Agenda

- Introduction
- DVP-MC
- New series: AS500
- New series: AX-308E
- AX-8 Series
- DIADesigner-AX
- Roadmap
- Delta Motion Control Solutions: Verticals & Applications
- Successful cases

Delta Motion Controller Product Portfolio

DVP

Cost effective

High C/P

AS

Multi-function

Modularized

Easy installation

AH

Hot Swap

Redundancy

CODESYS AX

Flexibility

Scalability

DVP-MC

DVP50MC Highlights

MODBUS Communication ports

Serial RS232 and RS485 ports to support MODBUS RTU communication protocol

SSI port

SSI interface to support external absolute encoders

Incremental encoder port

Incremental encoder interface to support 2 external incremental encoders

EtherCAT port (Motion)

Dedicated EtherCAT interface for motion control

Integrated I/O port

High-speed digital inputs (16) and digital outputs (8)

DS301 CANopen ports

2 CANopen master/slave ports

Ethernet port

1 Ethernet 10/100Mbps port

Up to 6 or 24 axes, NPN outputs

DVP50MC Highlights

Cost-effective motion controller series

- DVP-MC Series Motion Controller
- Up to 32 virtual axes
- Support encoder axis
- Support PLCopen
- Single-axis motion: position, speed, torque, homing commands
- Multi-axis motion: ECAM, Rotary Cut, coordinated movements
- G-code: linear, circular, helical interpolation

EtherCAT CANopen Modbus EtherNet/IP PLCopen motion control

DVP50MC Highlights

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Ethernet port

1 Ethernet 10/100Mbps port

EtherCAT®

Up to 6 or 24 axes, NPN outputs

DVP50MC: New CPU Models

New CPU models

- **DVP50MC11T**
  24 axes, NPN outputs
- **DVP50MC11T-06**
  6 axes, NPN outputs
- **DVP50MC11P** NEW
  24 axes, PNP outputs
- **DVP50MC11P-06** NEW
  6 axes, PNP outputs
- **DVP50MC11T-04S** NEW
  4 PTP axes, NPN outputs
- **DVP50MC11T-16S** NEW
  16 PTP axes, NPN outputs

EtherCAT CANopen Modbus EtherNet/IP PLCopen motion control

Sergey Zubov

Igor Lapko (i.lapko@rts.ua)

23.06.2021

DVP50MC

AS/AX:

Определения (что мы понимаем под motion, что под point to point):

Function	Motion axis	P2P axis
Single axis – position	Y	Y
Single axis – Velocity	Y	Y
Single axis – Torque	Y	Y
Multi-axis – Linear	Y	N
Multi-axis – Arc	Y	N
Multi-axis – CAM	Y	N
Multi-axis – Gear	Y	N
Multi-axis – Group	Y	N

С уважением,

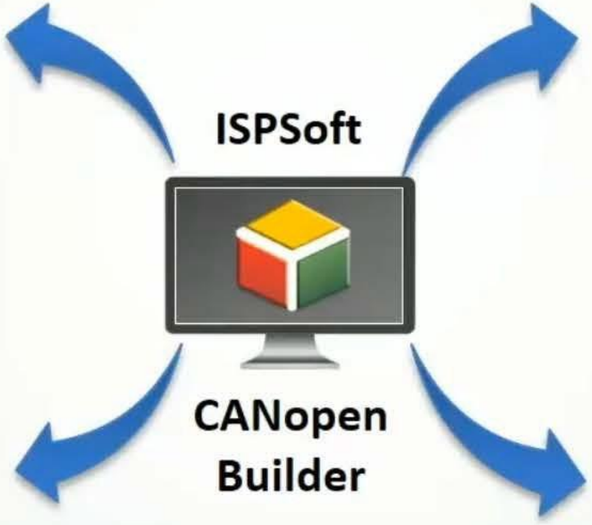
New Series: AS500

Introduction

AS500s are modular mid-range motion controllers compatible with Delta AS I/O modules. Supported fieldbus technologies for motion control are EtherCAT (AS516E) and CANopen (AS524C).

AS516E (16 axes)

16/24 axes
+ max 32 virtual axes



AS524C (24 axes)

EtherCAT®

CANopen®

Same MC engine of DVP-MC!

AS516E Highlights

Multiple built-in communication interfaces

MODBUS Communication ports

Serial RS232 and RS485 ports to support MODBUS RTU communication protocol

EtherCAT port (Motion)

Dedicated EtherCAT interface for motion control

EtherCAT®

Ethernet port

1 Ethernet 10/100Mbps port

Integrated I/O port

High-speed digital inputs (16) and digital outputs (8)

DS301 CANopen ports

2 CANopen master/slave ports

Encoder interfaces

Incremental and SSI encoder interfaces

AS524C Highlights

Multiple built-in communication interfaces

MODBUS Communication ports

Serial RS232 and RS485 ports to support MODBUS RTU communication protocol

Ethernet ports

2 independent Ethernet 10/100Mbps ports

CANopen port (Motion)

Dedicated CANopen interface for motion control

CANopen®

Integrated I/O port

High-speed digital inputs (16) and digital outputs (8)

DS301 CANopen ports

2 CANopen master/slave ports

Encoder interfaces

Incremental and SSI encoder interfaces

AS500 Highlights

Mid-performance CPU for motion control applications

- AS500 Series Motion Controller
- Up to 16 or 24 axes, depending on the version
- Up to 32 virtual axes
- Support encoder axis
- Support PLCopen
- Single-axis motion: position, speed, torque, homing commands
- Multi-axis motion: ECAM, Rotary Cut, coordinated movements
- G-code: linear, circular, helical interpolation

EtherCAT CANopen Modbus EtherNet/IP PLCopen motion control

AS500 Highlights

Mid-performance CPU for motion control applications

- AS500 Series Motion Controller
- Up to 16 or 24 axes, depending on the version
- Up to 32 virtual axes

Like DVP-MC!

- Support encoder axis
- Support PLCopen
- Single-axis motion: position, speed, torque, homing commands
- Multi-axis motion: ECAM, Rotary Cut, coordinated movements
- G-code: linear, circular, helical interpolation

EtherCAT CANopen Modbus EtherNet/IP PLCopen motion control

New Series: AX-308E

AX-308E

PLC-based Motion Controller

AX-308E Highlights

Multiple built-in communication interfaces

Encoder interfaces

1 SSI port, 2 incremental encoder interfaces

MODBUS Communication ports

Serial RS232 and RS485 ports to support MODBUS RTU communication protocol

Modbus

Interfaces

2 switched Ethernet ports (10/100 Mbps), 1 USB port, 1 SD card slot

OPC UA Modbus EtherNet/IP

Integrated I/Os

16 fast digital inputs, 8 fast digital outputs (support 4 train pulse outputs)

EtherCAT Master

Integrated EtherCAT Master up to 8 axes

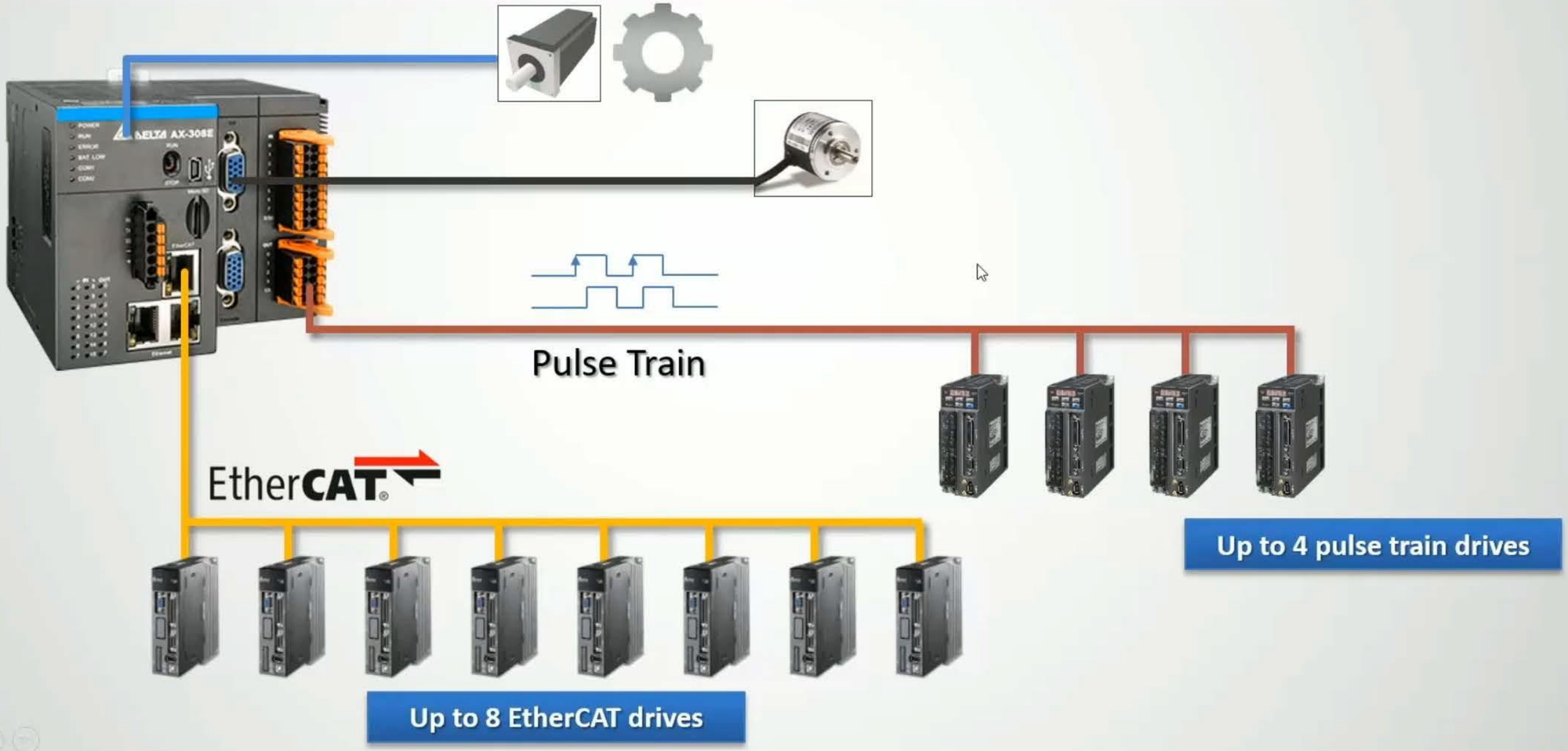
EtherCAT

AX-308E Highlights

Compatible with AS I/O modules

AX-308E Highlights

Axis control: EtherCAT, pulse train, encoder, virtual axes



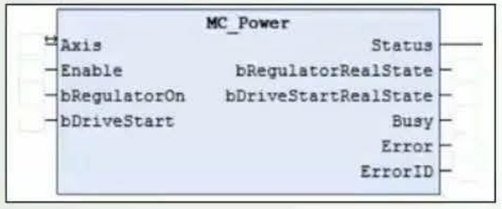
AX-308E Highlights

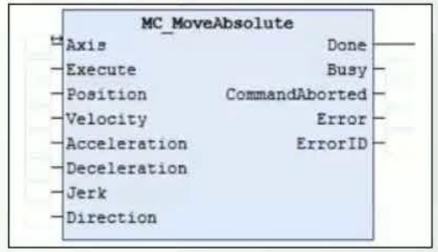
Motion control features

- Support IEC61131-3 and PLCopen standards
- Support virtual axes
- Support encoder axes
- Position, speed, torque, homing commands
- Gearing, ECAMs, Interpolation

