

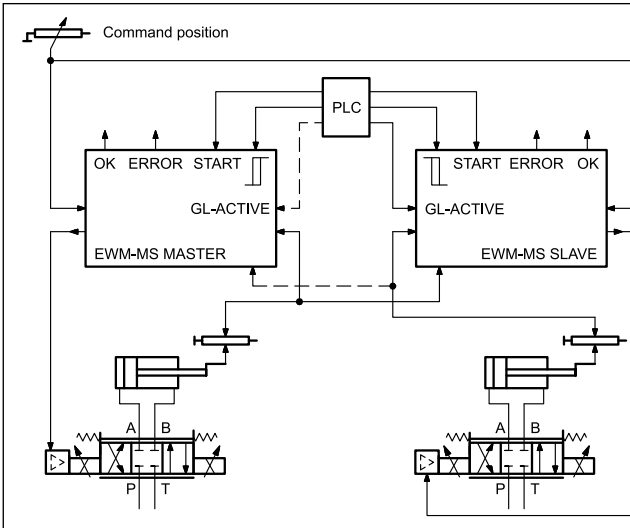
EWM-MS-AA

CARD FOR SYNCHRONIZATION CONTROL WITH ANALOGUE SIGNALS SERIES 21



RAIL MOUNTING TYPE: DIN EN 50022

OPERATING PRINCIPLE



- This card has been developed for an easy synchronization of two actuators (up to 6 axes in master-slave mode) with an overriding synchronization controller.
- The card can drive only an axis; one card per axis is needed.
- Proportional valves with integrated electronics can be driven by the differential output. A version with amplifier is also available.
- Analogue feedback sensors (scalable via software)
- Analogue position input. The axes speed can be limited by an external analogue speed input.
- 2 control mode: SDD and NC
- Card setup via software only, through an on-board USB-B port.

TECHNICAL CHARACTERISTICS

Power supply	V DC	12 + 30 ripple included external fuse 1,0 A (3A for M2 version)
Current consumption: - E versions - M2 version	mA W	<100 60 depending on the solenoid
Command value	V mA	0 + 10 (R _f = 25 kΩ) 4 + 20 (R _f = 240 Ω)
Position input value resolution	%	0,003, 1μm max
Speed input value	V mA	0 + 10 (R = 90 kΩ) 4 + 20 (R _f = 240 Ω)
Feedback value	V mA	0 + 10 (R _f = 25 kΩ) 4 + 20 (R _f = 240 Ω)
Output value: - E version, voltage - E version, current - M2 version	V mA A	±10 (max load 10 mA) 4 + 20 (max load 390 Ω) 0,5 - 2,6 stepless
Interface		USB B type 2.0
Electromagnetic compatibility (EMC)		Immunity EN 61000-6-2: 8/2005 Emissions EN 61000-6-4: 6/2007; A1:2011
Housing material		thermoplastic polyamide PA6.6 - combustibility class V0 (UL94)
Housing dimensions	mm	120(d) x 99(h) x 23(w) (M2 version: w = 46)
Connector		4x4 (4x7 M2 version) poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20

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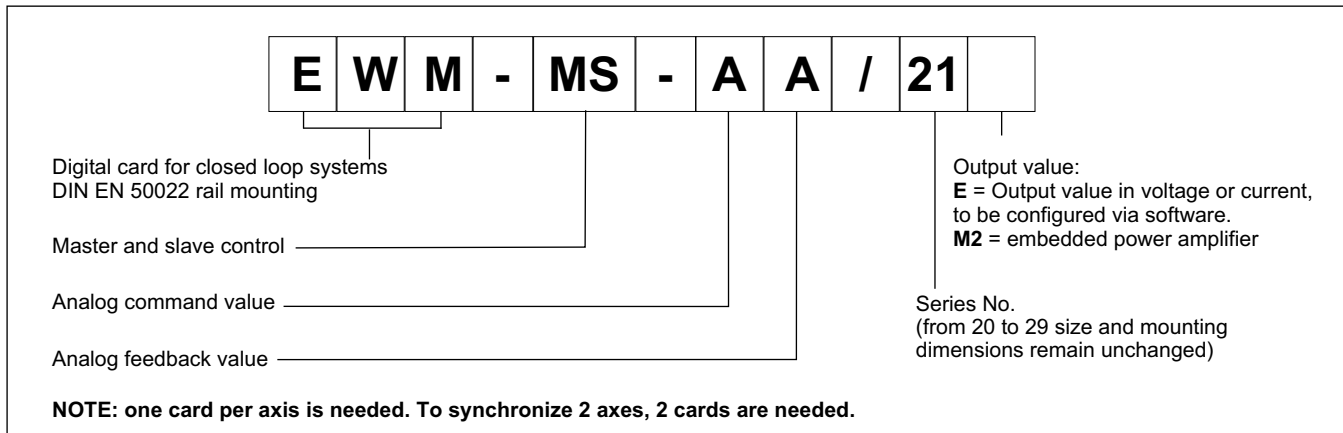
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1 - IDENTIFICATION CODE



