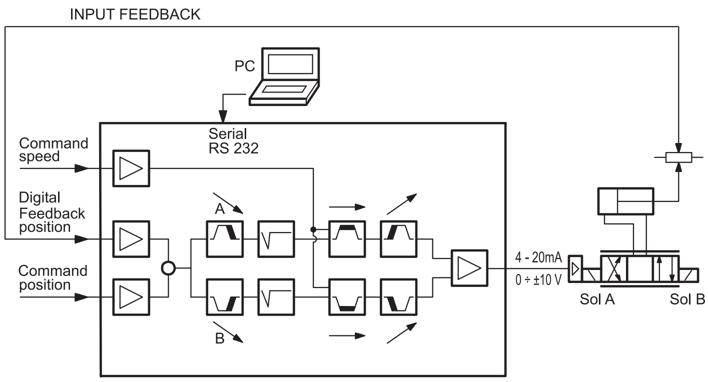
EWM-S-AD

ANALOGUE POSITIONING CARD FOR STROKE CONTROL IN CLOSED LOOP SYSTEMS WITH DIGITAL FEEDBACK

SERIES 10

RAIL MOUNTING TYPE: DIN EN 50022

OPERATING PRINCIPLE



— This card has been developed for closed loop positioning of hydraulics actuators where an high accuracy is needed, using a digital sensor with SSI interface to measure the position.

— The card controls a directional proportional valve with integrated electronics and allows an optimal use of overlapped and zero-overlapped proportional valves. Internal function and failure are monitored with two digital output easy to read.

— Velocities can be defined also by an external speed command. Two versions are available, with output value in voltage or in current.

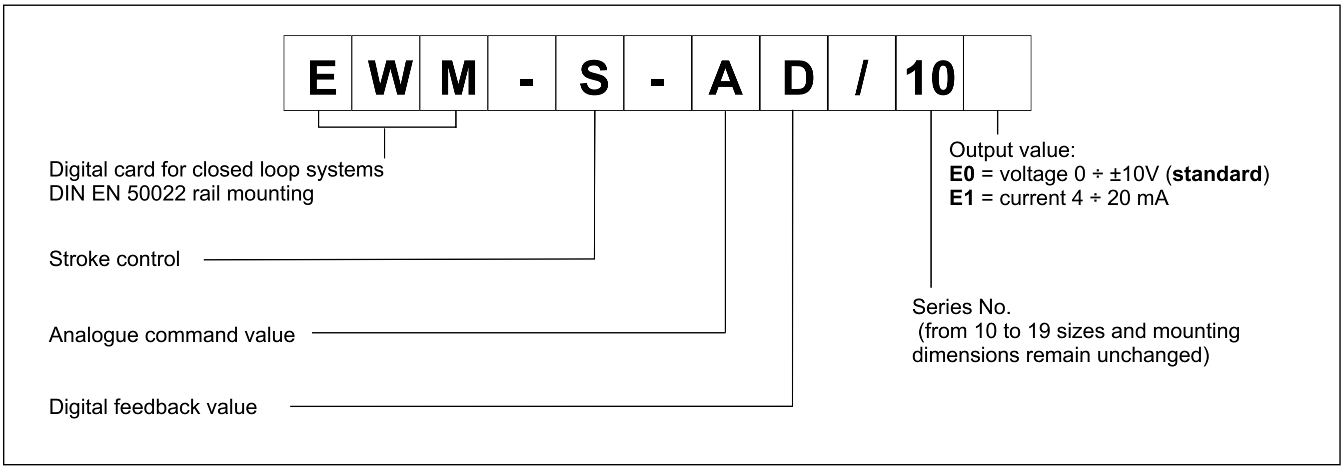
— The positioning control loop can be made in two ways: stroke depending deceleration or NC mode.

