adjustable	Serial interface
Stabilised output voltage	10 VDC (with 24 VDC) 8 VDC (with 12 VDC) Max. load 30 mA	EMV	USB (plug type B) for parameterising with «PASO»
		Immunity	EN 61 000-6-2
		Emission	EN 61 000-6-4

**DIMENSIONS**


**CONNECTOR WIRING DIAGRAM / PIN ASSIGNMENT**
**USB-interface, USB Type B X2**


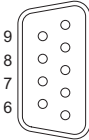
- 1 = VBUS
- 2 = D-
- 3 = D+
- 4 = GND

The parameterisation cable is not included in the delivery (commercially available USB cable, plug type A to plug type B)

**Device receptacle CANopen, J1939 (male) X4 (option)**


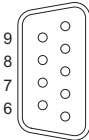
- 1 = Reserved
- 2 = CANLow
- 3 = CANGnd
- 4 = Reserved
- 5 = CANShield
- 6 = Reserved
- 7 = CANHigh
- 8 = Reserved
- 9 = Reserved

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

**Device receptacle Profibus (female) X4 (option)**


- 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.

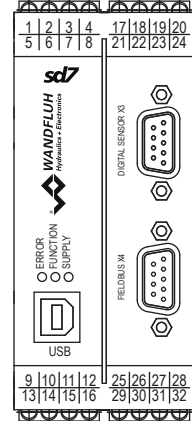
**Device receptacle Sensor (female) X3**


- 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-pole) is not included in the delivery.

**Basic controller**

- 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 = Analog ground
- 9 = Analog input 1+
- 10 = Analog input 1-
- 11 = Analog input 2+
- 12 = Analog input 2-
- 13 = Output solenoid driver 2 +
- 14 = Output solenoid driver 2 -
- 15 = Output solenoid driver 1 +
- 16 = Output solenoid driver 1 -
- 21 = HART (option) Analog input 3 +
- 22 = HART (option) Analog input 3 -

**PIN assignment X1**

**Additional Enhanced controller**

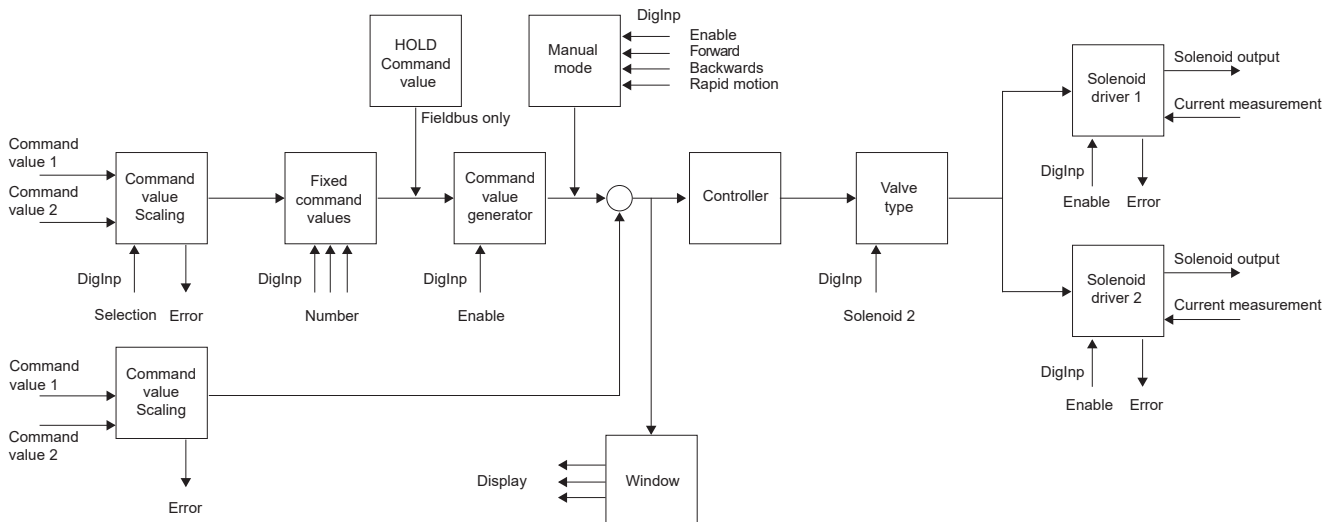
- 17 = Digital input 3
- 18 = Digital input 4
- 19 = Digital input 5
- 20 = Digital input 6
- 21 = Digital input 7
- 22 = Digital input 8
- 23 = Digital output 3
- 24 = Digital output 4
- 25 = Analog input 3 +
- 26 = Analog input 3 -
- 27 = Analog input 4 +
- 28 = Analog input 4 -
- 29 = Digital ground
- 30 = Analog ground
- 31 = Stabilised output voltage
- 32 = Analog output

