

Topic 4

Introduction to Drive Technology in Mechatronics





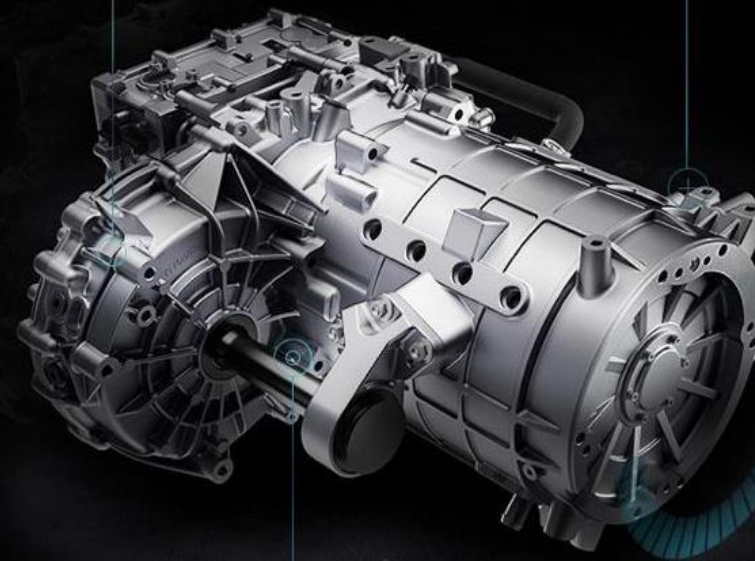
• Build Your Dream



最高转速
15,000
r/min



峰值功率
240
kW

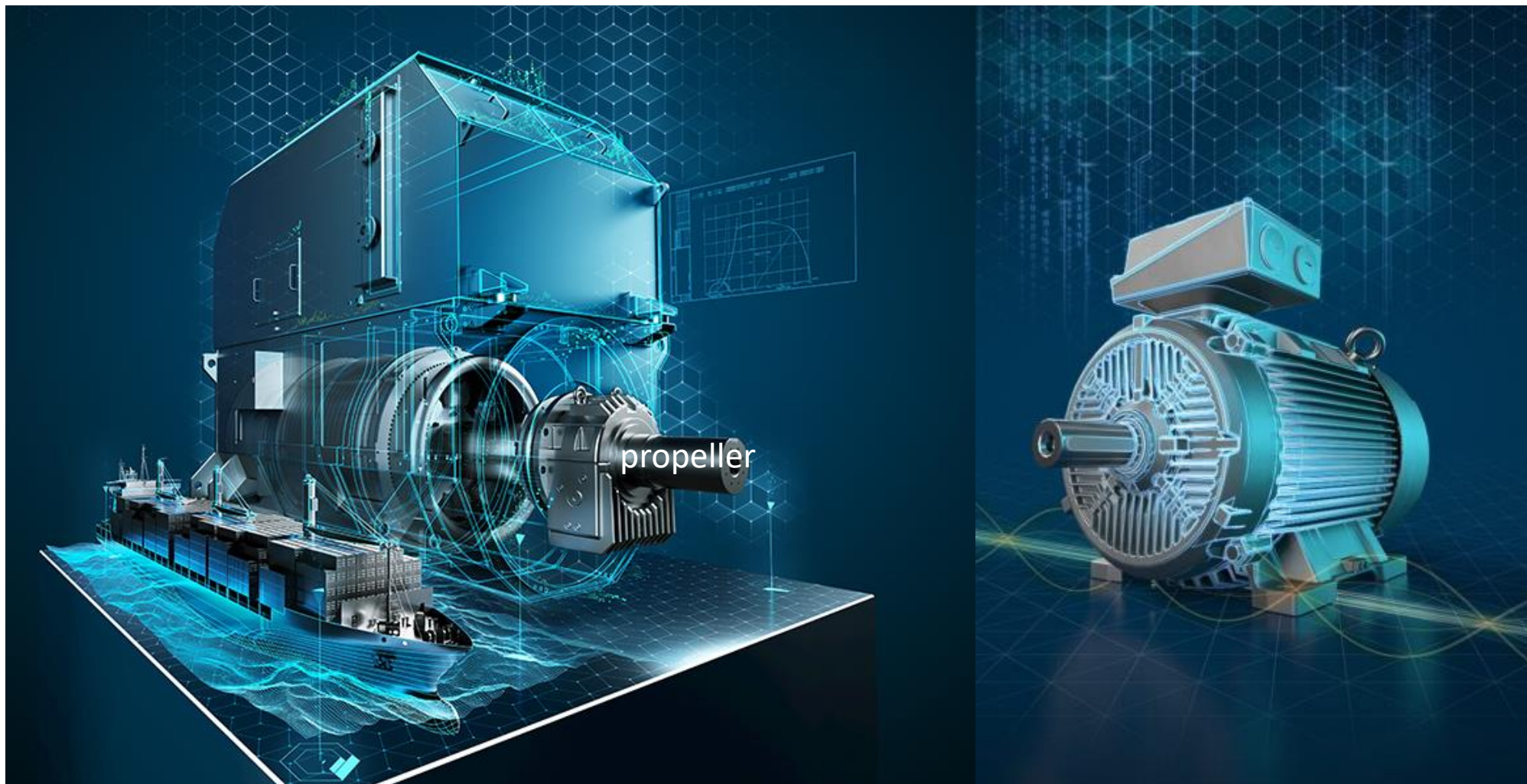


峰值扭矩
420
N·m

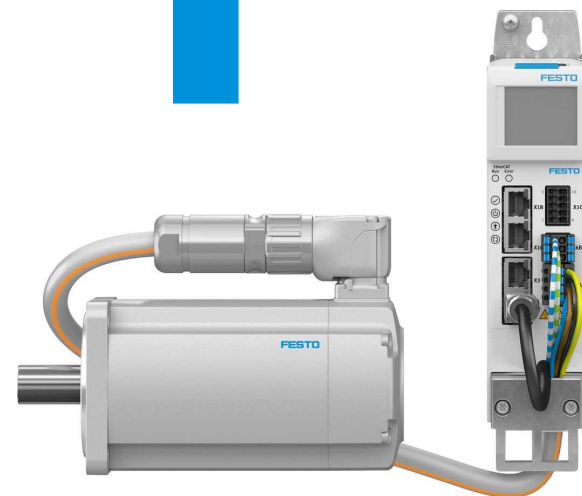
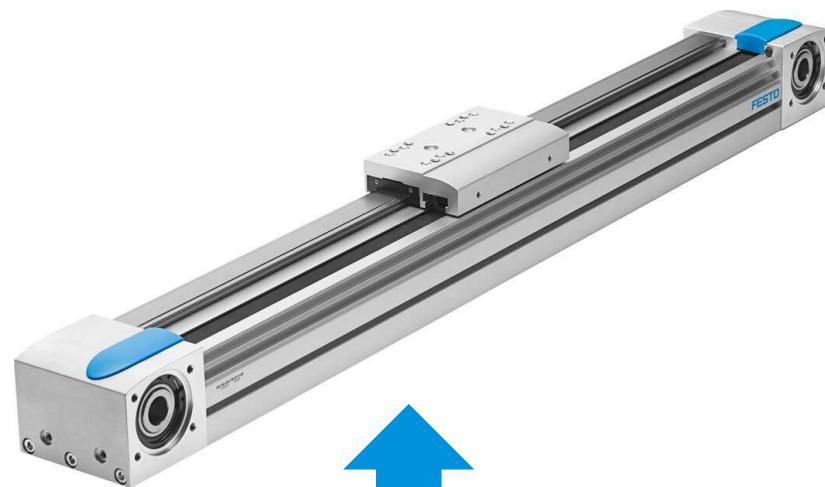
240kW 高性能感应电驱动系统

