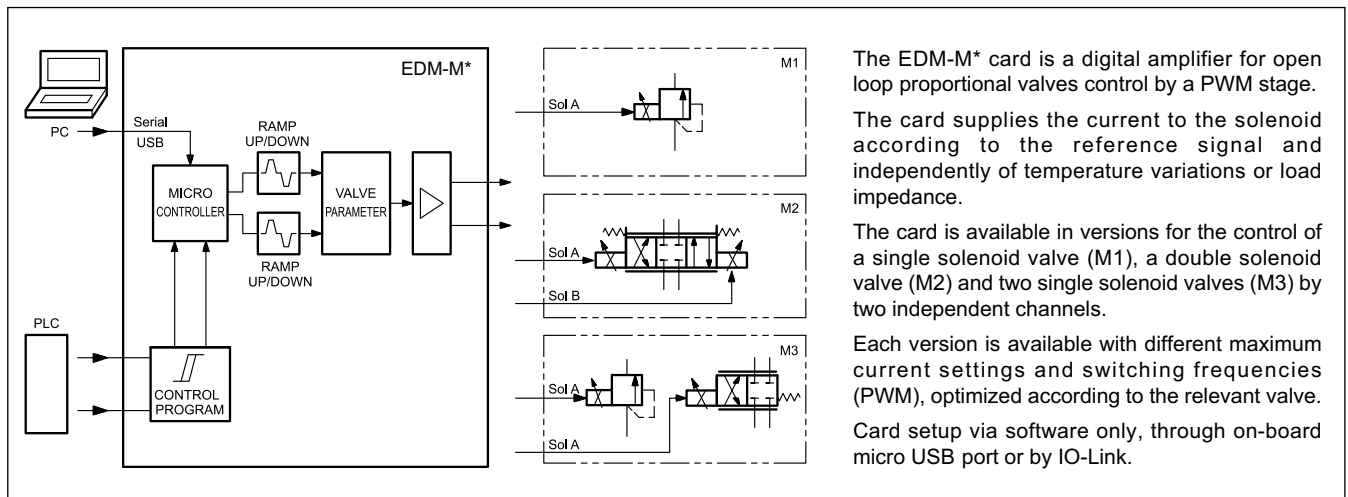# EDM-M*
DIGITAL AMPLIFIER FOR OPEN LOOP PROPORTIONAL VALVES
SERIES 31

EDM-M1 single solenoid
EDM-M2 double solenoid
EDM-M3 two single solenoids
        independent channels

RAIL MOUNTING TYPE: DIN EN 50022

OPERATING PRINCIPLE

The EDM-M* card is a digital amplifier for open loop proportional valves control by a PWM stage.

The card supplies the current to the solenoid according to the reference signal and independently of temperature variations or load impedance.

The card is available in versions for the control of a single solenoid valve (M1), a double solenoid valve (M2) and two single solenoid valves (M3) by two independent channels.

Each version is available with different maximum current settings and switching frequencies (PWM), optimized according to the relevant valve.

Card setup via software only, through on-board micro USB port or by IO-Link.

TECHNICAL CHARACTERISTICS

Power supply (U$_b$)	V DC	E0 / E1: 9 ÷ 36 ripple included IOL: 19 ÷ 30 ripple max 3 V
Required power	W	min 20 - max 60 (see point 5.2)
Max input current	A	4.5
Output current	A	maximum 4.5 (see point 5.2)
Available reference signals	V mA digital	±10, 0 ÷ 10 (input resistance 11 kohm) 4 ÷ 20 (input resistance 56 ohm) via IO-Link
Additional output aux voltages to external potentiometer (E0, E1 versions only)	V	+10V DC (50 mA) -10V DC (50 mA)
Digital input		ON > 8 to U$_b$ OFF < 5V (resistance 17 kohm)
Digital output		Low level < 2 V, high level > max U$_b$ (U$_b$ = power supply)
Fuse, external	A	6A, medium time lag
Electromagnetic compatibility (EMC)		according to 2014/30/EU standards
Housing material		ABS
Housing dimensions	mm	23x98x122
Connector		Plug-in terminal block with tightening screws: 15 poles - micro USB
Operating temperature range	°C	-20 / +70
Protection degree		IP20
Mass	kg	0.15

1 - IDENTIFICATION CODE

E	D	M	-	M					/	31		-	

Digital amplifier
for rail mounting DIN EN 50022

For open loop

Versions:
1 = for single solenoid proportional valve
2 = for double solenoid proportional valve
3 = two channels for an independent
control of two single solenoid valves

Max current (I Max):
(first channel for EDM - M3 version)
0 = 780 mA   **3** = 1600 mA   **6** = 1530 mA
1 = 860 mA   **4** = 1880 mA
2 = 1200 mA   **5** = 2600 mA

Only for EDM-M3 version: omit for other versions
Max current (I Max) second channel:
0 = 780 mA   **3** = 1600 mA
1 = 860 mA   **4** = 1880 mA
2 = 1200 mA   **6** = 1530 mA

Pin 12 function:
Omit for IOL version
A = external enable on PIN 12
B = 24 V aux on PIN 12
(internal enable) (**standard**)

Reference signal:
E0 = voltage ±10V (**standard**)
E1 = current 4 ÷ 20 mA
IOL = IO-Link interface

Series N.
(from 30 to 39 sizes and mounting dimensions
remain unchanged)

Only for EDM-M3 version: omit for other versions
Switching frequency (PWM) of the second channel:
1 = 100 Hz   **3** = 300 Hz
2 = 200 Hz   **4** = 400 Hz

Switching frequency (PWM):
(first channel for EDM-M3 version)
1 = 100 Hz   **3** = 300 Hz
2 = 200 Hz   **4** = 400 Hz

NOTE: other setting available upon request. Please contact our technical dept.

2 - FEATURES

Card with analogue reference signal: version A and version B

The versions differ for pin 12 function.

EDM-M*/30*-A is configured for external enable: the amplifier is powered but not operational, and will supply current to the valve only if an enabling signal received from the outside (PLC) is present. The enable signal is expected on pin 12.

This version offers faster response times as it eliminates initialization times at power up. The external enable can be deactivate by parameter.

On EDM-M*/30*-B the pin 12 duplicates the power supply signal 9 ÷ 36 V from pin 1 so it operates as an auxiliary power supply.

The enable is internal. This is a non-editable and backward-compatible setting with 20 series.

Card with IOL interface

Reference signal and enabling are set via IO-Link. A redundant enable signal can be activated via software on pin 12.