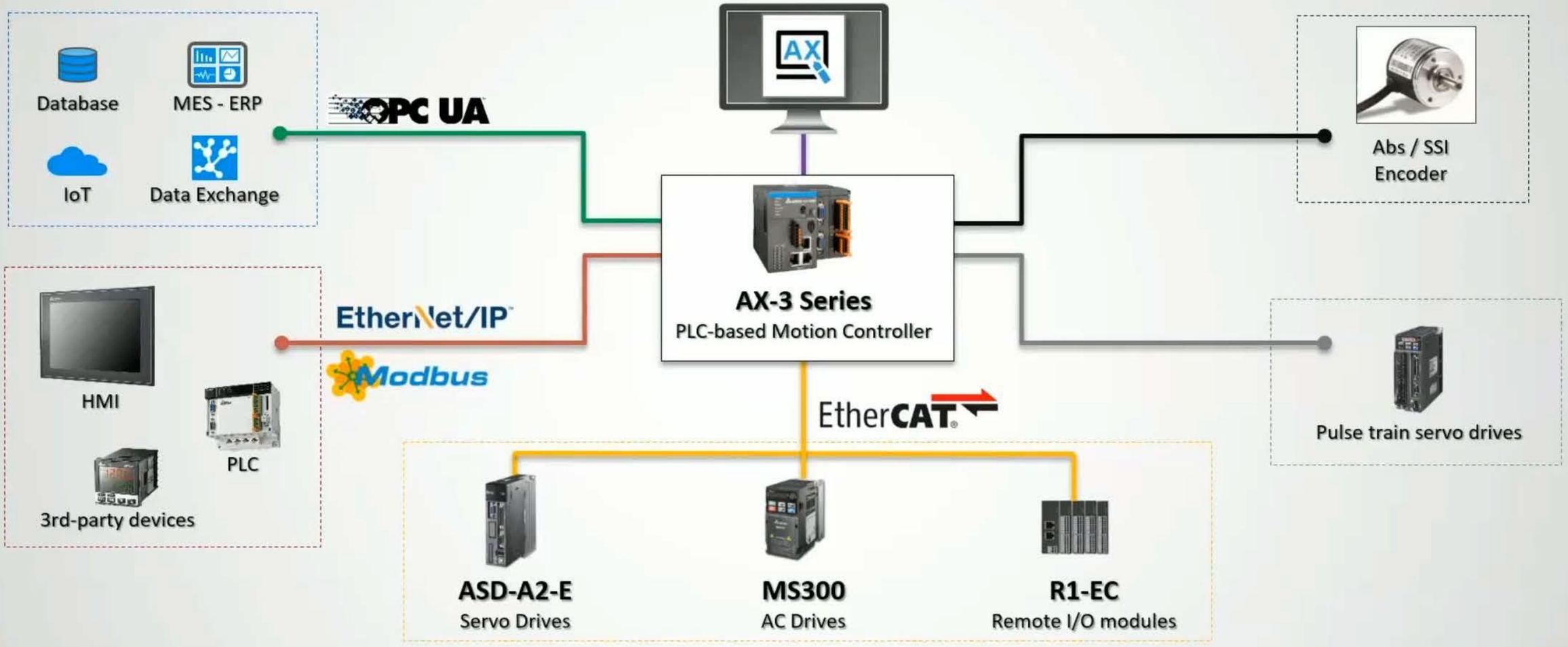
PLCopen logic ST LD IL SFC FBD IEC 61131-3

PLCopen motion control





AX-308E Highlights



CODESYS EtherCAT OPC UA Modbus EtherNet/IP PLCopen logic IEC 61131-3 PLCopen motion control

AX-8 Series

AX-8

PC-based Motion Controller

CODESYS

AX-8 PC-based Motion Controller Introduction

AX-8 series is a multi-axis motion controller based on a powerful industrial PC platform. Thanks to CODESYS, Windows 10 IoT and the embedded interfaces, it offers a high degree of flexibility and allow to approach all motion control applications, including robotics and CNC.

Windows 10 IoT

CODESYS

EtherCAT®

AX-8 Highlights

Multiple built-in communication interfaces

Windows OS & Powerful processor

Windows 10 IoT and CODESYS live in the same device

Windows 10 IoT

HDMI port

Standard HDMI port to connect industrial monitors

Interfaces

2 Ethernet ports (1Gbps), 4 USB ports, 1 SD card slot

Integrated I/Os

8 fast digital inputs, 8 fast digital outputs, incremental encoder interface, SSI encoder interface, RS-422 / RS-485 serial port

EtherCAT Master

Integrated EtherCAT Master up to 64 axes

EtherCAT®

CODESYS

AX-8 Highlights

High-performance CPU for Motion Control applications

- Industrial PC with Windows 10 IoT
- Integrated high-speed DI / DO, incremental encoder interface, and RS-422/RS-485 serial ports
- EtherCAT, Modbus, OPC UA, Ethernet/IP
- Up to 16, 32 or 64 axes
- CODESYS SoftMotion
- CODESYS SoftMotion with CNC+Robotics
- Delta SoftHMI

CODESYS Windows 10 IoT EtherCAT OPC UA Modbus EtherNet/IP PLCopen logic ST LD IL SFC FBD IEC 61131-3 PLCopen motion control

AX-8 Highlights

One platform for all motion control applications

SoftMotion CNC+Robotics

SoftMotion

SoftPLC

CODESYS

Standard Motion

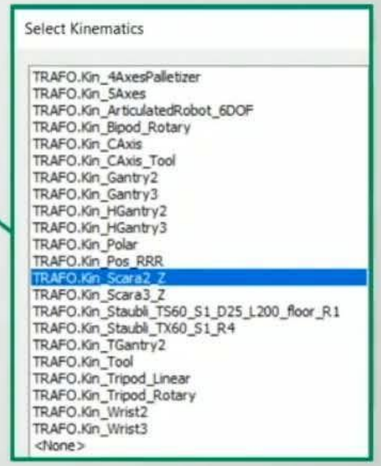
SoftMotion

IEC61131-3
PLCOpen
ECAMs

Advanced Motion

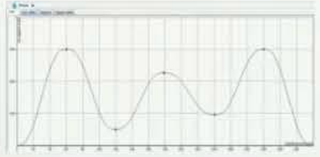
SoftMotion
CNC & Robotics

G-code
Kinematic Transformations
(Robotics)