- 业内最大功率乘用车异步感应电机
- 国内首台量产铜转子及激光熔焊技术电机
- 电机、齿轮箱和电机控制器“三合一”
- 双三相拓扑结构逆变器技术

Electric drives



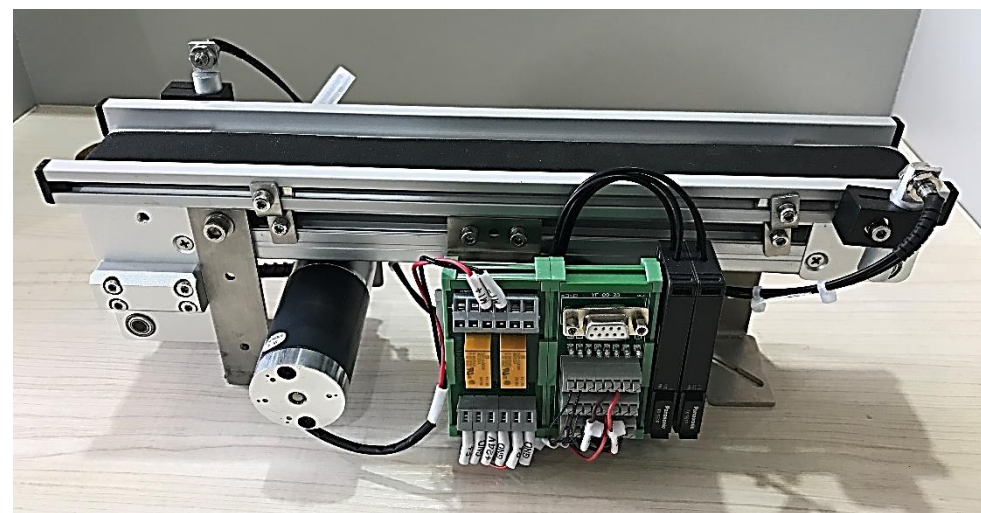
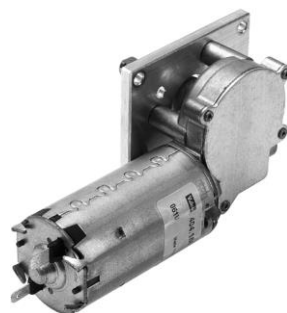
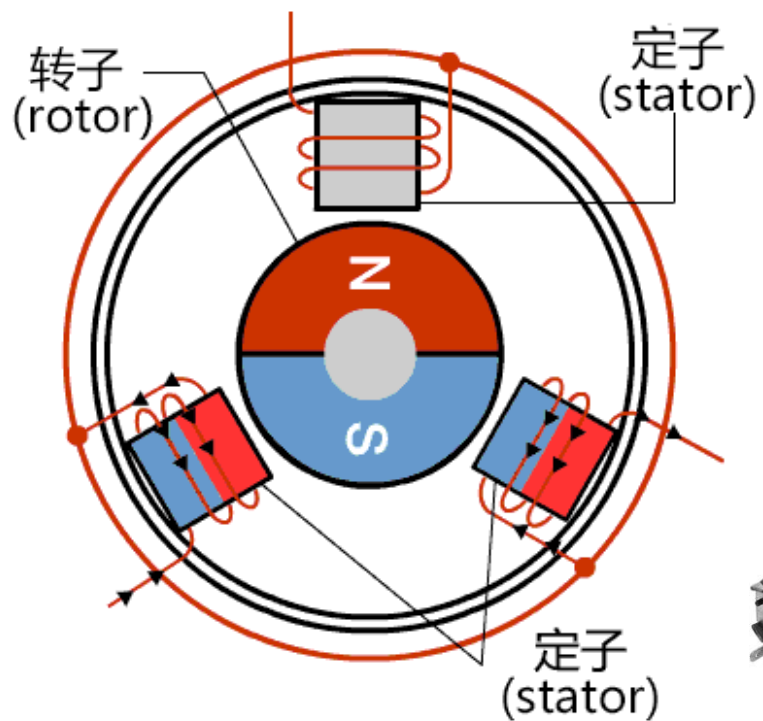
Pneumatic VS Electric drive



Direct Current Motor

- DC

Speed



Alternating Current Motor

Speed

- AC



- 220V 380V



- Micromaster 420



- SINAMICS V20



- SINAMICS G120

Step Motor

CMMT-ST



MD2504



CMMO-ST



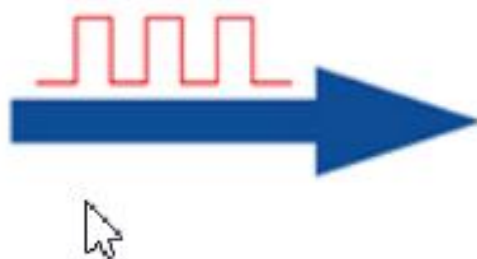
How is Step Motor working

Position

controller



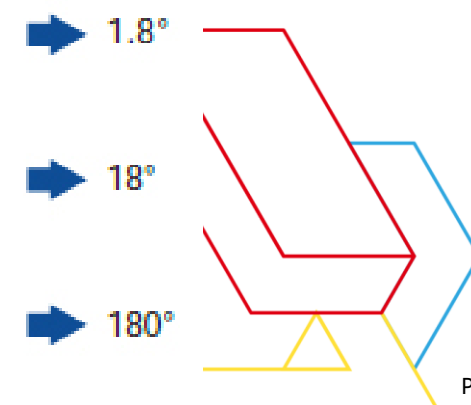
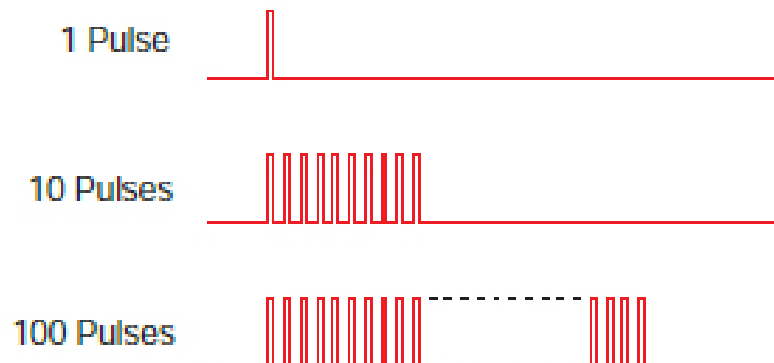
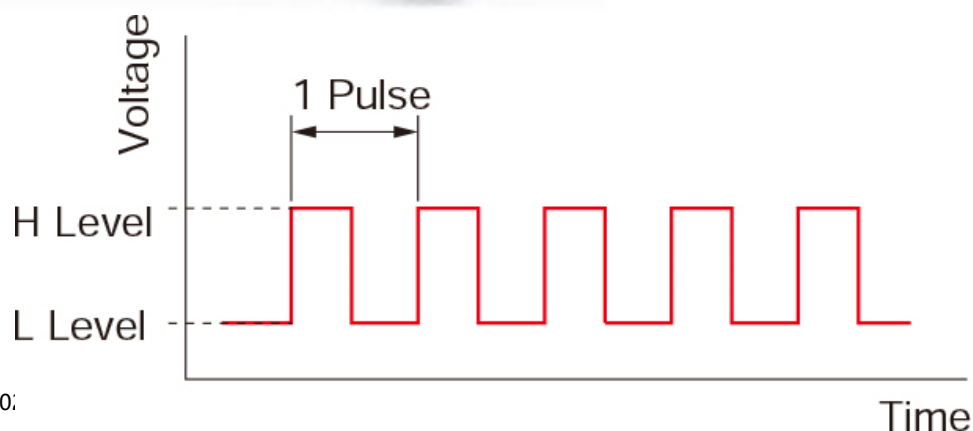
Pulse signal



