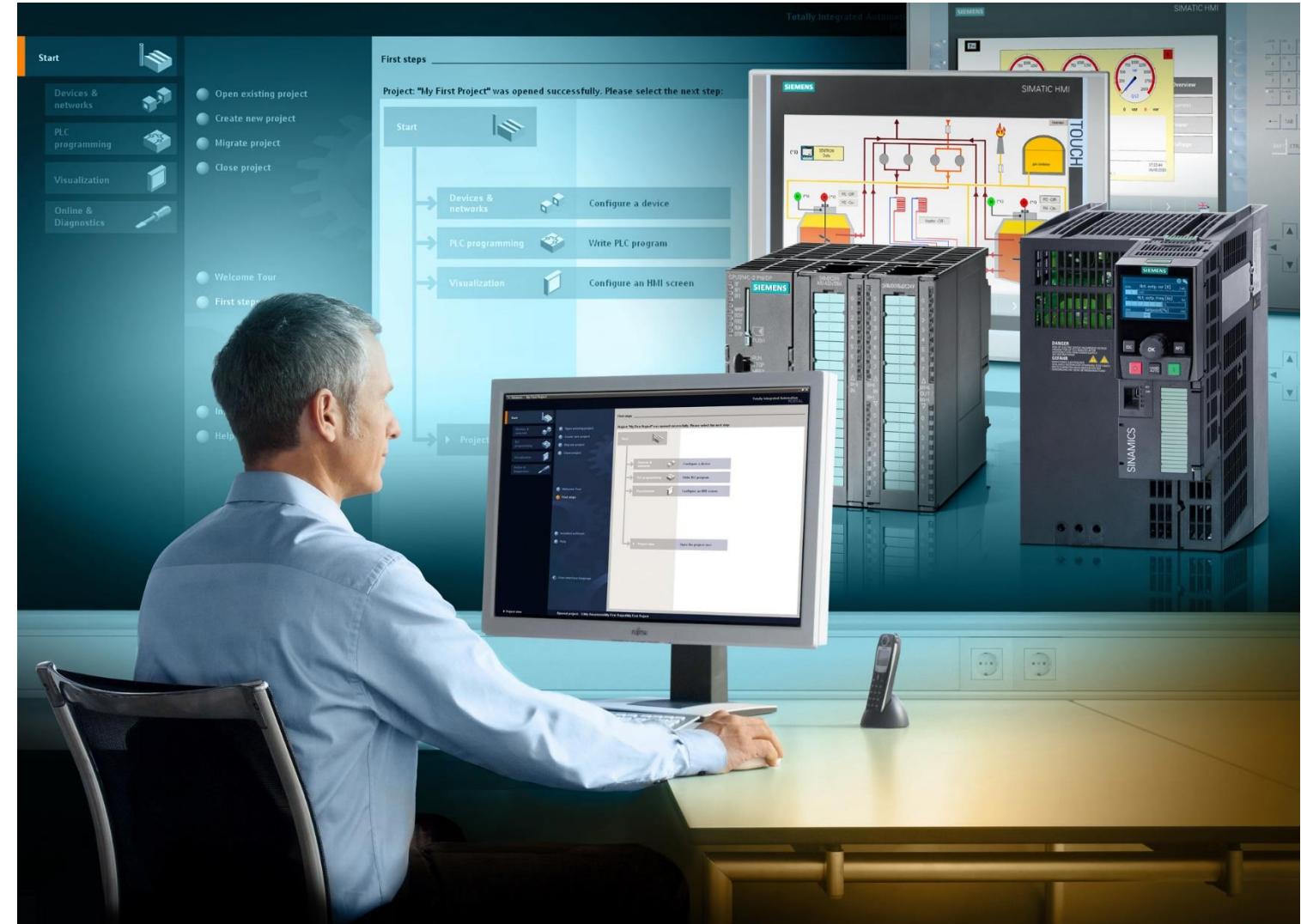


بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِيْمِ

PLC COURSE

LECTURE : 1



AHMAD KHEIRANDISH

Industrial Automation is defined by the Automation Federation as "the creation and application of technology to monitor and control the production and delivery of products and services." **Industrial automation** has produced many of today's technological advances such as computers and cell phones. **Automation** allows the creation of complex applications to become a reality, thus emphasizing its importance.



Importance of AUTOMATION

The **importance of automation** has also been stressed through its number of advantages it has brought to the manufacturing world. **Automation** has helped manufacturers increase their:

- Production rates
- Productivity
- Efficiency with materials
- Product quality
- Worker safety
- Flexibility and convertibility in manufacturing processes
- **Automation** has also helped reduce waste, factory lead times, and production costs. It has allowed manufacturers to produce a broader range of products with the ease of being able to switch from product A to B without having to reconstruct entire production lines. As technology increases, so does the **importance of automation**

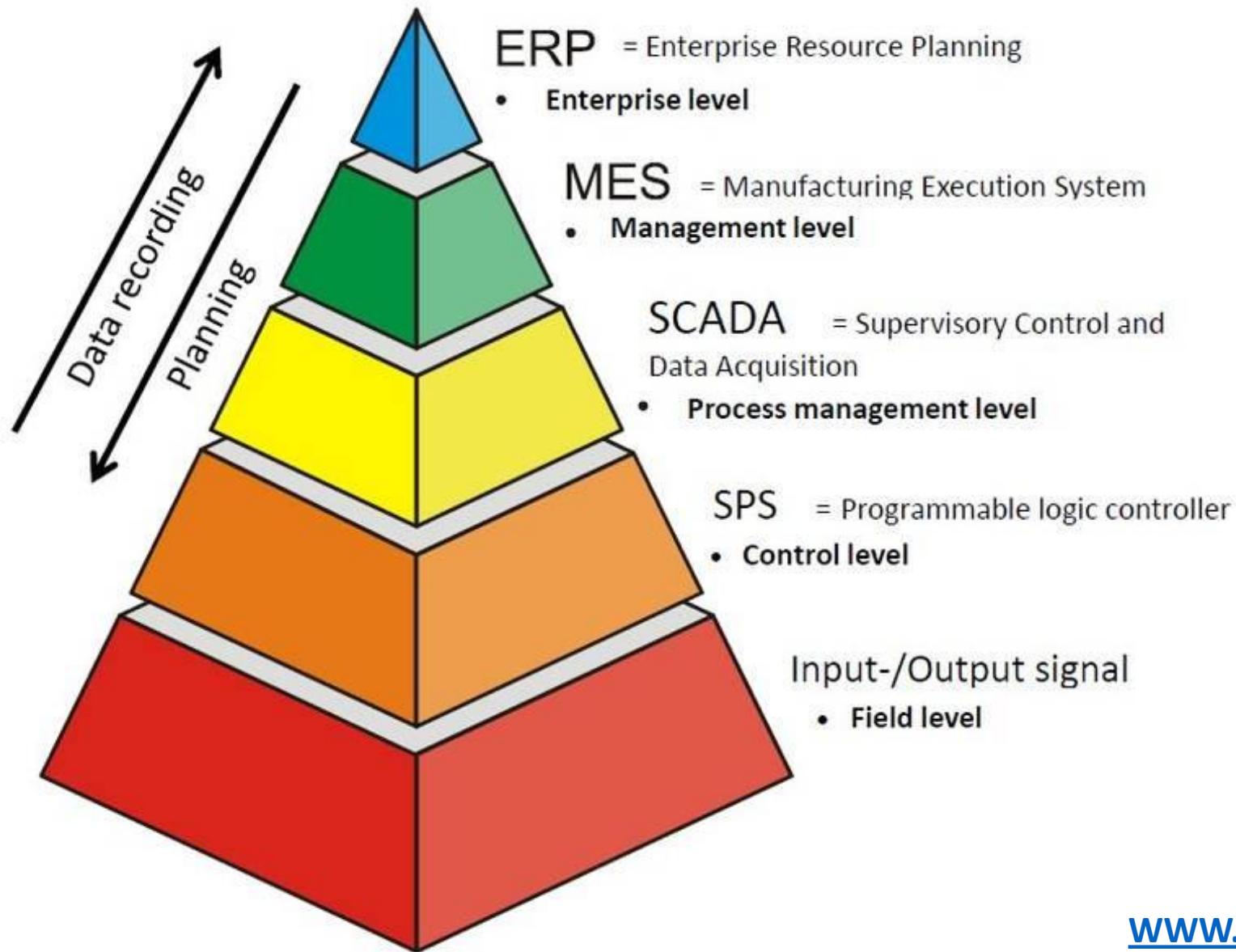


ADVANTAGES OF INDUSTRIAL AUTOMATION :

1. Repeatability
2. Quality Control
3. Waste Reduction
4. Integration with Business Systems
5. Increased Productivity
6. Reduction of Labor Costs
7. Faster Cycle Times
8. Improved Workplace Safety
9. Remaining Competitive in Global Economy
10. ...



AUTOMATION PYRAMID

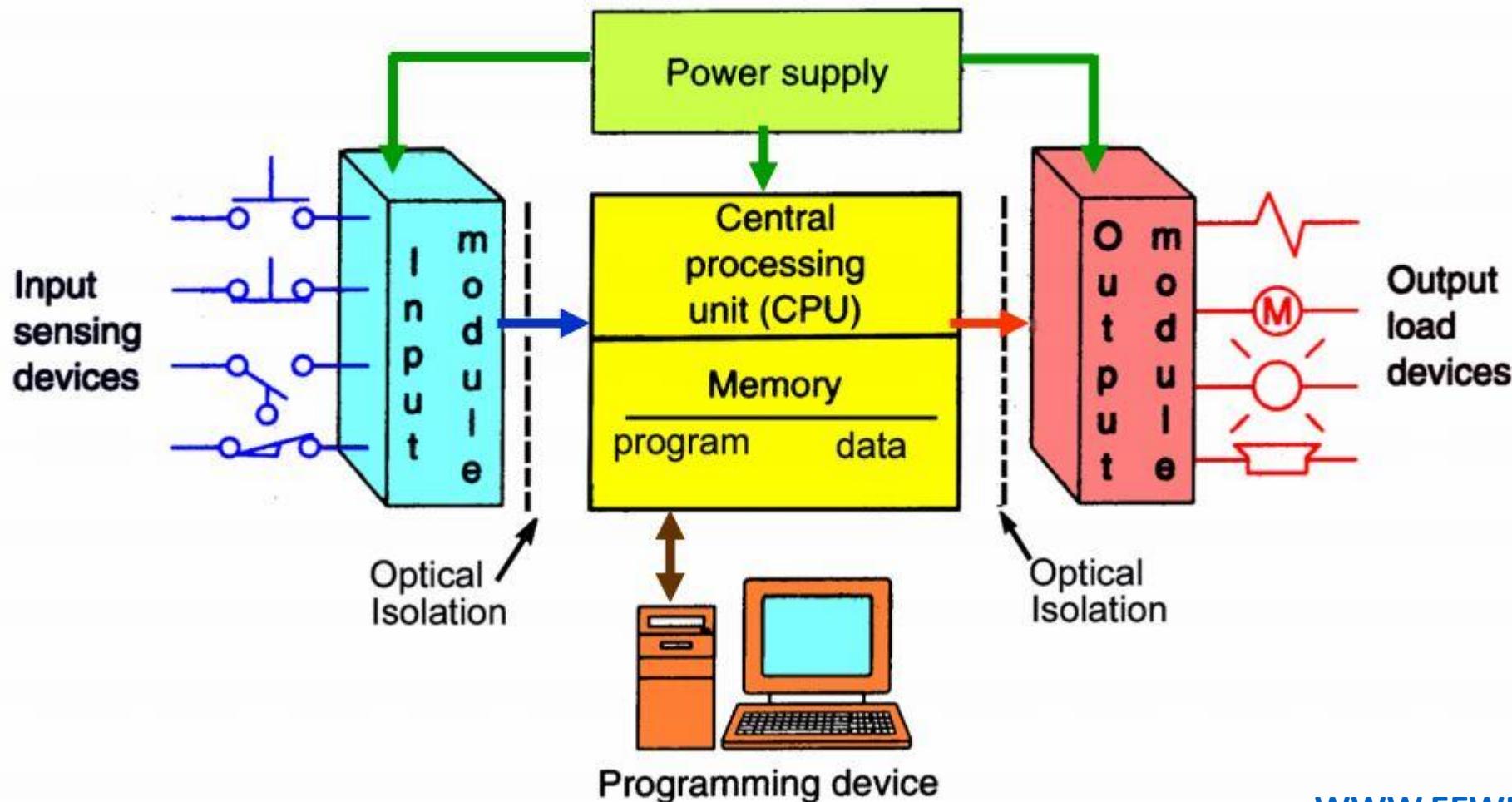


FIELD LEVEL



CONTROL LEVEL

PLC System



PROCESS MANAGEMENT LEVEL



SCADA



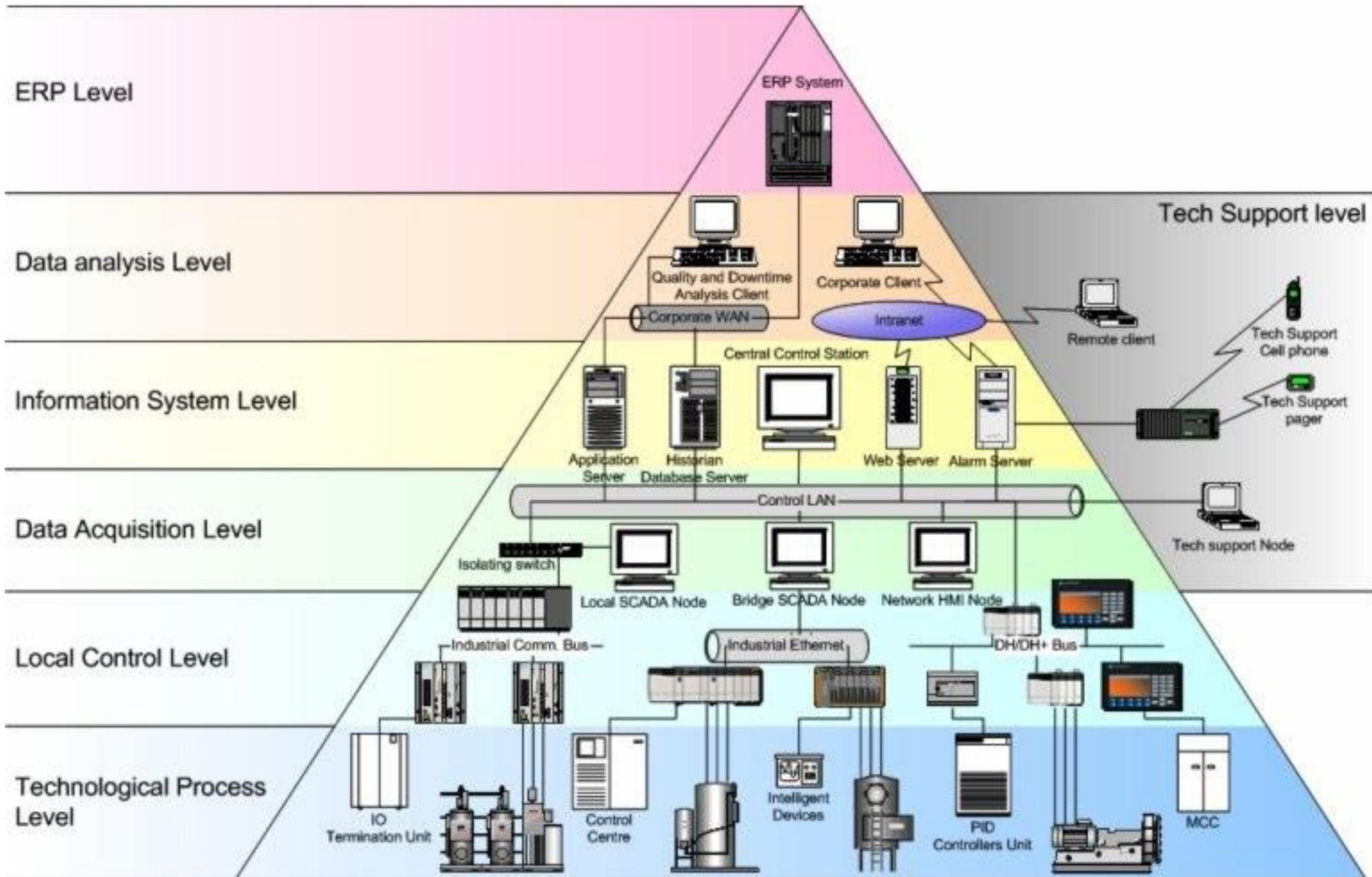


MES



ERP

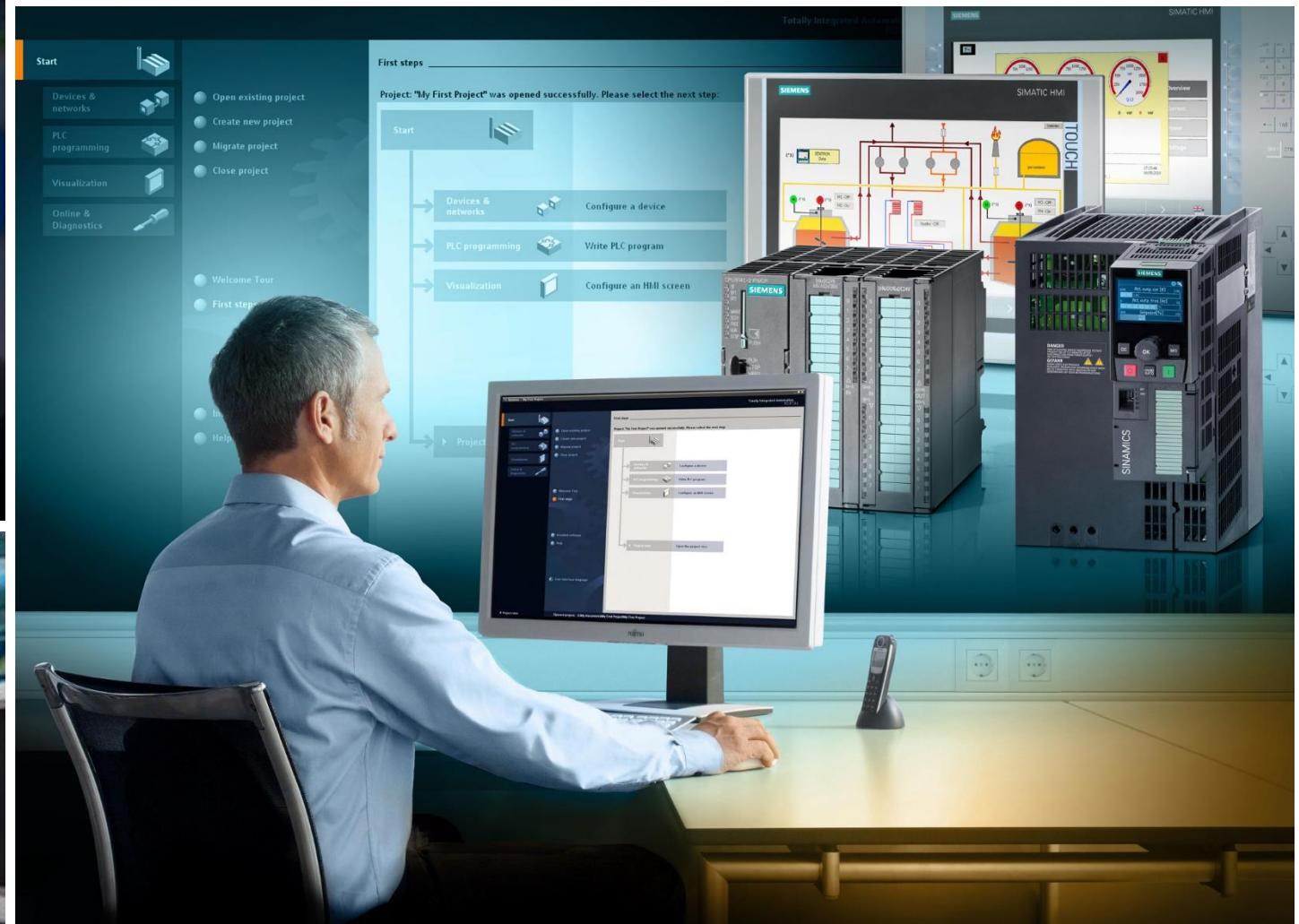
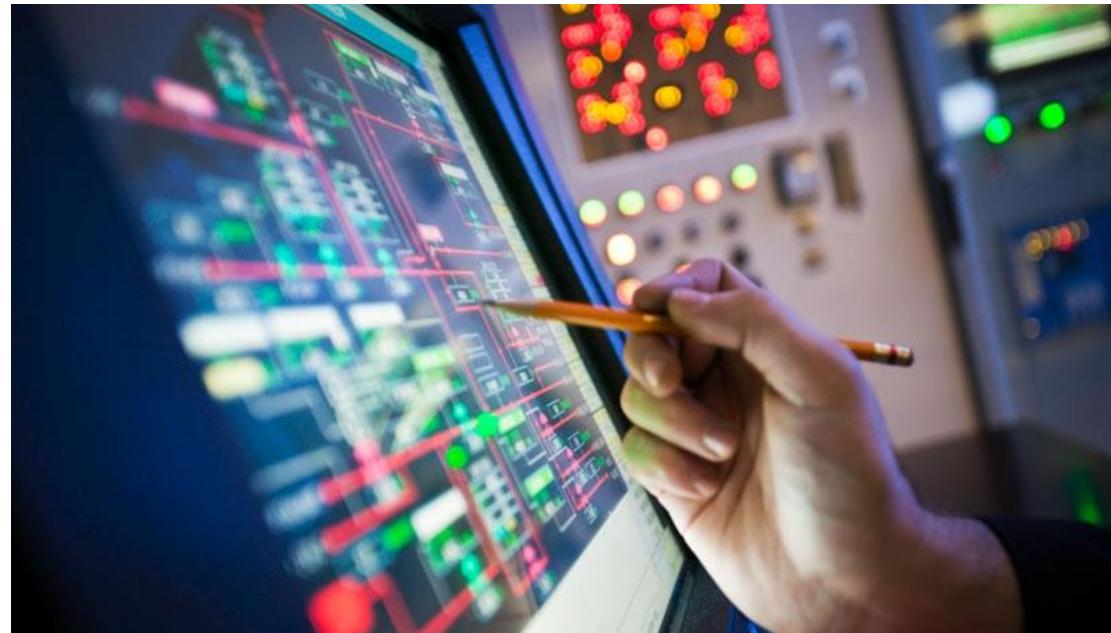




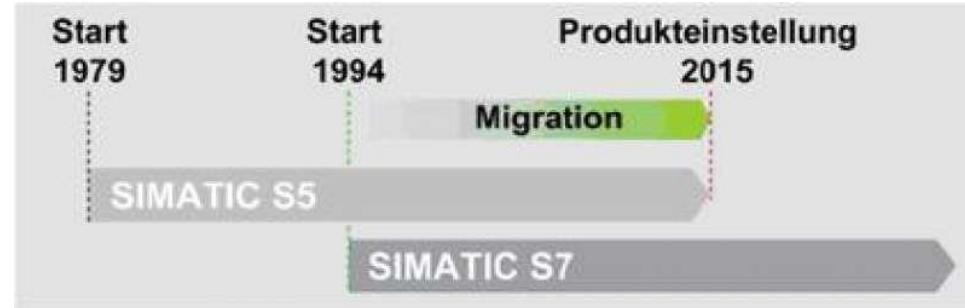
World's Automation Companies

| | | |
|---|--|--|
|  |  |  WONDER SYSTEMS |
| SIEMENS |  Crompton Greaves EVERYDAY SOLUTIONS |  GE FANUC |
|  Allen-Bradley |  CO-TRUST |  LARSEN & TOUBRO It's all about Imagineering |
| ABB | TOSHIBA |  |
|  UNITRONICS |  MITSUBISHI ELECTRIC |  Fuji Electric |
|  DELTA | OMRON® | GEFRAN |
| Kinco Automation |  POWTRAN® |  YASKAWA The Drive for Quality™ |

SIEMENS



Siemens PLC's



S7:

- ✓ **200**
- ✓ **300**
- ✓ **400**
- ✓ **1200**
- ✓ **1500**



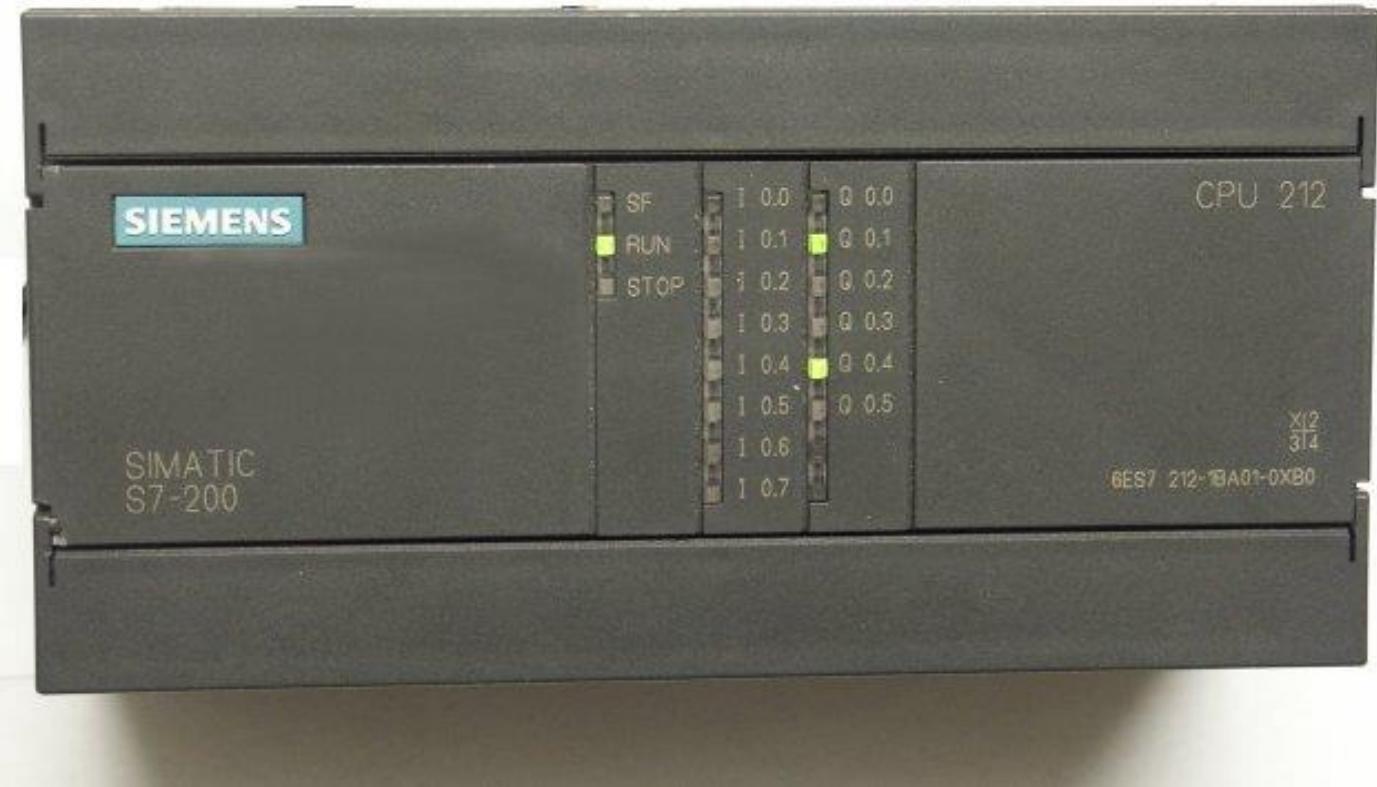
S7 200 & 1200



S7-200

SIMATIC S7-200 Micro PLC is in a class by itself: Exceptionally compact yet remarkably capable – especially with respect to its real-time performance – it is fast, features great communication options, and comes with easy to operate hardware and software. But there's more to it than that: The **SIMATIC S7-200** Micro PLC has a consistently modular design – for customized solutions which are not too large for the present but open-ended enough to be expanded anytime in the future.

