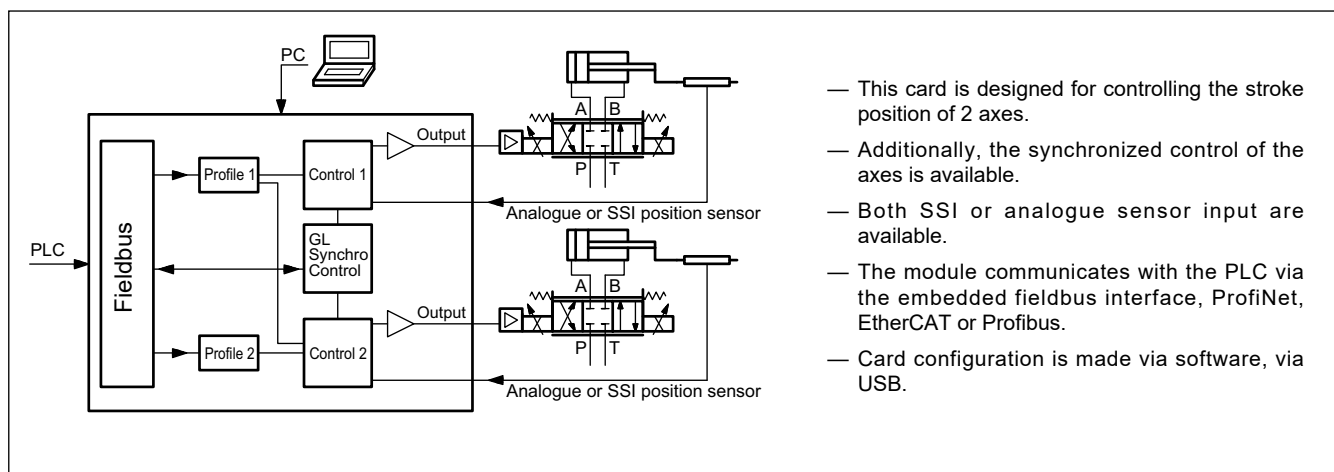![DUPLOMATIC MOTION SOLUTIONS]

EWM-2SS-DAD
WITH FIELDBUS INTERFACE

CARD FOR 2 AXES POSITIONING AND SYNCHRONIZATION IN CLOSED LOOP CONTROL

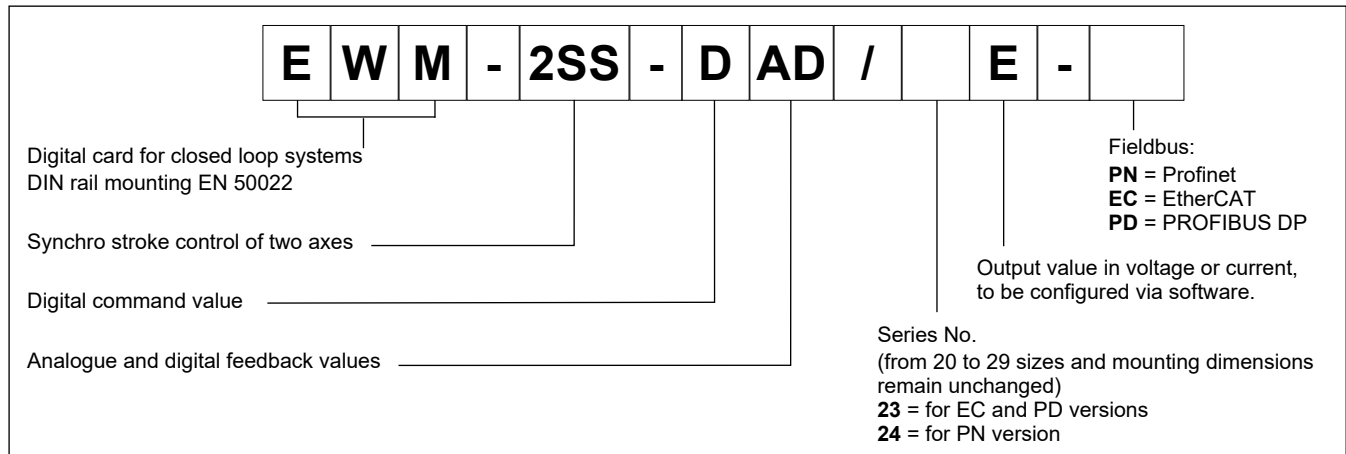## RAIL MOUNTING TYPE:
DIN EN 50022

OPERATING PRINCIPLE

— This card is designed for controlling the stroke position of 2 axes.