Step Driver



Step Motor



Speed control of Step Motor

Speed

100 Hz



➡ 30r/min

1000 Hz

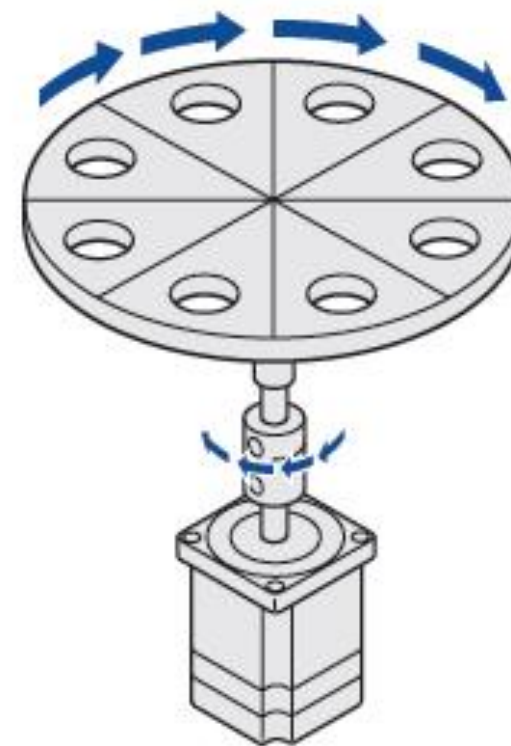


➡ 300 r/min

2000 Hz



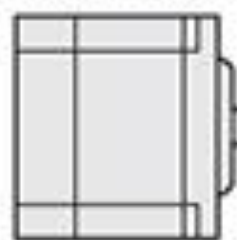
➡ 600 r/min



When the winding is energized,.....