All this makes the **SIMATIC S7-200 Micro PLC** a highly effective and economical solution for automated control in the compact performance range.





Features of S7-200 CPU's

Features:

| | CPU 221 | CPU 222 | CPU 224 | CPU 226 | CPU 226XM |
|-----------------------------|-------------|-------------|-------------|-------------|-------------|
| Integral inputs/outputs | 6DE/4DA | 8DE/6DA | 14DE/10DA | 24DE/16DA | 24DE/16DA |
| Max. expansion modules | - | 2 | 7 | 7 | 7 |
| Max. inputs and outputs | 10 | 78 | 168 | 248 | 248 |
| Analog channels (I/O/max) | - | 8/4/10 | 28/14/35 | 28/14/35 | 28/14/35 |
| Program data memory | 4KB/2KB | 4KB/2KB | 8KB/5KB | 8KB/5KB | 16KB/10KB |
| Execution time | 0,37 µs |
| Memory bits/counters/timers | 256/256/256 | 256/256/256 | 256/256/256 | 256/256/256 | 256/256/256 |
| High-speed counters | 4 x 30 kHz | 4 x 30 kHz | 6 x 30 kHz | 6 x 30 kHz | 6 x 30 kHz |
| Real-time clock | Optional | Optional | Integrate | Integrate | Integrate |
| Pulse outputs | 2 x 20 kHz |
| Comms. interface | 1x RS-485 | 1x RS-485 | 1x RS-485 | 2x RS-485 | 2x RS-485 |
| Analog potentiometer | 1 | 1 | 2 | 2 | 2 |

S7-1200

Simatic S7-1200 is the latest member of Siemens mini-controller family. Its main feature is perfect interaction with both the new Simatic HMI Basic Panels and the engineering system. The programming, project planning and commissioning software is a totally integrated system, which sets whole new standards in engineering. In developing this controller, special attention was paid to its seamless integration and perfect interaction between controller, HMI and software. The new Simatic Step 7 Basic engineering system enables fully integrated engineering for both Simatic controllers and Simatic HMI Basic Panels. Task-oriented and intuitive editors in Simatic Step 7 Basic V13 provide a unique degree of user-friendliness and high engineering efficiency.



S7-1200 Overview

- The new modular miniature controller from the SIMATIC S7 family
- Comprising:
 - Controller with integrated PROFINET IO controller interface for communication between SIMATIC controllers, HMI, programming device or other automation components
 - Communication module with PROFIBUS DP master interface
 - Communication module PROFIBUS DP slave interface
 - GPRS module for connection to GSM/G mobile phone networks
 - Integrated web server with standard and user-specific web pages
 - Data logging functionality for archiving of data at runtime from the user program
 - Powerful, integrated technology functions such as counting, measuring, closed-loop control, and motion control
 - Integrated digital and analog inputs/outputs
 - Signal boards for direct use in a controller
 - Signal modules for expansion of controllers by input/output channels
 - Communication modules for expansion of controllers with additional communications interfaces
 - Accessories, e.g. power supply, switch module or SIMATIC Memory Card
- The miniature controller that offers maximum automation at minimum cost.
- Extremely simple installation, programming and operation.
- Large-scale integration, space-saving, powerful.
- Suitable for small to medium-size automation engineering applications.
- Can be used both for simple controls and for complex automation tasks.
- All CPUs can be used in stand-alone mode, in networks and within distributed structures.
- Suitable for applications where programmable controllers would not have been economically viable in the past.
- With exceptional real-time performance and powerful communication options.

| Feature | CPU 1211C | CPU 1212C | CPU 1214C |
|--------------------------------|--|-------------------------------|-------------------------------|
| Physical size (mm) | 90 x 100 x 75 | 90 x 100 x 75 | 110 x 100 x 75 |
| User memory | | | |
| • Work memory | • 25 Kbytes | • 25 Kbytes | • 50 Kbytes |
| • Load memory | • 1 Mbyte | • 1 Mbyte | • 2 Mbytes |
| • Retentive memory | • 2 Kbytes | • 2 Kbytes | • 2 Kbytes |
| Local on-board I/O | | | |
| • Digital | • 6 inputs 4 outputs | • 8 inputs 6 outputs | • 14 inputs 10 outputs |
| • Analog | • 2 inputs | • 2 inputs | • 2 inputs |
| Process image size | | | |
| • Inputs | • 1024 bytes | • 1024 bytes | • 1024 bytes |
| • Outputs | • 1024 bytes | • 1024 bytes | • 1024 bytes |
| Bit memory (M) | 4096 bytes | 4096 bytes | 8192 bytes |
| Signal modules expansion | None | 2 | 8 |
| Signal board | 1 | 1 | 1 |
| Communication modules | 3 | 3 | 3 |
| High-speed counters | 3 | 4 | 6 |
| • Single phase | • 3 at 100 kHz | • 3 at 100 kHz 1 at 30 kHz | • 3 at 100 kHz 3 at 30 kHz |
| • Quadrature phase | • 3 at 80 kHz | • 3 at 80 kHz 1 at 20 kHz | • 3 at 80 kHz 3 at 20 kHz |
| Pulse outputs ¹ | 2 | 2 | 2 |
| Memory card (optional) | Yes | Yes | Yes |
| Real time clock retention time | 10 days, typical / 6 day minimum at 40 degrees C | | |
| Real math execution speed | 18 µs/instruction | | |
| Boolean execution speed | 0.1 µs/instruction | | |

¹ Only the DC output (non-relay) CPUs support the pulse outputs.

The different CPU models provide a diversity of features and capabilities that help you create effective solutions for your varied applications. For detailed information about a specific CPU, see the technical specifications (Page 99).

S7-300



S7-300

A graded CPU range with a wide performance range is available for configuring the controller. The product range comprises 7 standard CPUs, 7 compact CPUs, 5 fail-safe CPUs and 3 technology CPUs. The CPUs are available from a width of only 40 mm.

- Particularly in the finishing technique the S7-300 is used in the following industries:
- Automobile industry
- General mechanical engineering
- Building of special machines
- Series mechanical engineering, OEM
- Plastics processing
- Packaging industry
- Food and Beverage industry
- Process engineering
- Fast counting/fairs with direct access on the hardware counters
- Simply positioning with direct control the MICROMASTER frequency static frequency changers
- PID-Regulation with integrated functional module



S7-400



S7-400

- The S7-400 is especially suitable for data-intensive tasks in the process industry. High processing speeds and deterministic response times guarantee short machine cycle times on high-speed machines in the manufacturing industry.
- The S7-400 is used preferably to coordinate overall plants and to control lower-level systems. This is guaranteed by the high communication power and the integral interfaces.
- Many of the S7-400 components are also available in a [SIPLUS version](#) for extreme environmental conditions.



S7-400

- The power of the S7-400 is scalable thanks to a graded range of CPUs; the capacity for I/O is almost unlimited.
- The power reserves of the CPUs enable new functions to be integrated without further hardware investment, e.g. processing of quality data, user-friendly diagnosis, integration into higher-level MES solutions or high-speed communication via bus systems.
- The S7-400 can be structured in a modular way; there is a widely varied range of modules available both for centralized configurations and distributed structures. This results in very cost-effective spare parts handling.
- The configuration of the distributed I/O of the S7-400 can be modified during operation (Configuration in Run). In addition signal modules can be removed and inserted while live (hot swapping). This makes it very easy to expand the system or replace modules in the event of a fault.
- The storage of the complete project data including symbols and comments on the CPU simplifies service and maintenance calls.
- Safety engineering and standard automation can be integrated into a single S7-400 controller; plant availability can be increased through the redundant structure of the S7-400.
- Many of the S7-400 components are also available in a SIPLUS version for external environmental conditions, e.g. extended temperature range (-25 +60°C) and for use where there is aggressive atmosphere/condensation.
- The high-speed backplane bus of S7-400 ensures efficient linking of central I/O modules

S7-1500



S7-1500

Performance

- Fast, faster, SIMATIC S7-1500: The exceptional system performance allows for extremely fast response times for optimal control quality and highest system performance.

Processing Speed

- SIMATIC S7-1500 provides even faster signal processing for shorter response times and higher productivity.

High-Speed backplane bus

The new backplane bus with a high baud rate and efficient transmission protocol yields the crucial performance advantage for fast signal processing.

Communication

- SIMATIC S7-1500 has up to 3 PROFINET ports.
- Two ports with identical IP addresses for field level communication and
- a third one with its own IP address for integration into the company network.
- PROFINET IRT allows defined response times and highly precise plant behavior.

S7-1500

Integrated Webserver

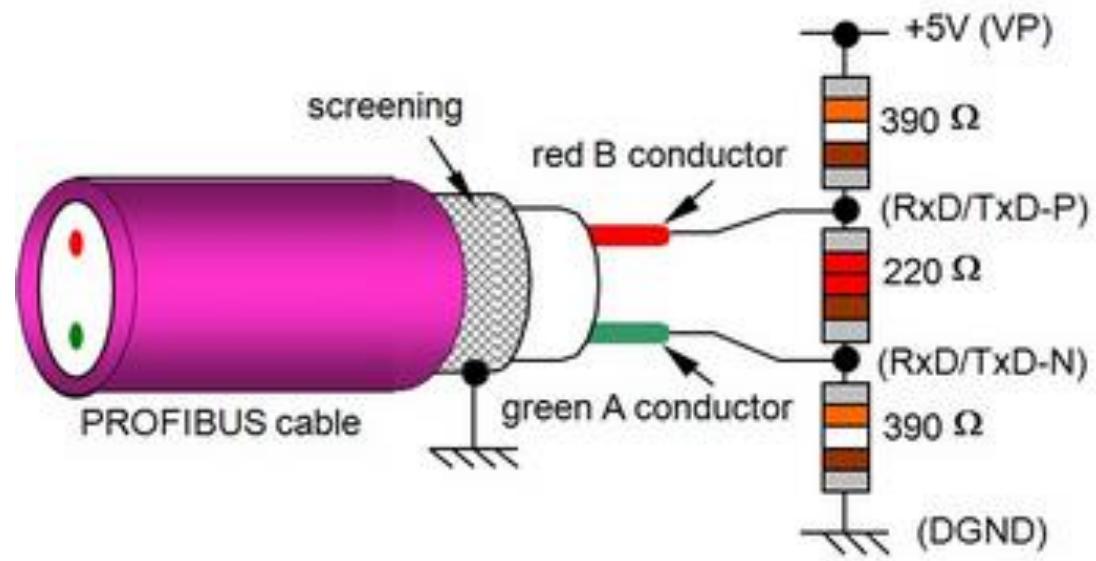
CPU status requests are performed over a standard Internet browser, independent of location. Process variables displayed in graphics form and user-defined websites facilitate the acquisition of information.