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

TECHNICAL CHARACTERISTICS

Power supply	V DC	12 ÷ 30 ripple included - external fuse 1,0 A
Current consumption	mA	100 + sensor power consumption
Command value	V mA	0 ÷ 10 (R_I = 25 kΩ) 4 ÷ 20 (R_I = 250 Ω)
Command speed	V	0 ÷ 10 (R_I = 25 kΩ)
Feedback value	SSI	digital sensor with any SSI interface
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): according to 2004/108/CE standards		Emissions EN 61000-6-3 Immunity EN 61000-6-2
Housing material		thermoplastic polyamide 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



This module supports the simple point-to-point positioning with hydraulic drives. The deceleration characteristics can be defined with the command CTRL, choosing between linear (LIN) or nearly square root (SQRT1) parameters. See at par. 4, adjustments.

The sampling time of the control loop is 1 ms.

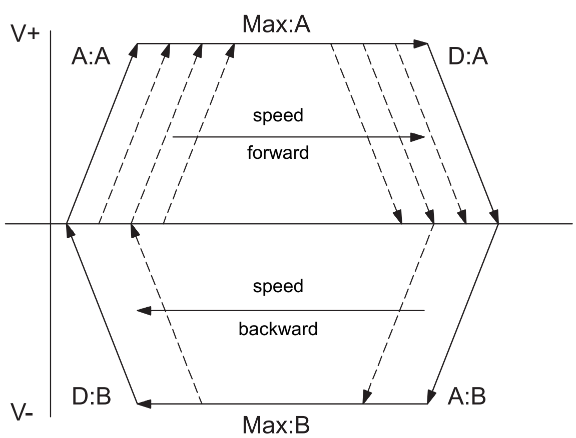
Two operating modes can be selected:

A - stroke depending deceleration, that means the control gain will be adjusted with the parameters D:A and D:B This is a time-optimal positioning structure with very high stability.

B - NC mode, where the position value is generated from the following error.

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 contradictory requirements (short positioning time and high accuracy) have to be considered in the system design.

flow (volume) P→A and B→T



The actuator position is detected by a digital 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 by an external speed input command.

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 inductivity 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 the sensors.

2.2 - Electrical protections

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

2.3 - 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 with current <50mA. See the block diagram at paragraph 8 for the electric connections.

2.4 - Command value

The card accepts an analogue input signal. The command value can be 0 ÷ 10 V (R_I = 25 kΩ) or 4 ÷ 20 mA (R_I = 250Ω).

2.5 - Command speed

The card accepts an analogue input signal. The command speed must be 0 ÷ 10 V (RI = 90 kΩ).

2.6 - Input 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 (see parameters table). The max sensor resolution is 0,001mm.

2.7 - Analogue output values

E0 version: output voltage 0 ±10 V.
E1 version: output current 4 ÷ 20 mA.

A feedback monitor signal is available as 0 ÷ 10V output on PIN 17 and 18.

2.8 - Digital Output

Two digital output are available, INPOS and READY, that are displayed via LEDs on the front panel.
Low level <2V High Level > 10 V Max 50 mA with load 200Ω.

3 - LED FUNCTIONS

There are two LED on the card: GREEN and YELLOW.

GREEN: Shows if the card is ready.

ON - The card is supplied
OFF - No power supply
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 - ADJUSTMENTS

On the EWM cards, 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 with all the available commands, with their parameters, the default setting, the measuring unit and an explanation of the commands and its uses. The parameters change depending on the card model.

