



## **Electric Clamping**

**efficient and ready for serial production.**



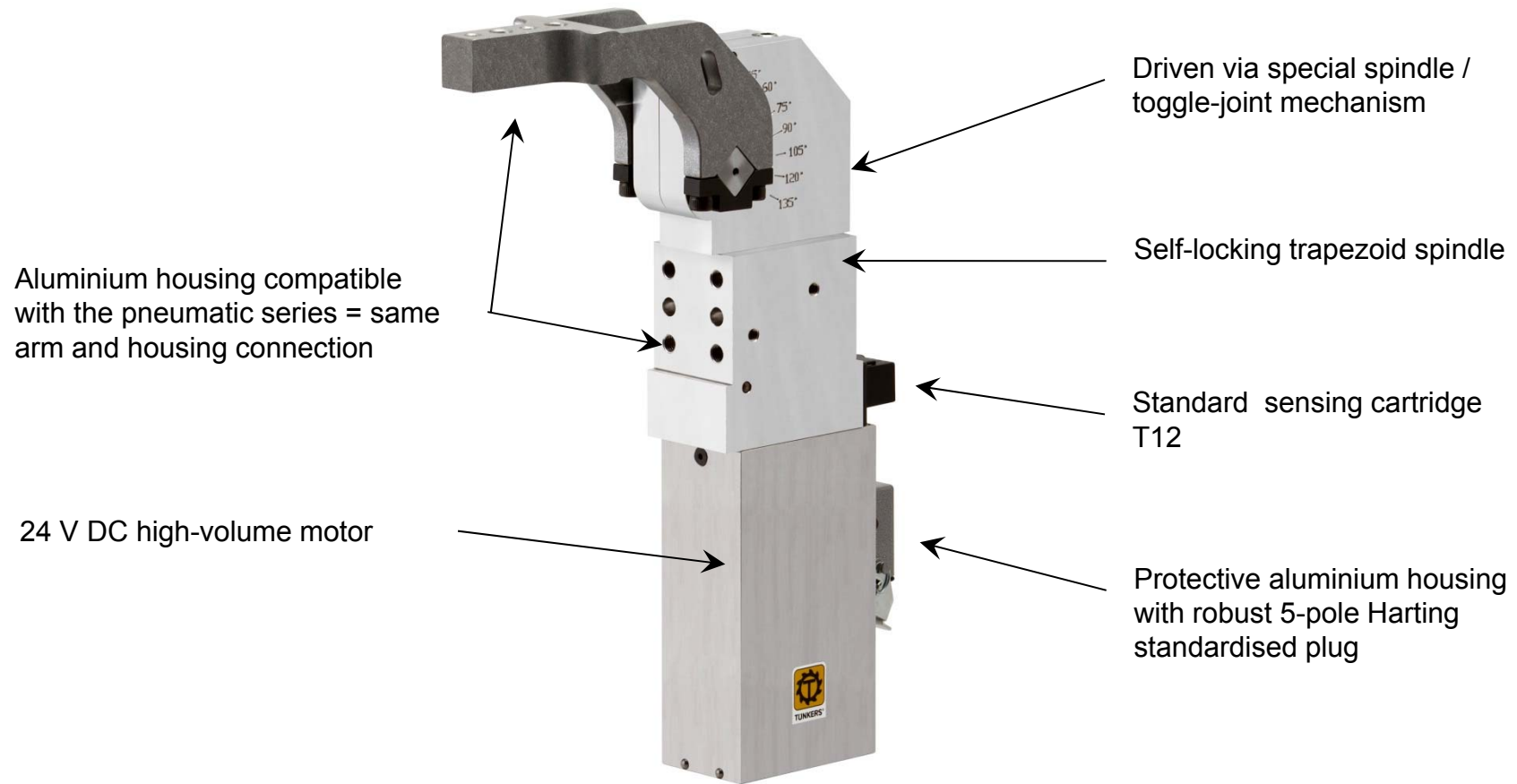
## Electric clamps – no witchcraft involved



- Electric clamps are no longer innovations
  - TÜNKERS has been supplying e-clamps for more than 20 years!
- ⇒ 2 disadvantages prevented industrial breakthrough
1. Efficiency  
The technically complex concept including motor (servo), reduction gear unit and toggle-joint mechanism, lead to prices of factor 3-5 in comparison with pneumatic clamps.
  2. Lack of acceptance of 240/ 400 V – drives by production  
The blanket application of 240/ 400 V clamps is rejected by most plants for safety reasons.

