

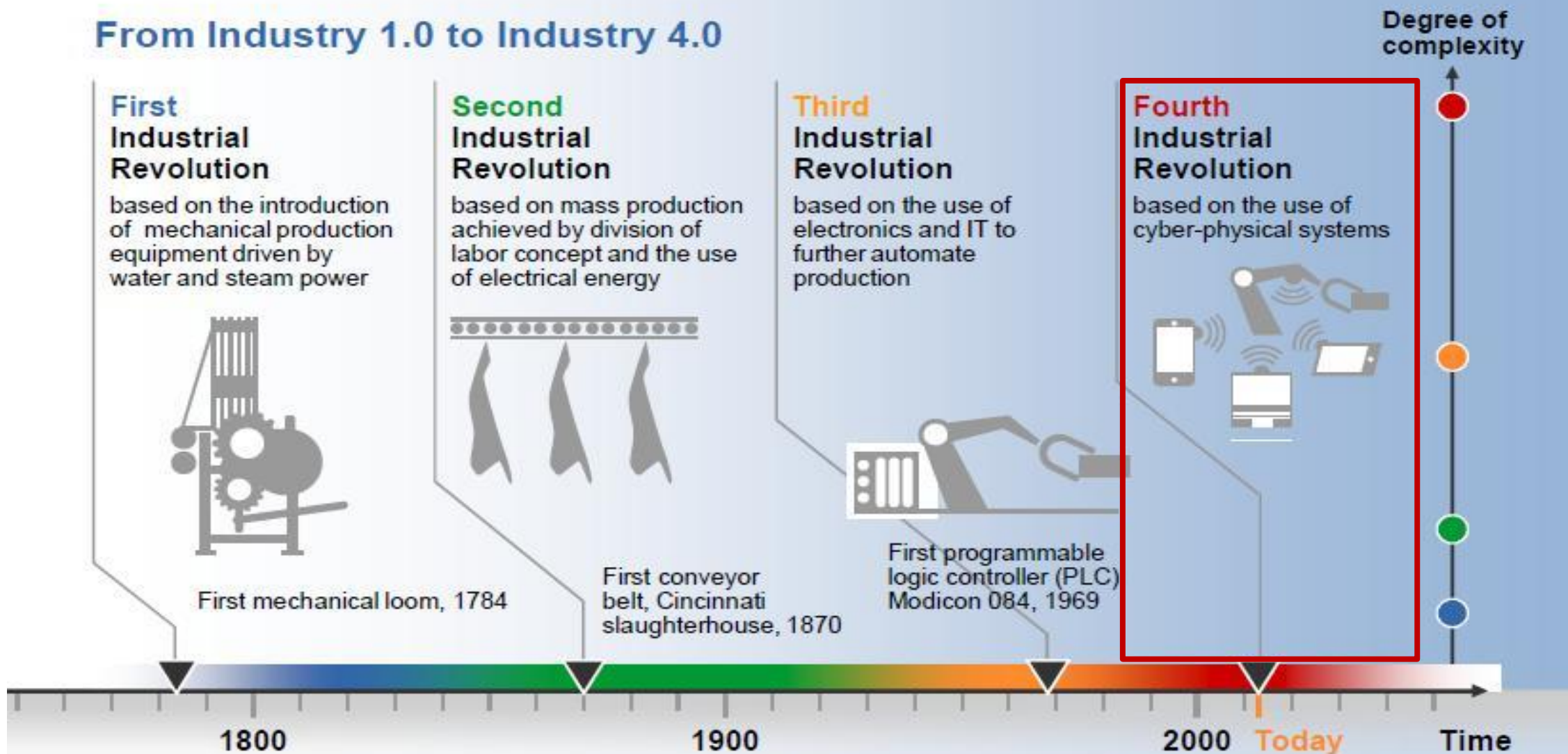
Advantech CODESYS Solutions

Industrial IoT Solutions for
Control, Computing, and Connectivity

Advantech
iFactory SRP
Darren Chiu

The Evolution of Industry 4.0

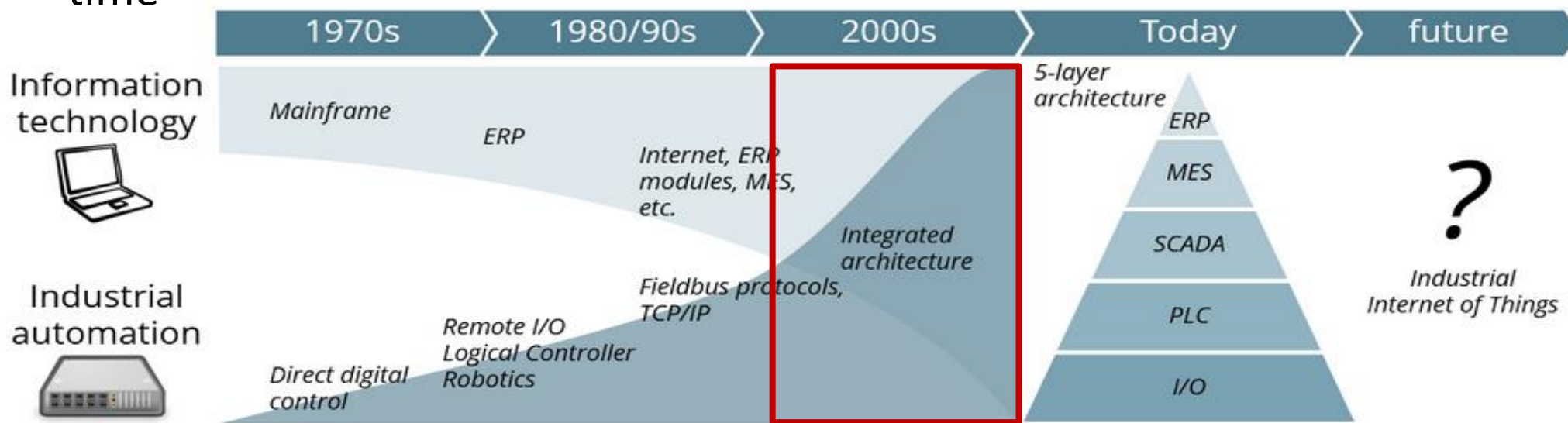
From Industry 1.0 to Industry 4.0



Industrial Internet of Things (IIoT)

Convergence of IT and Automation

- Rapid adaptation to multiple models
- Incorporate machine learning and big data technology
- Improves efficiency and reduces training time



The boundary is disappearing

Current Obstacles to Industry 4.0

Data Analysis

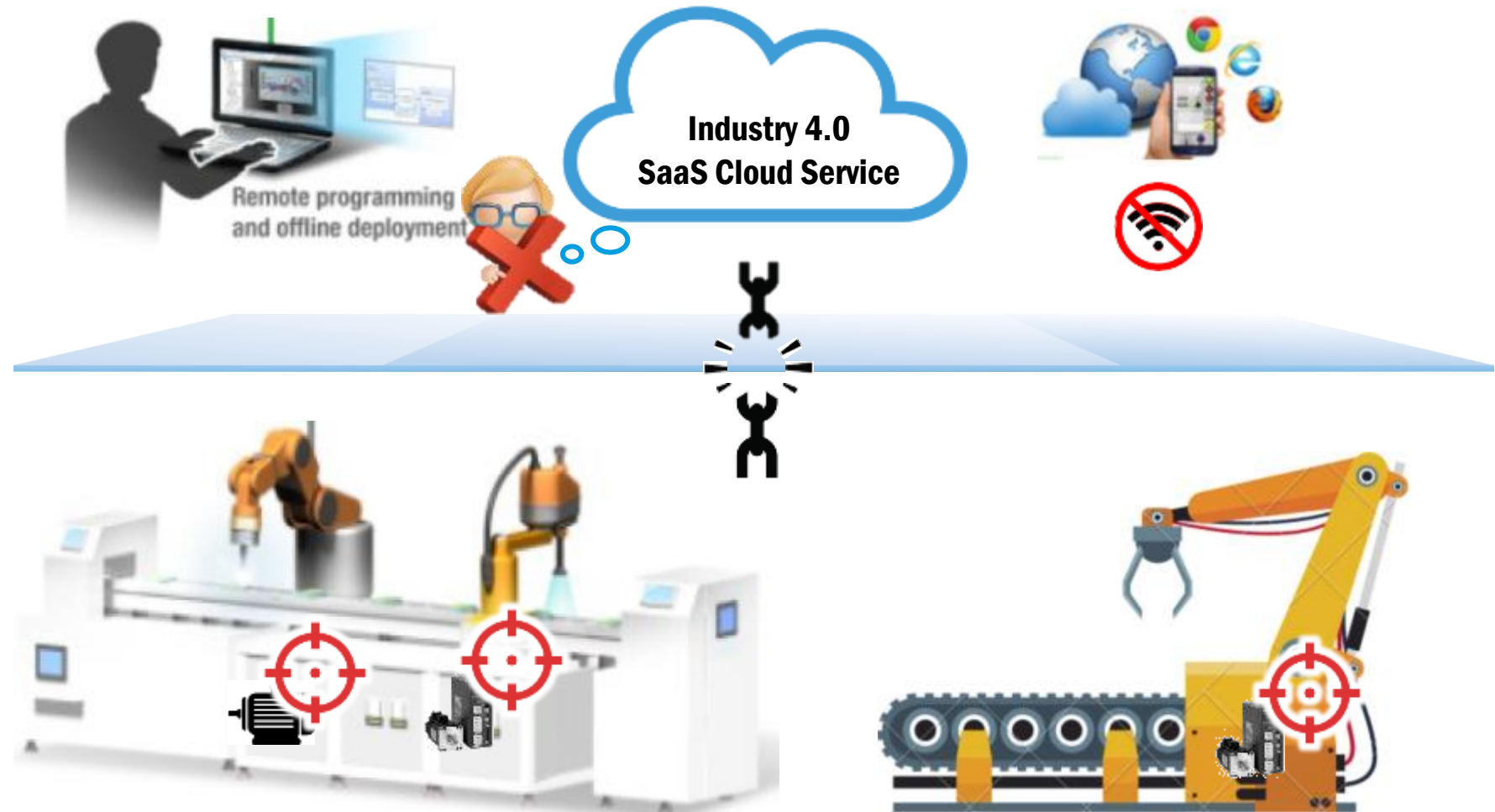
- Historical data not traceable
- Difficult to conduct remote monitoring and control
- Difficult to conduct predictive maintenance

PAIN POINT



Data Acquisition

- Difficult to integrate PLCs of different brand
- Cannot collect real-time data from all internal sensing devices



What you will need...

PC-Based Controller

For integrating information technology, big data, data storage, and data analysis

Standardized Control Programming

Compliant with the IEC 61131-3 and PLCopen standards

Status Monitoring and **Fieldbus Control**

Feature with real-time fieldbus support for data collection from fieldbus I/O



Benefits of Advantech's CODESYS Solution



Abundant Application

- Support real-time industrial fieldbus protocols
- Support OPC UA and Modbus servers/ clients
- Software has wide applicability for diverse projects & applications.