2 - FEATURES

Controller functions

- stroke control and synchronization of axes
- 2 different working mode for synchronization:
 - master-master (2 axis maximum)
 - master-slave (up to 6 axis)
- 2 method for positioning control:
 - SDD – Stroke Depending Deceleration - time-optimal positioning structure with very high stability
 - NC – Numerically Controlled - To follow the position profile
- Different gain parameters available via software for SDD and NC control modes
- Command position signal can be single or separate for each card.
- PT1 filter to stabilize the control behaviour
- Command, feedback and speed in mm and mm/s respectively
- Analogue feedback scalable via software
- Analogue command position scalable via software
- Speed limit managed by analogue input or internally
- Emergency function (EOUT)

Adaptation of the valve characteristic curve

- CTRL function to adapt the braking characteristics to positive and zero overlapped proportional valves
- Advanced deadband compensation: non-linearity compensation by a double-gain characteristics

Monitoring functions

- In-position error
- Cable break, in-position error and fault of feedback sensors
- Solenoids monitored for M2 version
- 2 Digital output to read the status

Other characteristics

- Output value in voltage or current, to be configured via software.
- Card configuration is made via software, through on-board USB

3 - FUNCTIONAL SPECIFICATIONS

3.1 - Power supply

This card is designed for 12 to 30 VDC (typical 24 V) of a power supply. This power supply must correspond to the actual EMC standards. All inductivities at the same power supply (relays, valves) must be provided with an over voltage protection (varistors, freewheeling diodes).

It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

NOTE: in the M2 version the value of the power supply voltage on the card must not be lower than the rated working voltage of the solenoids to be controlled.

3.2 - Electrical protections

All inputs and outputs are protected with suppressor diodes and RC-filters against transient overshoots.

3.3 - Digital Input

The card accepts digital input. The digital input must have a voltage from 12 to 24 V; Low level: <2V, high level >10V. Input resistance 25 kΩ. See the block diagram at paragraph 4 for the electric connections.

3.4 - External command position

The card accepts an analogue input signal. The command value can be 0 ÷ 10 V (RI = 25 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

3.5 - External command speed

The card accepts an analogue input signal. The command speed can be 0 ÷ 10 V (RI = 90 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

3.6 - Feedback value

The card accepts analogue feedback input. The feedback value can be 0 ÷ 10 V (RI = 25 kΩ) or 4 ÷ 20 mA (RI = 240 Ω).

3.7 - Analogue output values

Output values can be in voltage or current, to be configured via software (parameter SIGNAL:U). The same parameter defines the polarity also.

E Voltage: ± 10 V Differential output (PIN 15 to PIN 16).

E Current: 4 ÷ 20 mA (PIN 15 to PIN 12).

M2: embedded power stage configurable via software. Value range 0,5 ÷ 2.6 A stepless.

All analogue output have to be wired with screened cables.

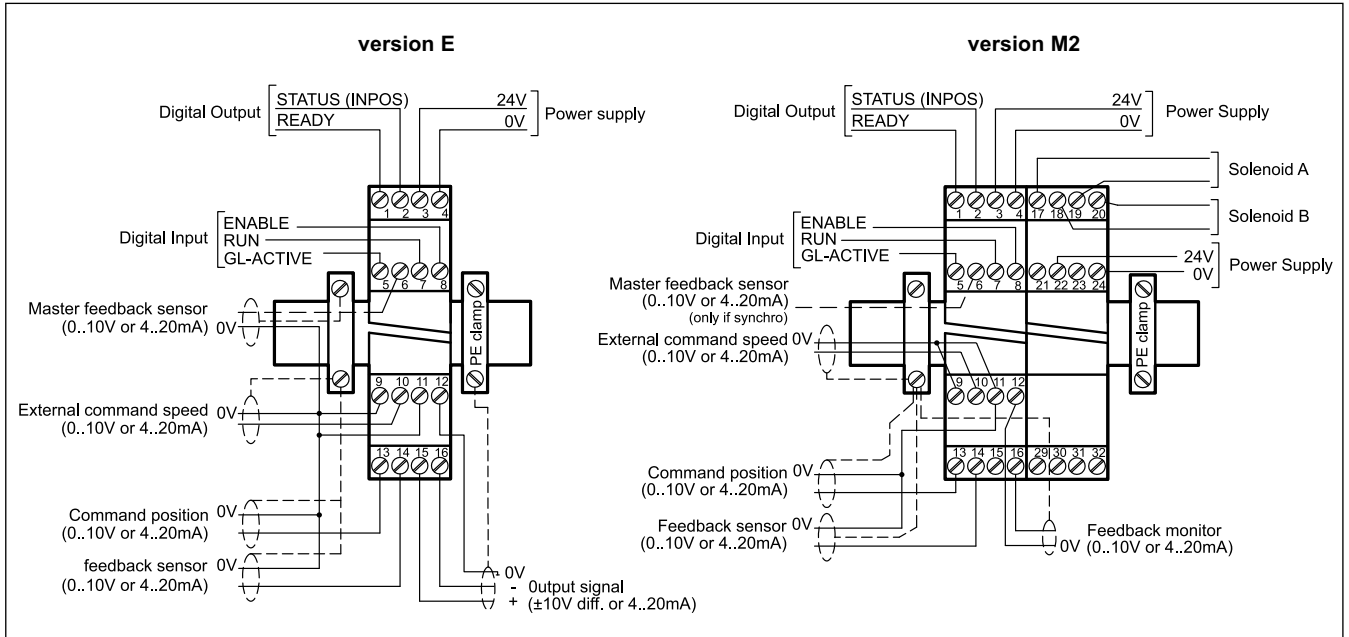
3.8 - Digital output

Two digital output are available, STATUS and READY, that are displayed via LEDs on the front panel.