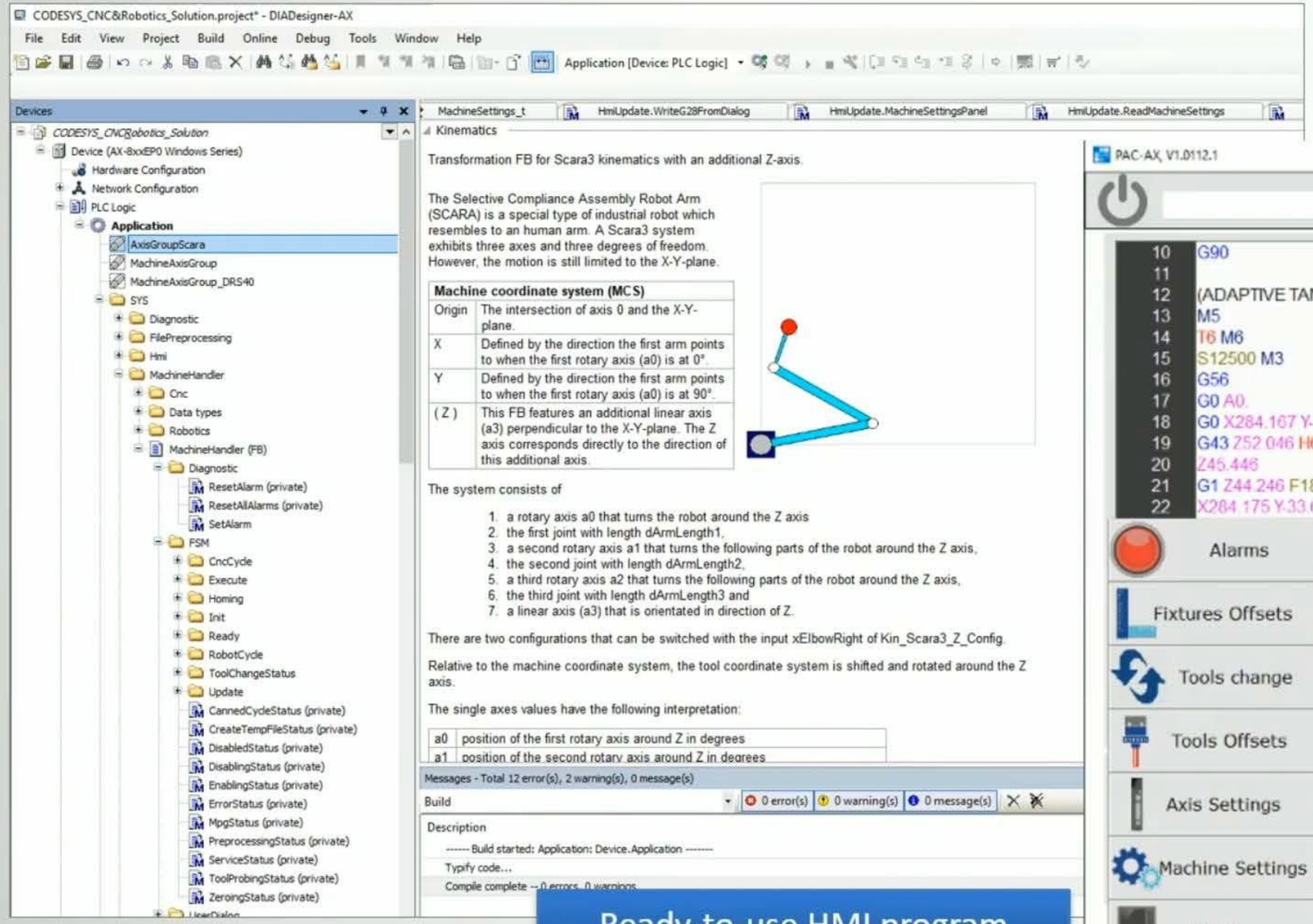


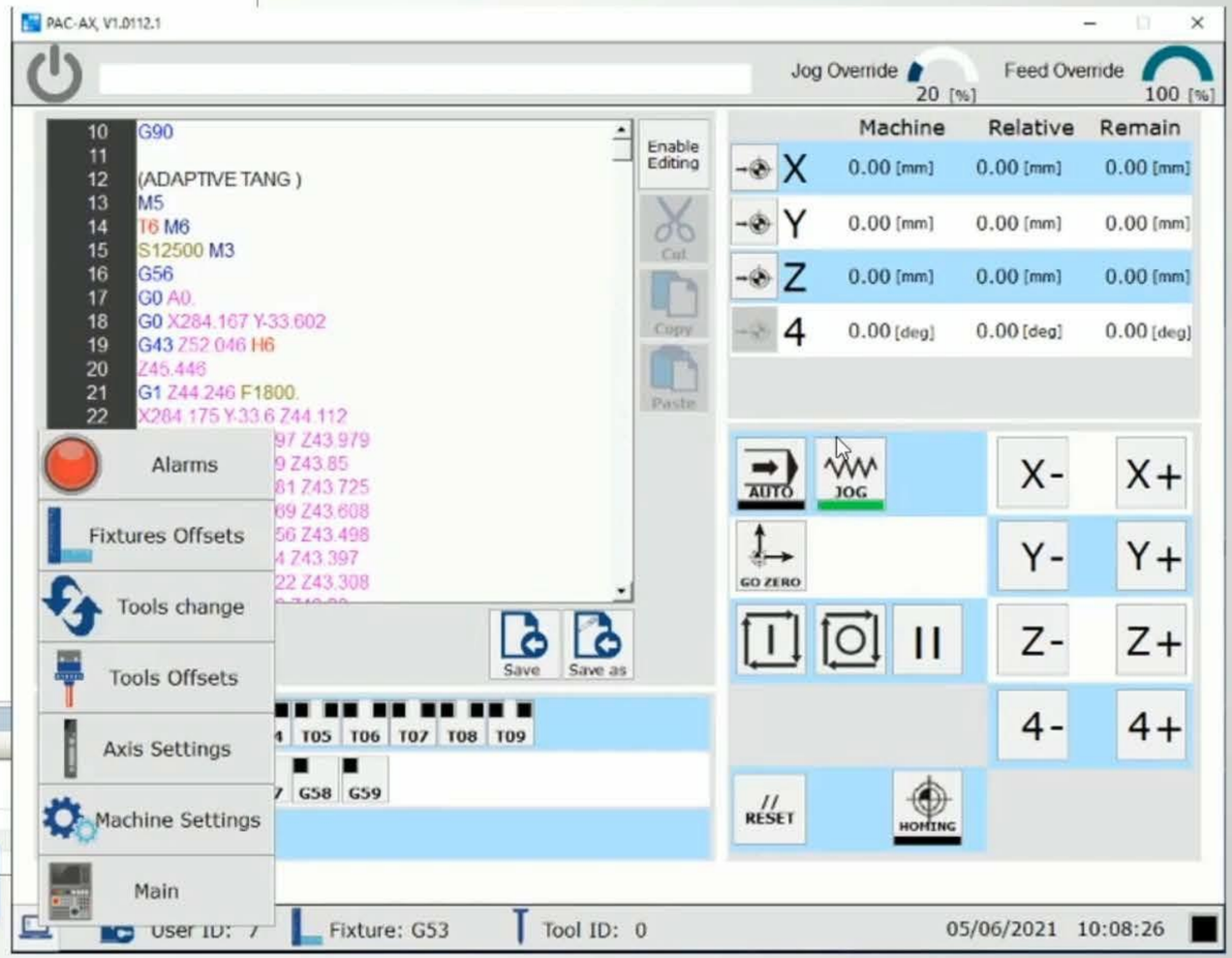
PLCopen logic ST LD IL SFC FBD IEC 61131-3