Controller functions

Power amplifier with current controlled by analogue input signal for three different applications:

M1: control of 1 single solenoid proportional valve
(e.g. throttle, pressure, directional.)

M2: control of 1 dual solenoid proportional valve
(e.g. directional)

M3: control of 2 single solenoid proportional valves, via 2 independent channels.

- The current to solenoid is closed loop controlled, so is independent from supply and solenoid resistance.

- Parameters programmable via software: ramps, PWM frequency, offset, gain, dither.

Adaptation of the valve characteristic curve

- Deadband compensation

Monitoring functions

- The output stage is monitored for cable breakdown, is short circuit proof and disables the power stage in case of an error
- Failure monitoring for current analogue inputs

Other characteristics

- Scaling of analogue inputs
- Card configuration via software
- Diagnostic

additional for IOL version:

- Autorestore
- Improved diagnostic available at PLC
- Independent enabling / disabling for each channel in M3 version.

3 - FUNCTIONAL SPECIFICATIONS

3.1 - Power supply

This card is designed for 9 to 36 V DC (typical 24 V) of a power supply. This power supply must correspond to the current EMC standards. All inductivities at the same power supply (relays, valves) must be provided with an over-voltage protection (varistors or freewheeling diodes).

The power supply for the IOL card version must comply with IO-Link standards so the requested range for power supply is 19 to 30 V DC (24 V DC ± 10%)

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

NOTE: 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.

For EMC requirements the 0V DC of the power supply must be connected to GND on electrical cabinet.

3.2 - Electrical protections

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

3.3 - Digital Input

The digital input must have a voltage from 12 to 24 V;

ON > 8 to U_b
OFF < 5V. Input resistance 17 kohm.

See block diagrams and wiring for connections.

3.4 - Digital Output PIN 9 - Card OK

This output permits to check the state of the card: when the card works normally, there is the same voltage as for the power supply on this pin, referred to the 0V, pin 2; when there is an anomaly, the control logic forbids the power output to the solenoids and switch this output to zero.

Max current 50 mA.

Low level < 2 V
High level > max U_b, where U_b = power supply

3.5 - Auxiliary voltages (for E0 and E1 versions)

PIN 13 - Voltage equals to +10 V - Max current 50 mA
PIN 14 - Voltage equals to -10 V - Max current 50 mA.

On EDM-M B version only:

PIN 12 - Voltage equals to power supply voltage
(pin 1 - referred to pin 2) - Max current 100 mA

3.6 - Output value

The output value is current, maximum range 200 ÷ 4000 mA, according to the configuration of the card ordered.

All cables which lead outside must be screened.

3.7 - Reference signals

EDM-M* cards versions E0 and E1 accept voltage reference signals 0 ÷ 10 V and ± 10 V, current reference signal 4 ÷ 20 mA, coming from an external generator (PLC, CNC) or from an external potentiometer powered by the card itself.

The card EDM-M* IOL version accept a digital signal from PLC.

Reference value depends on the card version as stated in diagrams here below.

EDM-M1

0	+10 [V]
4	20 [mA]
0	+100%

EDM-M2

-10 [V]	0	+10 [V]
4 [mA]	12	20 [mA]
-100%		+100

EDM-M3

0	+10 [V]
4	20 [mA]
0	+100 %
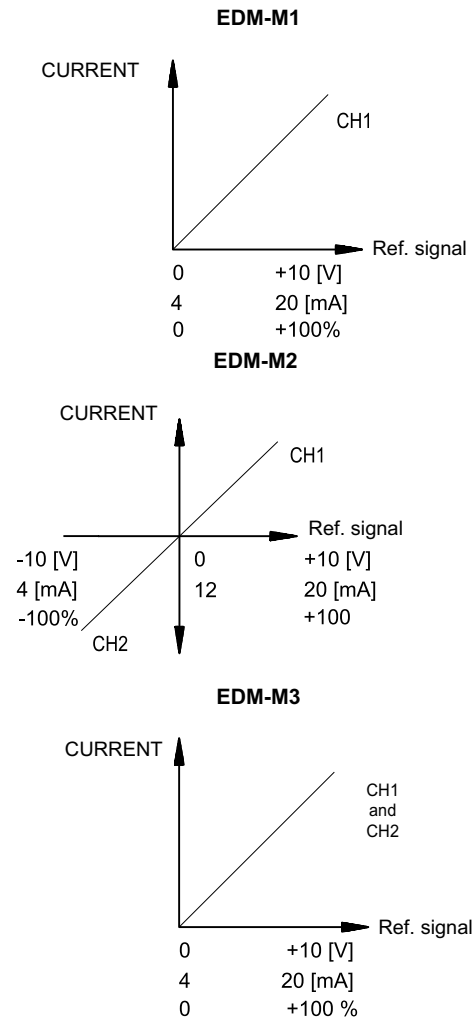
4 - EDM-M, DUPLOMATIC VALVES AND DEFAULT SETTINGS

EDM-M card is pre-set at factory. The following table shows the default settings of EDM-M standard versions and the current Duplomatic valves to be coupled with. Different settings are available upon request.

Curve adaption parameters (point 8.4) permit to scale the current up to 120% of the nominal CURRENT value set.

Cards are tuned by the manufacturer to optimize the performance in accordance with the reference coil selected. Working conditions far from nominal settings could require advanced tuning. Apply for them at our technical dept.

NOTE about EDM-M3: Combinations shown here below are just few examples of possible matches. All combinations provided in the ordering code are possible.

CARDS FOR 24V SOLENOIDS

CARD					VALVES TO MATCH		
Name	I Min [mA]	I Max [mA]	I Lim [mA]	PWM [Hz]	Name	single coil	double coil
EDM-M101	200	780	1100	100	DSE2	▪	
EDM-M102	100	780	1100	200	PLKE08; PZME3	▪	
EDM-M111	200	860	1125	100	DSPE*, RPCED1, RPCED1-T3, RPCE2, RPCE3, BLS6, ZDE3, QDE3	▪	
EDM-M112	200	860	1125	200	DSE3, DSE3B, PRE*, PRE3, PDE3, DZCE*, PZE3	▪	
EDM-M131	200	1600	1958	100	DSE5, QDE5	▪	
EDM-M201	200	780	1100	100	DSE2		▪
EDM-M211	200	860	1125	100	DSPE*, ZDE3, BLS6		▪
EDM-M212	200	860	1125	200	DSE3, DSE3B		▪
EDM-M231	200	1600	1958	100	DSE5		▪
EDM-M31111	200 200	860 860	1125 1125	100 100	DSPE*, RPCED1, RPCED1-T3, RPCE2, RPCE3, BLS6, ZDE3, QDE3	▪ ▪	
EDM-M31122	200 200	860 860	1125 1125	200 200	DSE3, DSE3B, PRE*, PRE3, PDE3, DZCE*, PZE3	▪ ▪	
EDM-M33012	200 100	1600 780	1958 100	100 200	VPPM-*PQCE, regulator (DSE5 + PLKE08)	▪ ▪	

