## 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)
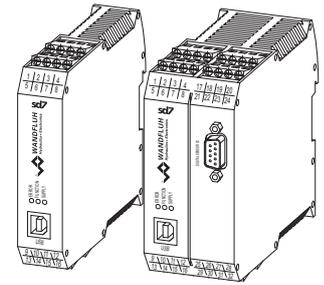
DESCRIPTION

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 mm²
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:

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

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TYPE CODE

```
                                        S  D7  3  □  2  □□  □  -  □  □  #  □
```

Control cubicle	
Digital	
Adjustable with PASO	
Software configuration (function of card):	
• Basic controller	3
• Enhanced controller	6
2-solenoid version	
Supply voltage: 24 VDC	D2
12 VDC	D3

Basic controller:
• Analog input 1: voltage   `0`
                  2: current
• Analog input 1 and 2: both voltage   `1`
• Analog input 1 and 2: both current   `2`

   Analog input 3: always current (with HART only)

Enhanced controller:
• Analog input 1 and 3: both voltage   `4`
   Analog input 2 and 4: both current
• Analog input 1 to 4: all voltage   `5`
• Analog input 1 to 4: all current   `6`
• Analog input 1 and 2: both voltage   `7`
   Analog input 3 and 4: both current
• Analog input 1 and 2: both current   `8`
   Analog input 3 and 4: both voltage

• Analog input 3 and 4: always current (with HART only)

Basic controller without HART
• Analog input 1 and 2: 10-bit resolution   `A`

Basic controller with HART
• Analog input 1 and 2: 10-bit resolution   `B`
• Analog input 3: 16-bit resolution

Enhanced controller
• Analog input 1 and 2: 10-bit resolution   `B`
• Analog input 3 and 4: 16-bit resolution

Option fieldbus:
• without fieldbus   `A`
• with Profibus DP   `P`
• with CANopen   `C`
• with J1939   `J`
• with HART   `H`

Design-index (Subject to change)

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ELECTRICAL SPECIFICATIONS

Protection class	IP 30 according to EN 60 529
Supply voltage	24 VDC or 12 VDC
Voltage range:	
• 24 VDC	21…30 V
• 12 VDC	10,5…15 V
Residual ripple	<10 %
Fuse	Low
Current consumption:	
• No-load current	approx. 40 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)
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
Resolution	10-bit (for analog inputs 1 and 2) 16-bit (for analog inputs 3 and 4)
Input resistance	Voltage input >18 kΩ Load for current input = 250 Ω
Measuring system input	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)
Analog output	Enhanced controller: Voltage output ± 10 VDC Max. output current ± 3 mA Enhanced controller with HART: Current output 0...20 mA Max. output voltage 12 VDC
Stabilised output voltage	10 VDC (with 24 VDC) 8 VDC (with 12 VDC) Max. load 30 mA

Fieldbus (option)	
• Device receptacle	DSUB, 9-pole, CANopen, J1939, Profibus
• Screw terminals	HART
• Bus topology	Line, differential signal transmission
• Potential separation	500 VDC
Solenoid current:	
• Minimal current I_{min}	Adjustable 0…950 mA Factory setting 150 mA
• 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
• 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.
Dither	Frequency adjustable 2…500 Hz Factory setting 100 Hz Level adjustable 0…400 mA Factory setting 100 mA
Temperature drift	<1 % at ΔT = 40 °C
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)
Digital outputs	Low-Side-Switch: U_{max} = 40 VDC I_{max} = -700 mA
Ramps adjustable	0…500 s
Serial interface	USB (plug type B) for parameterising with «PASO»
EMV	
Immunity	EN 61 000-6-2
Emission	EN 61 000-6-4