EXAMPLE OF PARAMETERS TABLE

Command	Parameters	Defaults	Units	Group	Description
LG x	x= DE|GB	GB	-	STD	Changing language help texts.
MODE x	x=STD|EXP	STD	-	STD	Mode parameter.
TS x	x= 5..30	10	0,1 ms	EXP	Changing the controller sample time.
STROKE x	x= 10..10000	100	mm	STD	Working stroke or the sensor.
VS x	x= EXT|INT	INT	-	STD	Switch over between internal and external velocity preset.
VELO x	x= 1..10000	10000	0,01%	STD	Here the max velocity can be limited internally. The limitation function corresponds to the external velocity preset if VS was parameterized with EXT
VRAMP x	x= 10..5000	200	ms	VS=EXT	Ramp time for velocity input.
VMODE x	x= SDD|NC	SDD	-	EXP	Control structure for positioning process. SDD: stroke-dependent deceleration is activated. From the set deceleration point the drive then switches to control mode and moves accurately to the desired position. NC: In this mode a position profile is generated internally. The system always works under control and uses the following error to follow the position profile.
VMAX x	x= 1..3000	50	mm/s	VMODE=NC	Max velocity in NC mode.
EOUT x	x= -10000..10000	0	0,01%	EXP	When an input error occurs the adjusted value of 'EOUT' will be displayed at the output pin 15/16. A value less than 100 deactivates this function.
POL x	x= -|+	+	-	STD	For changing the output polarity. All **A** and **B** adjustments depend on the output polarity. The right polarity should be defined first.
SENS x	x= ON|OFF|AUTO	AUTO	-	STD	Activation of the sensor and internal failure monitoring.
AIN:W **AIN:X**	A= -10000..10000 B= -10000..10000 C= -500..10000 X= V|C	A: 1000 B: 1000 C: 0 X: V	-	STD	Analogue output selection. **W** and **X** for the inputs and **V** = voltage, **C** = current. 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:A x **A:B x**	x= 1..5000 x= 1..5000	100 100	ms ms	STD	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:A x **D:B x** **D:S x**	x= 1..10000 x= 1..10000 x= 1..10000	25 25 10	mm mm mm	VMODE=SDD	Deceleration stroke dependent from direction. The loop gain is calculated by the deceleration stroke. The shorter the higher. In case of instabilities longer deceleration stroke should be set Loop Gain = STROKE / D:A o STROKE / D:B.
V0:A x **V0:B x**	x= 1..200 x= 1..200	10 10	1/s 1/s	VMODE=NC	Loop Gain for NC mode: D:A = VMAX / V0:A e D:B = VMAX / V0:B Loop Gain = STROKE / D:A o STROKE / D:B.
CTRL x	x= lin|sqrt1|sqrt2	sqrt1	-	STD	Selection of the control function: (see **NOTE)** **lin** = standard linear P-control, **sqrt1** = progressive time optimized deceleration curve. **sqrt2** = sqrt1 with a higher gain in position.
HAND:A x **HAND:B x**	x= -10000..10000 x= -10000..10000	3330 -3330	0,01% 0,01%	STD	Hand speed (in manual mode) For the corresponding switch input the direction can be defined by the sign.

MIN:A x **MIN:B x**	x= 0..6000 x= 0..6000	0 0	0,01% 0,01%	STD	Zero point setting /following error compensation.
MAX:A x **MAX:B x**	x= 3000..10000 x= 3000..10000	10000 10000	0,01% 0,01%	STD	Maximum output signal limitation.
TRIGGER x	x= 0..4000	200	0,01%	STD	Trigger threshold for activating the following error compensation (MIN).
OFFSET x	x= -4000..4000	0	0,01%	STD	Offset value added to the output signal. (setpoint - actual value + offset).
INPOS x	x= 2..200000	200	µm	STD	Range for InPos signal. (See **NOTE**)

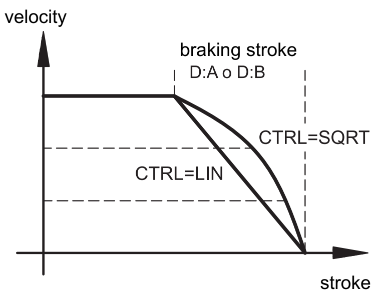
NOTE about the INPOS command: The INPOS command defines the window in relation to the stroke where the INPOS message is indicated. The monitored area is derived from the setpoint value minus the half “Inpos” value until setpoint value plus the half “Inpos” value. The positioning process is not influenced by this message. The controller remains active. In NC-mode this message has to be interpreted alternatively as following error.

NOTE about the CTRL command:: This command controls the braking characteristic of the hydraulic axis. With positive overlapped proportional valves one of both SQRT braking 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 braking characteristics (control gain corresponds to: 10000 / d:i).