Easy Management

- Application are integrated and can be edited using a single interface that support all PLCopen IEC-61131-3 programming languages (FBD, LD, IL, ST, SFC)
- Support Web HMI design and visualization for management.

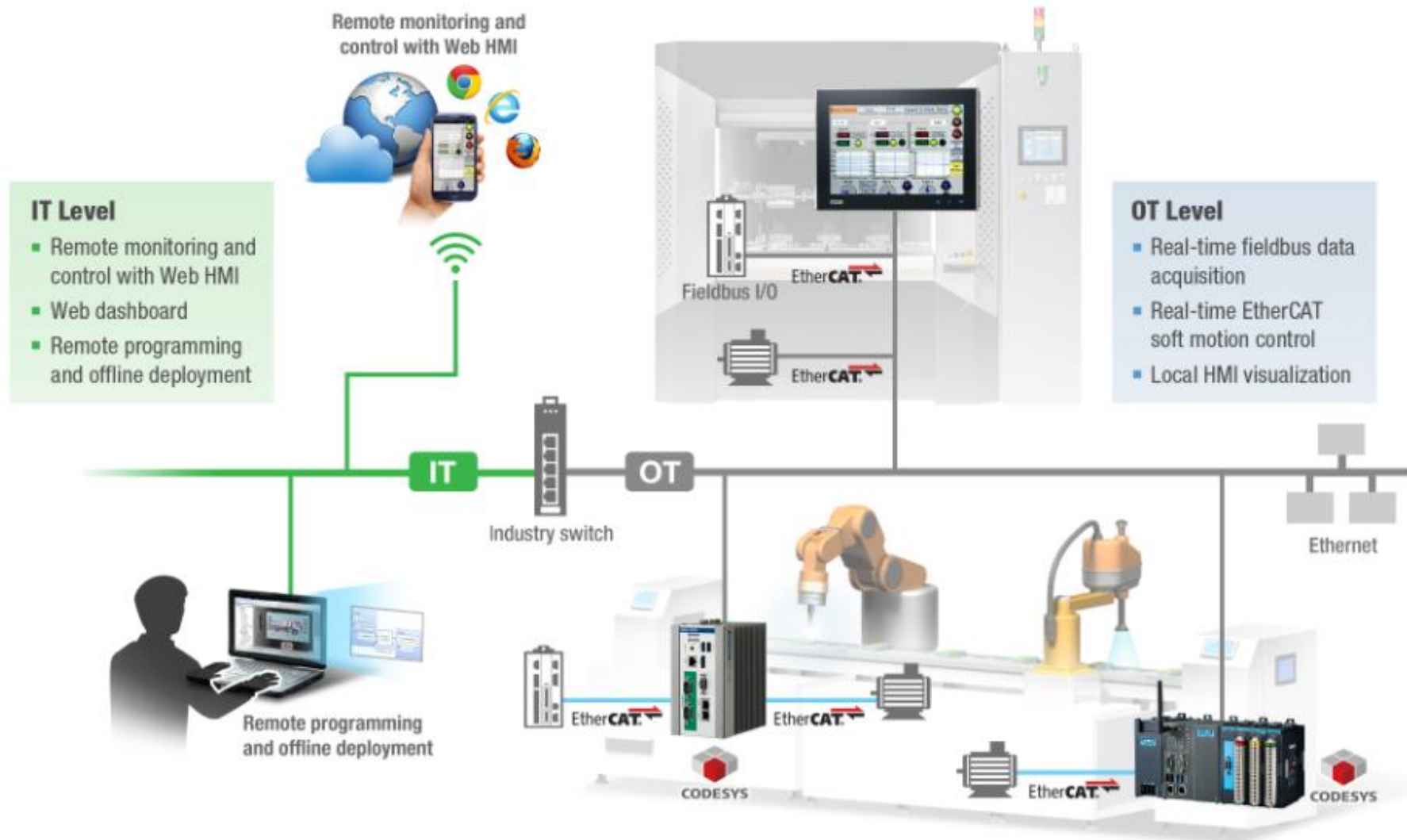


Powerful Control

- High-performance control IPC ideal for complex motion control operations.
- Support real-time dual fieldbus data acquisition of PROFINET and EtherCAT communications
- Comprehensive library of proven components for reuse in diverse applications.



Advantech's CODESYS Solution Architecture



Software Architecture and Key Design Features



SoftPLC Design Features

IEC 61131-3 Programming

1. Instruction List (IL)
2. Structured Text (ST)
3. Ladder Programming (LD)
4. Function Chart Programming (FBD)
5. Sequential Function Chart (SFC)



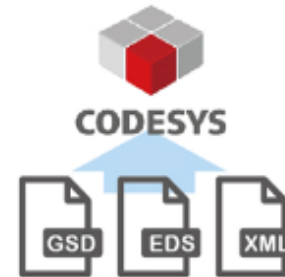
CODESYS Soft Motion Module

1. Single-Axis Function Block
 - Move Absolute • Move Relative
 - Home • Stop • Power
2. Multi-Axis Function Block
 - CamIn • CamOut • GearIn
 - GearOut



Visualization

1. Controller/ Input options
2. Table/ chart
3. Graphical /animation options
4. Web-based visualization for remote control



Compliant with 3rd party Fieldbus Device

Supports GSD/ EDS/ XML file import

Why CODESYS

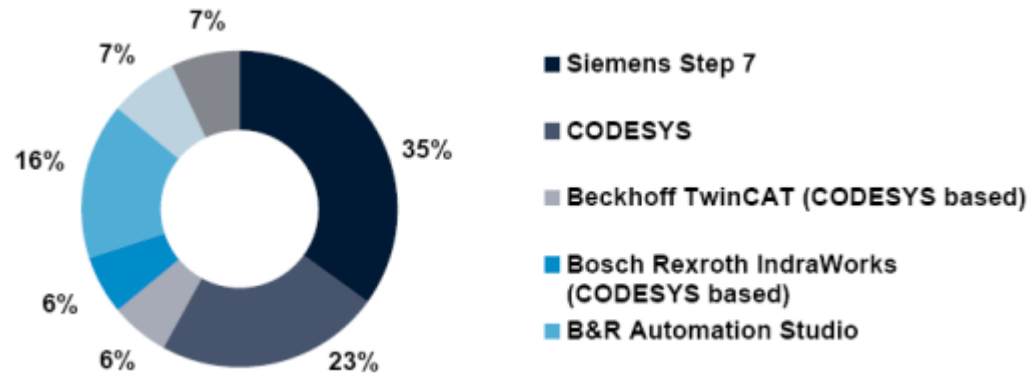
CODESYS : The World NO.1 Control Software



Survey conducted by one of the most important German Automation Magazines "Computer&AUTOMATION", ITQ and two German Universities (9/2011):

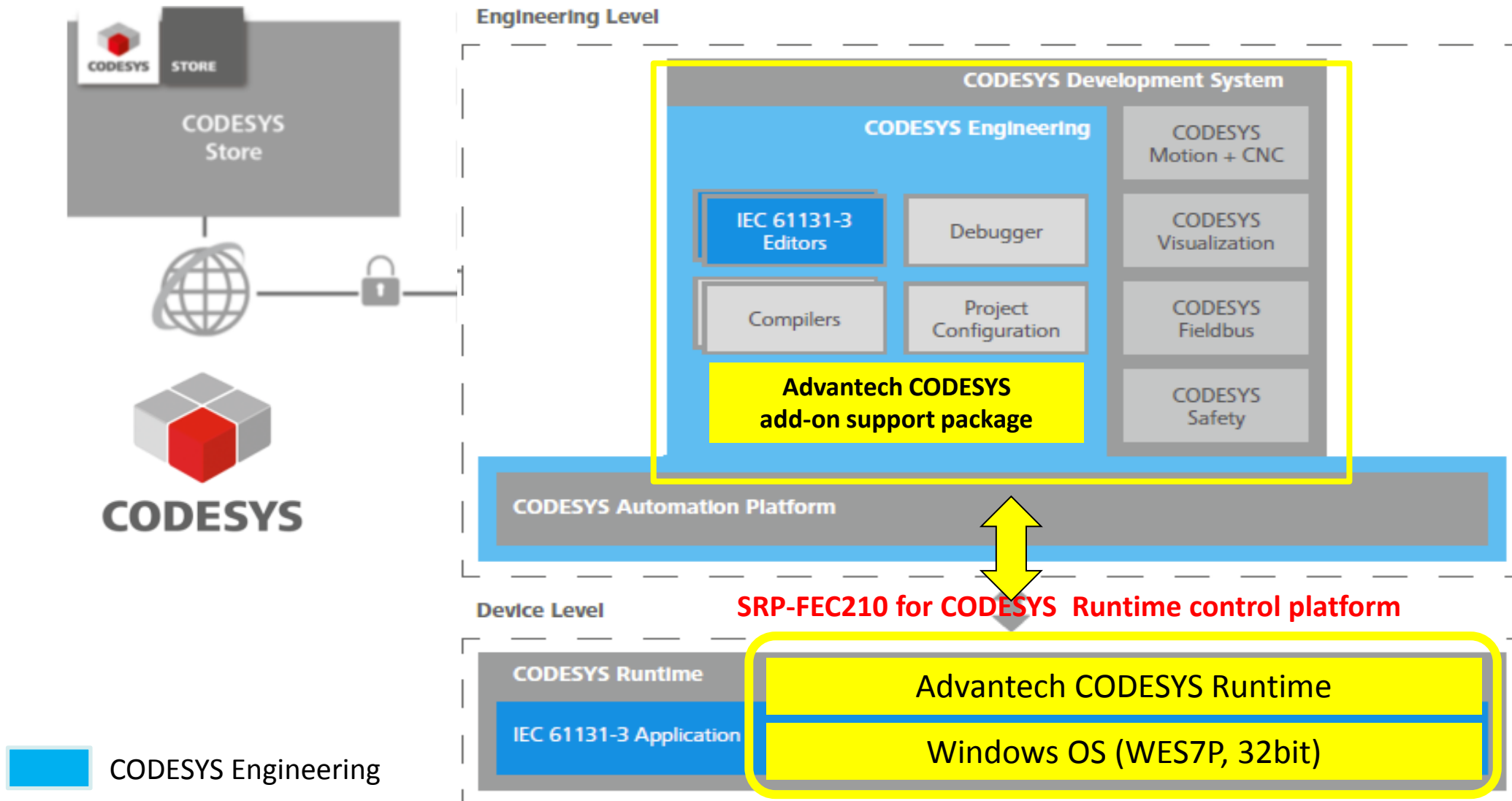
70 companies (machine- and plant manufacturers) were interviewed. One of the questions asked was: Which development tool do you use to program your controller systems?