CARDS FOR 12V SOLENOIDS

CARD					VALVES TO MATCH		
Name	I Min [mA]	I Max [mA]	I Lim [mA]	PWM [Hz]	Name	single coil	double coil
EDM-M141	300	1880	2250	100	DSPE*, BLS6, QDE3	▪	
EDM-M142	300	1880	2250	200	DSE3, DSE3B, CRE, PRE*, PRE3, PDE3, DZCE*, ZDE3, PZE3	▪	
EDM-M151	500	2600	3333	100	DSE5, QDE5	▪	
EDM-M162	400	1530	1900	200	DSE2	▪	
EDM-M163	200	1530	1900	300	PLKE08, PZME3	▪	
EDM-M241	300	1880	2250	100	DSPE*, BLS6		▪
EDM-M242	300	1880	2250	200	DSE3, DSE3B, ZDE3		▪
EDM-M251	500	2600	3333	100	DSE5		▪
EDM-M262	200	1530	1900	200	DSE2		▪
EDM-M34411	300 300	1880 1880	2250 2250	100 100	DSPE*, RPCED1, RPCED1-T3, RPCE2, RPCE3, BLS6, ZDE3, QDE3	▪ ▪	
EDM-M34422	300 300	1880 1880	2250 2250	200 200	DSE3, DSE3B, PRE*, PRE3, PDE3, DZCE*, PZE3	▪ ▪	
EDM-M35412	500 300	2600 1880	3333 2250	100 200	DSE5+ DSE3	▪ ▪	

5 - INSTALLATION

5.1 - Wires sizing

Suggested cable cross sections for solenoid supply are shown in the table below. However, the sizing has to ensure a voltage to the coil of not less than 90% of its nominal value.

The voltage drop through the card is 0.5 V.

Suggested cable cross sections for solenoid supply [mm²]

Card supply voltage	Coil type	Cable length		
		< 10 m	10 to 25 m	25 to 50 m
24V	780 mA - 24V	0.5	0.5	1
	860 mA - 24V	0.5	0.5	1
	1600 mA - 24V	0.5	1	2.5
	1530 mA - 12V	0.5	0.5	0.5
	1880 mA - 12V	0.5	0.5	0.5
	2600 mA - 12V	0.5	0.5	0.5
12V	1530 mA - 12V	1	2.5	4
	1880 mA - 12V	1	2.5	6 (**NOTE**)
	2600 mA - 12V	1.5	4	6

NOTE: in order to use a wire with a smaller cross section it is possible to increase the supply voltage.

Power supply cable must be tailored in accordance with the rules above, taking into account the number of coils connected.

- The 15-poles terminal strip accepts connection of a 1.5 mm² conductor with ferrule. Applications that require larger cross sections require mandatorily a junction box.
- We suggest a cross section of 0.25 mm², up to 10-meter length for signal cables.

As a general rule, the valve and the electronic card 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.

5.2 - Card power consumption

The power required by the card depends on output current to be supplied (determined by the card version) and on the nominal voltage of the coil to be feed.

A conservative value of the required power can be considered as the product of V x I.

Examples:

- an EDM-M111 card with maximum current 860 mA coupled with a coil with nominal voltage 24V requires 20W power.
- an EDM-M35411 card with maximum current 4500 mA coupled with a coil with nominal voltage 12V requires 54W power.

The maximum power consumption of the card is 60 W.

6 - LED KEY

The card is equipped with LEDs on the front panel. L1 to L4 led are for a fast check of the card operation.

- ALL LEDS BLINKING: low voltage on power supply.
This state is also showed when the USB communication is active but the card is not powered.

- GREEN led: power
  (ON: card powered, OFF no power supply)
- YELLOW led: functions as in tables below, according to the card version.

EDM-M1				
LED	ON (function ok)	FLASHING (failure) slow	fast	OFF
L1	Reference	signal missing	-	-
L2	Solenoid	open coil	short circuit	not enabled **NOTE 1**
L3	not in use			
L4	Ready	-	-	fault **NOTE 2**

EDM-M2				
LED	ON (function ok)	FLASHING (failure) slow	fast	OFF
L1	Reference	signal missing	-	-
L2	Solenoid 1	open coil	short circuit	not enabled **NOTE 1**
L3	Solenoid 2			
L4	Ready	-	-	fault **NOTE 2**

EDM-M3				
LED	ON (function ok)	FLASHING (failure) slow	fast	OFF **NOTE 3**
L1	Reference 1	signal missing	-	-
L2	Solenoid 1	open coil	short circuit	not enabled **NOTE 1**
L3	Reference 2	signal missing	-	-
L4	Solenoid 2	open coil	short circuit	not enabled **NOTE 1**

L5 and L6 led are for the IO-Link communication (IOL version only).

LED	ON	FLASHING
L5	-	device linked to Master
L6	disconnected device	powered device, not connected to Master

NOTE 1: only for EDM-M*-A.

NOTE 2: with the diagnostics in AUTO mode, in the event of a 'open coil' error, the card attempts to reset cyclically so the LED flashes.

NOTE 3: if the channel has been disabled via software, the relative LEDs are disabled also.

7 - DEVICE SETUP

⚠ **Please note that the USB port is not galvanically isolated.**

The latest released version of EBC software can be downloaded from Duplomatic MS website.

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

**Please refer to *89251 ETM* Technical Manual.**

7.1 - E0 and E1 versions

Card configuration occurs by EBC software from a PC or by EBC app. Cable connection with the card is always necessary.

All the ancillary equipment is available as a separate kit.

7.2 - IOL version

Card configuration must occur by the IO-link master, that stores the parameters set in the PLC. In the event of a reset or a card replacement the parameter set will be restored by the PLC. Please refer to the 89251 ETM Technical Manual for stored parameters list.