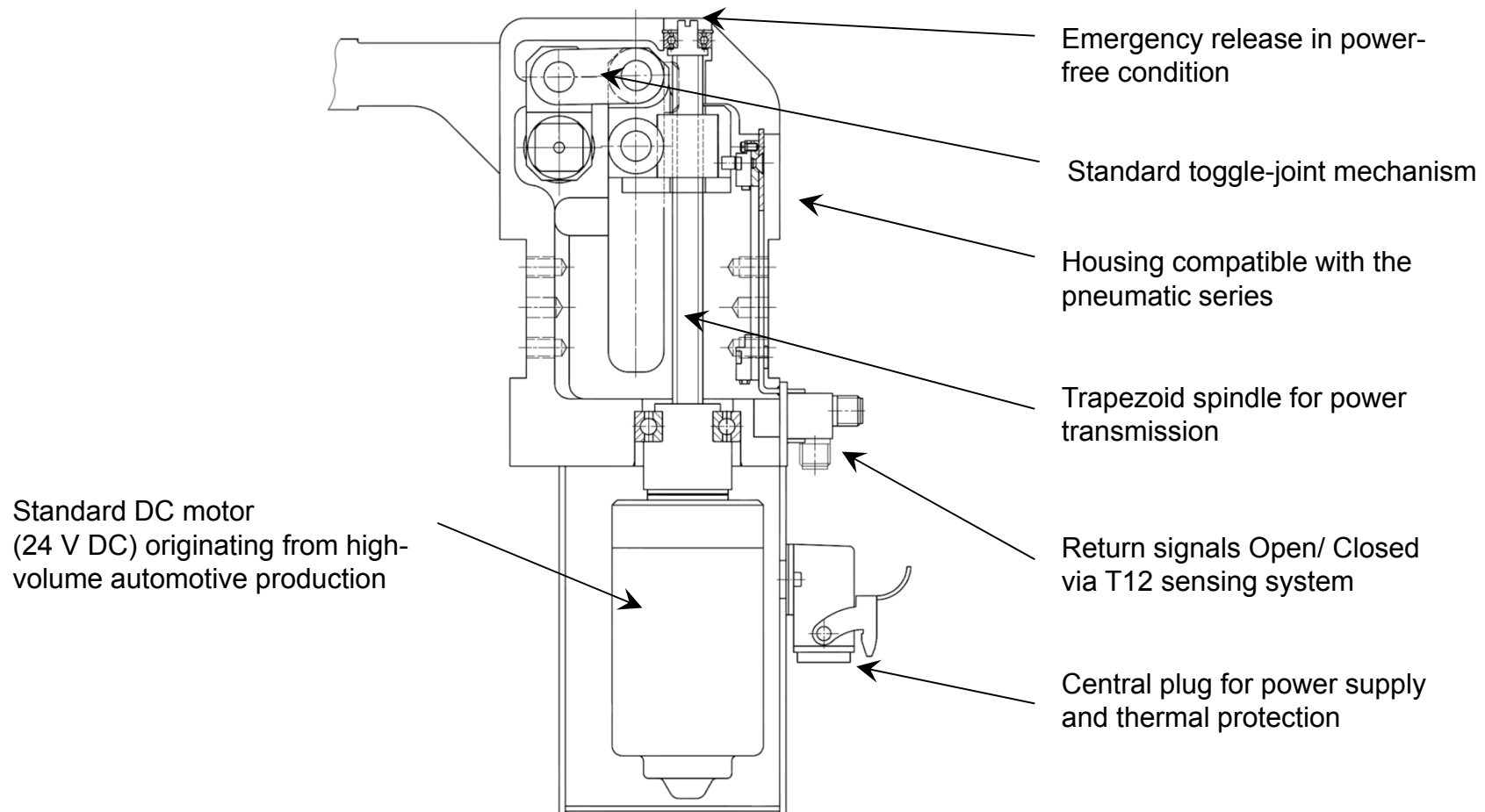


# New TÜNKERS electric compact clamp 24 V DC (low voltage)





# Principle of electric clamp with DC motor (24 V)



## Serial Vario concept



- The desired opening angle can be set freely via the bottom end switch of the sensing system.
- The self-locking function of the spindle also ensures safe positioning in opened position.



## Overview of technical data

|                 | <b>EK 25</b> | <b>EK 40/40.5</b> | <b>EK 50</b> | <b>EK 63</b> | <b>EK 80</b> |
|-----------------|--------------|-------------------|--------------|--------------|--------------|
| Clamping moment | 8 Nm         | 120 Nm            | 160 Nm       | 380 Nm       | 800 Nm       |
| Holding moment  | 25 Nm        | 200 Nm            | 800 Nm       | 1500 Nm      | 2500 Nm      |
| Weight          | 1,5 kg       | 3.15 kg           | 4.2 kg       | 5.2 kg       | -            |
| Length          | 212 mm       | 296 mm            | 315 mm       | 345 mm       | -            |
| Depth           | 70 mm        | 127 mm            | 130 mm       | 140 mm       | -            |
| Width           | 52 mm        | 50 mm             | 60 mm        | 70 mm        | -            |