Step Motor

步进电机



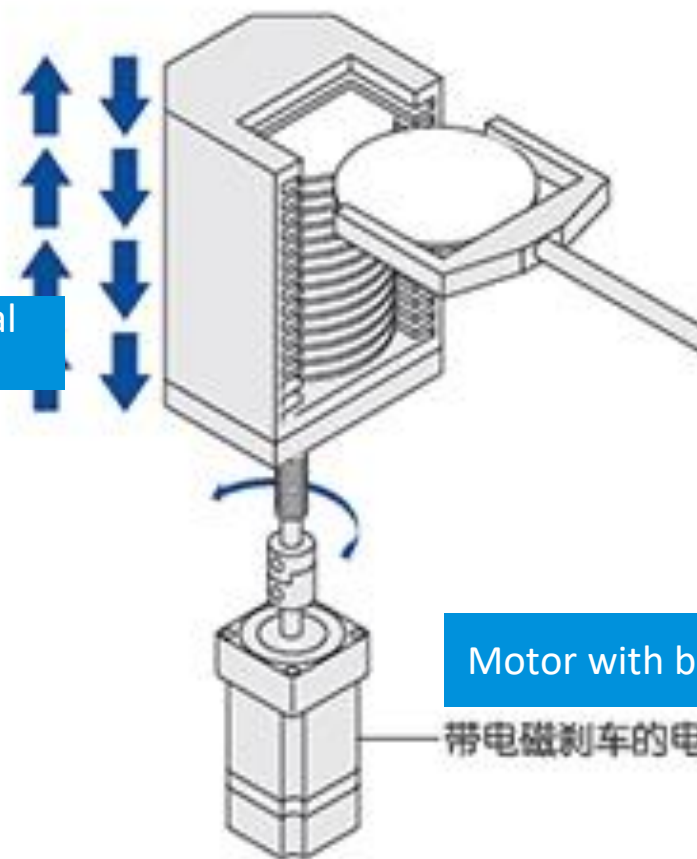
联轴器

coupling

当绕组通电时，电机保持在当前位置。

外部推力

External thrust



Motor with brake

带电磁刹车的电机

Servo Motor

CMMP-AS



CANopen

PROFI
BUS

DeviceNet

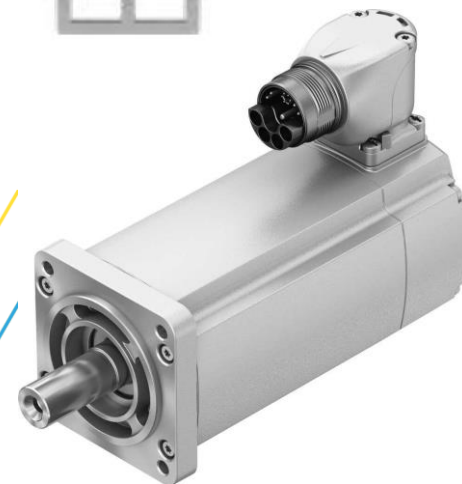
Modbus

EtherCAT

EtherNet/IP

PROFI
NET

CMMT-AS



Structure of servo motor

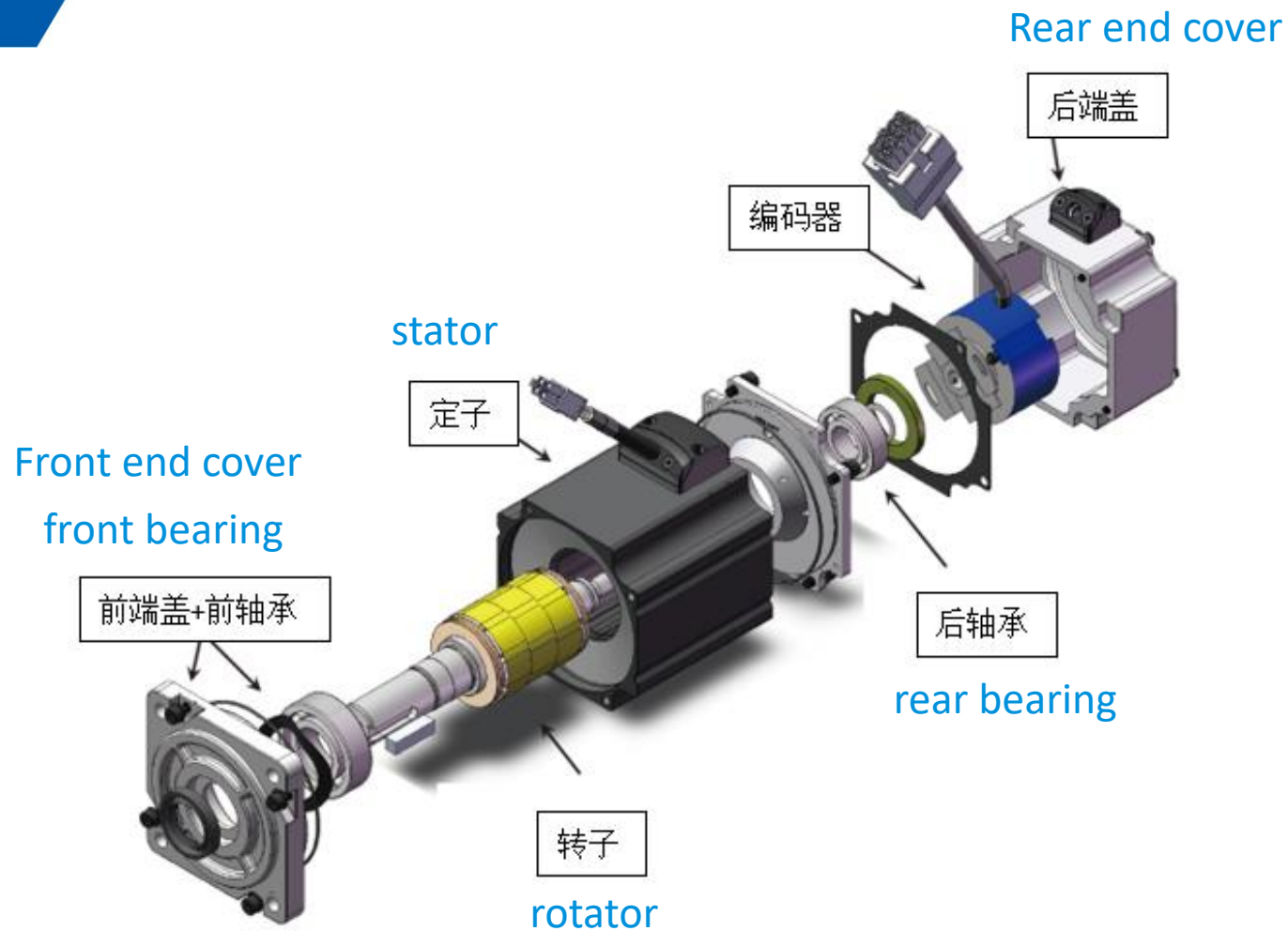
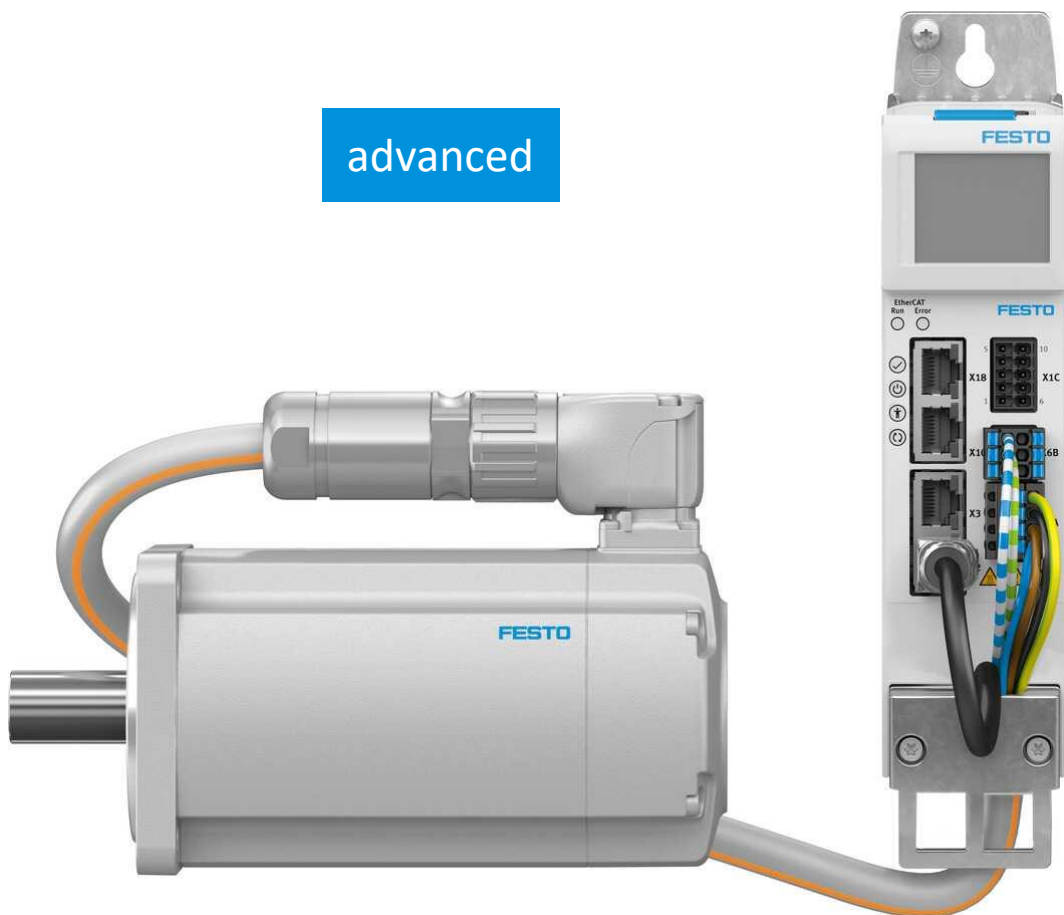


图 4.2.10: SM 系列伺服电机结构



Motor + Driver Connection

advanced



traditional



Actuator



图 4.2.12: 丝杆式电缸 EGC-HD-BS



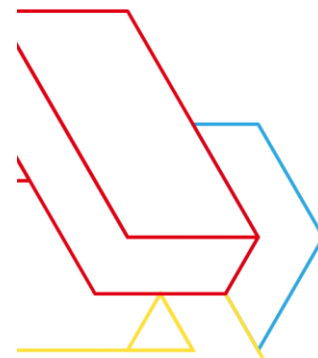
图 4.2.14: 齿形带式电缸 EGC-TB



图 4.2.15: 悬臂式电缸 ELCC



图 4.2.16: 齿形带式电缸结构



Simplified Motion Series

Spindle axis unit



Mini slide unit



Electric cylinder unit

Toothed belt axis unit



Rotary drive unit



customized



Servo technology

Servo motors and servo drives with extensive connectivity

Reliable servo technology from Festo can help you solve your automation problems. In this section, we will give a brief overview of the components and tools we provide so you can select the servo solution that is most suitable for your application.