PLCopen motion control



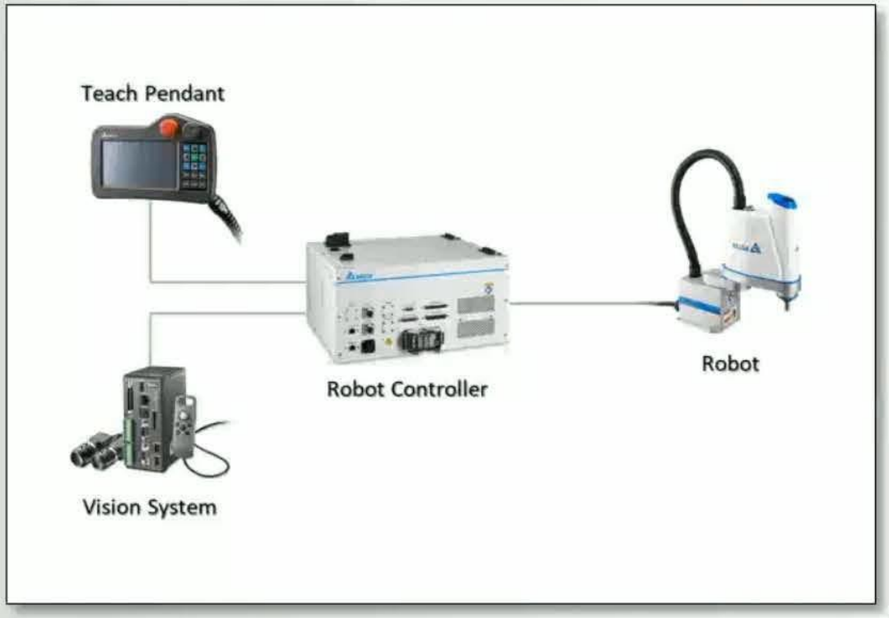
Delta CODESYS-based CNC Solution





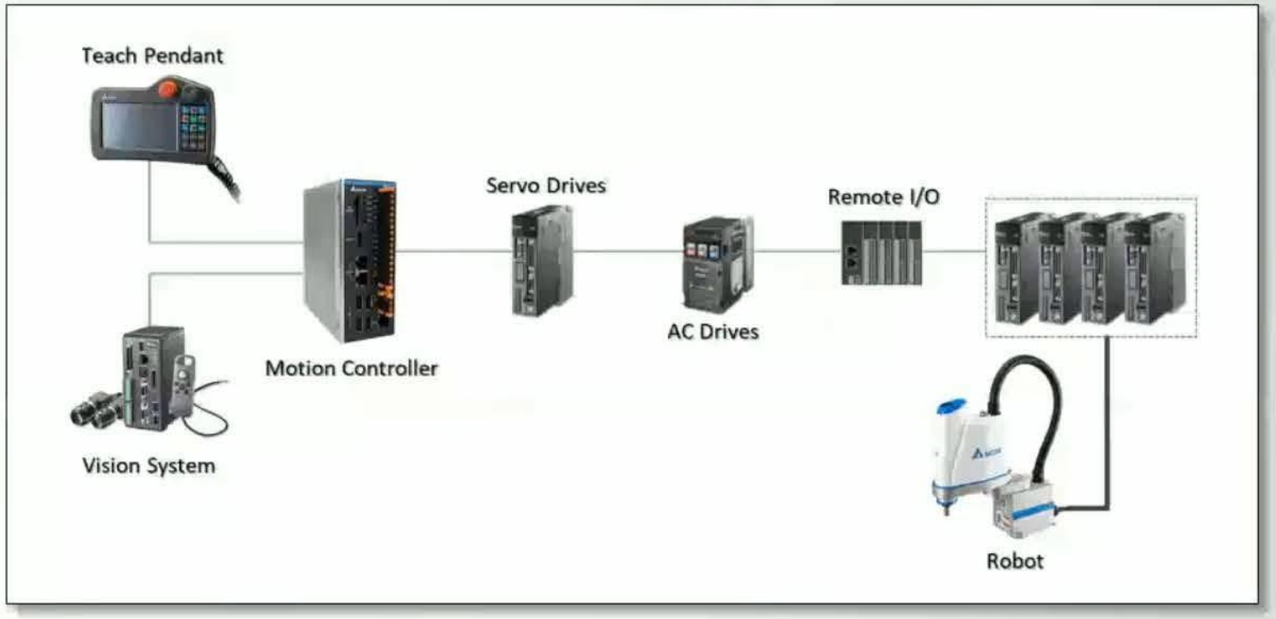
Ready-to-use HMI program

Robotics: two different solutions



Standalone Robotics

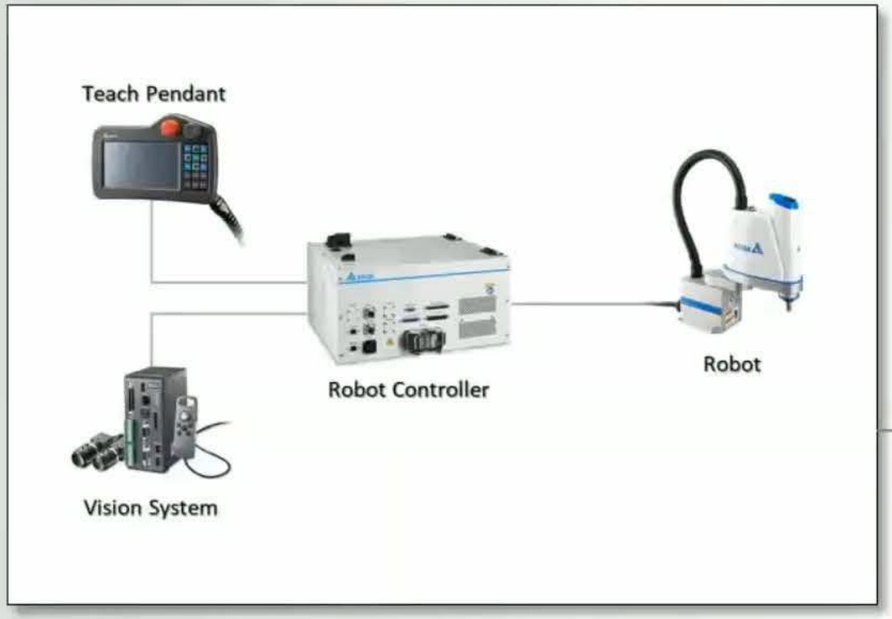
Dedicated robot controller



Integrated Robotics

Robot as component of an Automation Platform

Robotics: two different solutions



Standalone Robotics

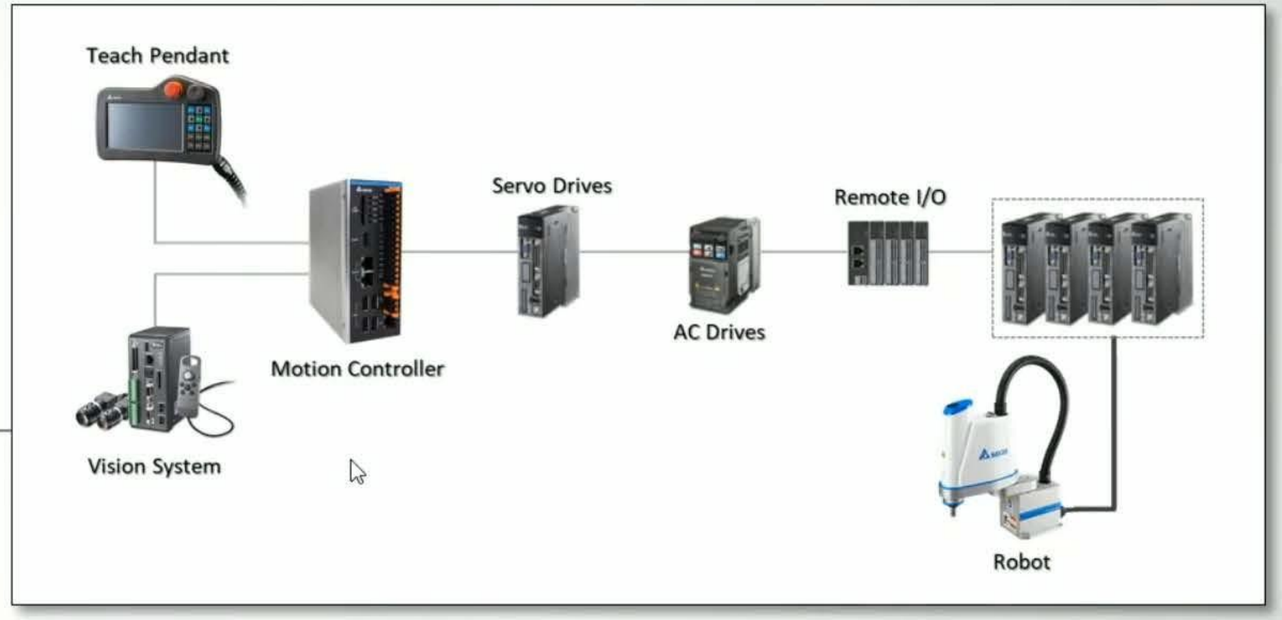
Dedicated robot controller

The robot controller is only in charge of the robotic aspects of the machine. It is programmed by dedicated SW tools and connected to the main PLC by means of hardwired I/O signals or not-deterministic communication protocols.

- Dedicated robot controller to manage the robots and their related devices (e.g. teach pendant).
- Dedicated engineering tool: robot language programming, commissioning, simulation.
- Need of an external general motion controller to manage the rest of the machine.
- Need to develop the interface with the general motion controller / PLC that manages the production line.

Robotics: Integrated Robotics

- Use of a single hardware device to control all the production island
- One software platform