Industrial Network



PROFIBUS



PROFINET





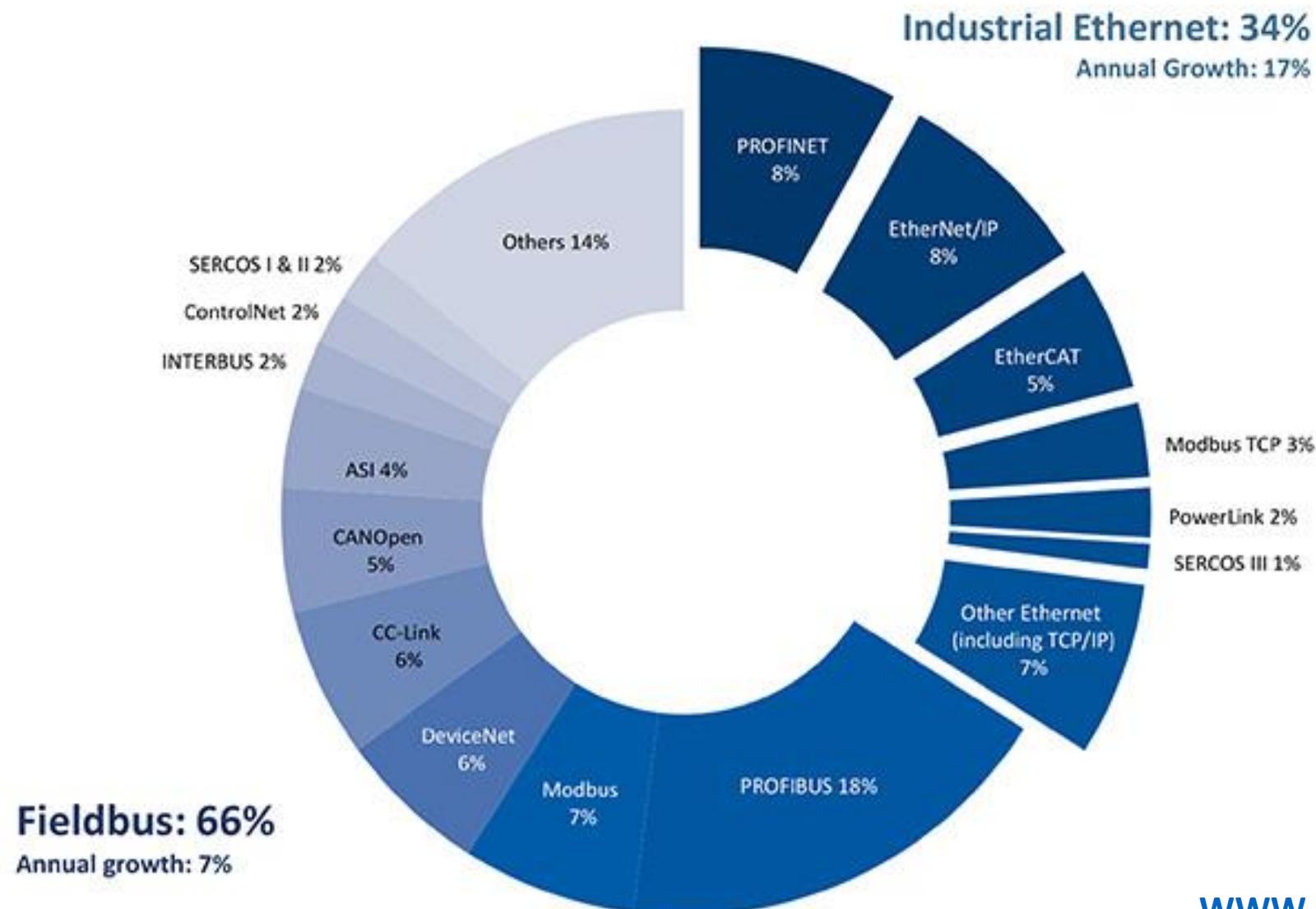
MPI



MODBUS



Fieldbus vs. Industrial Ethernet



PLC'S MODULES

PS → POWER SUPPLY

IM → INTERFACE MODULE

SM → SIGNAL MODULE

FM → FUNCTION MODULE

CP → COMMUNICATION PROCESSOR

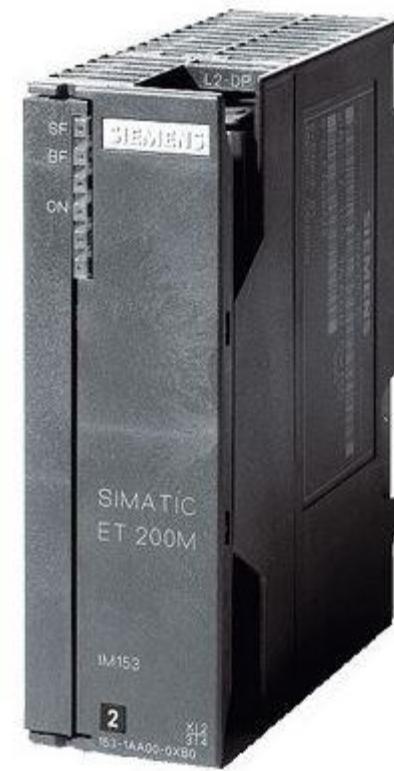
PS

2 - 5 - 10 A



IM

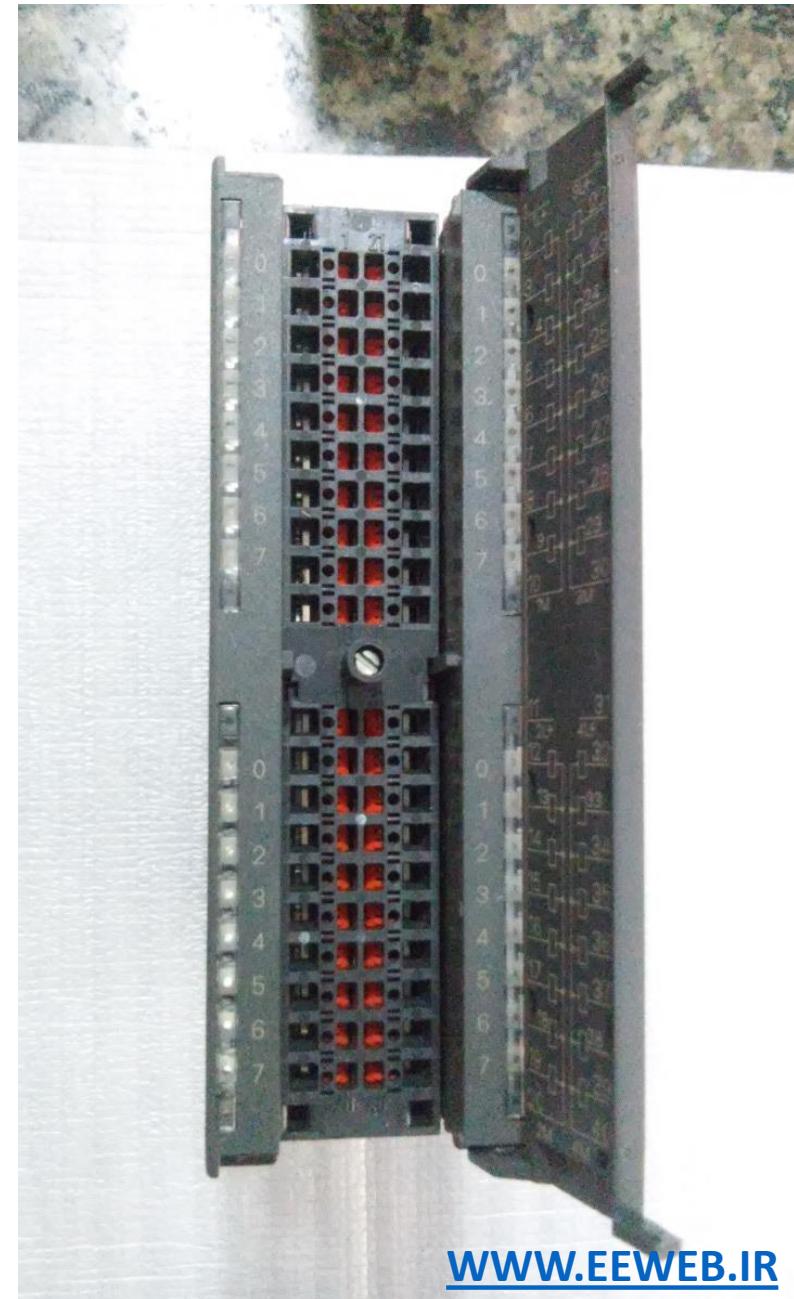
ET 200



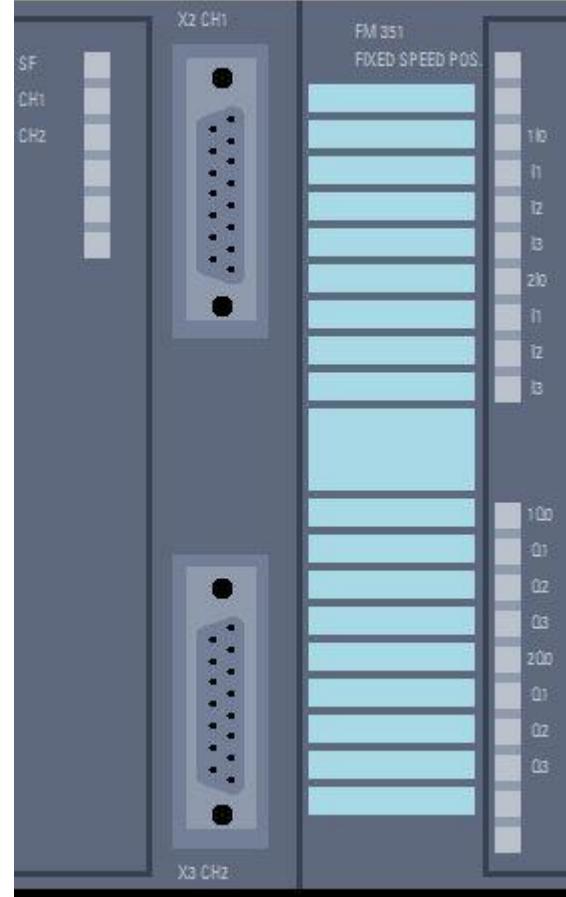
SM



SM



FM



CP

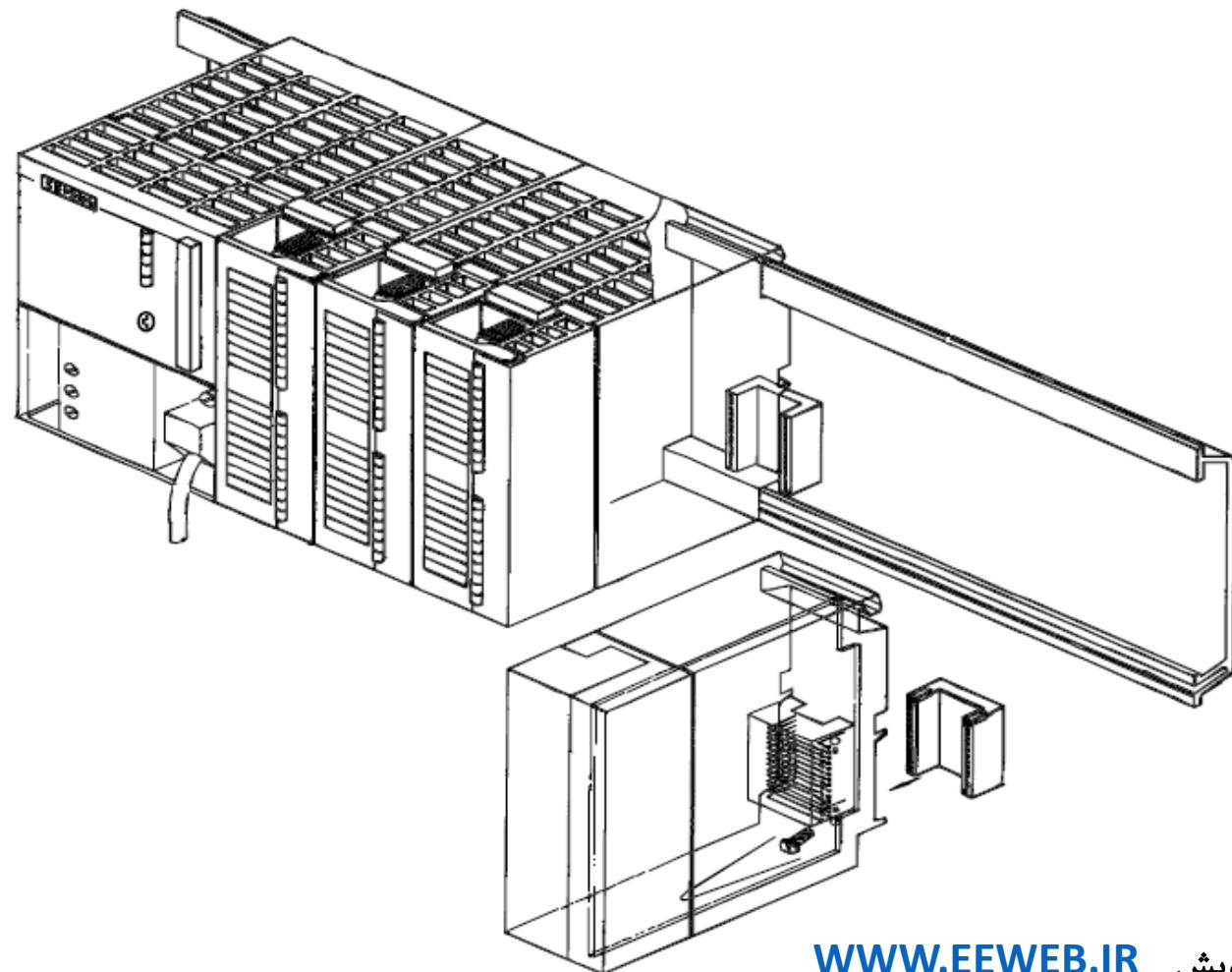


OTHER MODULES

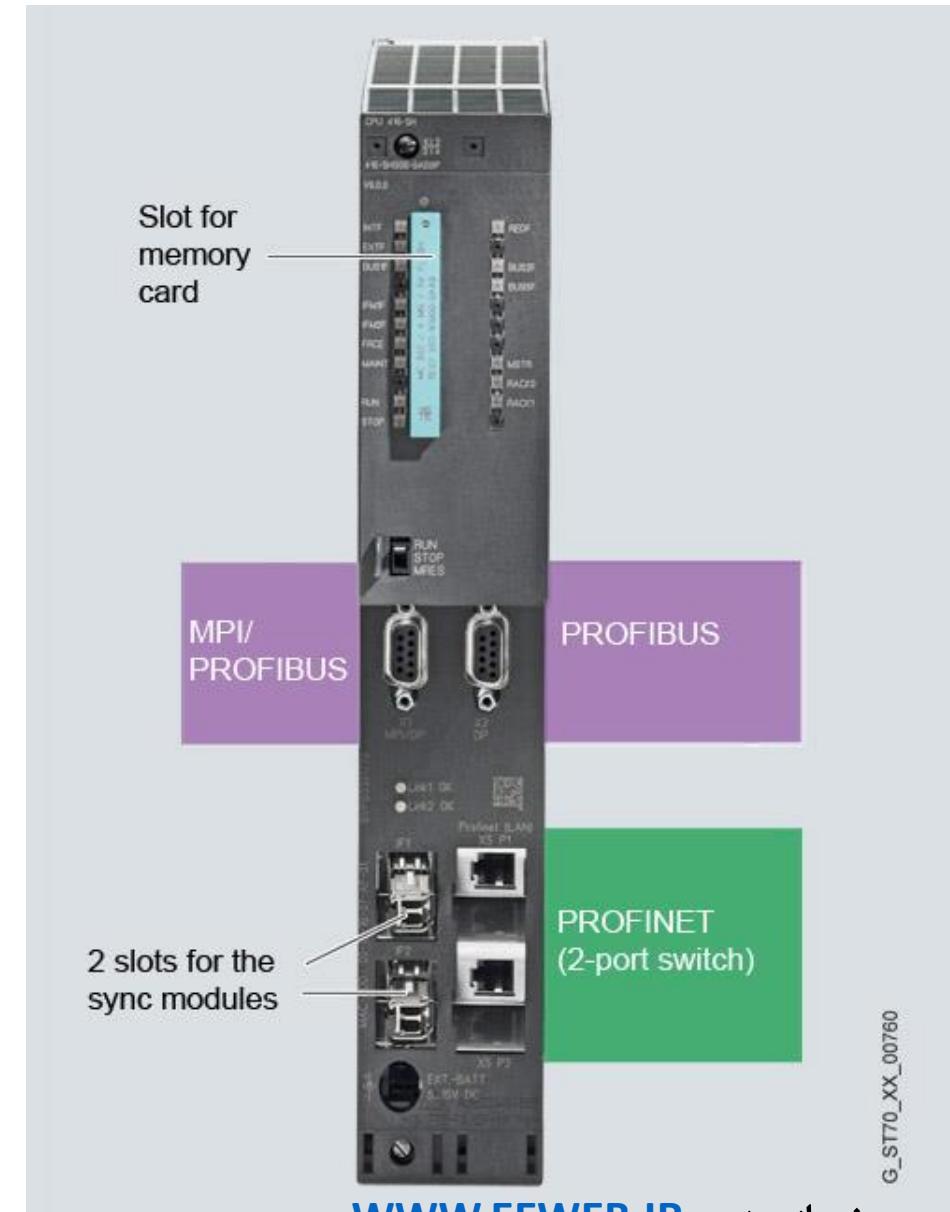


BUS CONNECTOR

S7-300™



OTHER MODULES





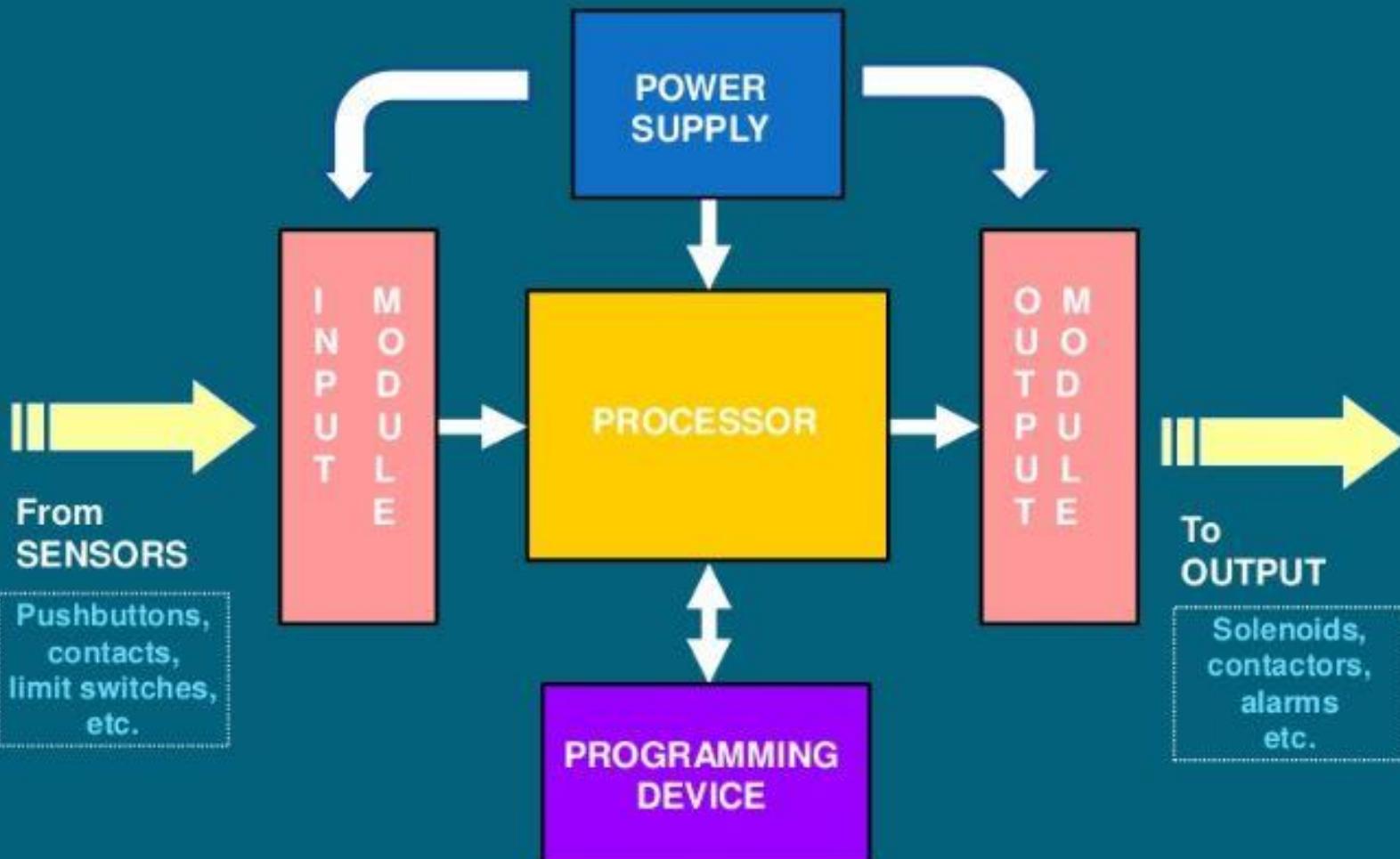
A **programmable logic controller**, **PLC**, or **programmable controller** is a digital computer used for automation of typically industrial electromechanical processes, such as control of machinery on factory assembly lines, amusement rides, or light fixtures. PLCs are used in many machines, in many industries.

PLC PROGRAMMING LANGUAGE IN SIEMENCE AUTOMATION;

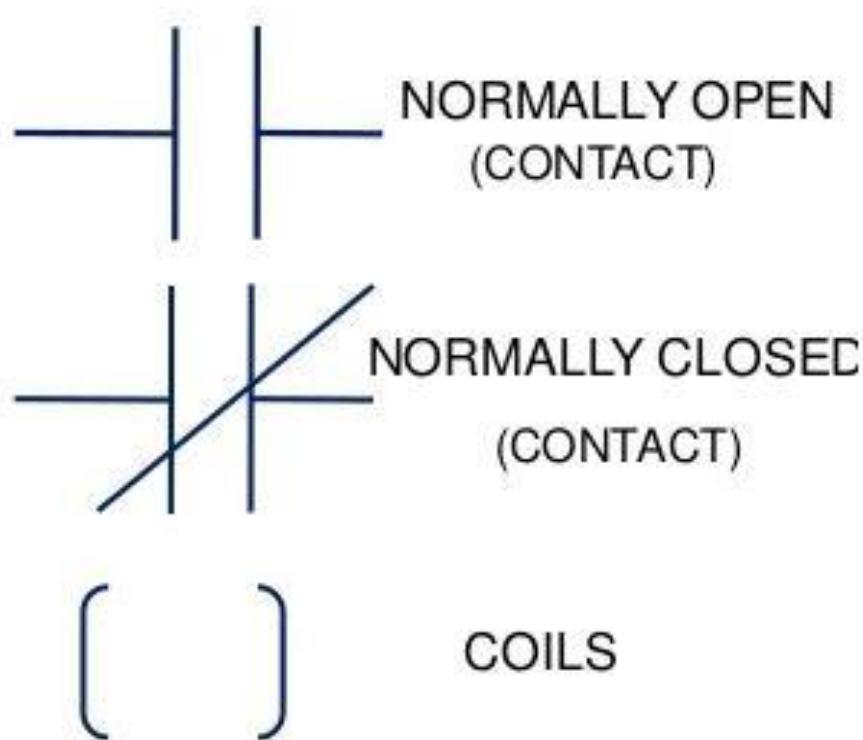
LAD / **FBD** / **STL** / **GRAPH** / **SCL**

... / **IL** → Instruction List

Major Components of a Common PLC



LAD→LADDER

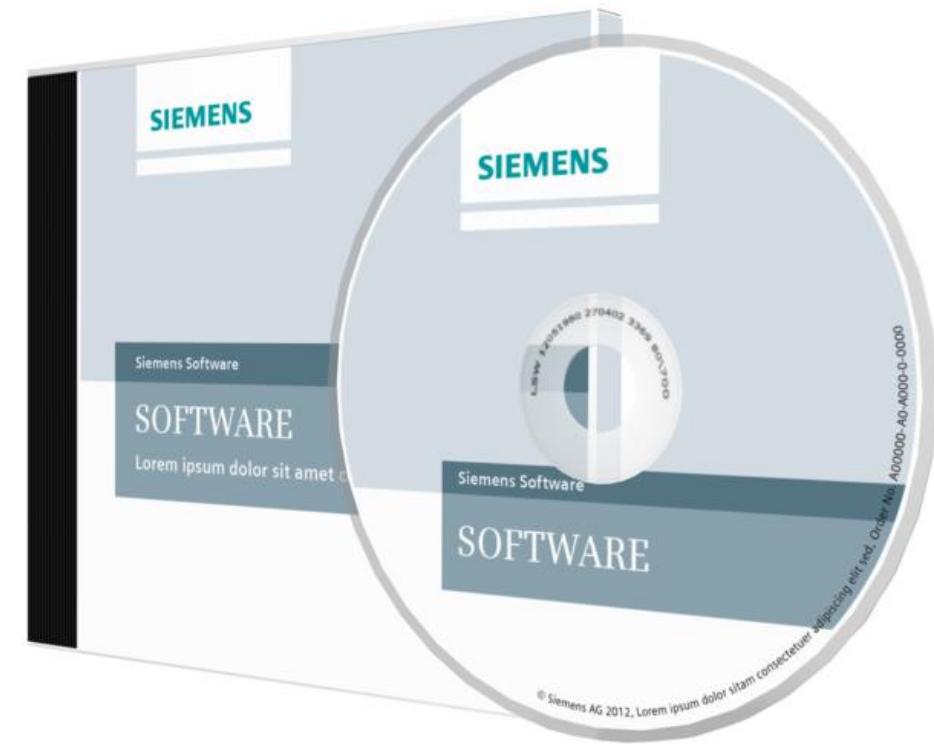


TOTALLY INTEGRATION AUTOMATION

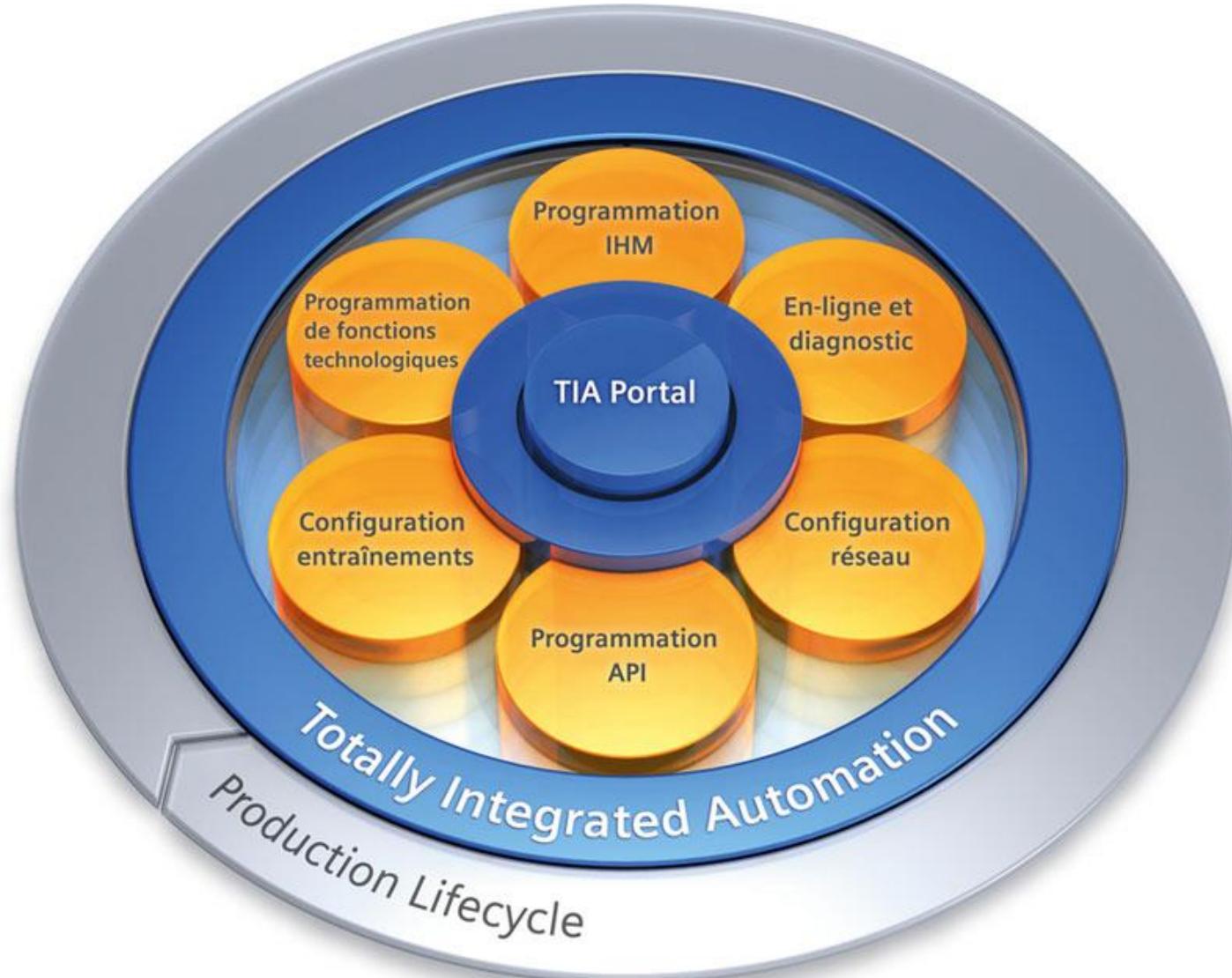
SIEMENS

Totally Integrated Automation
PORTAL V13

© Siemens AG, 2008-2014



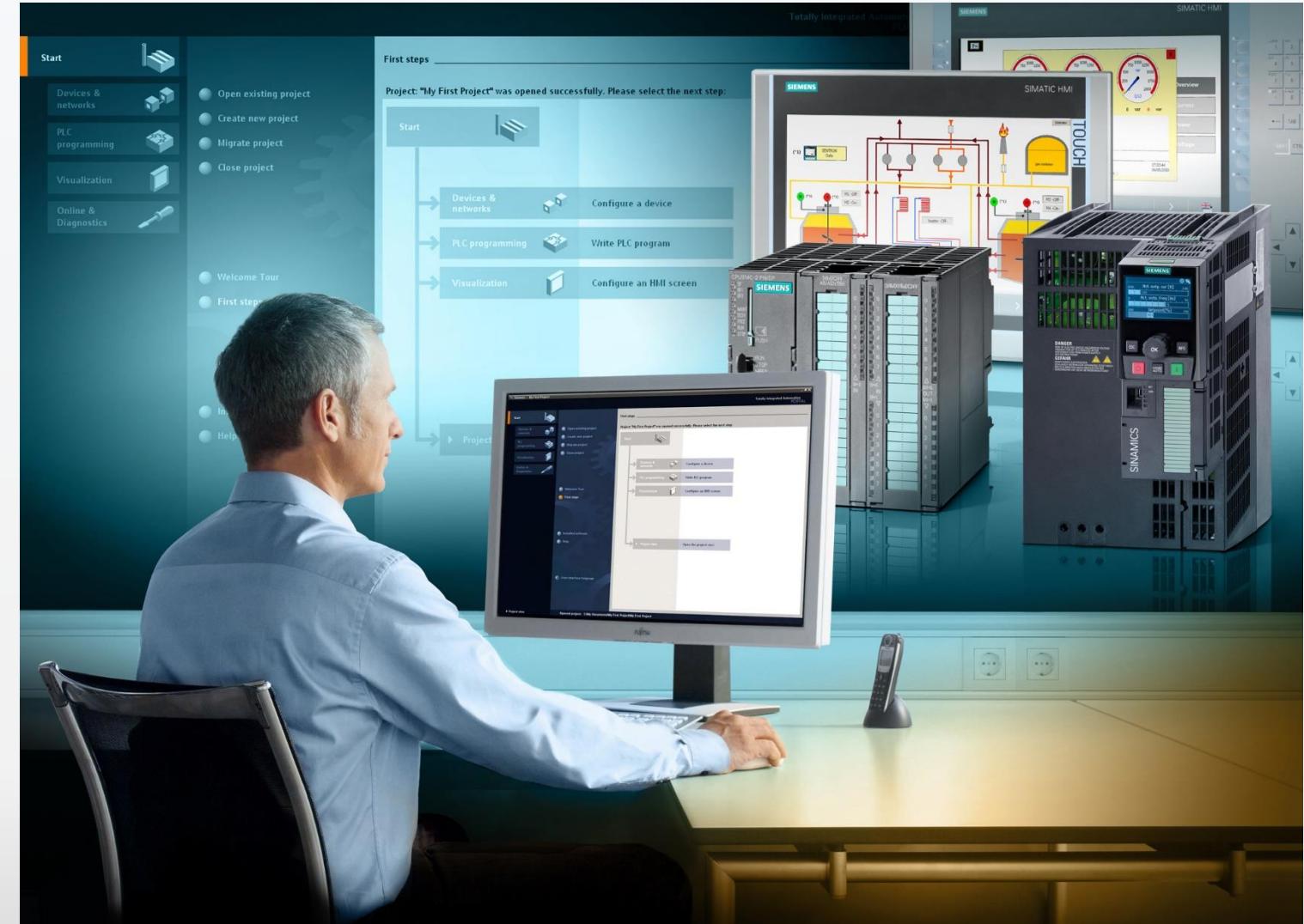
TIA v13



بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِيْمِ

PLC COURSE

LECTURE : 2



AHMAD KHEIRANDISH

Modules Placement

PS

CPU

JM

SM

...



SIEMENS

Totally Integrated Automation
PORTAL V13

Start

Devices &
networksPLC
programmingMotion &
technology

Visualization

Online &
Diagnostics**Open existing project****Create new project****Migrate project****Close project****Welcome Tour****First steps****Installed software****Help****User interface language****Open existing project****Recently used**

| Project | Path | Last change |
|-----------------------------|--|----------------------|
| Project1 | C:\Users\AHMAD\Desktop\Project1 | 2/26/2016 10:24:5... |
| V20_at_S7-1200_USS_proj_V13 | C:\Users\AHMAD\Desktop\V20_at_S7-1200_USS_proj_V13 | |
| Project9 | C:\Users\AHMAD\Desktop\PLC_Project\Project9 | |
| Project8 | C:\Users\AHMAD\Desktop\PLC_Project\Project8 | |
| SCL-1 | C:\Users\AHMAD\Desktop\PLC_Project\SCL-1 | |
| Project7 | C:\Users\AHMAD\Desktop\PLC_Project\Project7 | |
| Project6 | C:\Users\AHMAD\Desktop\PLC_Project\Project6 | |
| Project5 | C:\Users\AHMAD\Desktop\PLC_Project\Project5 | |
| Project4 | C:\Users\AHMAD\Desktop\PLC_Project\Project4 | |
| 1 | C:\Users\AHMAD\Desktop\PLC_Project1 | |
| Project2 | C:\Users\AHMAD\Desktop\PLC_Project\Project2 | |
| Project3 | C:\Users\AHMAD\Desktop\PLC_Project\Project3 | |
| EXAMPLE | C:\Users\AHMAD\Desktop\PLC_Project\EXAMPLE | |
| test y1 | C:\Users\AHMAD\Desktop\PLC_Project\test y1 | |

Browse**Open**

Start

Devices &
networksPLC
programmingMotion &
technology

Visualization

Online &
Diagnostics

Open existing project

Create new project

Migrate project

Close project

Welcome Tour

First steps

Installed software

Help

User interface language

Create new project

Project name:

Project2

Path:

C:\Users\AHMAD\Desktop

Author:

AHMAD

Comment:

Create

Start

Devices &
networksPLC
programmingMotion &
technology

Visualization

Online &
Diagnostics

Open existing project

Create new project

Migrate project

Close project

Welcome Tour

First steps

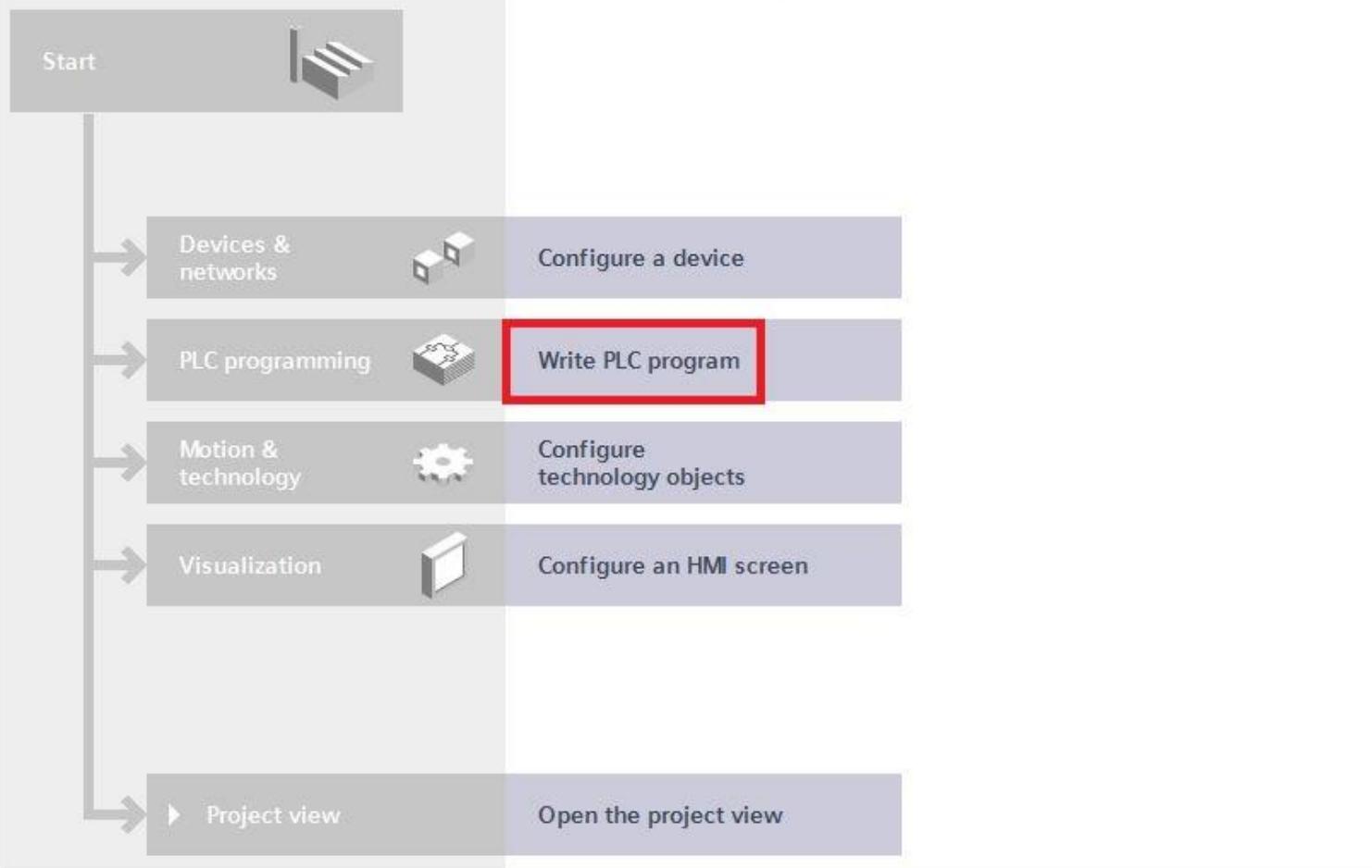
Installed software

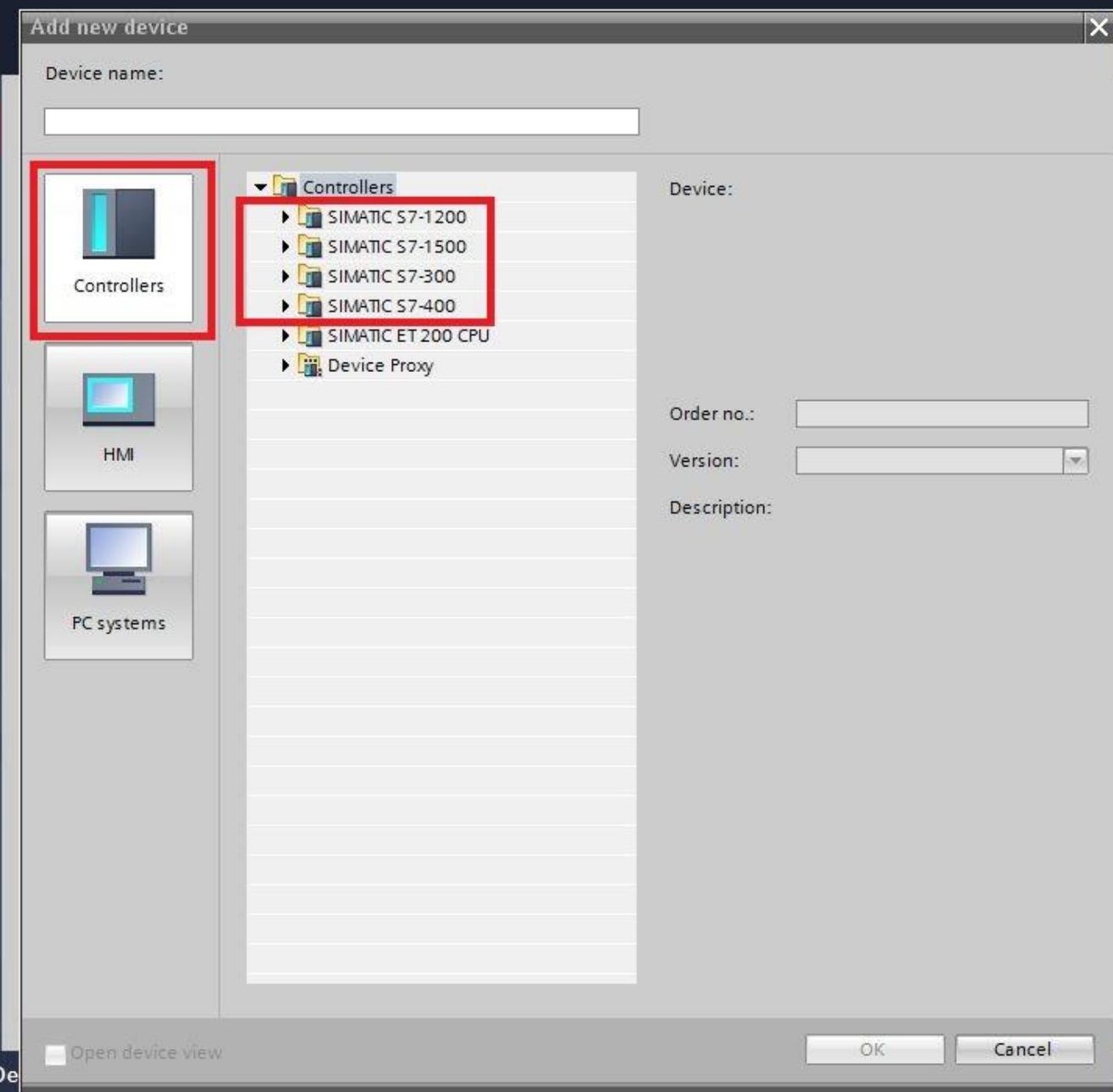
Help

User interface language

First steps

Project: "Project2" was opened successfully. Please select the next step:





Start

Devices &
networksPLC
programmingMotion &
technology

Visualization

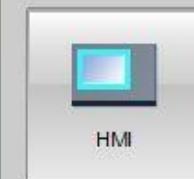
Online &
Diagnostics

Device: <No device created>

Add new device

Device name:

PLC_1



Controllers

- ▶ SIMATIC S7-1200
- ▶ SIMATIC S7-1500
- ▼ SIMATIC S7-300
 - ▶ CPU
 - ▶ CPU 312
 - ▶ CPU 312C
 - ▶ CPU 313C
 - ▶ CPU 313C-2 DP
 - ▶ CPU 313C-2 PtP
 - ▶ CPU 314
 - ▶ CPU 314C-2 DP
 - ▼ CPU 314C-2 PN/DP
 - 6ES7 314-6EH04-0AB0
 - ▶ CPU 314C-2 PtP
 - ▶ CPU 315-2 DP
 - ▶ CPU 315-2 PN/DP
 - ▶ CPU 317-2 DP
 - ▶ CPU 317-2 PN/DP
 - ▶ CPU 319-3 PN/DP
 - ▶ CPU 315F-2 DP
 - ▶ CPU 315F-2 PN/DP
 - ▶ CPU 317F-2 DP
 - ▶ CPU 317F-2 PN/DP
 - ▶ CPU 319F-3 PN/DP
 - ▶ Unspecified CPU 300

Device:



CPU 314C-2 PN/DP

Order no.: 6ES7 314-6EH04-0AB0

Version: V3.3

Description:

Work memory 192KB; 0.6ms/1000 instructions; DI24/DO16; AI5/AO2 integrated; 4 pulse outputs (2.5kHz); 4 channels counting and measuring with 24 V (60kHz) incremental encoders; integrated positioning function; PROFINET interface and 2 Ports; MRP; PROFINET CBA; PROFINET CBA Proxy; TCP/IP transport protocol; combined MPI/DP interface (MPI or DP master or DP slave); multi-tier configuration up to 31 modules; capable of sending and receiving in direct data exchange; constant bus cycle time; routing; firmware V3.3

OK

Cancel

Start

Devices &
networksPLC
programmingMotion &
technology

Visualization

Online &
Diagnostics

Device: PLC_1

Show all objects

Details List Thumbnails

 Show all objects Add new block Show cross-references Show program structure Help

Organization blocks (OB)



Main

TIA Portal Siemens - Project2

Project Edit View Insert Online Options Tools Window Help

Save project Go online Go offline ? Main

Totally Integrated Automation PORTAL

Project tree Devices

Start PLC_1 [CPU 314C-2 PN/DP]

- Device configuration
- Online & diagnostics
- Program blocks
 - Add new block
 - Main [OB1]
- Technology objects
- External source files
- PLC tags
- PLC data types
- Watch and force tables
- Online backups
- Device proxy data
- Program info

Details view

Name Address

Device information Connection information Alarm display

All devices offline

Online... Opera... Device/module Message Details Help

Properties Info Diagnostics

Instructions Options

Favorites Basic instructions

| Name | Description |
|-----------------------|-------------|
| General | |
| Bit logic operations | |
| Timer operations | |
| Counter operations | |
| Comparator operations | |
| Math functions | |

Extended instructions

| Name | Description |
|----------------------------|-------------|
| Date and time-of-day | |
| String + Char | |
| Process image | |
| Distributed I/O | |
| PROFenergy | |
| Module parameter assign... | |
| Interrupts | |
| Alarming | |
| Diagnostics | |
| Data block control | |
| Table functions | |
| Addressing | |
| Additional functions | |

Tasks Libraries

Technology Communication

Portal view Overview Main

Project Project2 created.