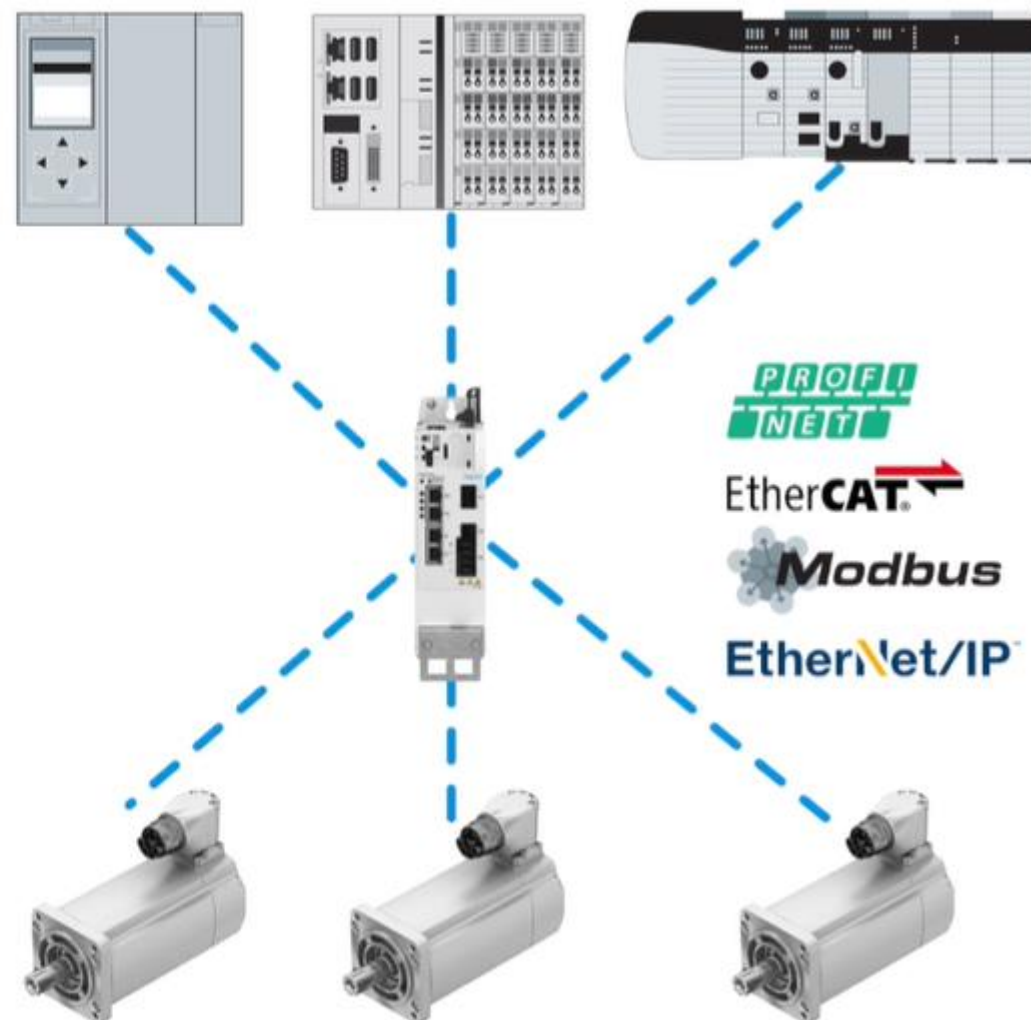


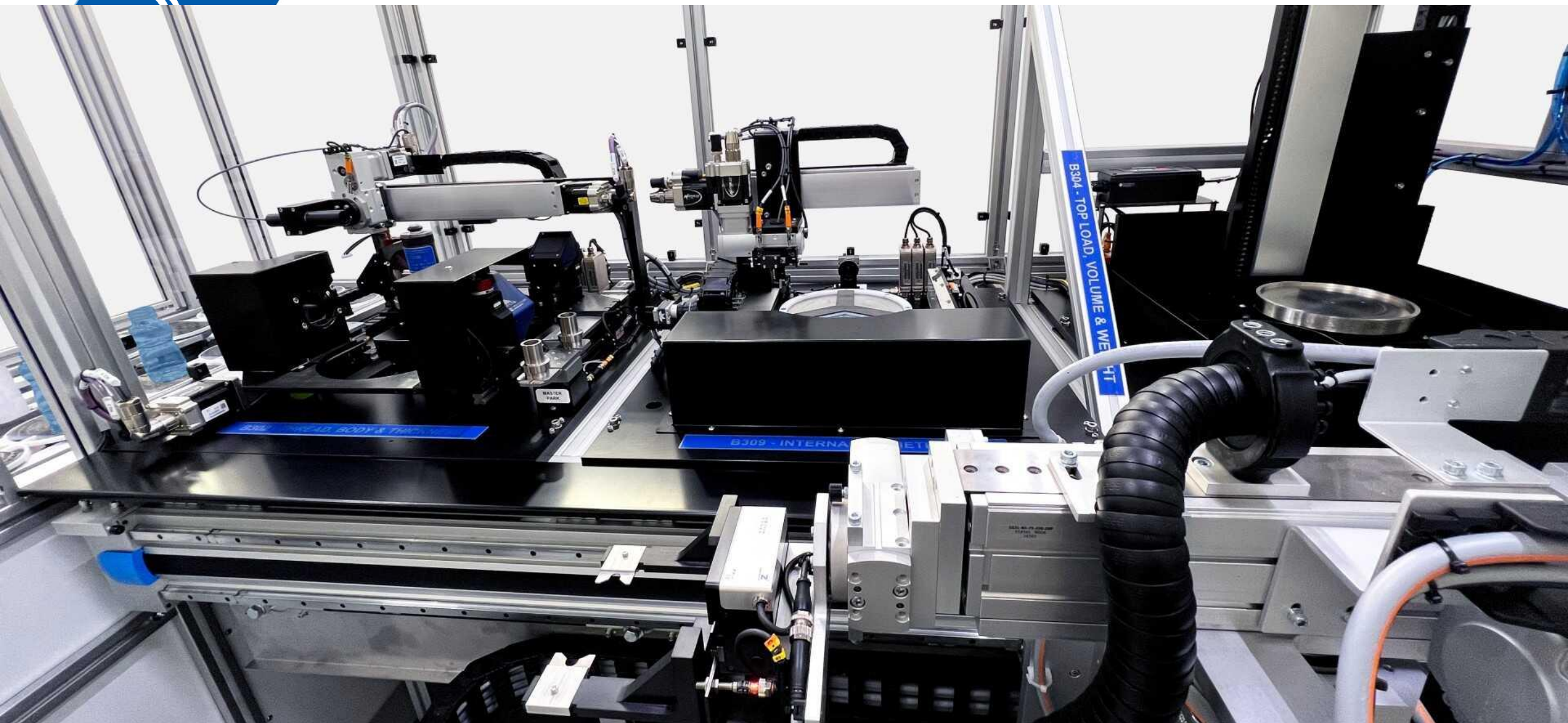
The diagram illustrates a Festo Multi-Protocol Servo Drive, a white industrial unit with a blue top section. To the left of the drive, a large blue double-headed arrow points between a cluster of protocol logos and a blue circle. The logos include PROFIBUS, Modbus, EtherNet/IP, and EtherCAT. The blue circle contains the text 'All-in-one'. The drive itself has a small display screen and several ports on its front panel.

The Multi-Protocol Servo Drive
Seamlessly switch between multiple field buses,
all in a single servo drive.



