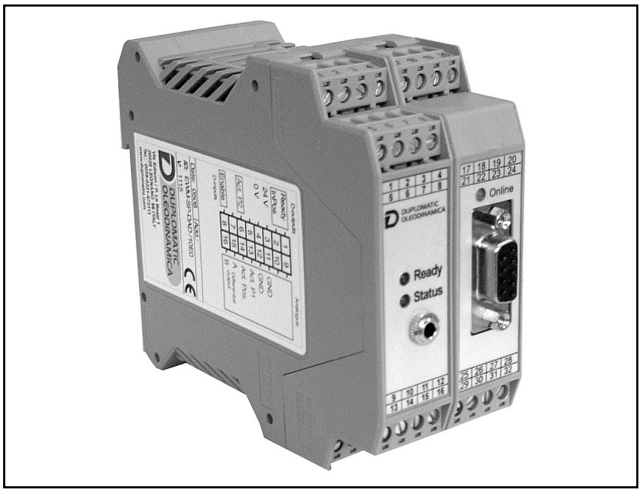


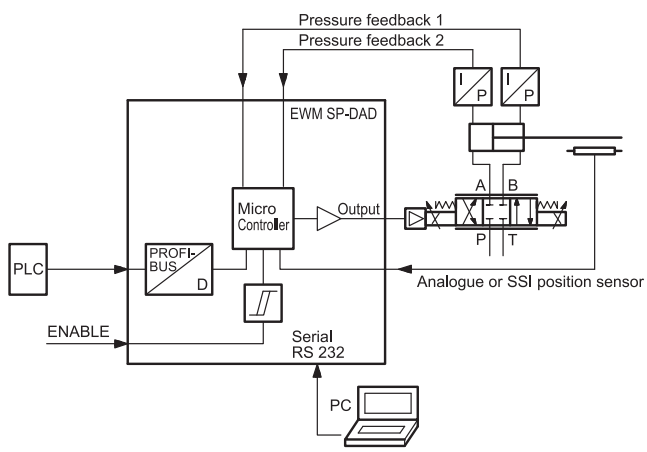
EWM-SP-DAD

CARD FOR AXIS CONTROL (STROKE AND PRESSURE) WITH PROFIBUS COMMUNICATION INTERFACE

SERIES 10

RAIL MOUNTING TYPE: DIN EN 50022

OPERATING PRINCIPLE



— This card has been developed to drive the positioning of the hydraulics actuators where an high accuracy is needed, using a digital sensor with SSI interface to measure the positions, or an analog sensor with an accuracy of up to 0,01%

— Additionally an integrated control for pressure limitation, for one or two sensors (differential pressure), is implemented

— The card works as an axis controller and communicates with the PLC via the integrated Profibus interface and vice versa.

— The card works in three ways: stroke depending deceleration, NC mode and force control mode.

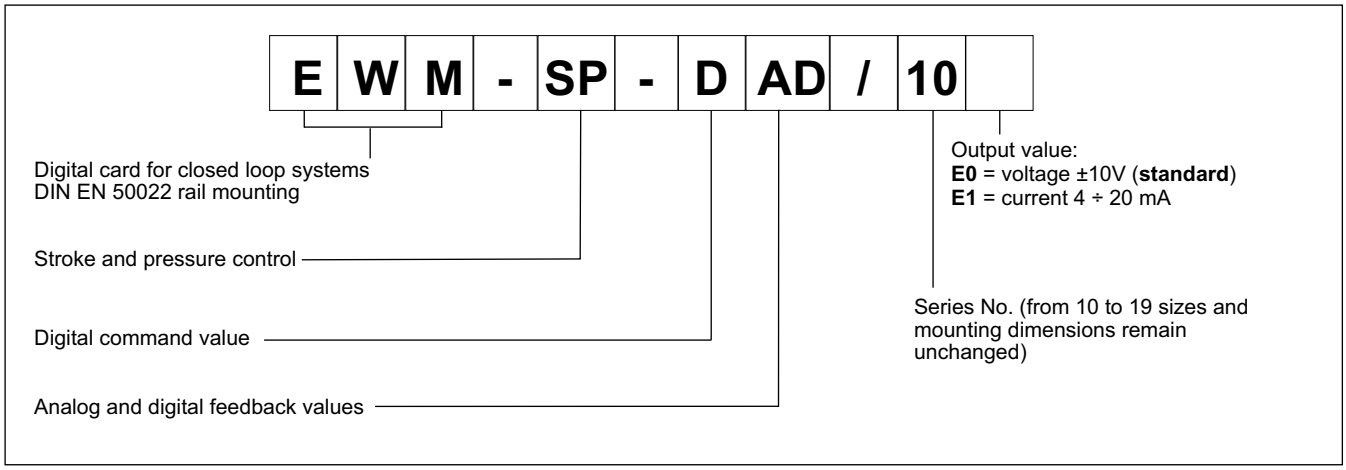
— Tipically used for general positioning control with integrated closed loop pressure control.

