

**THE (A)DVANCED
ART OF CONTROL
NEXT GENERATION**

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**NEW UPGRADED
VERSION!**

Universal Digital Module Amplifier
for DIN Mounting Rail (Top-Hat Rail)

DMA-22(A)-01/02

VERSIONS FOR OPEN LOOP APPLICATIONS

- Amplifier module for 1 or 2 proportional valves without feedback
- High performance 32 bit floating point CPU
- Superfast cycle time --> best dynamic behavior
- Supply voltage range nom. 10 - 32 V DC
- Operating temperature range - 40° C - + 70° C
- Very wide range of output currents and also servo valve versions available
- Analog inputs U/I selectable (16 bit resolution)
- USB-C interface for easy usage / operation by means of **HCSTool** - w. 4-channel oscilloscope
- Version with individually controllable output stages by 2 independent analog inputs available
- Optional bus interface (PROFIBUS, PROFINET, ETHER-NET/IP, CANopen; multi module configurations)
- Adaptation possible to all kinds and makes of proportional valves
- Full digital PI current controller for both output stages
- Universal usage for hydraulic, pneumatic and other applications
- **NEW:** On/Off Version --> significant **energy savings** with switching valves or usable for quick switching functions!



**PROFI[®]
BUS**

**PROFI[®]
NET**

1 Applications and usage

Amplifier and controller boards series DMA-22(A) are used for:

- Control of proportional valves of all kinds (only without feedback): proportional directional (direct and pilot operated), flow control, pressure limiting and pressure reduction valves, cartridge and servo valves
- Optional D/A-converter with 1 analog output to enable subsequent electronic devices and monitoring (0 ... ± 10 V 12 bit resolution) also for ease of commissioning and trouble shooting (monitor signal for internal values)

2 Features

- Fully digitized amplifier module
- All adjustments and parameter setting possible by means of USB-C interface and HCSTool --> no on-board potentiometers or jumpers
- Flexible and reliable system; use of a modern high performance 32-bit floating-point CPU
- Power supply for parameter setting and software update possible by means of USB-C interface
- Flexibility due to possible hardware and software extensions and options for customer and application specific requirements (e.g. bus interface, special output stages, etc.)
- Variable settings for all kinds of solenoid systems and also for servo valves depending on hardware version. Very wide output current range:
 - Servo valve version: 20 - 550 mA
 - Proportional valve version: 800 - 3500 mA
- Change of selected parameters "on-the-fly" without interference or interruption of function; monitoring of display values and visualization of dynamic processes with 4-channel oscilloscope by means of [HCSTool](#)
- Very high resolution and accuracy for analogue set points due to a 16-bit A/D-converter

NEU!

Version for applications with On/Off valves

Controlling on&off valves with the full performance and monitoring features of a fully digital amplifier unit.

Outstanding features:

Dramatic reduction of holding current after switching ensures significant energy savings. Simultaneously, reduced heat generation at the solenoid, in the machine, and in the control cabinet. Reduction of size for power supply possible!

Some major advantages:

- Full digital control of output currents with safety monitoring (short & open circuit detection, over current protection)
- Max. current adjustable between 0.8 A and 3.5 A
- Peak and constant current can be defined independently
- Transition between peak and constant current adjustable
- Pre-energization adjustable
- Universal usable for 1 valve with two coils or two valves with one coil each
- Also applicable for fast switching function
- **Can be combined with all HCS Bus interfaces**
--> **PROFIBUS, PROFINET, ETHERNET/IP, CANopen**
for full control and monitoring possibilities.

On/Off valves energy saving and IOT capable!

Or for fast switching function!

3 New generation „DMA-22(A)“ replacing DMA-22

The predecessor board „DMA-22“ (more than 45,000 devices are being used world wide), which has been used very successfully to date, with all kinds of variants and versions, will be fully replaced by the new generation. Naming of the new generation remains the same, except for the suffix (A). The new version is thus called "DMA-22(A)".

Key target points for introduction of the successor generation are:

- Provide a basically 100% function and pin-compatible successor
- Ensure availability for the next decade to come
- Extend general functionality
- Improve functionality for all analog inputs
- Boost performance to a significant higher level
- Advanced computational power due to usage of 32 bit floating point CPU
- 6-fold increased resolution for analog inputs (16 bit vs 12 bit for the A/D converter)
- Extended temperature range from - 40° C to + 70° C
- Introduction of an USB-C interface instead of RS232

4 Technical data

Feature	Range, characteristics
Model	Modular digital amplifier in snap-on mounting technology
Supply voltage	10 V DC - 32 V DC; residual ripple < 10 % ^{*1}
Duty cycle	100 %
Preliminary fuse	3.15 A; quick blowing
Ambiant operating temperature	- 40 °C ... + 70 °C
Storage temperature	- 45 °C ... + 85 °C
Humidity (relative air humidity)	max. 95 % non condensing
Max. elevation	2,000 m (mamsl)
Class of protection	IP20 (EN60529)
EMC	In accordance with the applicable industrial standards (CE - conformity) ^{*2}
Connection, type of connector	16 pole (4 x 4); screw terminals for 0.2 - 2.5 mm ² (AWG 24 -12) Phoenix Combicon connector with screw terminals, type: MSTBT 2,5/ 4-ST for detailed technical data refer to Phoenix Contact Combicon Product Catalog
Cable specification	1.5 mm ² (AWG16) for supply and solenoids, shielding recommended, max length: 50 m 0.5 mm ² (AWG20) for analog and digital signals, shielding mandatory, max length: 50 m
Mounting/housing	Mounting: top-hat rail (mounting rail) in accord. with EN50022 with integrated PE contact Housing configuration: ventilated (IP20) Material: PA 66 - FR (blue); flammability in accordance with UL94V0 Dimensions approx.: (w x h x d) 22,5 x 100 x 114 mm Weight: approx. 0.13 kg (including mating connectors)
Mounting position	Any; preferably vertical for better heat dissipation through convection
Analog inputs	2 inputs with 16 Bit resolution (differential; 0 ... +-10 V, 0 / 4 ... 20 mA)
Digital inputs	Mode 1: 5 inputs (S1.01, S1.02, S1.03, S1.04, ENABLE); Mode 2: 3 inputs (S1.01, S2.01, ENABLE)
Solenoid current (output)	2 PWM output stages, each for up to 3.5 A (with over-energ. and quick de-energization) Servo valves current ranges from 20 mA to 550 mA also available on request
Digital output	1 voltage output e.g. for signaling error, comparator status
Reference output (option)	+10 V output, e.g. for potentiometer application
Analog output (option)	1 output with 12 Bit resolution, 0 ... +-10 V, for monitoring or forwarding to other devices
Status signals	1 multi color „STATUS“ LED at front. Run/OK = green; Enable = yellow; Error = red
Interface	USB-C at front
Interface 2 (only one available per module) Versions with Bus-Interface only!	PROFIBUS-DP: RS485, Sub-D 9-pole female PROFINET (in/out): 2 x RJ45 (integrated switch) ETHERNET/IP: RJ45 CANopen: Sub-D 9-pole male  
Dither frequency range	1 ... 300 Hz - independant from PWM frequency (other frequency range on request)

*1: limitations for solenoid current may apply

*2: details on request

Remark:

all values nominal if not stated otherwise!