Servodrive Multi-Protocol CMMT-AS-MP





Torus and Festo design total handling solution for TQ-Lab | Festo GB

Author: Gao Haihua



In practice

Colorful combination on the transport track

Today filling and packaging thousands of bottles of perfume, tomorrow just a few tubes of cream and the ...



In practice

Carefully packaged

The servo-controlled horizontal cartoner HK-S from ECONO-PAK gently and efficiently places scratch-sens ...



In practice

Colorful combination on the transport track

Today filling and packaging thousands of bottles of perfume, tomorrow just a few tubes of cream and the ...

Transport system | Festo GB

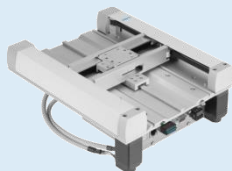


Author: Gao Haihua

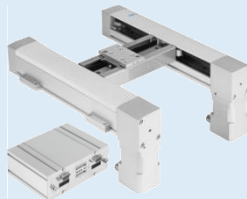
An innovative Handling System: EXCM

Product

EXCM-10



EXCM-30



Compact
Modular
Functional

Application fields

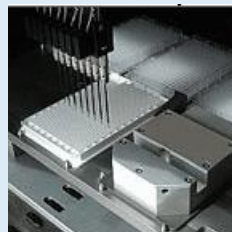
Electronic



Small part assembly



Laboratory



Didactic



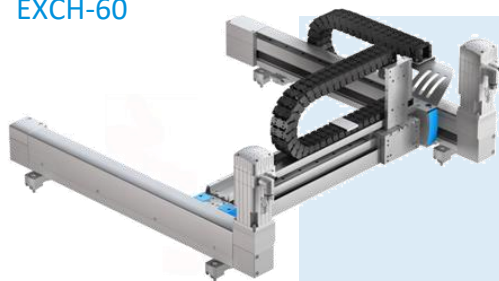
Features

- Small and compact
 - Fits in desktop format
- High dynamic
 - For short lanes
- Integrated motor controller
 - Independent simple X Y movement
- Easy commissioning
- Low cost
 - Below other solution with single components



System Segmentation (Working Area)

EXCH-60



X 2600 mm
6 kg Payload

EXCH-40



X 2000 mm
4 kg Payload

EXCM-30



X 700 mm
3 kg Payload

EXCM-10



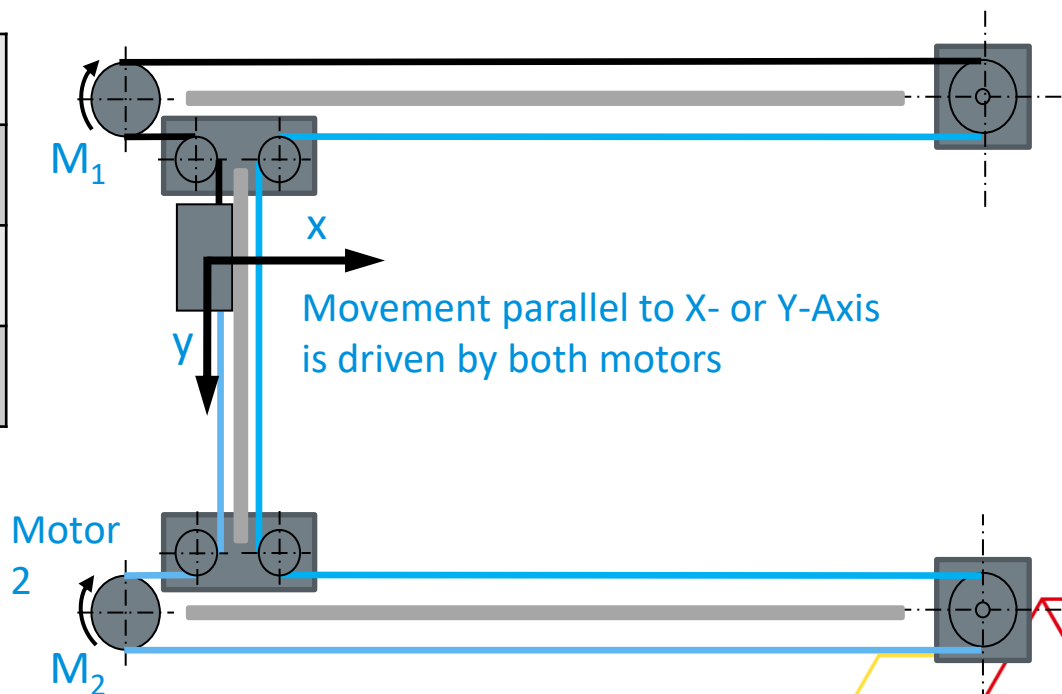
X 700 mm
0.5 kg Payload

Y 1000 mm
Y 360 mm
110 mm

Y 1500 mm

Highlighting the main features of parallel kinematic drive

	 M2+		 M2-
 M1-			
			
 M1+			



Advantage of parallel kinematic drive principle

- Compact design
- Reduced moving mass → higher dynamic
- Superposed movement → double drive power in X or Y movement → higher dynamic

Author: Gao Haihua



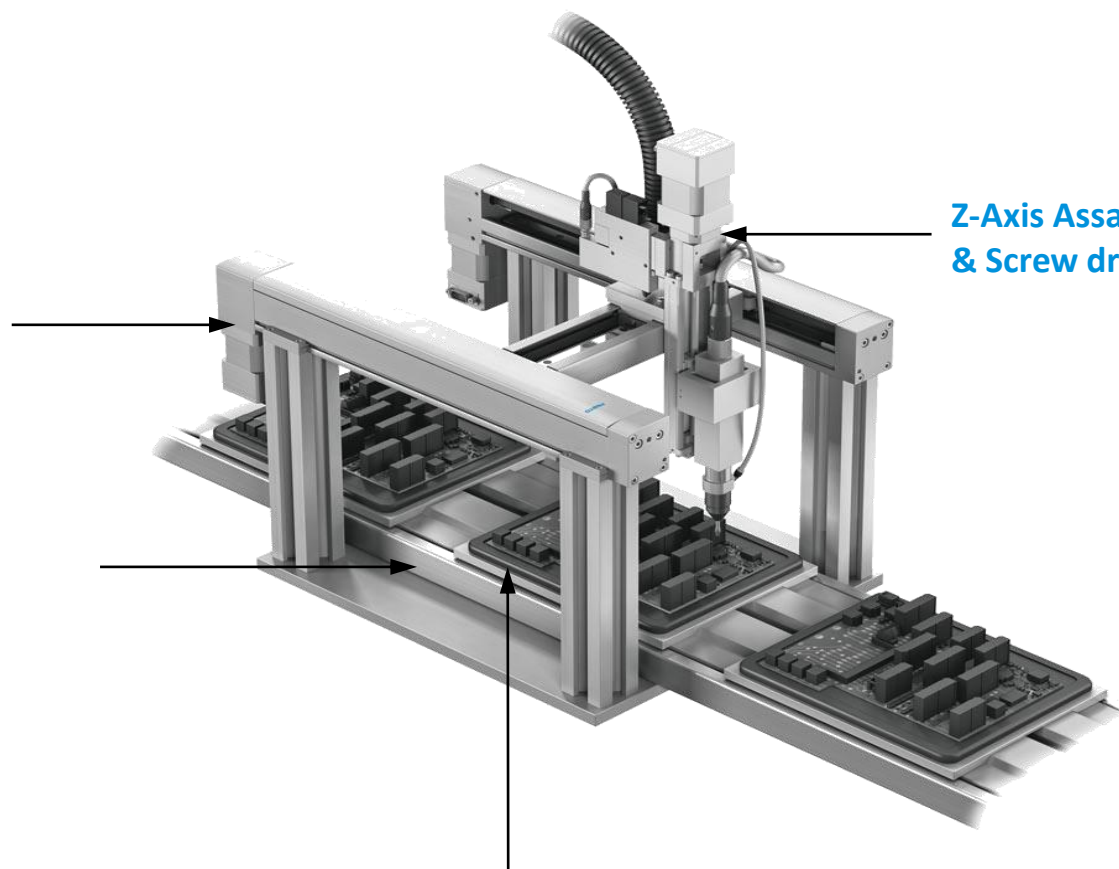
Example: Desktop Screw Driver Application