DIMENSIONS

- Basic controller Analog

- Basic controller fieldbus
- Enhanced controller

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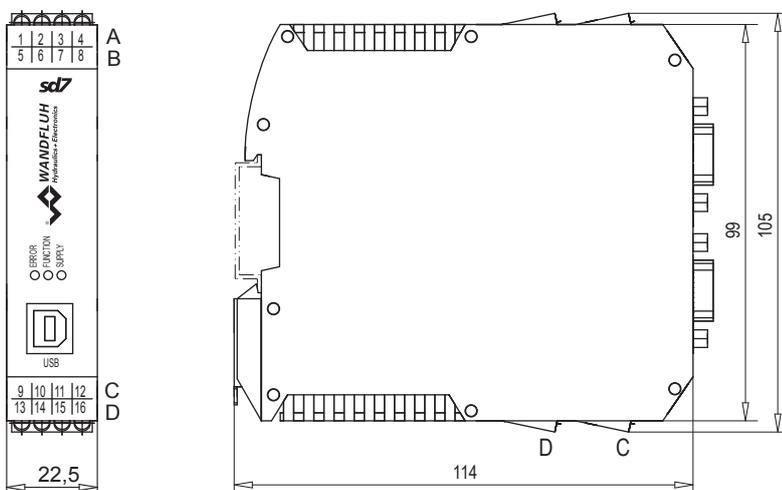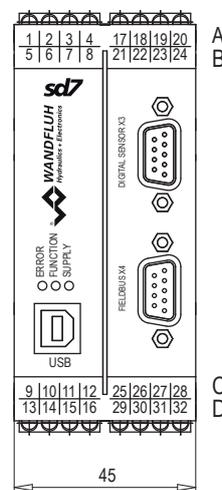
CONNECTOR WIRING DIAGRAM / PIN ASSIGNMENT

USB-interface, USB Type B X2
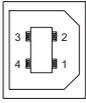
1 = VBUS
2 = D-
3 = D+
4 = GND

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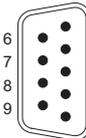
1 = Reserved   6 = Reserved
2 = CANLow   7 = CANHigh
3 = CANGnd   8 = Reserved
4 = Reserved   9 = Reserved
5 = CANShield

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

Device receptacle Profibus (female) X4 (option)
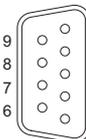
1 = Reserved   6 = VP
2 = Reserved   7 = Reserved
3 = RxD / TxD - P   8 = RxD / TxD - N
4 = Reserved   9 = Reserved
5 = DGND

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

Device receptacle Sensor (female) X3 (Enhanced only without HART)
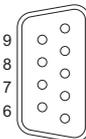
1 = Digital input +   6 = Clock output -
2 = Digital input –   7 = Output +5VDC
3 = Reserved   8 = Sensor ground
4 = Reserved   9 = Output +24VDC
5 = Clock output +

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 -

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 -

- Basis controller Analog
- Basis controller fieldbus
- Enhanced controller

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.

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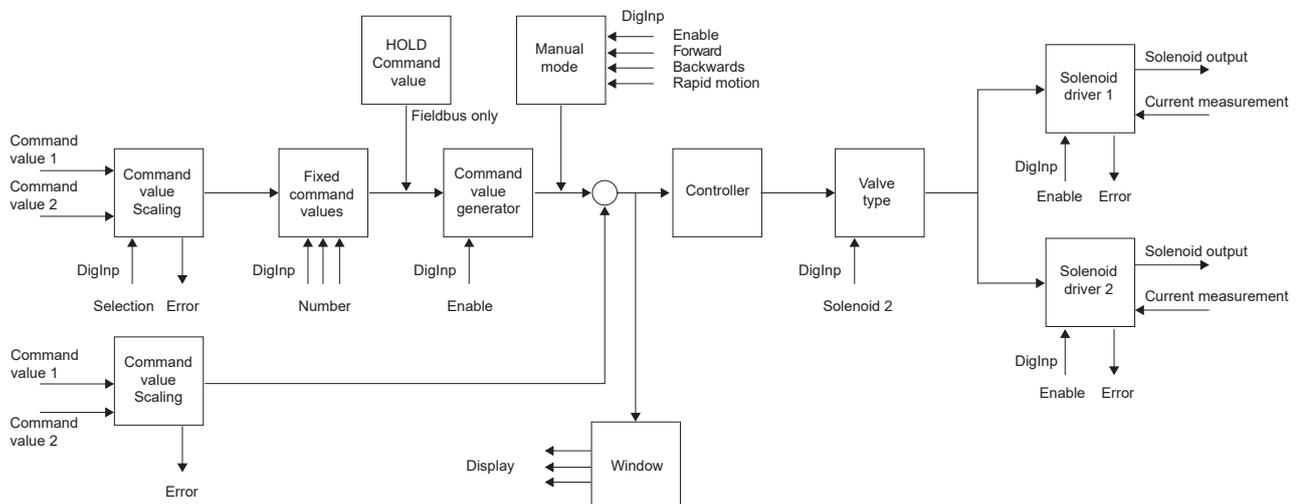
CONTROLLER MODULE SD7