The setting of parameters not included in the 'stored parameter list' of the IO-Link master is feasible using the EBC software, but this parameterization must be saved and kept separately because in the event of a parameter reset by the master it would be overwritten.
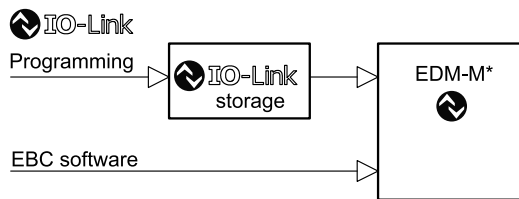
Configurations made by the EBC software are recommended only for special card upgrades (card firmware, etc..) or special needs.

7.3 - EDMPC/30 kit (code 3898201020)

The kit includes:

- USB communication cable
  (micro USB-B male - USB A male),
  length = 3 m
- USB key with software to be installed on a PC
- Adapter cable for OTG USB2.0 smartphone
  (USB A female - USB Micro-B male)
- Adapter cable for OTG USB3.0 smartphone
  (USB A female - USB-C male)

The applicable adapter cable depends on the device being in use.

7.4 - EBC app

The app requires Android devices that support OTG function (Usb On-The-Go), and can be downloaded from the Play Store.

On-line registration is required at first access. Once registered the app can even work off-line.

The EBC app allows diagnostic and configuration activities of USER level parameters. To apply changes requires a password.

8 - MAIN FEATURES

8.1 - Diagnostics

Activates / deactivates the error detection. Off is useful in troubleshooting tasks.

parameter DIAGNOSTICS (ENABLE | DISABLE | AUTO)
  default for EDM-M*/31*-A: ENABLE
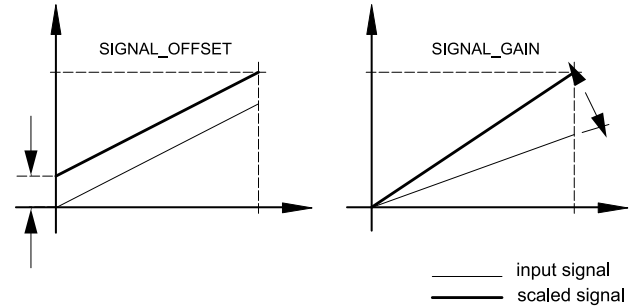 default for EDM-M*/31*-B: AUTO

8.3 - Input signal scaling

Set the coefficients for offset and gain of the input signal.

EDM-M1	EDM-M2	EDM-M3
SIGNAL_OFFSET	SIGNAL_OFFSET	SIGNAL1_OFFSET SIGNAL2_OFFSET
range: E0: -3 … 3V	E1: -4 … +4 mA default: 0.00	
SIGNAL_GAIN	SIGNAL_GAIN	SIGNAL1_GAIN SIGNAL2_GAIN
range: 0.40 …10.00 default: 1.00		

8.4 - Curve adaption

Deadband compensation and current input scaling are customizable. Values in percent.

EDM-M1	EDM-M2	EDM-M3
ADJ_MIN	ADJ_MIN_A ADJ_MIN_B	ADJ1_MIN ADJ2_MIN
range: 0 … 50% default: according to the card version		
ADJ_MAX	ADJ_MAX_A ADJ_MAX_B	ADJ1_MAX ADJ2_MAX
range: ADJ_min … 120% default: 100%		
ADJ_TRIGGER	ADJ_TRIGGER	ADJ1_TRIGGER ADJ2_TRIGGER
range: 0… 20% default: 1.5%		
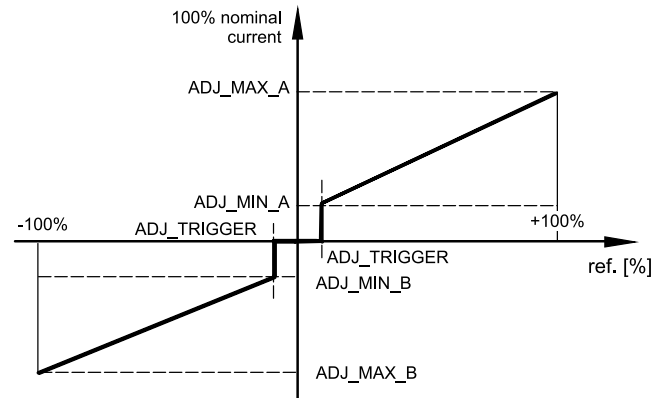
8.5 - Ramps

Parameters for ramp up and ramp down can be set in milliseconds. A and B tag the quadrants. These values set the amount of time that the command signal will take to follow a step change in the reference signal 0 ÷ 100.

EDM-M1	EDM-M2	EDM-M3
RAMP_UP RAMP_DOWN	RAMP_UP_A RAMP_DOWN_A RAMP_UP_B RAMP_DOWN_B	RAMP1_UP RAMP1_DOWN RAMP2_UP RAMP2_DOWN
range: 0 … 20000 ms default: 0		
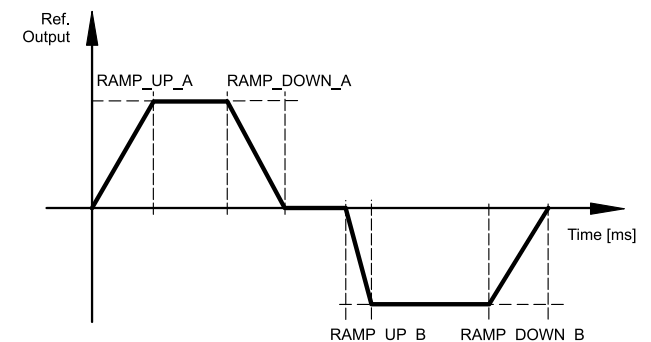
8.6 - PWM

Pwm frequencies for current output.

EDM-M1	EDM-M2	EDM-M3
PWM	PWM	PWM1 PWM2
range: 70 … 500 Hz default: preset value, according to the card version		

8.2 - Enable (version A only)

Activates / deactivates the external enable.
  parameter ENABLE (INT|EXT)
  default: EXT

NOTE: if switched to INT, the PIN 12 still not used. No other function are possible on this PIN.