SQRT*: Root function for the calculation for the braking curve.
SQRT1: with small control error. control gain corresponds to 30000 / d:i ;
SQRT2: control gain corresponds to 50000 / d:i



PARAMETER FOR SSI SENSOR

Command	Parameters	Defaul	Units	Group	Description
INPX x	x= ANA|SSI	ANA	-	STD	Sensor input changeover.
SSI:OFFSET x	x= -1000000… 1000000	0	µm	INPX=SSI	Position Offset.
SSI:POL x	x= +|-	+	-	INPX=SSI	Sensor polarity. To reverse the sensor working direction its polarity can be changed with this command.
SSI:RES x	x= 100… 10000	500	10 nm	INPX=SSI	Sensor resolution. The sensor signal resolution is defined with this parameter. Data is entered with the resolution of 10 nm (nanometer or 0.01µm). This means that if the sensor has 1 µm resolution the value 100 must be specified.
SSI:BITS x	x= 8… 31	24	bits	INPX=SSI	Number of bits trasmitted.
SSI:CODE x	x= GREY|BIN	GREY	-	INPX=SSI	Transmission coding.

5 - INSTALLATION

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

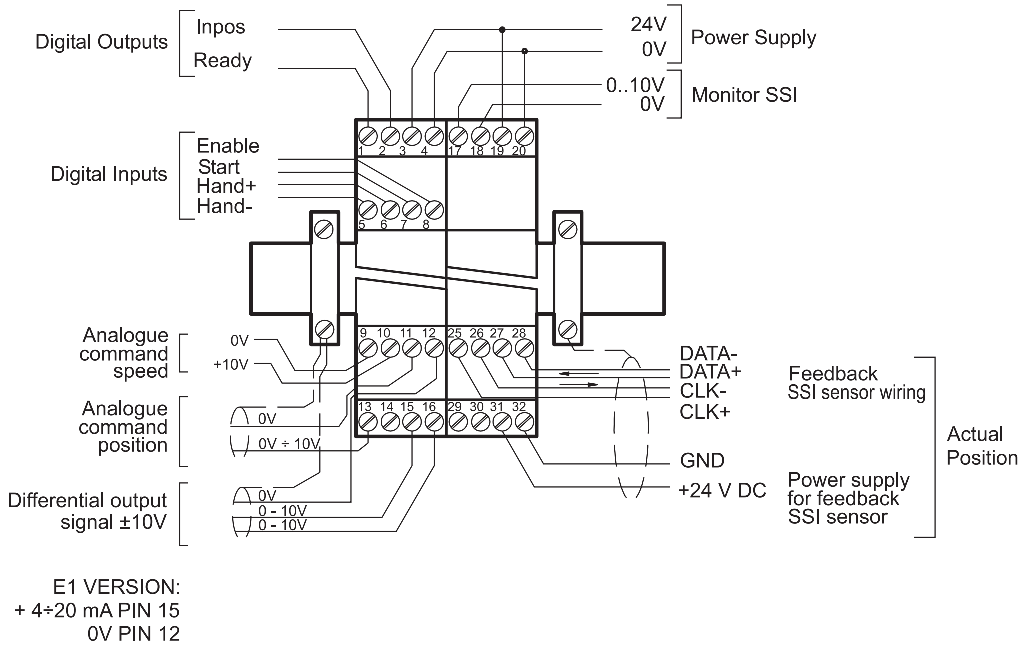
6 - SOFTWARE KIT EWMPC/10 (code 3898401001)

The software kit includes a USB cable (2.70 mt length) 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.

7 - WIRING DIAGRAM



DIGITAL INPUT AND OUTPUT

PIN 1 — READY output.
General operationality, ENABLE is active and there is no sensor error. 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.
The output is only active if START = ON.

PIN 5 — HAND- input
Hand mode (START = OFF), driving with the programmed velocity. After deactivation the actual value is taken over as command position.

PIN 6 — HAND+ input:
Hand mode (START = OFF), driving with the programmed velocity. After deactivation the actual value is taken over as command position.

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.