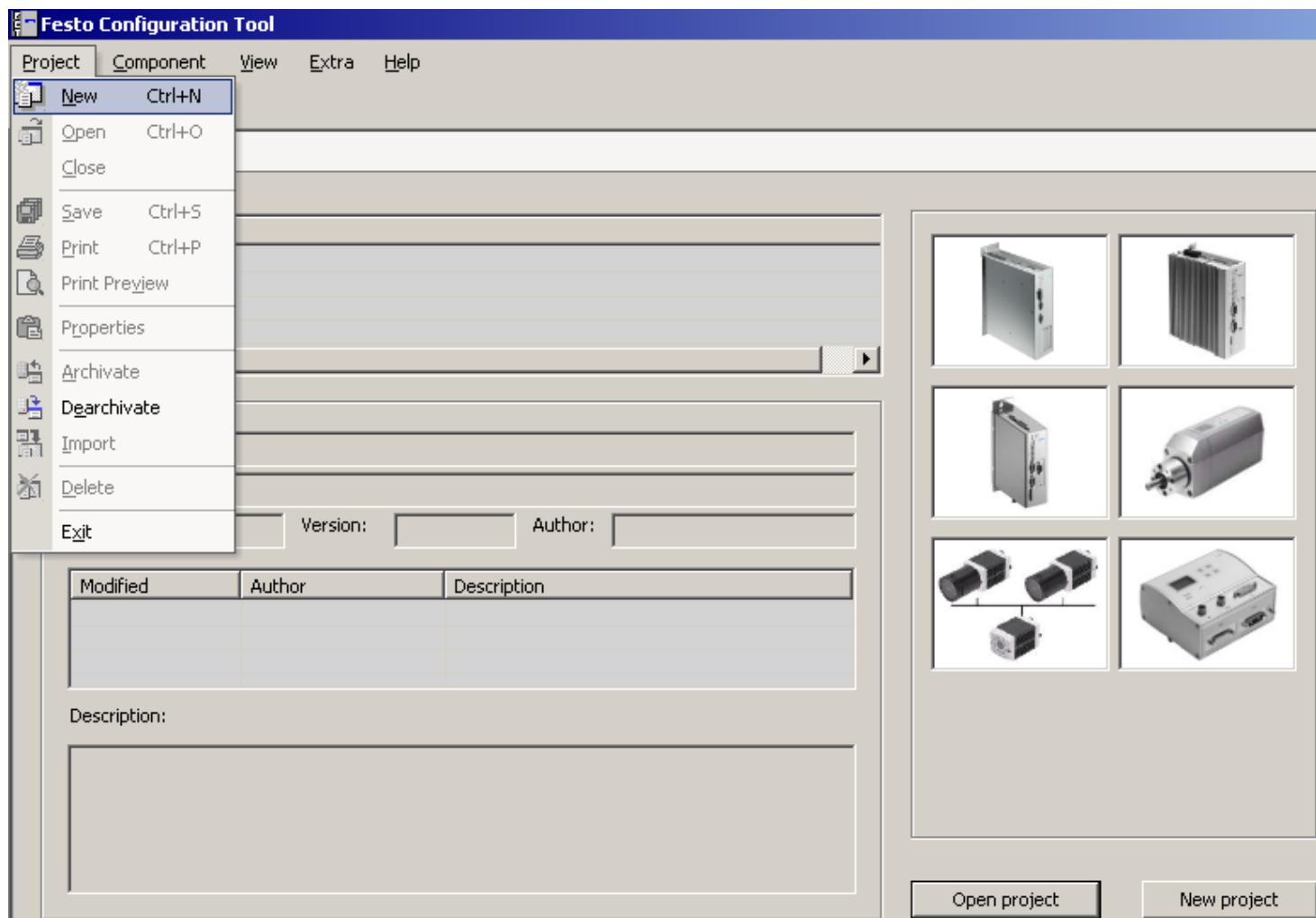
EXCM H-Gantry
(XY-movement)

