TÜNKERS
Electric Clamp Units

TÜNKERS®
Ingenuity in series.

Electric Clamps: Motivation

- High efficiency
- Approx. 95% of energy are not being used in a pneumatic system
- Less CO_2 emissions

- No air-system needed (big impact in new production sites)
- Clamps are one of the last pneumatic units in BIW production

- Depending on technology: More control of the clamping action
  - force, position, time and predictive maintenance

- What is the main motivation to go full electric?
  - Reducing cost
  - Reducing CO_2 emissions
  - Reducing down time
  - Increasing feedback
  - Predictive maintenance
  - Industry 4.0
  - Airless production line / no compressed air available

History of electrical clamping technology

From a small design office to the innovative market leader in automation technology for series production

1964 — **Toggle-lock clamp** with special bearing for 1,000,000 cycles

1972 — **First Generation** of electro clamp with **400V** motor

1994 — Invention of **42V** E-clamp

2000 — E-clamp with 400V for **Audi wind tunnel**

2012 — **Next Generation:** cheaper and electric clamps **24V** motor

2015 — **Opel Vauxhall** project with 24V EK-clamp and TMI8 control system

2016 — **Ford Australia** project with 24V EK-clamp and TMI8 control system

2017 — **Ford Thailand** project with 24V EK-clamp and TMI8 control system

2019 — **Ford Turkey** project with 24V EK-clamp and TMI8 control system

2019 — EK clamp are implement in every **AGV**

2020 — **Magna Massiv** with 24V EK-clamp and TMI8 control system

2020 — **Next Generation:** 24V EK-clamp with integrated intelligent for regulation

Structure

TÜNKERS electric compact clamp 24V DC (low voltage)

Aluminium housing compatible with the pneumatic series = same arm and housing connection

24 V DC high-volume motor

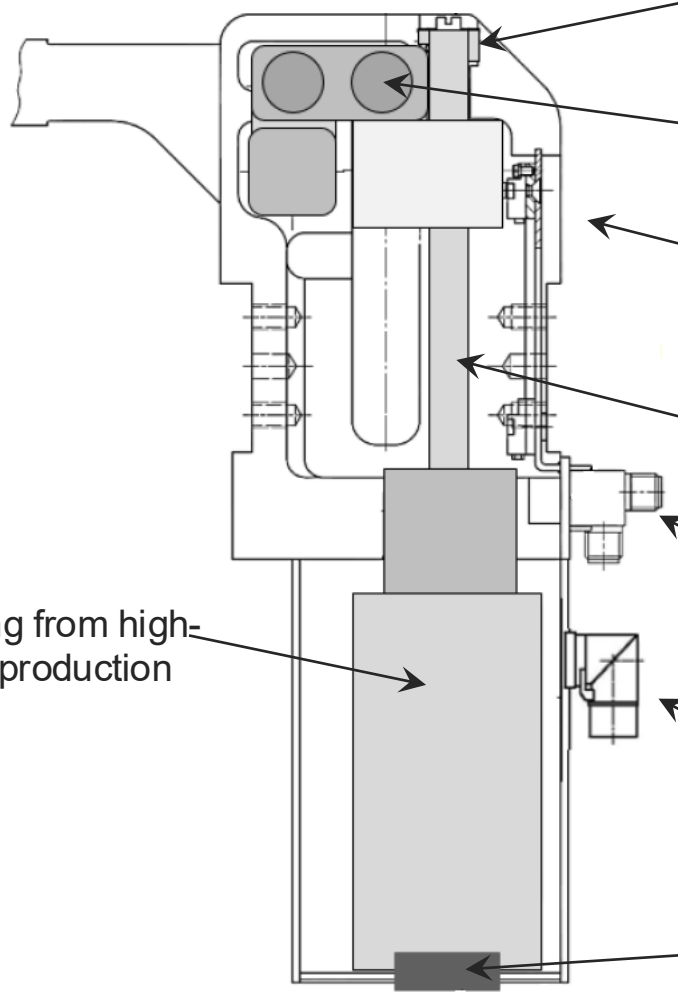
Driven via special spindle / toggle-joint mechanism

Standard sensing cartridge T12. The desired opening angle can be set freely via the bottom end switch of the sensing system.

Protective housing with robust M23 standardised plug

Principle of electric clamp with DC motor (24 V)

Principle



Emergency release in power-free condition

Standard toggle-joint mechanism

Housing compatible with the pneumatic series

Trapezoid spindle for power transmission

Standard DC motor (24 V DC) originating from high-volume automotive production

Return signals Open/ Closed via T12 sensing system

Central plug for power supply

Emergency release in power-free condition

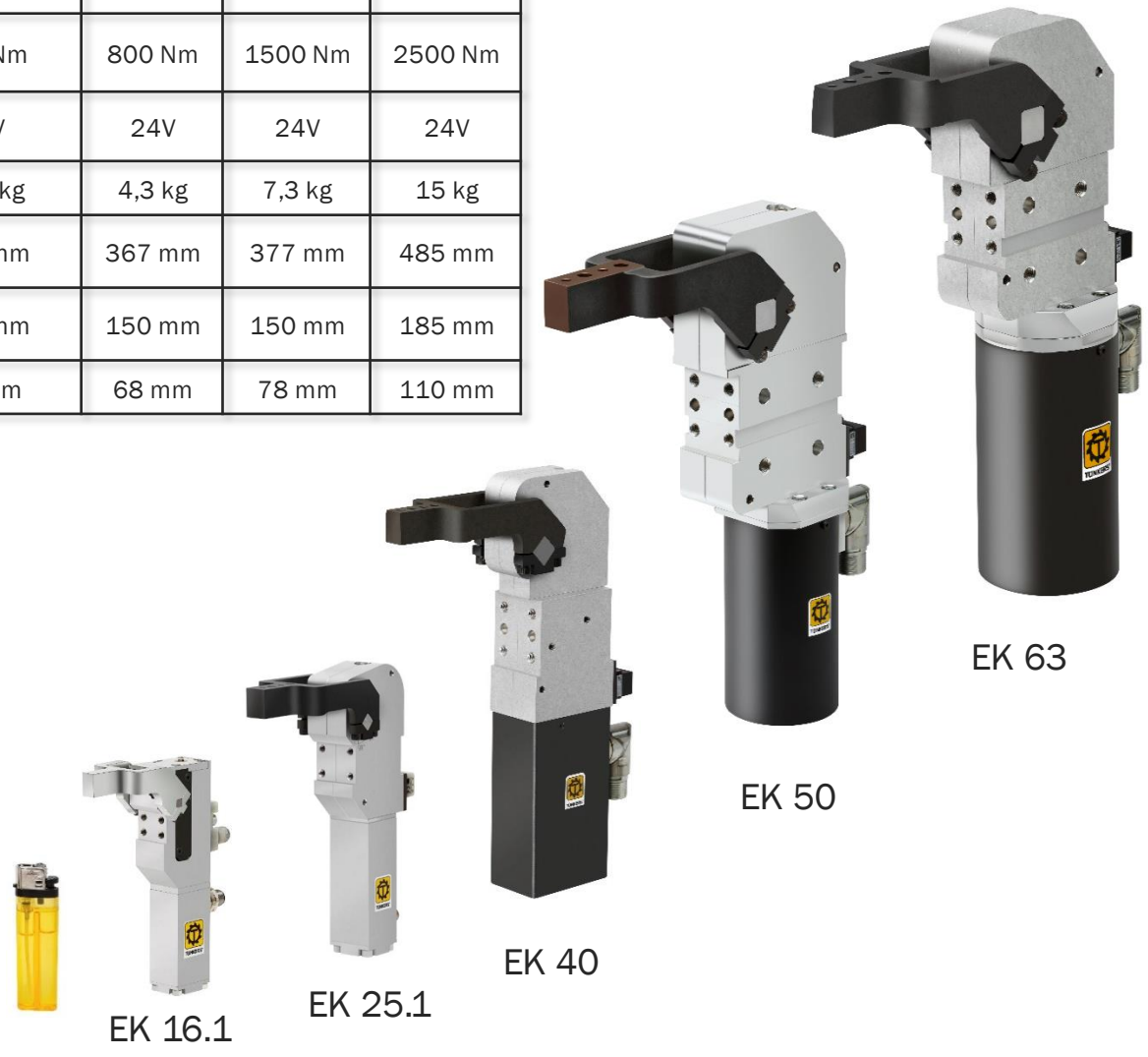
Vario Concept as standard

With the lower limit switch of the query, the desired opening angle can be adjusted continuously.

The self-locking of the threaded spindle ensures safe positioning even in the open position.