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 are 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).
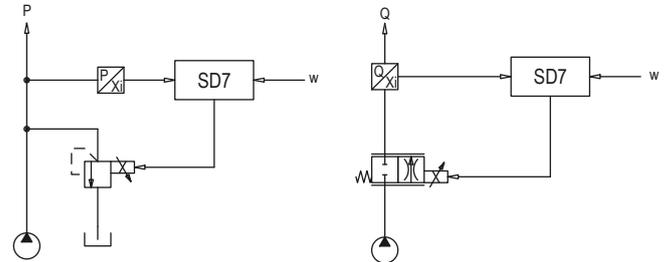
Controller mode «Pressure control (2-sol)»

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.
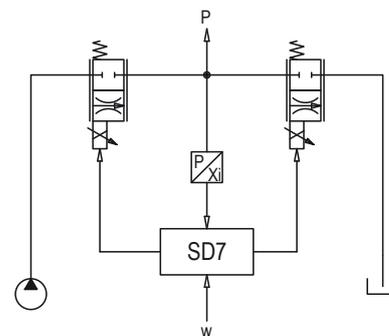

Controller mode «Axis position controlled»

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.

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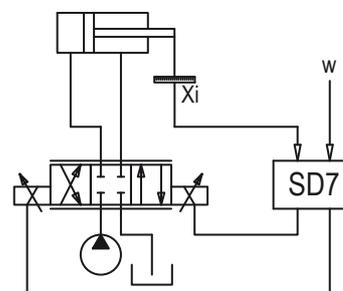
Controller mode «Speed control (2-sol)»
Control of a 2-solenoid spool, throttle or flow control valve in closed control circuit (with feedback value signal). Two solenoids can be controlled with it.
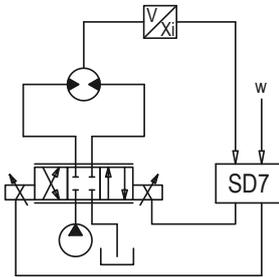
Controller mode «2-point controller (2-sol)»
Control of a 2-solenoid valve with switching solenoid or of two 1 solenoid valves with switching solenoid in closed control circuit (with feedback value signal). Two solenoids can be controlled with it.
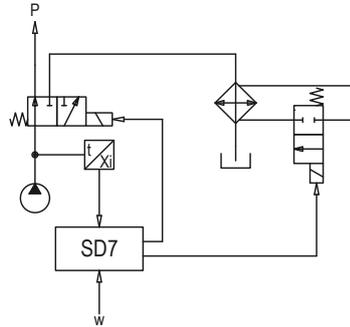
Controller mode «2-point controller (1-sol)»
Control of a 1-solenoid valve with switching solenoid in closed control circuit (with feedback value signal). Only one solenoid can be controlled with it (corresponds to the solenoid driver 1).
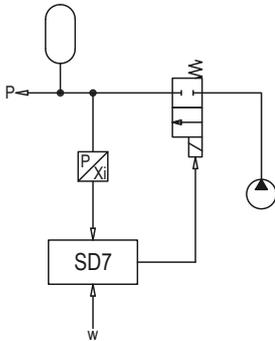
Controller mode «3-point controller (2-sol)»
Control of a 2-solenoid valve with switching solenoid or of two 1-solenoid valves with switching solenoid in closed control circuit (with feedback value signal). Two solenoids can be controlled with it.
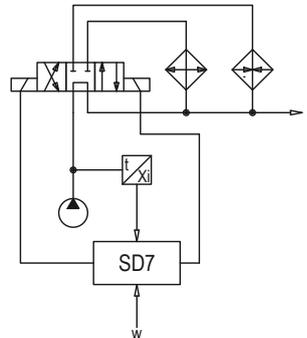
Valve type
The operating mode is set here for the open loop controller modes. It is also possible to select whether proportional or switching solenoids are to be controlled.