— Additionally, the synchronized control of the axes is available.

— Both SSI or analogue sensor input are available.

— The module communicates with the PLC via the embedded fieldbus interface, ProfiNet, EtherCAT or Profibus.

— Card configuration is made via software, via USB.

TECHNICAL CHARACTERISTICS

Power supply	V DC	24 (±10%)
Fuse, external	A	1A medium time lag
Current consumption	mA	500
Command position value		via fieldbus (ProfiNet CC-B or EtherCAT IEEE 802.3), via Profibus DP
Profibus DP data rate		9.6, 19.2, 93.75, 187.5, 500, 1500, 3000, 6000, 12000 - ID number 1810h
Sampling time	ms	1
Max position accuracy	μm	1
Feedback position values	SSI V mA	digital sensor with any interface SSI - 150 kbaud 4 ÷ 20 (RI = 240 ohm) 0 ÷ 10 (RI min 25 kohm)
Output value - voltage - current	V mA	±10 differential (max load 10 mA) 4 ÷ 20 (max load 390 ohm)
Resolution of output value	%	0.007
Interface		USB-B 2.0 / fast Ethernet 2x100 Mbit/s full duplex, 9 pol. D-SUB Profibus
Electromagnetic compatibility (EMC):		EN 61000-6-4:2007 + A1:2011 - EN 61000-6-3:2005
Housing material		thermoplastic polyamide PA6.6 combustibility class V0 (UL94)
Connectors		11x4 poles screw terminals PE direct via DIN rail - USB-B 2.0
Operating temperature range	°C	-20 / +60
Protection degree		IP20

1 - IDENTIFICATION CODE

| E | W | M | - | 2SS | - | D | AD | / | | E | - | |

Digital card for closed loop systems
DIN rail mounting EN 50022

Synchro stroke control of two axes

Digital command value

Analogue and digital feedback values

Fieldbus:
PN = Profinet
EC = EtherCAT
PD = PROFIBUS DP

Output value in voltage or current,
to be configured via software.

Series No.
(from 20 to 29 sizes and mounting dimensions
remain unchanged)
23 = for EC and PD versions
24 = for PN version

2 - FEATURES OVERVIEW

Controller Functions

- Synchronized or independent positioning control of two axes in closed loop
- Command position, speed parameters, actual value response, on loop control byte and status byte via fieldbus.
- Fine positioning - 1 µm resolution
- 2 methods for positioning control:
  SDD – Stroke Depending Deceleration - time-optimal positioning structure with very high stability
  NC – Numerically Controlled - To follow the position profile
- 2 methods for synchronized control:
  Master-slave
  Average value controller
- Data for lengths in mm
- For digital SSI sensor
- As alternative, the card can be set via software for operate with analogue position sensors
- Analogue sensors scalable via software
- Gain adjustment made via software with independent parameters for SDD and NC modes
- PT1 compensator for optimized control of hydraulic drives
- Emergency function (EOUT)
- Safe and error-free data transmission
- Manual mode available via fieldbus.

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-pressure error and fault of feedback sensors
- 2 Digital output to read the status

Other characteristics

- Output in voltage or current, to be set via software
- Card configuration is made via software, USB-B socket on the module
- Parameterization available also via Profinet, EtherCAT or Profibus interface.

3 - FUNCTIONAL SPECIFICATIONS

3.1 - Power supply

This card is designed for 24 V DC of a power supply. This power supply must correspond to the existing 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.

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 kohm. See the block diagram at point 4 for the electric connections.

3.4 - Reference signal

The reference signals run via fieldbus, with Profinet, EtherCAT or Profibus interface.

3.5 - Position feedback values

The card accepts a digital feedback input from a sensor with any SSI interface with RS422 specifications. Bit, code and resolution are settable via software.

Use SSI sensors with the same resolution (max 1 µm)

Eventually, an analogue input could be used as feedback. The card accepts a 0 ÷ 10 V (Ri min 25 kohm) or 4 ÷ 20 mA (Ri = 240 ohm).

The analogue signal resolution is of 0,01 % incl. oversampling.

⚠ Using analogue sensors, the SSI parameters in the software assume default preset values that the user must do not change.