## Features: E-clamp with 24 V DC drive



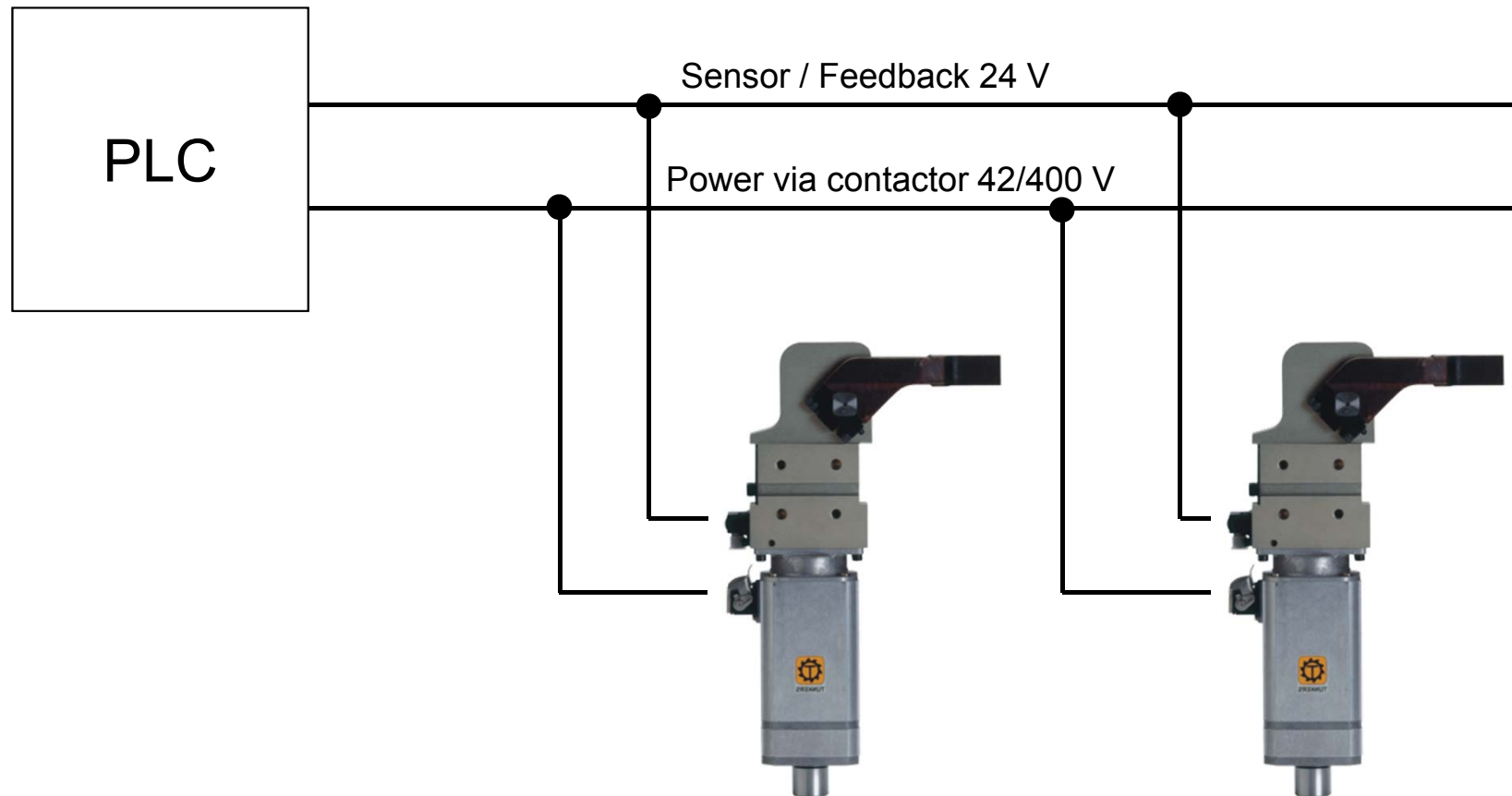
- 24 V DC voltage is already used by automotive plants for control and sensing technology
- Low voltage – Safe operator protection!
- Broad and cost-effective range of very compact motors of different manufacturers on the market
- Only the energy that is actually needed is consumed. Maintenance of voltage is not required during standstill.
- Energy consumption is subject to loads. More energy can be saved by optimising the weight of the clamping point



- Additional 24 V net required (transformers and decentralised supply)
- High currents ⇒ limited cable lengths, large cross-sections and central power supply