Result: PLC Benchmark



- Eliminates the need for proprietary programming systems
- Provides a single tool for control, communication, and HMI functions
- Transforms Windows-based IPCs into powerful real-time controllers

Engineering in the CODESYS Landscape

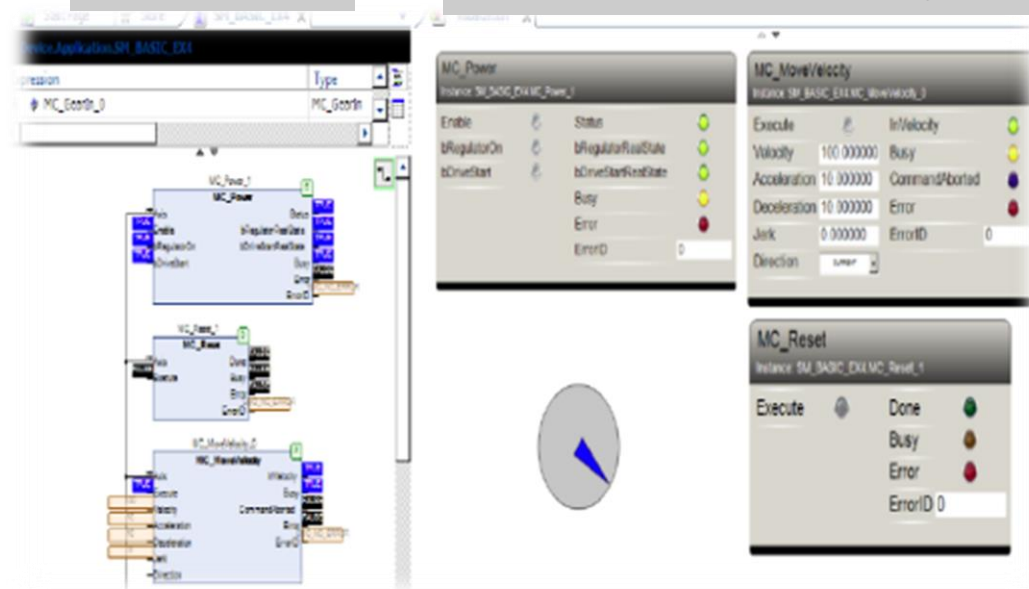


Open Engineering Software



PLC Project

HMI Visualization Project



Visualized Control Software Powered by CODESYS

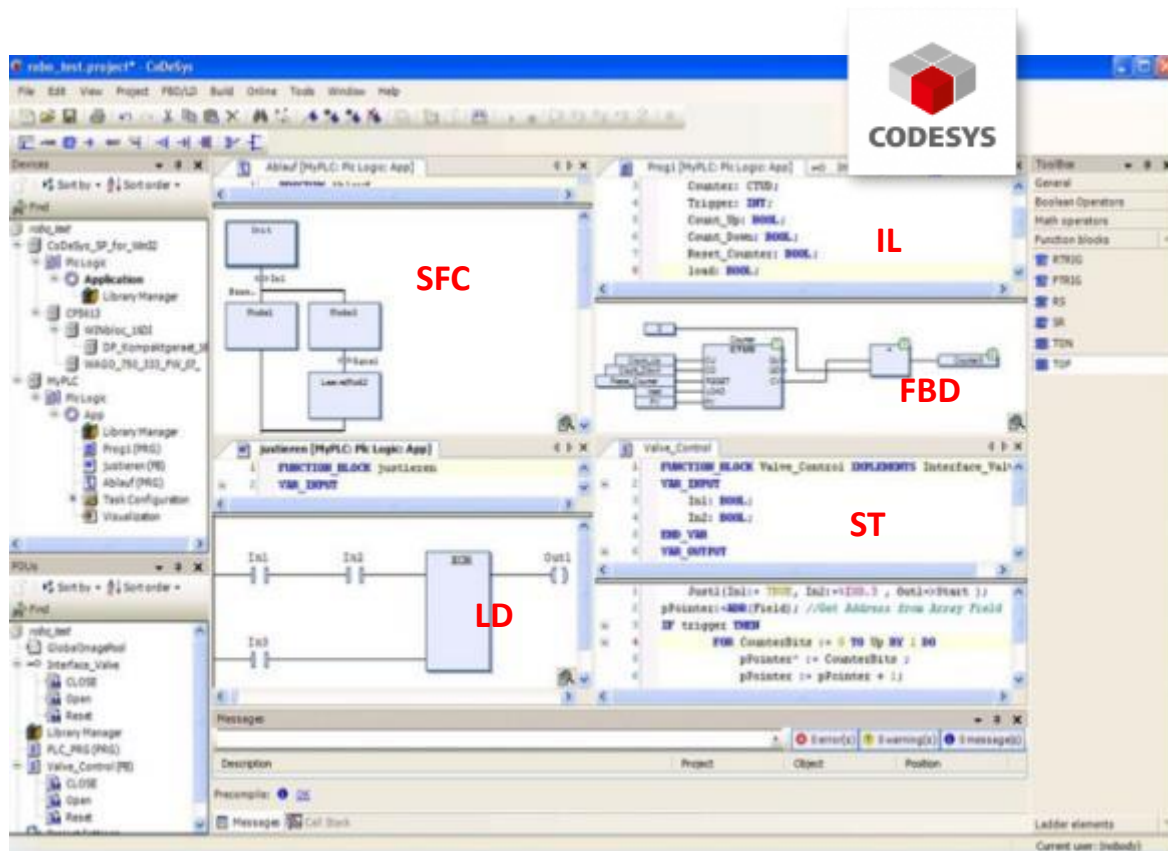
The CODESYS V3.5 SP10 Development Environment

- IEC 61131-3 applications professionally engineered by technicians and software engineers using an all-in-one tool.
- Supports LD, ST, CFC, IL, SFC, FBD, and UML programming languages, HMI visualization, and flexible platform expansion for creating structured and efficient applications
- Download CODESYS IDE software free of charge from <https://www.codesys.com>



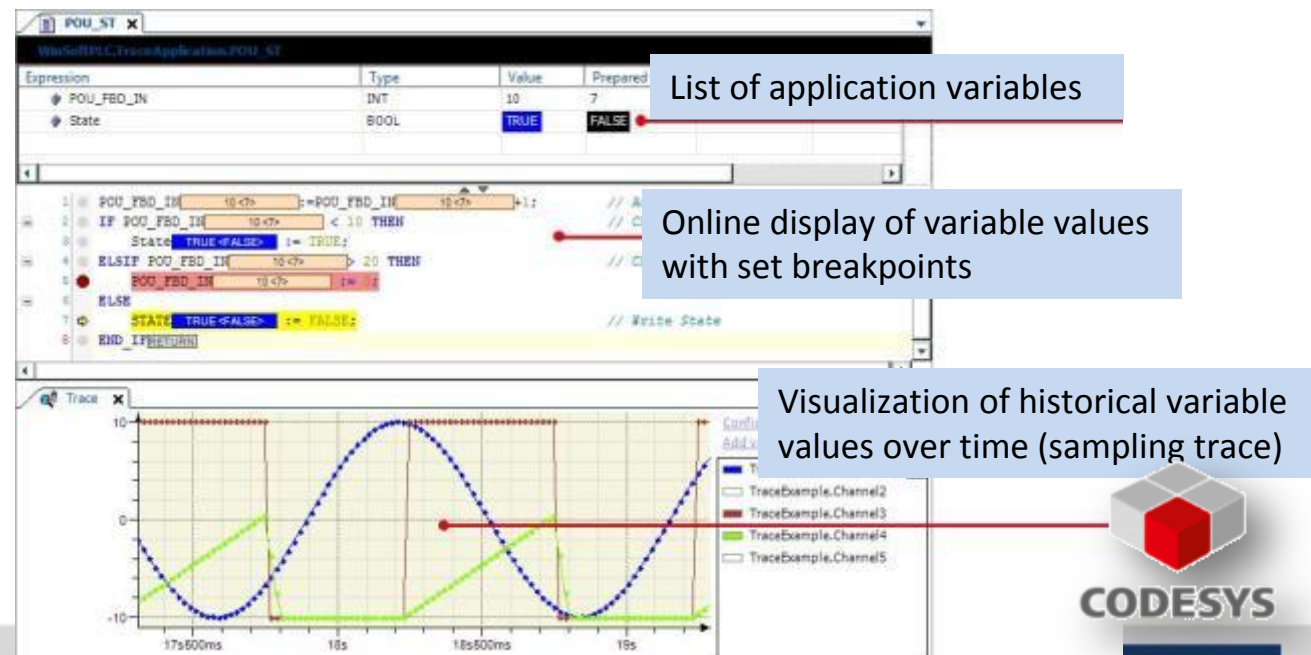
Cross Languages for PLC Programming

CODESYS development environment for SoftPLC function



Features :

- ☑ Display of application data at runtime in simulation mode on SoftPLC and discrete controllers.
- ☑ Supports reading, writing, and forced setting of variable values, directly in the respective editor.
- ☑ Enables monitoring of specifically selected values in watch lists.
- ☑ Supports code execution in single steps or complete cycles
- Supports the setting of conditional and absolute breakpoints and execution points



CODESYS HMI Visualization

Create visualization screens directly in the PLC development system for display on a target device, PC, or web browser

CODESYS – On-Site Machine Operation and Systems Monitoring

Local HMI



The platform-independent variant shows the user interface directly on the controller via an integrated or connected display. Thus, control and visualization functions are integrated into a single TPC or UNO device for machine operation and systems monitoring. An optional extension of the runtime system is necessary in order to use CODESYS TargetVisu.

CODESYS – Remote Web-Based Access for Service and Diagnosis

Remote Web HMI

The web-based display variant enables remote access, monitoring, diagnosis, and service over the Internet. Standard web-browsers communicate (with optional SSL decryption) with the web-server on the controller using JavaScript, while HTML5 is used for visualization displays. This technology is supported by most browsers and compatible with iOS and Android.