Project tree

Project2 > PLC_1 [CPU 314C-2 PN/DP]



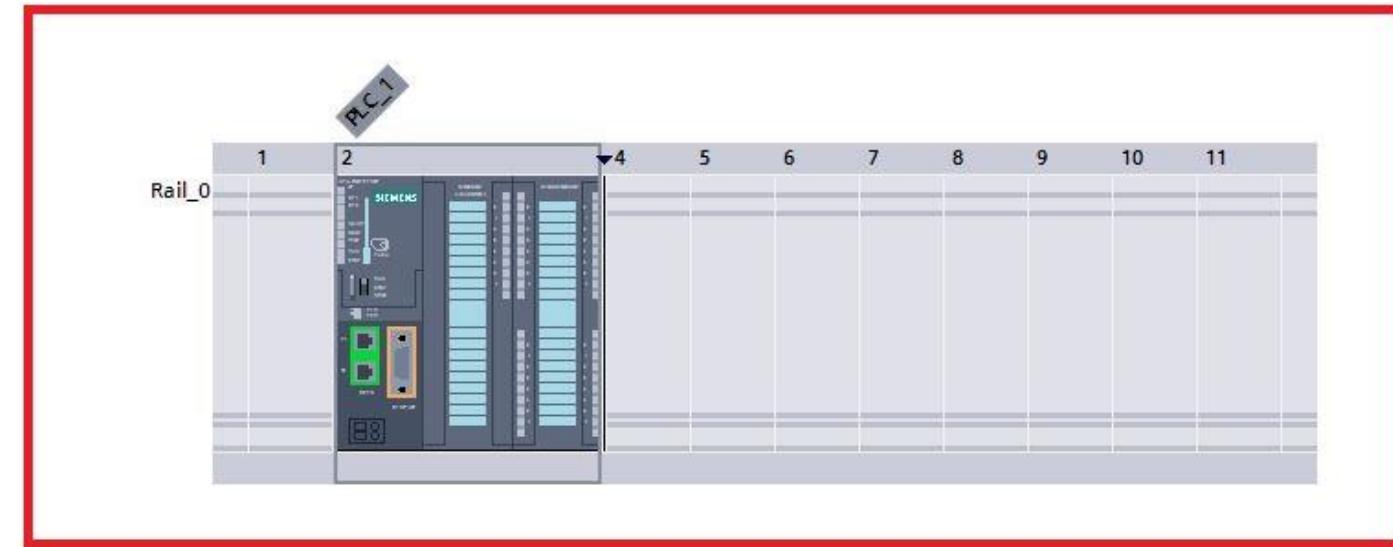
Devices & networks

Devices

- > PLC_1 [CPU ...
 - Device ...
 - Online & ...
- > Program ...
 - Add ...
 - Main [...]
- > Technolo...
 - External...
 - PLC tags
 - PLC dat...
 - Watch an...
 - Online ...
 - Device pr...

Details view

Name



Topology view

Network view

Device view



Device information

Connection information

Alarm display

All devices offline



Details

Help

Portal view

Overview

Main

PLC_1

Project Project2 created.

Hardware catalog

Options

Catalog

<Search>

 Filter

- > Rack
- > PS
- > CPU
- > IM
- > DI
- > DO
- > DI/DO
- > AI
- > AO
- > AI/AO
- > Communications modules
- > FM
- > IQ-SENSE
- > Special
- > Interface modules

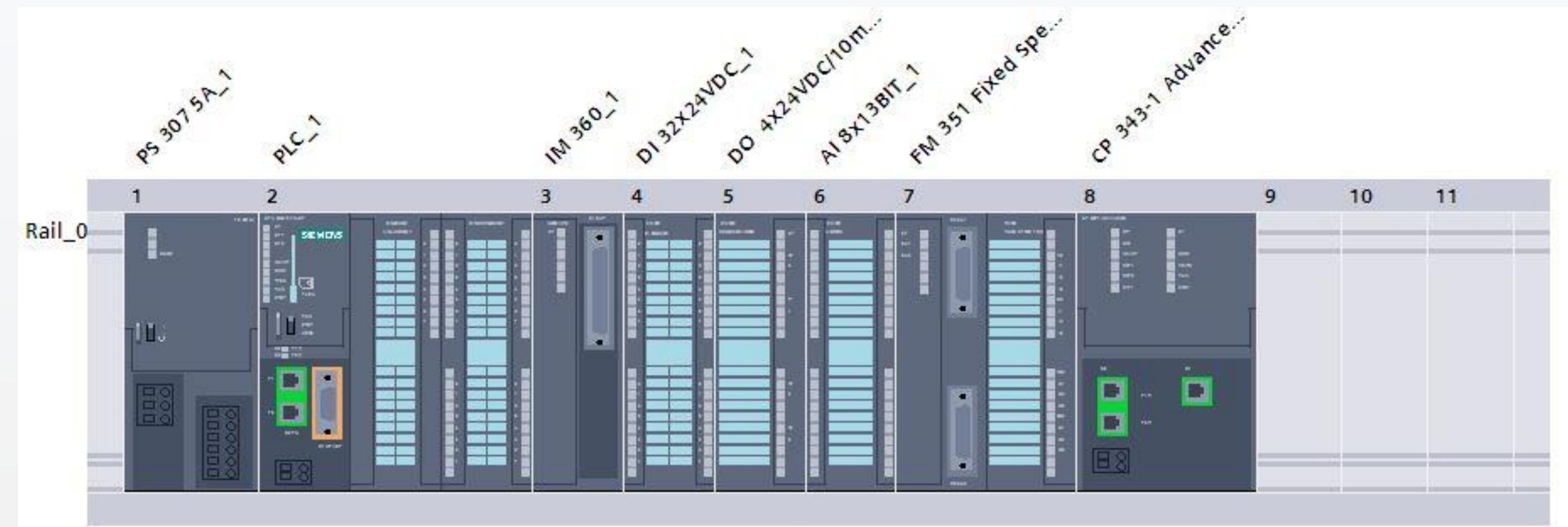
Hardware catalog

Online tools

Tasks

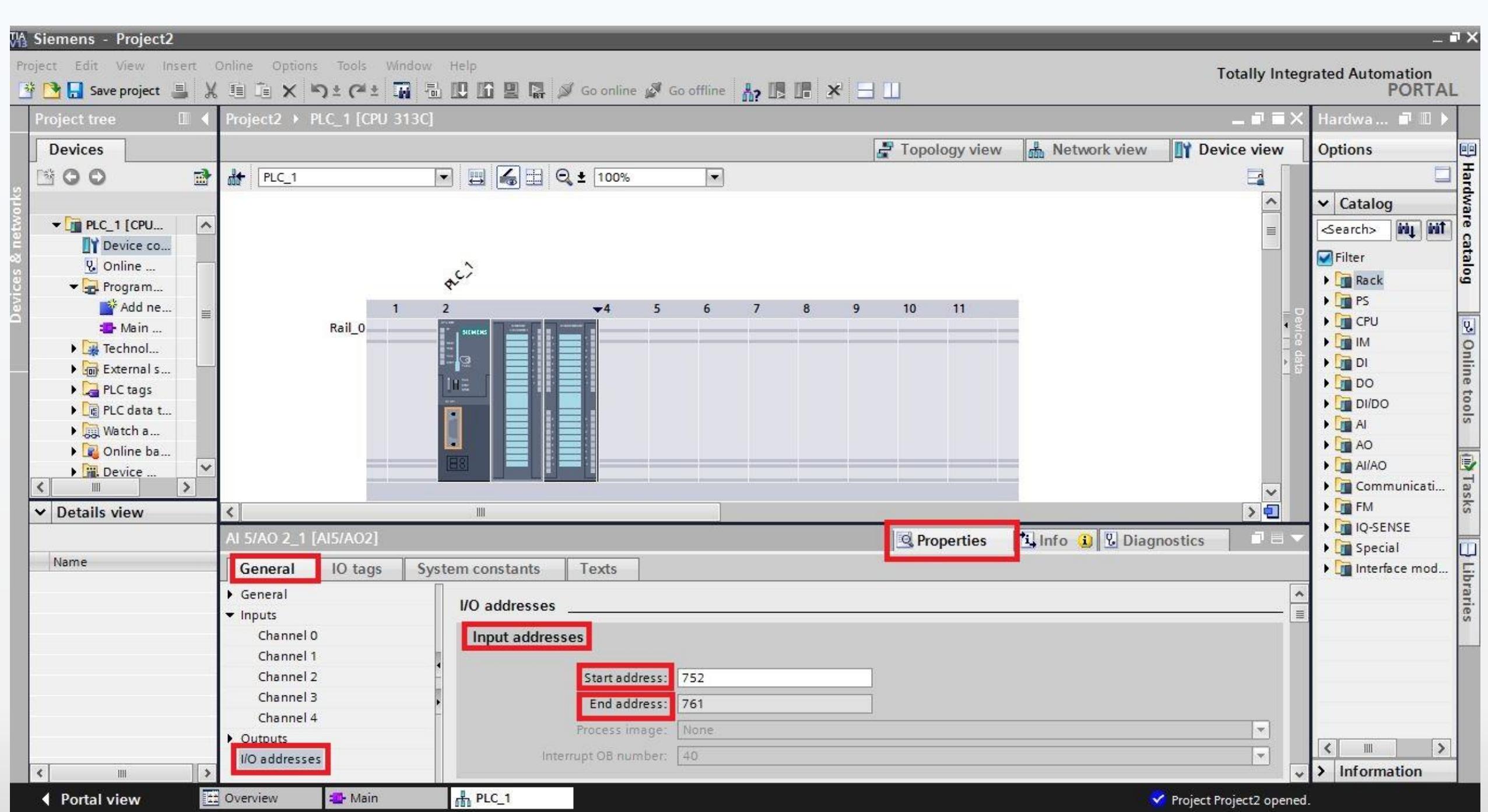
Libraries

> Information



I/O ADDRESS CONFIGURATION

تنظیم آدرس های ورودی و خروجی





Project2 > PLC_1 [CPU 313C]



Project tree

Devices

- PLC_1 [CPU...]
 - Device co...
 - Online ...
- Program...
 - Add ne...
 - Main ...
- Technol...
- External s...
- PLC tags
- PLC data t...
- Watch a...
- Online ba...
- Device ...

PLC_1

Topology view Network view Device view

Rail_0 1 2 4 5 6 7 8 9 10 11

SIEMENS

AI 5/AO 2_1 [AI5/AO2]

Properties Info Diagnostics

Name

General IO tags System constants Texts

General Inputs Outputs I/O addresses

Input addresses

Start address: 0

End address: 9

Process image: OB1-P1

Interrupt OB number: 40

Portal view Overview Main PLC_1

Project Project2 opened.

Hardware catalog

Catalog

Search Filter

- Rack
- PS
- CPU
- IM
- DI
- DO
- DI/DO
- AI
- AO
- AI/AO
- Communication
- FM
- IQ-SENSE
- Special
- Interface mod...

Online tools Tasks Libraries Information



Project tree Project2 > PLC_1 [CPU 313C]

Devices Topology view Network view Device view

Hardware catalog Options

Details view

AI 5/AO 2_1 [AI5/AO2]

Name: AI 5/AO 2_1 [AI5/AO2]

Properties Info Diagnostics

General IO tags System constants Texts

Process image: OB1-PI

Inputs

- Channel 0
- Channel 1
- Channel 2
- Channel 3
- Channel 4

Outputs

I/O addresses

Output addresses

Start address: 0

End address: 3

Process image: OB1-PI

Rail_0

1 2 4 5 6 7 8 9 10 11

Device data

Catalog

Filter

- Rack
- PS
- CPU
- IM
- DI
- DO
- DI/DO
- AI
- AO
- AI/AO
- Communication
- FM
- IQ-SENSE
- Special
- Interface mod...

Online tools Tasks Libraries

Information

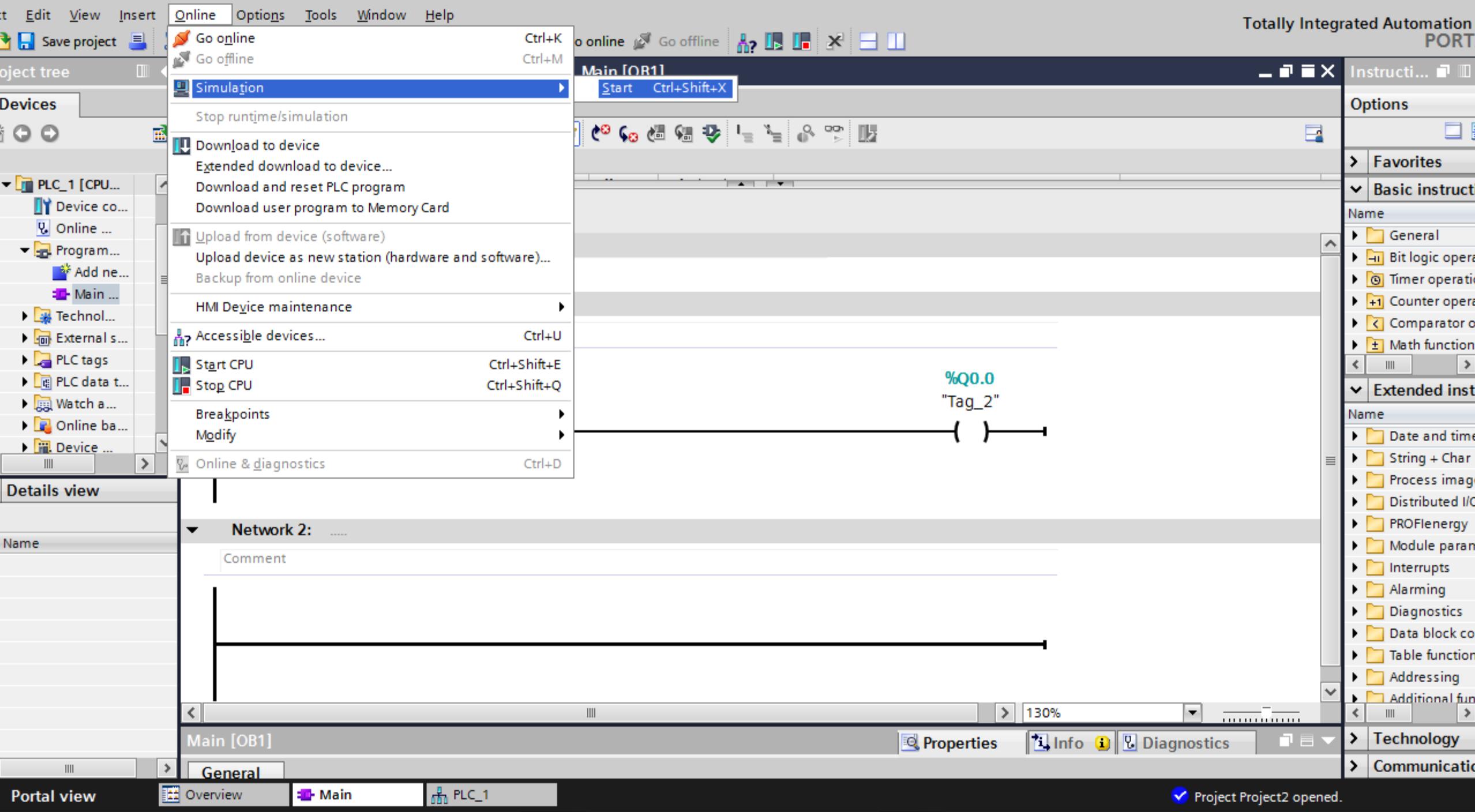
Portal view Overview Main PLC_1

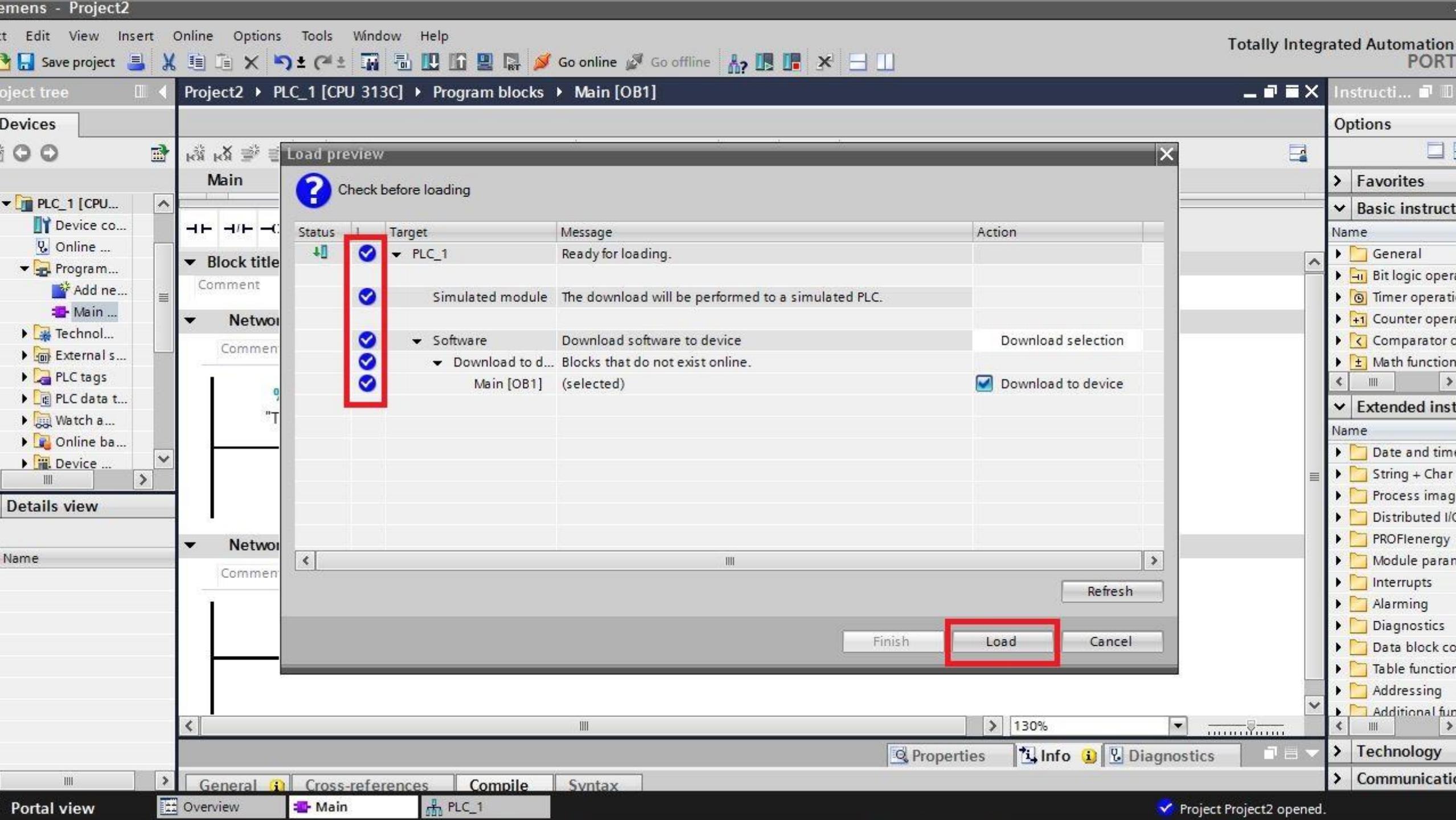
Project Project2 opened.

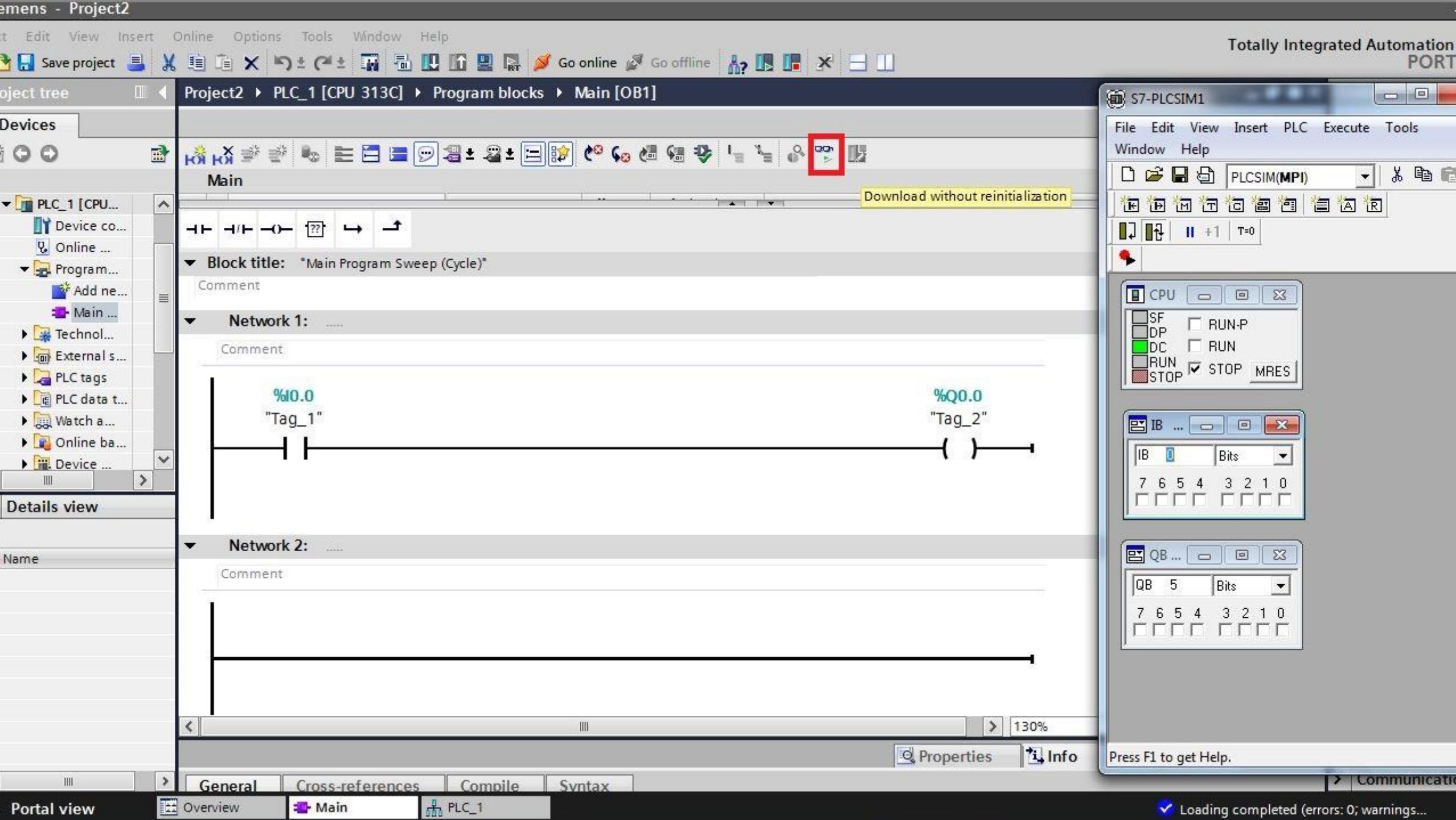
PROJECTS: PROJECT 1

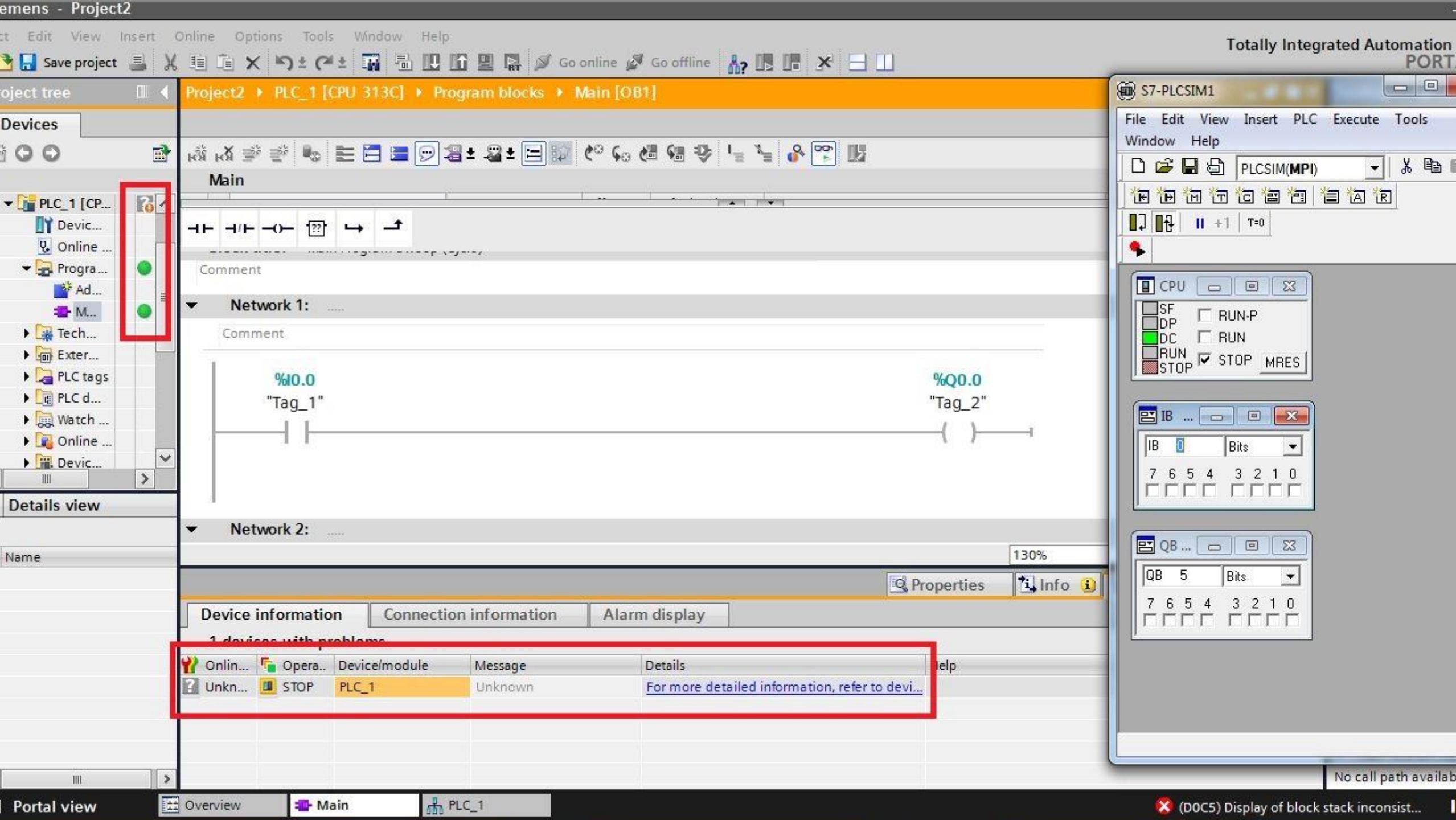
برنامه ای بنویسید که یک سیگنال را در خروجی تولید نماید.