— The card use the RS232C interface, and is settable via notebook, using the software kit (EWMPC).

TECHNICAL CHARACTERISTICS

Power supply	V DC	24 ±5% ripple included - external fuse 1,0 A
Current consumption	mA	400 + sensor power consumption
Command value		via Profibus DP - ID number 1810h
Feedback value	V mA SSI	0 ÷ 10 (R_I = 33 kΩ) 4 ÷ 20 (R_I = 250 Ω) digital sensor with any interface SSI
Output value: - E0 version - E1 version	V mA	±10 (max load 5 mA) 4 ÷ 20 (max load 390 Ω)
Position accuracy	%	± 2 bits of sensor resolution
Interface		RS 232 C
Electromagnetic compatibility (EMC):		Emissions EN 61000-6-2:8/2002 Immunity EN 61000-6-3:8/2005
Housing material		thermoplastic polyammide PA6.6 combustibility class V0 (UL94)
Housing dimensions	mm	120 (d) x 99(h) x 46(w)
Connector		4x4 poles screw terminals - PE direct via DIN rail
Operating temperature range	°C	-20 / +60
Protection degree		IP 20

1 - IDENTIFICATION CODE



The card EWM-SP-DAD is an evolution of an analog model (EWM-S-AD). The hydraulic axes can be realized as a positioning controller with digital stroke measuring via a universal SSI-interface or via analogue sensor. Additionally a force respectively a differential pressure control is integrated. So the customer can choose between two sensor types: analog or digital and the communication with the PLC is via Profibus DP.

Positioning: this function is similary to the EWM-S, the axis can be used as point to point controller (stroke depended deceleration) as well as in NC mode.

With only a few parameters the controller can be optimized and the movement profile is preset via Profibus (position and velocity).

Here below an example of profile with a switch speed:

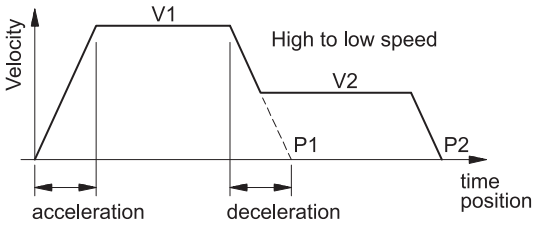
- the target position is command value 2 (P2) combined with velocity 2 (V2).

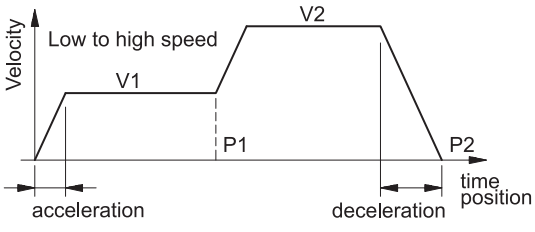
- the switch over position is command value 1 (P1), combined with velocity 1 (V1).