**Enhanced controller with HART**

- 17 = Analog output +
- 18 = Analog output -
- 19 = Digital input 3
- 20 = Digital input 4
- 21 = Analog input 3 + HART
- 22 = Analog input 3 - HART
- 23 = Analog input 4 +
- 24 = Analog input 4 -

**FUNCTION DESCRIPTION**

The controller module can be parameterised by means of the parameterisation software «PASO» through the USB-interface. In addition, the parameterisation software makes a data analysis possible.



**CONTROLLER MODULE SD7**
**Command value scaling**

The command value can be applied via the fieldbus or as a voltage, current, digital, frequency or PWM signal. The input used can be selected for each command value. The scaling is carried out via the «Interface» and «Reference» parameters. Furthermore, each command value can be monitored for cable break (except HART, voltage and digital signal). For every command value, a dead band can also be set. Optionally one can operate with two command values. The characteristic of these command values can be adjusted.

**Profiles/Fixed command values (Enhanced controller only)**

There are 7 fixed command values available, which can be selected via 3 digital inputs. Optionally, travel profiles can also be used. The SD7 controller module is able to store and to travel whole travel profiles, which have been previously generated by the user in the profile generator. A travel profile consists of the following data:

- Target position (target or end position of the sequence)
- Speed (of the travel)
- Acceleration (to reach the speed)
- Deceleration (starting from the speed)
- Stop time (after reaching the end position of the sequence)
- Setting of a digital output when reaching the end position of the sequence
- Adjust whether the command value or the feedback value for the end of the sequence is to be queried

**Command value generator**

In the open-loop controller modes, there are two linear ramps for up and down per solenoid output available, which can be adjusted separately. In the closed-loop controller modes, there is a positive and a negative travel speed available.

**HOLD command value (option Fieldbus only)**

If via fieldbus the device is put into the «HOLD» state, the respective command value is activated.

**Feedback value scaling**

The feedback value can be applied via HART or as voltage, current, frequency or PWM signal. For the feedback value, the input used can be selected. The scaling is carried out via the «Interface» and «Reference» parameters. In addition, the feedback value can be monitored for cable break (except HART and voltage signal).

**Manual operation (Enhanced controller only)**

The commands Enable, Forward, Reverse and Fast speed are available. This makes it possible to move the cylinders through a superimposed control without specifying a command value.

**Window**

A target, tracking error and solenoid stop window is available. The threshold and delay time can be set for each window.

**Controller**

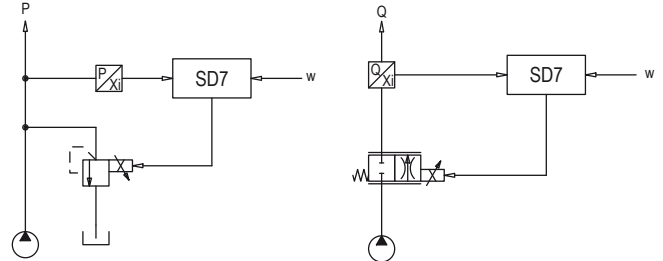
The SD7 controller module has a controller circuit. This is built up as PID controller. The following controller modes can be selected:

**Controller mode «Pressure/flow valve control»**

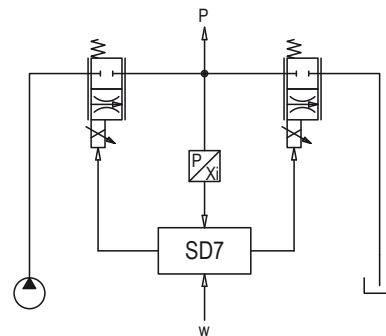
Control of a pressure relief, pressure reducing, throttle or flow control valve in open control circuit (without feedback value signal). The number of solenoids controlled depends on the selected operating mode of operation.