5 Detailed electrical data

Feature	Range, characteristics
Power consumption	1.2 VA, solenoid not energized 41 VA, one solenoid energized with 3,5 A 81 VA, both solenoids energized with 3,5 A
Solenoid output I _{out} PWM frequency Cycle time current controller	Rectangular voltage, pulse-modulated, with over-energization and quick de-energization Output stages are released on the hardware side by enable signal I _{max} = 4.5 A 22 kHz 45 µs
Analog input Voltage is selected Current is selected over current protection	U _{max} = + 28 V U _{min} = - 15 V Typ. R _{in} = 200 kΩ Differential Typ. R _{in} = 5 MΩ Input Fb1, Fb2 Typ. R _{in} = 255 Ω All inputs Typ. > 23 mA
Digital input Supply 10 V Supply 24 V Low level High level	U _{max} = +28 V Typ. I _{in} = 0.5 mA Typ. I _{in} = 1.1 mA U _{in} < 2.6 V U _{in} > 9.2 V
Digital Output Supply 24 V Supply 12 V	Protected at I _{outmax} typ. 40 mA Typ. U _{out} > 18 V @ I _{out} 2 mA Typ. U _{out} > 15 V @ I _{out} 10 mA, Protected at I _{outmax} typ. 20 mA Typ. U _{out} > 8 V @ I _{out} 2 mA Typ. U _{out} > 5 V @ I _{out} 10 mA
Analog output (option)	The analog output is released on the hardware side by the CPU - 10 V ... + 10 V, tol. ± 0.020 V
Reference output (option)	+ 10 V, tol. ± 0.1 V - 10 V, tol. ± 0.1 V I _{outmax} < 10 mA

6 Technical data for optional bus interfaces

Feature PROFIBUS	Range, characteristics
Supply voltage	Via DMA-22(A)
Temperature ranges, EMC, Mounting/housing	Refer to page 3
PROFIBUS-DP 	- Certified by PNO - Supports PROFIBUS-DP Slave in accordance with IEC 61158 - Supports PROFIBUS DPV1 - Maximum 244 Byte in-/output data - Supports up to 12 Mbaud (autodetect) - Electrical isolated and opto-decoupled
Connection / Type of connector	RS485, Sub-D 9-pole female
Status signals	LED „Buserror“ (red): DMA-22(A) error LED is used
Address selection	DIP switch 1- 8, each on/off

Feature PROFINET	Range, characteristics
Supply voltage	Via DMA-22(A)
Temperature ranges, EMC, Mounting/housing	Refer to page 3
PROFINET 	- Approved by PNO - Meets the standard IEC 61158 and IEC 61784 - LAN 10/100Base-T(X) - 2 x RJ-45 LAN (Daisy Chain) - Cycling data exchange RT and IRT with PROFINET IO-Controller - Sending and receiving of diagnostic - and process alarms - I&M0...4-data available - Supporting of PROFINET naming (device name) and TCP/IP addressing - Fast Startup functionality supported - Shared Device supported - Media Redundancy Protocol support. - Electrical isolated interface
Connection / Type of connector	In/Out: 2 x RJ45 (integrated switch)
Status signals	Power (green), Error (red), Maint (yellow), Sync (yellow), Status (yellow)
Future usage	DIP switch 1- 3, each on/off

Feature ETHERNET/IP	Range, characteristics
Supply voltage	Via DMA-22(A)
Temperature ranges, EMC, Mounting/housing	Refer to page 3
ETHERNET/IP	- Approved by PNO - Meets the standard IEC 61158 and IEC 61784 - LAN 10/100Base-T(X) - 2 x RJ-45 LAN (Daisy Chain) - Cycling data exchange RT and IRT with PROFINET IO-Controller - Sending and receiving of diagnostic - and process alarms - I&M0...4-data available - Supporting of PROFINET naming (device name) and TCP/IP addressing - Fast Startup functionality supported - Shared Device supported - Media Redundancy Protocol support. - Electrical isolated interface
Connection / Type of connector	In/Out: 2 x RJ45 (integrated switch)
Status signals	Power (green), Error (red), Maint (yellow), Sync (yellow), Status (yellow)
Future usage	DIP switch 1- 3, each on/off

Feature CANopen	Range, characteristics
Supply voltage	Via DMA-22(A)
Temperature ranges, EMC, Mounting/housing	Refer to page 3
CANopen	- Approved by PNO - Meets the standard IEC 61158 and IEC 61784 - LAN 10/100Base-T(X) - 2 x RJ-45 LAN (Daisy Chain) - Cycling data exchange RT and IRT with PROFINET IO-Controller - Sending and receiving of diagnostic - and process alarms - I&M0...4-data available - Supporting of PROFINET naming (device name) and TCP/IP addressing - Fast Startup functionality supported - Shared Device supported - Media Redundancy Protocol support. - Electrical isolated interface
Connection / Type of connector	In/Out: 2 x RJ45 (integrated switch)
Status signals	Power (green), Error (red), Maint (yellow), Sync (yellow), Status (yellow)
Future usage	DIP switch 1- 3, each on/off

7 Block diagram hardware

Diagram for version: DMA(A)-22-02-xxx-SOnOff; Operation Mode: 02

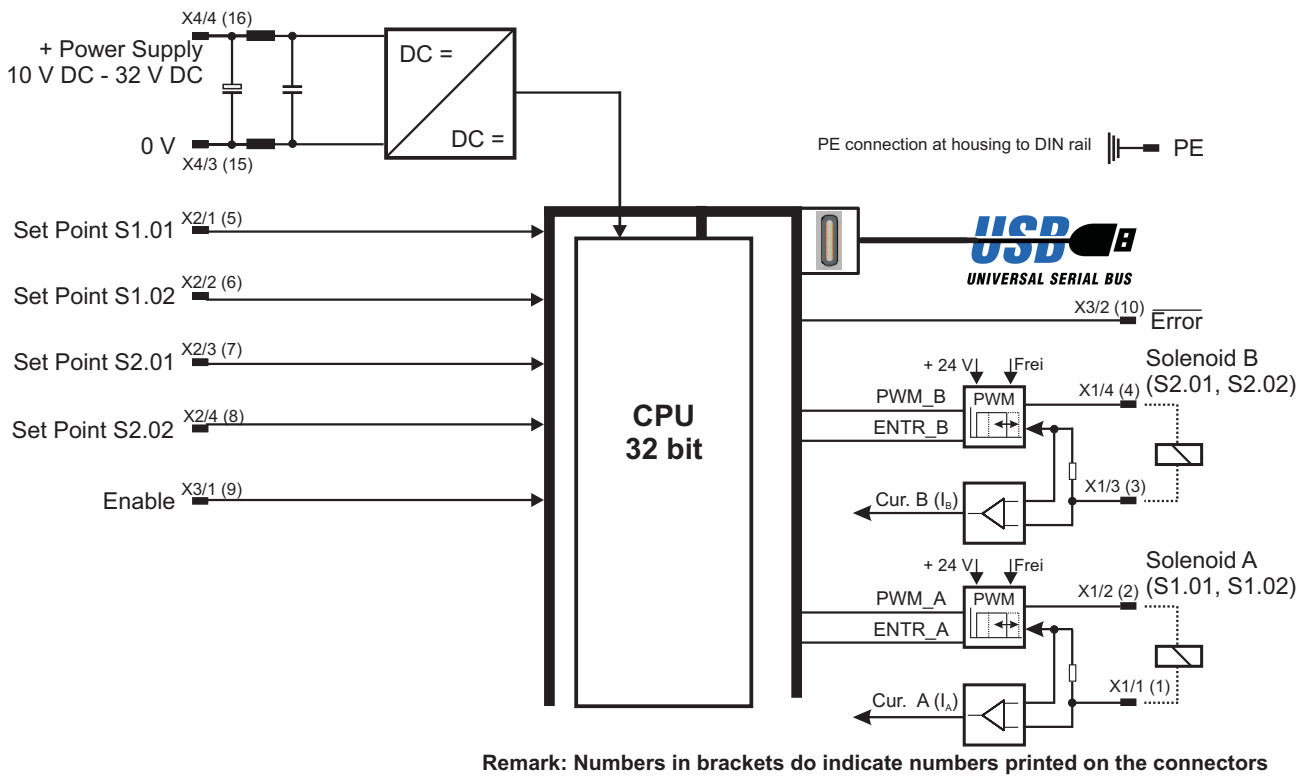
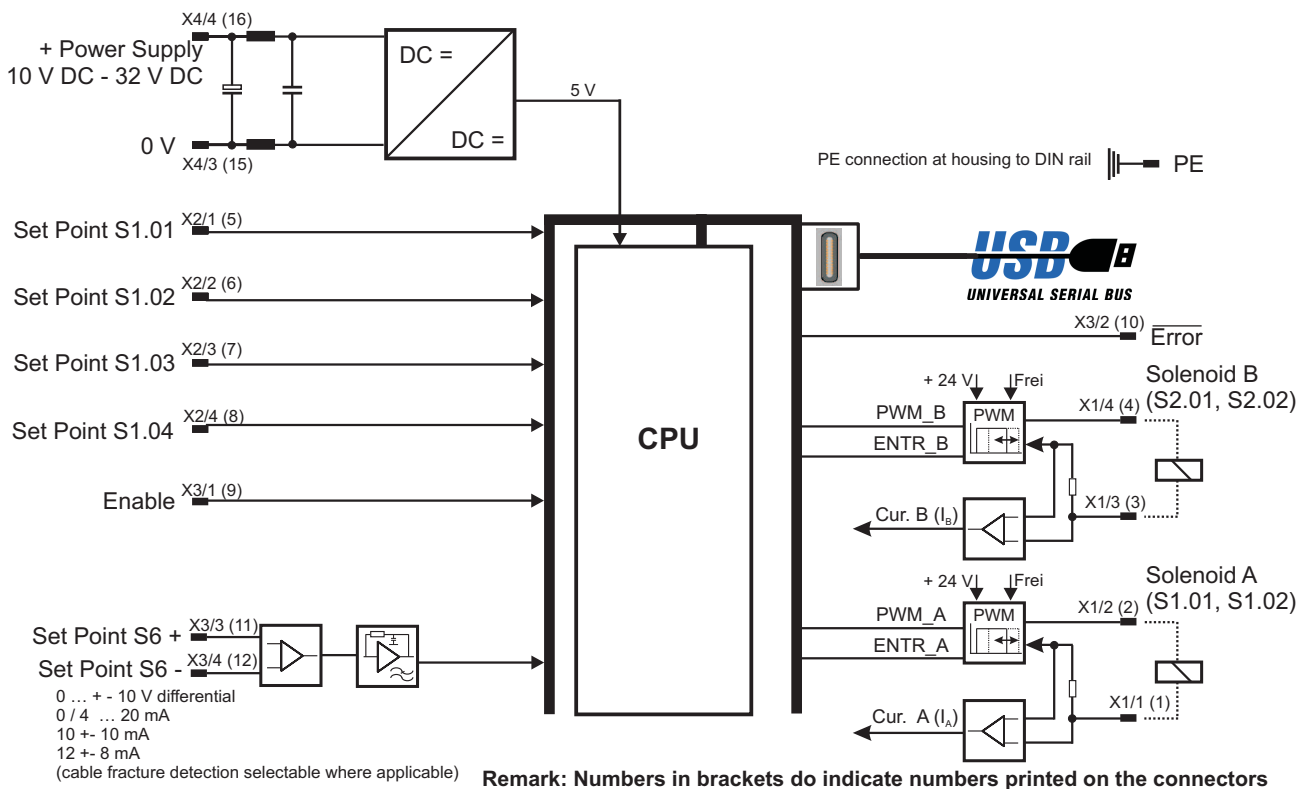