SIGNAL_OFFSET SIGNAL_GAIN

—— input signal
—— scaled signal

100% nominal current
ADJ_MAX_A
ADJ_MIN_A
ADJ_TRIGGER
-100%
ADJ_TRIGGER
ADJ_MIN_B
+100%
ref. [%]
ADJ_MAX_B

Ref. Output
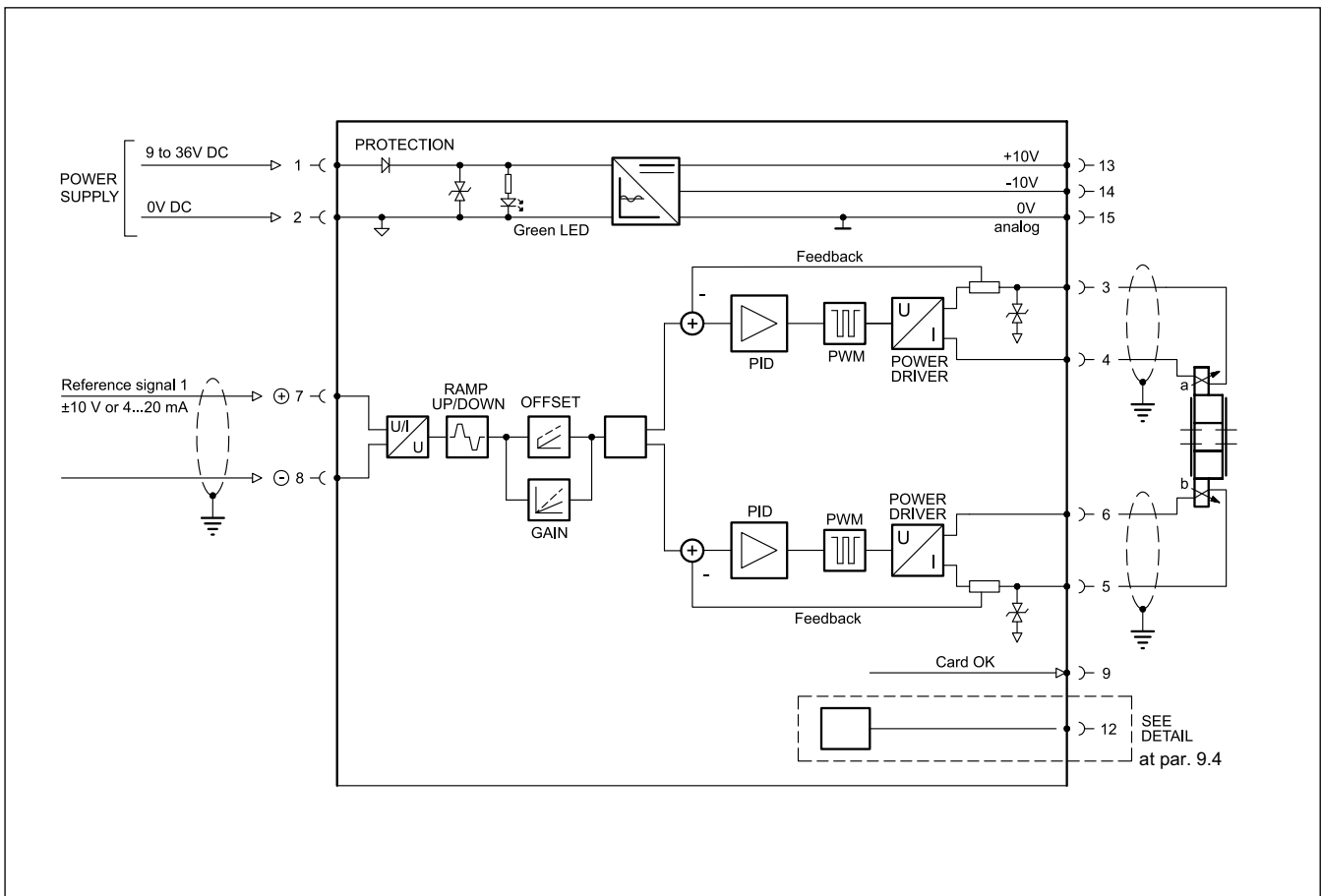RAMP_UP_A RAMP_DOWN_A
Time [ms]
RAMP_UP_B RAMP_DOWN_B

9 - BLOCK DIAGRAMS

The function of PIN 12 varies depending on the card version. Those with E0 or E1 type of reference signal can be either ENABLE input (A version) or an auxiliary voltage output (B version).