Switching over position from a high to a lower speed is calculated by the deceleration func-tion and V2.

Switching over from a low to a high velocity is carried out at the position (P1) via the acceleration ramp; see below.

- If the positioning command value 2 (P2) is between the actual and the position command value 1 (P1), to position 2 (P2) can only be driven with speed 1 (V1).





Pressure limitation control function:
For p/Q control a dynamic zero-overlapped control valve is necessary. If the B-side of the cylinder can not be relieved, pressure in both cylinder sides has to be measured.
The cylinder can be driven in both directions in positioning mode with limited velocity. The P command value via Profibus presets the max differential pressure. If this pressure (or force) exceedes, the controller reduces the output signal to the valve (also in the negative range), so that the preset pressure will be kept. To go backwards for keeping the force is possible.

2- FUNCTIONAL SPECIFICATIONS

2.1 - 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, free-wheel diodes).
It is recommended to use a regulated power supply (linear or switching mode) for the card supply and for the sensors.

2.2 - Electrical protections
All inputs and outputs are protected against overvoltage and have filters.

2.3 - Digital Input (ENABLE)
The card accepts digital input. The digital input must have a voltage from 12 to 24 V with current <0,1A. As common potential 0V (PIN4) is used: Low level <4V High level >12V. See the block diagram at paragraph 8 for the electric connections.

2.4 - Command value
The card accepts the input via Profibus, ID number 1810h (see paragraph 4). Use the profibus interface mounted on the front panel.

2.5 - Input feedback values
The card accepts analog and digital feedback input. The digital sensor parameters are settable via software (see parameters table).

2.6 - Output values
The card is designed for two type of output values, voltage ±10V (E0 version) or current 4 ÷ 20 mA (E1 version); standard output value is E0 type.

2.7 - Digital Output

Two digital output are available, INPOS and READY, and their signals are displayed from the leds. The outputs are available on PIN1 and PIN2. The output is 24V. The PIN 4 is used as common potential 0V: low level <4V high level >12V (I_{max} 50 mA with load of 200Ω).