Diagram for version: DMA(A)-22-01-xxx-S0; Operation Mode: 01



7 Block diagram hardware continued

Diagram for version: DMA(A)-22-**02**-xxx-S0; Operation Mode: **02**

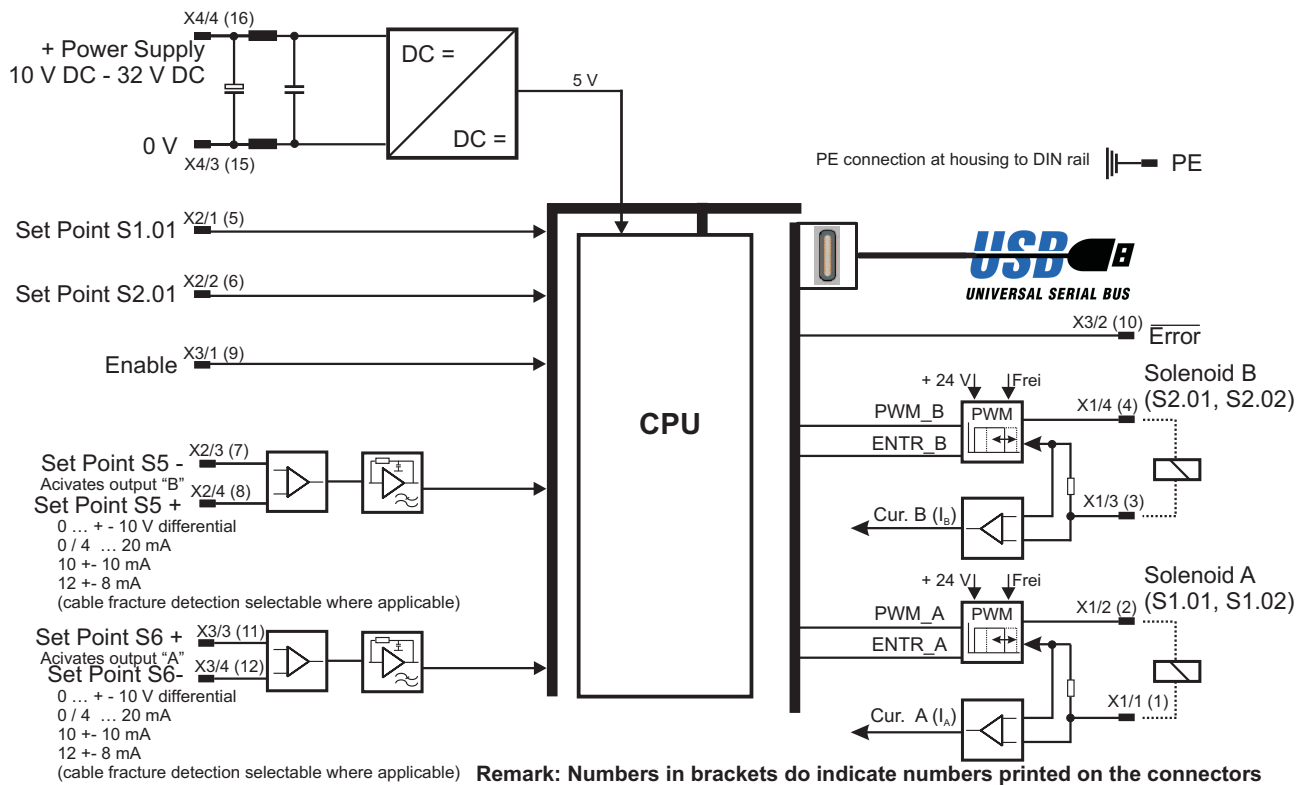
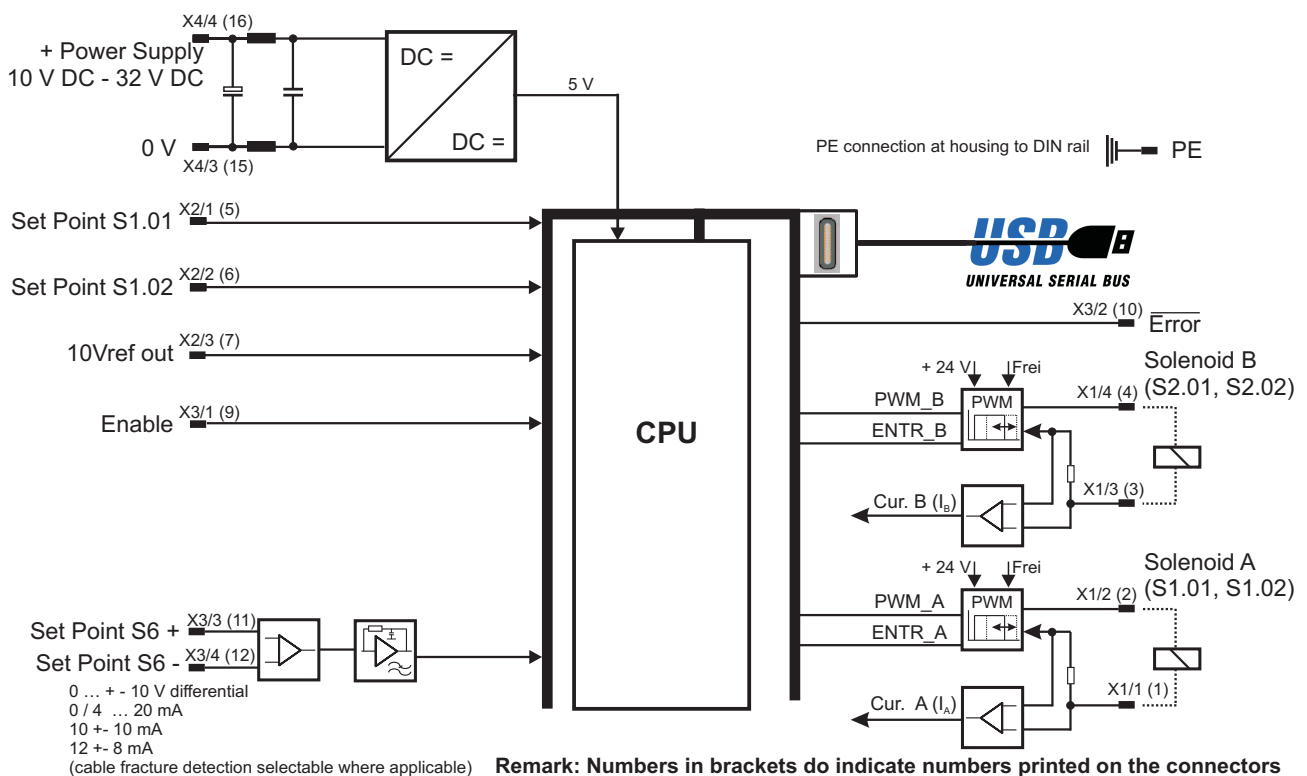
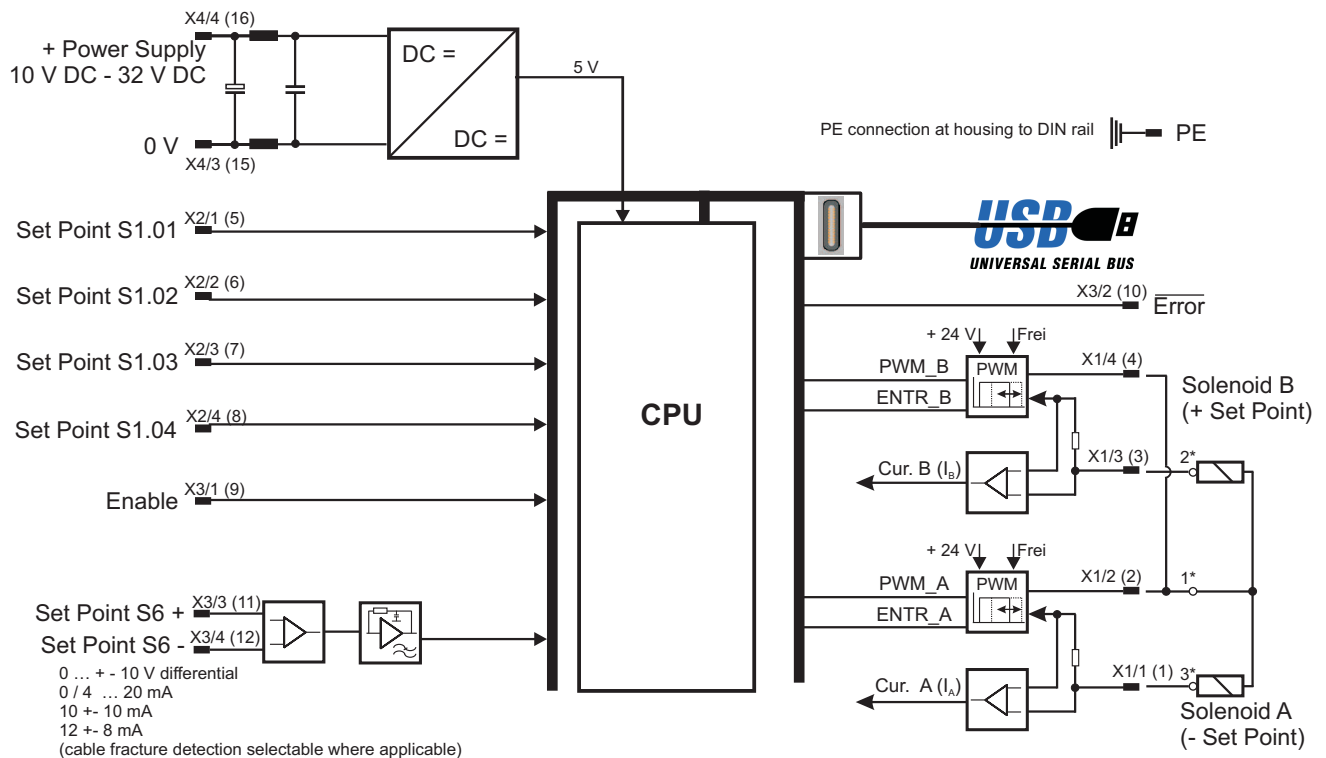