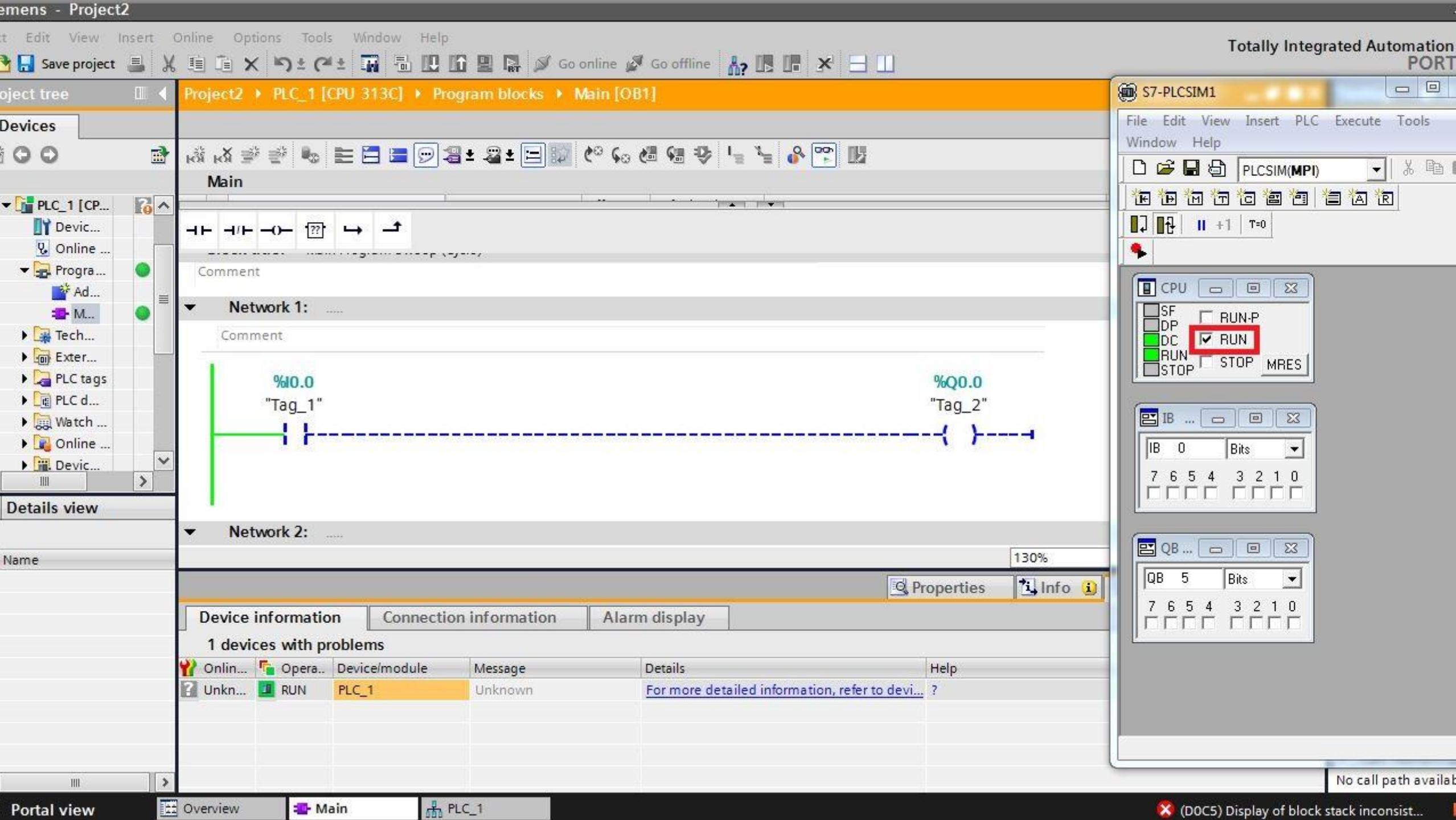


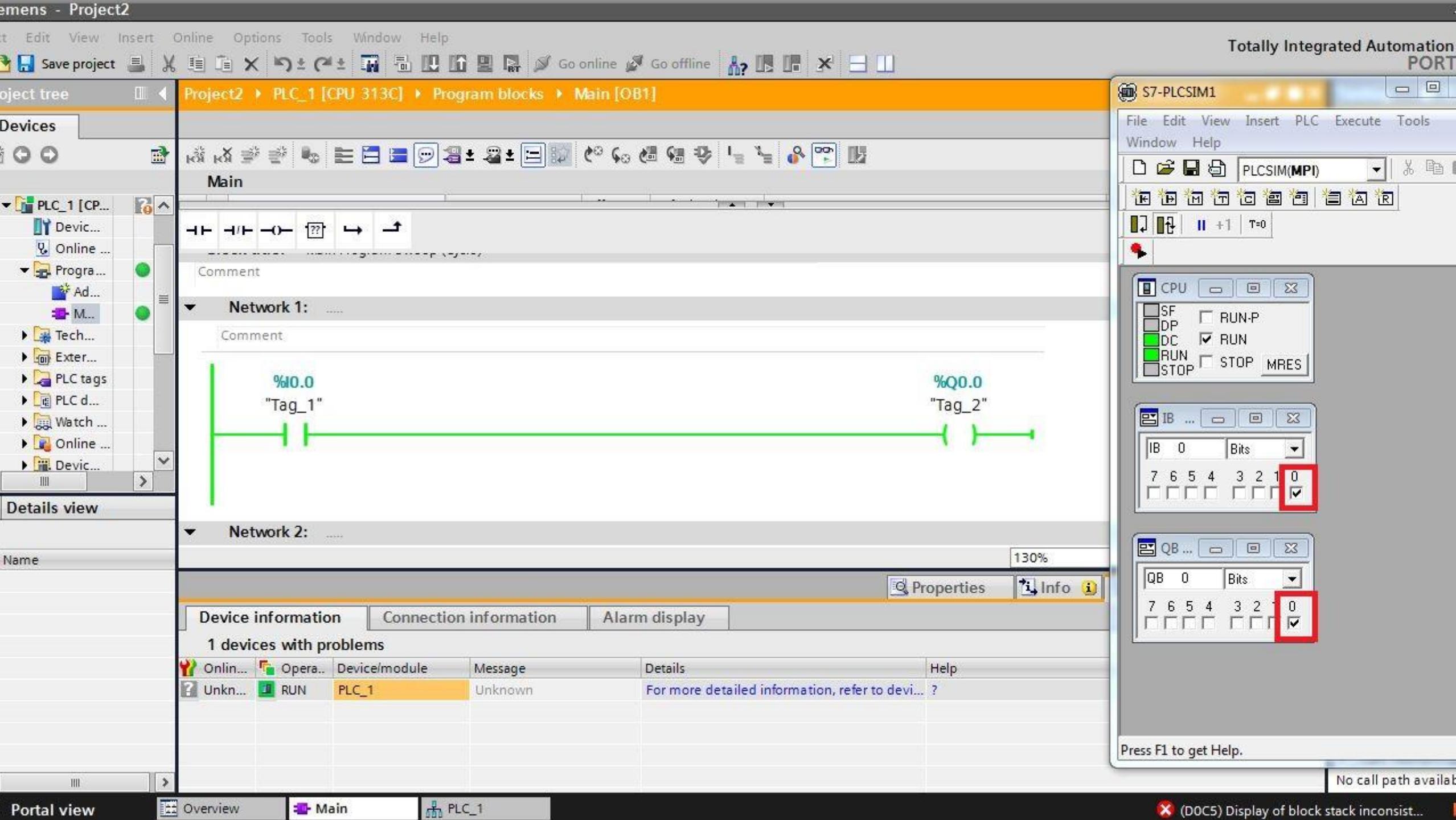




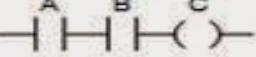
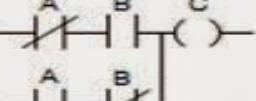
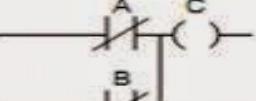
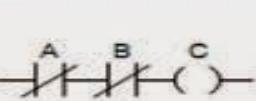








Gates In LAD

| Logic Diagram | Truth Table | Ladder Diagram | | | | | | | | | | | | | | | |
|---|--|----------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|
|  AND Gate | <table><thead><tr><th>A</th><th>B</th><th>C</th></tr></thead><tbody><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></tbody></table> | A | B | C | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 |  AND Equivalent Circuit |
| A | B | C | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | | | | | | | | | | | | | | | |
| 0 | 1 | 0 | | | | | | | | | | | | | | | |
| 1 | 0 | 0 | | | | | | | | | | | | | | | |
| 1 | 1 | 1 | | | | | | | | | | | | | | | |
|  OR Gate | <table><thead><tr><th>A</th><th>B</th><th>C</th></tr></thead><tbody><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></tbody></table> | A | B | C | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 |  OR Equivalent Circuit |
| A | B | C | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | | | | | | | | | | | | | | | |
| 0 | 1 | 1 | | | | | | | | | | | | | | | |
| 1 | 0 | 1 | | | | | | | | | | | | | | | |
| 1 | 1 | 1 | | | | | | | | | | | | | | | |
|  Exclusive-OR Gate | <table><thead><tr><th>A</th><th>B</th><th>C</th></tr></thead><tbody><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></tbody></table> | A | B | C | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |  Exclusive-OR Equivalent Circuit |
| A | B | C | | | | | | | | | | | | | | | |
| 0 | 0 | 0 | | | | | | | | | | | | | | | |
| 0 | 1 | 1 | | | | | | | | | | | | | | | |
| 1 | 0 | 1 | | | | | | | | | | | | | | | |
| 1 | 1 | 0 | | | | | | | | | | | | | | | |
|  NAND Gate | <table><thead><tr><th>A</th><th>B</th><th>C</th></tr></thead><tbody><tr><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></tbody></table> | A | B | C | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |  NAND Equivalent Circuit |
| A | B | C | | | | | | | | | | | | | | | |
| 0 | 0 | 1 | | | | | | | | | | | | | | | |
| 0 | 1 | 1 | | | | | | | | | | | | | | | |
| 1 | 0 | 1 | | | | | | | | | | | | | | | |
| 1 | 1 | 0 | | | | | | | | | | | | | | | |
|  NOR Gate | <table><thead><tr><th>A</th><th>B</th><th>C</th></tr></thead><tbody><tr><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></tbody></table> | A | B | C | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 |  NOR Equivalent Circuit |
| A | B | C | | | | | | | | | | | | | | | |
| 0 | 0 | 1 | | | | | | | | | | | | | | | |
| 0 | 1 | 0 | | | | | | | | | | | | | | | |
| 1 | 0 | 0 | | | | | | | | | | | | | | | |
| 1 | 1 | 0 | | | | | | | | | | | | | | | |

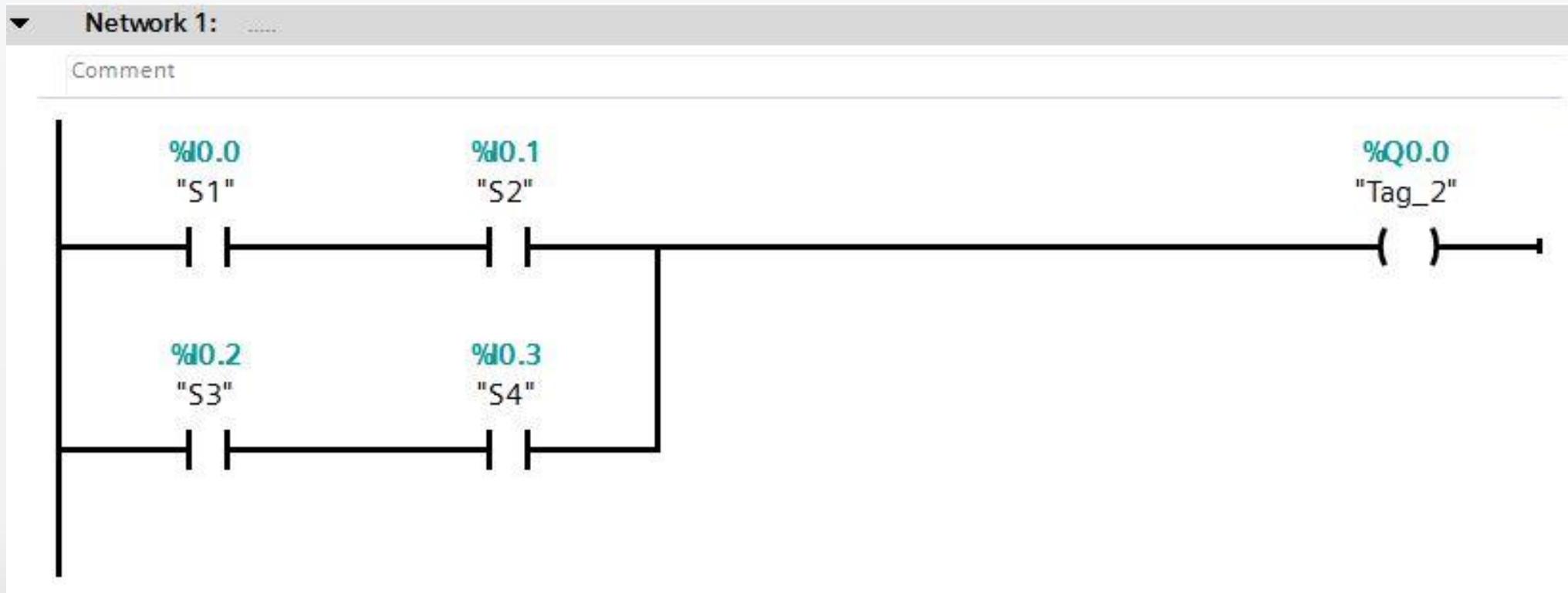
PROJECTS: PROJECT 2

برنامه ای بنویسید که فقط با یکبار فشردن شستی S1 خروجی بصورت دائم فعال شود.



PROJECTS: PROJECT 3

برنامه ای بنویسید که با فشردن ورودی شستی S1 و S3 یا S2 و S4 خروجی فعال گردد.



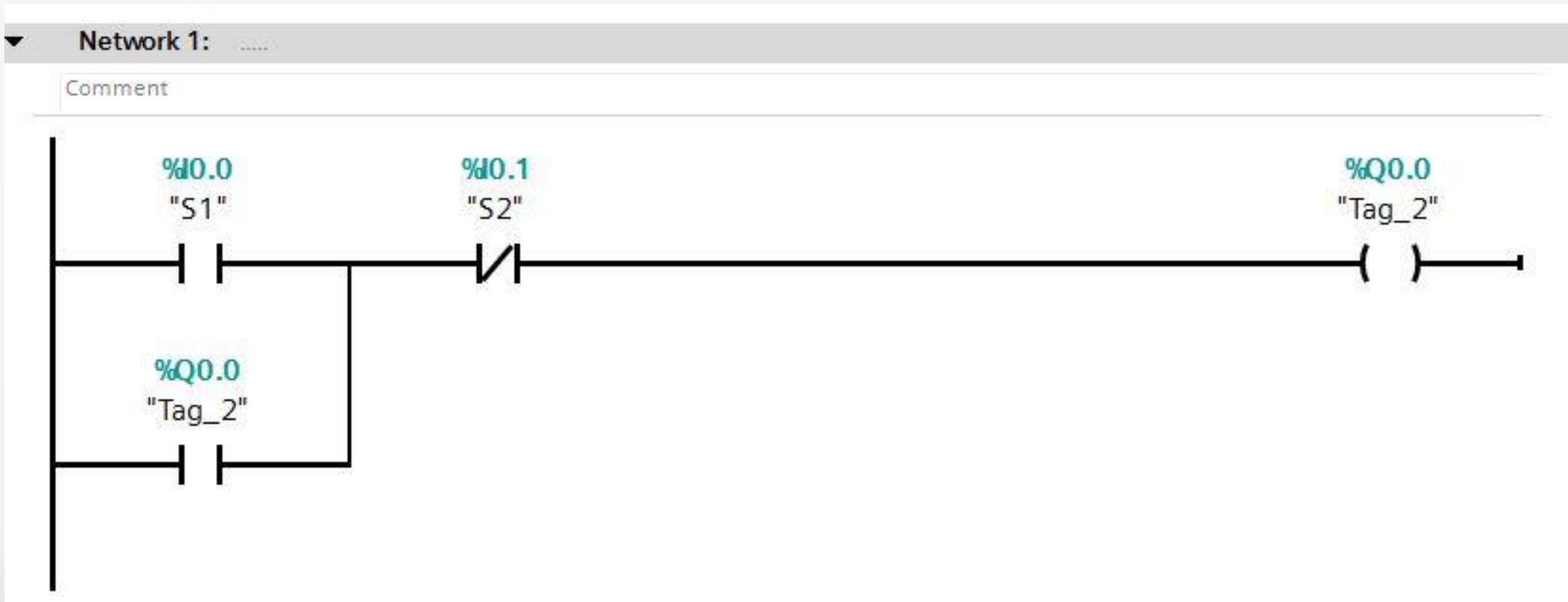
PROJECTS: PROJECT 4

برنامه ای بنویسید که با فشردن شستی S1 خروجی روشن و با فشردن شستی S2 خروجی غیرفعال گردد.



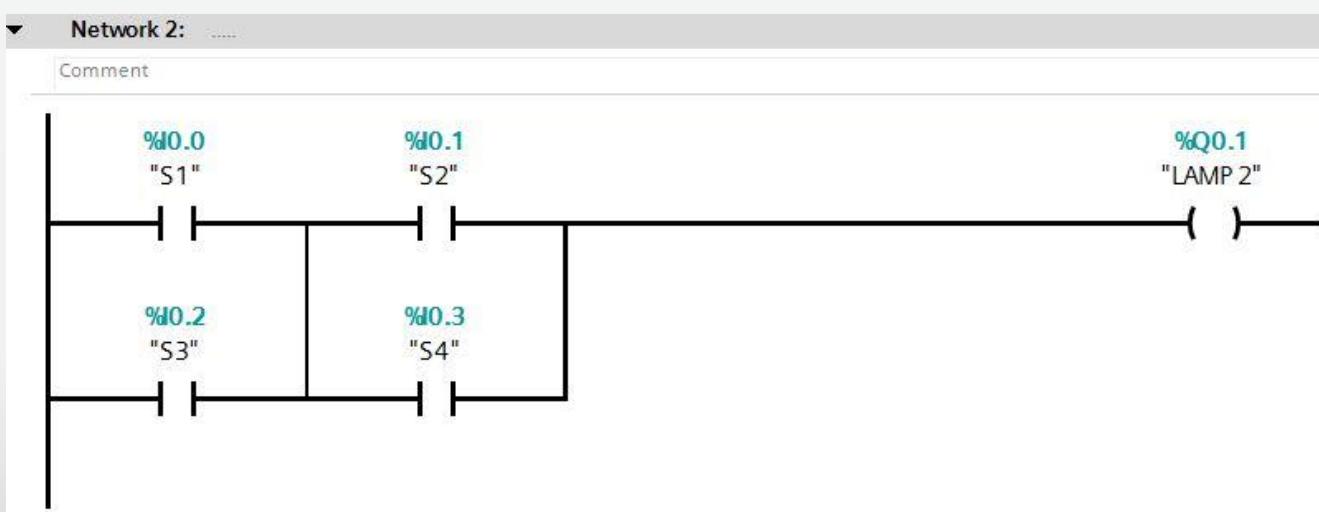
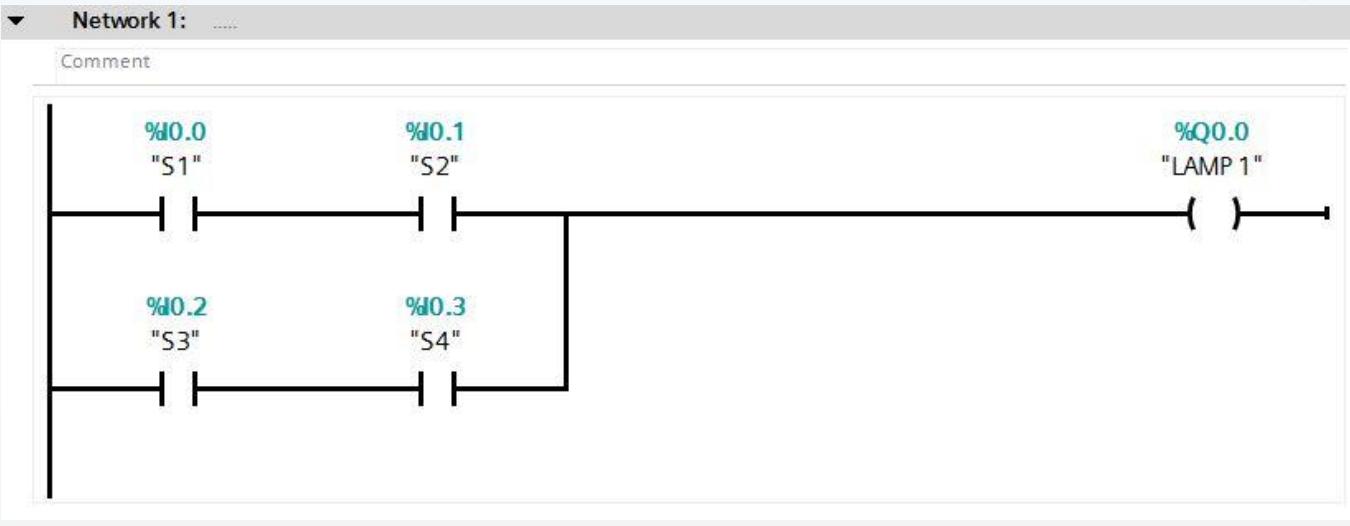
PROJECTS: PROJECT 5

برنامه ای بنویسید که با زدن شستی S1 خروجی به صورت دائم فعال و با زدن شستی S2 خروجی غیرفعال گردد.



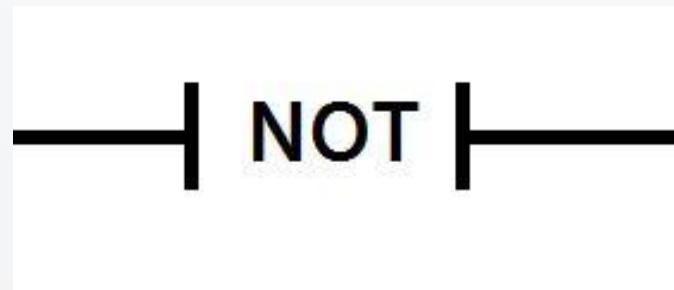
PROJECTS: PROJECT 6

برنامه ای بنویسید که در صورتی که شستی S1 و S2 یا S3 و S4 باهم فشرده شوند، خروجی Lamp1 روشن و در غیر اینصورت Lamp2 روشن شود.



PROJECTS: PROJECT 7

INVERT POWER FLOW ;

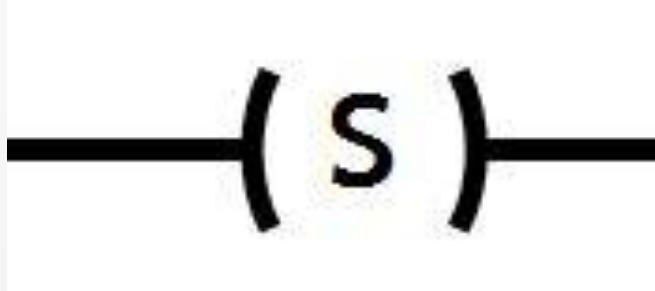


وضعیت منطقی ورودی را معکوس کرده و در خروجی قرار می دهد.