HMI VisuElement Toolkit

Manufacturers and users can expand the available elements with their own system- or industry-specific visualization elements, and **all new visualization elements are automatically integrated into the CODESYS Development System.**

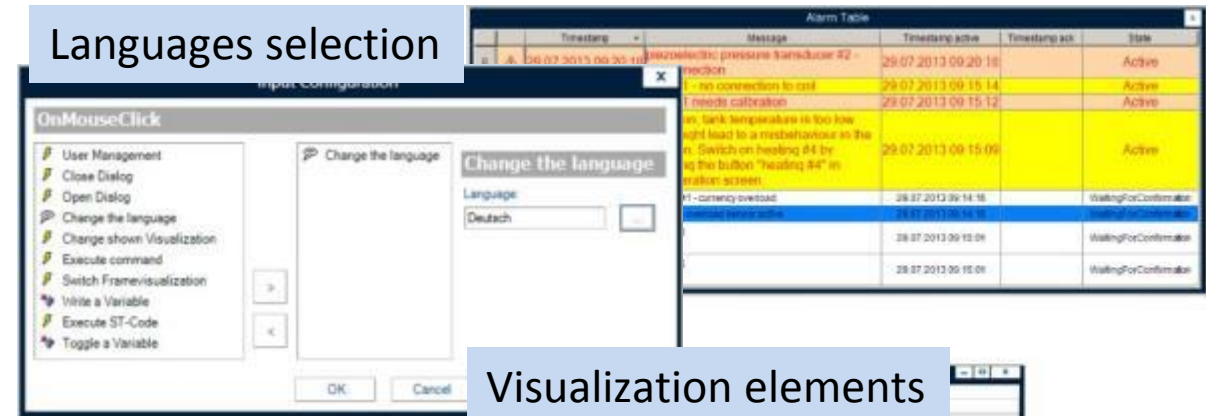
However, the optional CODESYS VisuElement toolkit is required for this functionality. Additionally, because the elements are created directly in the CODESYS Development System using IEC 61131-3 programming languages, no additional platforms are required

HMI visualization function list :

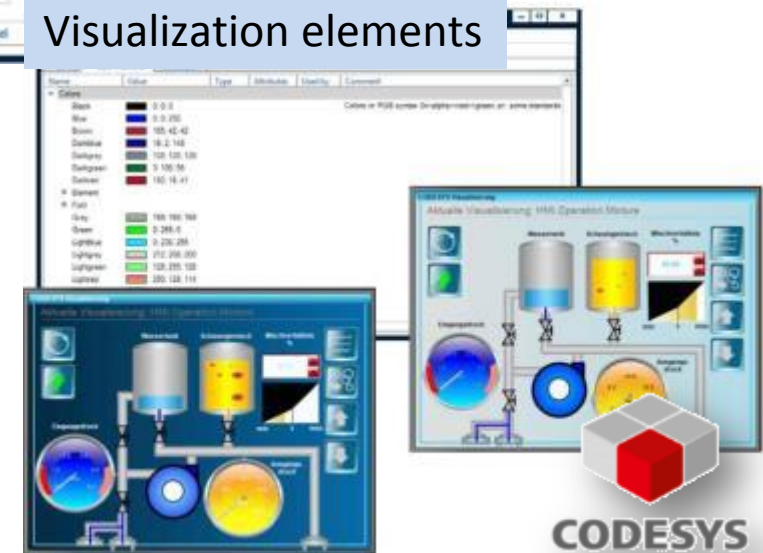
Basic elements	Basic controller elements	Input options	Special controller elements	Graphical elements	Practical controls	Animation options
Rectangles	Buttons	Keys	Trace	Banners & tables for the alarm management	Pointer instruments	Text display
Ellipses	Tables	Toggles	ActiveX elements		Lamps	Color change
Curves	Text fields	Image switches	Waiting symbols		Switches	Visible/invisible
Polygons	Scroll bars	Mouseovers	Text editors		Potentiometers	Operable/inactive
Bitmaps	Slide controls	Function calls			Bar graphs	Shift
Buttons	Progress bars					Resizing
Frames	Radio buttons					Rotation
Bézier curves	Checkboxes					Font properties
						Character properties

Alarm management

Languages selection



Visualization elements



Example Application for Mechanical Control



Description:

Achieve SoftLogic machine control with the integration of IEC 61131-3 CODESYS software and a PC-based controller to reduce manual operations and realize lean production, even for unmanned production operations.

- **Softlogic control** of packaging, printing, labeling machine in F&B industries.
- **Position-to-position** movement control with multi-axis machine for automated board/system testing operations

SRP-FEC210-AE



PLCopen
IEC 61131-3
Standard

WAGO
Remote/IO



WAGO
Remote/IO



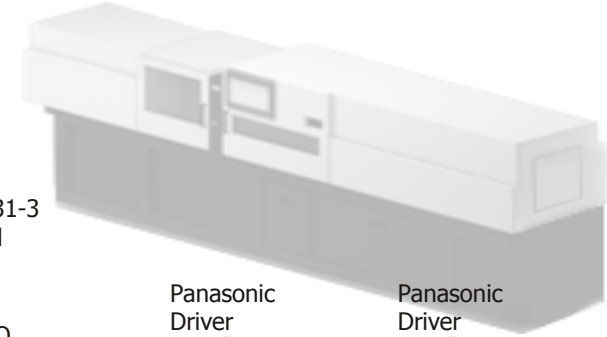
Panasonic
Driver



Panasonic
Driver



EtherCAT

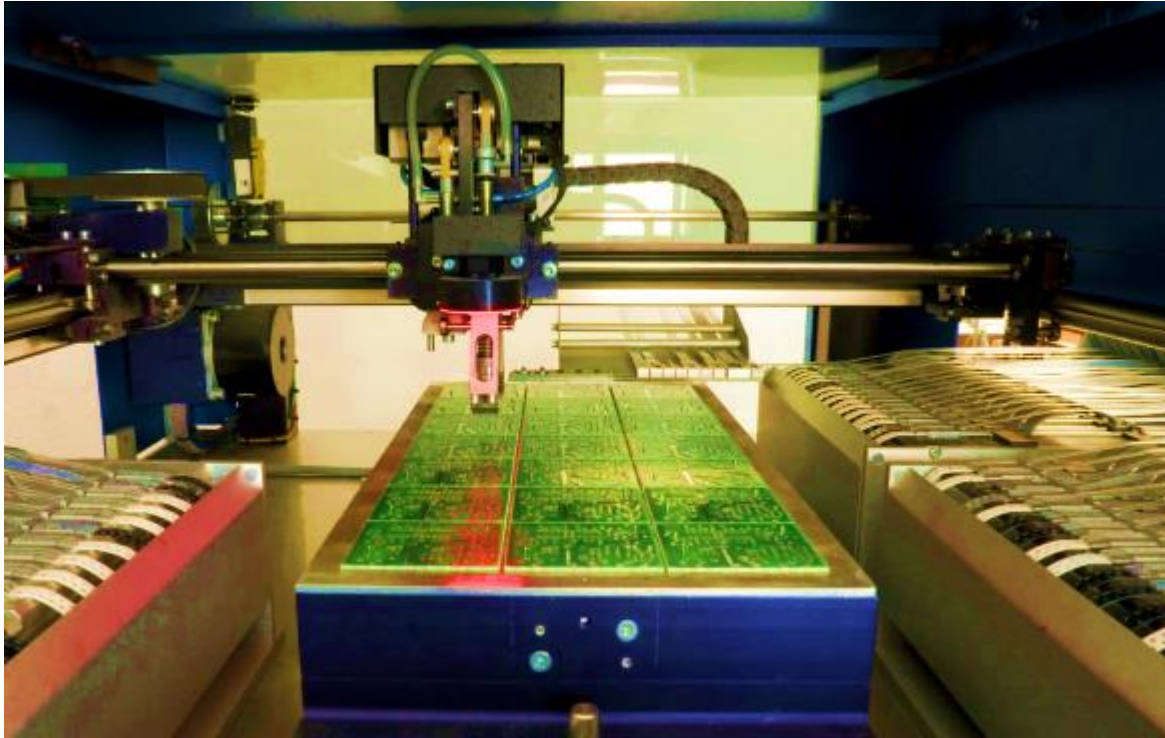


EtherCAT



CODESYS

Example Application for Machine Monitoring & Predictive Maintenance



Description:

Monitor essential production line equipment by using sensors to collect production status data and transmit real-time data to the cloud for big data analysis, downtime forecasting, and predictive maintenance in order to increase productivity and reduce maintenance costs.

- Protocol gateway for **collecting big data in a distributed I/O system** that includes frequency/time/temperature/oil/pressure parameters
- **HMI visualization** enables predictive maintenance and flexible on-site repairs

Scenarios

SRP-FEC210-HAE



PLCopen
IEC 61131-3
Standard



EtherCAT

WAGO
Remote/IO



Proximity sensor

Modbus

ADAM-4000



WebAccess/HMI



ADVANTECH

Why Choose Advantech

Highlights:

- Advantech's open control solutions are equipped with an optimized Intel® LAN chip, BIOS utility, and OS for real-time operations.
- Advantech provides a CODESYS software driver development tool that facilitates the integration of Advantech's automation products for SoftLogic applications.
- Advantech offers a wide range of controller and iDoor expansion modules to support diverse automation applications.



Open Control -Panel Controller System Highlights



SRP-FEC210-HAE (TPC-5152T)

+ Features-Front

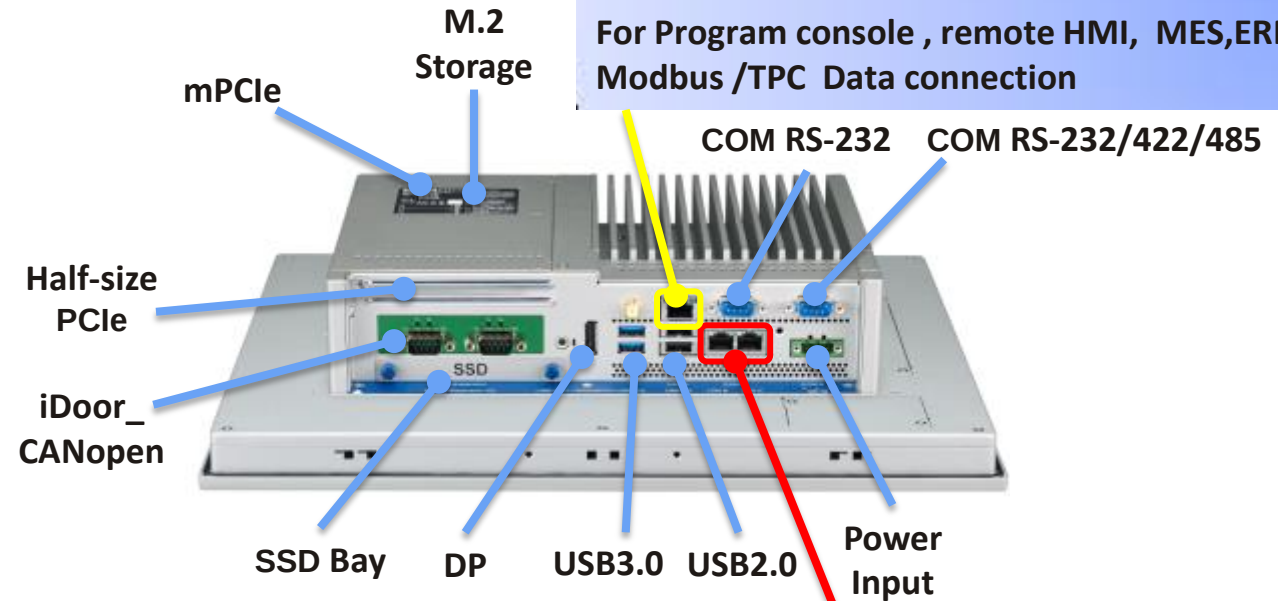
- ✓ Multi-touch
- ✓ IP66 Waterproof protection

WIFI
Antenna



- ✓ iKey for Customized Keys for Intuitive Operation
- Home Key
- LED Indicator for Power Input

+ Features- Rear



LAN A : IT Ethernet communication Interface
For Program console , remote HMI, MES,ERP ,
Modbus /TPC Data connection

LAN B/C : Main Controller Ethernet
communication Interface:
For Industry fieldbus control PROFINET,
EtherCAT, EtherNet/IP ,ModbusTCP