Diagram for version: DMA(A)-22-**01**-xxx-S10VRef; Operation Mode: **01**



7 Block diagram hardware continued

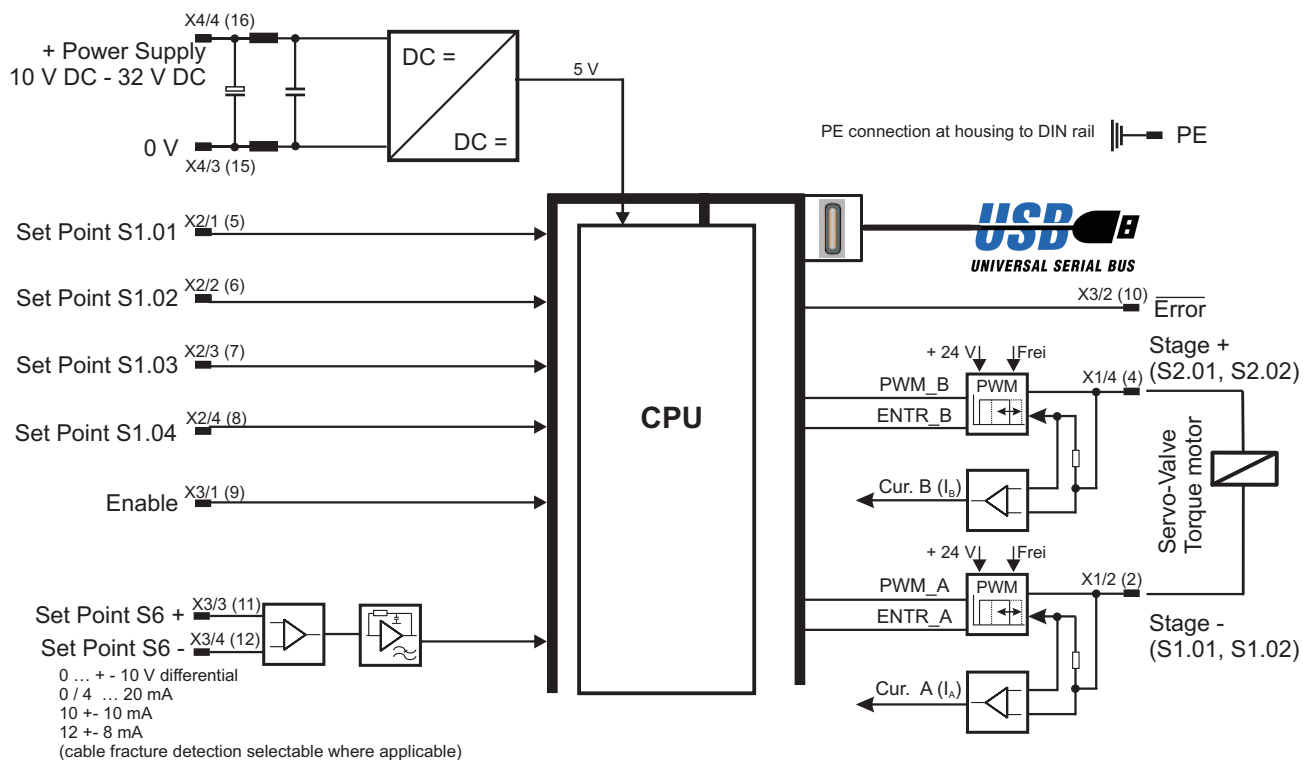
Diagram for version: DMA(A)-22-01-xxx-SHAWE/SHPR; Operation Mode: 01



Remark: Numbers in brackets do indicate numbers printed on the connectors

1*, 2* and 3*: HAWE Twin Solenoid connection points. 1* = common point!