Low level < 2 V High Level > 12 V (max 50 mA).

4 - WIRING DIAGRAMS

4.1 - Basic wiring



DIGITAL INPUT AND OUTPUT

- PIN 1** READY output.
General operability, ENABLE is active and there is no sensor error (by use of 4 + 20 mA sensors). This output corresponds with the green LED.
- PIN 2** STATUS output.
Monitoring of the control error (INPOS). Depending on the INPOS command, the status output will be deactivated, if the position difference is greater than the adjusted window. If SC-ACTIVE (pin 5) is on, this output is used to monitor the synchronization error. The output is only active if START = ON.
- PIN 5** GL-ACTIVE:
Synchronisation controller. If this input is not active, the module works as normal positioning controller.
- PIN 7** START input:
The positioning controller is active; the external analogue command position is taken over as command value. If the input is switched off during movement, the command position is set to the actual position plus a defined emergency deceleration stroke.
- PIN 8** ENABLE input:
This digital input signal initializes the application. The analogue output is active and the READY signal indicates that all components are working correctly. Target position is set to actual position and the drive is closed loop controlled.

for M2 version only:

- PIN 16** Feedback monitor (scaled)
range 0 + 100% corresponds to 0 + 10V or 4 + 20 mA

ANALOGUE INPUT

- PIN 6** Feedback value (K) of the master axis
range 0+100% corresponds to 0 + 10V or 4 + 20 mA
- PIN 9/10** External command speed (V),
range 0 + 100 % corresponds to 0 + 10 V
- PIN 13** Command position (W),
range 0 + 100% corresponds to 0 + 10V or 4 + 20 mA
- PIN 14** Feedback value (X),
range 0 + 100% corresponds to 0 + 10V or 4 + 20 mA

E version - ANALOGUE OUTPUT voltage

- PIN 16/15** Differential output (U)
 $\pm 100\%$ corresponds to $\pm 10V$ differential voltage