Product range of the EK-Series

	EK 16.1	EK 25.1	EK 40.1/40.5	EK 50.1	EK 63.1	EK 80.1
Clamping moment	10 Nm	25 Nm	120 Nm	160 Nm	380 Nm	800Nm
Holding torque	30 Nm	75 Nm	200 Nm	800 Nm	1500 Nm	2500 Nm
Voltage	24V	24V	24V	24V	24V	24V
Weight	0,4 kg	1,5 kg	3,15 kg	4,3 kg	7,3 kg	15 kg
Length	156 mm	212 mm	296 mm	367 mm	377 mm	485 mm
Depth	52 mm	70 mm	140 mm	150 mm	150 mm	185 mm
Width	42mm	52 mm	54 mm	68 mm	78 mm	110 mm



Comparison pneumatic to electric clamp

Input:

Spannergröße / clamp size	63
Anzahl Spanner / quantity of clamps	1000
pro Tag [Zyklen pro Tag] / per day [cycles per day]	1000
Arbeitstage pro Jahr [Tage] / working days per year [Days]	250
Projektlaufzeit [Jahre] / duration of project [years]	5

			Pneumatikspanner / Pneumatic clamp		Elektrospanner / Electric Clamp	
Baugröße / size: 63 Öffnungswinkel / opening angle: 135°	P	E	Vario.Serie		EK-Serie	
			1 Spanner / clamp	1000 Spanner / clamps	1 Spanner / clamp	1000 Spanner / clamps
Energieverbrauch (bei 6 bar)			[l]	[l]	[kWh]	[kWh]
Energieverbrauch (l bzw. kWh) [pro Zyklus] / Energy Consumption (l or kWh) [per cycle]			2,70	2700,00	0,00003	0,0300
Energieverbrauch (Zyklus) Spannerstelle inkl. Druckluftzuleitung (3m) » 1,8 l / Energy consumption (cycle) clamping point incl. Compressed-air supply line (3m) » 1,8	1,8		4,51	4509,56		
Energieverbrauch (0,13 kWh/m³) / Energy consumption (0,13 kWh/m³)	**0,13**	**0,13**	[kWh]	[kWh]	[kWh]	[kWh]
pro Tag [1000 Zyklen pro Tag] / per day [1000 cycles per day]:	1000		0,59	586,24	0,03	30,00
pro Jahr [250 Tage] / per year [250 Days]:	250		147	146.561	7,50	7.500
Im Projekt [5 Jahre] / during the project term [5 years]:	5		733	732.803	38	37.500
CO2-Emission (500 g/kWh) / CO2-emission (500 g/kWh)	**500**		[kg]	[kg]	[kg]	[kg]
pro Tag [1000 Zyklen pro Tag] / per day [1000 cycles per day]:	1000		0,29	293,12	0,02	15,00
pro Jahr [250 Tage] / per year [250 Days]:	250		73	73.280	3,8	3.750
Im Projekt [5 Jahre] / during the project term [5 years]:	5		366	366.402	19	18.750
Betriebskosten (1,43 ct/m³ – 11 ct/kWh)	**1,43**	**11**	[€]	[€]	[€]	[€]
pro Tag [1000 Zyklen pro Tag] / per day [1000 cycles per day]:	1000		0,064 €	64,49 €	0,003 €	3,30 €
pro Jahr [250 Tage] / per year [250 Days]:	250		16,12 €	16.121,67 €	0,83 €	825,00 €
Im Projekt [5 Jahre] / during the project term [5 years]:	5		80,61 €	80.608,34 €	4,13 €	4.125,00 €

CO_2 emissions
- 95%

Operational costs
- 95%

TÜNKERS
Control concepts

Why did TÜNKERS develop his own control concepts?

E-clamp with 24 V DC drive

Features

- 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. Maintanance 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

  Solution: TÜNKERS supply module (TVM) to two TMI8 for up to 16 clamps
- With central voltage supply and long cable lengths, large cross sections are required

  Solution: Decentralized voltage supply by TVM and cascaded control of the tensioners by the TÜNKERS motor island (TMI)

TÜNKERS Control Cabinet Module (Concept 1)

- 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

1x EK Electric Clamp

1x TSM1 in the control cabinet

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

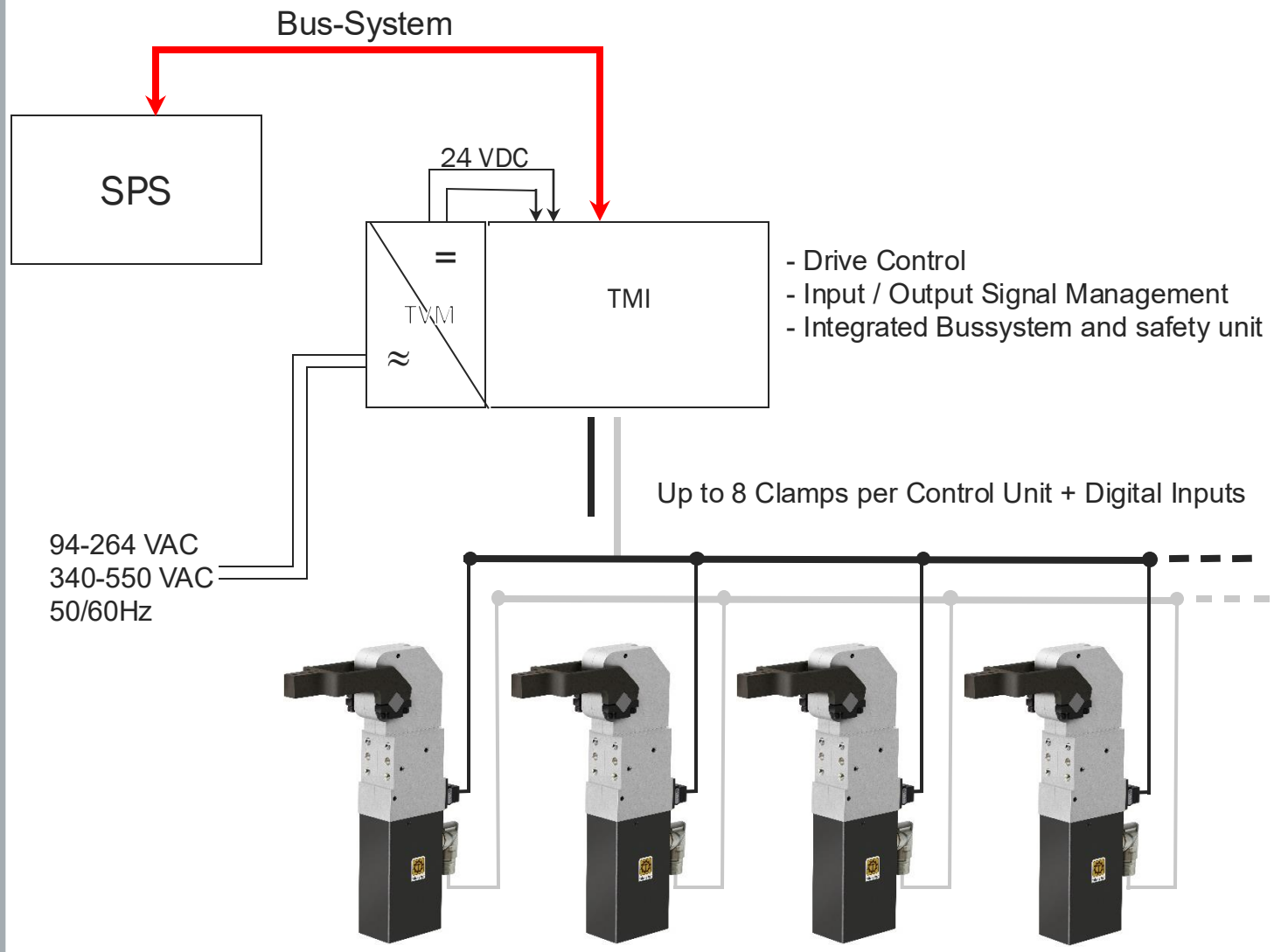
TÜNKERS Decentral Module TDM1 (concept 2)

- Decentral Module for controlling an electrical clamping device
- Equipped with a H-bridge that allows the DC motor to be operated and braked in both directions
- Status-LEDs
- Ideal use in conveying technology