3.6 - Output values

Output values can be in voltage or current and they need to be configured via software (SIGNAL_x:U parameters).

voltage : ± 10 V differential output	PIN 15 and 16 PIN 19 and 20
current: 4 ÷ 20 mA	PIN 15 to PIN 12 PIN 19 to PIN 18.

3.7 - Digital output

The READY digital output is available and displayed by a LED on the front panel.

Low level < 2 V High Level > = V supply (max current 50 mA).

4 - WIRING DIAGRAM
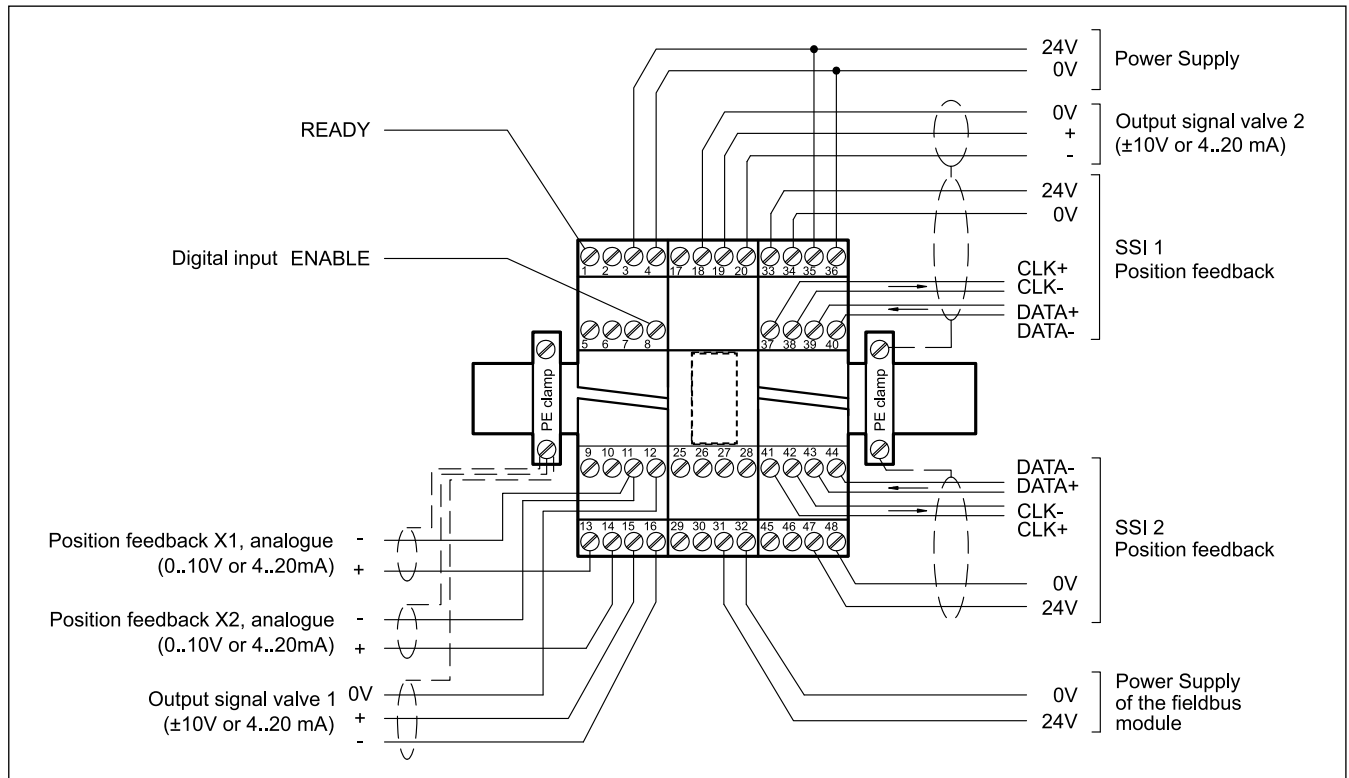
DIGITAL INPUT AND OUTPUT

PIN 1   READY output.
General operationality. It's on when ENABLE (PIN 8 and fieldbus bit) is active and there are no sensor errors.
This output corresponds with the green led in the USB module.

PIN 8   ENABLE input:
This digital input signal initializes the application.
The controller and the READY signal are activated.
The output signal to the control element is enabled.
Target position is set to actual position and the drive stays stationary, in closed loop.
The ENABLE bit via fieldbus must be active, too.