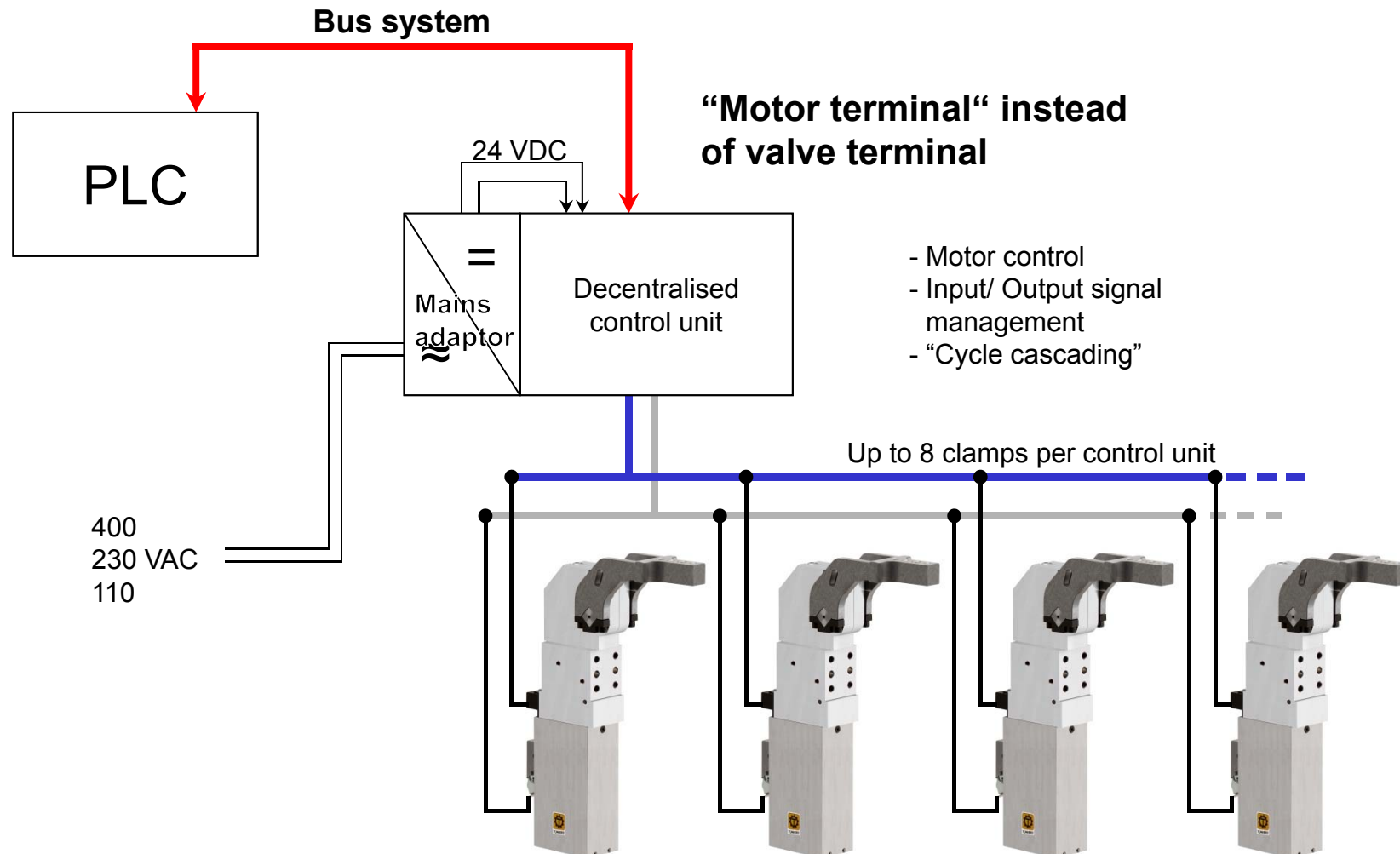


# Conventional control concept Electric clamps



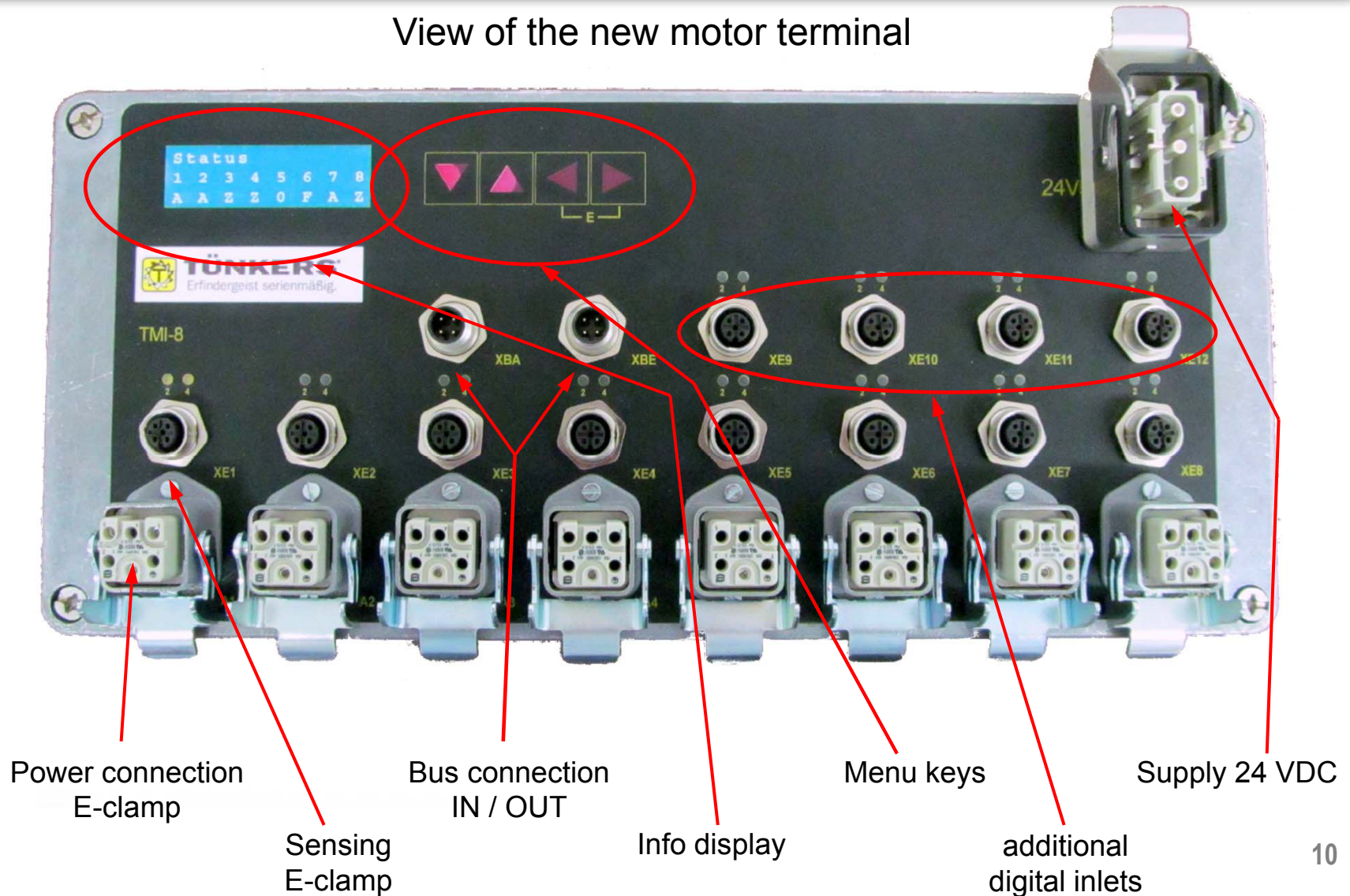


# Concept for decentralised control unit



# Motor terminal Control unit for up to 8 clamps

View of the new motor terminal



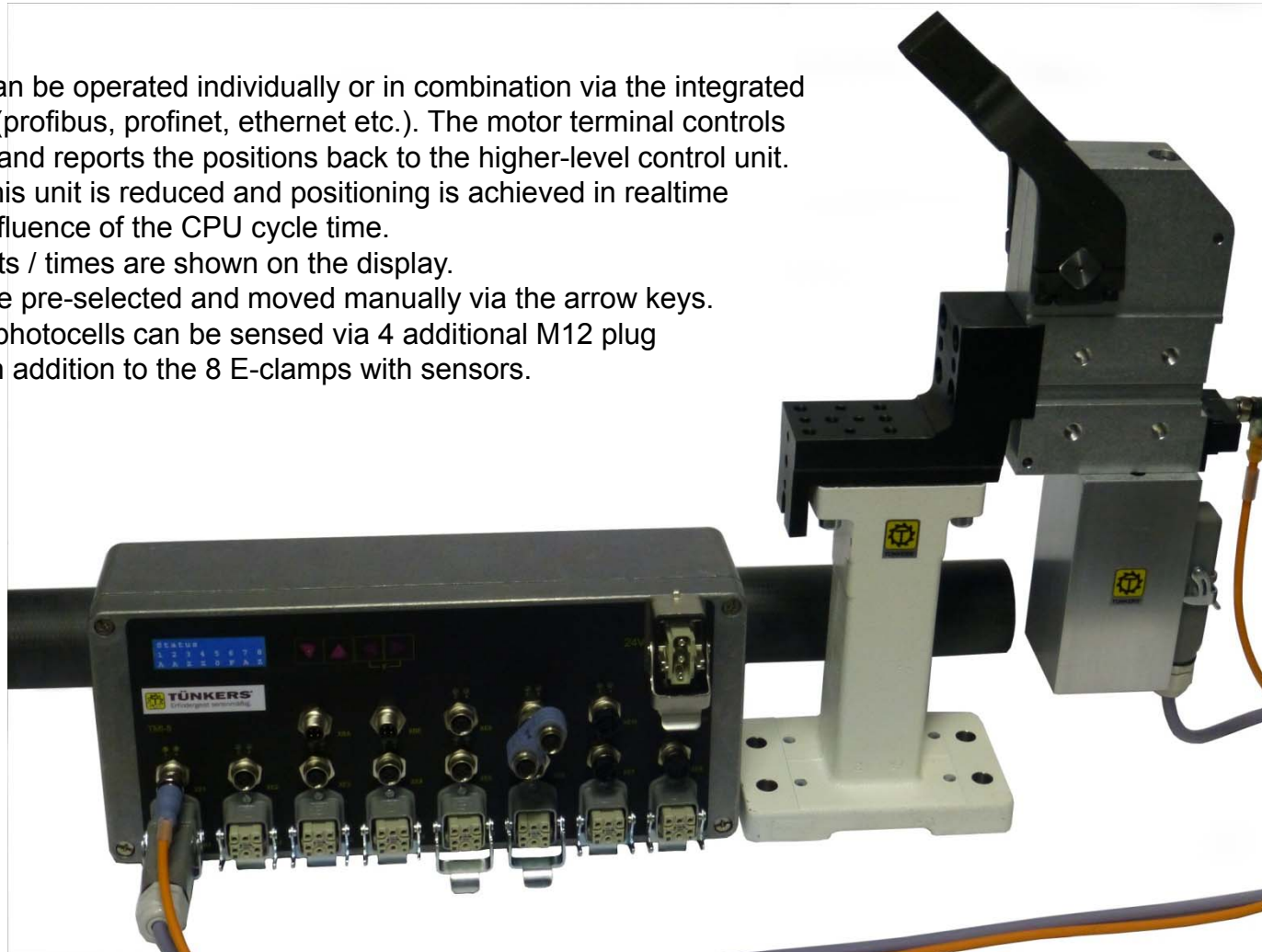
## Motor terminal with connected E-clamp

The clamps can be operated individually or in combination via the integrated bus interface (profibus, profinet, ethernet etc.). The motor terminal controls the E-clamps and reports the positions back to the higher-level control unit. The load on this unit is reduced and positioning is achieved in realtime without any influence of the CPU cycle time.