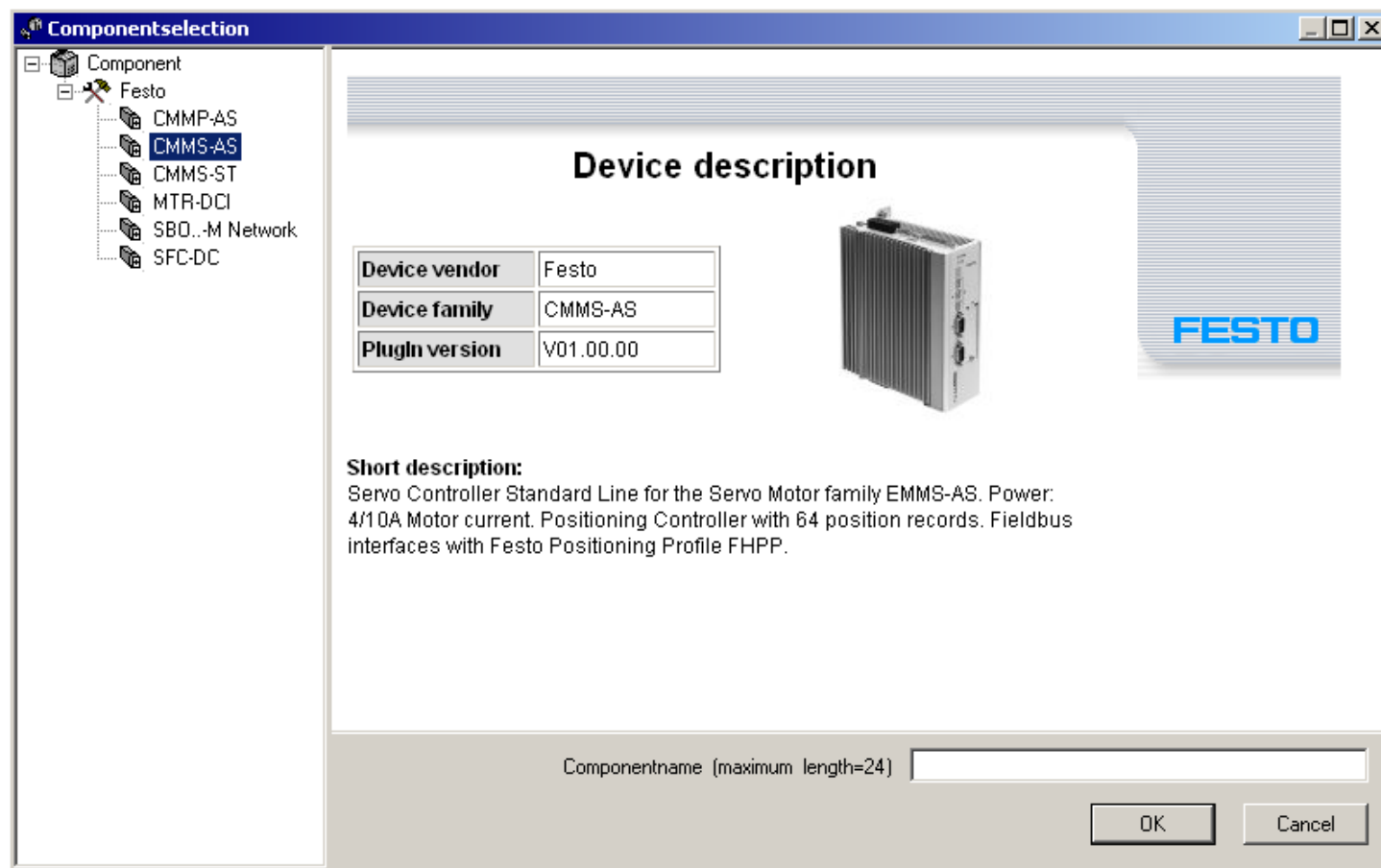
Control
enclosure

Z-Axis Assembly ex. camera
& Screw driver

Fixture







"Configuration" parameters	Selection
Option slot	empty
Motor type	EMMS-AS...xM
Size	55-S
Gear unit	None
Axis type	User-defined axis of rotation
Positioning range	10000 rev
Limit switch type	NC, normally closed

Workspace

Project: Servo motor

- Components
 - CMMS-AS: CMMS-AS
 - Configuration
 - Application Data
 - Axis
 - Homing
 - Measure
 - Motor Data
 - Controller
 - Control Interface
 - Digital I/O
 - Analogue I/O
 - Jog Mode
 - Position Set Table
 - Closed Loop
 - Error Management
 - Trace Configuration
 - Trace Data

Projects **CMMS-AS ***

Controller Type: CMMS-AS-C4-3A

Option Slot: Empty

Motor Type: EMMS-AS-...-xM

Motor Size: 55-S ☐ Brake

Gearbox: None

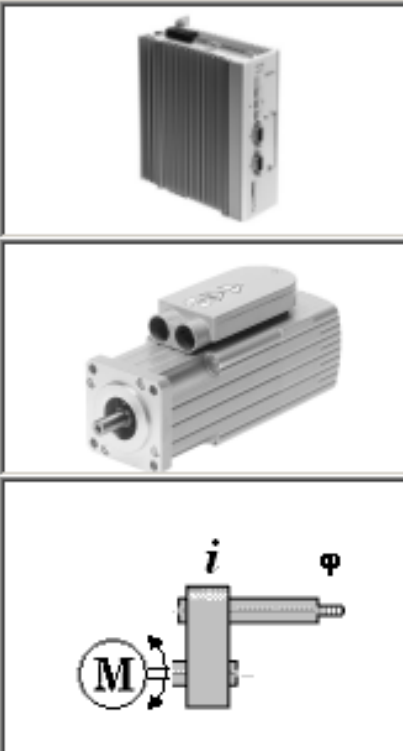
Axis Type: User defined rotating axis

Axis Size:

Position Range: 10000 r ☐ Unlimited

Type Of Limit Switch: NC - Normally Closed

External Gearbox: ☐ Present



"Application data" parameters	Operating mode selection tab	Environment/installation tab
Control interface	Digital I/O	—
Operating modes used	Positioning mode homing mode	—
Parameters	—	Reversing of rotation direction activated
Application data for mass moment of inertia	—	2.500 kgcm ²

The screenshot displays the CMMS-AS software interface. On the left, the 'Workspace' pane shows a project tree for 'Project: Servo motor'. The 'Components' folder is expanded, showing 'CMMS-AS: CMMS-AS' with sub-items: 'Configuration', 'Application Data' (highlighted), 'Axis', 'Homing', 'Measure', 'Motor Data', 'Controller', 'Control Interface' (with sub-items 'Digital I/O' and 'Analogue I/O'), 'Jog Mode', 'Position Set Table', 'Closed Loop', 'Error Management', 'Trace Configuration', and 'Trace Data'. On the right, the 'Projects' pane shows 'CMMS-AS *'. The 'Operating Mode Settings' panel is active, featuring tabs for 'Environment' and 'Messages'. It includes fields for 'Selected Axis' (set to 'User defined rotating axis 10000 r') and 'Control Interface' (set to 'Digital I/O'). Below these are two sections: 'Used Operating Modes' with checkboxes for 'Profile Position Mode' (checked), 'Homing Mode' (checked), 'Interpolated Position Mode' (unchecked), 'Profile Velocity Mode' (unchecked), and 'Profile Torque Mode' (unchecked); and 'Used Functions' with checkboxes for 'X10 Function' (unchecked) and 'Flying Measure' (unchecked). A red arrow points from the 'Application Data' component in the workspace to the 'Operating Mode Settings' panel. A blue arrow points from the 'Control Interface' sub-item to the 'Control Interface' dropdown menu. A yellow arrow points from the 'X10 Function' checkbox to the 'X10 Function' dropdown menu.

Workspace

Project: Servo motor

- Components
 - CMMS-AS: CMMS-AS
 - Configuration
 - Application Data
 - Axis
 - Homing
 - Measure
 - Motor Data
 - Controller
 - Control Interface
 - Digital I/O
 - Analogue I/O
 - Jog Mode
 - Position Set Table
 - Closed Loop
 - Error Management
 - Trace Configuration
 - Trace Data

Projects CMMS-AS *

Operating Mode Settings Environment Messages

Selected Axis: User defined rotating axis 10000 r

Control Interface: Digital I/O

Used Operating Modes

- ☒ Profile Position Mode
- ☒ Homing Mode
- ☐ Interpolated Position Mode
- ☐ Profile Velocity Mode
- ☐ Profile Torque Mode

Used Functions

- ☐ X10 Function:
- ☐ Flying Measure

Workspace

- Project: Servo motor
 - Components
 - CMMS-AS: CMMS-AS
 - Configuration
 - Application Data**
 - Axis
 - Homing
 - Measure
 - Motor Data
 - Controller
 - Control Interface
 - Digital I/O
 - Analogue I/O
 - Jog Mode
 - Position Set Table
 - Closed Loop
 - Error Management
 - Trace Configuration
 - Trace Data

Operating Mode Settings | **Environment** | Messages

Selected Axis: User defined rotating axis 10000 r

Parameters

☒ Horizontal ☐ Vertical

☒ Inverse Rotation Polarity

Application Data

Total Load: 2,500 kgcm²

Thank You !