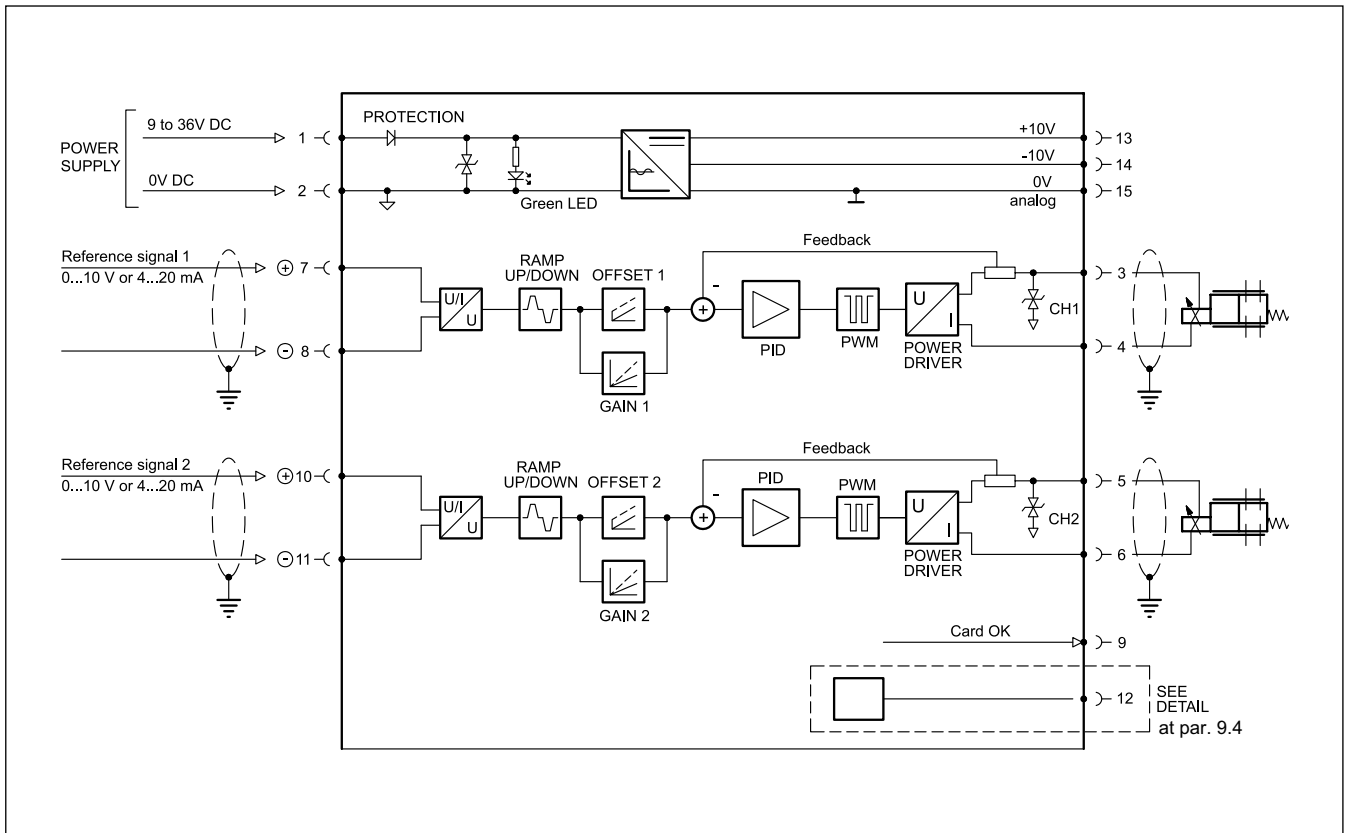### 9.1 - EDM-M1 with reference signal type E0 or E1
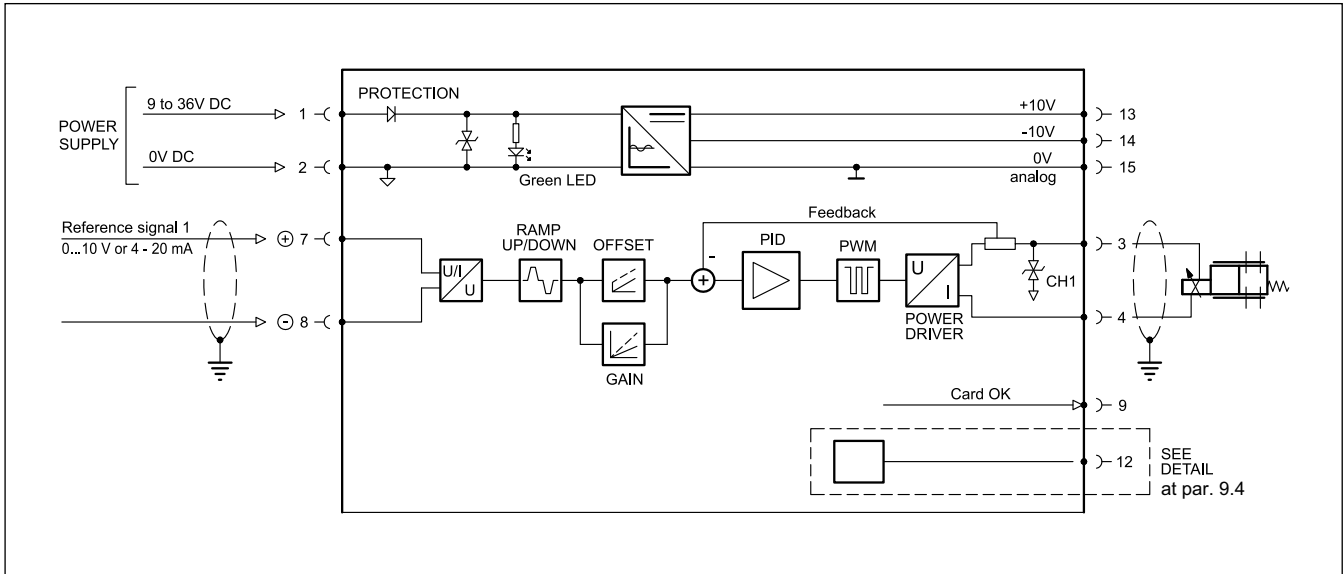