Status / defects / times are shown on the display.

Clamps can be pre-selected and moved manually via the arrow keys.

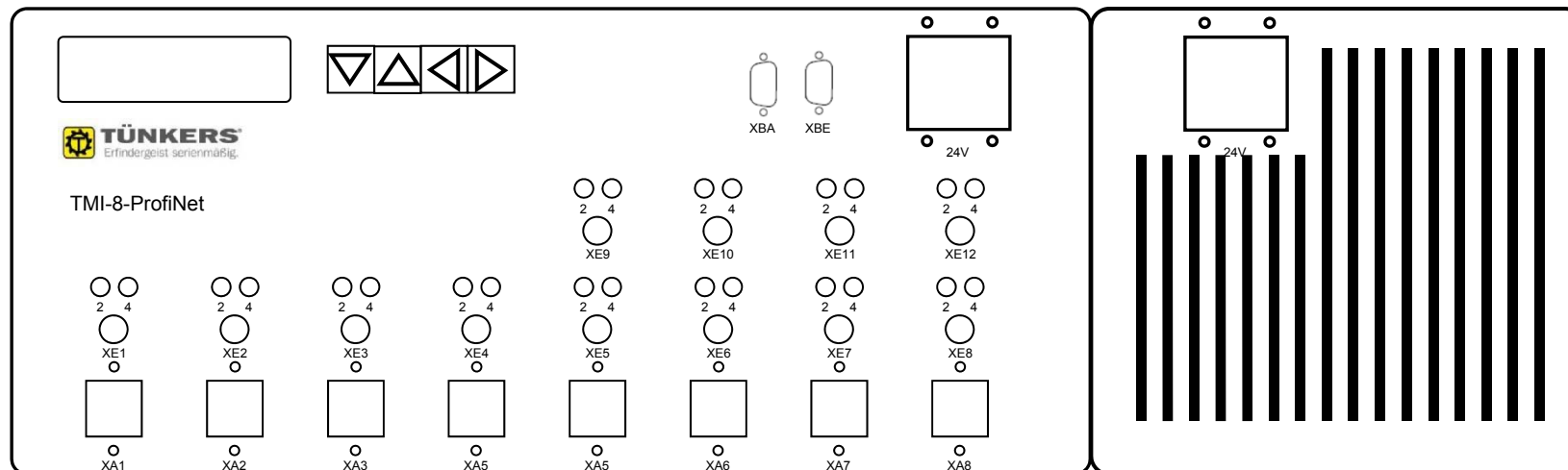
8 initiators or photocells can be sensed via 4 additional M12 plug connections in addition to the 8 E-clamps with sensors.





# Motor terminal with upstream power supply unit

- The power supply of each motor terminal is safeguarded by a power supply unit.
- The input voltage is adjusted to the customer's grid.
- As an encapsulated version needs to be offered as well, electrochemical double layer capacitors are used because currents of 8 x 6 A are to be realised.
- The housing dimensions fit harmonically into the overall design of the motor terminal.