Open Control - Cabinet Controller System Highlights



**SRP-FEC210-AE
(UNO-1372G)**

+ Features-Front

Built-in MRAM 2MB in side:
PLC Control Process Retain Value

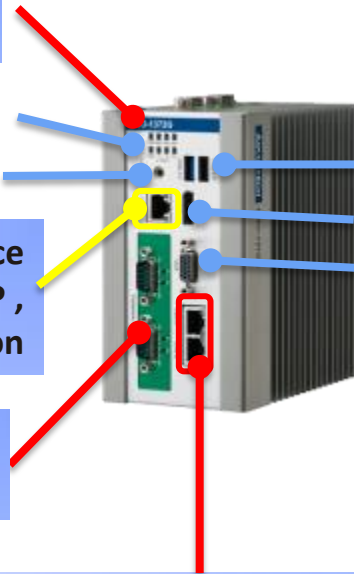
LEDs diagnostic indicator

Audio Line Out

LAN C : IT Ethernet communication Interface
For Program console , remote HMI, MES,ERP ,
Modbus /TPC Data connection

iDoor Expansion card or secondary fieldbus
Card PROFINET,EtherNet/IP ,CANOpen

LAN A/B : Main Controller Ethernet communication Interface:
For Industry fieldbus control PROFINET, EtherCAT,
EtherNet/IP ,ModbusTCP



USB 2.0, USB 3.0

HDMI Display

VGA Display

+ Features- Top

Dual-Power Input

COM1 RS-232

COM2 RS-422/485

USB2.0

Athena hole reserved

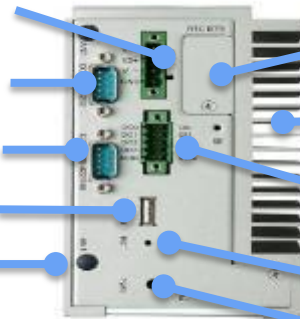
RTC Battery

Heat Sink

4DI/4DO

POWER ON/OFF

System Reset



Product Specification

Series	Cabinet Controller	Panel Controller
Ordering P/N	SRP-FEC210-AE	SRP-FEC210-HAE
Platform	UNO-1372G-E3AE	TPC-5152T-633AE
Operating System	Microsoft Windows Embedded 7 Pro (32 bit)	Microsoft Windows Embedded 7 Pro (32 bit)
Control Software	CODESYS V3.5 SP8 Control RTE & Visualization	CODESYS V3.5 SP10 Control RTE & Visualization
CPU	Intel Atom E3845 Quad-core 1.91 GHz	Core™ i3-6100U dual-core processor (2.30 GHz)
Memory	4GB DDR3L	4GB DDR4
Backup Memory	2MB MRAM	2MB MRAM
Display Size/Type	HDMI: 1920 x 1080 @60Hz VGA: 1920 x 1200 @60Hz	15" XGA TFT LED LCD
Max. Resolution	N/A	1024 x 768
Backlight MTBF(hrs)	N/A	50,000 hrs
Touchscreen	N/A	Projected capacitive
Storage	128G SSD	64GB SSD
Expansion Slots	Full-size Mini PCIe x 1 mSATA x 1	Full-size Mini PCIe slot x 2, Half-size PCIe1 x
Mounting	DIN-rail, Wall	Panel, stand, and VESA (with optional kit)
Network(LAN)	3 x RJ45, 10/100/1000 Mbps IEEE 802.3u 1000Base-T Fast Ethernet	3 x 10/100/1000 Base-T (2 x Intel® I210, 1 x Intel® I219)
I/O	1 x RS-232	1 x RS-232, 1 x RS-232/422/485
	1 x RS-422/485, DB9, auto flow control	2 x USB 3.0, 2 x USB 2.0
	3 x RJ45, 10/100/1000 Mbps	1 x Audio Line-Out
	3 x USB Ports (2 x USB2.0, 1 x USB 3.0)	1 x DisplayPort 1.4 Out
	4-ch digital input, 4-ch digital output (2500 VDC)	
	1 x VGA, supports 1920 x 1080	
	1 x HDMI 1.4a, supports 1920 x 1080	

Series	Cabinet Controller	Panel Controller
iDoor Expansion	iDoor x1	iDoor x1
DC Power Input (Voltage)	24 VDC ± 20%	24 VDC ± 20%
Ingress Protection	IP40	Front Panel IP66
Operating Temperature	- 20 ~ 60°C	0 ~ 55 °C
Storage Temperature	-40 ~ 85 °C	-20 ~ 60 °C
Dimensions (W x D x H)	85 x 139 x 152 mm	383.2 x 307.3 x 85.9 mm
Certification	CE, FCC, UL, CCC, BSMI	CE, FCC, UL, CCC, BSMI

Ordering Information

Controller Platform:

CODESYS Bundle P/N	Description
SRP-FEC210-AE	UNO-1372G-E3AE, CODESYS SoftMotion & Vis., 128G SSD, WES7P
SRP-FEC210-HAE	TPC-5152T-633AE, CODESYS SoftMotion & Vis., 64G SSD, WES7P
APAX-5580CDS	APAX-5580, CODESYS SoftMotion & Vis., 64G SSD, WES7P

Optional :

CODESYS Bundle P/N	Accessories P/N	Description
SRP-FEC210-AE	AMAX-4830-AE	EtherCAT Distributed Digital I/O
	AMAX-4834-AE	EtherCAT Distributed Digital Output
	FPM-7121T-R3AE	12.1" XGA Ind. Monitor w/ Resistive TS
	PWR-247-CE	Power Adaptor
SRP-FEC210-HAE	1702002600	Power cable (US) 1.8 M
	EWM-W150H02E	Wi-Fi module 802.11 bgn/RT5390 1T1R with USB signal
	PCM-26D2CA-AE	2-Port isolated CANBus mPCIe, CANOpen, DB9
APAX-5580CDS	APAX-5402-E2A0AE	2 PCIe expansion slots to support
	APAX-5343-AE	72W, Power Supply for APAX-5580 (Support Dual Power)
	PWR-244-AE	96W AC to DC power adapter
	1702002600	Power Cable US Plug 1.8 M

Contact Information

Open HMI & Control Solutions Product Division

Role	Name	Role	Name
PDH	Wilson Dai Wilson.dai@advantech.com.tw VOIP:511 EXT:7332	MKT	Jasmine Chiang Jasmine.chiang@advantech.com.tw VOIP:511 EXT:7476
PM	Darren Chiu Darren.chiu@advantech.com.tw VOIP:511 EXT:7426	SAE	Peter Shen peter.shen@advantech.com.tw VOIP:511 EXT:7168

Partnering for Smart City & IoT Solutions

驅動智慧城市創新 共建物聯產業典範



Industrial Cloud
& Cloud Networks

Private Cloud

iConnectivity

Transportation

IoT Devices

Computer On Modules

Video and RFID

Power & Energy

Environmental & Facility Monitoring

Embedded Software

iBuilding/BEMS

Industrial HMI

Embedded Design-in Services

Intelligent Display

Intelligent Systems

iRetail & Hospitality

iHospital

Image & Video Processing

Machine Automation

WebAccess+

Digital Healthcare

Digital Logistics

Industrial PCs

CODESYS Solution Demo Box Overview

Demo in box

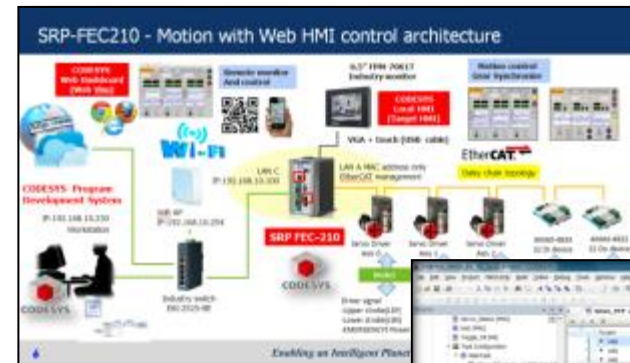


Demo Suitcase



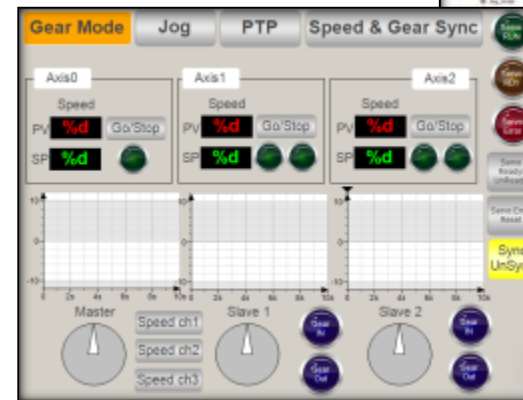
Demo Project and Guide Line

Demo Guide line slide

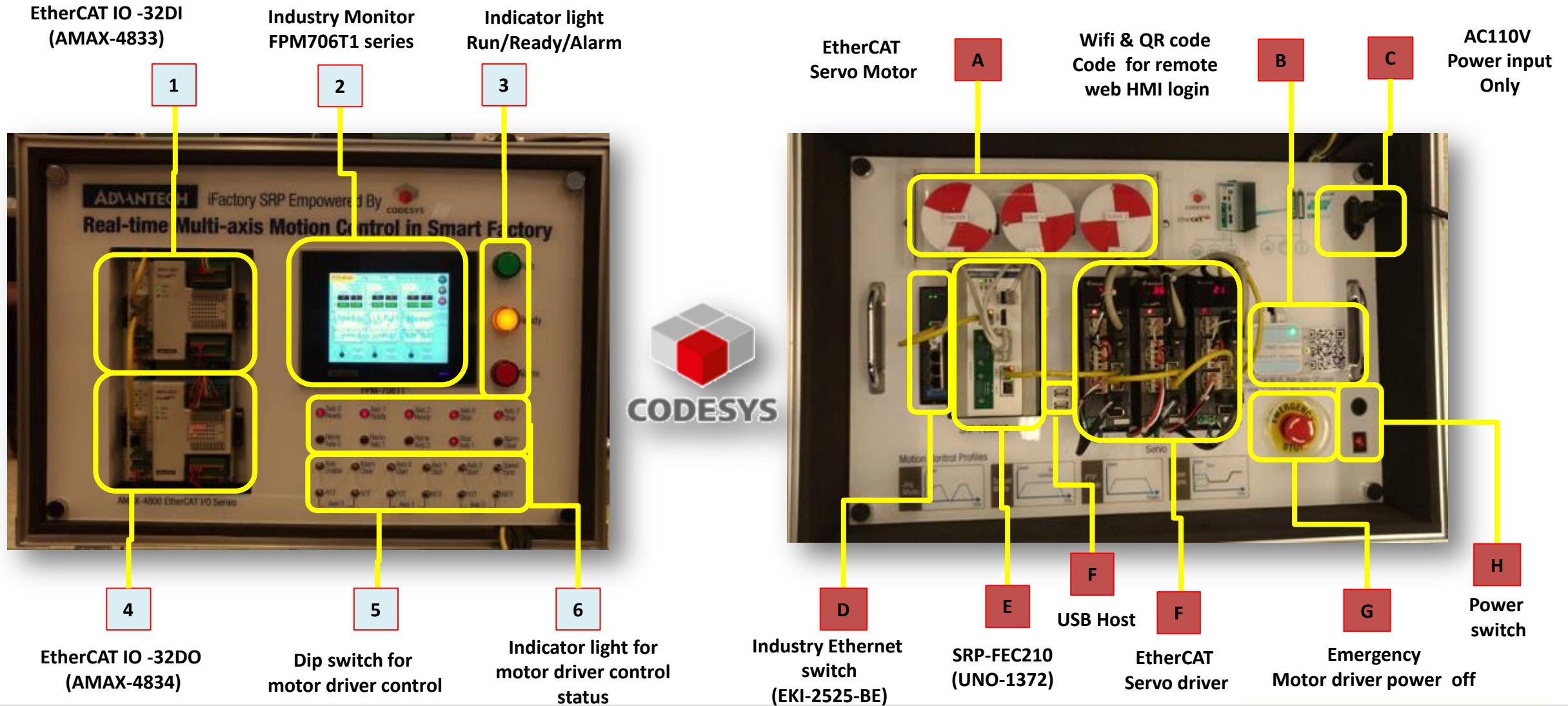


CODESYS IEC61131-3
PLC Project

Local HMI with
web remote HMI



Demo Box Architecture



Demo Box Features

SRP-FEC210 Control Platform Demo feature POWER by CODESYS SoftMotion with HMI,Web Visualization