1x TDM1 in field for
1x EK Electric Clamp

“Motor-Island“ instead of Valve Island

Decentralised control concept 3
TÜNKERS Supply Module and Engine Island

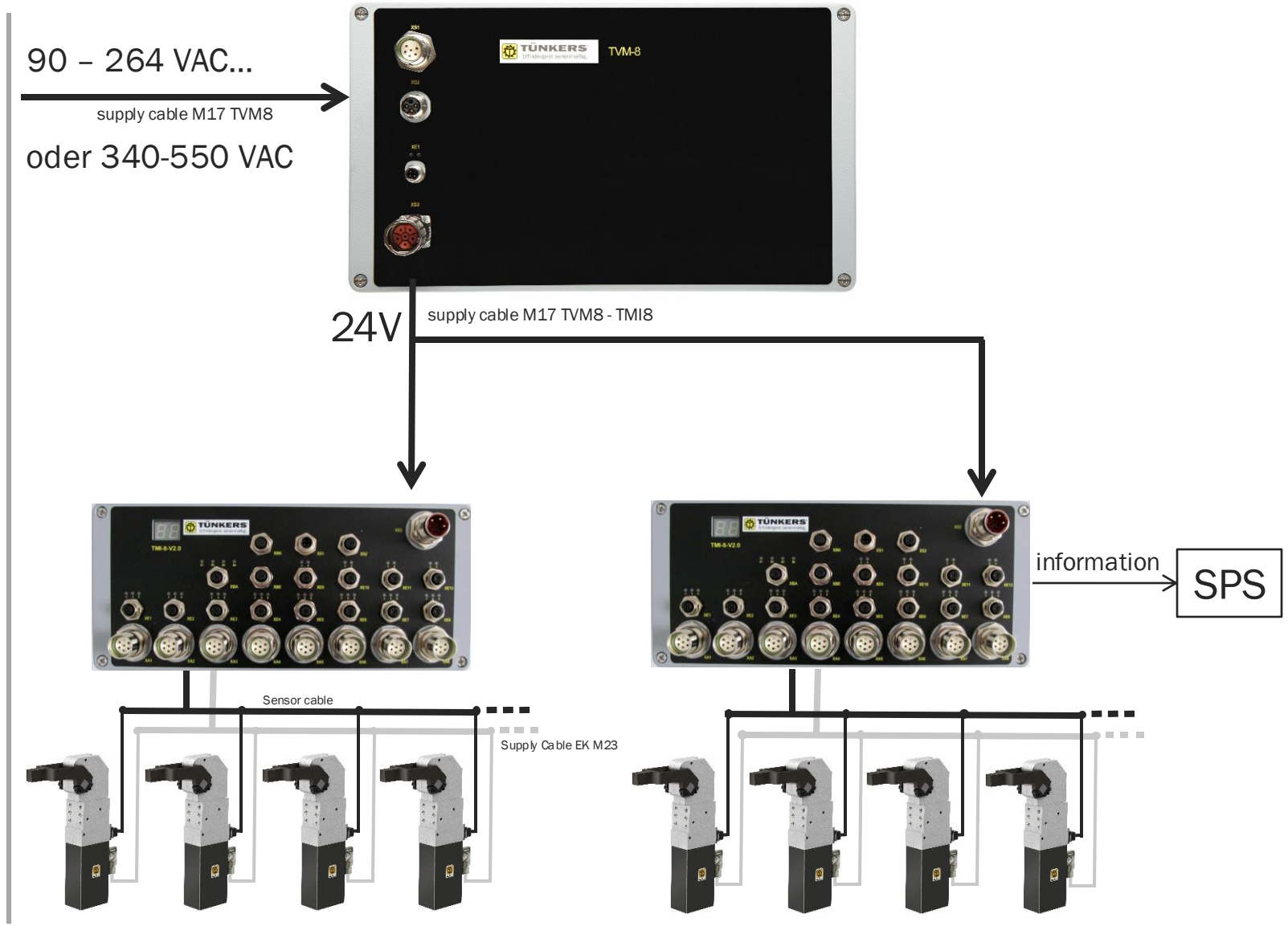


Motor Island instead of Valve Island

1x TVM

2x TMI8

16x EK Spanner max.

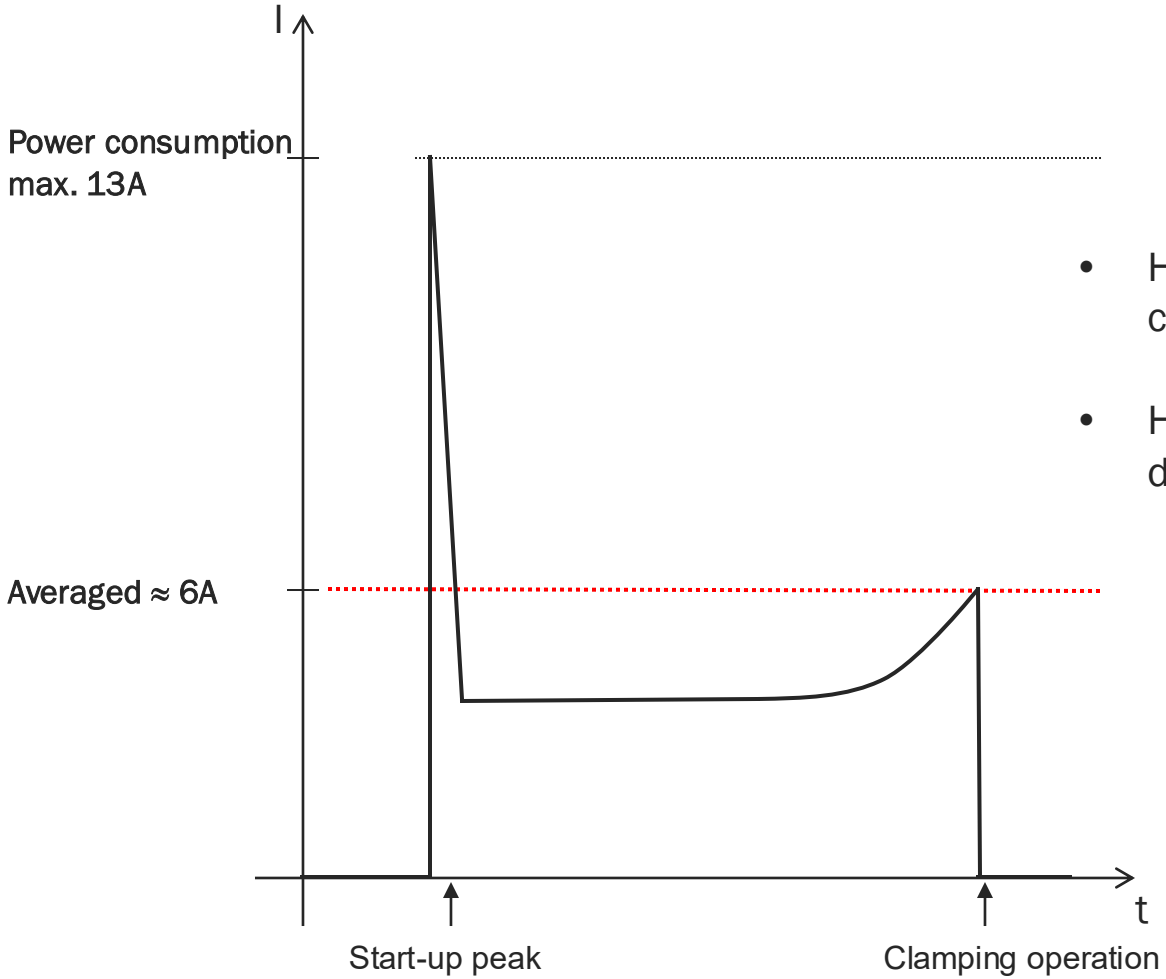


Motorisland TMI8 control unit for 8 clamps

Motor Terminal TMI8

- Power supply for 8 clamps (engine performance and sensor)
- Integrated bus interface (Profi-Bus, Profi-Net, Ethernet, IP, etc.)
- Moving single electric clamps or groups,
- Motor island provides the tact cascading to prevent voltage peaks of the engines independently of the PLC
- Control and feedback of e-clamp position to higher-level PLC
- The CPU is relieved and the positioning is done in a timely manner without influence of the CPU cycle time.
- Display for status of the e-clamp
- Preselection and control (open / close) of the clamp with arrow keys
- 4 additional M12 connectors for up to 8 additional initiators or photocells

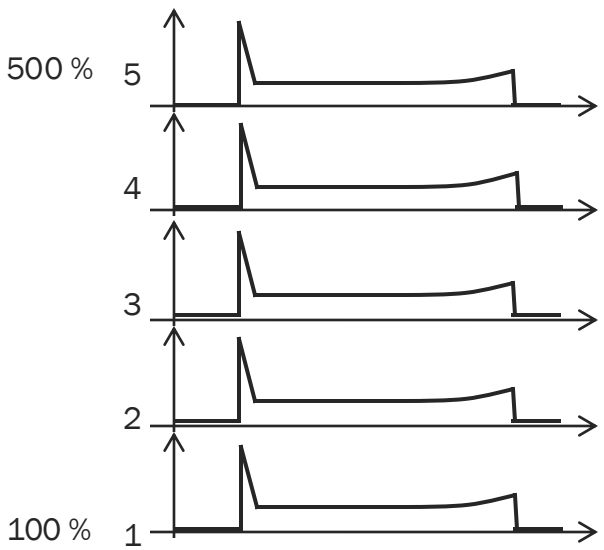
Power consumption of an electric clamp (here EK 50.1)