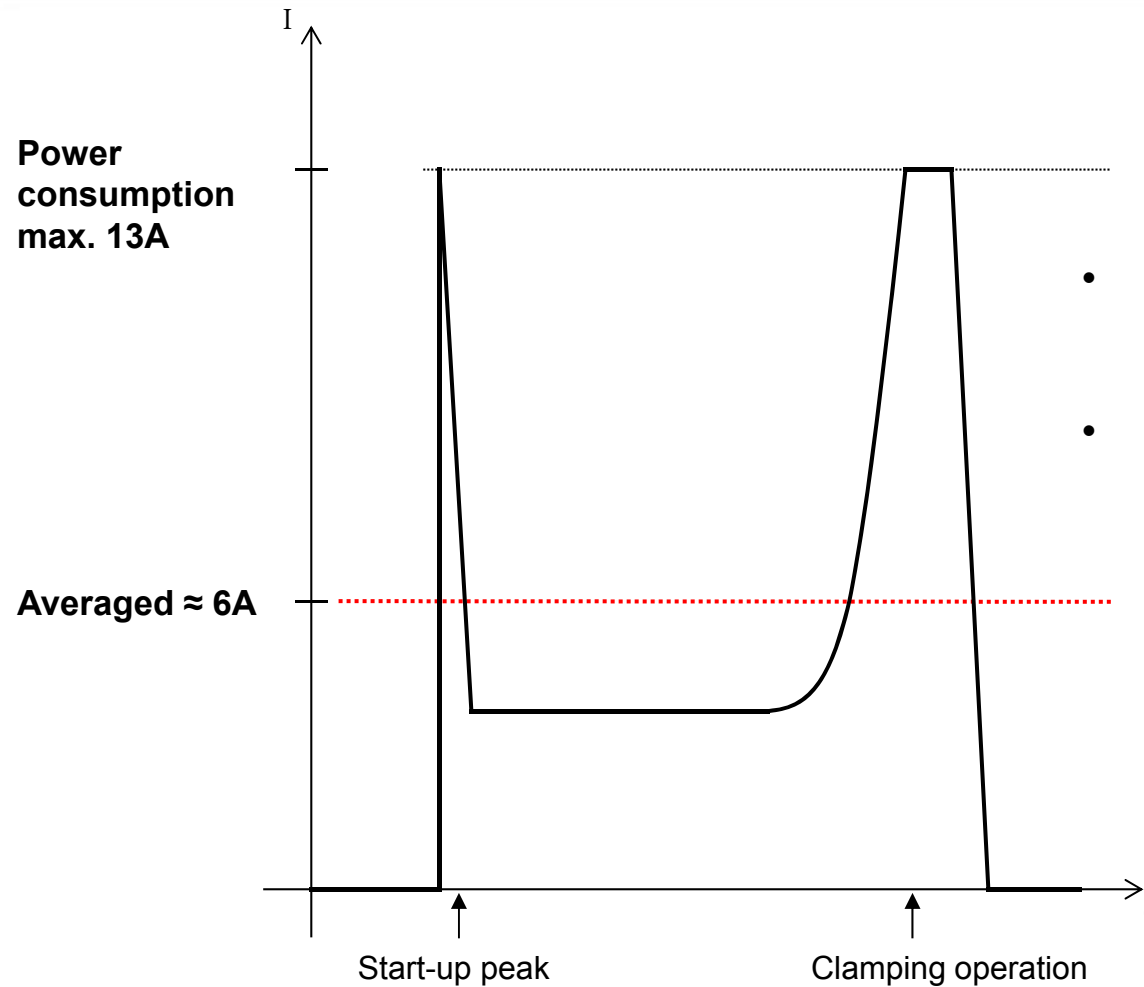


Motor terminal

Power supply unit



## Power consumption of an electric clamp (here EK 50.1)

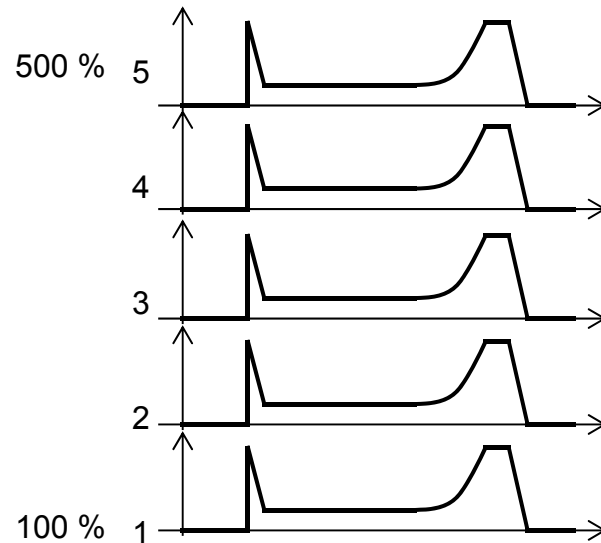


- High momentary power consumption during start-up
- High power consumption during closing / clamping



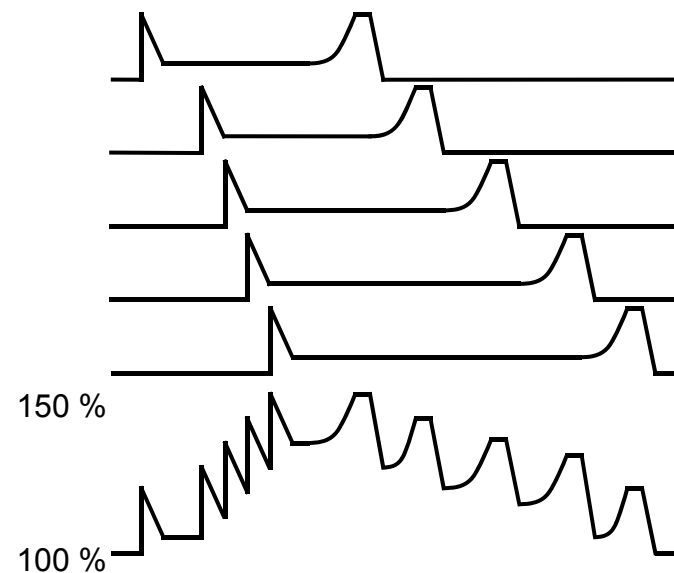
# “Motor terminal“ — Manager of power consumption

A. Theoretical overlap of power consumption, e.g. when 5 clamps are purely operated in parallel



- ⇒ High net/ transformer output
- ⇒ 5-fold power consumption in total!