ANALOGUE INPUT

PIN 9/10 — External command speed (V)
range 0 ÷ 100 %
corresponds to 0 ÷ 10 V

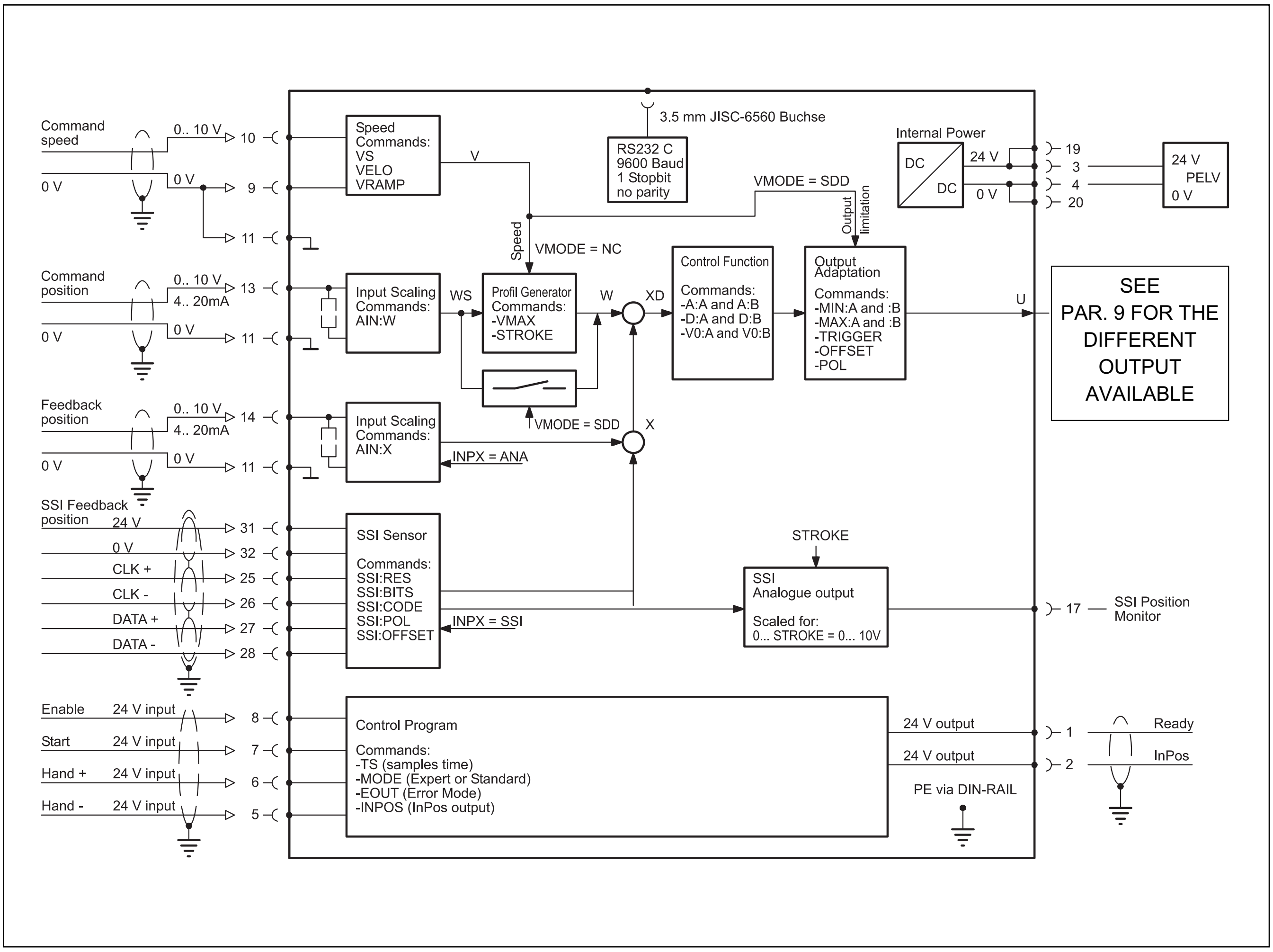
PIN 13/11 — Command position (WL)
range 0 ÷ 100%
corresponds to 0 ÷ 10V or 4 ÷ 20 mA