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

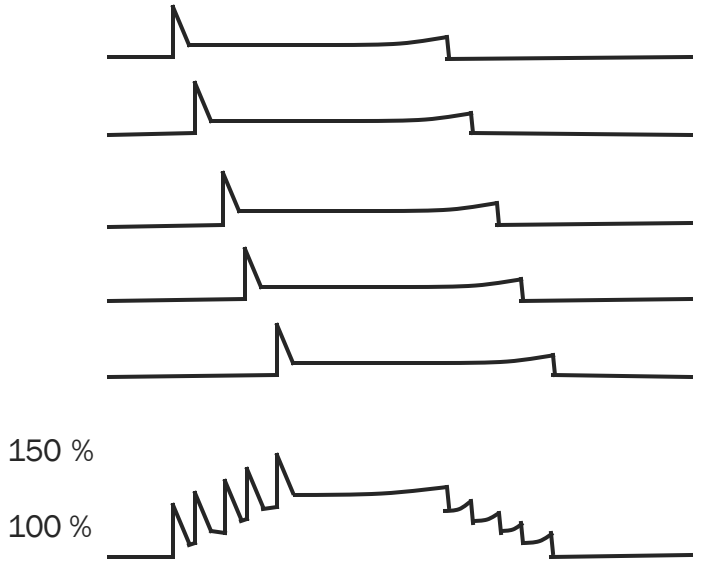
“Motor terminal“

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

TÜNKERS manual panel TMP
HMI for hand mode and status

TÜNKERS TVM8 supply module

Input voltage

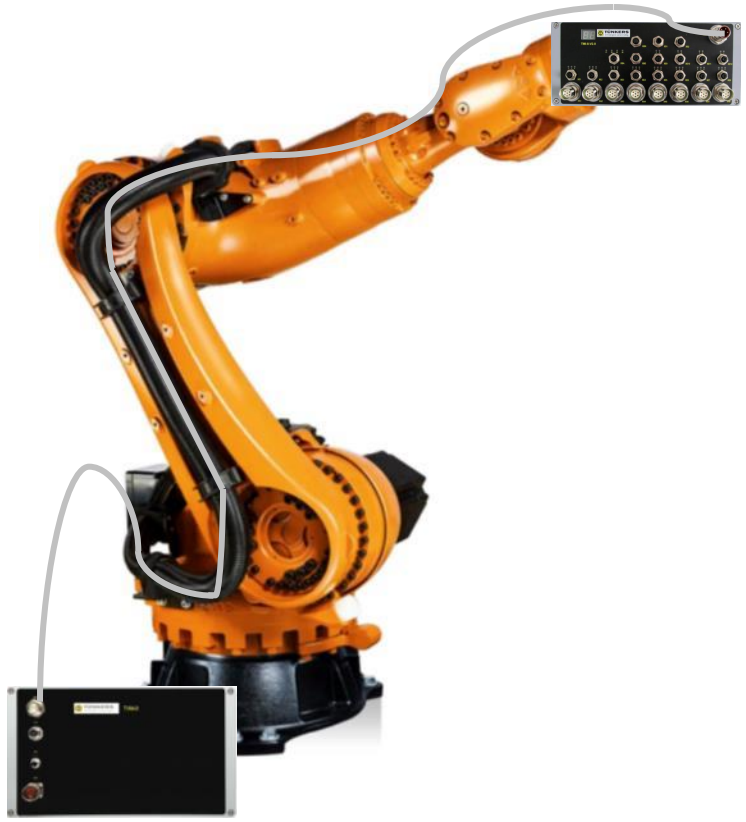
94-264 VAC
340-550 VAC
50/60Hz

M23 – Sockets
6Pol

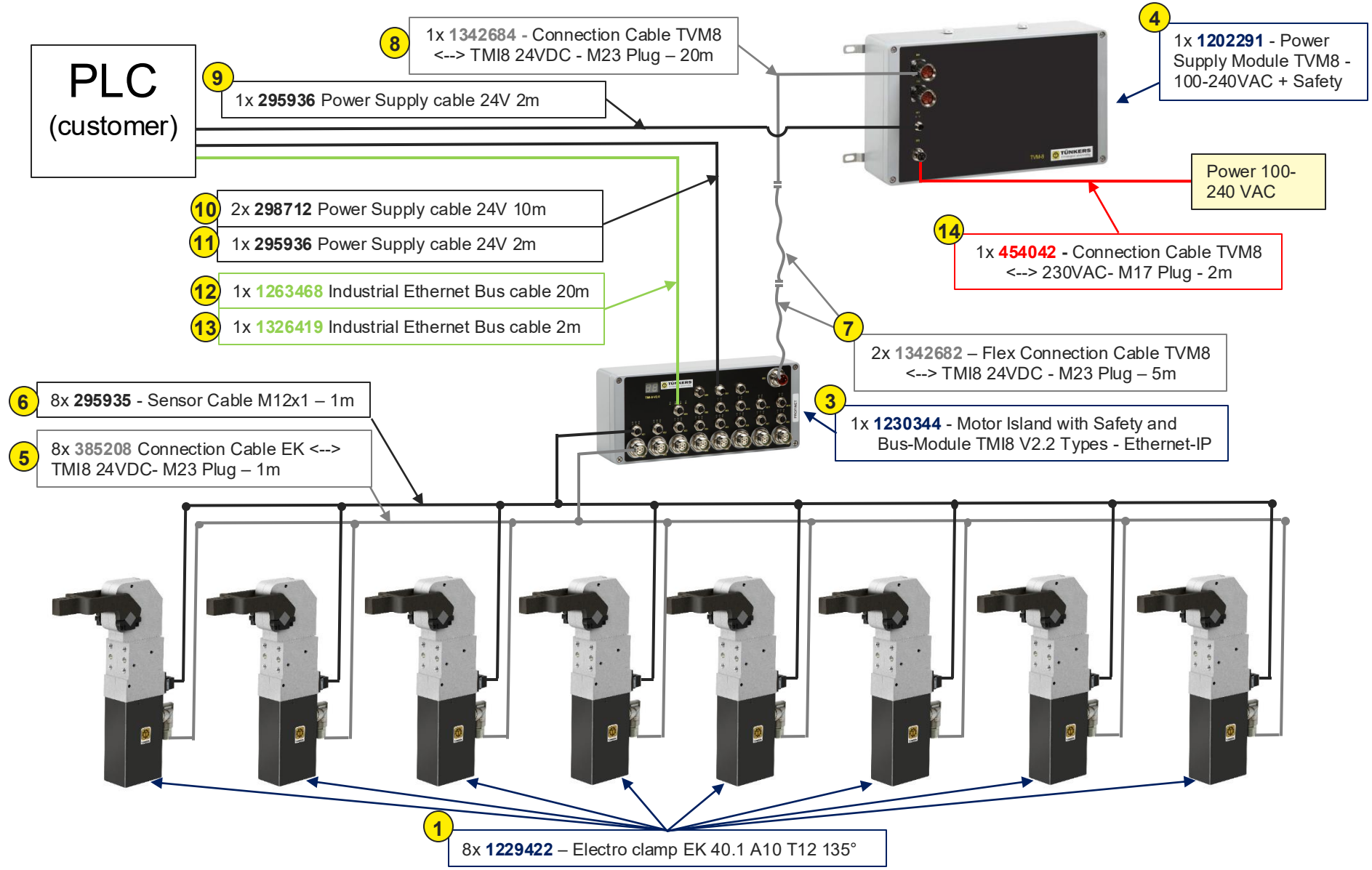
Connection of up to 2 TMIs
(16 clamps)

XS1, XS2 voltage supply TMI8
XS3 entrance power supply 230V
XA1 outlet status TVM8

Example gripper design



Gripper Application - Overview



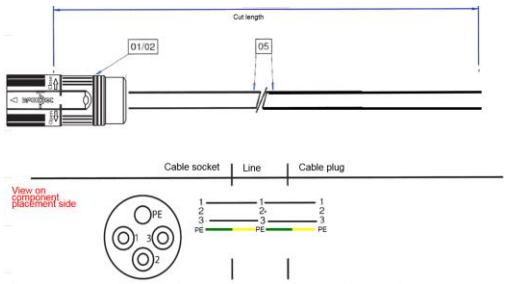
Benefits

- No compressed air needed
- Lower CO2 emission (factor 17.5)
- Lower operational costs (factor 19.6)
- Better safety, due the safety control
- Better safety , due the safety control
- Controlled Movement after emergency stop
- Locked in every position because of self holding spindle