EXAMPLE OF PARAMETERS TABLE

Commands	Parameter	Defaults	Units	Description
inpx	X= SSI|ANA	SSI	-	Selection of the sensor input channel.
pdpadr x	X= 1… 126	5		profibus address
sens x	x= on|off	on	-	Activation of the sensor and internal failure monitoring.
ain:i a b c x	i= XL|XP1|XP2 a= -10000… 10000 b= -10000… 10000 c= -10000… 10000 x= V|C	: 10000 : 10000 : 0 : V	- - 0,01% -	Analogue input scaling. **XL**, **XP1** or **XP2** for the input signal. **V** = voltage input and **C** = current input. With the parameters **a**, **b** and **c** the inputs can be scaled (output = a / b * (input - c)). Because of the programming of the **x**-value (x = **C**) the corresponding input will be switched over to current automatically.
a:i x	i= A|B x= 1… 2000	:A 200 :B 200	ms ms	Acceleration time depending on direction. **A** indicates analogue output 15 and **B** indicates analogue output 16. Normally **A** = flow P-A, B-T and **B** = flow P-B, A-T.
d:i x	i= A|B|S X= 50… 10000	:A 2500 :B 2500 :S 1000	0,01% 0,01%	Deceleration stroke depending on direction. The loop gain is calculated by the deceleration stroke. The shorter the higher. In case of instabilities longer deceleration stroke will be sufficient.
ctrl x	x= lin|sqrt1|sqrt2	sqrt1	-	Selection of the control function: **lin** = standard linear P-control, **sqrt1** = progressive time optimized deceleration curve **sqrt2** = **sqrt1** with a higher gain in position
stroke x	X= 2… 3000	500	mm	Sensor stroke.
ssioffset X	X= -30000… 30000	0	0,01 mm	Zero point adjustment of the sensor.
ssires X	X= 1… 1000	1000	ink/mm	Resolution of the sensor.
ssibits x	X= 8… 31	24	-	Bits of the data word.
ssicode x	X= GRAY|BIN	GRAY	-	Format of the data word.
ssipol x	X= +|-	+	-	Sensor polarity, attention: SSIOFFSET has to be set to compensate negative position values.
vramp x	x= 1… 2000	200	ms	Ramp time for velocity input.
vmax x	X= 1… 20000	50	mm/s	Parameter is active in vmode = ON only. **VEL** defines the maximum speed. Via the external command speed an actual speed between 0,5… 100 % can be selected.
vmode x	x= on|off	off	-	Activation of the NC-generator. The command position is generated by a velocity profile (internal or external preset of v). The axis drives more or less speed controlled.
hand:i x	i= A|B x= -10000… 10000	:A 3300 :B -3300	0,01% 0,01%	Degree of output signal in manual mode
ap:i x	i= UP|DOWN x= 0… 60000	:A 100 :B 100	ms ms	Ramp time for pressure UP and DOWN.
inpos x	i= S|D X= 0… 5000	32	0,01%	Range for the InPos signal (status output) **S** is used for the static INPOS window. **D** is used for the dynamic (following error) monitoring in NC mode.
poffset x	x= -2000… 2000	0	0,01%	Pressure offset.
pol x	x= +|-	+	-	For changing the output polarity. All **A** and **B** adjustments depend on the output polarity. The right polarity should be defined first.
c:i x	i= P|I|D|T1|IC :P x= 0… 10000 :I x= 0… 2050 :D x= 0… 120 :T1 x= 0… 100 :IC x= 0… 10000	:P 50 :I 400 :D 0 :T1 1 :IC 5000	0,01 ms ms ms 0,01%	PID-compensator used for pressure control. P-Gain, 50 = nominal gain of 0,5. I-Gain, in ms, can be deactivated by values > 2010. D-Gain, in ms. T1 in ms; damping of the D-Gain. IC-Factor; activation point of the integrator.
perror x	x= 0..2000	100	0,01%	Pressure error (abs(w-x) < error).
save	-	-	-	Storing the programmed parameter in E²PROM.
loadback	-	-	-	Reloading the parameter from E²PROM in working RAM
st				Status of the digital inputs.
wl, xl, xw, u, v, wp, xp, xp1, xp2, xwp, up	-	-	-	Actual signals: command value, actual value, process data, control divergence and reference value.
default	-	-	-	Preset values will be set.

3 - LED FUNCTIONS

There are three leds on the card: one on the profibus module, that indicates the online status of Profibus connection, and two on the other module:

GREEN: Shows if the card is ready.

ON - The card is supplied
OFF - No power supply or ENABLE is inactive.
FLASHING - Failure detected (internal or 4 ÷ 20 mA) only if SENS = ON

YELLOW: Is the signal of the control error monitoring.

ON - No control error
OFF - Error detected, depending of a parameter error.

4 - PROFIBUS DP LINKING

4.1 Profibus functions

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 by a terminal program, EWM-PC/10 or online via the Profibus. A diagnostic LED indicates the online status.

4.2 Installation

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. PIN 17 have to be connected with PE (low impedance).

The communication parameter are 16 bytes (8 words) for IN and OUTPUT variables

Byte	Function	Comment
1	control word Hi	
2	control word Lo	actual not used
3	command position 1 Hi	
4	command position 1	
5	command position 1	
6	command position 1 Lo	
7	velocity 1 Hi	
8	velocity 1 Lo	
9	command position 2 Hi	active, if a second velocity is programmed (Bytes 13 and 14)
10	command position 2	
11	command position 2	
12	command position 2 Lo	
13	velocity 2 Hi	
14	velocity 2 Lo	
15	-	reserved
16	-	reserved

the definition of the control word are:

Byte 1 - control word Hi		
bit	**Function**	
8	Enable (with hardware enable)	1 = ready
7	Start	1 = active
6	Hand-	1 = active
5	Hand+	1 = active
4		
3		
2		
1		