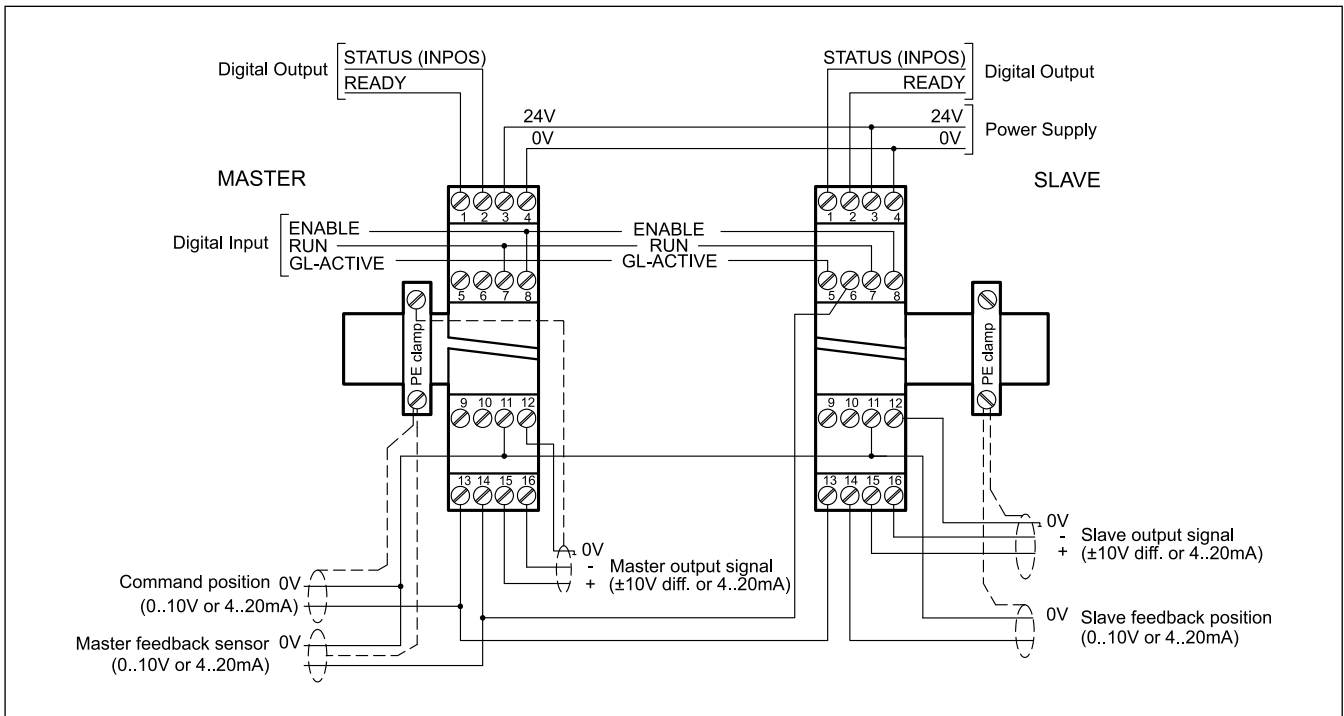
current

- PIN 12/15** $\pm 100\%$ corresponds to 4 + 20 mA

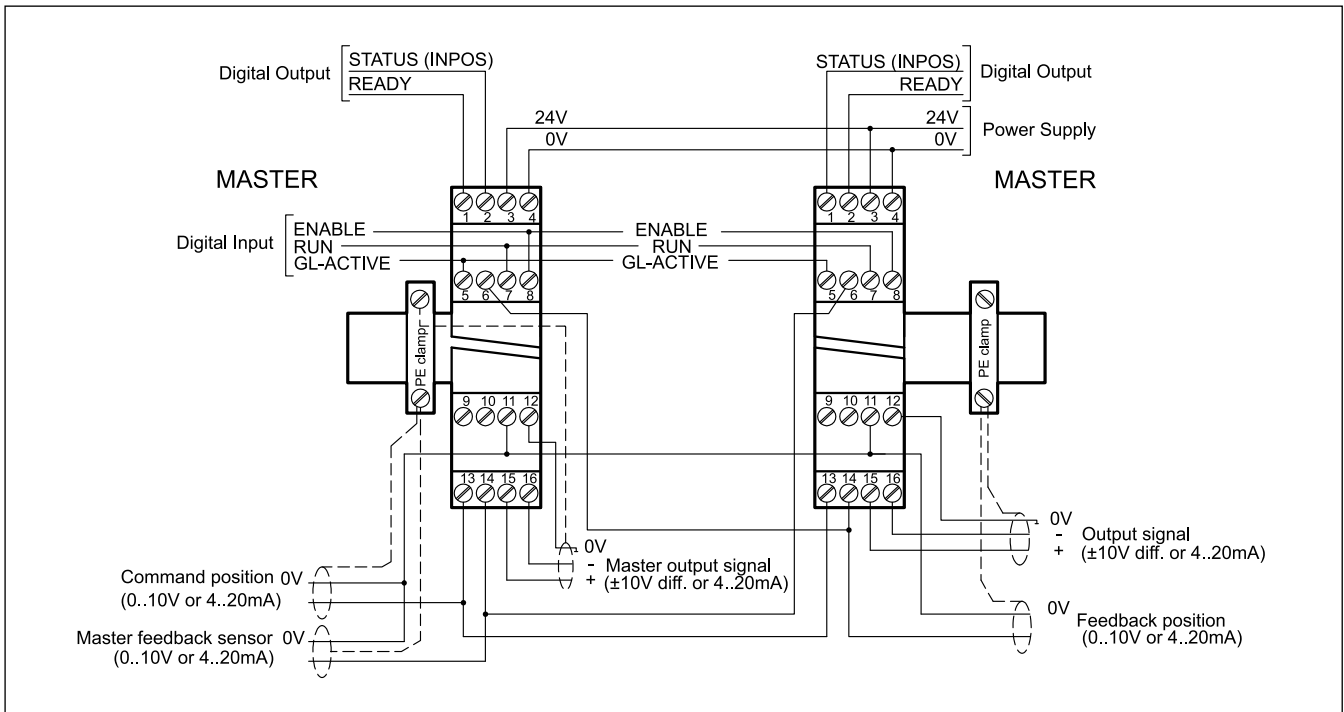
M2 version - ANALOGUE OUTPUT current

- PIN 17+19** Solenoid output A
- PIN 18+20** Solenoid output B

4.2 - Wiring example for MASTER / SLAVE configuration, output value type E*, up to 6 axes



4.3 - Wiring example for MASTER / MASTER configuration, output value type E, 2 axes only.



5 - INSTALLATION

For power supply and solenoid connections are recommended cable sections of 0.75 mm² up to 20 m length, and of 1.00 mm² up to 40m length.

For other connections use cables with a shielded jacket, connected to GND only on the card side.

NOTE : To observe EMC requirements it is important that the control unit electrical connection is in strict compliance with the wiring diagram.

As a general rule, the valve and the electronic unit connection wires must be kept as far as possible from interference sources (e.g. power wires, electric motors, inverters and electrical switches).

Complete protection of the connection wires can be requested in environments with critical electromagnetic interferences.