**Controller mode «Pressure/flow valve control (1-sol)»**

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


**Controller mode «Pressure control (2-sol)»**

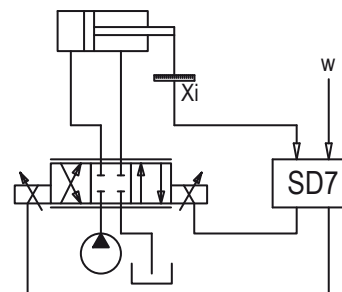
Control of two 1 solenoid throttle valves in closed control circuit (with feedback value signal) as pressure control. The one throttle valve serves as a loading valve and the other as an unloading valve. The loading valve corresponds to the solenoid driver 1, the unloading valve corresponds to the solenoid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


**Controller mode «Axis position controlled»**

Control of a spool valve in open control circuit (without feedback value signal). The number of solenoids controlled depends on the selected mode of operation.

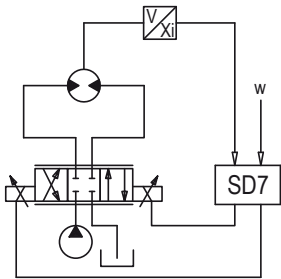
**Controller mode «Axis position controlled (2-sol)»**

Control of a 2-solenoid spool valve in closed control circuit (with feedback value signal). Two solenoids can be controlled with it.

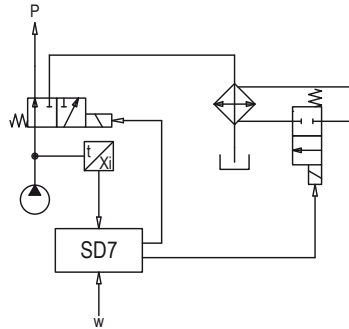


**Controller mode «Speed control (2-sol)»**

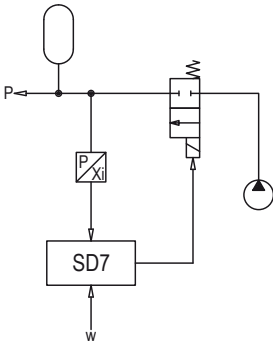
Control of a 2-solenoid spool, throttle or flow control valve in closed control circuit (with feedback value signal). Two solenoids can be controlled with it.


**Controller mode «2-point controller (2-sol)»**

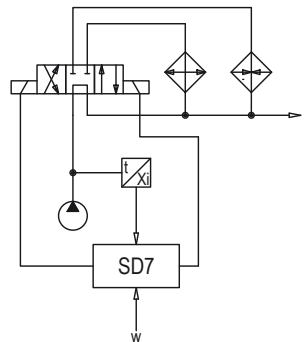
Control of a 2-solenoid valve with switching solenoid or of two 1 solenoid valves with switching solenoid in closed control circuit (with feedback value signal). Two solenoids can be controlled with it.


**Controller mode «2-point controller (1-sol)»**

Control of a 1-solenoid valve with switching solenoid in closed control circuit (with feedback value signal). Only one solenoid can be controlled with it (corresponds to the solenoid driver 1).


**Controller mode «3-point controller (2-sol)»**

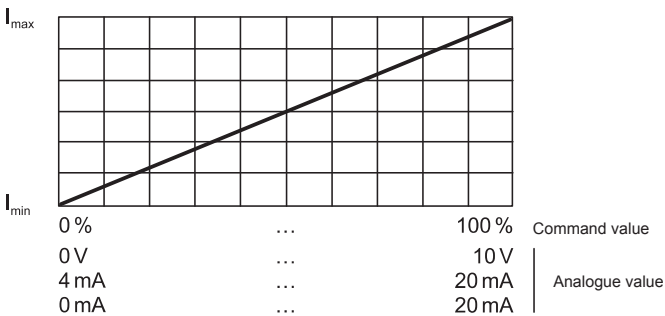
Control of a 2-solenoid valve with switching solenoid or of two 1-solenoid valves with switching solenoid in closed control circuit (with feedback value signal). Two solenoids can be controlled with it.