ANALOGUE OUTPUT

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

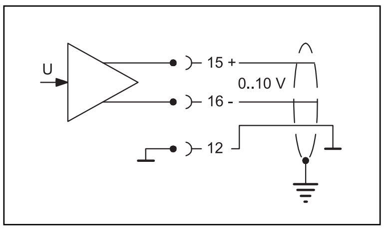
PIN 17/18 — Monitor of the SSI sensor position, 0 ÷ 10V

8 - STANDARD CARD BLOCK DIAGRAM

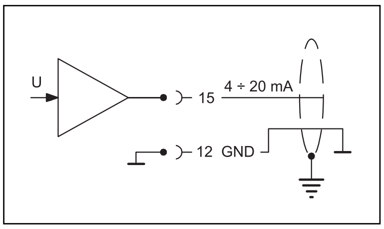


9 - OUTPUT SIGNALS AVAILABLE FOR DIFFERENT VERSIONS

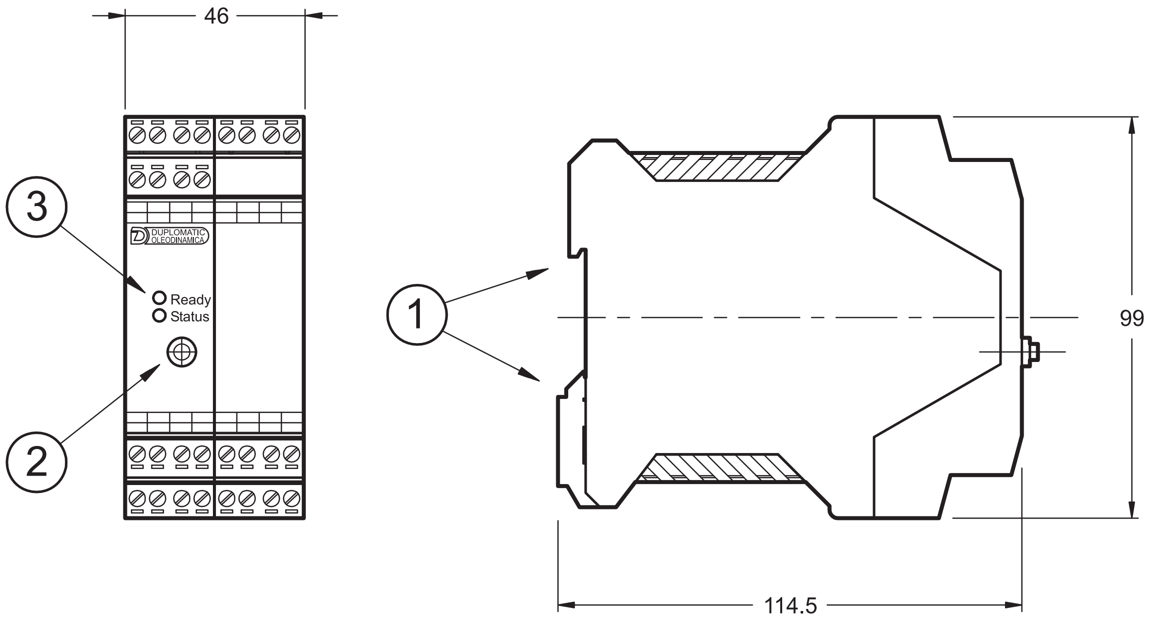
E0 VERSION



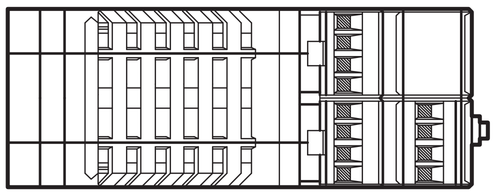
E1 VERSION



9 - OVERALL AND MOUNTING DIMENSIONS



1	DIN EN 50022 rail type fastening
2	plug for connection PC cable
3	LED for Output signals



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