Connection cables

TVM8 – open:

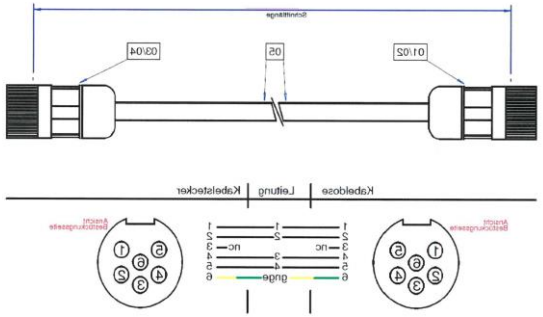
CABLE LENGTH	ID-No.:
1m	454038
2m	454042
3m	454043
4m	454044
5m	454045
6m	454046
7m	454047
8m	454048
9m	454049
10m	454050



Item	Quantity	Unit	Article-No	Designation
01	1,00	Pcs	BSTA-896-FR09-85-05	Cable socket 4-pole
02	3,00	Pcs	6019711	Bush crimp contact 1.5
03				
04				
05	x,xx	m		Ölflex YSLY-JZ 3x1.5

TVM8 – TVM8:

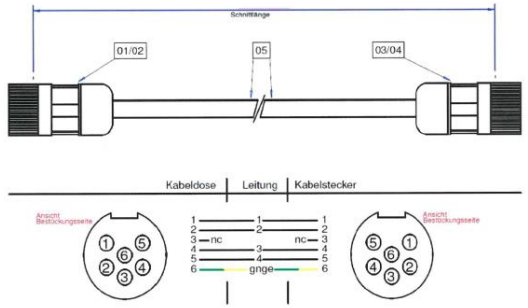
CABLE LENGTH	ID-No.:
1m	454024
2m	454025
3m	454026
4m	454027
5m	454028
6m	454029
7m	454030
8m	454031
9m	454032
10m	454033



Item	Quantity	Unit	Article-No	Designation
01	1.00	Pcs	BSTA-085-FR03-48-010	Cable socket 6-pole
02	3.00	Pcs	6030211	Female crimp contact
03	1.00	Pcs	BKUA-186-MR21-48-010	Cable socket 6-pole
04	3.00	Pcs	6102711	Male crimp contact 2.1
05	x.xx	m		ÖLFLEX YSLY-JZ 3x2.5

Modul – EK:

CABLE LENGTH	ID-No.:
1m	385208
2m	385212
3m	385213
4m	385214
5m	385216
6m	385217
7m	385219
8m	385220
9m	385221
10m	385222



Item	Quantity	Unit	Article-No	Designation
01	1.00	pcs	ASTA-152-FR12-0100-	Cable socket 6-pole
02	5.00	pcs	6001411	Female crimp contact 2.
03	1.00	pcs	ASTA-151-MR08-0100-	Cable socket 6-pole
04	5.00	pcs	6001111	Male crimp contact 2.0
05	x,xx	m		Ölflex FD 855 5x1.5mm²

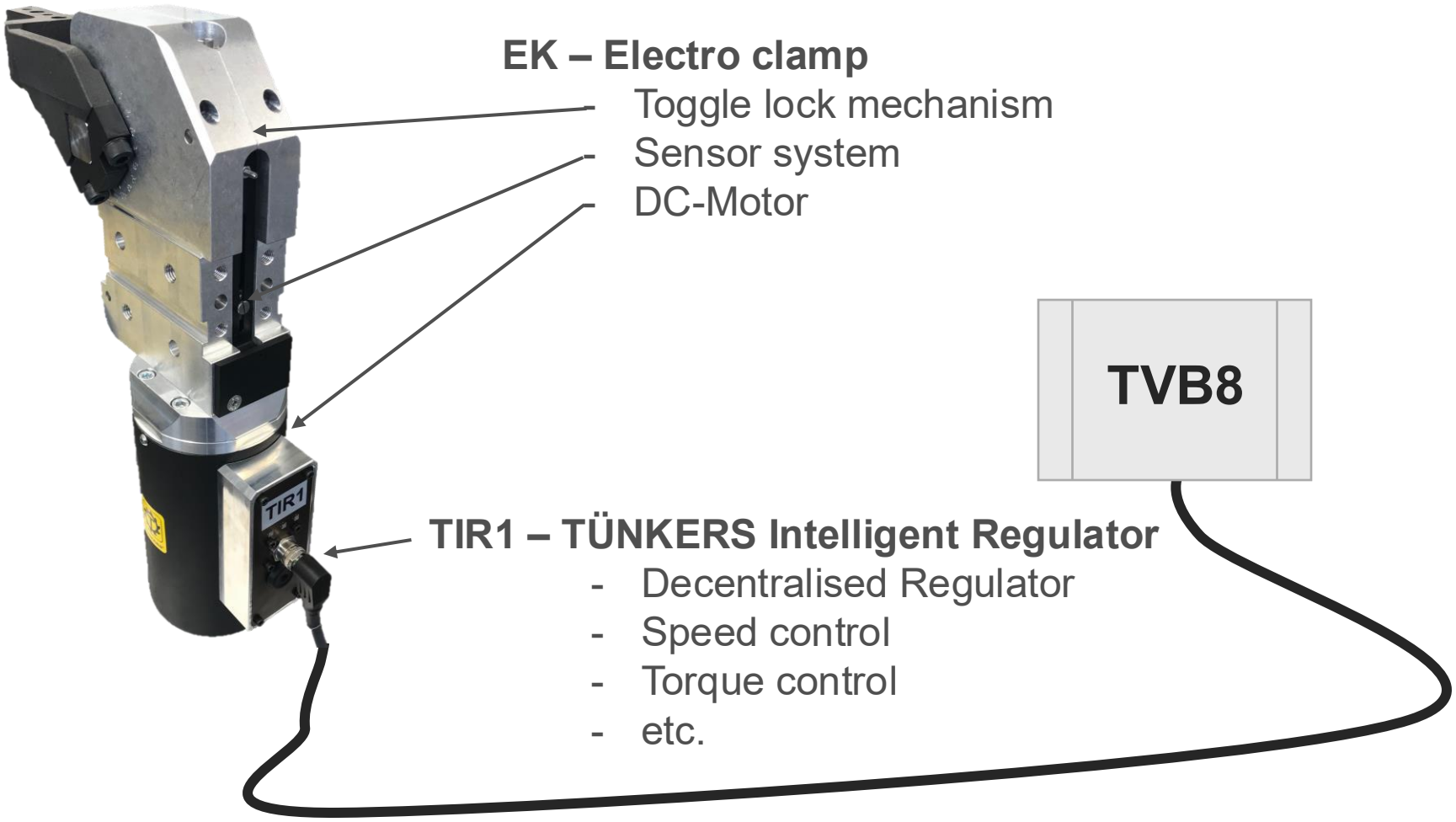
For further cables see control catalogue