**Valve type**

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

**Solenoid driver**

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



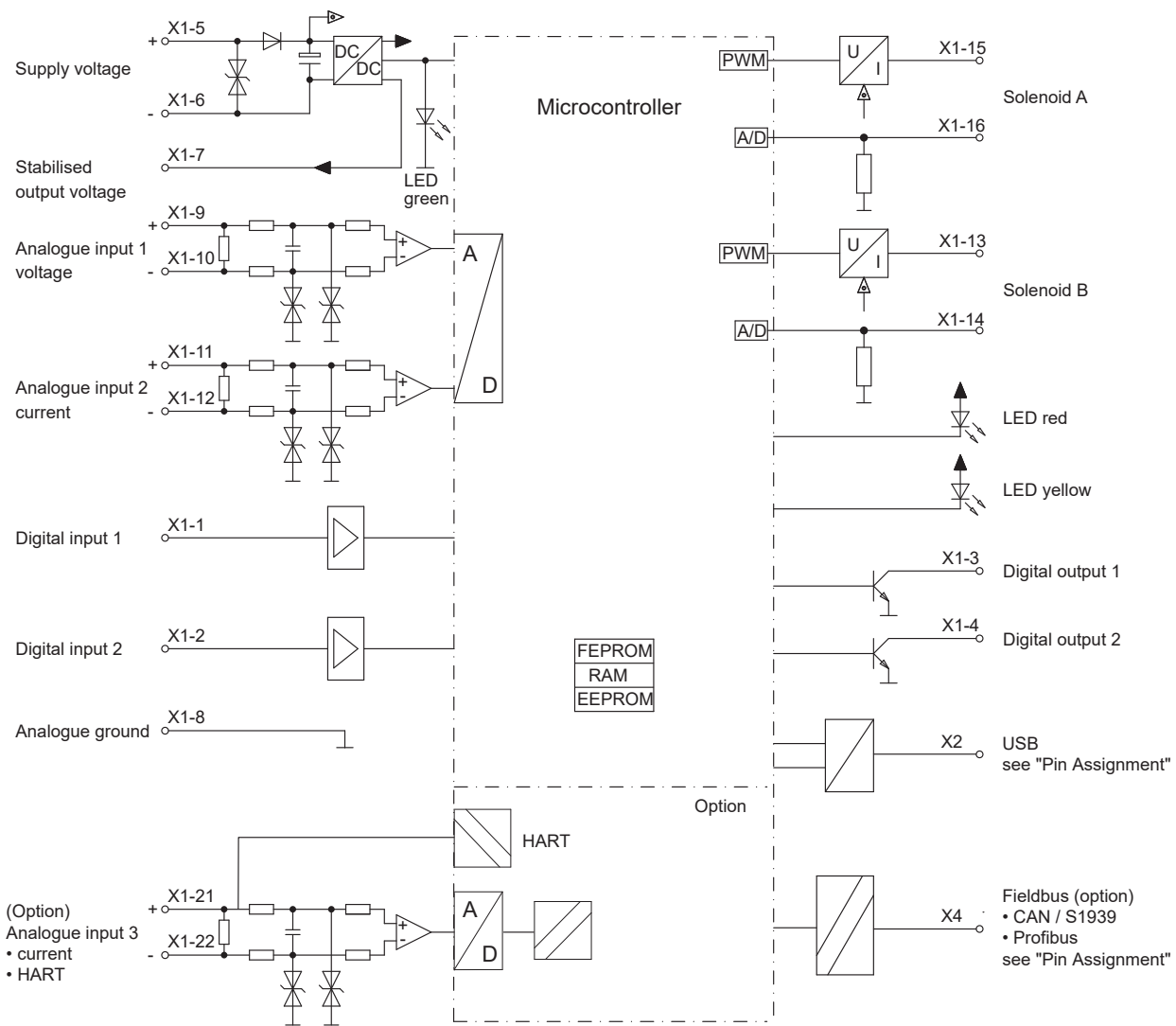
Changing over between the two solenoids by means of the selected digital input

**Signal recording**

The SD7 controller module has a signal recording function. This, by means of PASO, enables the recording of various system signals, such as command value, solenoid currents, etc., which can be represented on a common time axis.

**Optimisation of characteristic curve**

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

**BLOCK DIAGRAM BASIC CONTROLLER CONTROLLER**

**Configuration Analogue inputs Basic controller**

Type designation	Analog input 1	Analog input 2
SD7332Dx0-Ax	Voltage	Current
SD7332Dx1-Ax	Voltage	Voltage*
SD7332Dx2-Ax	Current	Current

\* x = P only 0...10VDC possible

**Configuration Analogue inputs Enhanced controller**

Type designation	Analog inputs			
	Nr. 1	Nr. 2	Nr. 3	Nr. 4
SD7362Dx4-Bx	Voltage	Current	Voltage	Current
SD7362Dx5-Bx	Voltage	Voltage*	Voltage	Voltage
SD7362Dx6-Bx	Current	Current	Current	Current
SD7362Dx7-Bx	Voltage	Voltage*	Current	Current
SD7362Dx8-Bx	Current	Current	Voltage	Voltage