PROJECTS: PROJECT 9

SET :

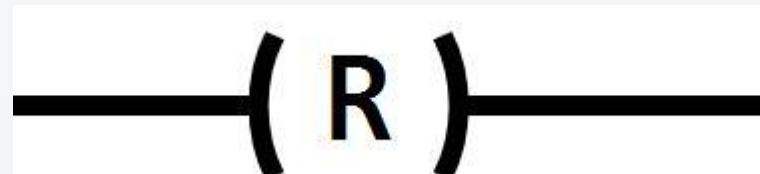


برای فعال نمودن یک خروجی به صورت
دائم و بدون استفاده از خود نگهدار



PROJECTS: PROJECT 10

RESET;

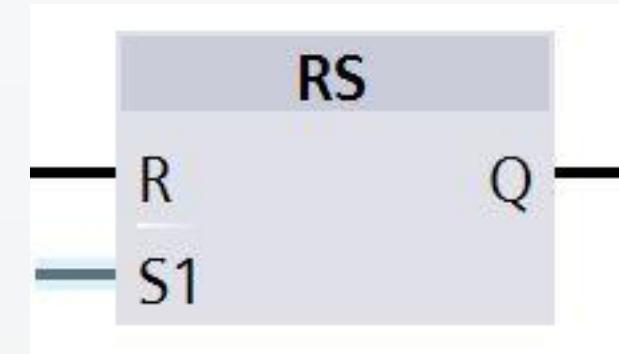


برای غیرفعال نمودن یک خروجی به
صورت دائم



PROJECTS: PROJECT 11

فیلپ فلامپ ها :



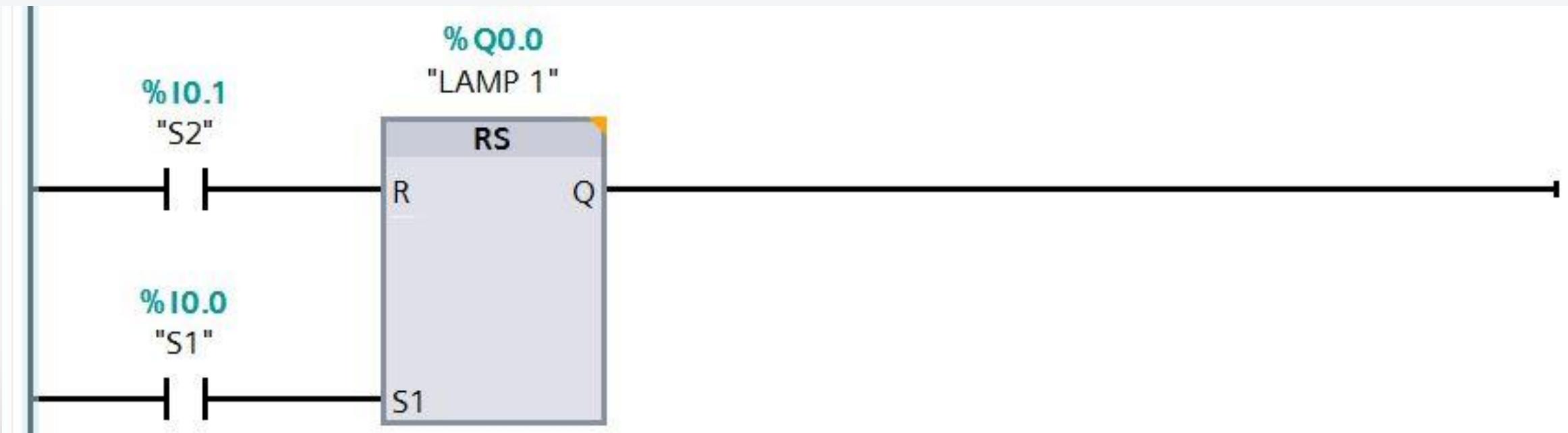
بر S تقدم دارد.

بر R تقدم دارد.

PROJECTS: PROJECT 11

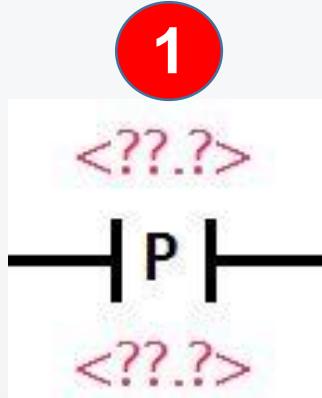
برنامه ای بنویسید که با تحریک شستی S1 خروجی بصورت دائم فعال بماند.

و با زدن شستی S2 خروجی بازهم فعال بماند.



PROJECTS: PROJECT 12

EDEGE DETECTION ;



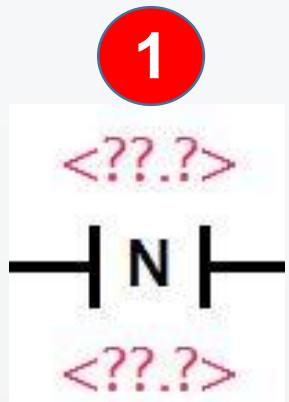
2

برای تشخیص لبه مثبت
(شخیص تغییر وضعیت از صفر به یک)

| Parameter | Declaration | Data type | Memory area | Description |
|------------|-------------|-----------|---------------------|---|
| <Operand1> | Input | BOOL | I, Q, M, D, L, T, C | Signal to be scanned |
| <Operand2> | InOut | BOOL | I, Q, M, D, L | Edge memory bit in which the signal state of the previous query is saved. |

PROJECTS: PROJECT 12

EDEGE DETECTION ;

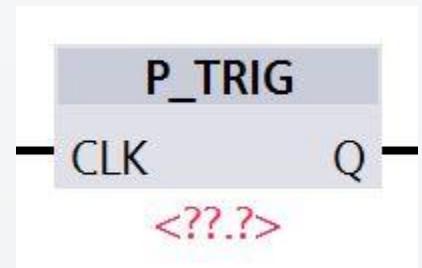


برای تشخیص لبه منفی
(شخیص تغییر وضعیت از یک به صفر)

| Parameter | Declaration | Data type | Memory area | Description |
|------------|-------------|-----------|---------------------|---|
| <Operand1> | Input | BOOL | I, Q, M, D, L, T, C | Signal to be scanned |
| <Operand2> | InOut | BOOL | I, Q, M, D, L | Edge memory bit in which the signal state of the previous query is saved. |

PROJECTS: PROJECT 13

Scan RLO for positive signal edge ;

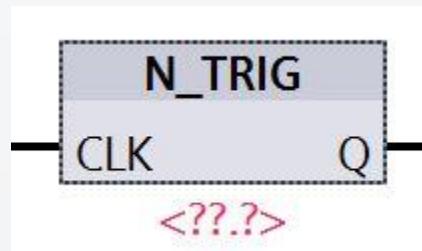


برای تشخیص لبه منفی
(شخیص تغییر وضعیت از یک به صفر)

| Parameter | Declaration | Data type | Memory area | Description |
|-----------|-------------|-----------|---------------|--|
| CLK | Input | BOOL | I, Q, M, D, L | Current RLO |
| <Operand> | InOut | BOOL | M, D | Edge memory bit in which the RLO of the previous query is saved. |
| Q | Output | BOOL | I, Q, M, D, L | Result of edge evaluation |

PROJECTS: PROJECT 13

Scan RLO for negative signal edge ;

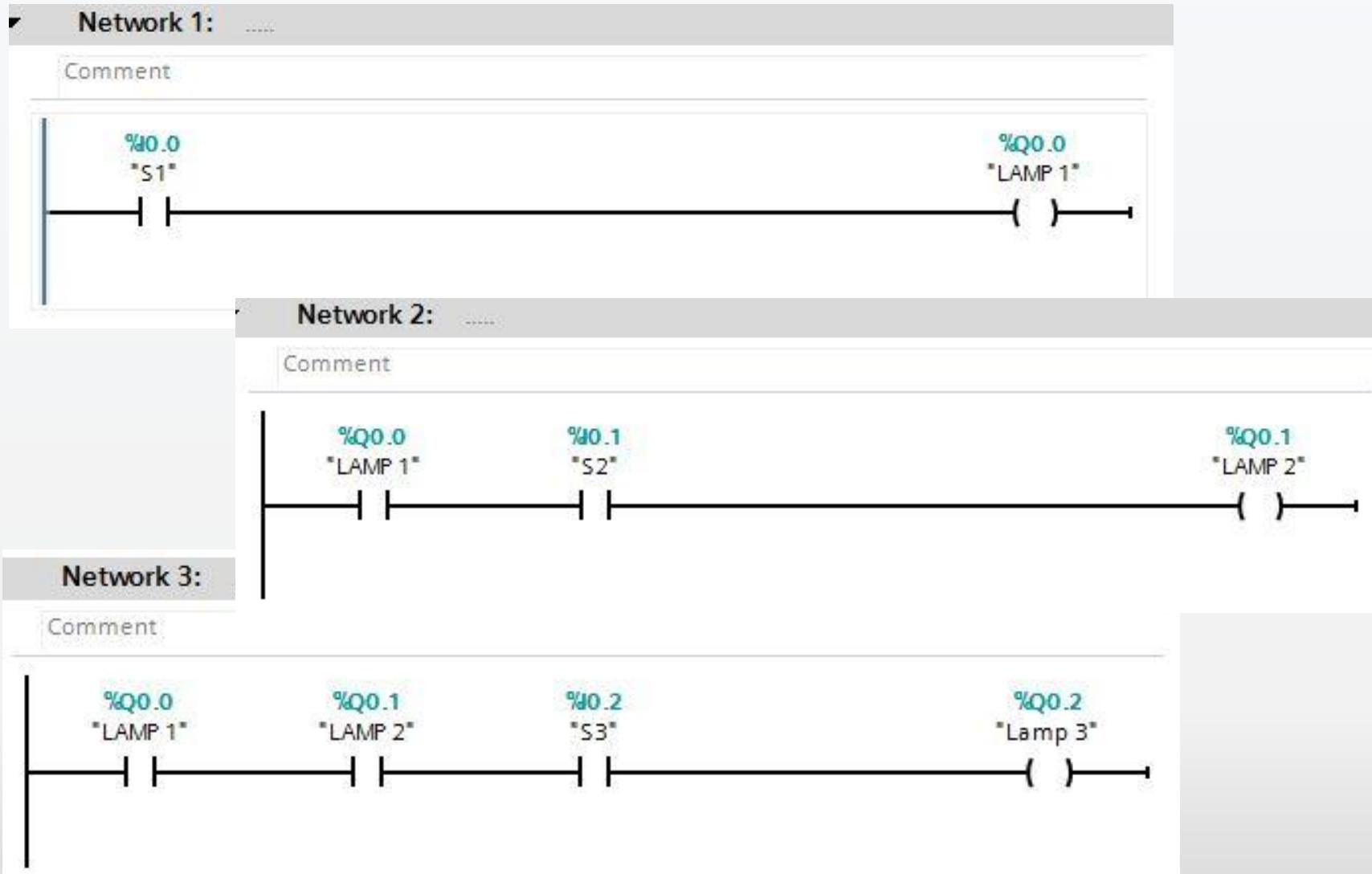


برای تشخیص لبه منفی
(شخیص تغییر وضعیت از یک به صفر)

| Parameters | Declaration | Data type | Memory area | Description |
|------------|-------------|-----------|---------------|--|
| CLK | Input | BOOL | I, Q, M, D, L | Current RLO |
| <Operand> | InOut | BOOL | M, D | Edge memory bit in which the RLO of the previous query is saved. |
| Q | Output | BOOL | I, Q, M, D, L | Result of edge evaluation |

PROJECTS: PROJECT 14

برنامه ای بنویسید که در ابتدا با فشردن S1 چراغ اول روشن شود و سپس با فشردن S2 چراغ دوم و به همین ترتیب با فشردن S3 چراغ سوم روشن گردد . و اگر ترتیب فوق رعایت نشود چراغ ها روشن نگردد .



بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِيْمِ

PLC COURSE

LECTURE : 3



AHMAD KHEIRANDISH

TIMERS



Timer Operations



SIMATIC TIMERS



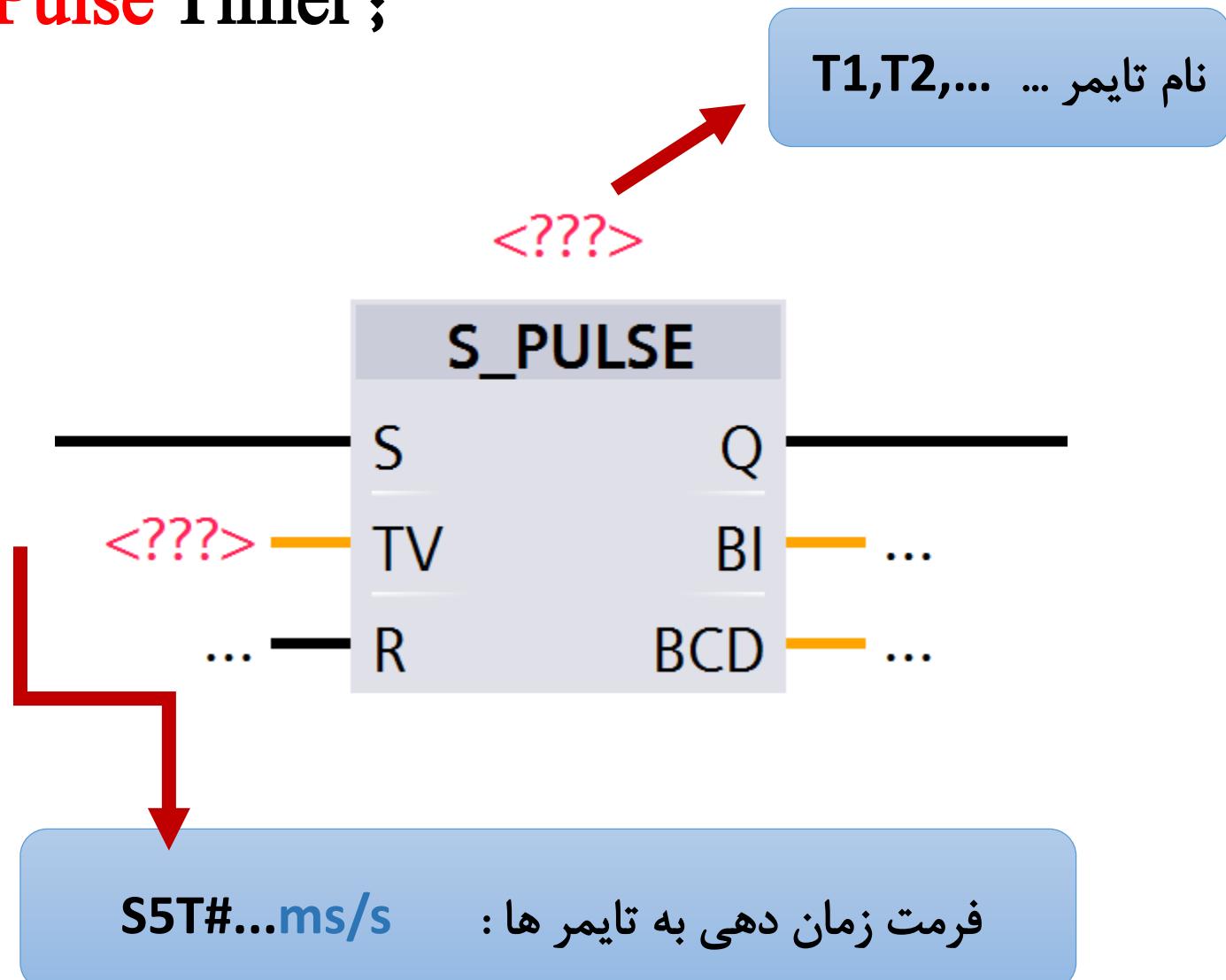
INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

Timer Operations

| IEC Timers | | |
|--|-----------------------------|--|
|  TP | Generate pulse | |
|  TON | Generate on-delay | |
|  TOF | Generate off-delay | |
| SIMATIC Timers | | |
|  S_PULSE | Assign pulse timer para... | |
|  S_PEXT | Assign extended pulse ... | |
|  S_ODT | Assign time as on-dela... | |
|  S_ODTS | Assign retentive on-del... | |
|  S_OFFDT | Assign off-delay timer ... | |
|  -(SP) | Start pulse timer | |
|  -(SE) | Start extended pulse ti... | |
|  -(SD) | Start on-delay timer | |
|  -(SS) | Start retentive on-delay... | |
|  -(SF) | Start off-delay timer | |

TIMER OPERATIONS

Pulse Timer ;

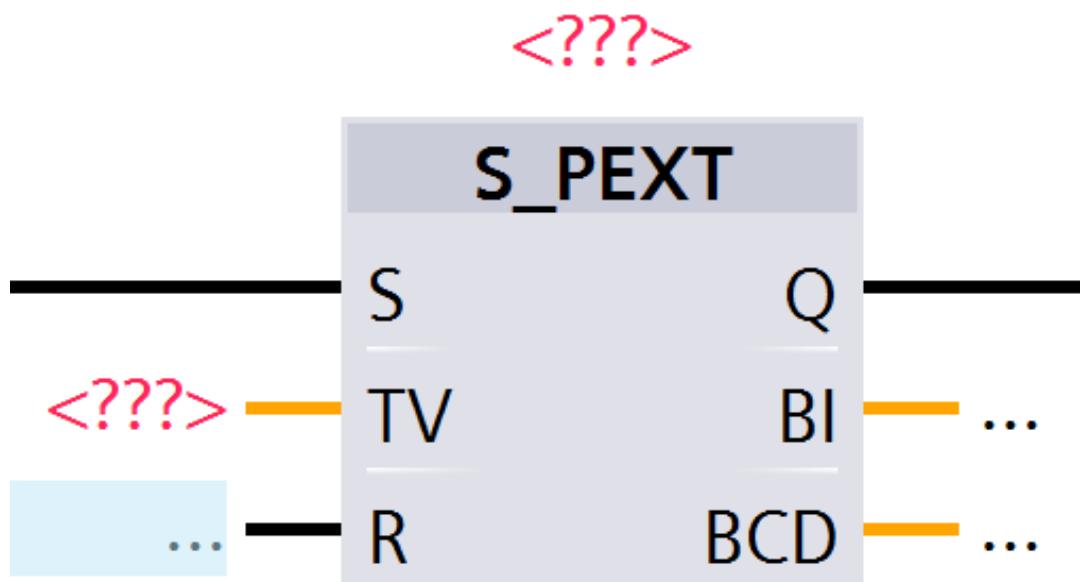


با فعال شدن پایه **S** به طور دائم تایмер شروع به زمان گیری کرده و به اندازه زمان تنظیمی در پایه **TV** خروجی دیجیتال آن فعال می شود و پس از سپری شدن زمان خروجی غیرفعال می گردد.

اگر پایه **S** در وسط زمان گیری غیرفعال شود تایмер متوقف شده و با فعال شدن مجدد آن زمان گیری از ابتدا انجام می شود .

TIMER OPERATIONS

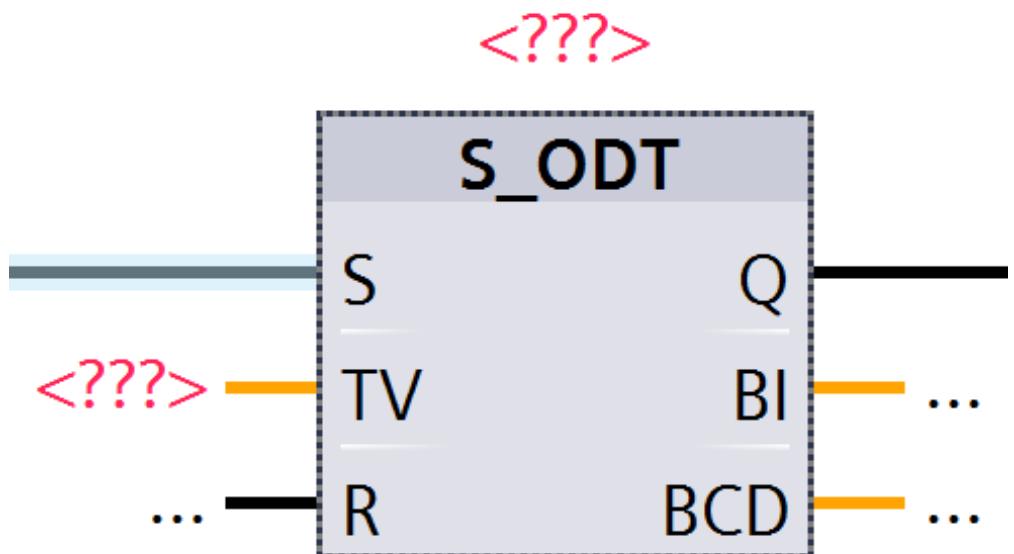
Extended Pulse Timer ;



ورودی تحریک این تایمر حساس به لبه می باشد یعنی با دریافت لبه بالا رونده تایمر شروع به زمانگیری کرده و اگر در این حین لبه‌ی دیگری بیاید ، تایмер مجدداً شروع به زمان گیری می کند .

TIMER OPERATIONS

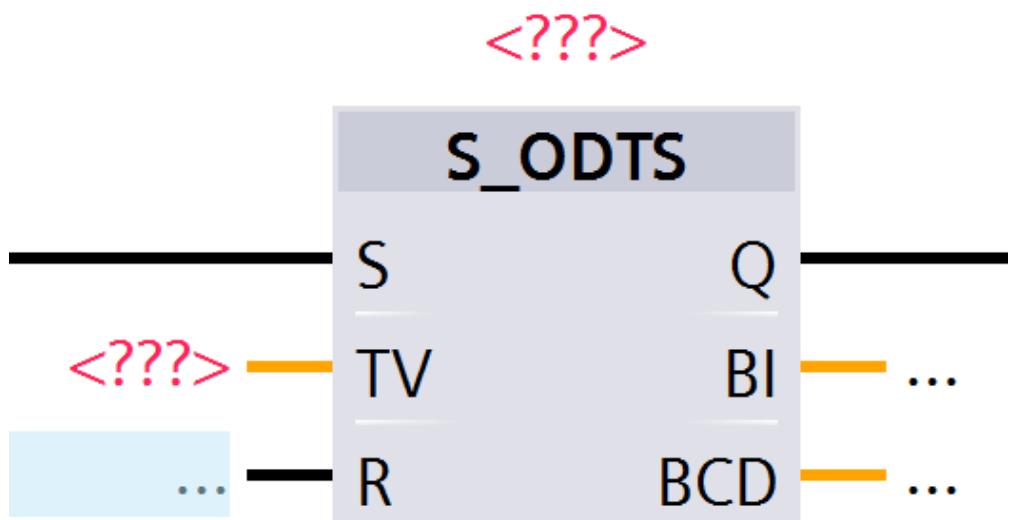
On-delay Timer ;



با فعال شدن پایه **S** به طور دائم خروجی پس از زمان تنظیمی فعال می گردد و اگر در مدت زمان گیری ورودی غیرفعال شود و دوباره فعال گردد ، زمانگیری از ابتدا آغاز می گردد .

TIMER OPERATIONS

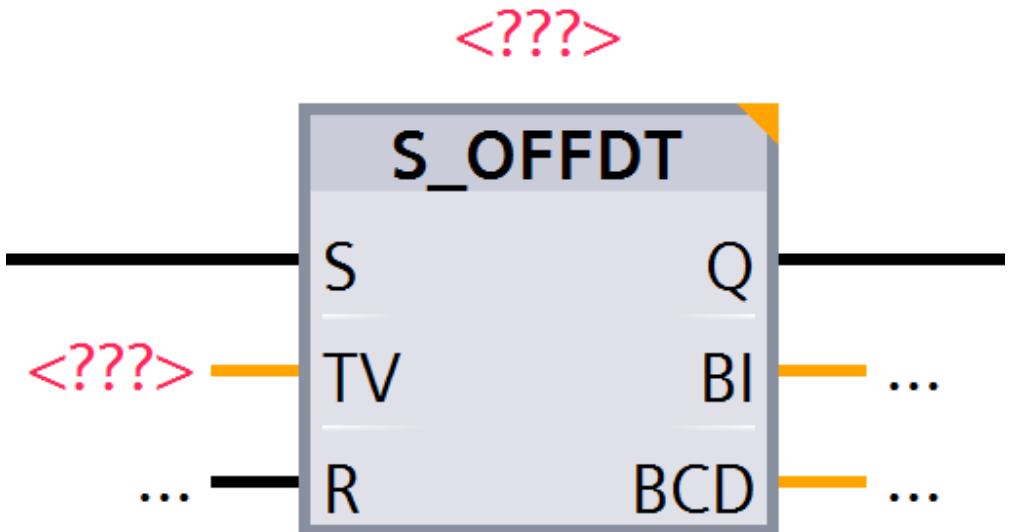
Retentive on-delay Timer ;



ورودی این تایمر حساس به لبه‌ی بالا رونده است و با تحریک لبه‌ی بالارونده شروع به زمانگیری می‌کند و اگر لبه‌ی بالارونده‌ی دیگری مشاهده کند، از ابتدا زمان گیری شروع می‌شود.

TIMER OPERATIONS

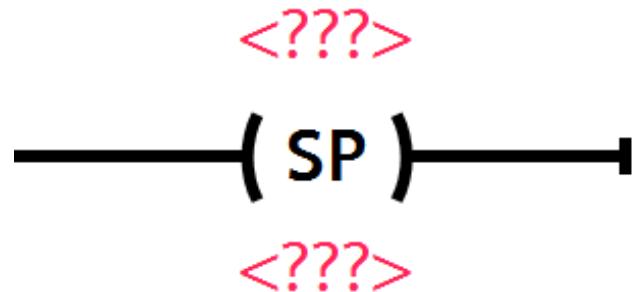
Off-delay Timer ;



این تایمر حساس به لبه‌ی پایین رونده است یعنی زمانی که در ورودی S این بلوک لبه‌ی پایین رونده قرار بگیرد تایмер شروع به زمان گیری می‌کند و پس از سپری شدن زمان تنظیمی در پایه TV، خروجی دیجیتالی غیرفعال می‌گردد. با آمدن لبه‌ی بالا رونده بعدی تایmer عکس العملی از خود نشان نمی‌دهد اما اگر تایmer در حال زمان گیری باشد و لبه‌ی پایین رونده بعدی تایmer بباید، زمان گیری را از ابتدا انجام خواهد داد.

TIMER OPERATIONS

Start Pulse Timer ;

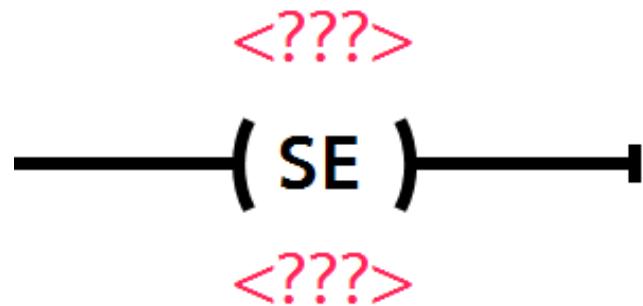


عملکرد این تایمر مشابه تایمر تأخیر در قطع می باشد.

| Parameter | Declaration | Data type | Memory area | Description |
|-----------------|-------------|--------------|---------------------------|---|
| <Time duration> | Input | S5TIME, WORD | I, Q, M, D, L or constant | Duration with which the timer expires. |
| <Timer> | Output | TIMER | T | Timer which is started. The number of timers depends on the CPU. |

TIMER OPERATIONS

Start Extended Pulse Timer ;

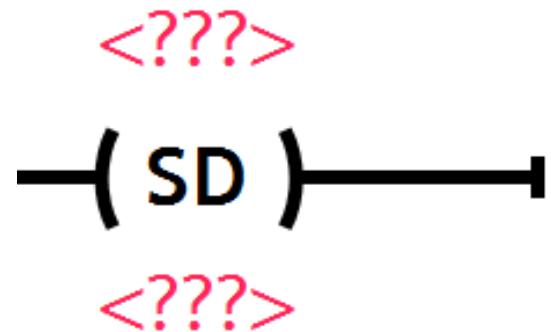


عملکرد این تایمر مشابه تایمر تاخیر در قطع دائمی می باشد .

| Parameter | Declaration | Data type | Memory area | Description |
|-----------------|-------------|--------------|---------------------------|---|
| <Time duration> | Input | S5TIME, WORD | I, Q, M, D, L or constant | Duration with which the timer expires. |
| <Timer> | Output | TIMER | T | Timer which is started. The number of timers depends on the CPU. |

TIMER OPERATIONS

Start On-Delay Timer ;

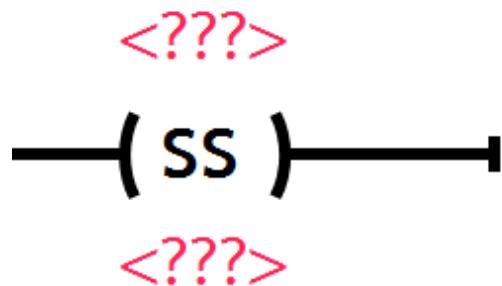


عملکرد این تایمر مشابه تایمر تأخیر در وصل می باشد.

| Parameter | Declaration | Data type | Memory area | Description |
|-----------------|-------------|--------------|---------------------------|---|
| <Time duration> | Input | S5TIME, WORD | I, Q, M, D, L or constant | Duration with which the timer expires. |
| <Timer> | Output | TIMER | T | Timer which is started. The number of timers depends on the CPU. |

TIMER OPERATIONS

Start Retentive On-Delay Timer ;



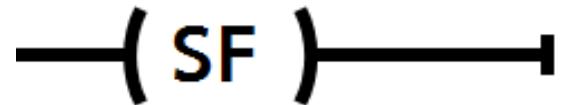
عملکرد این تایمر مشابه تایمر تأخیر در وصل دائمی می باشد .

| Parameter | Declaration | Data type | Memory area | Description |
|-----------------|-------------|--------------|---------------------------|---|
| <Time duration> | Input | S5TIME, WORD | I, Q, M, D, L or constant | Duration with which the timer expires. |
| <Timer> | Output | TIMER | T | Timer which is started. The number of timers depends on the CPU. |

TIMER OPERATIONS

Start Off-Delay Timer ;

<??>



<??>

عملکرد این تایمر مشابه تایمر تاخیر در قطع می باشد .

| Parameter | Declaration | Data type | Memory area | Description |
|-----------------|-------------|--------------|---------------------------|---|
| <Time duration> | Input | S5TIME, WORD | I, Q, M, D, L or constant | Duration with which the timer expires. |
| <Timer> | Output | TIMER | T | Timer which is started. The number of timers depends on the CPU. |

Timers Projects :

برنامه ای بنویسید که با فعال شدن دائم ورودی $S1$ پس از 7 ثانیه خروجی $Q0.0$ فعال شده و سپس با زدن $S2$ خروجی $Q0.1$ پس از 4 ثانیه روشن گردد و با زدن $S3$ هر دو خروجی غیر فعال گردد .