- Application over IT & OT Network topology integrated.
- SoftLogic IEC61131-3 PLCOpen EtherCAT servo motor motion control :

- Jog Control.
 - PTP Position control.
 - Speed control.
 - Gear Speed Synchronize control.
- **HMI function:**
- Target Visualization.
 - Web Visualization for browser based application with Dashboard.

Ex:

Thin Client PC, web terminal, mobile phone device, workstation PC.

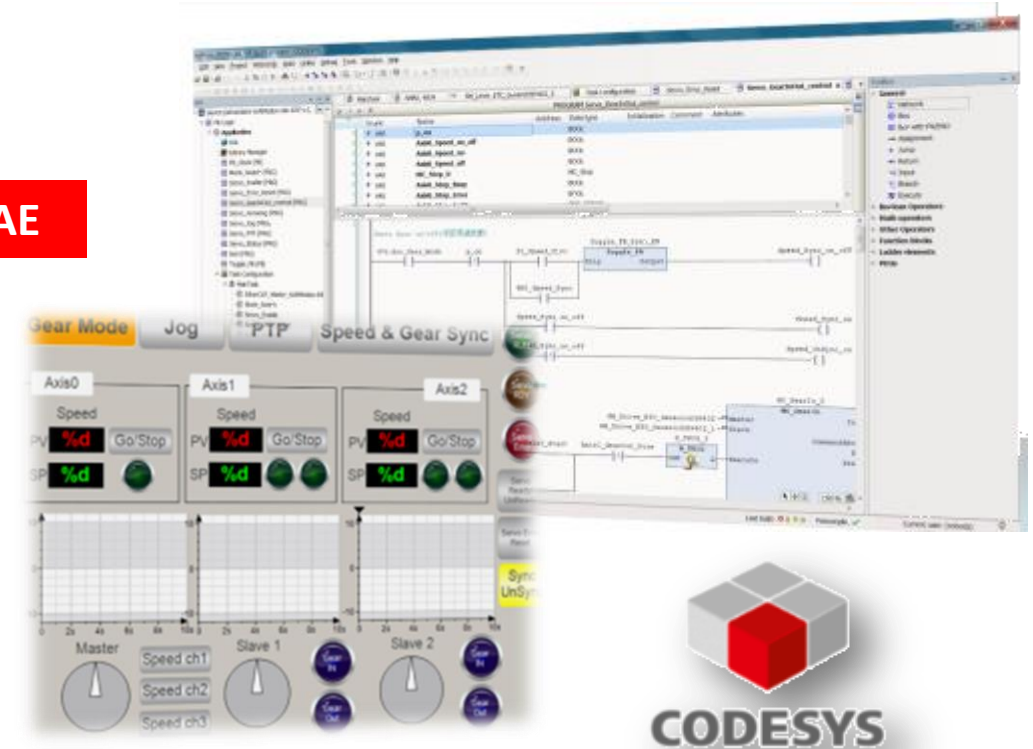


EtherCAT

EtherCAT
Servo Motor

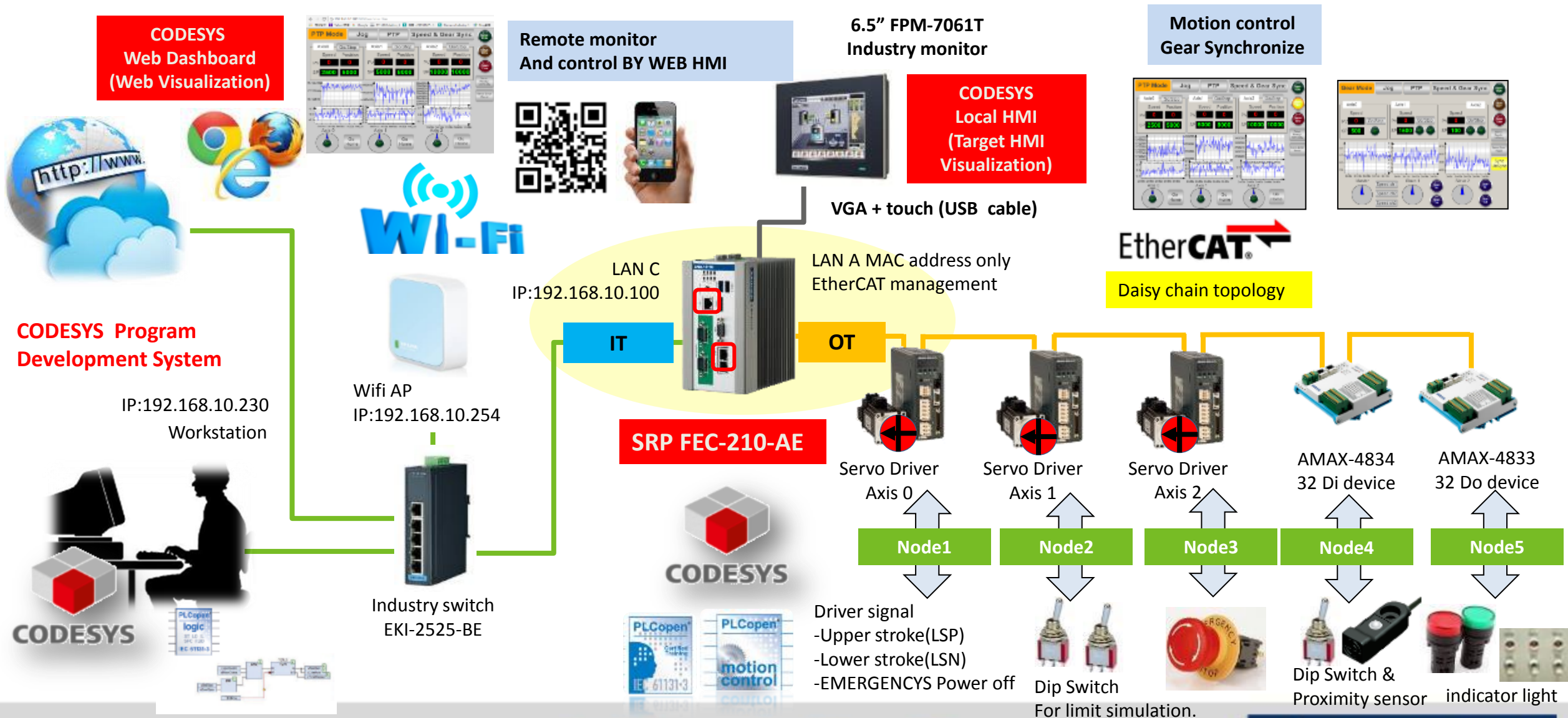


SRP-FEC210-AE



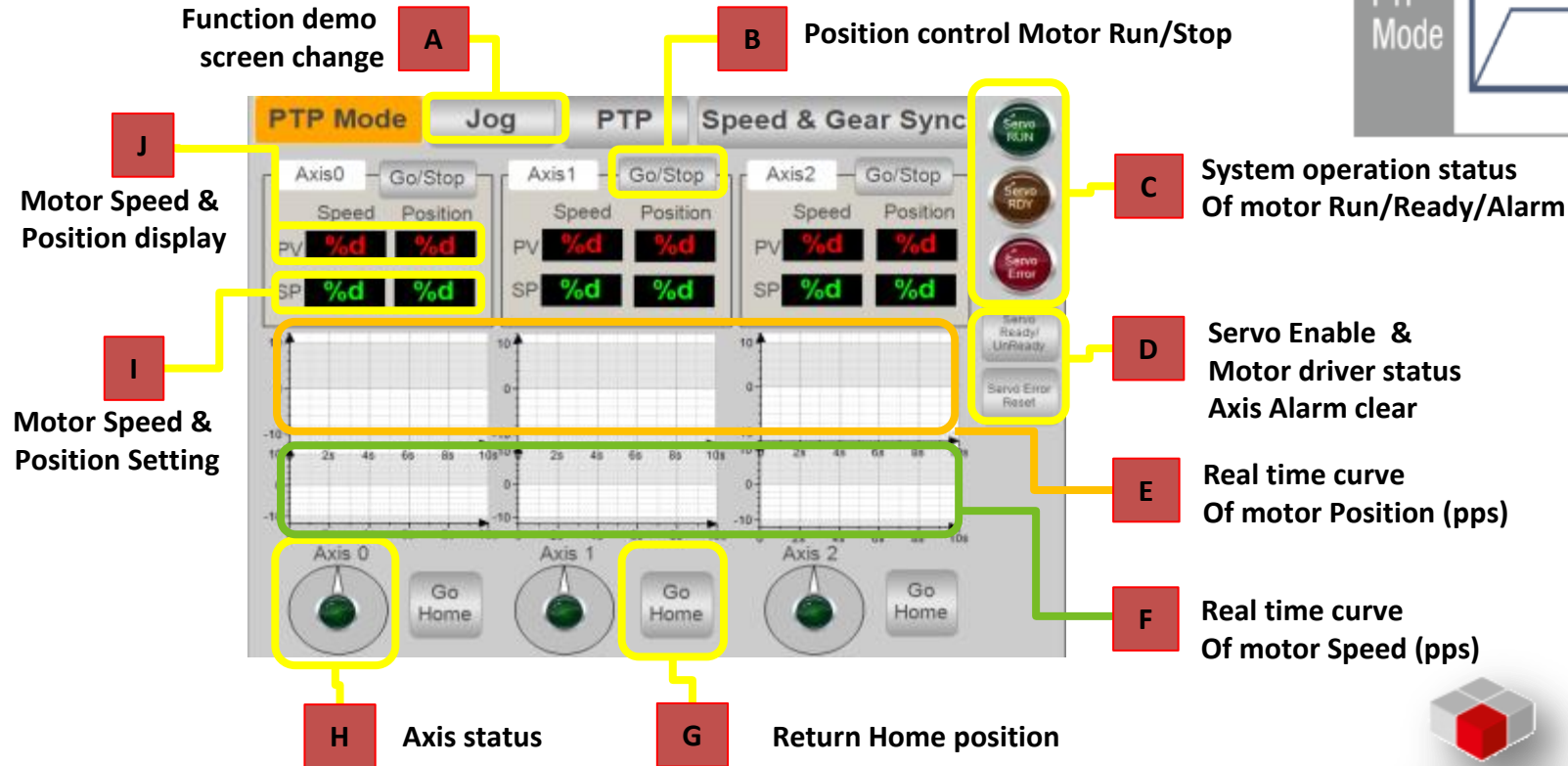
* The program project created by CODESYS IDE V3.5 SP10