ANALOGUE INPUT

PIN 13   Analogue position feedback value (X1),
range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

PIN 14   Analogue position feedback value (X2),
range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

ANALOGUE OUTPUT

voltage
PIN 16/15   Differential output (U1)
± 100% corresponds to ± 10V differential voltage

PIN 19/20   Differential output (U2)
± 100% corresponds to ± 10V differential voltage

current
PIN 12/15   current output U1: ±100% corresponds to 4 ÷ 20 mA

PIN 18/19   current output U2: ±100% corresponds to 4 ÷ 20 mA

SSI SENSOR INTERFACE

position 1		**position 2**	
PIN 37	CLK+ output	PIN 41	CLK+ output
PIN 38	CLK- output	PIN 42	CLK- output
PIN 39	DATA+ input	PIN 43	DATA+ output
PIN 40	DATA- input	PIN 44	DATA- output
PIN 33	24V Power supply of the SSI sensor	PIN 47	24V Power supply of the SSI sensor
PIN 34	0V Power supply of the SSI sensor	PIN 48	0V Power supply of the SSI sensor

5 - INSTALLATION

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

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 into 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 > 3 m.

With high frequencies EMI ferrite elements can be used.

Take into account a separation between the power part (and power cables) and signal part when arranging 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.

5.2 - PROFINET IO RT interface (PN version)

ProfiNet is a field bus based on Industrial Ethernet technology based on IEEE 802.3 and is based on the 100 Mbit/s version of full duplex and Ethernet.

Diagnostic LEDs are embedded on each port.

The characteristics of an I/O device are described in a GSDML file. It describes the structure of the cyclic input and output data transferred between the programmable controller and the fieldbus I/O device.

The communication parameters must be pre-set, 32 bytes for the input and 32 bytes for the output.

The .GSDML descriptor file is available for download on our website.

5.3 - Installation guidelines for PN version

ProfiNet IO field devices are exclusively connected via switches as network components.

A ProfiNet network can have a star, tree, ring or line structure. The transmission media are CAT5 copper cables.

To comply with IP20, RJ45 CAT5 connectors are used in the electrical cabinet, in accordance with EN 50173 or ISO / IEC 11801.

The connection between the components of the ProfiNet network is called the ProfiNet channel. In most cases, ProfiNet channels are built with copper cables according to IEC 61784-5-3 and IEC 24702, maximum length 100 m.

5.4 - EtherCAT IO interface

ETHERCAT (EtherNET for Control Automation Technology) is a fieldbus system based on EtherNET, the standard based on IEC 61158, IEC 61784 and ISO 15745-4, using full-duplex Ethernet physical layers.

5.5 - Installation guidelines for EC version

The EtherCAT network consists of a master and one or more slave devices and supports almost any topology, line, tree or star.

The cable length between two EtherCAT devices must not exceed 100 meters. This derives from Fast Ethernet technology, which for reasons of signal attenuation over the length of the line allows a maximum connection length of 5 + 90 + 5 m.

To connect EtherCAT devices use only Ethernet connections (cable + plug) at least category 5 (CAT5) according to EN 50173 or ISO IEC 11801. EtherCAT uses four wires of the cable for signal transmission and RJ45 connectors.

The contact assignment is compatible with the Ethernet standard (ISO / IEC 8802-3).

Diagnostic LEDs are embedded on each port.

The characteristics of an I/O device are described in an EtherCAT Slave Information (.ESI) file. It describes the structure of the cyclic input and output data transferred between the programmable controller and the fieldbus I/O device.

The communication parameters must be pre-set, 32 bytes for the input and 32 bytes for the output.

The .ESI file is available for download from our website.

5.6 - Profibus DP interface

Profibus has to be used to control the axis and can also be utilized to set the parameters.

The module supports all baud rates from 9,6 kbit/s up to 12000 kbit/s with auto detection of the baud rate.

The functionality is defined in IEC 61158. The Profibus address can be programmed using the software EWM20_SmartManager or online via the Profibus.

A diagnostic LED indicates the online status.

5.7 - Installation guidelines for PD version

A typical screened Profibus plug (D-Sub 9pol with switchable termination) is mandatory. Every Profibus segment must be provided with an active bus termination at the beginning and at the end. The termination is already integrated in all common Profibus plugs and can be activated by DIL switches.