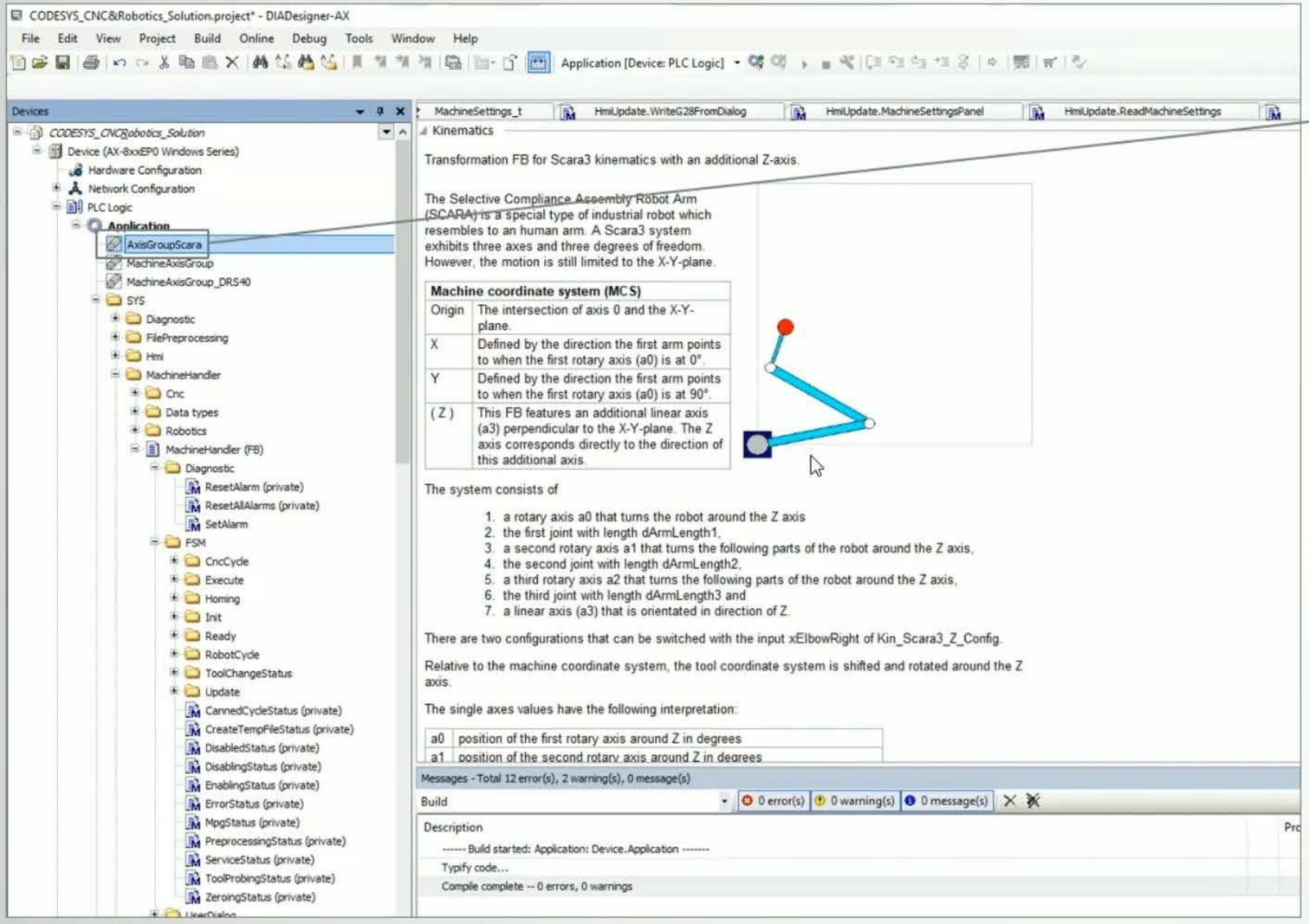


Integrated Robotics

Robot as component of an Automation Platform

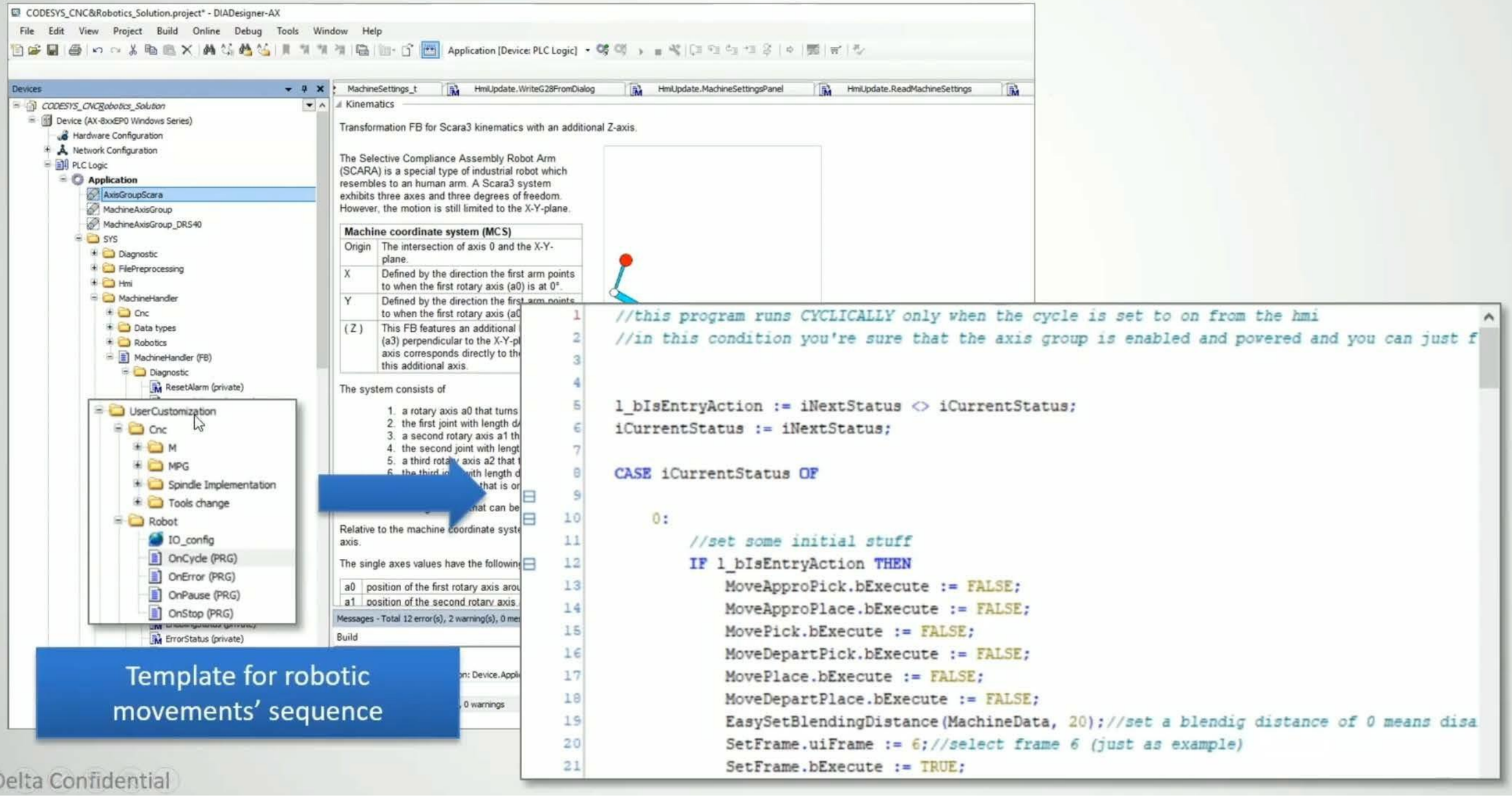
The robot is deeply integrated in the production line. The strict interconnection with other products (vision systems, inverters, remote I/O modules) requires a single SW tool to increase the performance.