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 (Imin) and maximum (Imax) current can be adjusted separately. The solenoid outputs can also be configured as switching outputs. Therewith for each output a power reduction can be adjusted separately.

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.

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

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

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BLOCK DIAGRAM BASIC CONTROLLER CONTROLLER
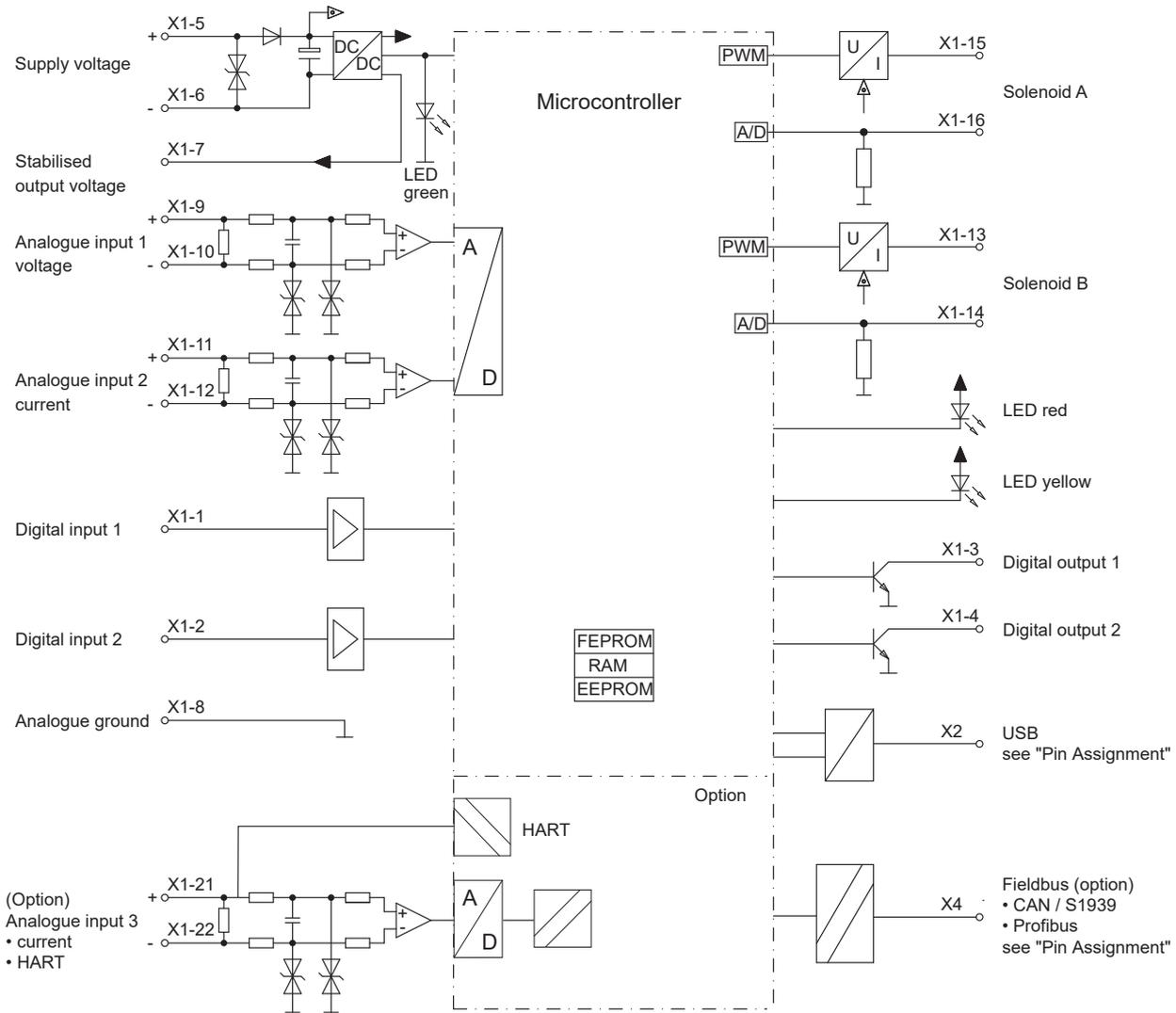
Configuration Analogue inputs Basic controller