Byte 3 to 6 - command position 1		
bit	**Function**	
from 25 to 32	Command position Hi byte	defined by the sensor resolution
from 17 to 24		
from 9 to 16		
from 1 to 8	Command position Lo byte	

Byte 7 and 8 - command velocity 1		
bit	**Function**	
from 9 to 16	velocity Hi byte	max 3f hex
from 1 to 8	velocity Lo byte	max ff hex

Byte 9 to 12 - command position 2		
bit	**Function**	
from 25 to 32	Command position Hi byte	defined by the sensor resolution
from 17 to 24		
from 9 to 16		
from 1 to 8	Command position Lo byte	

Byte 13 and 14 - command velocity 2		
bit	**Function**	
from 9 to 16	velocity Hi byte	max 3f hex
from 1 to 8	velocity Lo byte	max ff hex

The enable bit is combined with the external enable input; that means that both signals must exist, in order to enable the axes.

4.3 Data sent to the profibus

Totally, 16 bytes will be sent to the Profibus.

Byte	Function	Comment
1 (0)	status word Hi	
2 (1)	status word Lo	not used
3 (2)	actual position Hi	
4 (3)	actual position	
5 (4)	actual position	
6 (5)	actual position Lo	
7 (6)	internal command position Hi	
8 (7)	internal command position	

9 (8)	internal command position	
10 (9)	internal command position Hi	
11 (10)		
12 (11)		
13 (12)		
14 (13)		
15 (14)		
16 (15)		

the status word is encoded as follow:

Byte 1 - status word Hi		
bit	**Function**	
8	READY	1 = ready to operate
7	INPOS	1 = actual value in position window
6		
5		
4		
3		
2		
1		

Byte 3 and 4 - command position		
byte	**Function**	
from 25 to 32	Command position Hi-Byte	in resolution of the positioning sensor
from 17 to 24	Command position	
from 9 to 16	Command position	
from 1 to 8	Command position Lo-Byte	

Byte 5 and 6 - internal command position		
byte	**Function**	
from 25 to 32	Command position Hi-Byte	in resolution of the positioning sensor
from 17 to 24	Command position	
from 9 to 16	Command position	
from 1 to 8	Command position Lo-Byte	

4.4 Process data definition

The resolution (data via Profibus) of the command position is defined by the actual sensor resolution. The module works always with full sensor accuracy.

The scaled speed is defined by 0x3fff (16373) for 100% of the maximum programmed speed.

Optional two positions and two speeds can be sent to the module. In this mode high/low speed or low/high speed profiles are generated automatically. This mode is deactivated by programming zero for speed 2.

The module will be controlled by the control word, the command positions and speeds.

See the *Overhaul manual* for detailed information about the controls.

5 - ADJUSTMENTS

On the EWM card family, the adjustment setting is possible only via software. Connecting the card to the PC, the software automatically recognises the card model, and shows a table (see example on page 3) with all the available parameters, with their commands, the default setting, the measuring unit and an explanation of the command and its uses. The parameters changes depending on the card model, and they are fully described in the *Overhaul manual*.

6 - INSTALLATION

The card is designed for rail mounting type DIN EN 50022.

The wiring connections are on the terminal strip located on the bottom of the electronic control unit. It is recommended to use cable sections of 0.75 mm^2, up to 20 m length and of 1.00 mm^2 up to 40m length, for power supply and solenoid connections. For other connections it is recommended to use cables with a screened sheath connected to earth only on the card side.

NOTE 1

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).

In environments that are critical from the electromagnetic interference point of view, a complete protection of the connection wires can be requested.