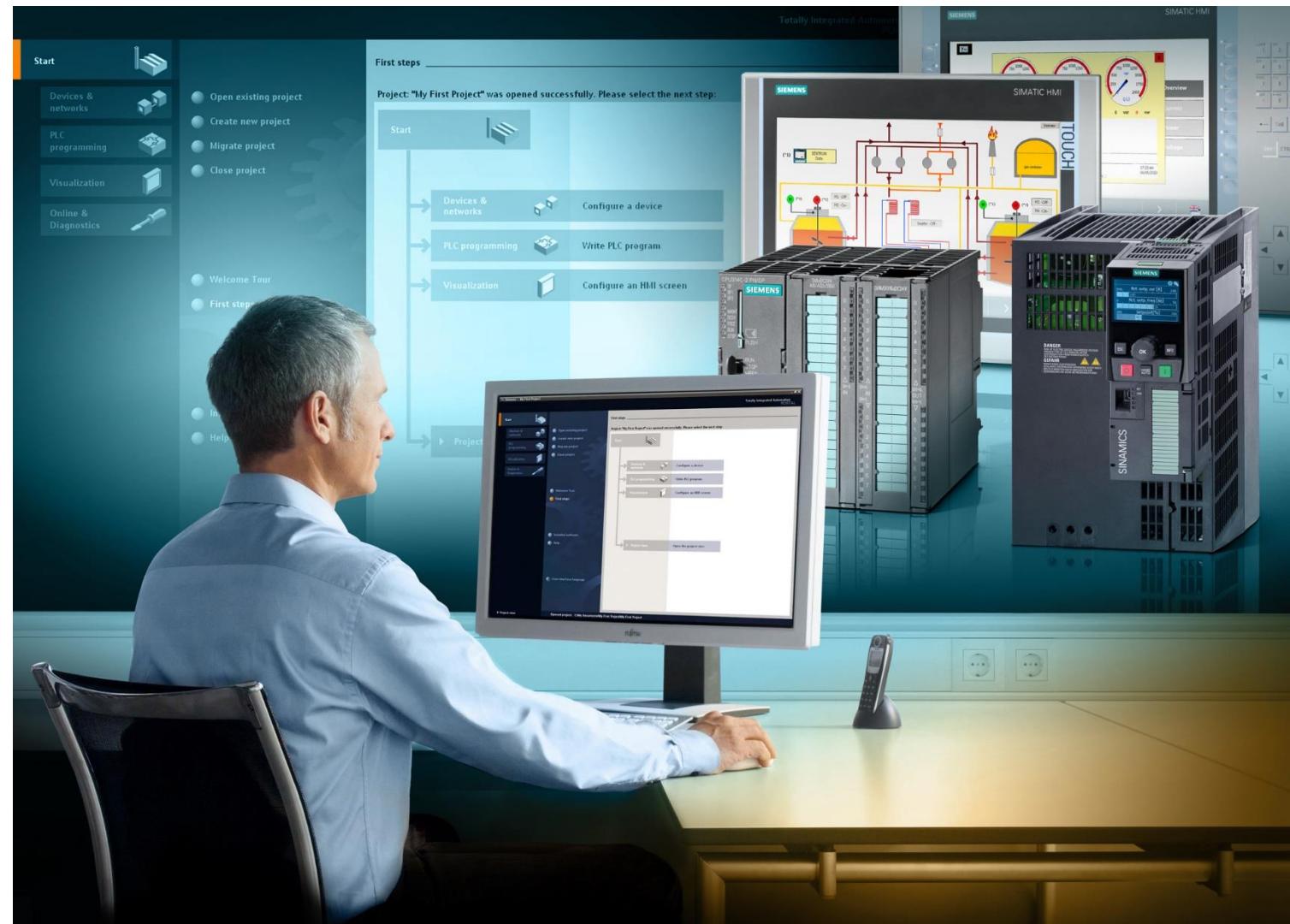
Timers Projects :

برنامه ای بنویسید که با فعال شدن دائم ورودی **S1** پس از 7 ثانیه خروجی **Q0.0** غیرفعال و سپس با زدن **S2** خروجی **Q0.1** پس از 4 ثانیه روشن گردد و با زدن **S3** هر دو خروجی غیر فعال گردد .

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِيْمِ

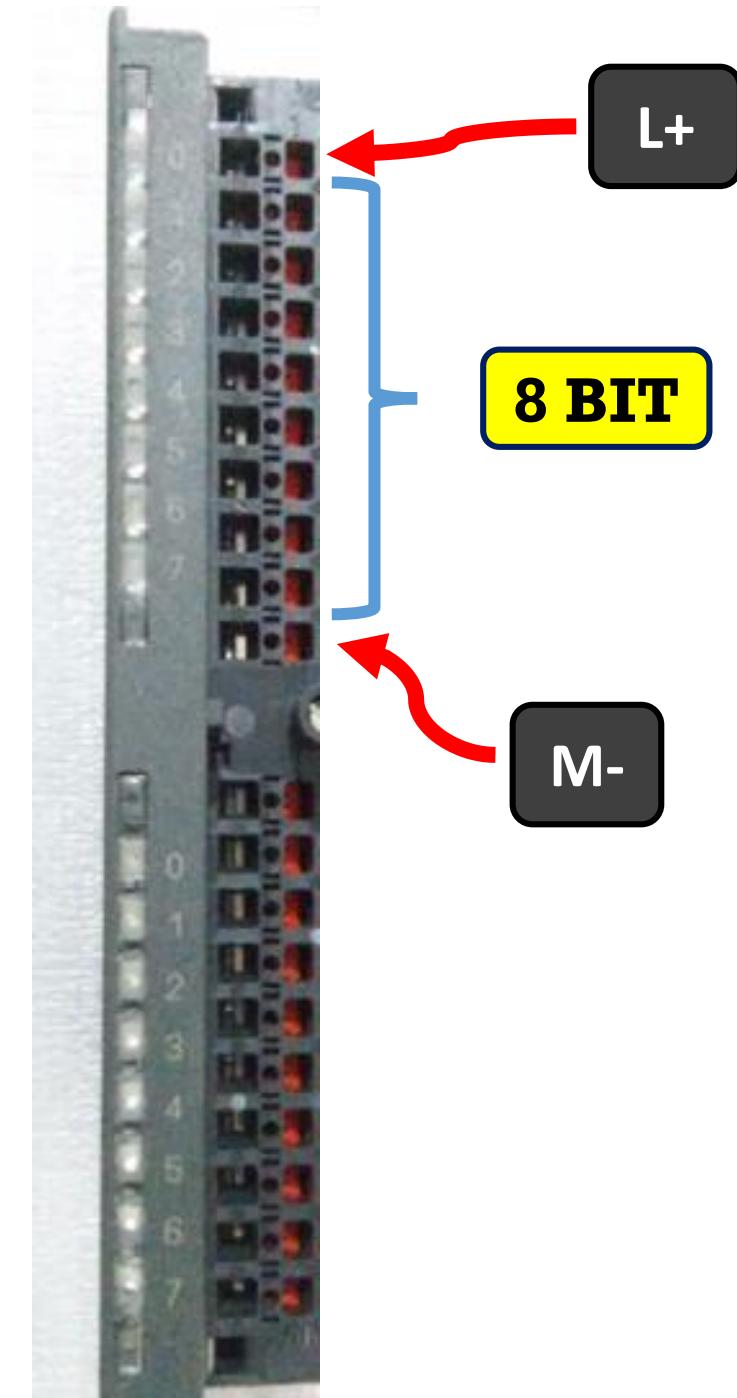
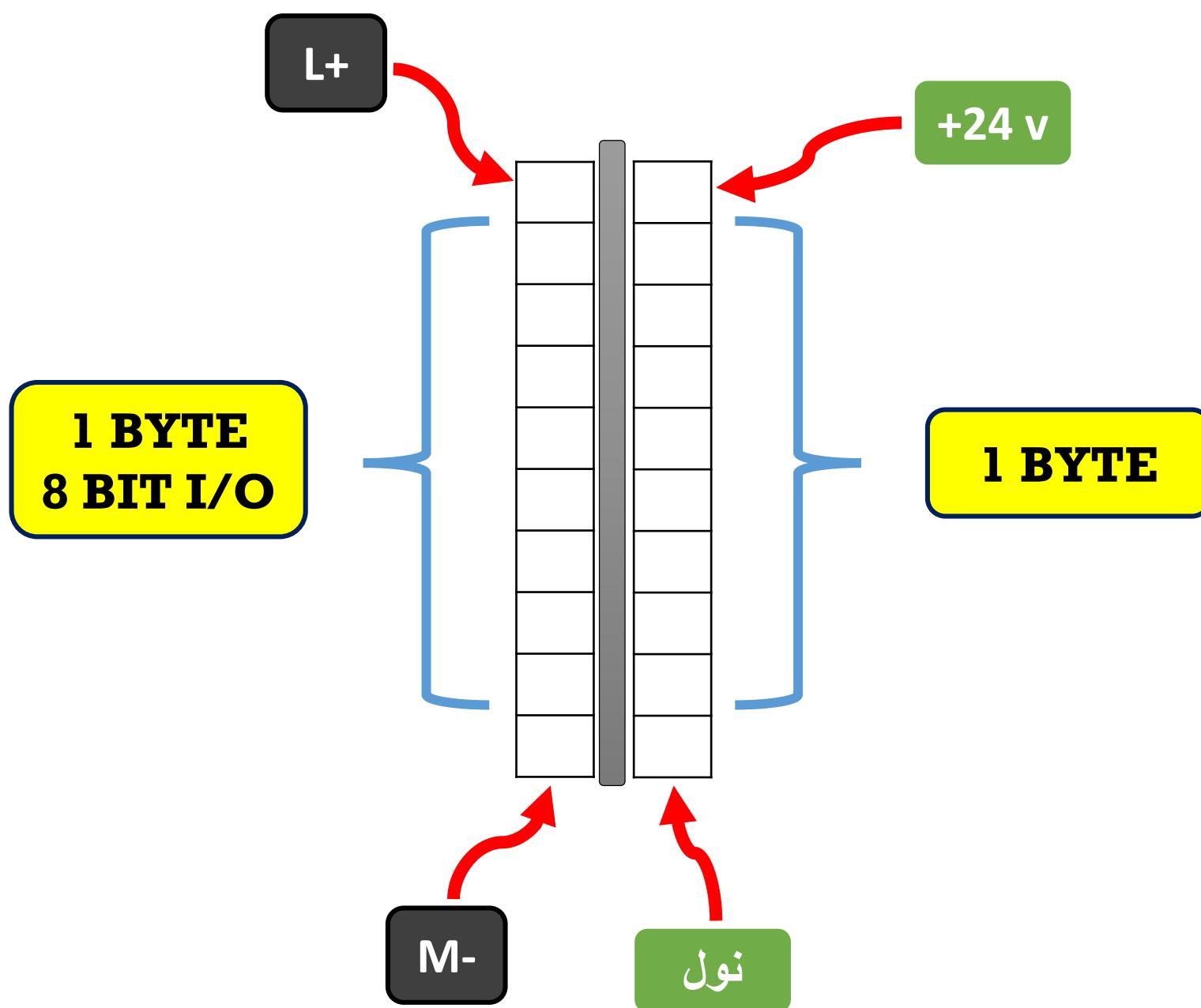
PLC COURSE

LECTURE : 4

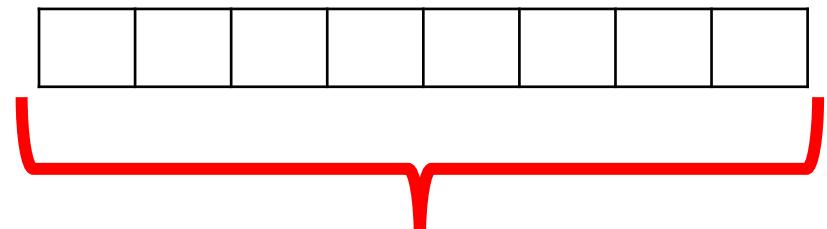


AHMAD KHEIRANDISH

I/O PINS



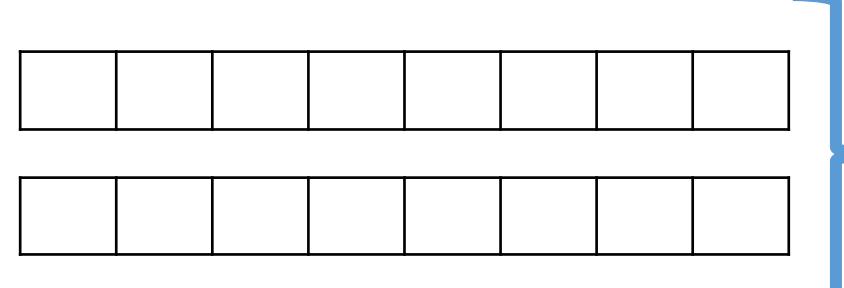
BIT/BYTE ...



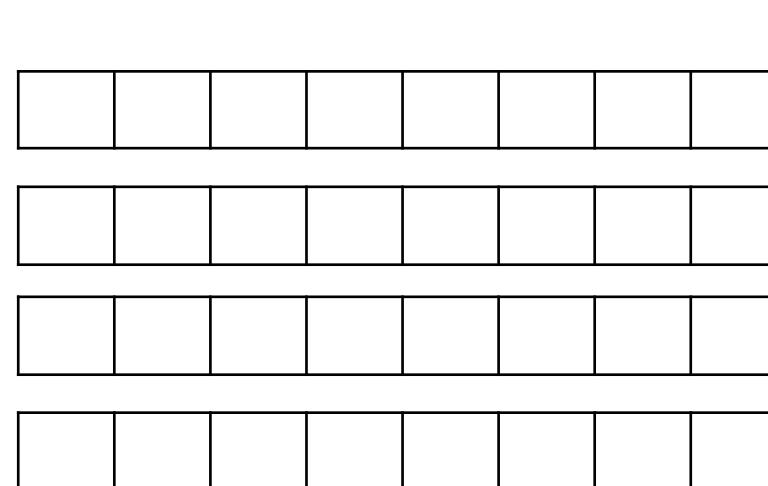
8 BIT
1 BYTE

0
 1

1 BIT



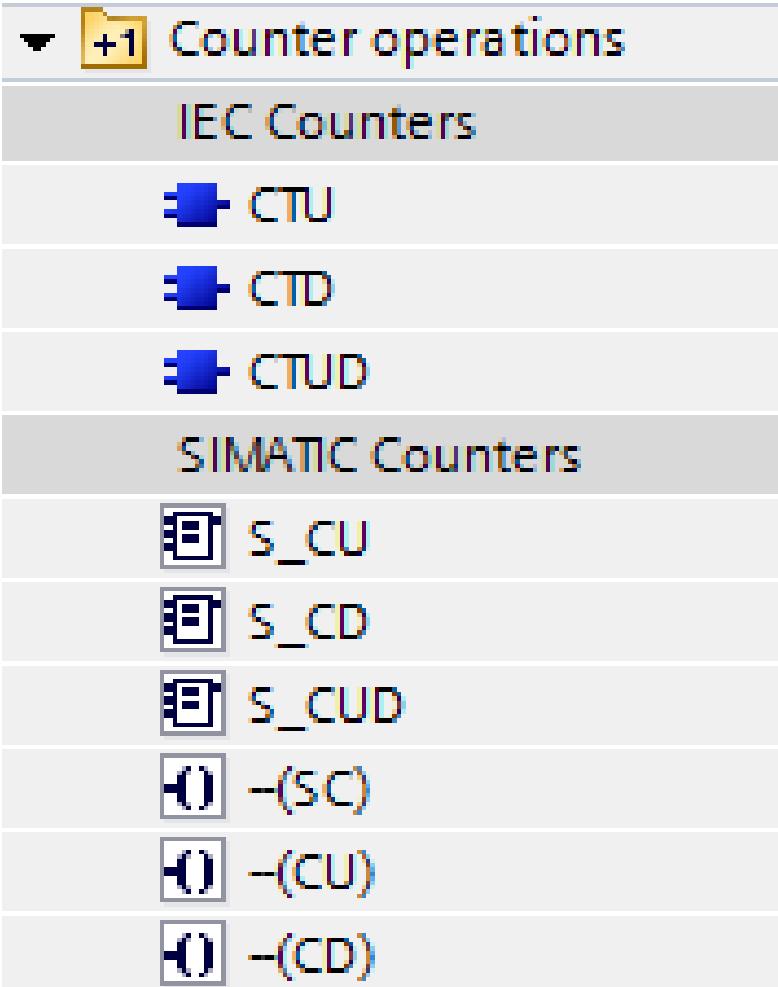
2 BYTE
1 WORD



4 BYTE
1 Double word

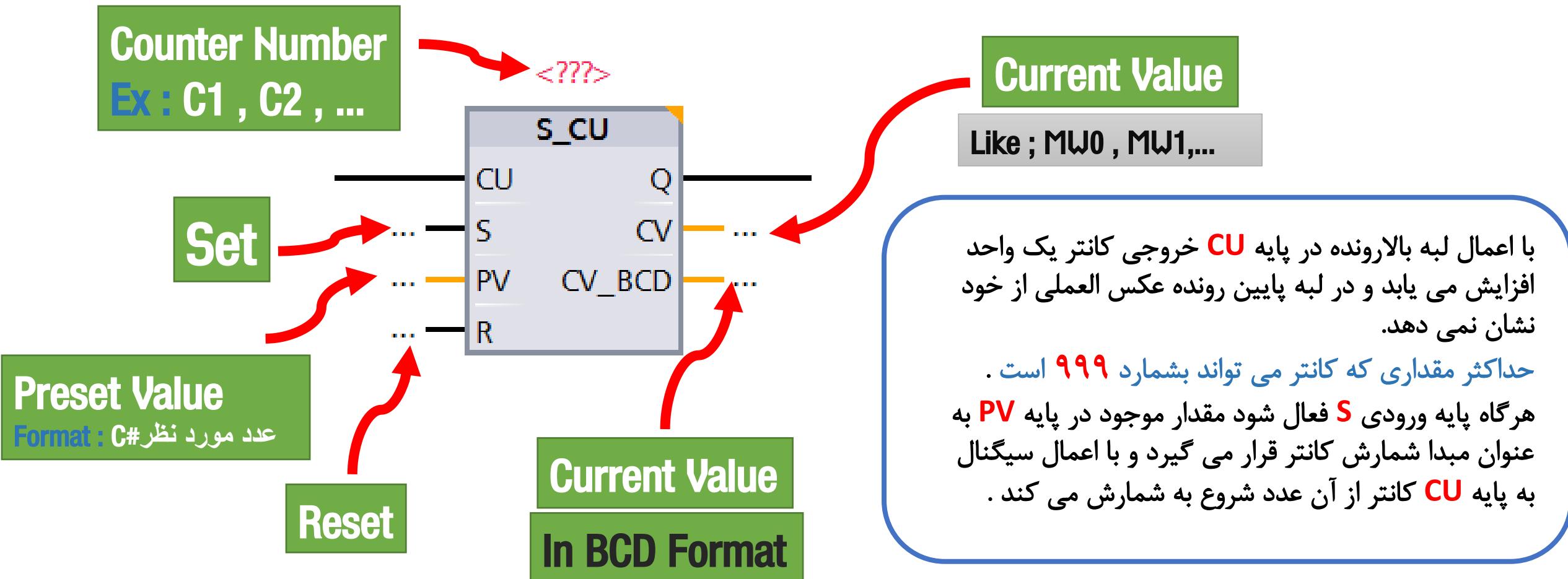
Counter Operations

عملگرهای شمارنده



Counter Operations

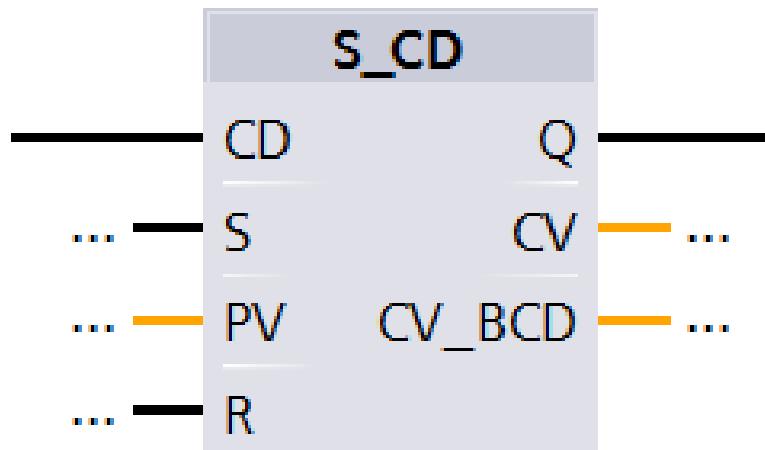
COUNT UP COUNTER ;



Counter Operations

COUNT DOWN COUNTER ;

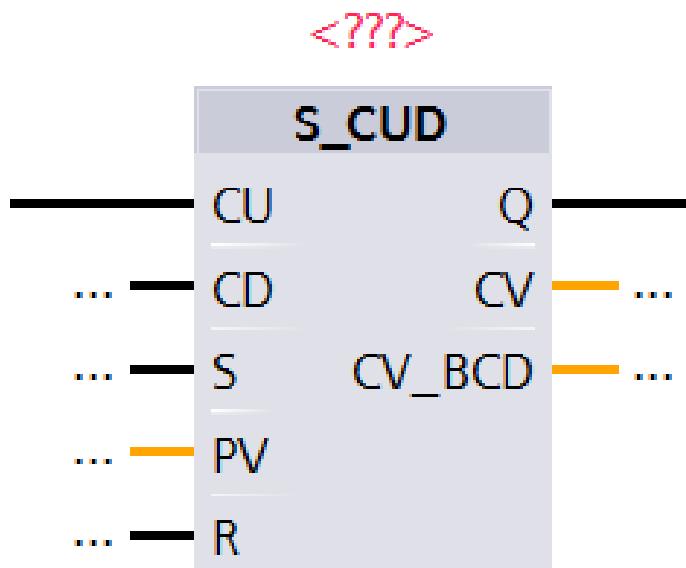
<??>



به ازای هر لبه بالارونده در پایه **CD** شمارنده یک واحد کاهش یافته تا به عدد صفر برسد و با صفر شدن مقدار کانتر، خروجی آن نیز غیرفعال می شود.

Counter Operations

COUNT UP & DOWN COUNTER ;

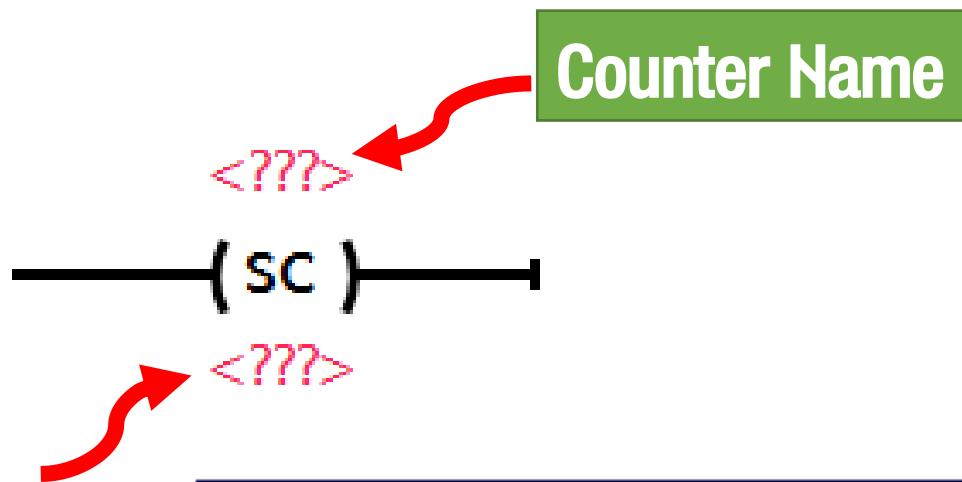


تلفیقی از دو بلوک قبلی بوده و با تحریک هر پایه **CU** و **CD** شمارنده به صورت پایین رونده و یا بالا رونده عمل می کند .

اگر هردو پایه همزمان فعال شوند هر دو عمل نموده و مقدار کانتر تغییر نخواهد کرد .