Type designation	Analog input 1	Analog input 2
SD7332Dx**0**-Ax	Voltage	Current
SD7332Dx**1**-Ax	Voltage	Voltage*
SD7332Dx**2**-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
SD7362Dx**4**-Bx	Voltage	Current	Voltage	Current
SD7362Dx**5**-Bx	Voltage	Voltage*	Voltage	Voltage
SD7362Dx**6**-Bx	Current	Current	Current	Current
SD7362Dx**7**-Bx	Voltage	Voltage*	Current	Current
SD7362Dx**8**-Bx	Current	Current	Voltage	Voltage

Configuration Analogue inputs Basic controller HART

Type designation	Analog inputs		
	Nr. 1	Nr. 2	Nr. 3
SD7332Dx**0**-BH	Voltage	Current	Current
SD7332Dx**1**-BH	Voltage	Voltage	Current
SD7332Dx**2**-BH	Current	Current	Current

Configuration Analogue inputs Enhanced controller HART

Type designation	Analog inputs			
	Nr. 1	Nr. 2	Nr. 3	Nr. 4
SD7362Dx**4**-BH	Voltage	Current	Current	Current
SD7362Dx**6**-BH	Current	Current	Current	Current
SD7362Dx**7**-BH	Voltage	Voltage	Current	Current
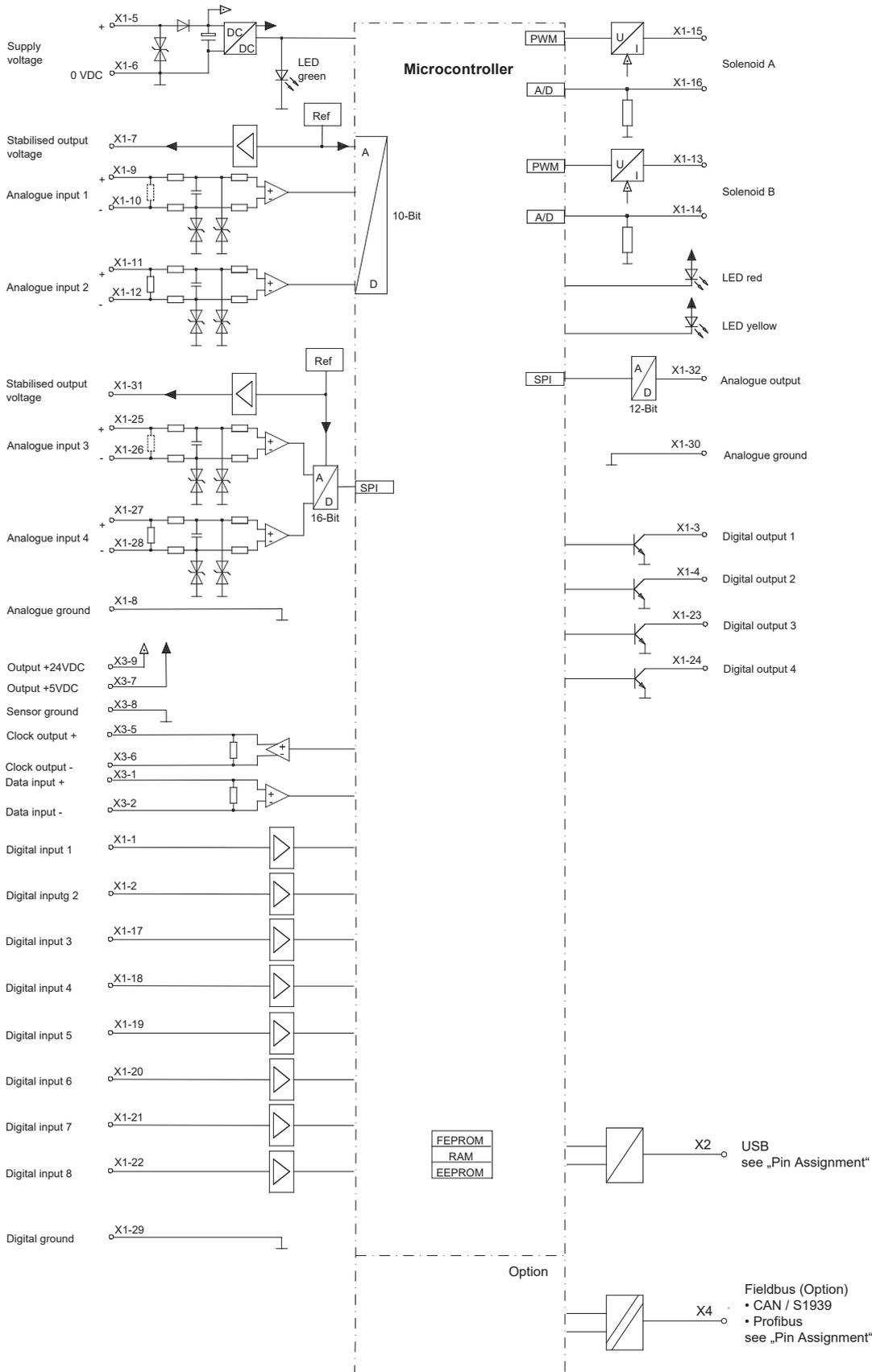
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BLOCK DIAGRAM ENHANCED CONTROLLER