The Profibus cable must be screened at determined contact clips in the Profibus plug.

The GSD data configuration files are available for download on our website. The communication parameters are 16 bytes (8 words) for IN/OUT variables.

6 - DEVICE SETUP

Card set-up is possible via software only, via USB port.

The system can be controlled in open loop, moving up and down the axis via fieldbus with commands HAND:B and HAND:A at the velocity set in parameter HAND to facilitate the commissioning of the card and its calibration.

6.1 - Software EWM20_SmartManager

The software EWM20_SmartManager can be easily downloaded from the Duplomatic MS website in the Products section.

EWM-2SS-DAD

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

Once connected, the software automatically recognises the card model and shows a table with 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 optimized for Microsoft OS Windows 10 and it is still compliant with Windows 7.

6.2 - Parameters table

The parameters table is available in English or German. The language is settable with LG parameter.

The MODE allows to choose between a display of the parameter list by functional areas (sensor interface, position, pressure, output signals) or a generic list that includes them all.

For a complete list of parameters and their settings please refer to the Technical Manual *89475 ETM*.

7 - MAIN FEATURES

The EWM-2SS-DAD is a card for positioning control loop.

The controller can be optimized by few parameters only and the movement profile is preset via fieldbus (position and velocity).

7.1 - Sequence of the positioning

The positioning is controlled via fieldbus.

You can switch from the positioning in closed loop to the manual movement in open loop and vice versa.

With READY active the system is ready. The open loop control is achieved by using the HAND bits and the speed parameter. When the bit HAND goes low the card assumes the current position as the requested one and the card is ready to work in closed loop.

Enabling the START bit also, the command position parameter (fieldbus) becomes active and the new command position will be taken over as a new target.

The axis moves immediately to the new position and indicates on the POSWIN status bit when it reaches the position. This output is active as long as the axis is within the InPos window or within the START bit is active.

Setting the synchronous bit (SC) will synchronize both axes and the synchronization controller will work according to the function mode selected (Master-slave, Average). The axis 2 is now following the axis 1 according to the master-slave-principle.

flow (volume) P→A and B→T
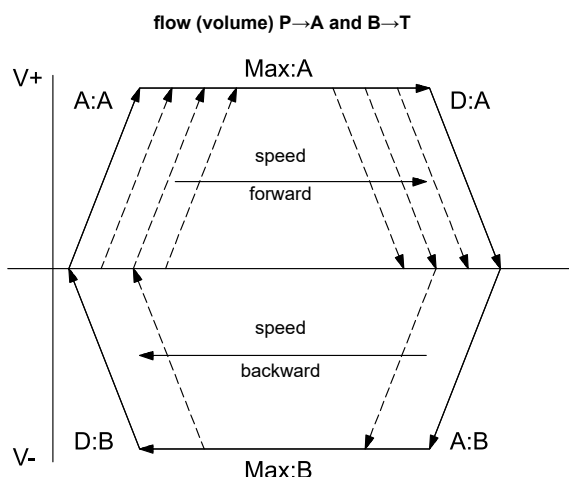
Two methods for positioning are available:

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 a transducer and compared with a specified target position. The target position and speed are set via fieldbus.

The positioning accuracy will almost be limited by the resolution of the transducer and by the size of the hydraulic valve. Therefore, the correct valve selection is the most important point to be evaluated during the planning stage, being careful on how to balance positioning time and system accuracy.

7.2 - 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 switched off and provides differentiated parameters for each axis.

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

The deceleration characteristic is set with this parameter. The SQRT function should be applied to positive overlapped proportional valves. The non-linear flow characteristic of these valves is linearized by the SQRT function.

The LIN or SQRT1 function should be applied to zero-lapped valves (control valves and servo valves) regardless of the application. The progressive characteristic of the SQRT1 function has better positioning accuracy but can also lead to longer positioning times in individual cases.

Different parameters available for each axes.

LIN: Linear deceleration characteristic (gain is increased by a factor of 1).

SQRT1: Root function for braking curve calculation. The gain is increased by a factor of 3 (in the target position). This is the default setting.