E-Clamping

Smart Solutions

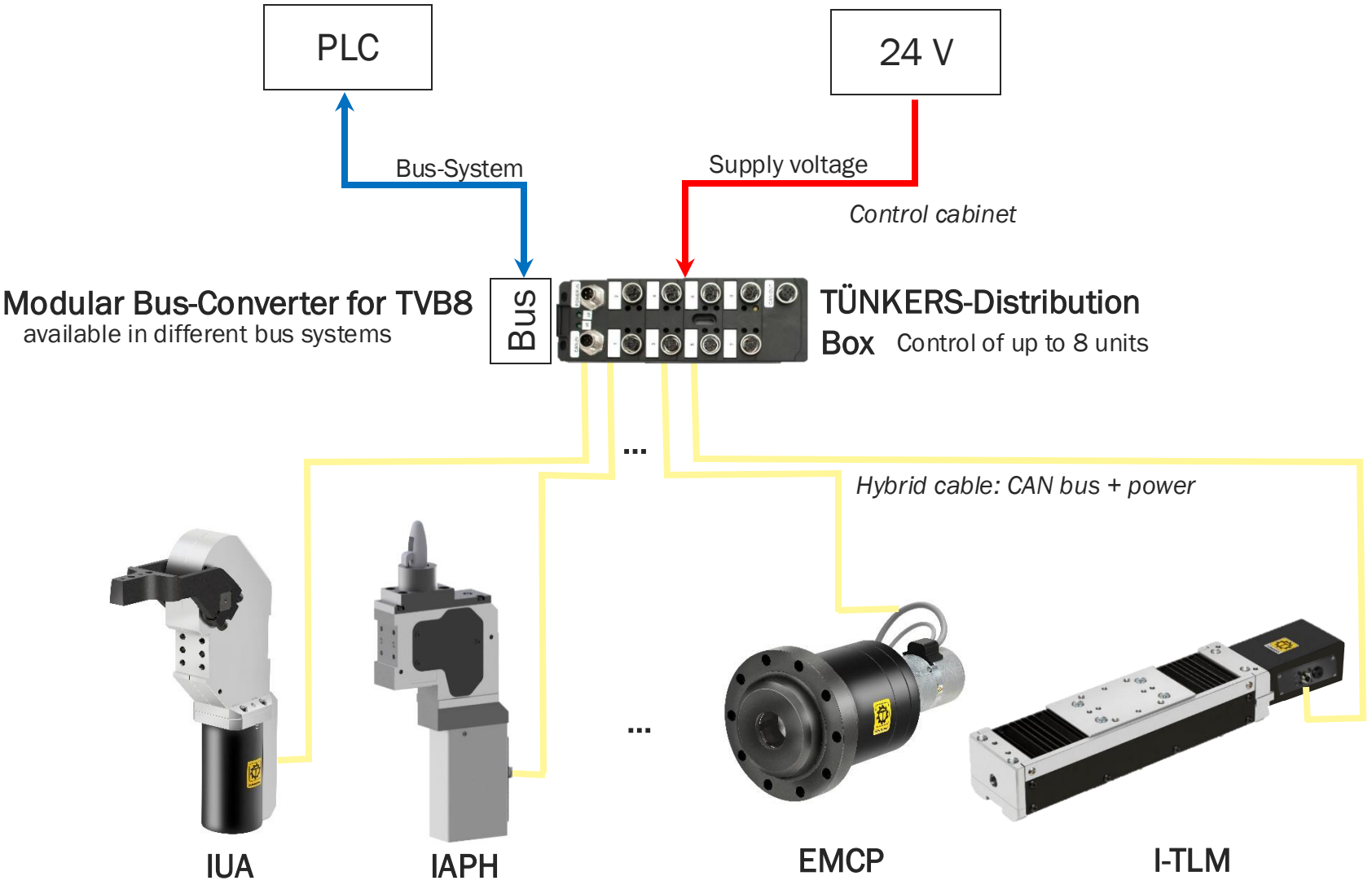
EK … TIR1

EK – Electro clamp with intgr. Control TIR1



Multi Control Concept - Decentralised

TÜNKERS Motor Control TIR1



Comparison against usual control units

TSM1	TIR1 new

• Control unit (control cabinet)
  • H-Bridge
  • ON / OFF
	• Regulator (decentralized, integrated)
	  • MiControl
	  • Var. speed control
	  • Var. torque control
	  • Ramp ride*
	  • Hardware addressing (15x)
	  • conditioning monitoring

In / output

• M12 sensor signal • M23 motor power	• M12 Hybrid cable

Benefits

• Actuator and control unit are separated • Simple construction • Simple operation	• Decentralized control concept to regulate the clamping movement & force Intelligence • One cable from unit to PLC • Diagnosis / Conditioning Monitoring / LED Display • TÜNKERS distribution box for up to 8 units - star-shaped • Simple replacement in the event of a defective unit • Compact, cost-effective, simple

* Ramp ride only possible with servo drive

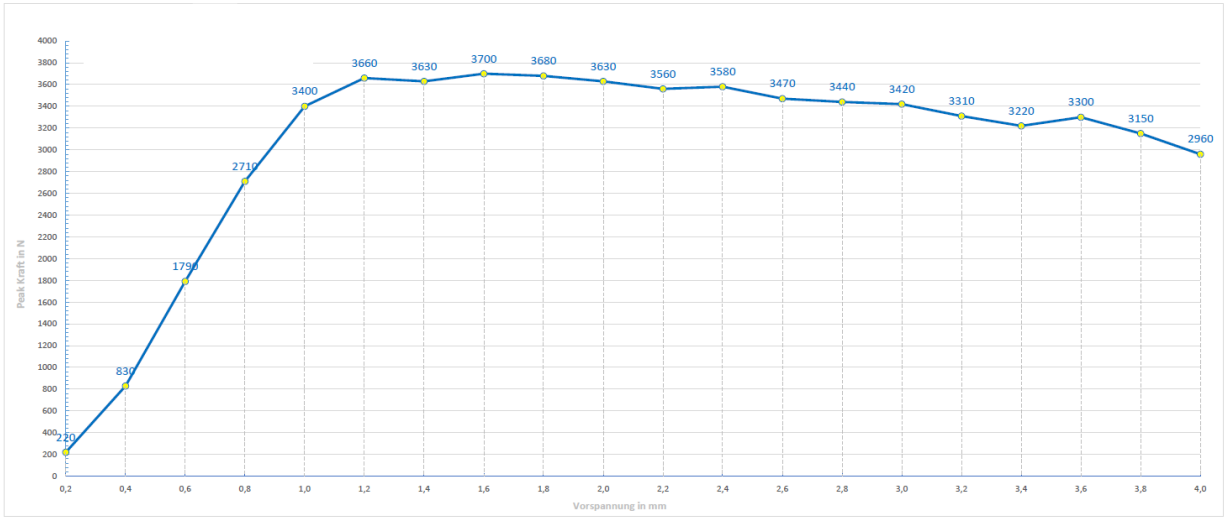
Servo electric toggle lock clamp

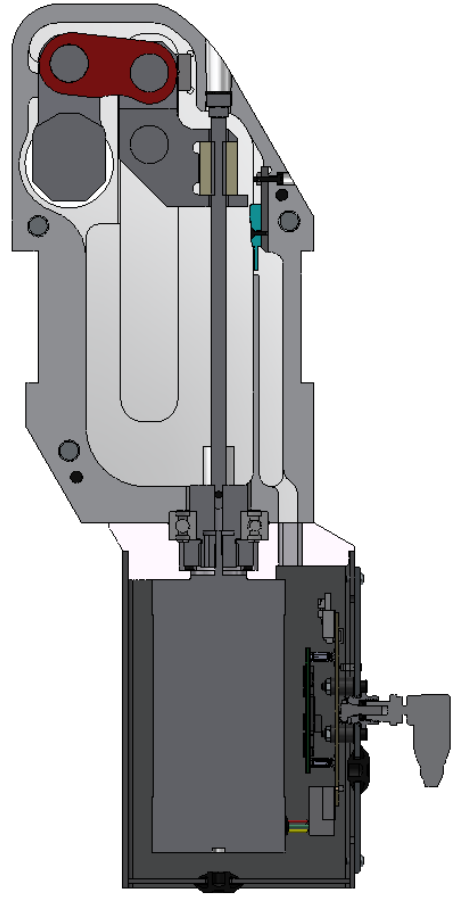
IUA series

- Smart clamp: servo drive with hall encoder
- 24V technology
- Control: CANbus communication
- One cable set up
- Toggle lock mechanism
- Position control & feedback
- Sheet thickness detection

TÜNKERS
Erfindergeist serienmäßig.

Vorspannung in [mm]	Peak Kraft [N]
0,2	220
0,4	830
0,6	1790
0,8	2710
1,0	3400
1,2	3660
1,4	3630
1,6	3700
1,8	3680
2,0	3630
2,2	3560
2,4	3580
2,6	3470
2,8	3440
3,0	3420
3,2	3310
3,4	3220
3,6	3300
3,8	3150
4,0	2960





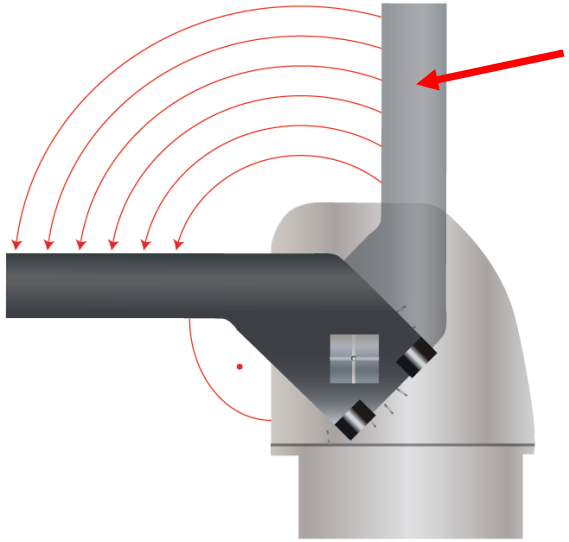
Servo electric plane-parallel clamp – IUP 63