5.1 Start-up

The module must be mounted and wired with attentions to EMC requirements. A star orientated ground connection should be used when other power consumers are sharing the same power supply. Following points have to be taken in account for wiring:

- Signal cable and power cable have to be wired separately.
- Analogue signal cables must be shielded.
- Other cables should be shielded in case of strong electrical disturbance (power relays, frequency controlled power driver) or at cable lengths > 3m.



WARNING! Plugs with free-wheeling diodes and LED indicators cannot be used with current controlled power outputs.

They interfere with the current control and can destroy the output stage.

With high frequency EMI inexpensive ferrite elements can be used.

Take in account a separation between the power part (and power cables) and signal part when arrange the areas inside the electrical cabinet. Experience shows us that the area next to the PLC (24 V area) is suitable.

Low impedance between PE “protected earth” and DIN-Rail should be used. Transient interference voltages at the terminals are discharged via DIN-Rail to the local PE. The screens have to be connected directly next to the module via PE terminals.

The power supply should be carried out voltage regulated (i. e. PWM controlled). The low impedance of controlled power supplies facilitates improved interference damping, therefore the signal resolution will be increased.

Switched inductance (relays and solenoids) operating from the same power supply has to be damped by surge protection elements directly by the inductance.

6 - DEVICE SETUP

Card set-up is possible via software only.

6.1 - Software EWMPC/20

The software EWMPC/20 can be easily downloaded from the Diplomatic MS website in the section SOFTWARE DOWNLOAD.

To connect the card to a PC or notebook is necessary a standard USB 2.0 cable A – B (standard USB printer cable).

Once connected, the software automatically recognises the card model and shows a table with all the available commands, their parameters, the default setting, the measuring unit and a brief explanation for correct set-up.

Some functions like baud rate setting, remote control mode, saving of process data for later evaluation are used to speed up the installation procedure.

The software is compliant with Microsoft OS Windows 7, 8 and 10.



WARNING! For card series 20, the default baud rate to select in the software has changed from 9600 baud to 57600 baud. This is adaptable in OPTION / SETTINGS / INTERFACE.

6.2 - Parameters table

The parameters table is available in English or German. The language is set in the parameters.

The parameter setting can be done at *standard* level, easier, or *expert*, where a greater number of parameters is displayed and can be customized.

For a complete list of the parameters and their settings please refer to the Technical Manual 89450 ETM.

7 - MAIN FEATURES

This module can be configured for:

- MASTER/MASTER positioning control for 2 axes (both GL input are active) where the positions information will be linked crosswise.
- MASTER/SLAVE positioning control, for up 6 axes, with selectable master function by deactivating of the GL input. If the synchronisation controller is active, it overrides the position control process. When the actual position of the master axis is given to the slave axis all slave axes will follow the master axis.
- INDEPENDENT POSITIONING by deactivation of both GL input and separate command positions at PIN 13.

The function of the STATUS output is - depending on GL input - in position signal or synchronisation error signal

For a reliable function of the synchronisation control the speed of the master axis should be limited to app. 70/80% of maximum speed. The slave axis must be able to increase the speed against the master axis to compensate position failures.

The card sample time is 1 ms.

7.1 - Sequence of the positioning

After the pre-parameterization and a successfully electrical verification of the control signals the system can be switched on. The positioning process will be controlled by switching the digital inputs.

After enabling (ENABLE input) the drive stays in the current position (i.e. the actual position is accepted as the required position). If the drive moves to an end position, the polarity is probably wrong.

The READY output indicates a general ready to operate.

The speed can be limited by means of the VELO parameter or the external speed demand (SIGNAL:V).

With the RUN signal the demand value of the analogue input is accepted and the axis moves to the predefined target position. STATUS output indicates if the axis is inside the "in position window".

GL-ACTIVE input has to be activated when a synchronized control is requested.

If each axis can be started-up individually this input has to be activated after the optimisation of the axes.

The operating mode can be:

SDD - stroke depending deceleration - means the control gain will be adjusted. This is a time-optimal positioning structure with very high stability.

NC mode - the position value is generated from the following error. The actuator position is measured by an analogue transducer and compared with a specified target position. The target position is adjusted with an external potentiometer or preset by an analogue input from an external controller (PLC). It's possible to define the axis speed also by an external command speed.

The positioning accuracy will almost be limited by the resolution of the transducer, and by the right size of the hydraulic valve. Therefore, the correct valve selection is the most important point. Additionally, two clashing requirements (short positioning time and high accuracy) have to be considered in the system design.

7.2 - Gain

The gain is settable and it's related with the braking distance (parameters available via software). Lower is the braking distance, higher is the gain.

7.3 - Emergency Output (EOUT)

This function is able to set the output at a specific value when a failure occurs (e.g. sensor error or ENABLE disabled). It can be used to move the axis to one of the two end positions with a programmed velocity. The function can be deactivate.

7.4 - Adaptation of the braking characteristic to the valve type (CTRL).