Diagram for version: DMA(A)-22-01-xxx-SServo; Operation Mode: 01, Servo valve version



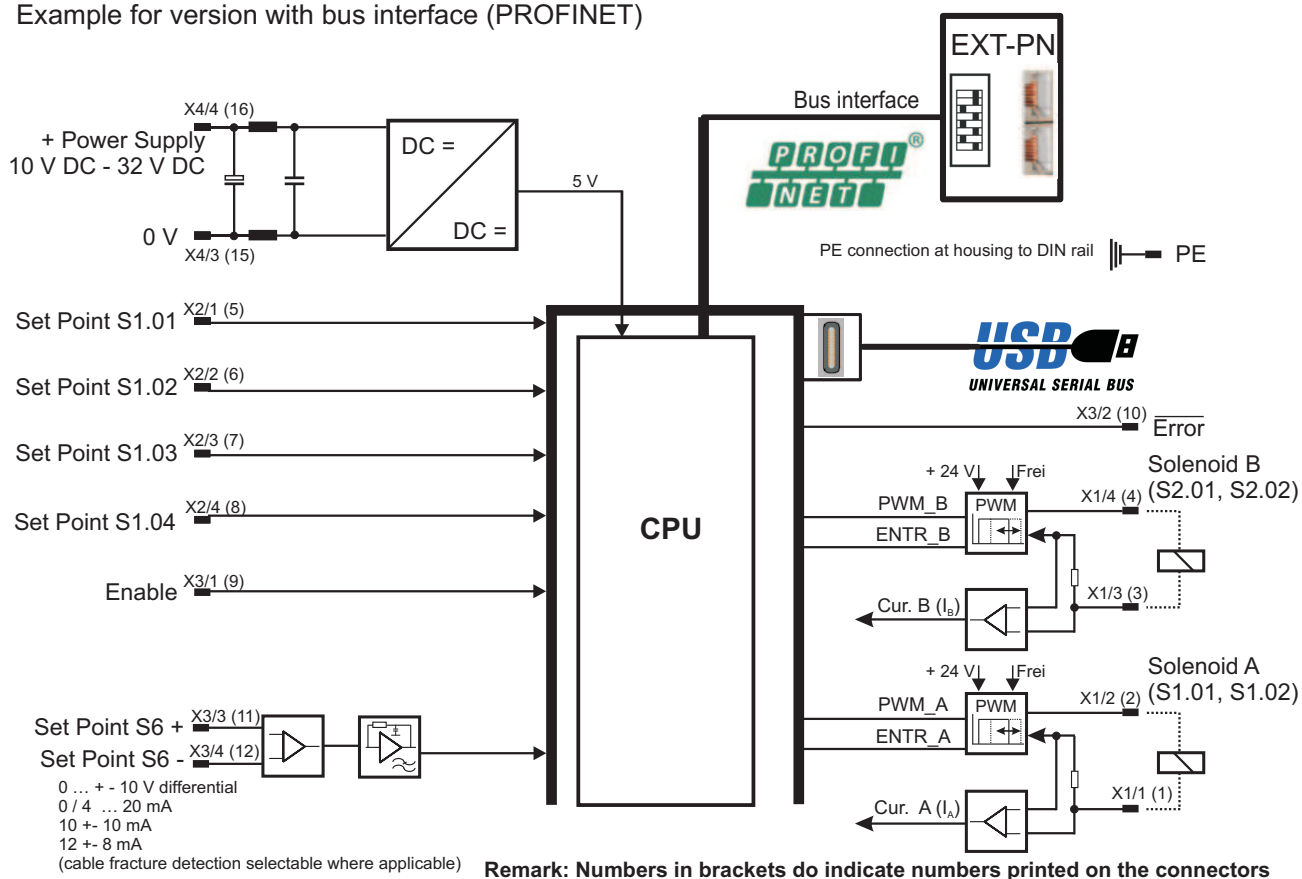
Remark: Numbers in brackets do indicate numbers printed on the connectors

1*, 2* and 3*: HAWE Twin Solenoid connection points. 1* = common point!

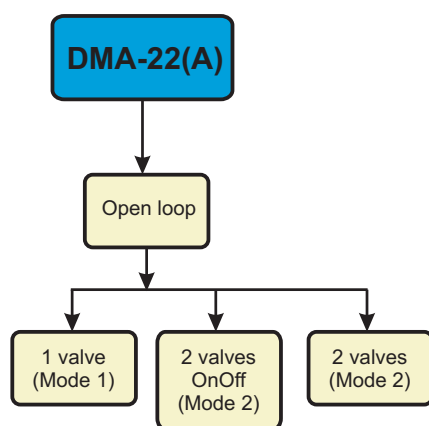
7 Block diagram hardware continued

Diagram for version: DMA(A)-22-01-xxx-S0; Operation Mode: 01

Example for version with bus interface (PROFINET)