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BLOCK DIAGRAM ENHANCED CONTROLLER WITH HART

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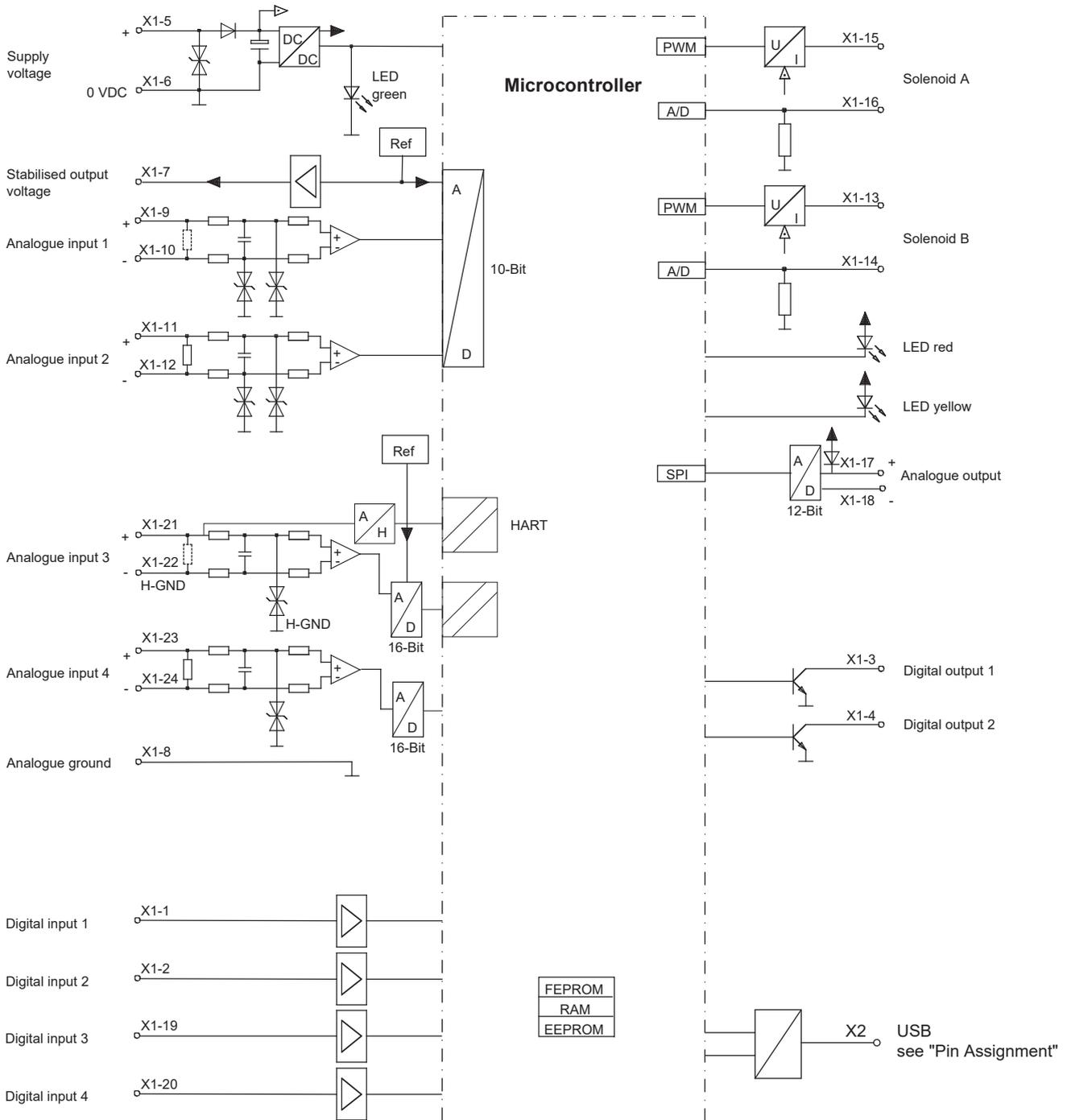
CONNECTION EXAMPLE

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

Command value preset
with potentiometer
on analogue input 1
e.g. 10 kOhm

	X1-7
	X1-9
	X1-10

Feedback value
on analogue input 2

| | X1-11 |
| | X1-12 |

| | X1-8 |

Supply voltage +
Supply voltage 0V DC

Fuse

| | X1-5 |
| | X1-6 |

Enable
on digital input 1

| | X1-1 |

Option
Command value preset
and enable
via fieldbus

Fieldbus Master — X4

Option
Command value preset
and enable
via HART

HART Master — X1-21 / X1-22

Solenoid A / Solenoid B
X1-15, X1-16, X1-13, X1-14

Error active — X1-3 — on digital input 1
Target window reached — X1-4 — on digital input 2
Supply voltage +

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CONNECTION EXAMPLE

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

Feedback value
at sensor input x3

Command value preset
with potentiometer
at analogue input 1

Enable
at ditigal input 1

Supply voltage +
Supply voltage 0V DC

Option
Command value preset
and enable
via fieldbus

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