Application over IT & OT Network Topology Integrated



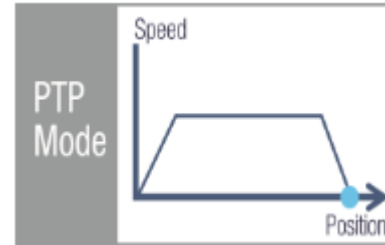
Position Control

PTP Position control mode with EtherCAT servo motor

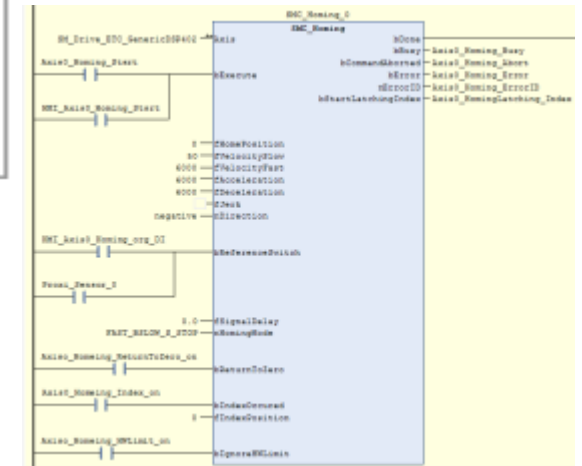


***Operation Step: use mode 1 of HMI or mode2 dip switch for start motion system control:**

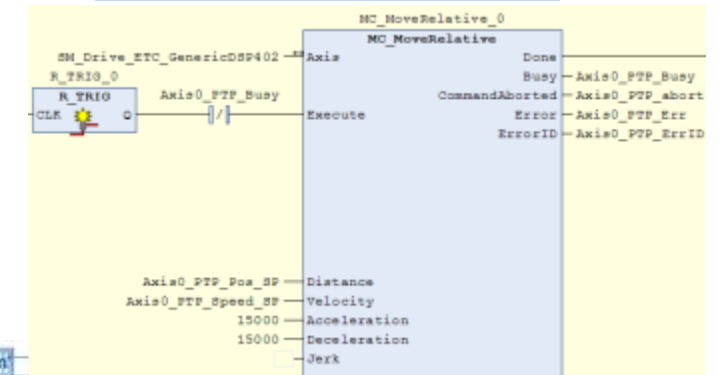
Mode 1= **D** Server ready → **G** Go home → **B** Position control Motor Run/Stop
 Mode 2= Server Enable → Go home → Axis 0 Start/Stop (toggle switch)



Function Block: Return to Home



Function Block: Position control



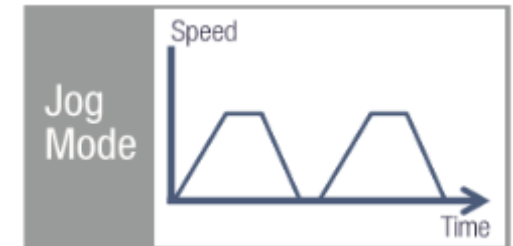
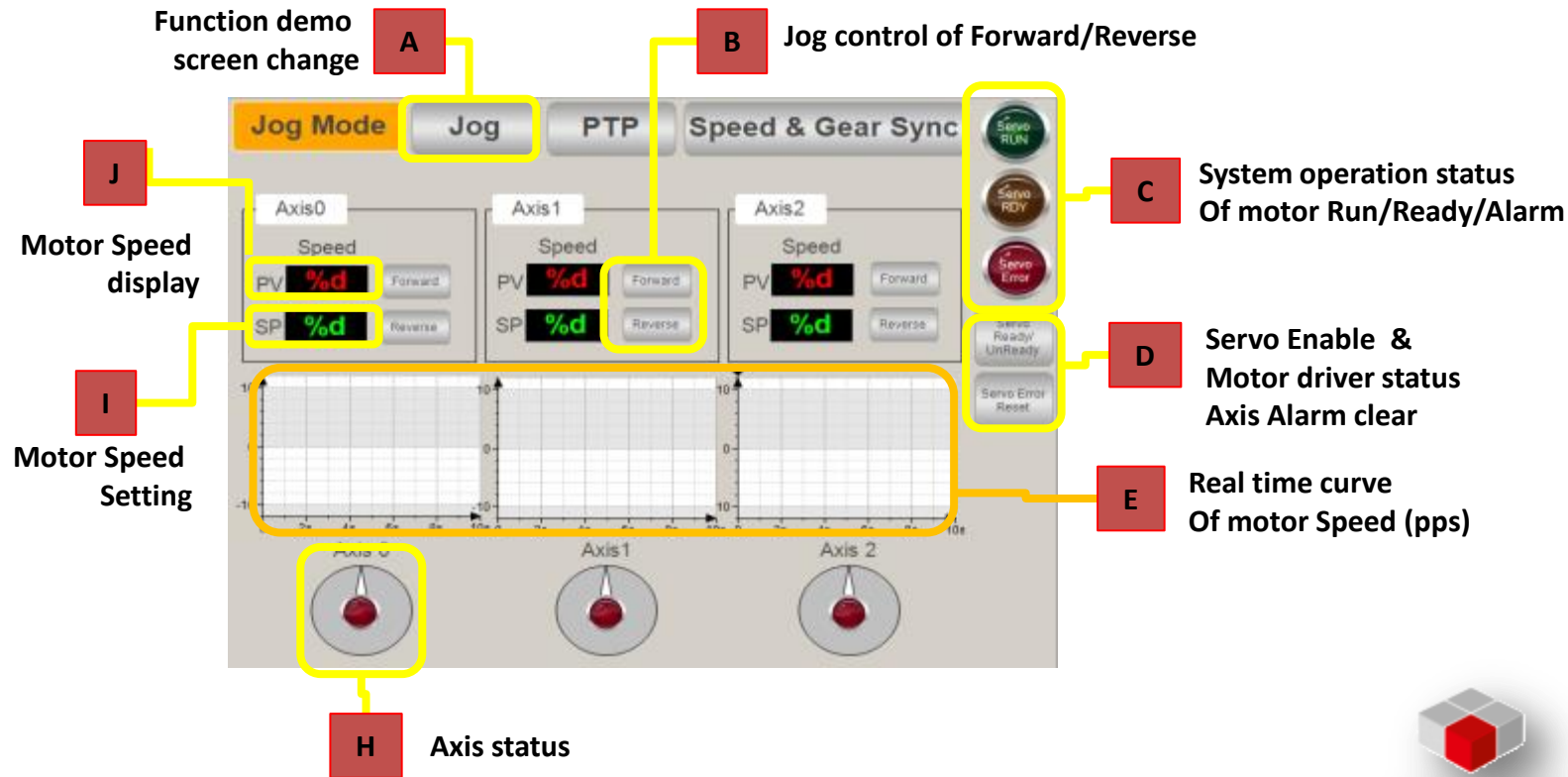
EtherCAT