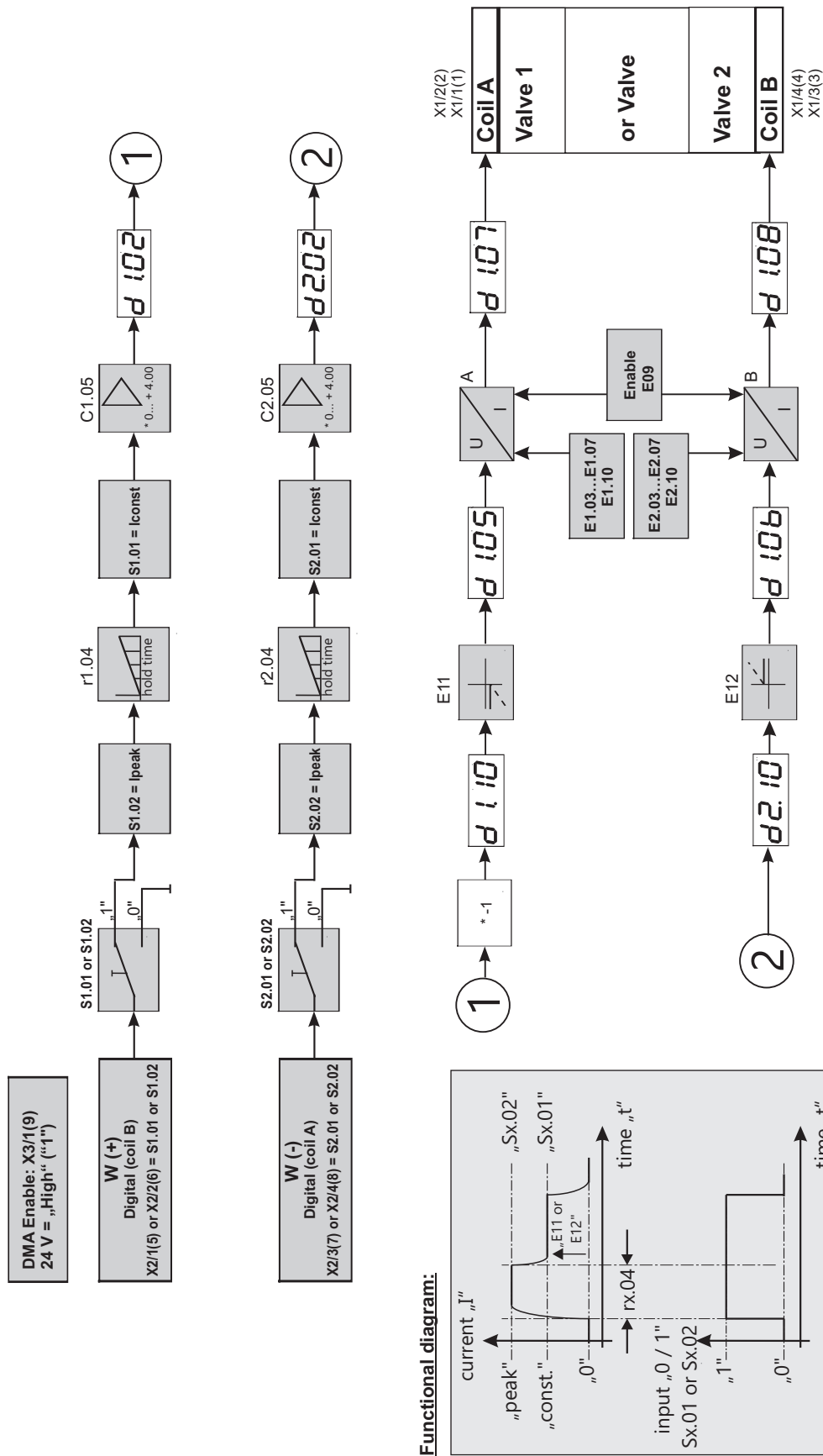


8 Available Operation Modes

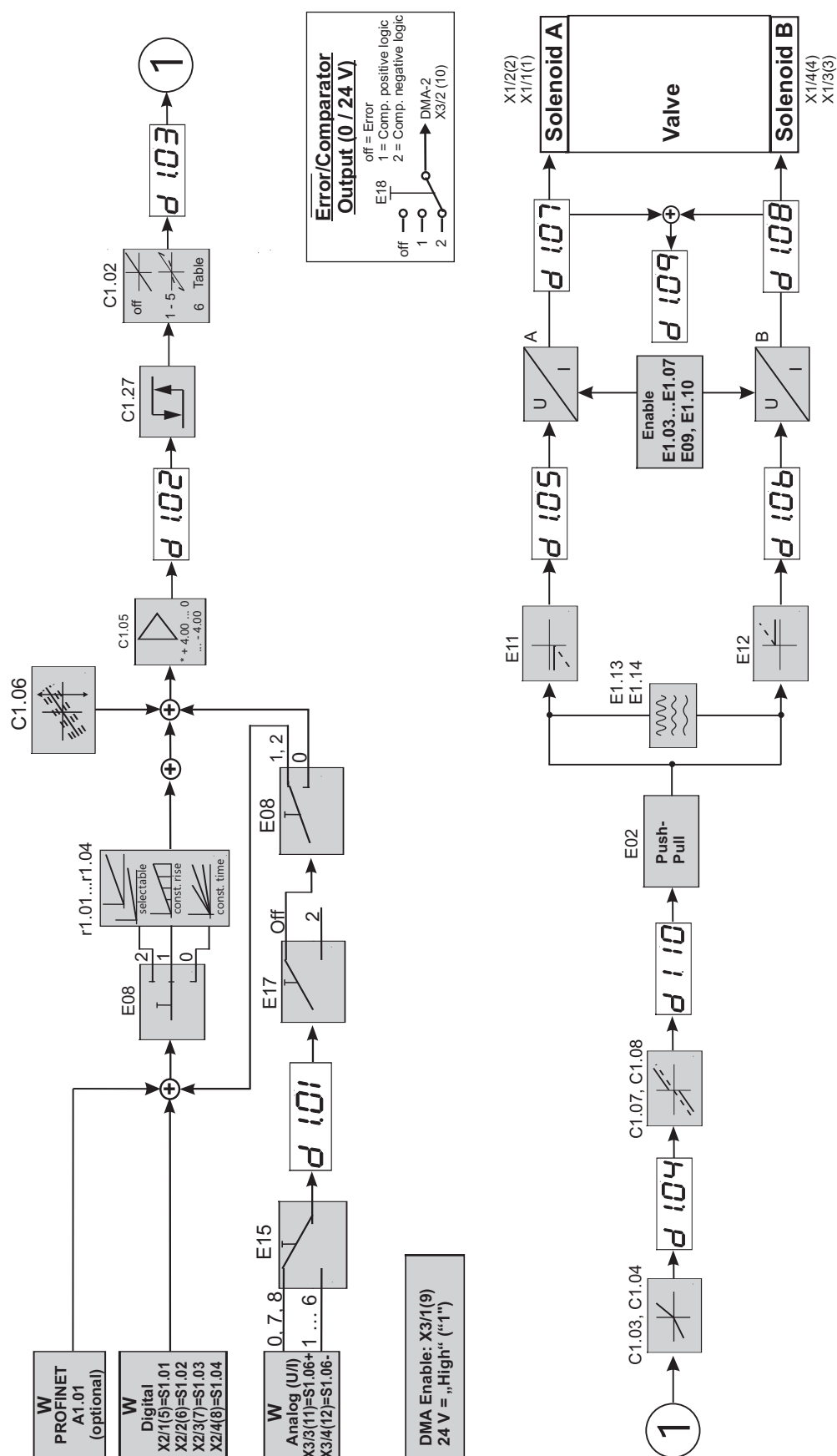


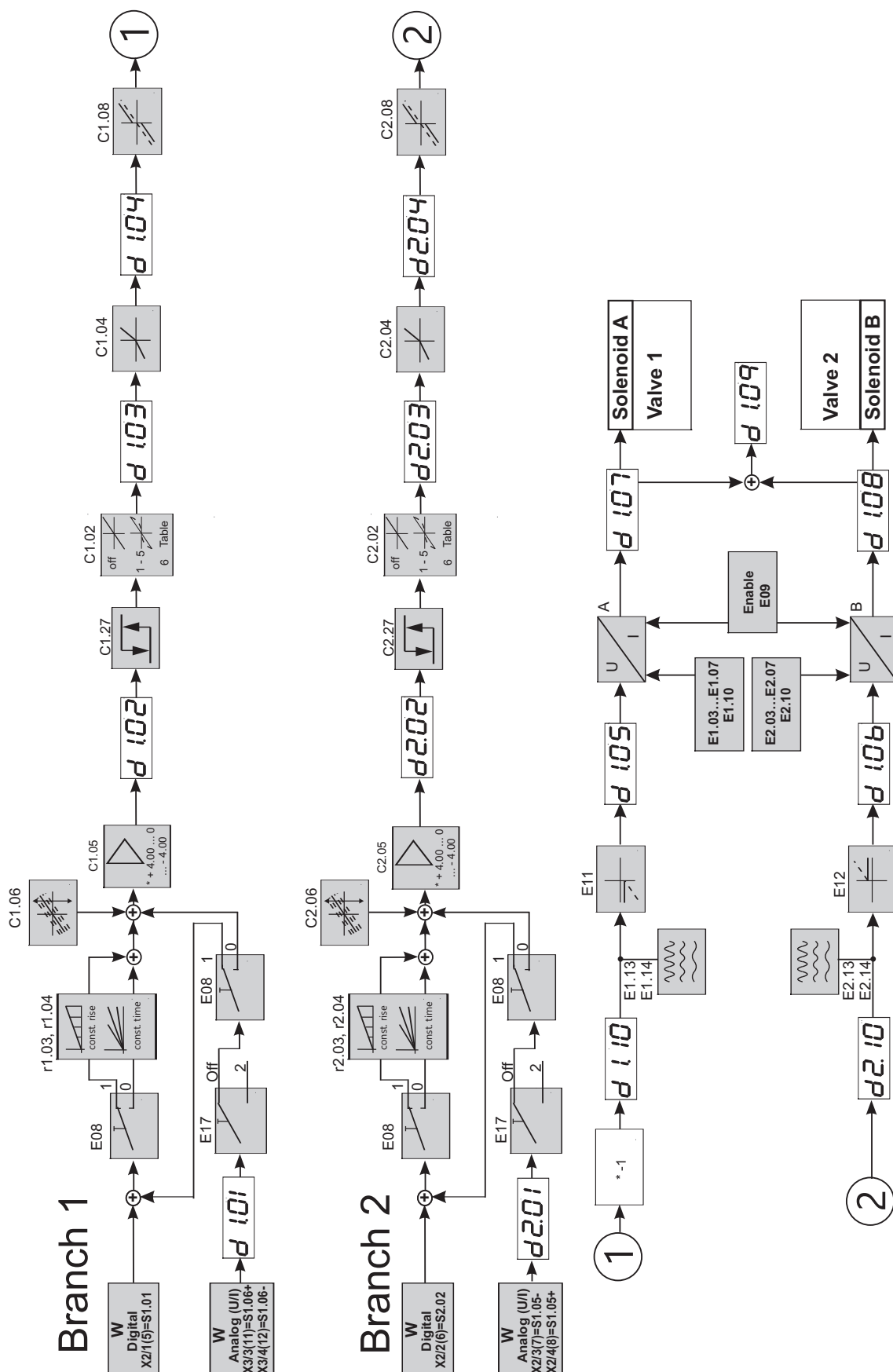
9 Example for Block Diagrams of Software Functions