7- SOFTWARE KIT EWMPC/10 (code 3898401001)

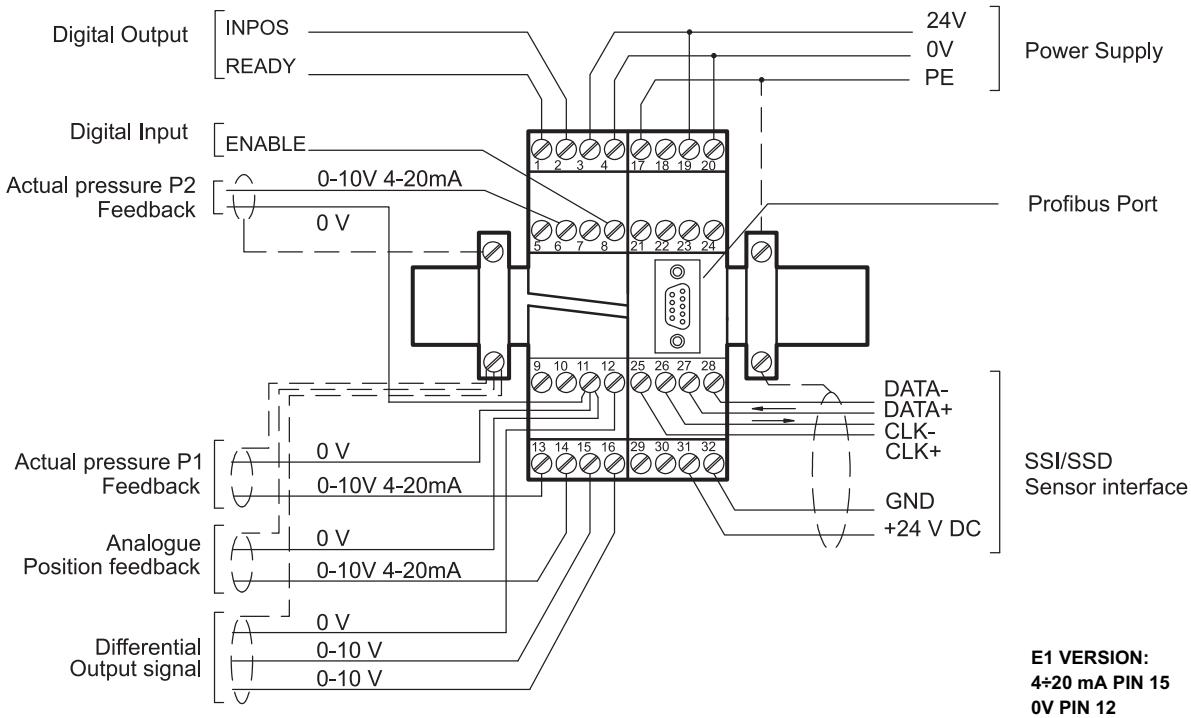
The software kit comprising a USB cable (2.70 mt lenght) to connect the card to a PC or notebook and the software.

During the identification all information are read out of the module and the table input will be automatically generated.

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 XP® operating systems.

8 - WIRING DIAGRAM



DIGITAL INPUT AND OUTPUT

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.

ANALOGUE INPUT AND OUTPUT

PIN 6 — Analogue pressure feedback value (XP2), range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

PIN 13 — Analogue pressure feedback value (XP1), range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

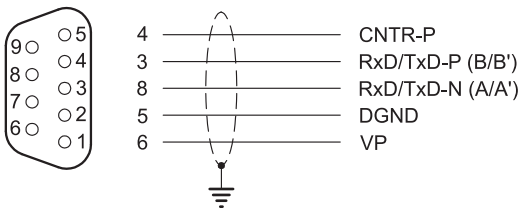
PIN 14 — Analogue position feedback value (XL), range 0 ÷ 100% corresponds to 0 ÷ 10V or 4 ÷ 20 mA

PIN 15/16 — Differential output (U)
±100% corresponds to ± 10V differential voltage, optionally (E1 version) current output ±100% corresponds to 4 ÷ 20 mA (PIN 15 to PIN 12)