- 24V servo drive
- Backlash-free and self-locking trapezoidal spindle
- Freely adjustable opening angle with intermediate positions possible
- conditioning monitoring
  - Sheet thickness detection
  - Detection of faults
  - Detection of missing parts
  - wear control

Plane-parallel clamping

Traditional clamp

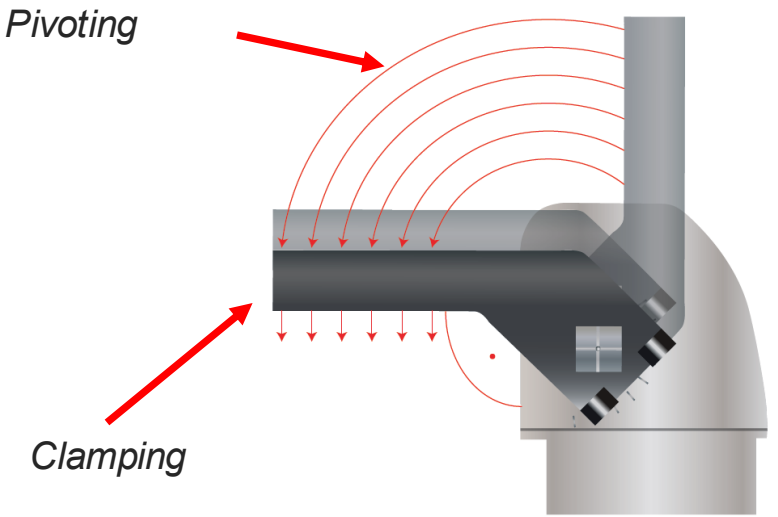
Pivoting clamp arm



- For defined sheet thicknesses
- Defined end position
- Clamping by rotation

IUP clamp

Parallel-plane increments

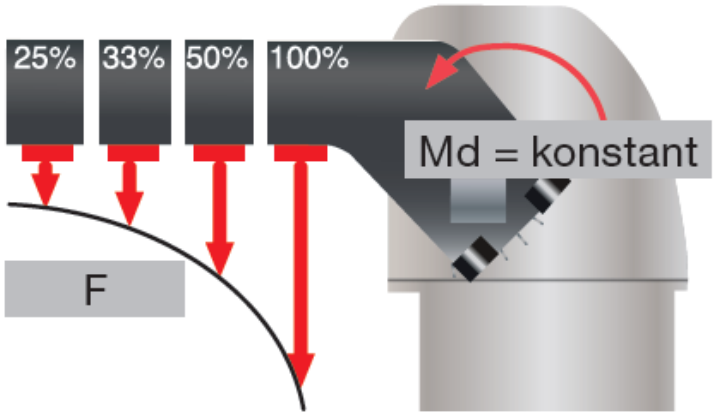


- For sheet thickness compensation
- Variable end position
- Clamping by lowering

Clamping force

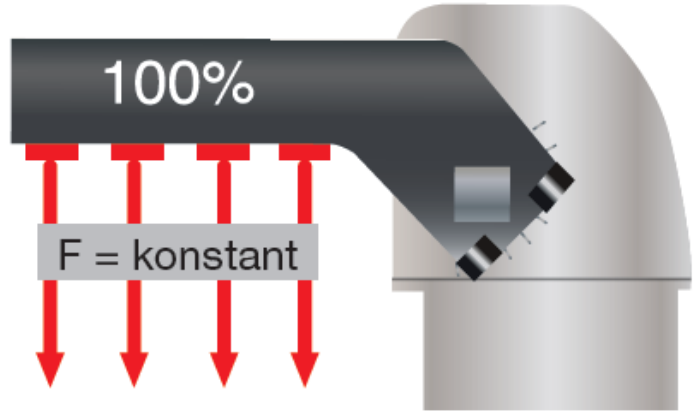
- The clamping force of the IUP series is always constant and independent of clamping arm length due to a special transmission mechanism. The clamping force can be continuously adjusted by controlling the drive torque

Traditional clamp



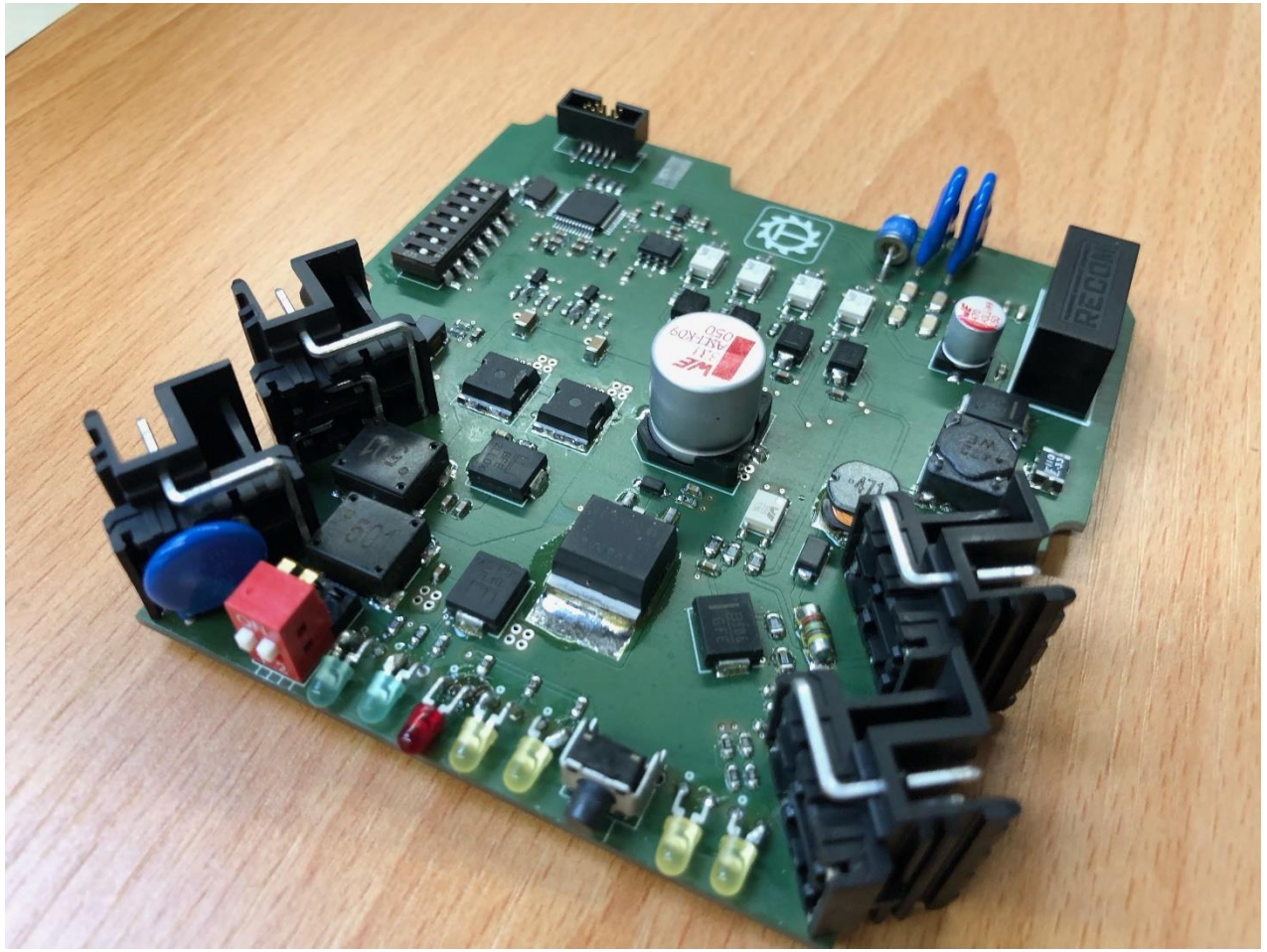
With traditional clamps, the clamping force decreases with the distance from the pivot point