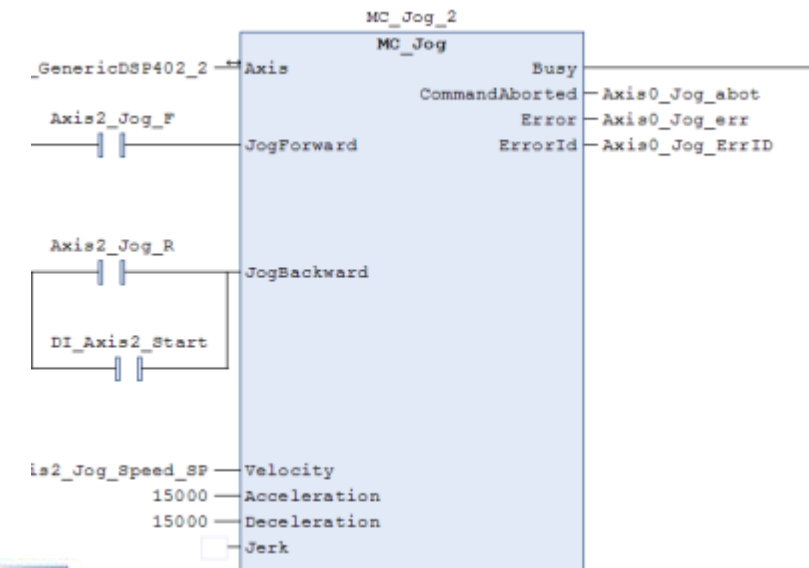
Target with Web HMI Visualization Ready

Jog control

Jog Control Mode with EtherCAT servo motor



Function Block: Jog control



EtherCAT



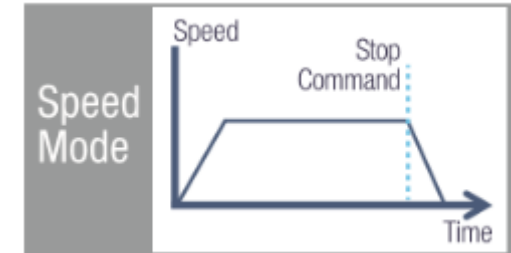
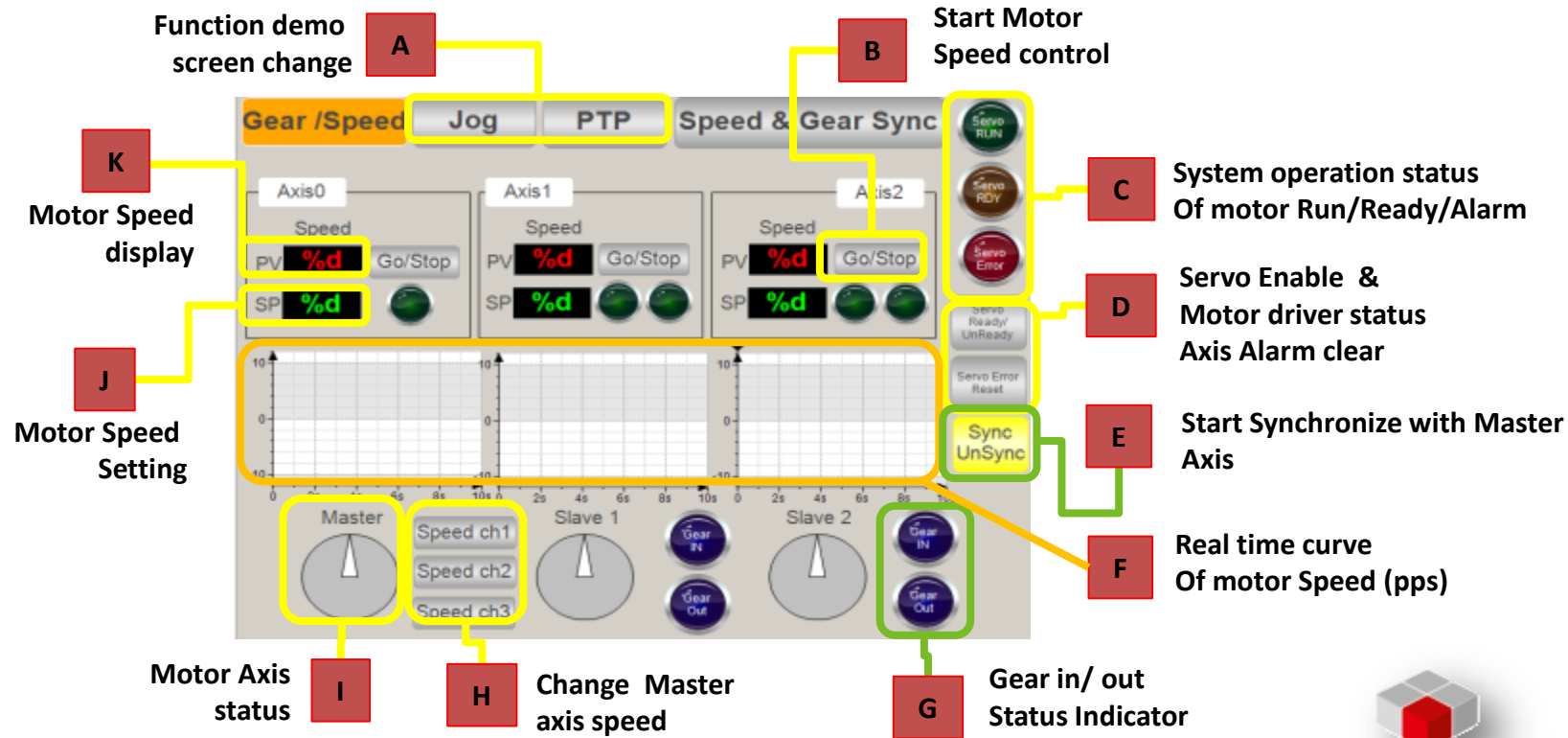
Target with Web HMI Visualization Ready

***Operation Step: use mode 1 of HMI or mode2 dip switch for start motion system control:**

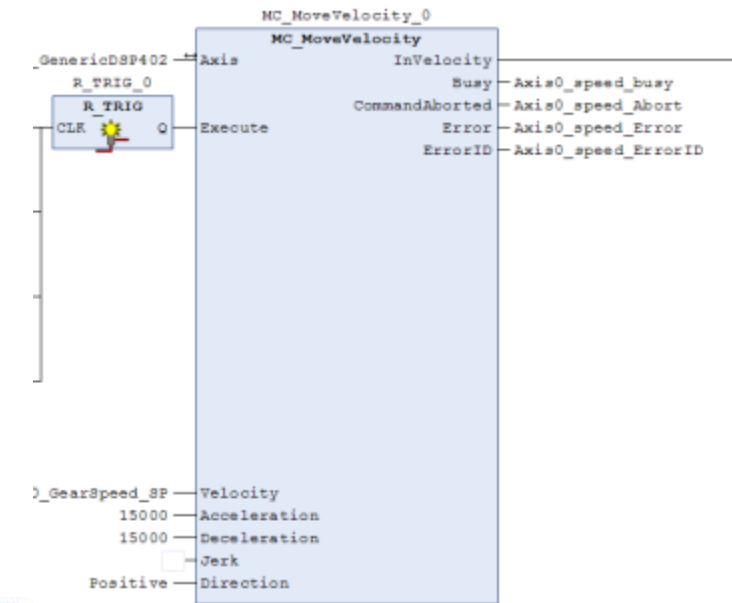
Mode 1= **D** Server ready → **B** Jog control of Forward/Reverse
 Mode 2= Server Enable → Axis 0 Start (toggle switch)

Speed Control

Speed Control with EtherCAT servo motor



Function Block: MoveVelocity



***Operation Step: use mode 1 of HMI or mode2 dip switch for start motion system control:**

Mode 1=		Server ready →		Axis 0,1,2 Speed control
Mode 2=		Server Enable →		Axis 0 Start /Stop(toggle switch)



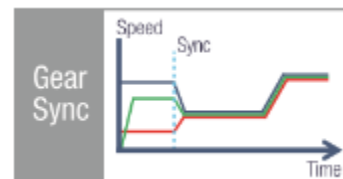
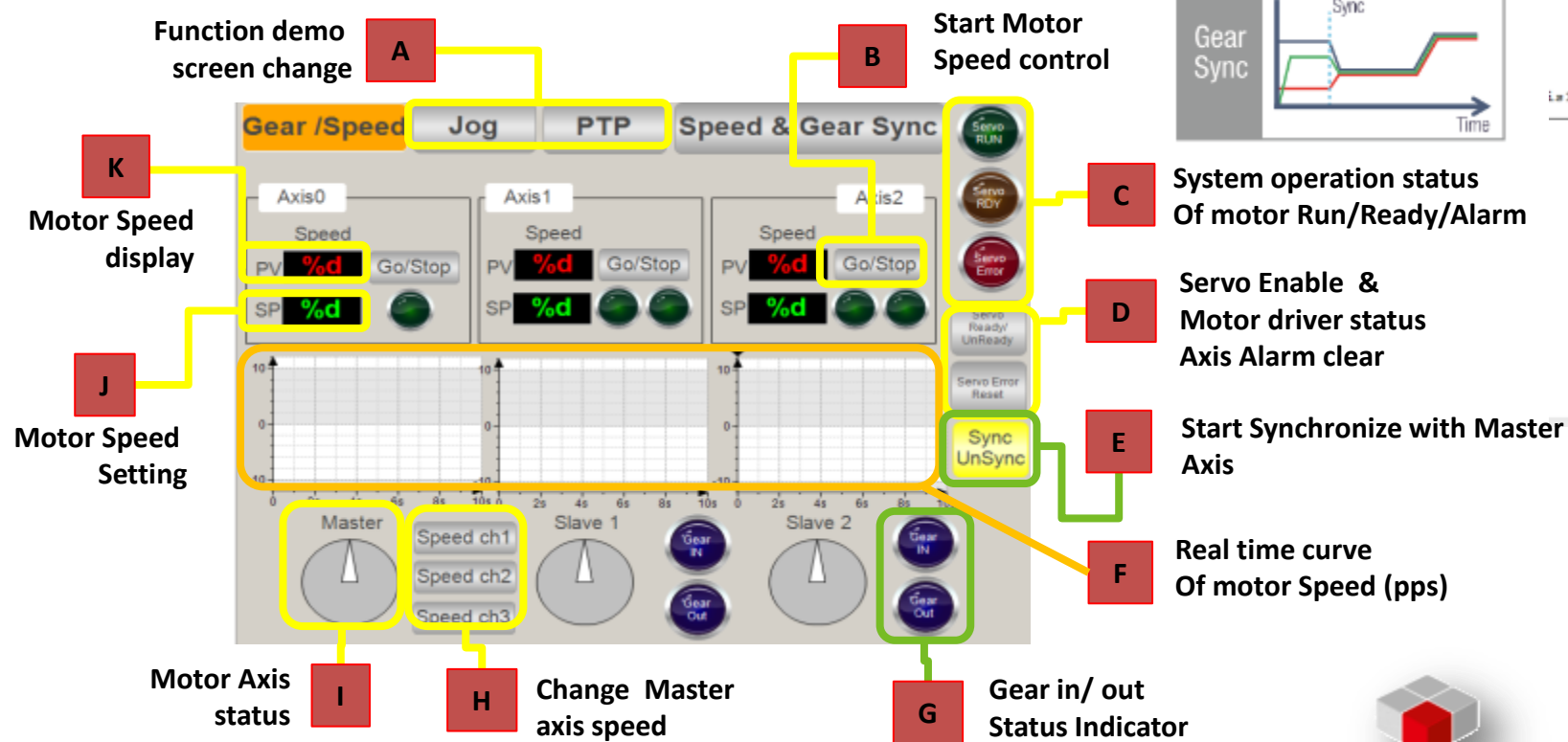
EtherCAT



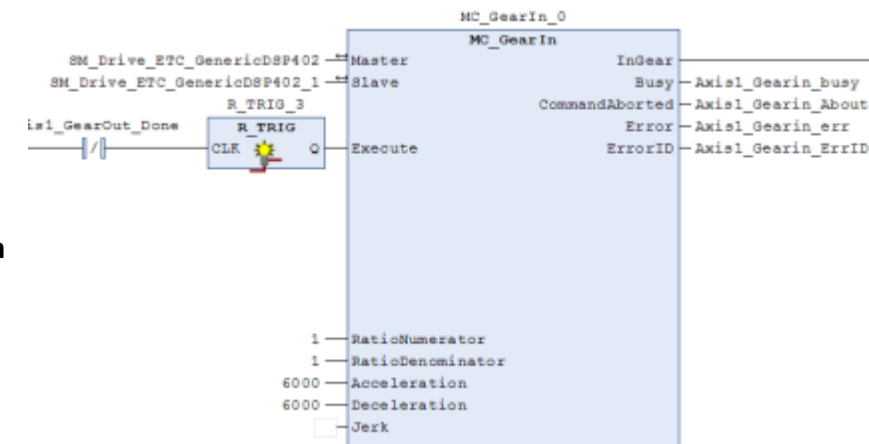
Target with Web HMI Visualization Ready

Gear In/ Out Speed Synchronize

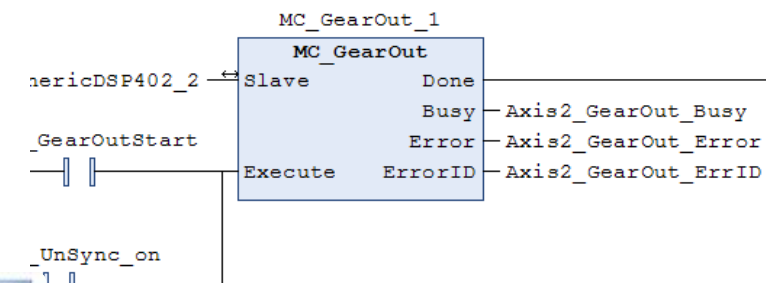
Speed Synchronize Control Gear mode with EtherCAT servo motor



Function Block: Gear in



Function Block: Gear out



***Operation Step: use mode 1 of HMI or mode2 dip switch for start motion system control:**

Mode 1= **E** Start Synchronize **H** Change Master Speed

Mode 2=  Speed Sync/unSync



EtherCAT



Target with Web HMI Visualization Ready

THANK YOU