SSI SENSOR INTERFACE

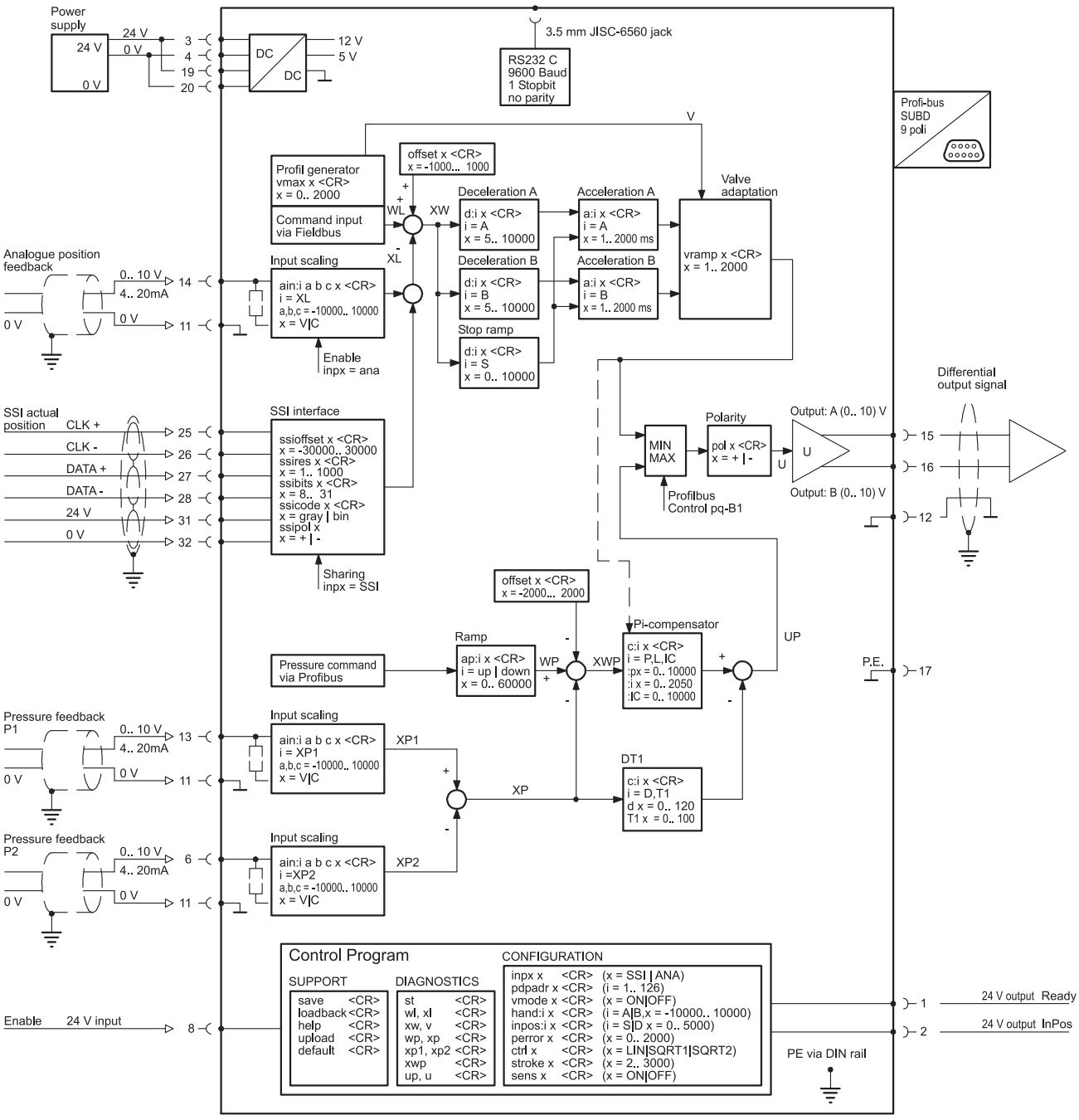
PIN 25 — CLK+ output
PIN 26 — CLK- output
PIN 27 — DATA+ input
PIN 28 — DATA- input
PIN 31 — 24V Power supply of the SSI sensor
PIN 32 — 0V Power supply of the SSI sensor