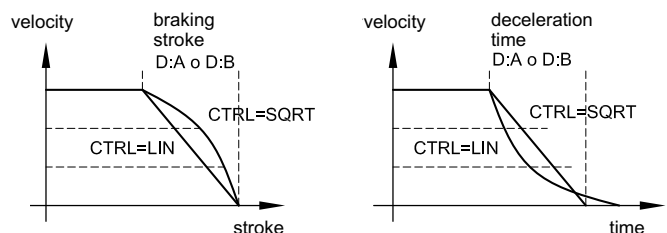
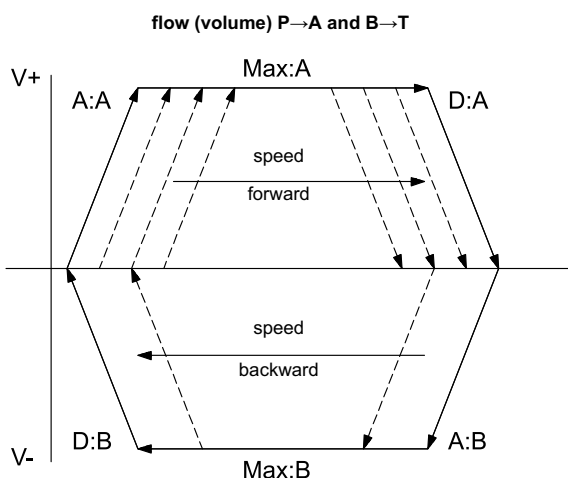
The command CTRL controls the braking characteristic curve of the hydraulic axis. The deceleration can be set with linear or nearly square root characteristic.

With positive overlapped proportional valves one of the SQRT characteristics should be used, because of the linearization of the non-linear flow curve typical of these valves; if zero overlapped proportional valves (control valves) are used, you can choose between LIN and SQRT1 according to the application.

The progressive gain characteristic of SQRT1 has the better positioning accuracy.

According to the application there is maybe a longer braking distance, so that the total stroke time will be longer.

- LIN: Linear characteristic (control gain corresponds to: 10000 / d:i).
- SQRT1: Root function with small control error. (corresponds to 30000 / d:i);
- SQRT2: Root function with higher gain corresponds to 50000 / d:i



7.5 - Adaptation of the output signal to the valve characteristic (TRIGGER).

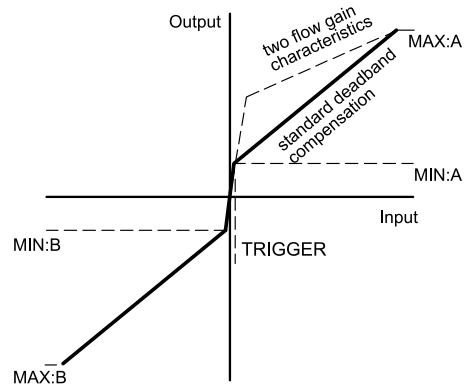
With TRIGGER command, the output signal is adapted to the valve characteristics.

The positioning controllers have a double-gain characteristic curve instead of a typical overlapped jump. The advantage is a better and more stable positioning behaviour. With this compensation, non-linear volume flow characteristic curves can be adjusted too.

If there exist also possibilities for adjustments at the valve or at the valve electronics, it has to be guaranteed, that the adjustment has to be carried out at the power amplifier or at the positioning module.