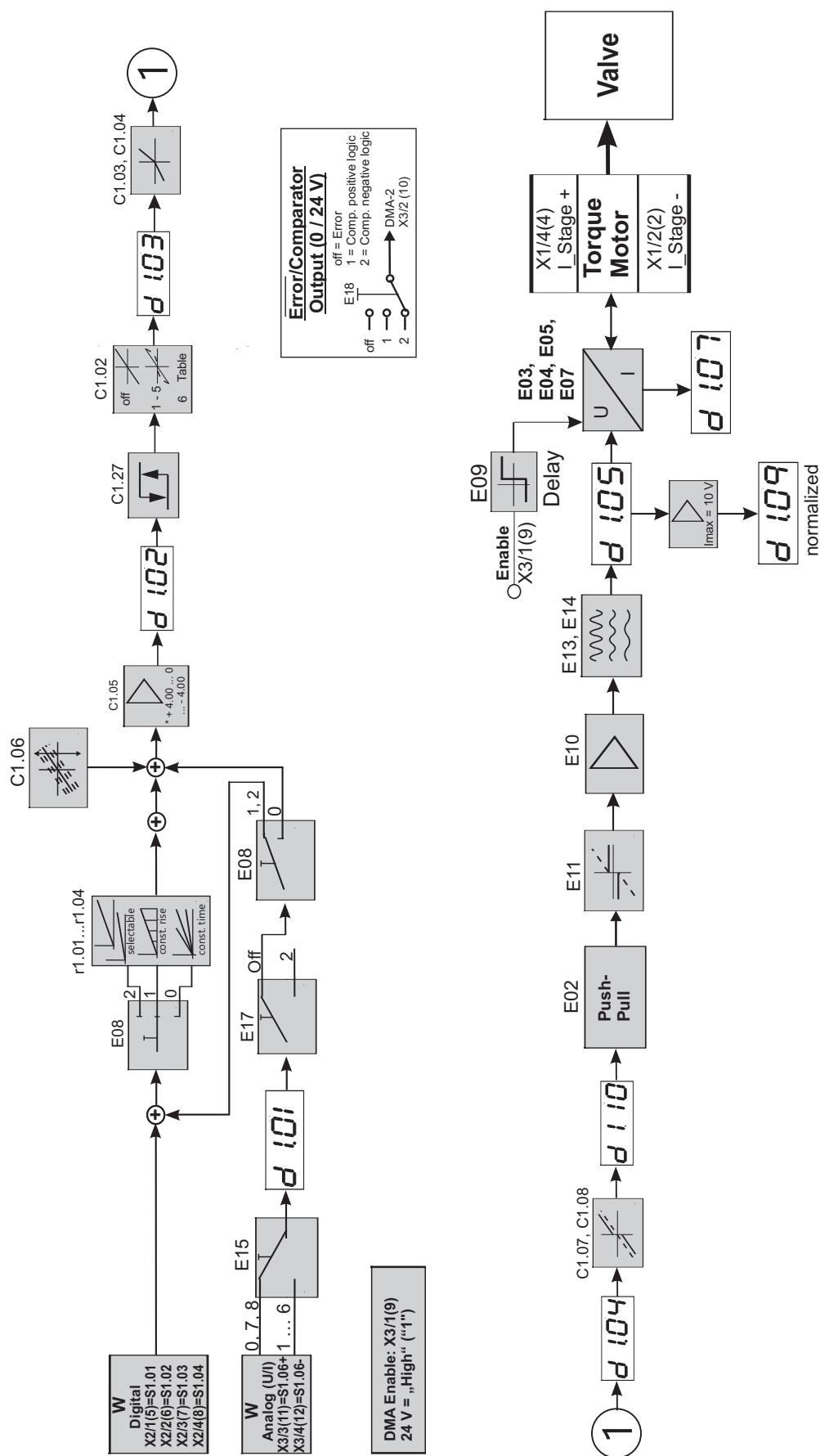
9.1 DMA(A)-22-02-xxx-SOnOff / Operation Mode: 02 ; 1 or 2 On/Off valves with max. 2 solenoids



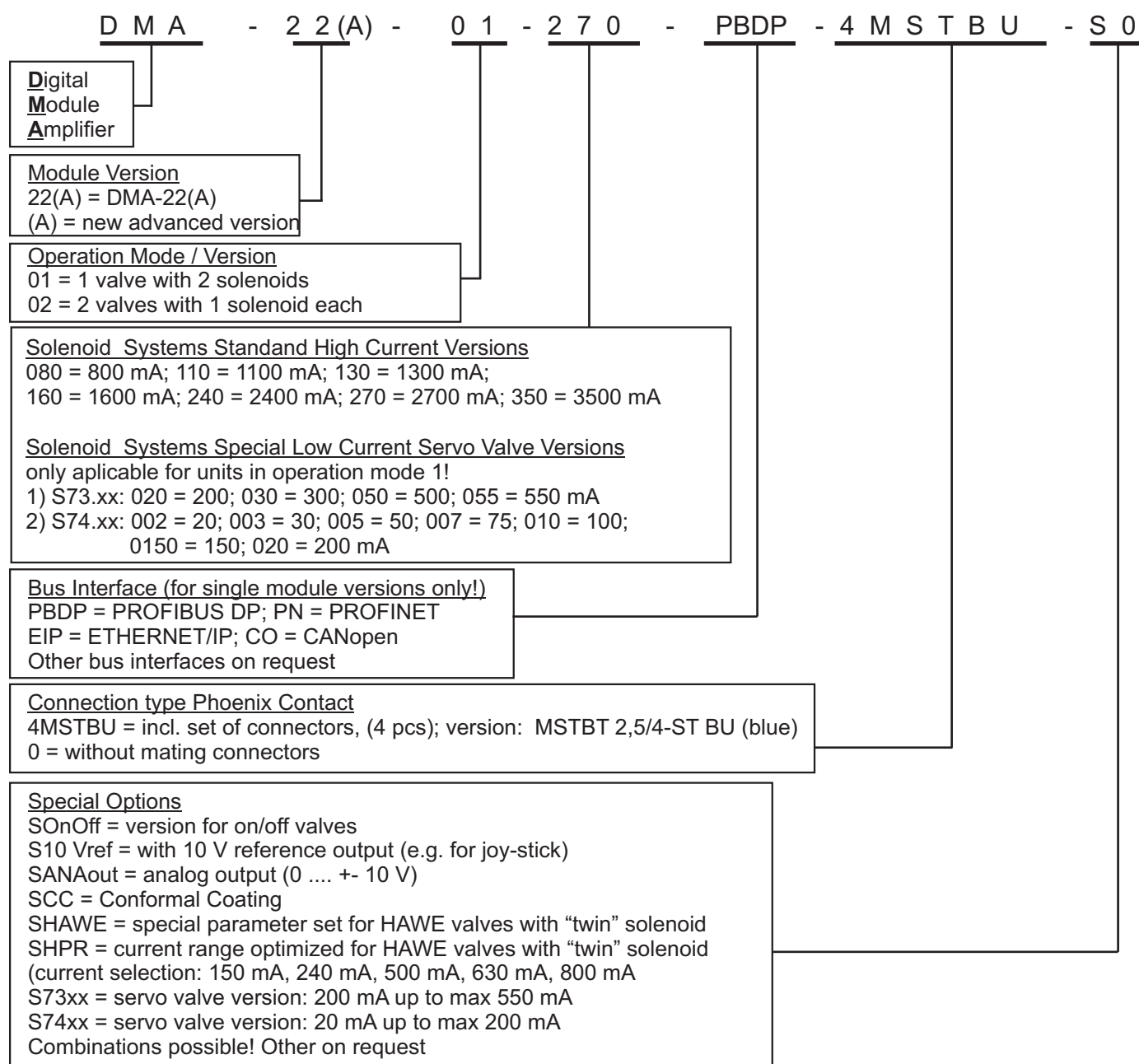
9.2 DMA-22(A)-01-xxx / Operation Mode: 01 ; 1 valve with 2 solenoids, open loop, addit. PROFINET



9.3 DMA-22(A)-**02**-xxx / Operation Mode: **02** ; 2 valves with 1 solenoid each, open loop

9.4 DMA-22(A)-**01**-xxx / Operation Mode: **01** ; 1 servo valve with torque motor, open loop

10 Ordering code; including single module bus versions (not all combinations available!)



Important note: for ordering of multi-module bus versions refer to according ordering code on page 15

Ordering code examples:

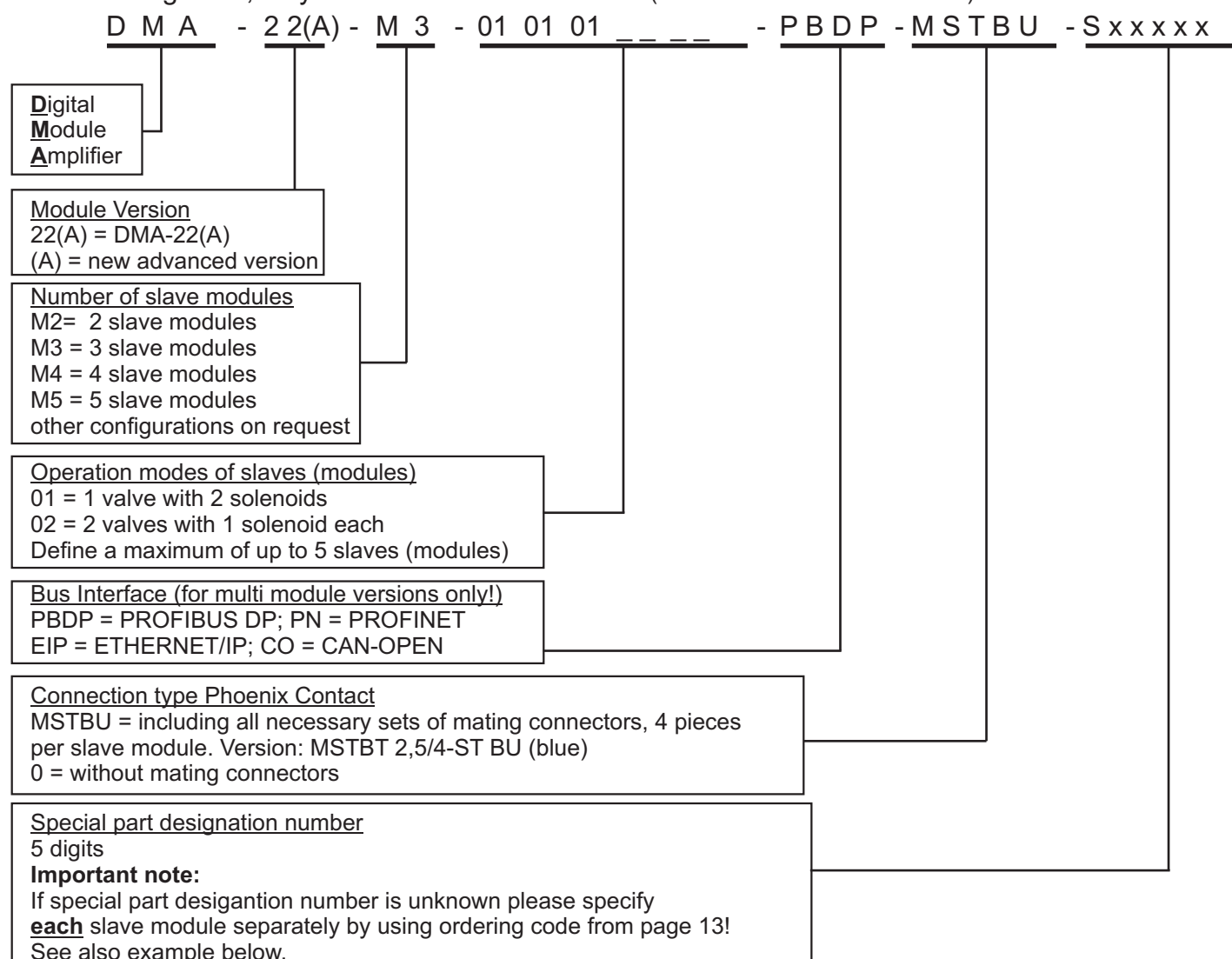
Version for one valve with 2.7 A solenoid;
operation in mode 1, including connectors

DMA-22(A)-01-270-4MSTBU-S0

Version with PROFIBUS for two valves and 0.8 A
solenoids; operation in mode 2, including connectors

DMA-22(A)-02-080-PBDP-4MSTBU-S0

11 Ordering code, only multi module bus versions (not all combinations available!)



Important note: for ordering single multi-module bus versions refer to ordering code on page 14

Ordering code example:

PROFIBUS version with 3 slaves (DMA-22(A) modules). Each of the 3 slaves (modules) is the same version for valves with two coils each with 2.7 A including the connectors.
Please specify each of the modules.

DMA-22(A)-M3-010101-PBDP-MSTBU-Sxxxxx containing

DMA-22(A)-01-270-x-S0 (module in operation mode 1)

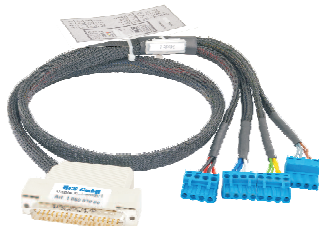
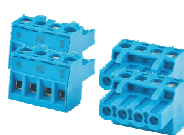
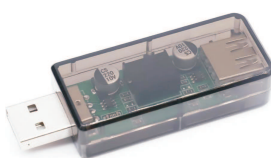
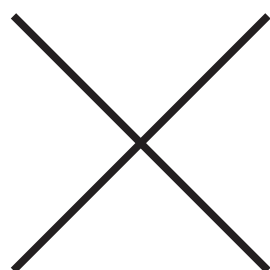
DMA-22(A)-01-270-x-S0 (module in operation mode 1)

DMA-22(A)-01-270-x-S0 (module in operation mode 1)

12 Accessories and Options

Name	Description
HCSTool	Software for parameterization, operation, monitoring, storage and documentation of adjustments. With 4-channel oscilloscope function. In E / F / DE. Download from internet free of charge: http://www.h-c-s-gmbh.de/download/
USB-A-USB-C-2m	Interface cable for communication between PC and DMA-22(A) for USB-C interface. 1 x USB-A connector (PC side), 1 x USB-C connector (DMA side) approx. 2 m cable
Galvanically Isolated USB Adapter	Adapter for communication between PC and DMA-22(A) for USB interface with galvanic isolation. Isolation voltage 1,500 V RMS. USB Type-A male to USB Type-A female. Bus-powered, no external supply required.
USB-C-USB-C-2m	Interface cable for communication between PC and DMA-22(A) for USB-C interface. 2 x USB-C connector (PC and DMA side), approx. 2 m cable
CU/DMA-2 Connection cable f. DMA	Commissioning unit for DMA-22(A). For adaptation of one DMA. For commissioning, servicing, testing and trouble shooting etc. at machines, systems, for laboratories and for training. Cables ordered separately depending on DMA version
4MSTBU	Set of 4 connectors for DMA; Phoenix Combicon connectors with screw terminals, type: MSTBT 2,5/ 4-ST - special HCS version with printed on reference numbers

Not to scale!

Commissioning Unit	Cable for Comm. Unit DMA version dependent	Interface Cable USB-A-USB-C-2m	Interface Cable USB-C-USB-C-2m
			
HCSTool	Connectors 4MSTBU	Galvanically Isolated USB Adapter	—
			

13 Our distributors and partners

<https://www.h-c-s-gmbh.de/en/sales-partners>

14 Declaration of conformity

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EC Declaration of Conformity in accordance with EMC Directive 2014/30/EU

**HCS Hydraulic Control Systems GmbH
Neuffener Str. 29
D-72636 Frickenhausen**

hereby declares that the product described as follows complies in terms of its design, as well as in the version placed in the stream of commerce by us, with the relevant requirements of the directive. This declaration is void in the event of any change to the product without our written agreement.

Product:	Digital Amplifier and Controller Module
Intended use:	Automation systems (industrial applications)
Model:	<u>DMA-22(A)-x</u>
Rated voltage:	24 V DC; SELV
Rated power:	max. 100 W
Protection class:	III
Protection degree:	IP00 (IP20 on request)
Relevant EU Directive:	EMC Directive 2014/30/EU
Applicable EU Standards:	
Emissions:	EN 61000-6-3:2007 + A1:2011 EN 61000-6-4:2007 + A1:2011
Immunity:	EN 61000-6-2: 2005
Date/manufacturer's signature	
01.01.2024	
Details of signatory:	Dipl.-Ing. (FH) Peter Deuschle (General Manager)

Hydraulic Control Systems GmbH Geschäftsführer / General Manager: Dipl.-Ing. (FH) Peter Deuschle + Dipl.-Ing. (FH) Volker Bremauer
Sitz / Head Quarter: D-72636 Frickenhausen Amstgericht / Register Court: AG Stuttgart HRB 224899

15 CiA Membership