PROFIBUS PORT WIRING AND LINKING CONFIGURATION

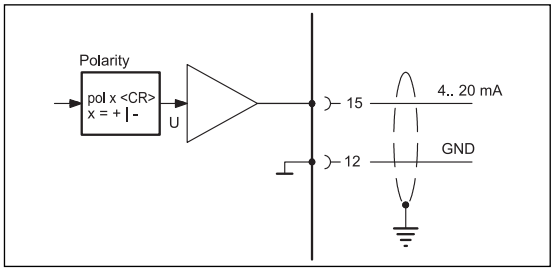


pin	Signal name	Function
1-2-7-9	not used	-
3	RxD/TxD-P (B-Line)	Receive/Send P data
4	CNTR-P/RTS	Request to Send
5	DGND	Data ground
6	VP	+5 V DC for external bus termination
8	RxD/TxD-N (A-Line)	Receive/Send N data

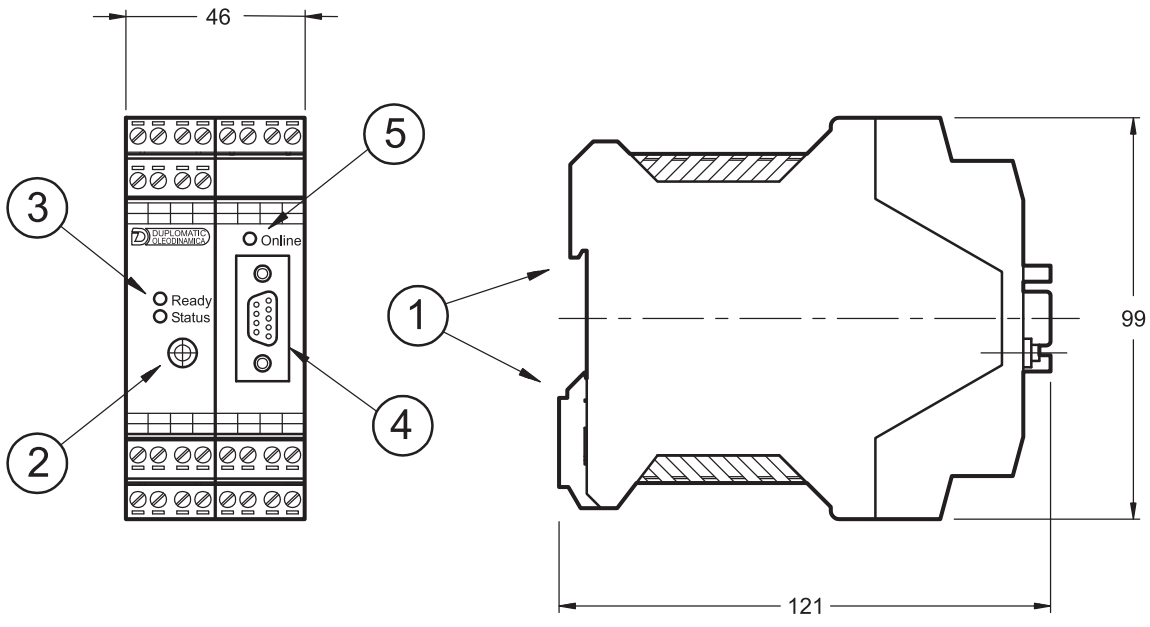
9 - CARD BLOCK DIAGRAM



OUTPUT SIGNAL - E1 VERSION



10 - OVERALL AND MOUNTING DIMENSIONS



1	DIN EN 50022 rail type fastening
2	Plug for PC cable connection
3	LED for Output signals
4	Profibus Interface port
5	Profibus LED

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