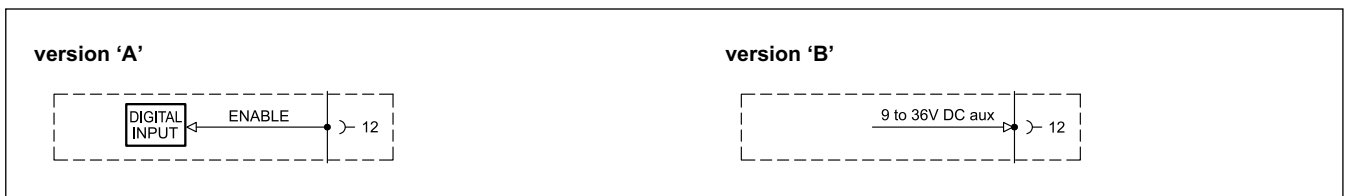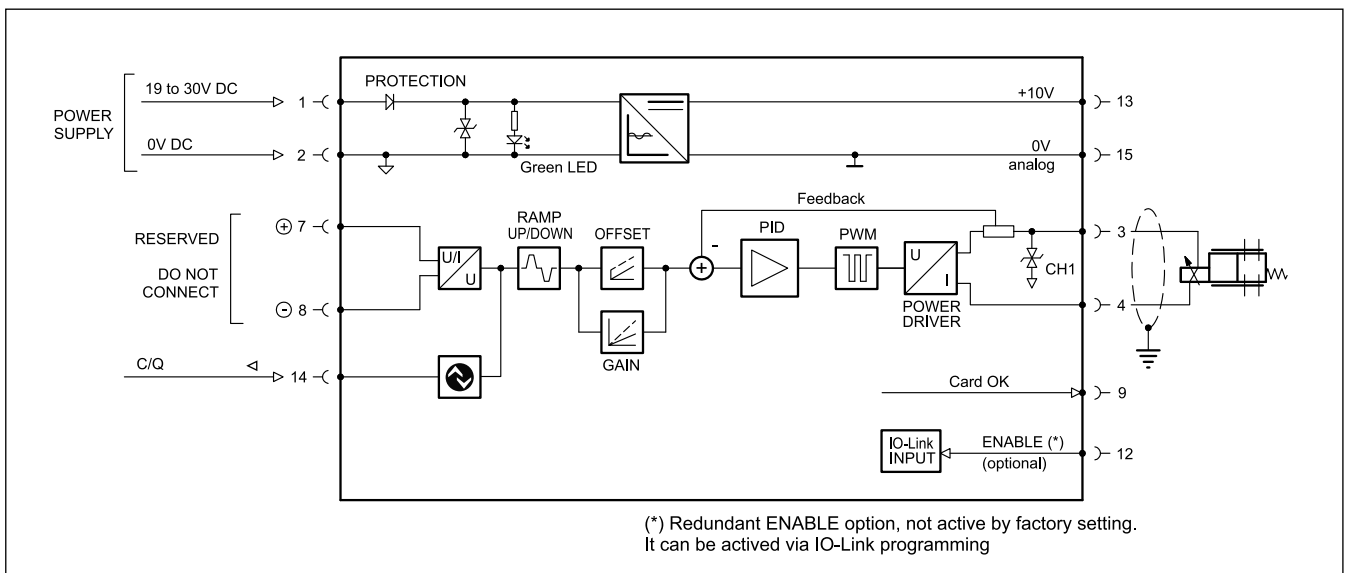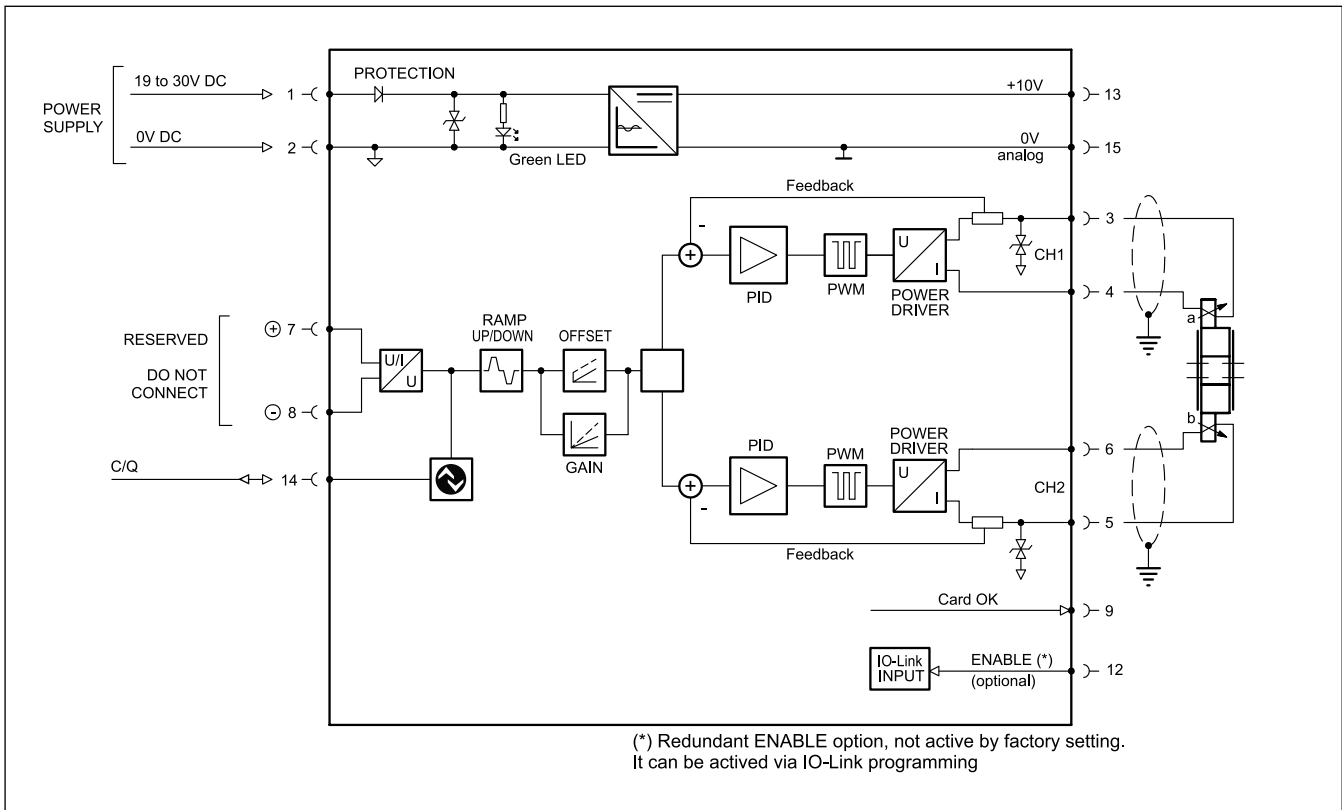### 9.2 - EDM-M2 with reference signal type E0 or E1