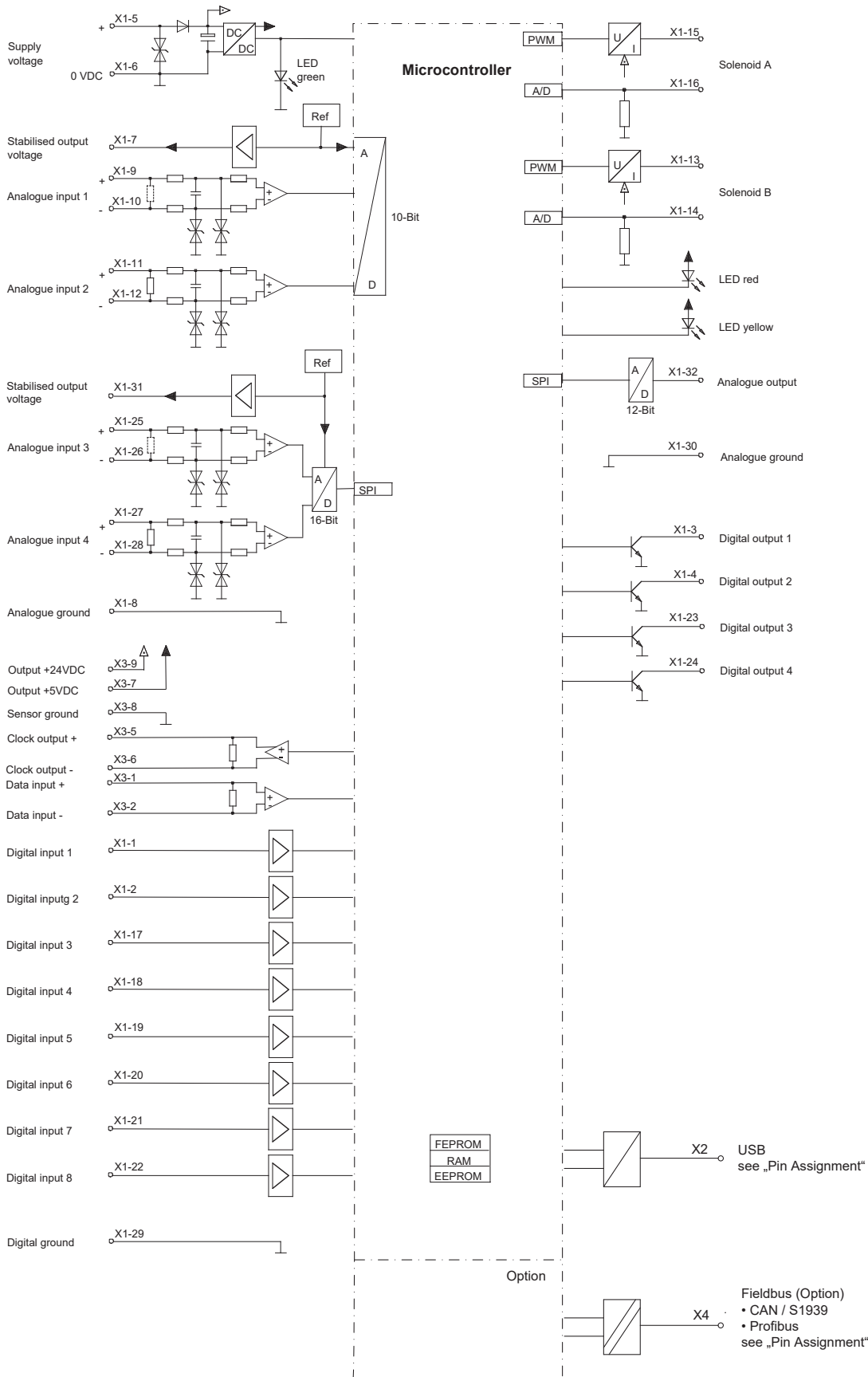
**Configuration Analogue inputs Basic controller HART**

Type designation	Analog inputs		
	Nr. 1	Nr. 2	Nr. 3
SD7332Dx0-BH	Voltage	Current	Current
SD7332Dx1-BH	Voltage	Voltage	Current
SD7332Dx2-BH	Current	Current	Current