SQRT2: Root function for braking curve calculation. The gain is increased by a factor of 5 (in the target position). This setting should only be used with a significantly progressive flow through the valve.
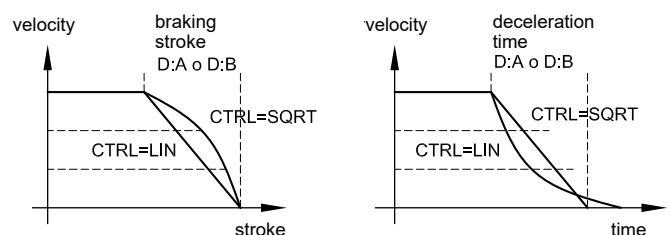
7.4 - Adaptation of the output signal to the valve characteristic (TRIGGER).

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 overlap step. The advantage is a better and more stable positioning behaviour. With this compensation, non-linear volume flow characteristic curves can be adjusted too.

If it is possible to apply adjustments to the valve or to the valve electronics, it has to be guaranteed, that the adjustment has to be carried out either at the power amplifier or at the positioning module.

If the deadband compensation value (MIN) is set too high, it influences the minimal velocity which cannot be adjusted any longer.
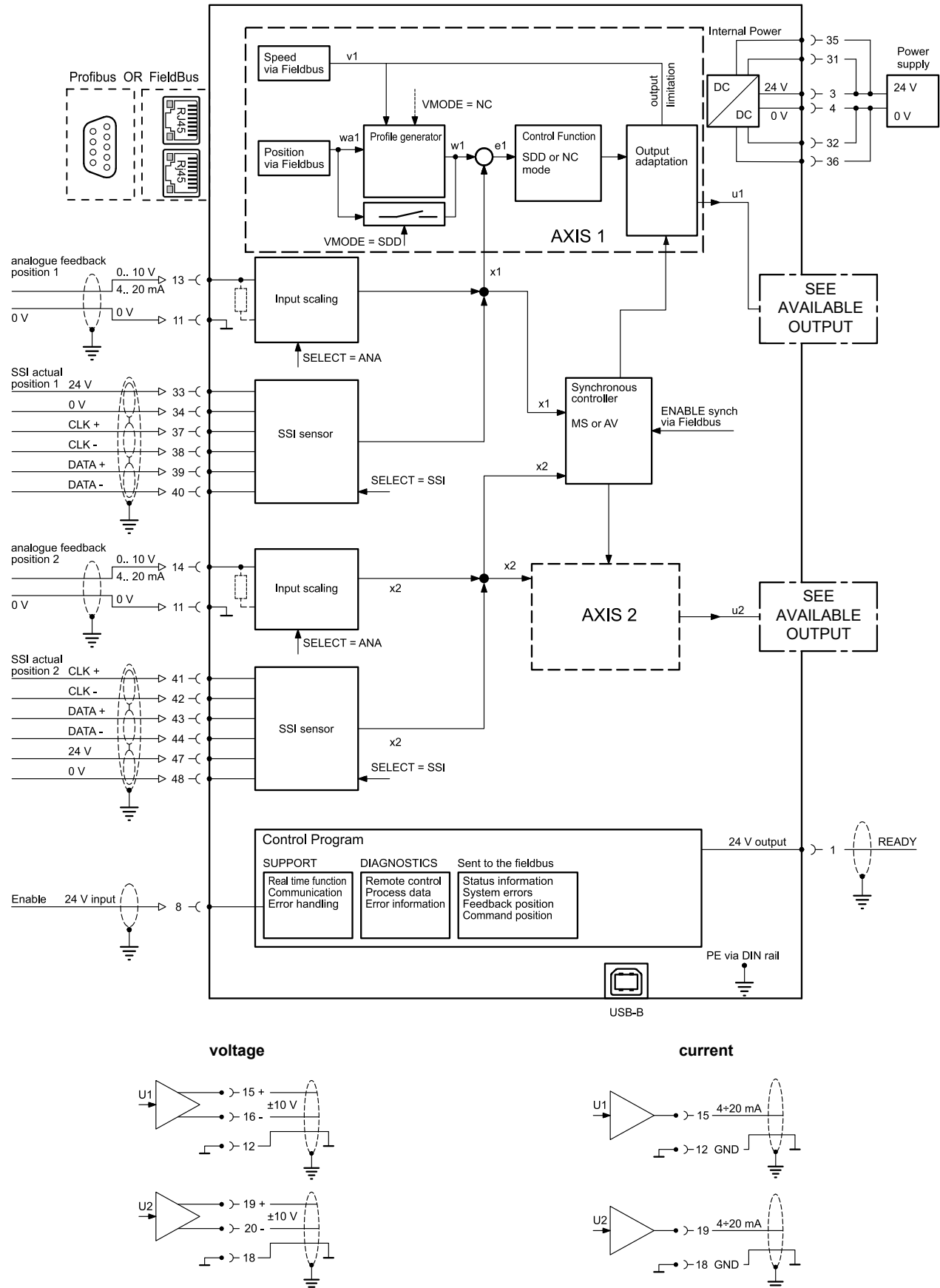
In extreme cases this results in oscillations around the closed loop controlled position.