9.3 - EDM-M3 with reference signal type E0 or E1

9.4 - Function of PIN 12 with reference signal type E0 or E1

version 'A'

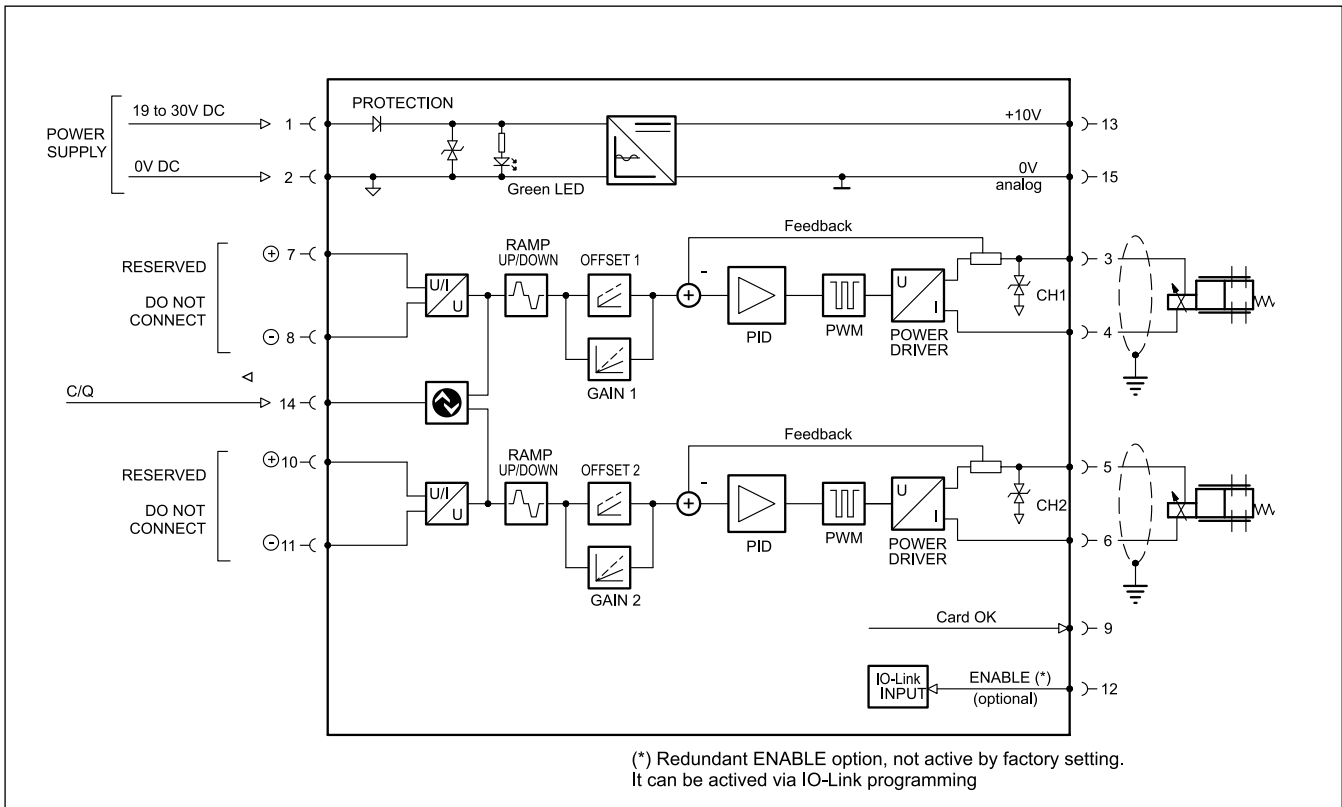DIGITAL INPUT ← ENABLE — 12

version 'B'

9 to 36V DC aux — 12

9.5 - EDM-M1 with reference signal type IOL

(*) Redundant ENABLE option, not active by factory setting.
It can be actived via IO-Link programming

9.6 - EDM-M2 with reference signal type IOL

(*) Redundant ENABLE option, not active by factory setting.
It can be actived via IO-Link programming

9.7 - EDM-M3 with reference signal type IOL

(*) Redundant ENABLE option, not active by factory setting.
It can be actived via IO-Link programming

10 - WIRING

10.1 - with reference signal type E0 or E1

EDM-M1

GENERATOR   ▷ 7
            ▷ 8   4…20 mA
            ▷ 2

POTENTIOMETER   ▷ 13
10 kΩ   TIP.   ▷ 7   0…10 V
            ▷ 15
            ▷ 2

EDM-M2

GENERATOR   ▷ 7
            ▷ 8   4…12…20 mA
            ▷ 2

POTENTIOMETER   ▷ 13
10 kΩ   TIP.   ▷ 7   ±10 V
            ▷ 14
            ▷ 2

EDM-M3

| | CHANNEL 1 | CHANNEL 2 | |

GENERATOR   ▷ 7   10
            ▷ 8   11   4…20 mA
            ▷ 2   2

POTENTIOMETER   ▷ 13   13
10 kΩ   TIP.   ▷ 7   10   0…10 V
            ▷ 15   15
            ▷ 2   2

NOTE: pin 8 (and 11 for EDM-M3 version) must be connected to pin 15 (0V), when the potentiometer is used as reference signal. This is recommended also when the generator has a pure differential output (not connected to ground).
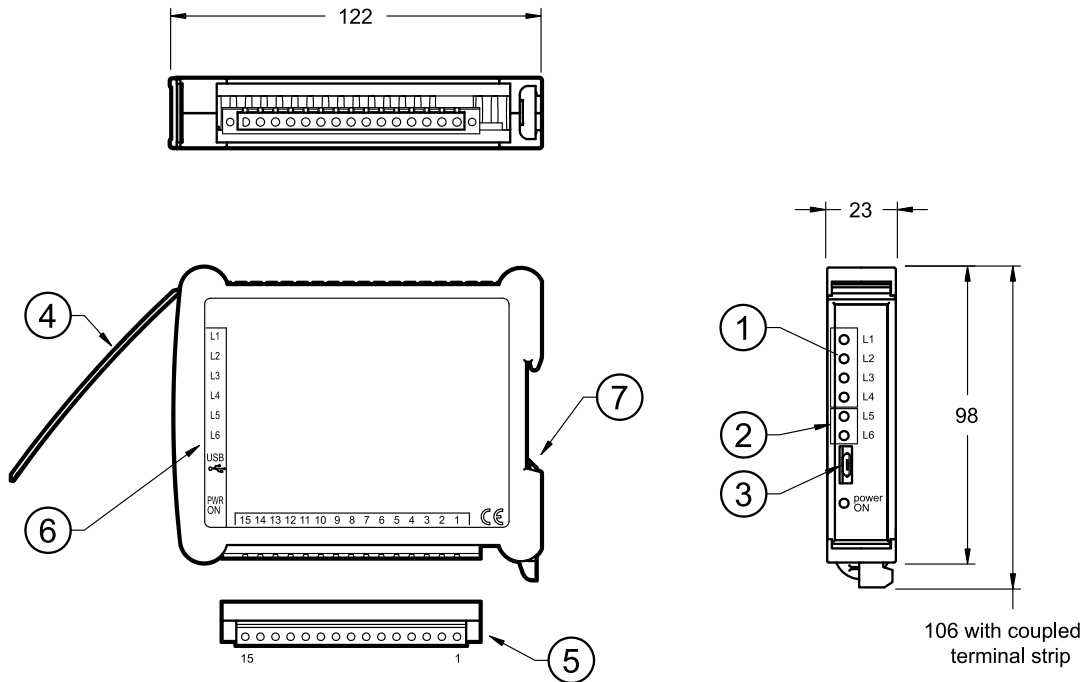
10.2 - with reference signal type IOL

Place the card in the control cabinet.

The card is not galvanically isolated.

The 0V power supply of the EDM-M* card must be connected to the same ground point of the PLC.

+24V   PLC   +24V POWER   EDM-M*

C/Q   C/Q

0V
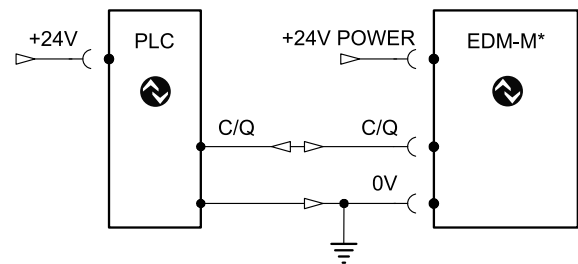
11 - OVERALL AND MOUNTING DIMENSIONS

dimensions in mm

122

23

98

106 with coupled
terminal strip

15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

15   1

1	Status LED
2	IO-Link communication LED
3	Micro USB socket
4	Protection flap
5	Terminal strip, plug-in, 15-pole with downwards cables output and fastening bolts
6	Label with circuit and wiring
7	DIN rail clip

DUPLOMATIC
MOTION SOLUTIONS

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