Delta CODESYS-based Robotics Solution



Selection of the kinematics

Delta CODESYS-based Robotics Solution

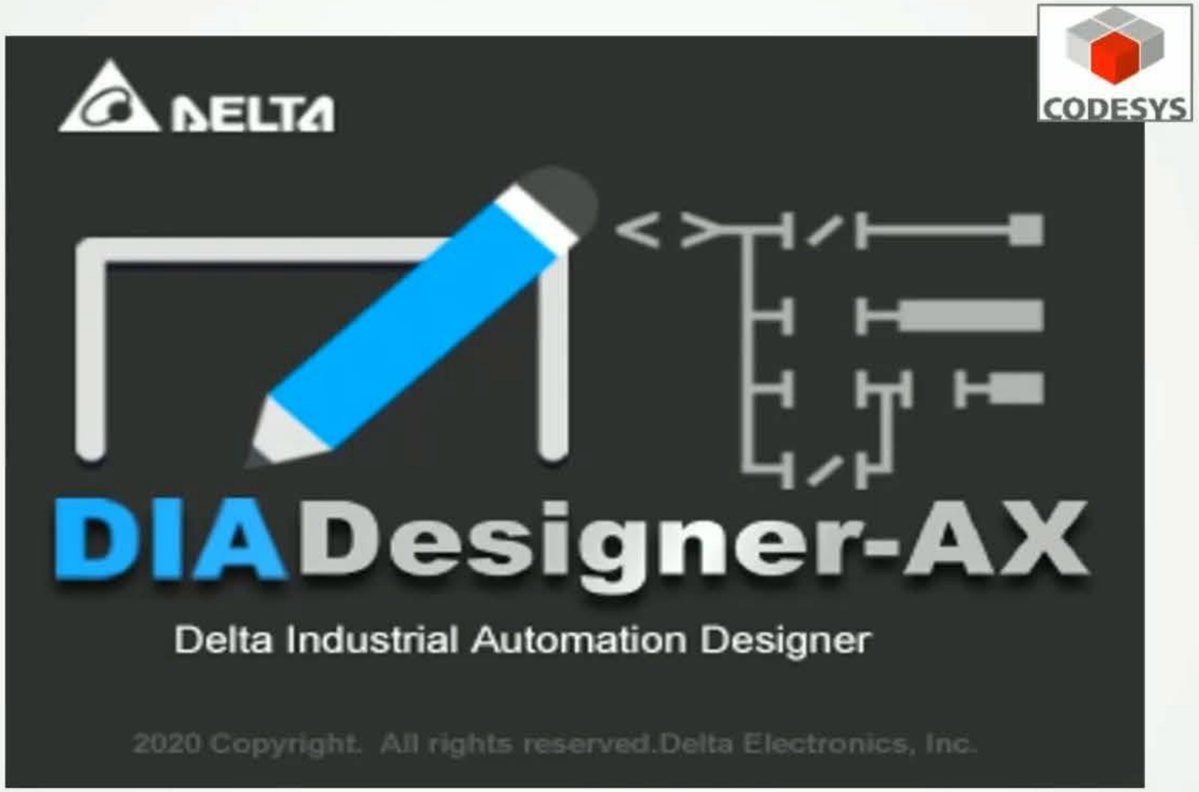


Template for robotic movements' sequence

DIADesigner-AX

DIADesigner-AX

DIADesigner-AX



DIADesigner-AX

IEC61131-3

PLCopen

Drive configuration

Single-axis

ECAMs

International Standards

Motion Platform

CNC+Robotics

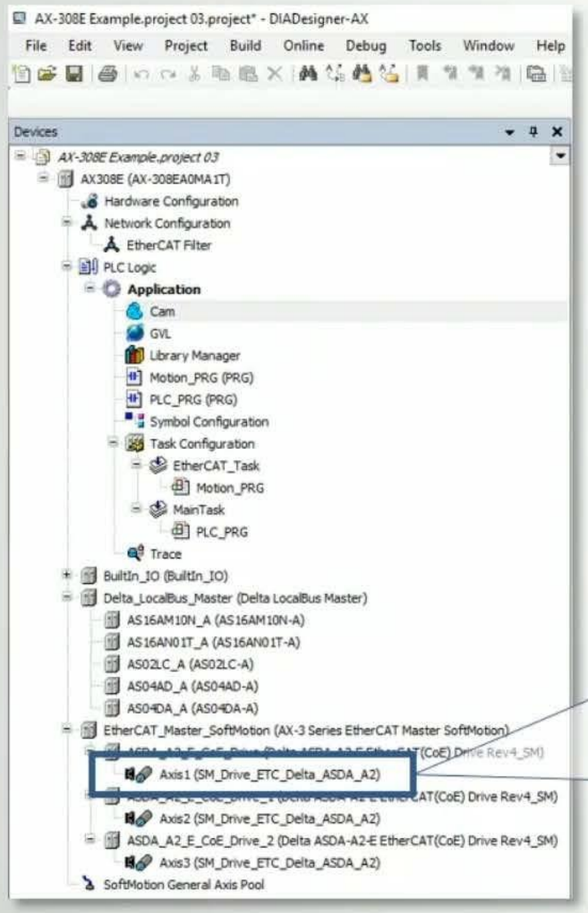
G-code

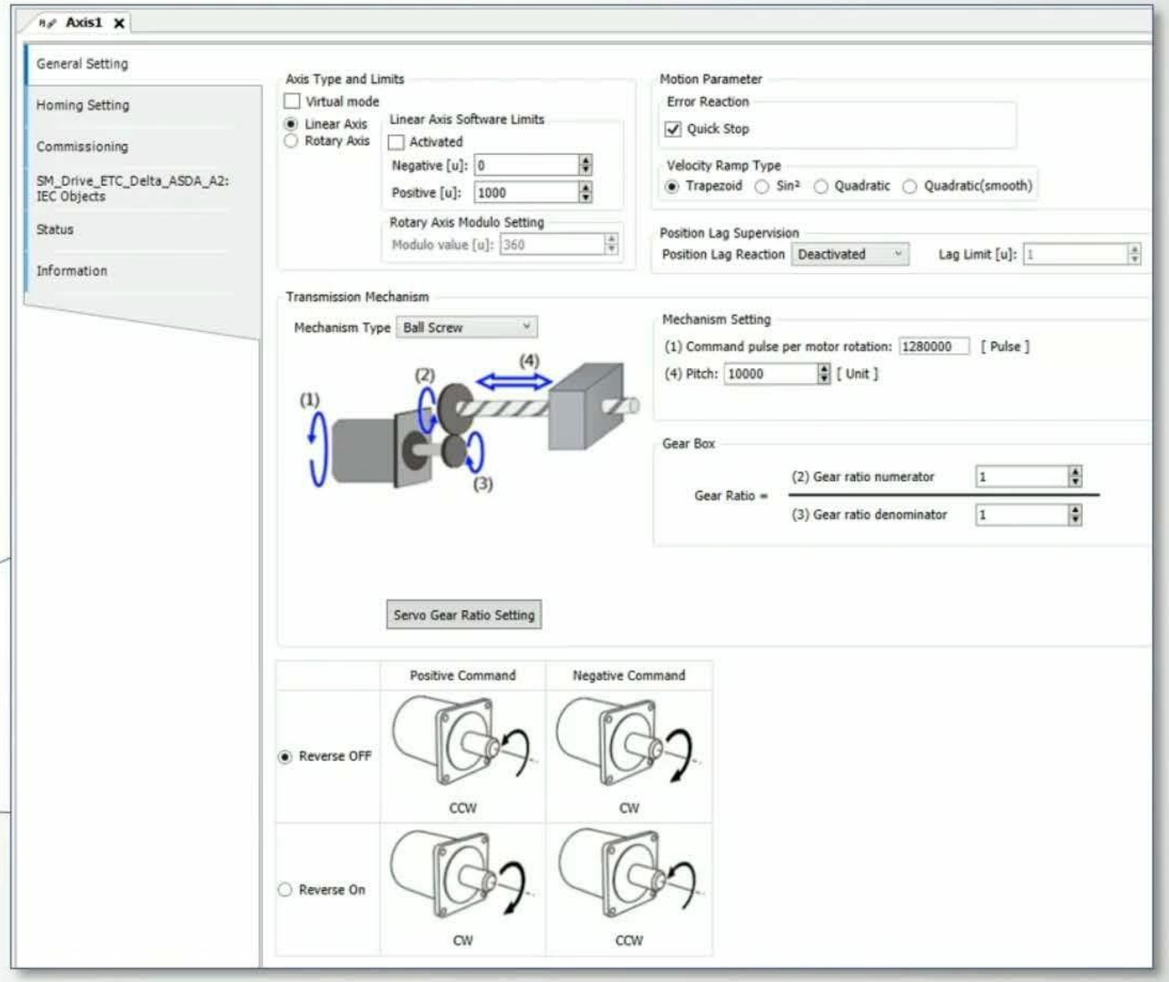
Robotics

Only AX-8

DIADesigner-AX

Same look&feel of CODESYS platform with additional tools





Roadmap

Delta Motion Controllers - Roadmap

SW

Jan | Mar | Jun | Sep | Dec

DVP-MC

DVP50MC 6-24 axes
PNP Outputs

DVP50MC
4/16 PTP axes

AS-500

AS516E
16 axes, EtherCAT

AS524C
24 axes, CANopen

CODESYS

AX-3

AX-308E
CODESYS, 8 axes, EtherCAT

AX-316E
CODESYS, 16 axes, EtherCAT

AX-304EL
CODESYS, 4 PTP axes, EtherCAT

CODESYS

AX-8

AX-8: Delta CODESYS-based
Robotics Package

AX-8: Delta CODESYS-based
CNC Package

Delta Motion Control Solutions

Product positioning

DIAStudio

CANopen

EtherCAT

CODESYS

Q. : What is the right device/technology/SW for my application?

A. : There's no single answer!

Delta Motion Controller Product Portfolio (EtherCAT)

Model	DVP50MC	AH-EMC	AX-308E	AX-8
Appearance				
Motion Control Bus	EtherCAT	EtherCAT	EtherCAT	EtherCAT
Number of axes	6, 24	8, 16, 32	8	16, 32, 64
Single-axis Motion	Yes	Yes	Yes	Yes
ECAM	Yes	Yes	Yes	Yes
Rotary cut	Yes	Yes	Yes	Yes
G-code	**Yes**	**No**	**No**	**Yes (“C” models)**
CNC	**No**	**No**	**No**	**Yes (“C” models)**
Robotics	**No**	**No**	**No**	**Yes (“C” models)**
3rd-party ECAT devices	**No**	**Yes**	**Yes**	**Yes**
Encoder interfaces	**Incremental (2), SSI (1)**	**Incremental (2)**	**Incremental (2), SSI (1)**	**Incremental (1), SSI (1)**
Other comm. procotols	Modbus, **CANopen**, Ethernet/IP	Modbus, **CANopen**, Ethernet/IP, **Devicenet, Profibus, BACNet**	Modbus, Ethernet/IP, **OPC UA**	Modbus, Ethernet/IP, **OPC UA**
SW	ISPSoft, CANopen Builder	ISPSoft	**CODESYS, DIADesigner-AX**	**CODESYS, DIADesigner-AX**

Delta Motion Controller Product Portfolio (EtherCAT)

Model	DVP50MC	AH-EMC	AX-308E	AX-8
Appearance				
Motion Control Bus	EtherCAT	EtherCAT	EtherCAT	EtherCAT
Number of axes	6, 24	8, 16, 32	8	16, 32, 64
Single-axis Motion	Yes	Yes	Yes	Yes
ECAM	Yes	Yes	Yes	Yes
Rotary cut	Yes	Yes	Yes	Yes
G-code	**Yes**	**No**	**No**	**Yes (“C” models)**
CNC	**No**	**No**	**No**	**Yes (“C” models)**
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Delta Motion Controller Product Portfolio (EtherCAT)

Model	DVP50MC	AH-EMC	AX-308E	AX-8
Appearance				
Motion Control Bus	EtherCAT	EtherCAT	EtherCAT	EtherCAT
Number of axes	6, 24	8, 16, 32	8	16, 32, 64
Single-axis Motion	Yes	Yes	Yes	Yes
ECAM	Yes	Yes	Yes	Yes
Rotary cut	Yes	Yes	Yes	Yes
G-code	**Yes**	**No**	**No**	**Yes (“C” models)**
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Delta Motion Controller Product Portfolio (EtherCAT)

Model	DVP50MC	AH-EMC	AX-308E	AX-8
Appearance				
Motion Control Bus	EtherCAT	EtherCAT	EtherCAT	EtherCAT
Number of axes	6, 24	8, 16, 32	8	16, 32, 64
Single-axis Motion	Yes	Yes	Yes	Yes
ECAM	Yes	Yes	Yes	Yes
Rotary cut	Yes	Yes	Yes	Yes
G-code	**Yes**	**No**	**No**	**Yes ("C" models)**
CNC	**No**	**No**	**No**	**Yes ("C" models)**
Robotics	**No**	**No**	**No**	**Yes ("C" models)**
3rd-party ECAT devices	**No**	**Yes**	**Yes**	**Yes**
Encoder interfaces	**Incremental (2), SSI (1)**	**Incremental (2)**	**Incremental (2), SSI (1)**	**Incremental (1), SSI (1)**
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Delta Motion Controller Product Portfolio (EtherCAT)

Model	DVP50MC	AH-EMC	AX-308E	AX-8
Appearance				
Motion Control Bus	EtherCAT	EtherCAT	EtherCAT	EtherCAT
Number of axes	6, 24	8, 16, 32	8	16, 32, 64
Single-axis Motion	Yes	Yes	Yes	Yes
ECAM	Yes	Yes	Yes	Yes
Rotary cut	Yes	Yes	Yes	Yes
G-code	**Yes**	**No**	**No**	**Yes (“C” models)**
CNC	**No**	**No**	**No**	**Yes (“C” models)**
Robotics	**No**	**No**	**No**	**Yes (“C” models)**
3rd-party ECAT devices	**No**	**Yes**	**Yes**	**Yes**
Encoder interfaces	**Incremental (2), SSI (1)**	**Incremental (2)**	**Incremental (2), SSI (1)**	**Incremental (1), SSI (1)**
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SW	ISPSoft, CANopen Builder	ISPSoft	**CODESYS, DIADesigner-AX**	**CODESYS, DIADesigner-AX**

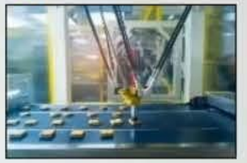
Delta Motion Controllers - Applications

Packaging
(Flowpack, wrapping, labelling)

General Machinery
(Assembling)

Woodworking
(Saw cutting, panel cutting, CNC)

Profile cutting
(leather, glass)



Robotics

SW

DVP-MC

CODESYS

AX-3

CODESYS

AX-8

Delta Motion Controllers - Applications

Packaging
(Flowpack, wrapping, labelling)

General Machinery
(Assembling)

Woodworking
(Saw cutting, panel cutting, CNC)

Profile cutting
(leather, glass)

Robotics

SW

DVP-MC

- PTP Motion
- ECAMs
- Flying cut
- Interpolation

Basic G-code

CODESYS

AX-3

CODESYS

AX-8

Advanced G-code (CNC features)

Robotics

Delta Motion Controllers - Applications

Packaging
(Flowpack, wrapping, labelling)

General Machinery
(Assembling)

Woodworking
(Saw cutting, panel cutting, CNC)

Profile cutting
(leather, glass)

Robotics

SW

DVP-MC

- PTP Motion
- ECAMs
- Flying cut
- Interpolation

Basic G-code

CODESYS

AX-3

CODESYS

AX-8

Advanced G-code (CNC features)

Robotics

Successful cases

Successful cases: DVP-MC

Wet wipes packaging machine

* Image for reference only

Technical details

- Wet Wipes Packaging Machine
- DVP50MC11T-06 motion controller
- 5 EtherCAT axes
- Complete Delta solution

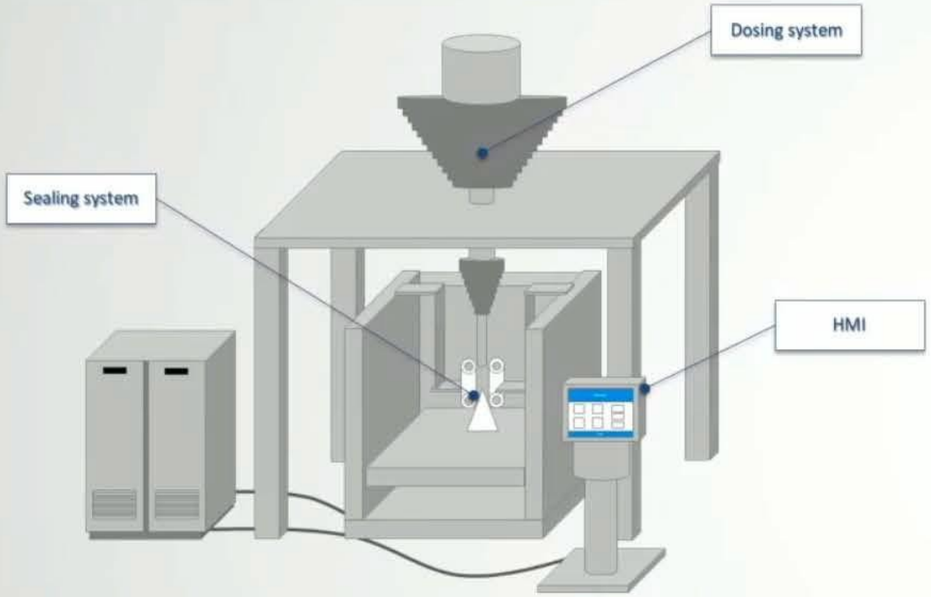
Configuration

WHY DVP-MC?