**Configuration Analogue inputs Enhanced controller HART**

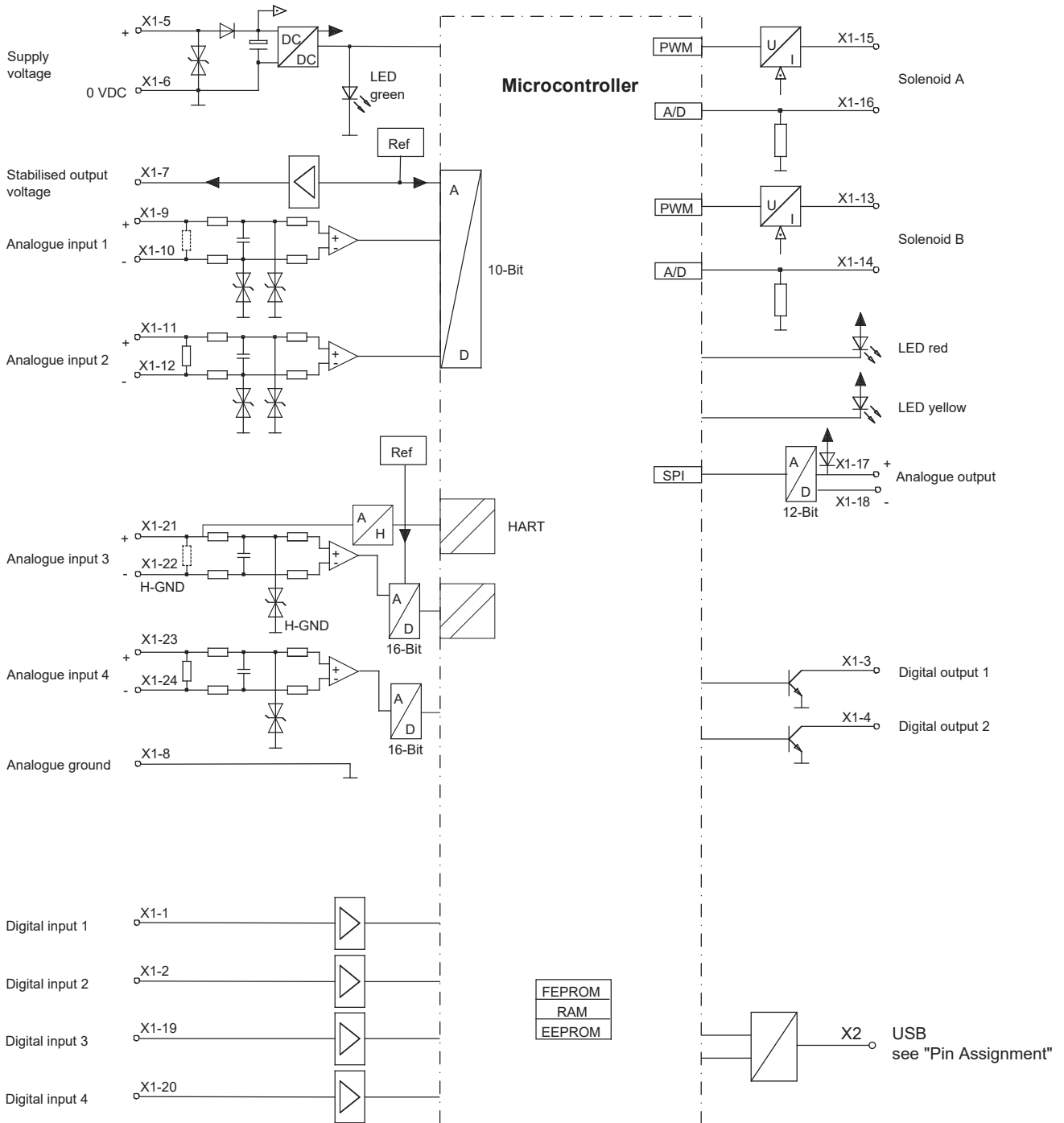
Type designation	Analog inputs			
	Nr. 1	Nr. 2	Nr. 3	Nr. 4
SD7362Dx4-BH	Voltage	Current	Current	Current
SD7362Dx5-BH	Voltage	Voltage	Current	Voltage
SD7362Dx6-BH	Current	Current	Current	Current
SD7362Dx7-BH	Voltage	Voltage	Current	Current
SD7362Dx8-BH	Current	Current	Current	Voltage