B. Cycle cascading through intelligent clamp control via “motor terminal“



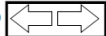



- ⇒ Low net/ transformer output
- ⇒ 1.5-fold power consumption in total

# Additional control variants (1/2)

## Control cabinet module TSM1

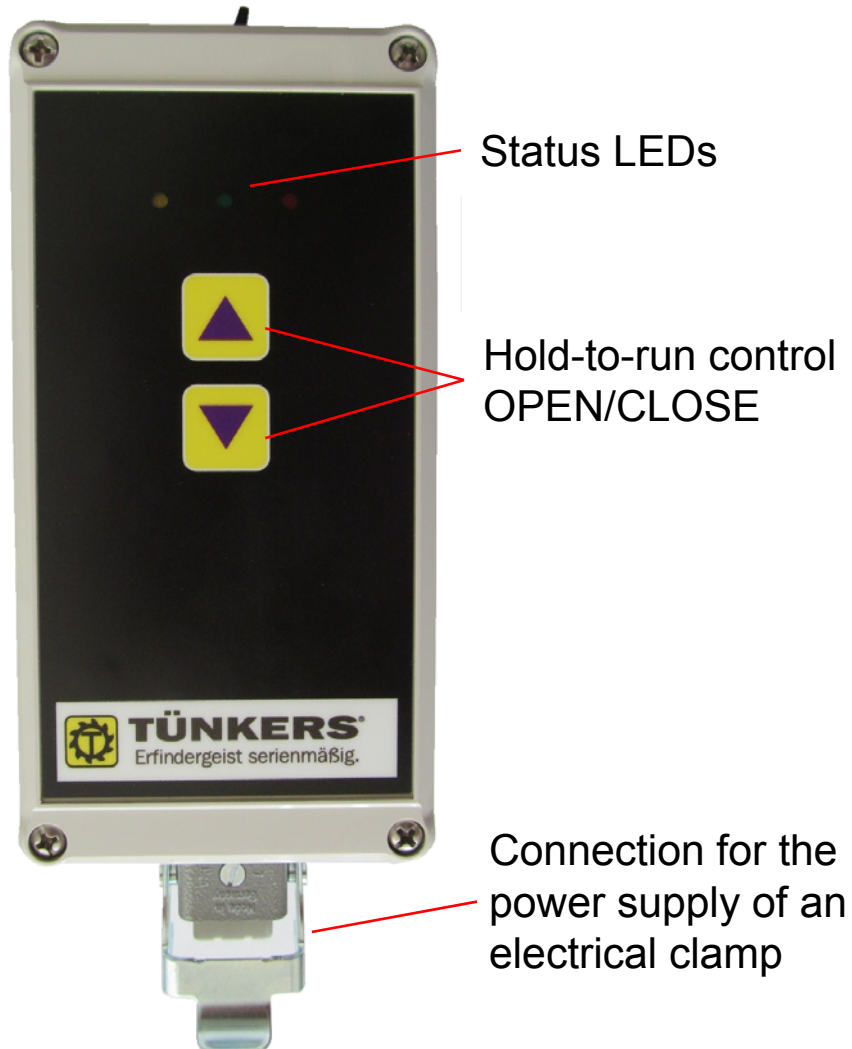


- Control cabinet module for Opening and Closing an Electrical Clamp
- Integrated H-bridge to gear the motor in both directions
- Housing compatible for control cabinet
- DIP switch to approach the movement speed in 4 steps
- Front LEDs

|          |   |                        |
|----------|---|------------------------|
| LED grün | +24V  | Power supply available |
| LED rot  | °C/F  | Overheated motor       |
| LED rot  | Motor   | Error outlet           |
| LED gelb |  | Opening                |
| LED gelb |  | Closing                |
| LED gelb |  | Opened                 |
| LED gelb |  | Closed                 |

## Additional control variants (2/2)

### Hand-held control



- Driving an electric clamp on handheld with integrated 24V battery for direct power supply of the clamp
- Tip operation and reduced speed for easy setup process






# Energy and cost comparison

## Example: Fixture with 10 size-50 clamps

| Size 50 serie; 135° opening angle   | Vario series |            | Electric clamp |         |
|---|--------------|------------|----------------|---------|
|   | Single clamp | Fixture    | Single clamp   | Fixture |
| <b>Energy consumption (at 6 bar)</b>  | [l]          | [l]        | [kWh]          | [kWh]   |
| Energy consumption (l or kWh) (cycle)   | 1,71         | 17,10      | 0,00003        | 0,0003  |
| Energy consumption (cycle) clamping point incl. compressed-air supply hose (3m) » 1,8 l | 3,52         | 35,20      |                |         |
| <b>Energy consumption (0,13 kWh/m³)</b>   | [kWh]        | [kWh]      | [kWh]          | [kWh]   |
| per day (1,000 cycles / day):   | 0,46         | 4,58       | 0,03           | 0,30    |
| per year (250 days):  | 114          | 1.144      | 7,50           | 75      |
| In the project (8 years):   | 915          | 9.151      | 60             | 600     |
| <b>CO2 consumption (600 g/kWh)</b>  | [kg]         | [kg]       | [kg]           | [kg]    |
| per day (1,000 cycles / day):   | 0,27         | 2,75       | 0,02           | 0,18    |
| per year (250 days):  | 69           | 686        | 4,5            | 45      |
| In the project (8 years):   | 549          | 5.491      | 36             | 360     |
| <b>Operating costs (1,43 ct/m³ – 11 ct/kWh)</b>   | [€]          | [€]        | [€]            | [€]     |
| per day (1,000 cycles / day):   | 0,050 €      | 0,50 €     | 0,003 €        | 0,03 €  |
| per year (250 days):  | 12,58 €      | 125,82 €   | 0,83 €         | 8,25 €  |
| In the project (8 years):   | 100,66 €     | 1.006,59 € | 6,60 €         | 66,00 € |

In terms of operating costs the electric clamp beats its pneumatic counterpart by the factor **15**



**Thank you for your attention.**



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