- Limited number of axes
- Complete Delta solution (no need to add 3rd-party devices)
- Cost effective

Successful cases: DVP-MC

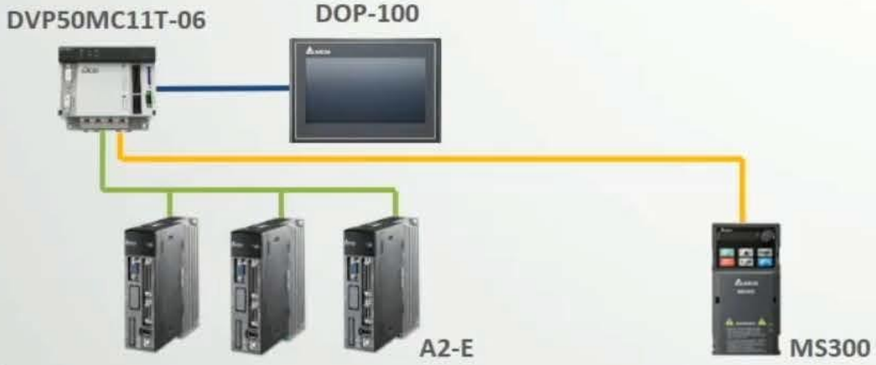
Vertical continuous packaging machine



Technical details

- Vertical Continuous Packaging System (dosing & sealing machine)
- DVP50MC11T-06 motion controller
- 3 EtherCAT axes, 1 MS300 controlled by CANopen
- Complete Delta solution

Configuration



WHY DVP-MC?

- Limited number of axes
- Complete Delta solution (no need to add 3rd-party devices)
- Cost effective

Successful cases: DVP-MC

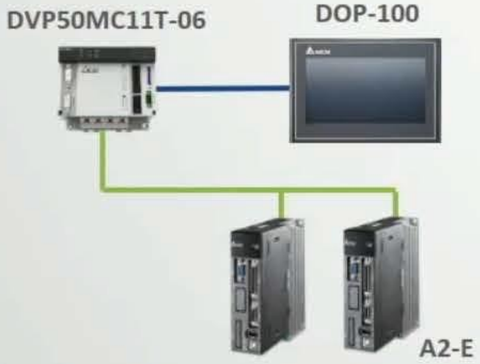
Pipe bending machine

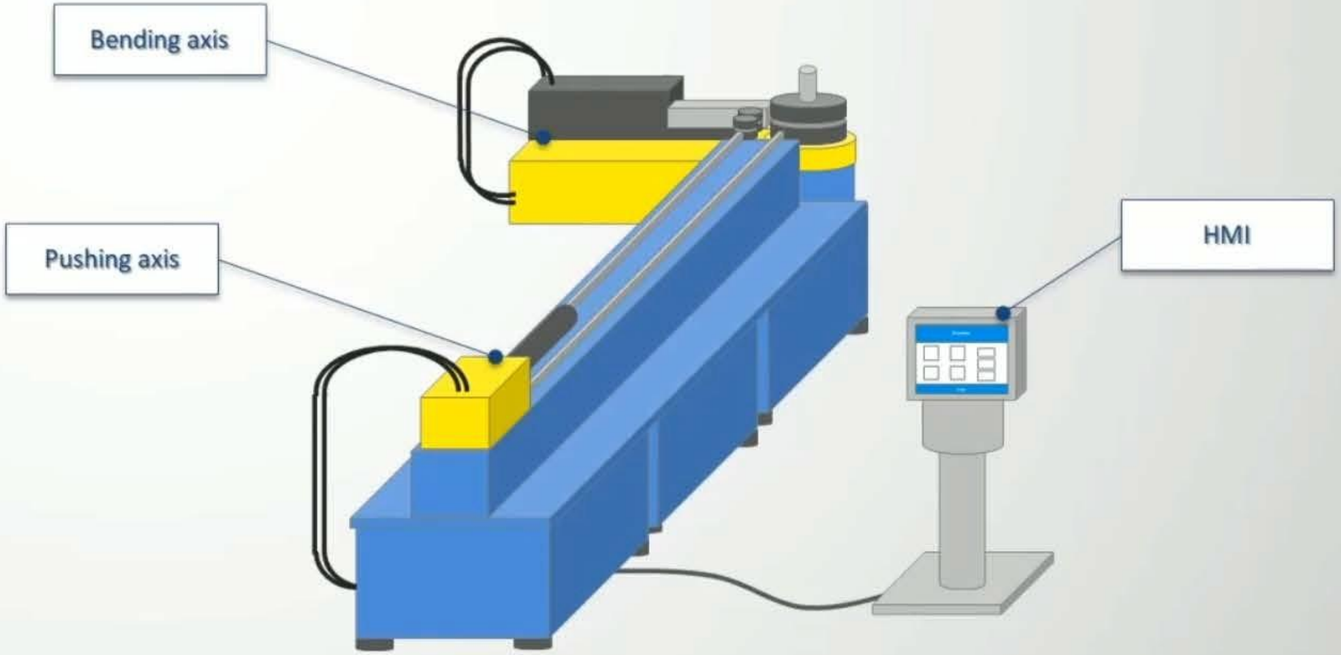
* Image for reference only

Technical details

- Pipe bending machine
- DVP50MC11T-06 motion controller
- 2 interpolated axes controlled by EtherCAT
- Complete Delta solution

Configuration





Successful cases: DVP-MC

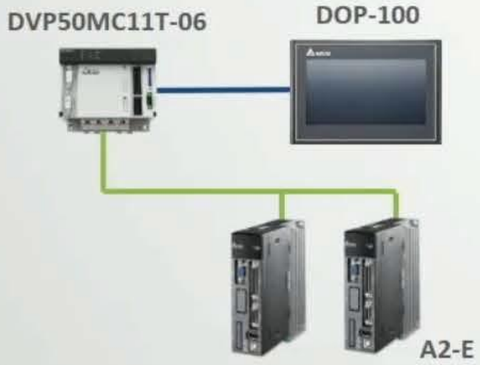
Pipe bending machine

* Image for reference only

Technical details

- Pipe bending machine
- DVP50MC11T-06 motion controller
- 2 interpolated axes controlled by EtherCAT
- Complete Delta solution

Configuration

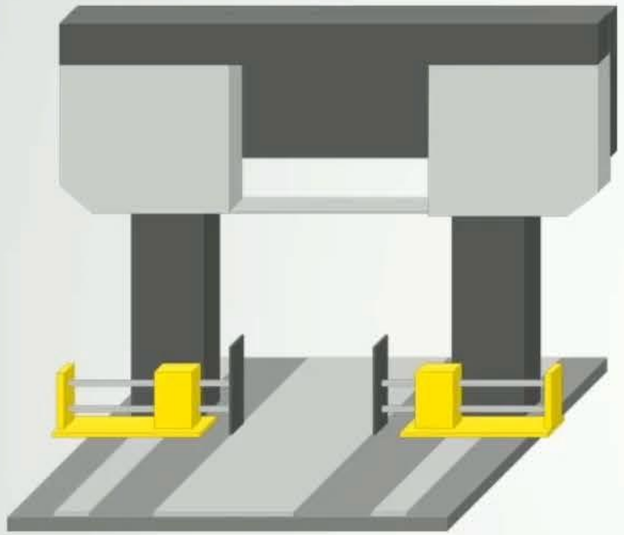


WHY DVP-MC?

- Limited number of axes
- Complete Delta solution (no need to add 3rd-party devices)
- Need of simple interpolation between the axes, configurable by the HMI
- Cost effective

Successful cases: AX-8

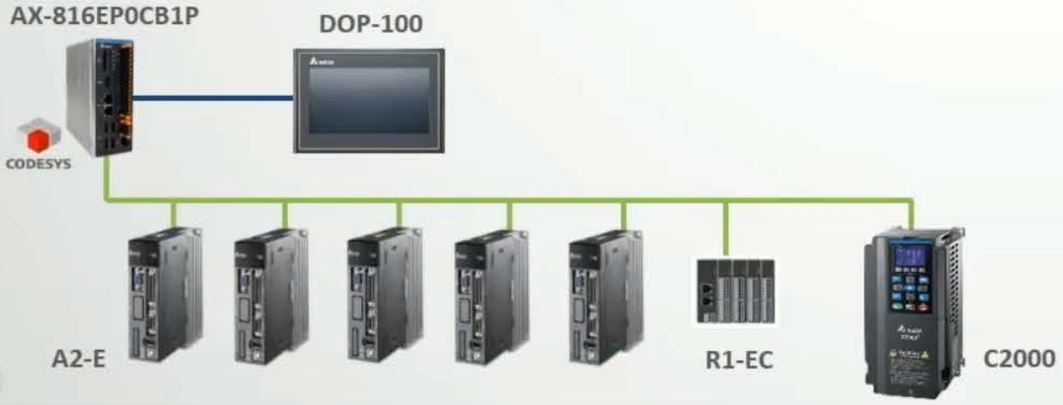
Bandsaw machine for metal cutting



Technical details

- Bandsaw machine for metal cutting with gantry and orientable saw
- AX-816EP0CB1P motion controller
- 5 EtherCAT axes, R1-EC I/O modules, 1 C2000
- Complete Delta solution

Configuration



WHY AX-8?

- Need of the CNC+Robotics license to manage the rotation of the saw (RTCP – Rotating Tool Center Point)
- OPC UA to connect the machine to a SW supervisor (Industry 4.0)
- Need of AX scalability to cover different types of machines, using the same SW platform

Successful cases: AX-8

Bandsaw machine for metal cutting

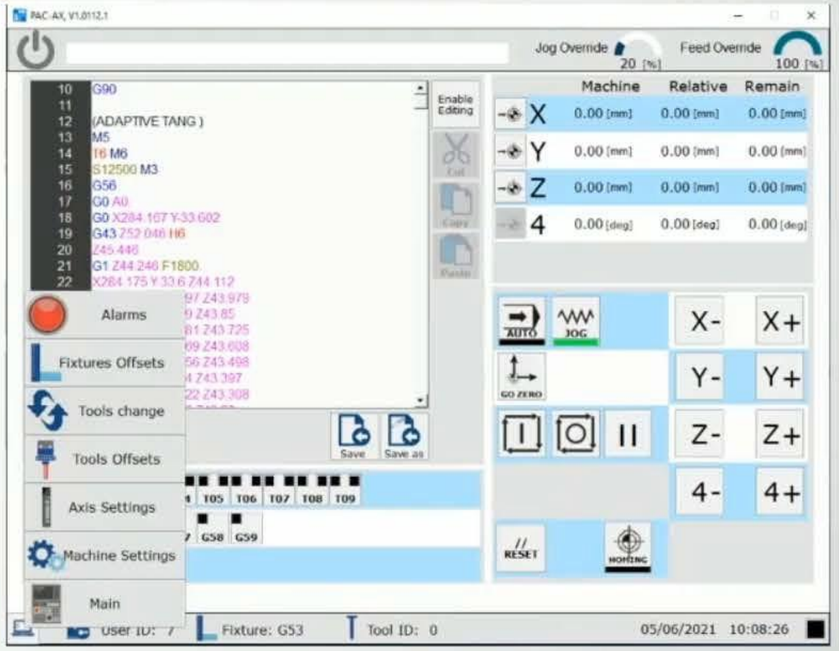
Successful cases: AX-8

Woodworking CNC Router (milling machine)

* Image for reference only

Technical details

- CNC router (milling machine) for woodworking applications
- Gantry axes on Y direction
- Additional 4th axis
- AX-816EP0CB1P motion controller + Delta CNC SW package
- 5 EtherCAT axes, R1-EC I/O modules, 1 MS300
- Complete Delta solution



Configuration

Successful cases: AX-8

Woodworking CNC Router (milling machine)

* Image for reference only

Technical details

- CNC router (milling machine) for woodworking applications
- Gantry axes on Y direction
- Additional 4th axis
- AX-816EP0CB1P motion controller + Delta CNC SW package
- 5 EtherCAT axes, R1-EC I/O modules, 1 MS300
- Complete Delta solution

Configuration

WHY AX-8?