Different parameters are available for each axis.
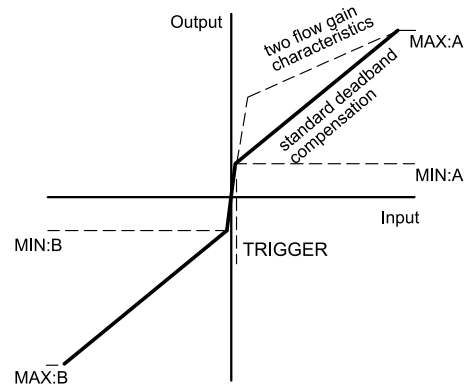
8 - CARD BLOCK DIAGRAM

Caution! PIN 4 is connected internally to PIN 11 and PIN 12. These connections serve as a reference potential for the analogue sensor or demand value signals.
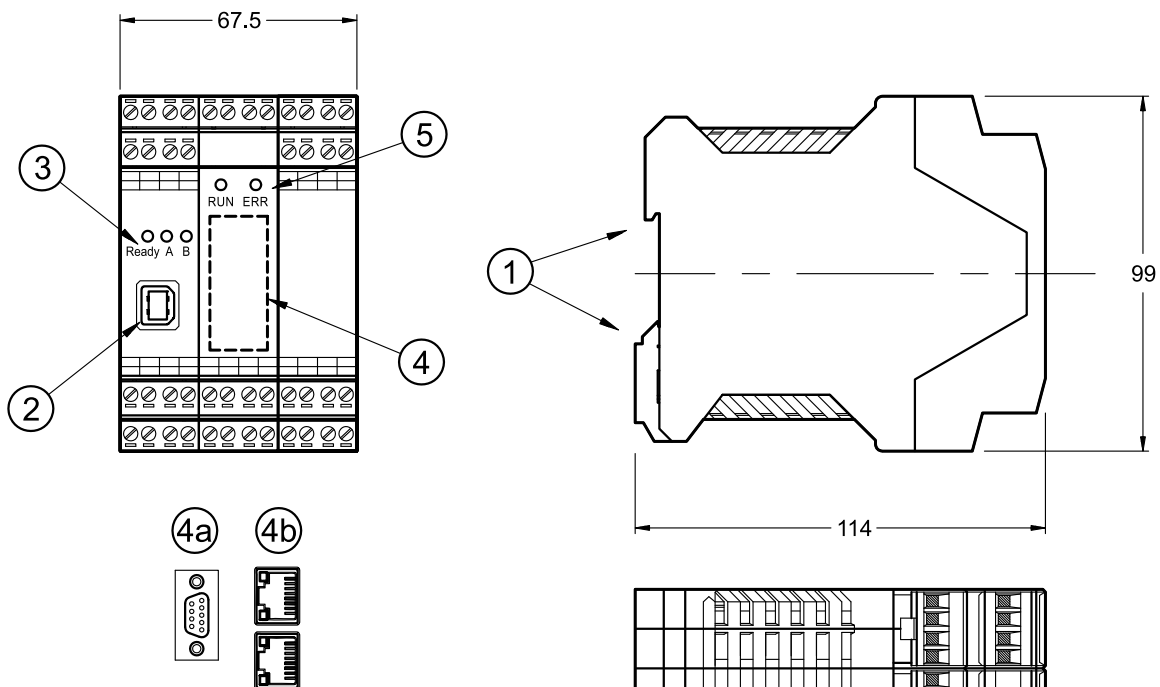
9 - OVERALL AND MOUNTING DIMENSIONS

1	DIN EN 50022 type rail fastening
2	USB port for PC connection
3	Status indicators for READY, axis 1 and axis 2.
4a	Profibus interface port
4b	Fieldbus RJ45 network ports with embedded led
5	Status led of the communication process