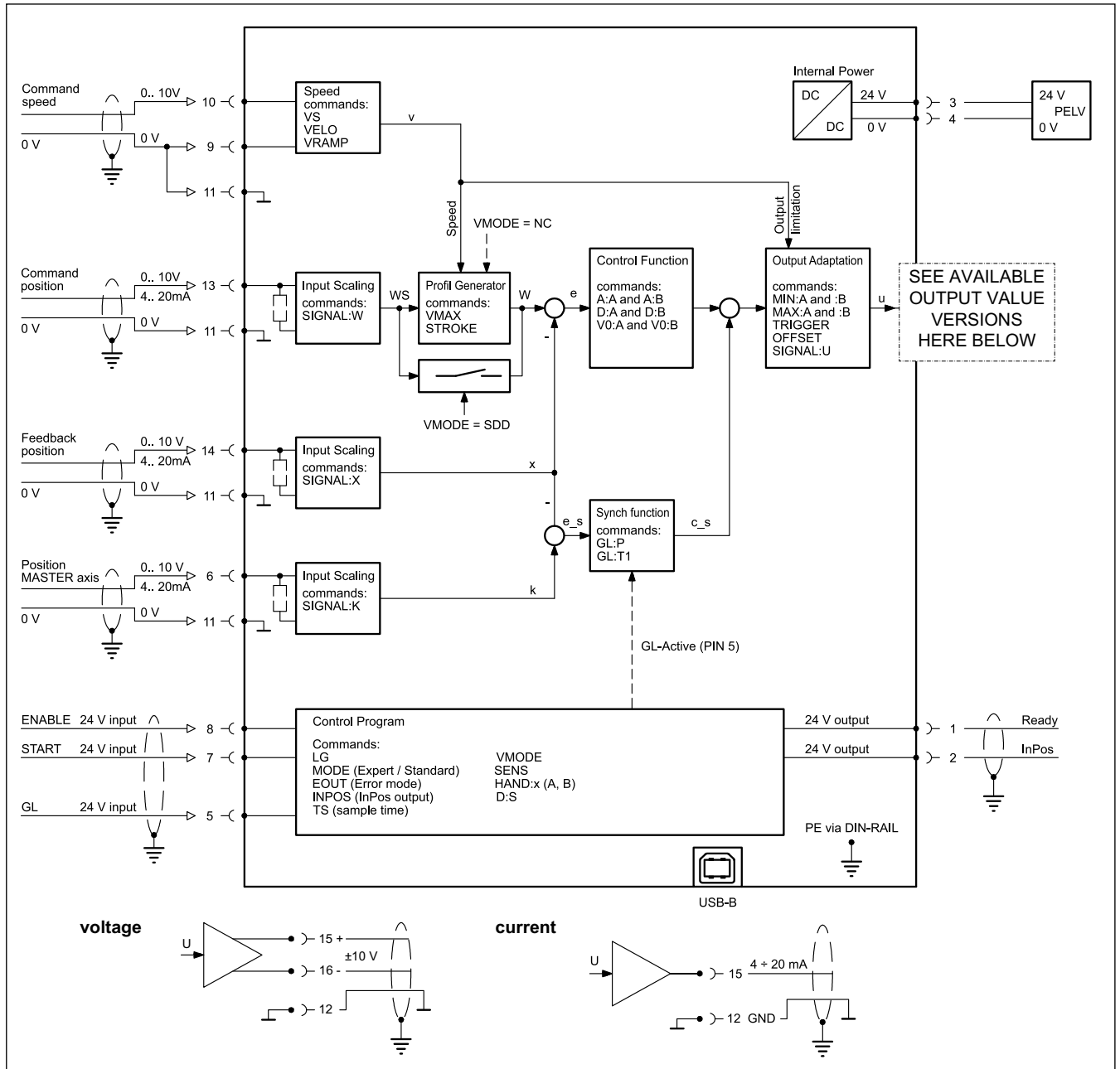
If the deadband compensation value is set too high, it influences the minimal velocity which cannot be adjusted any longer.

In extreme cases this causes to an oscillating around the closed loop controlled position.