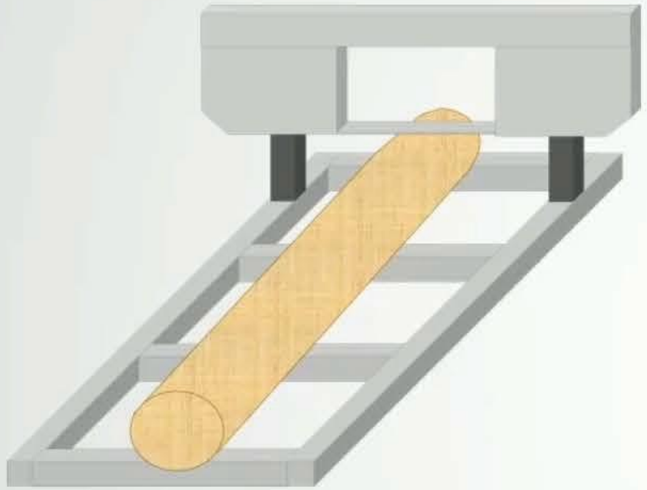
- Need of the CNC+Robotics license to manage all the CNC functionalities requested by the machine
- Need of ready-to-use Delta CNC SW package to speed the development up
- Need of EtherCAT fieldbus to improve the performance

Successful cases: AX-8

Woodworking CNC Router (milling machine)

Successful cases: AX-3

Bandsaw machine for woodworking



Technical details

- Horizontal bandsaw machine for woodworking
- AX-308E motion controller
- 3 EtherCAT axes , 1 MS300, AS I/O modules
- 3rd-party I/O modules

Configuration

WHY AX-3?

- Limited number of axes
- Need of an open platform to add 3rd-party EtherCAT slaves
- Need of AX scalability to cover different types of machines, using the same SW platform

Successful cases: AX-3

Bandsaw machine for woodworking

Successful cases: AX-8

Bottle unscrambler machine

* Image for reference only

Technical details

- Handling of plastic bottles
- AX-832E motion controller
- 18 EtherCAT axes
- Ethernet/IP communication with Allen Bradley PLC

Configuration

WHY AX-8?

- Need of a powerful CPU to manage an high number of axes
- Need of Ethernet/IP protocol to exchange data with the main PLC

Successful cases: AX-8

Bottle unscrambler machine

Successful cases: AX-8

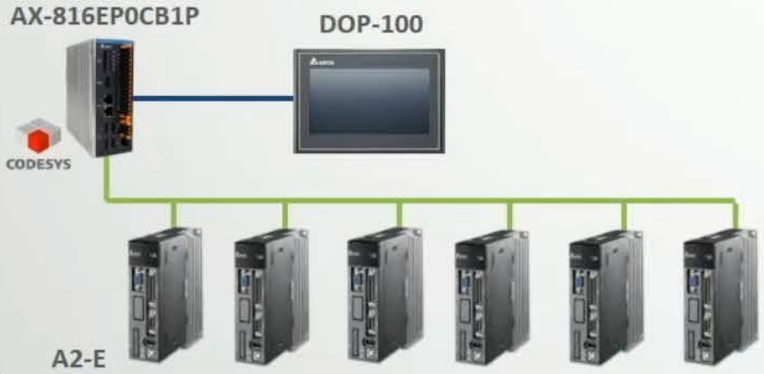
Articulated robot control

* Image for reference only

Technical details

- Control of a 3rd-party 6-axis articulated robot
- AX-816E motion controller with CNC+Robotics

Configuration

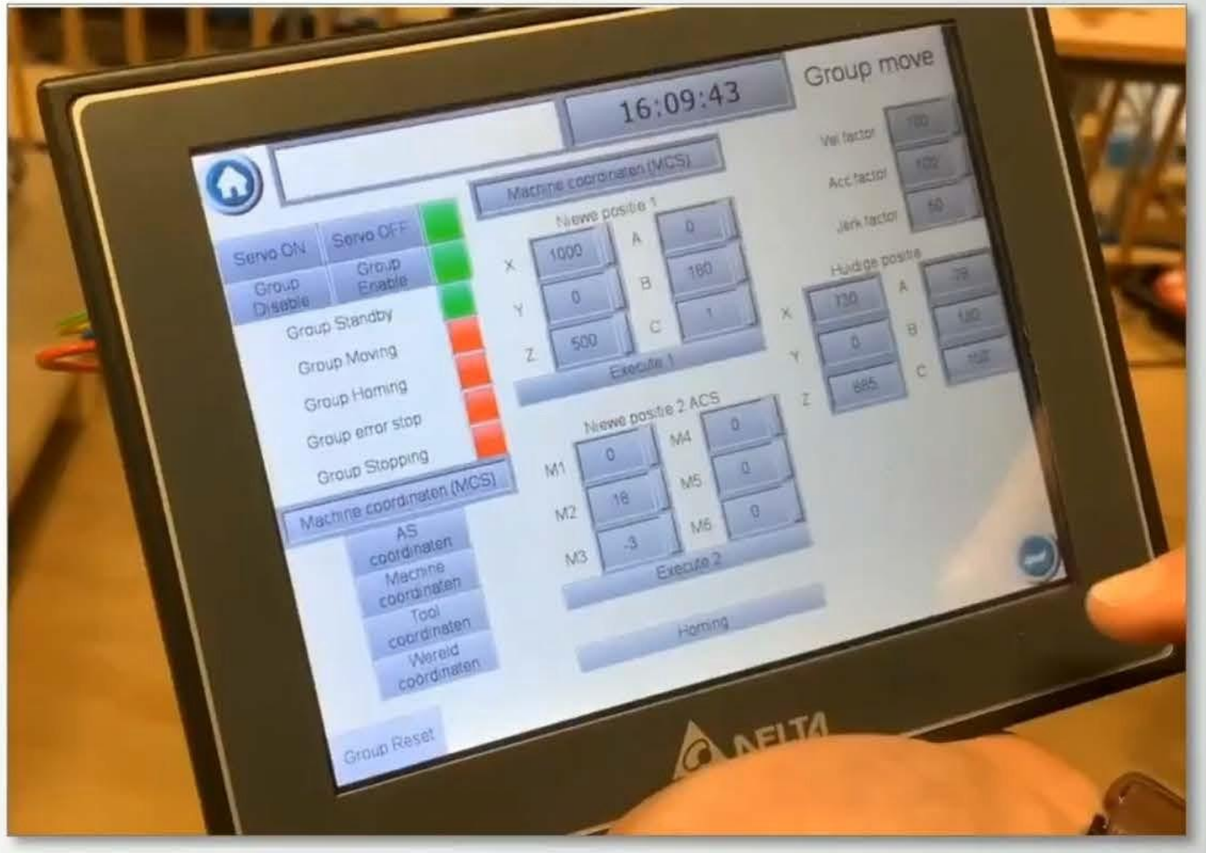


WHY AX-8?

- Need of the CNC+Robotics license to manage the kinematic transformation
- Need to improve the flexibility compared to a standard robotics solution

Successful cases: AX-8

Articulated robot control



Successful cases: AX-8

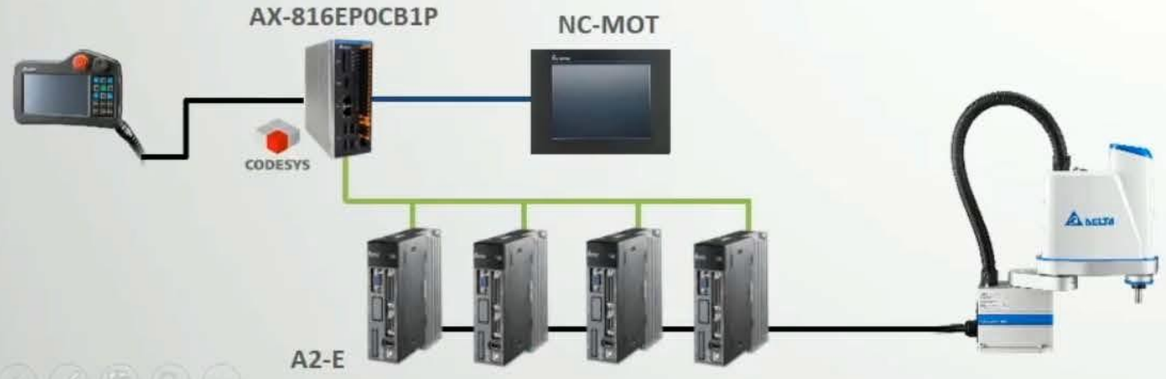
SCARA robot control

* Image for reference only

Technical details

- Control of a 3rd-party 4-axis SCARA robot
- AX-816E motion controller with CNC+Robotics

Configuration



WHY AX-8?

- Need of the CNC+Robotics license to manage the kinematic transformation
- Need to improve the flexibility compared to a standard robotics solution

Smarter. Greener. Together.