**BLOCK DIAGRAM ENHANCED CONTROLLER**



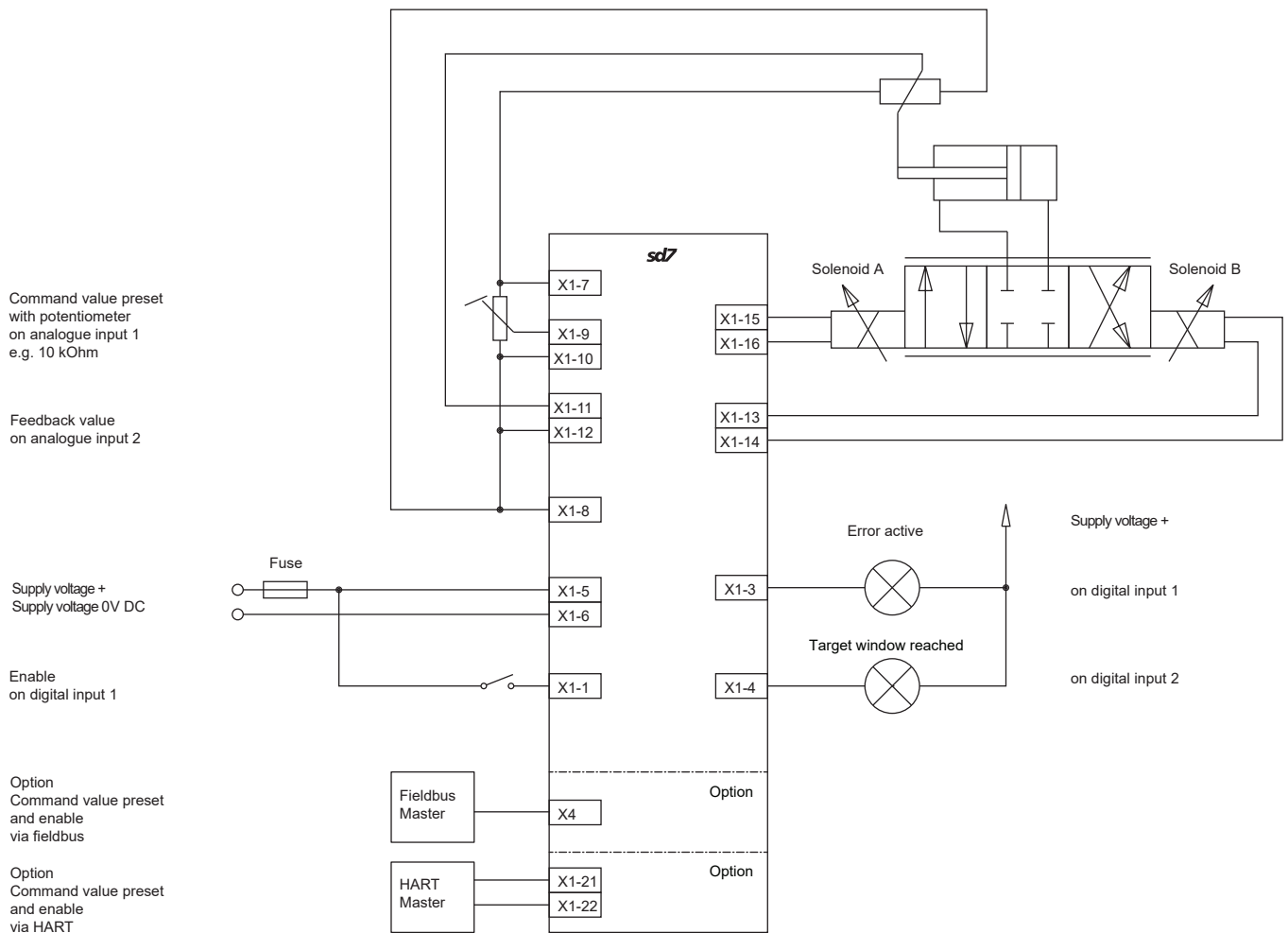


**BLOCK DIAGRAM ENHANCED CONTROLLER WITH HART**



**CONNECTION EXAMPLE**

Position control (command value and feedback value as voltage signal)



**CONNECTION EXAMPLE**

Position control (command value - voltage signal, feedback value via digital sensor)