IUP clamp



Defined clamping force

TÜNKERS Control Cabinet Module



Design Update

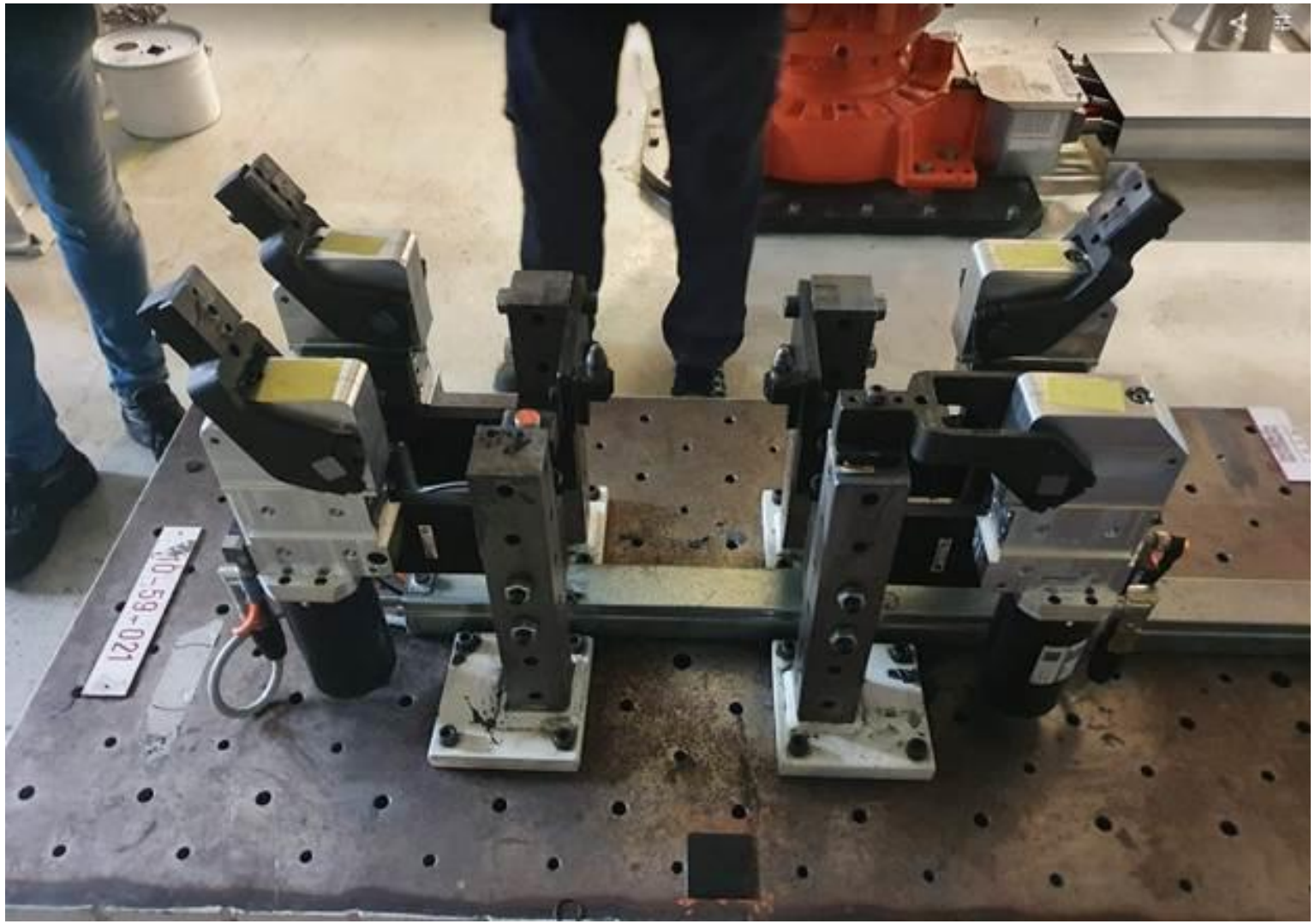
Application TSM1.2

Positioning of Skids

In this area no compressed air

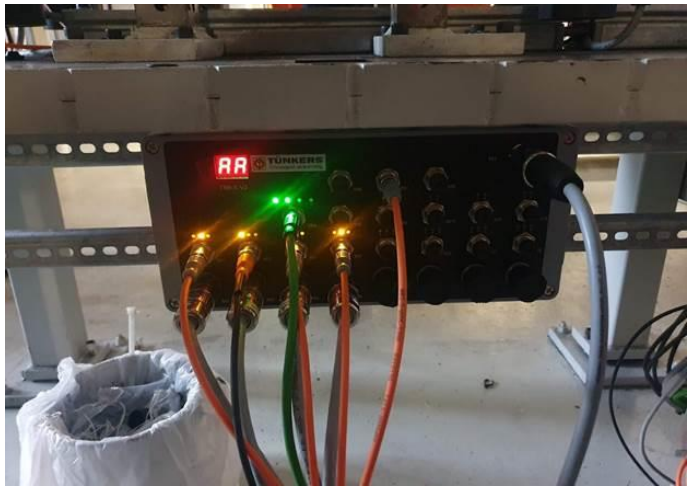
Less installation cost

Application
Welding Station



Application

Welding Application

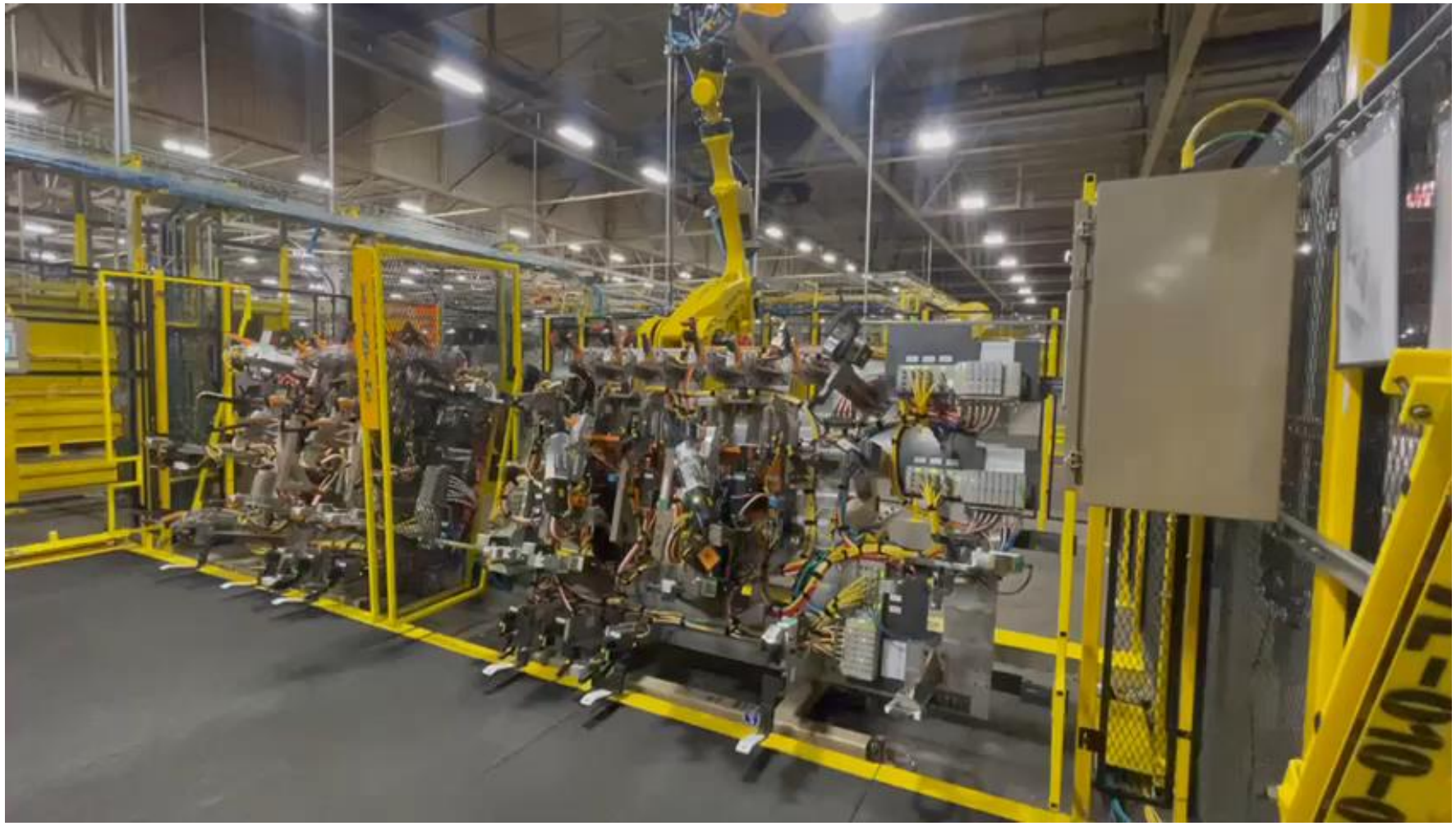


Showroom

All sizes available

Teststation

8x Electric Clamp in use



Anwendung: Heber

Anwendung: Heber

Contact

TÜNKERS Maschinenbau GmbH
Christian Eickhoff
Am Rosenkothen 4-12
40880 Ratingen

Telefon +49 (0) 2102-45 17-290
Telefax +49 (0) 2102-45 17-9999

E-Mail christian.eickhoff@tuenkers.de
Internet www.tuenkers.de

Thank You

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