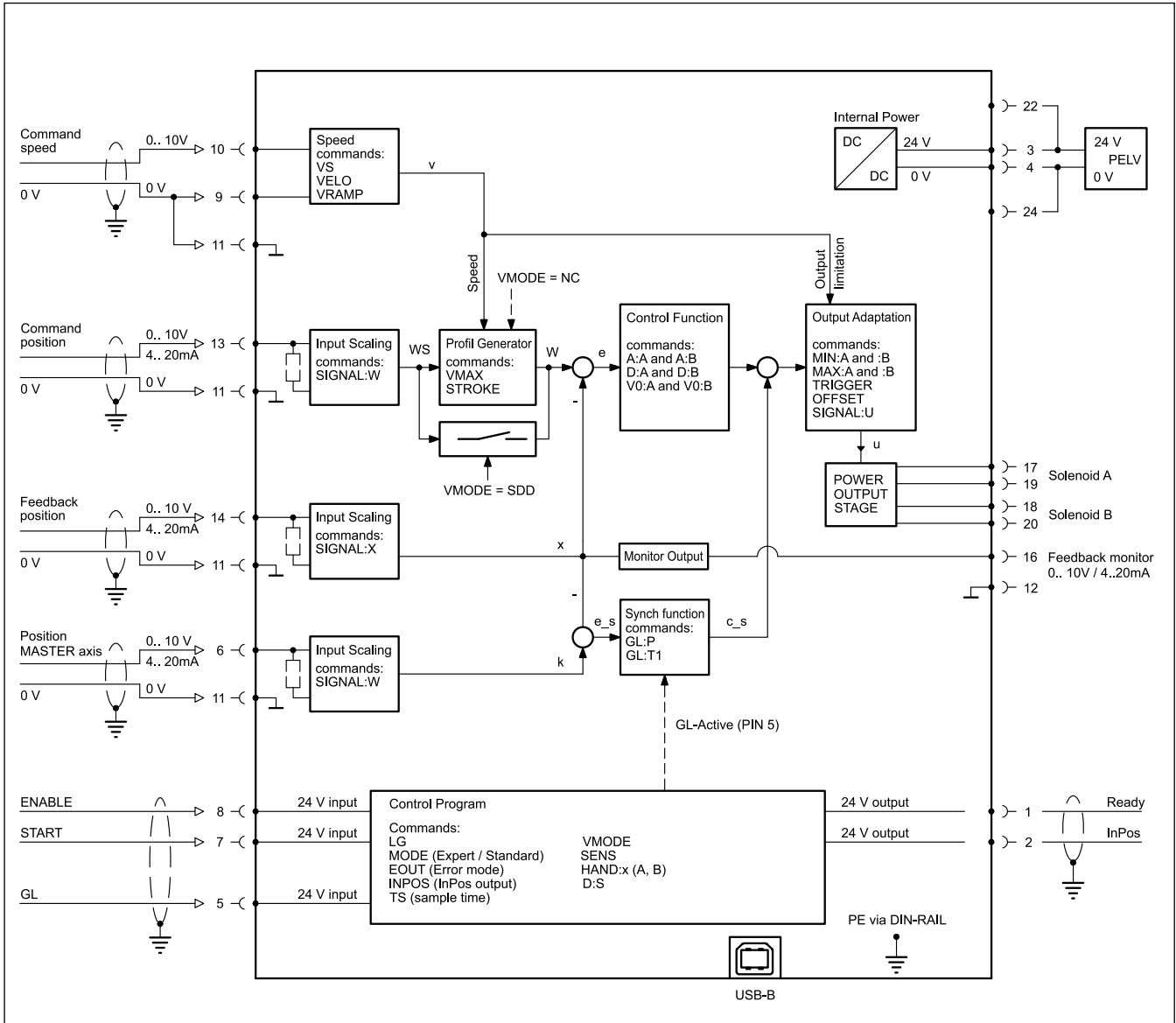
8 - CARD BLOCK DIAGRAMS

8.1 - 'E' version

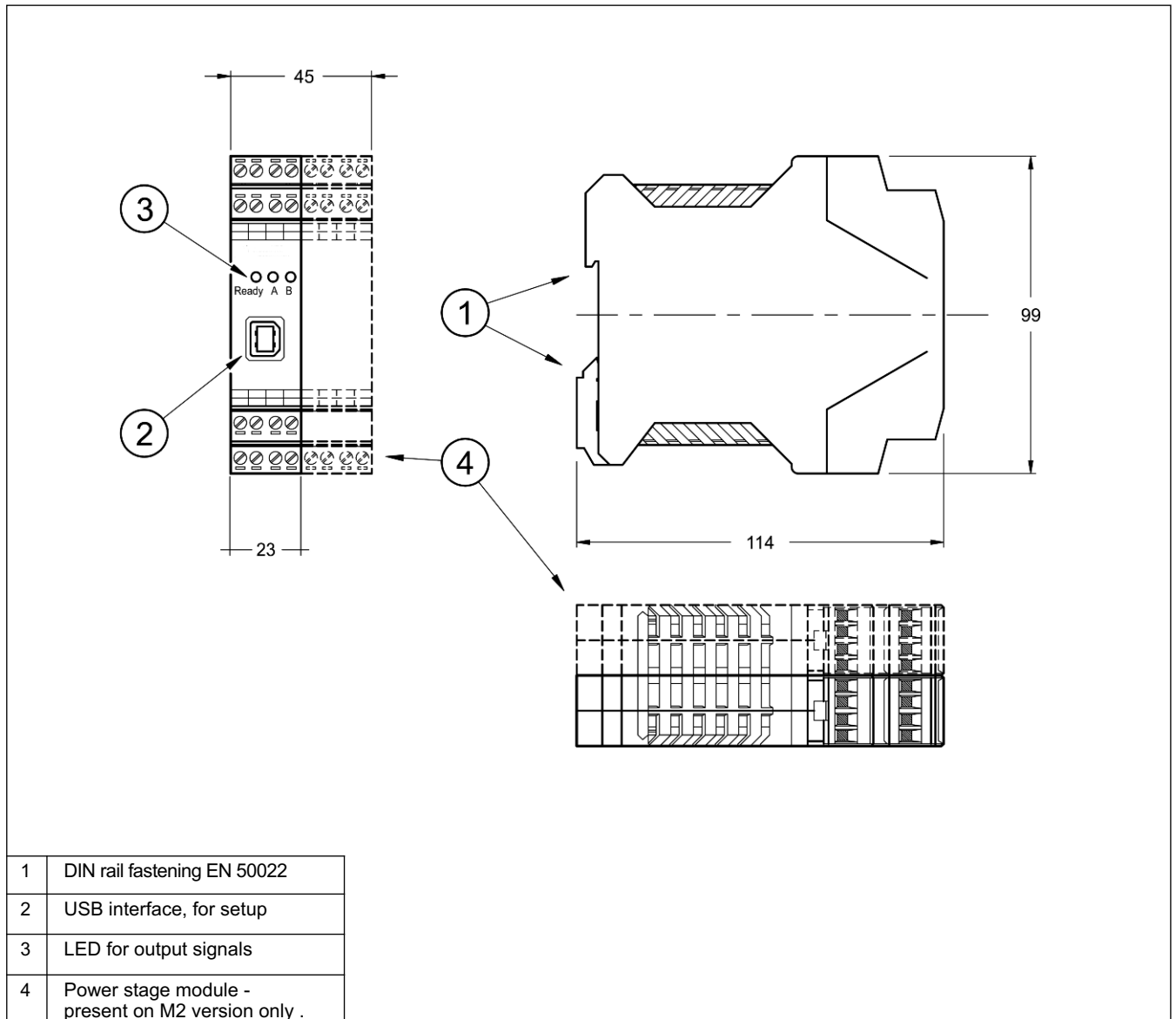




8.2 - M2 version - with output stage



9 - OVERALL AND MOUNTING DIMENSIONS



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