Counter Operations

SET COUNTER VALUE;

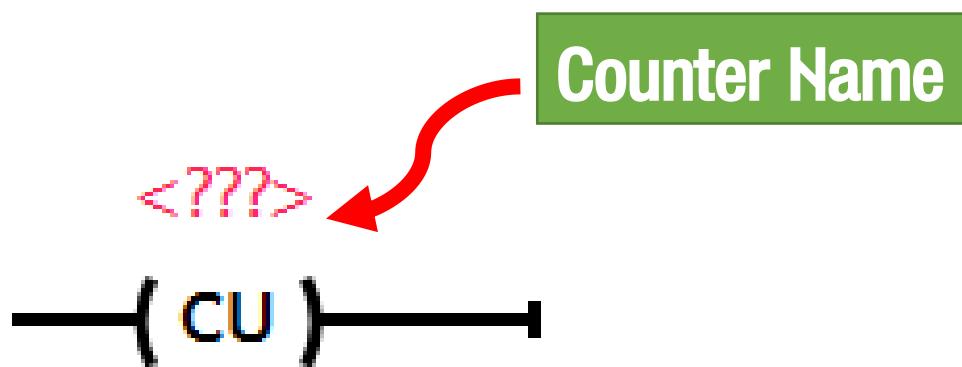


برای ست کردن یک شمارنده در عددی خاص به کار می رود.

| Parameter | Declaration | Data type | Memory area |
|---------------|-------------|-----------|---------------------------|
| <Count value> | Input | WORD | I, Q, M, D, L or constant |
| <Counter> | InOut/Input | COUNTER | C |

Counter Operations

COUNT UP ;

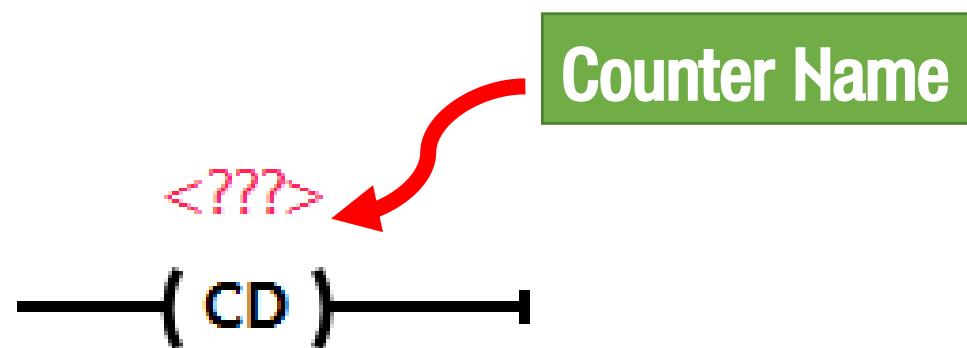


برای افزایش شمارش یک شمارنده به کار می رود .

| Parameter | Declaration | Data type | Memory area | Description |
|-----------|-------------|-----------|-------------|-------------------------------------|
| <Counter> | InOut/Input | COUNTER | C | Counter whose value is incremented. |

Counter Operations

COUNT DOWN ;

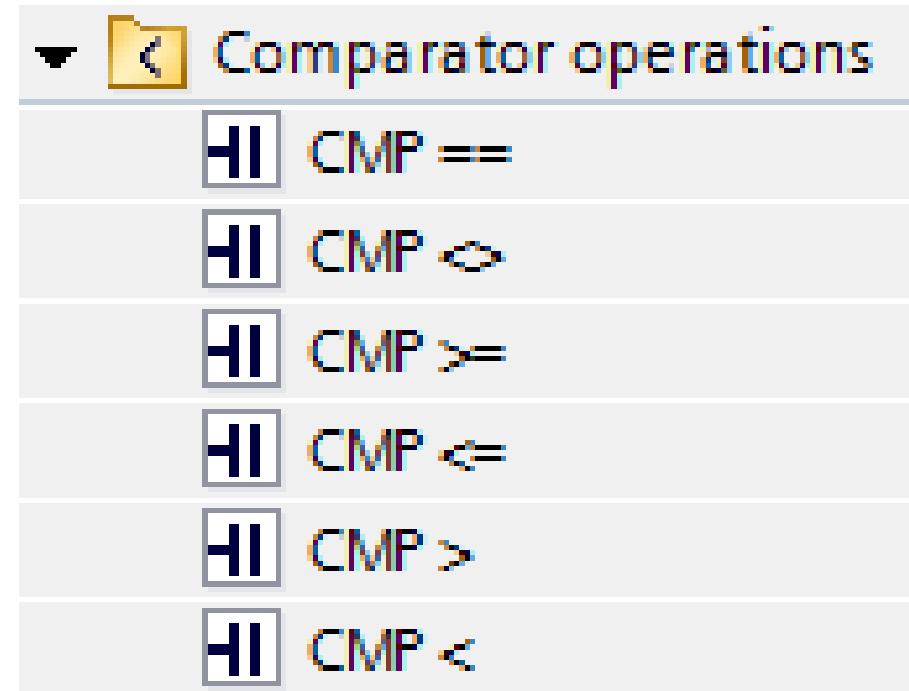


برای کاهش شمارش یک شمارنده به کار می رود .

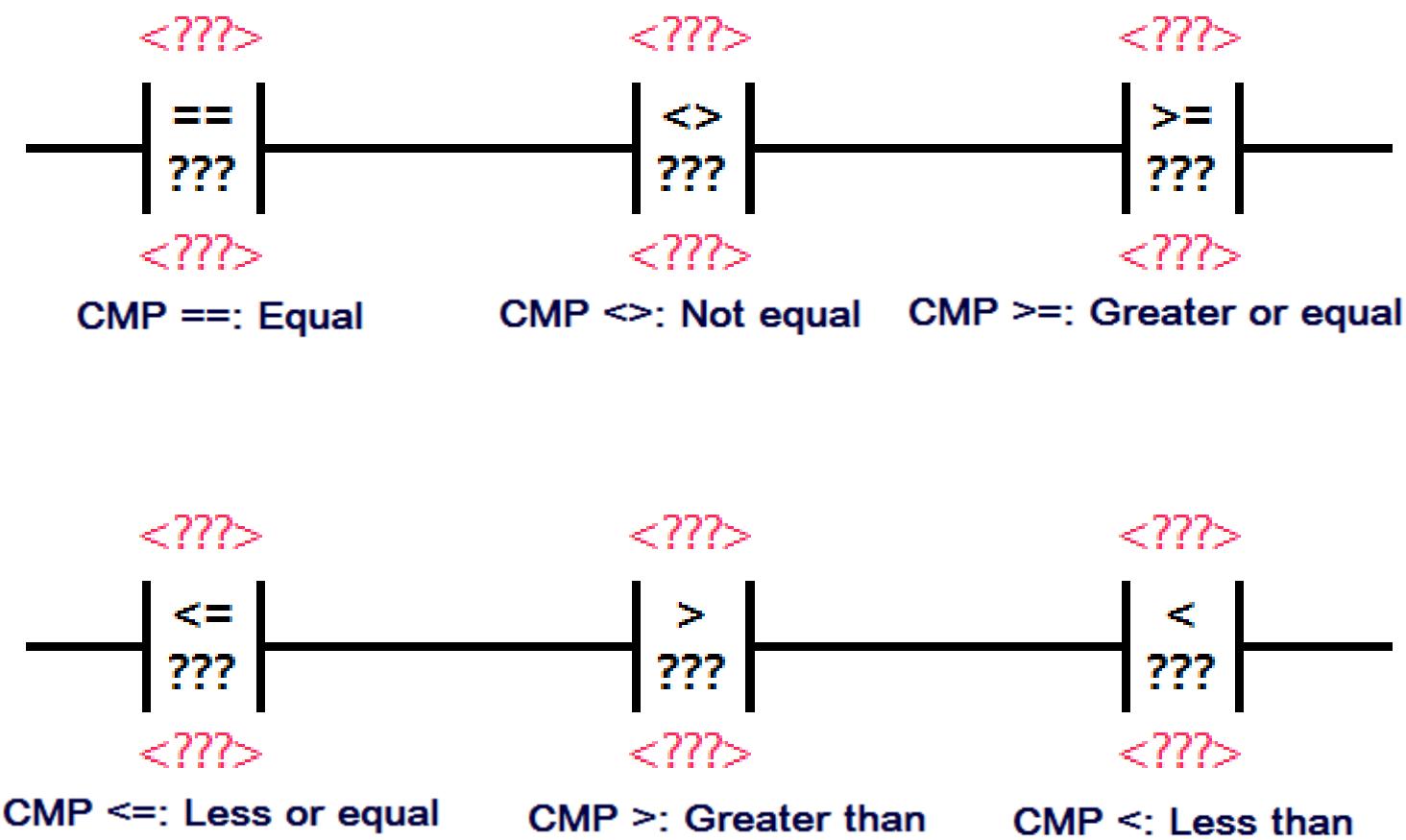
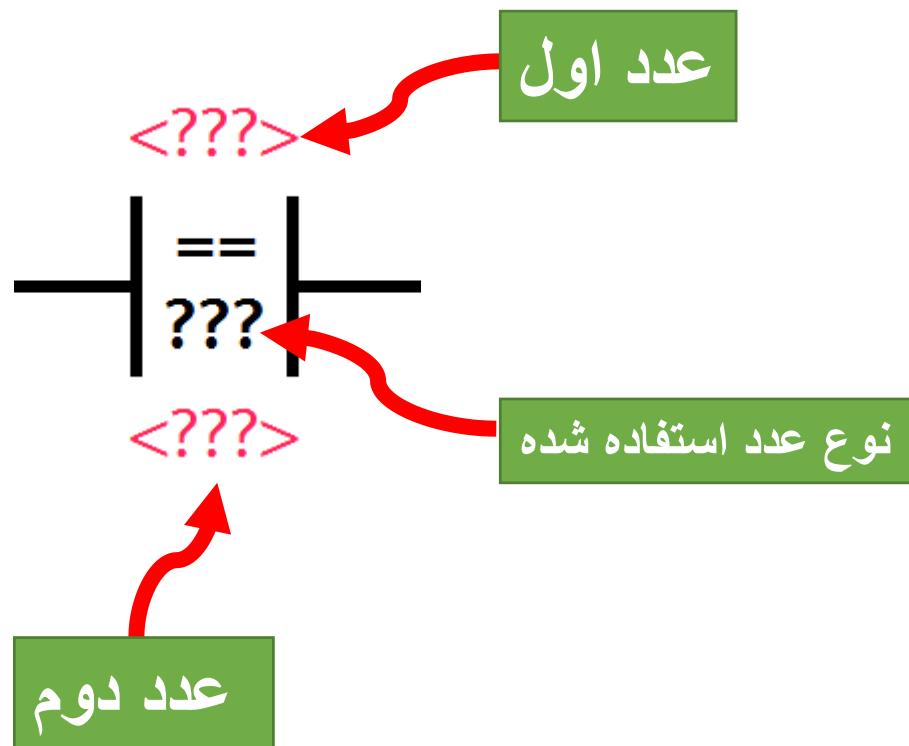
| Parameter | Declaration | Data type | Memory area | Description |
|-----------|-------------|-----------|-------------|-------------------------------------|
| <Counter> | InOut/Input | COUNTER | C | Counter whose value is incremented. |

Comparator Operations

عملگرهای مقایسه کننده



Comparator Operations



Data TYPES

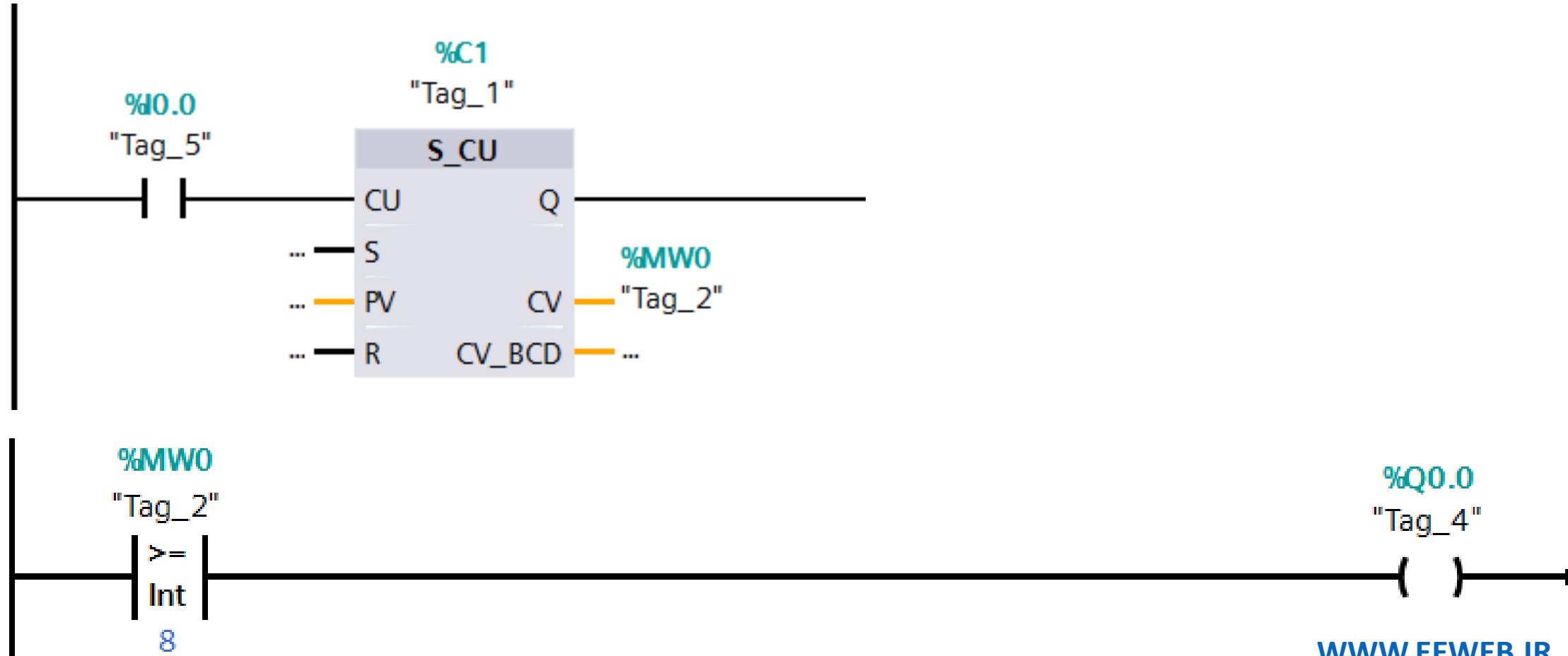
| نوع داده | فرمت | تعداد بیت | توضیحات |
|----------|------------|-----------|-----------------------|
| Bool | 0 – 1 | 1 | - |
| Byte | B#16# عدد | 8 | 00 ... FF |
| Word | W#16# عدد | 16 | 0000 ... FFFF |
| Dword | DW#16# عدد | 32 | 00000000 ... FFFFFFFF |
| Real | - | 32 | مجموعه اعداد اعشاری |
| Time | T# زمان | 32 | 24D20H31M23S647MS |

Data TYPES

| نوع داده | فرمت | تعداد بیت | توضیحات |
|----------------|-----------|-----------|---|
| S5Time | S5T# زمان | 16 | 2H46M30S0MS |
| Data | D# تاریخ | 16 | Yyyy-mm-dd |
| Char | ' ' | 8 | کاراکتر می تواند حرف یا عدد باشد و بین دو علامت ' ' قرار بگیرد. |
| Integer | - | 16 | عدد صحیح با علامت از ۳۲۷۶۸+ تا ۳۲۷۶۸- |
| Double integer | L#... | 32 | L#-214783648 L#+2147423647 |

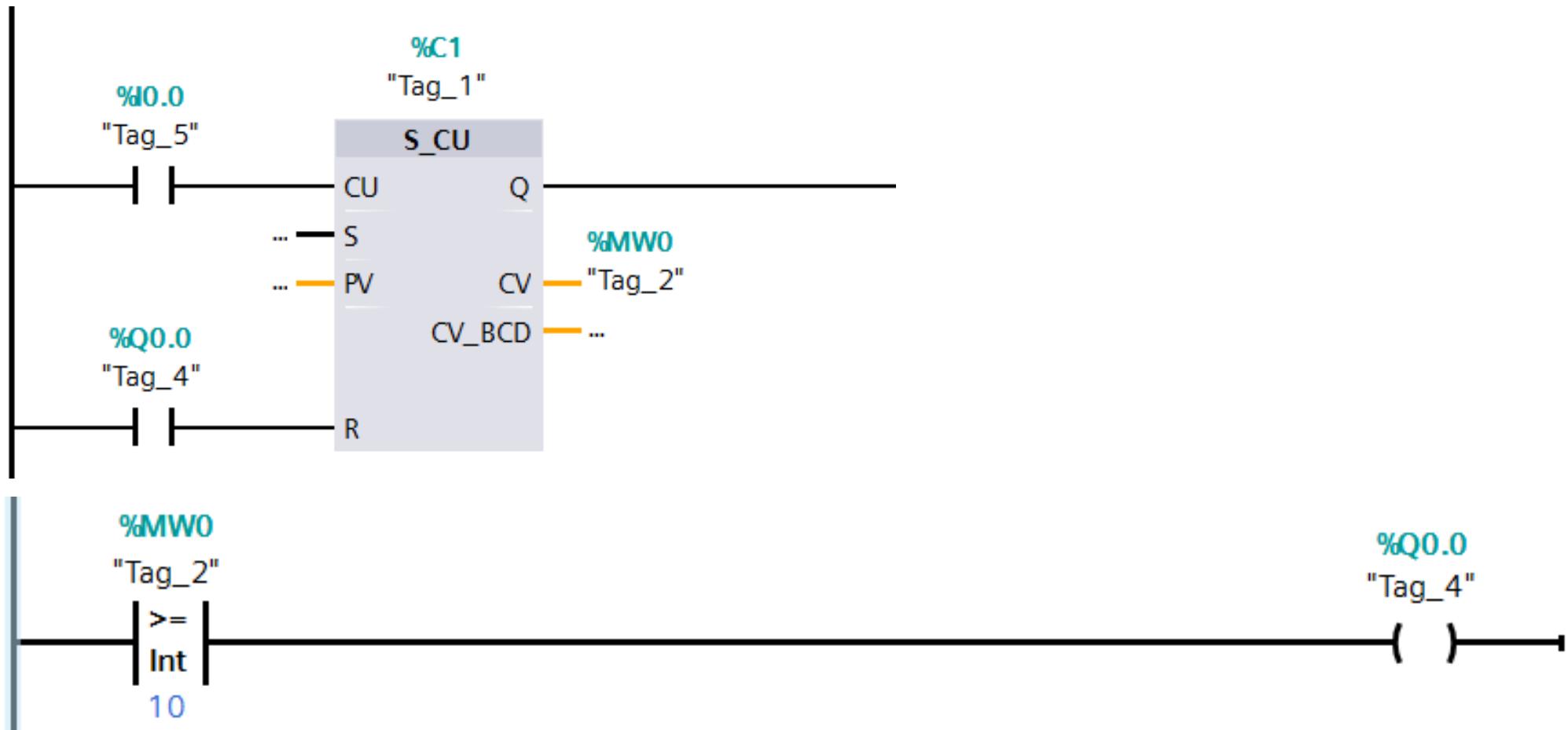
PROJECTS: PROJECT 1

برنامه ای بنویسید که با هر بار فعال شدن سنسور الکتریکی با آدرس **10.0**، یک واحد به شمارنده اضافه شود و اگر **۸** مرتبه تحریک شد، جک هیدرولیکی با آدرس **Q0.0**، فعال شود.



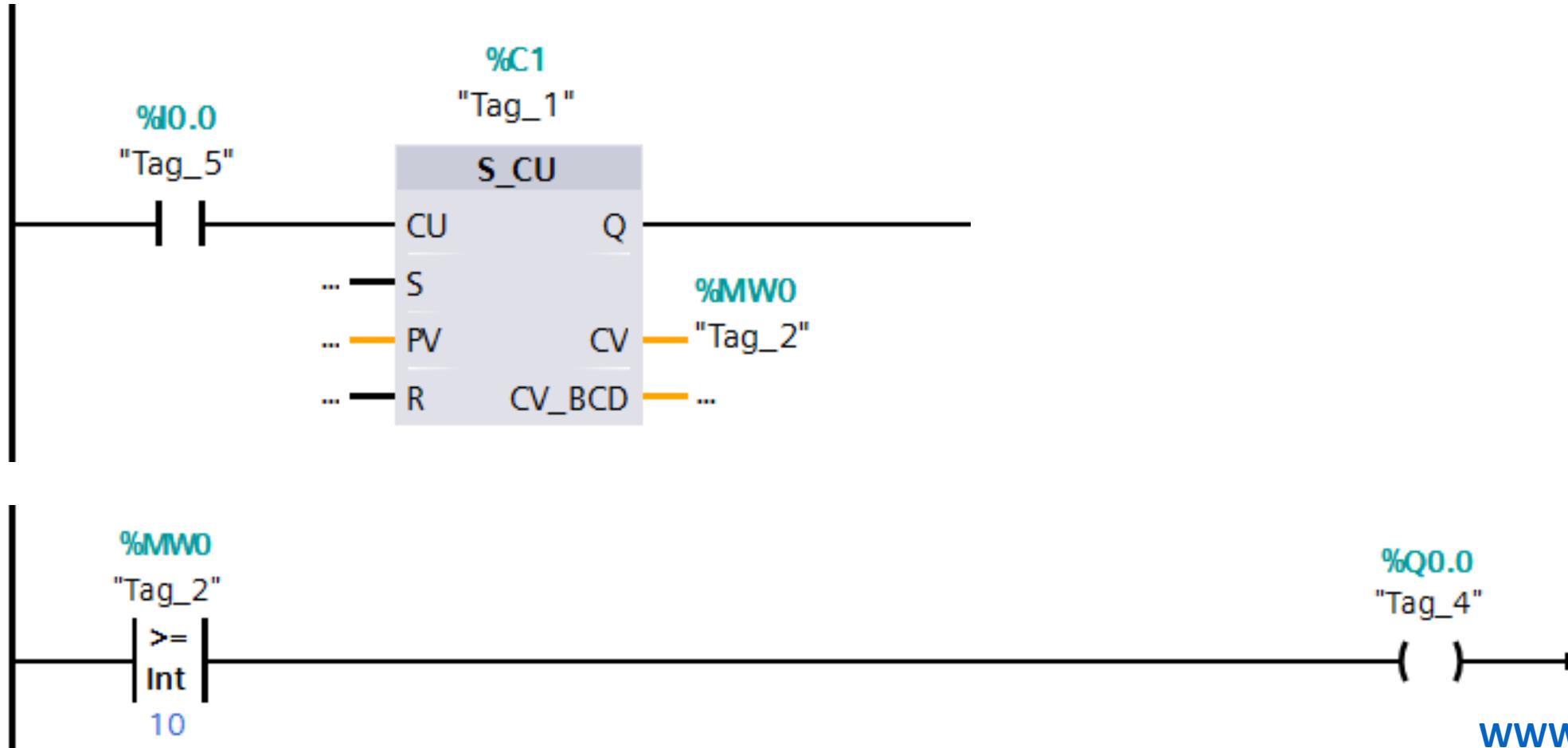
PROJECTS: PROJECT 2

برنامه ای بنویسید که با هر بار فعال شدن سنسور الکتریکی با آدرس 10.0، یک واحد به شمارنده اضافه شود و اگر 10 مرتبه تحریک شد، به طوراتوماتیک reset شود و دوباره از صفر شروع به شمارش نماید.

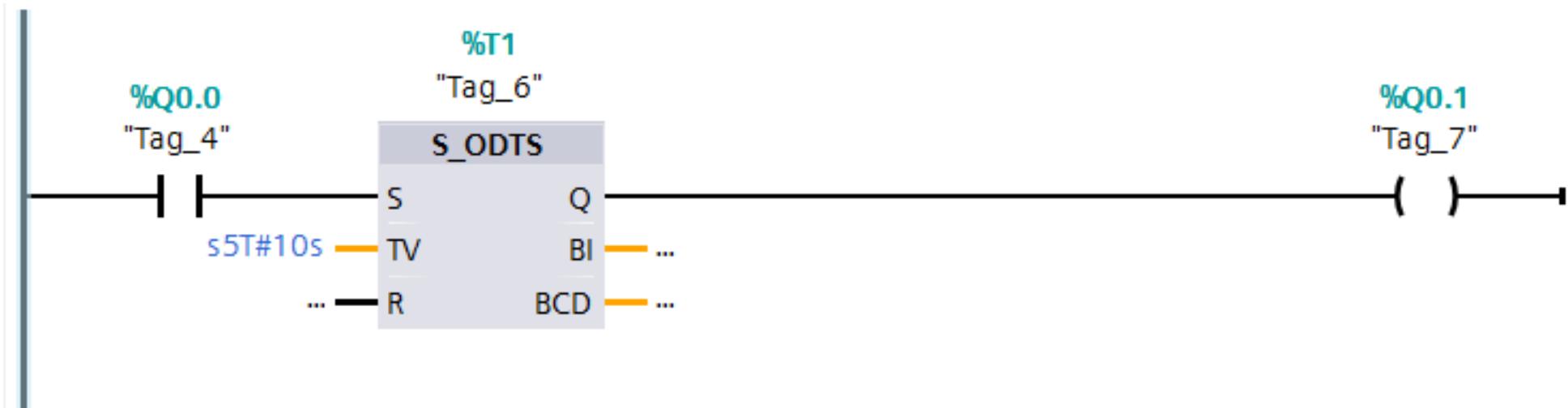


PROJECTS: PROJECT 3

برنامه ای بنویسید که با هر بار فعال شدن سنسور الکتریکی با آدرس 10.0، یک واحد به شمارنده اضافه شود و اگر ۱۰ مرتبه تحریک شد، جک هیدرولیکی با آدرس Q0.0، پس از 10s به طور دائم فعال شود.

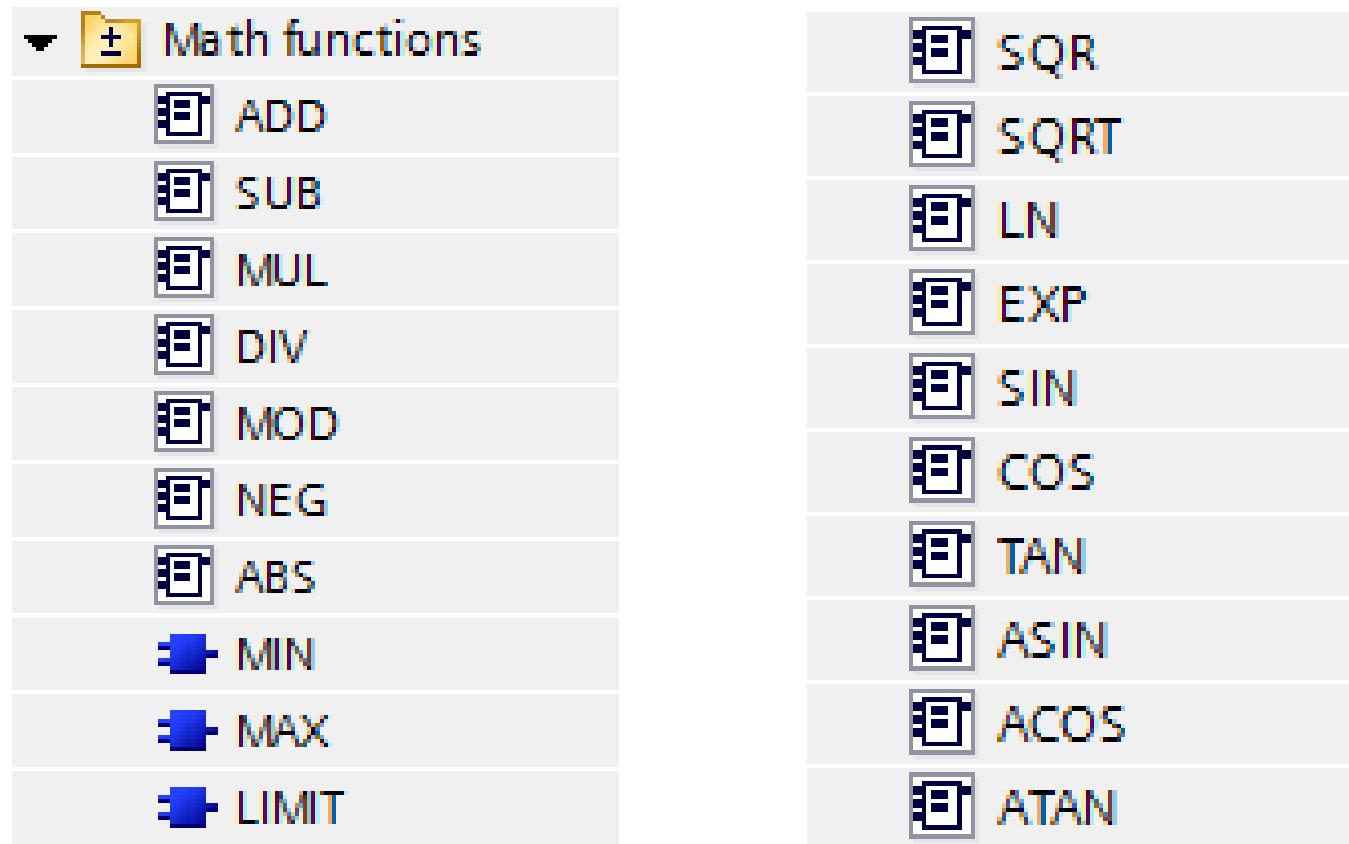


PROJECTS: PROJECT 3

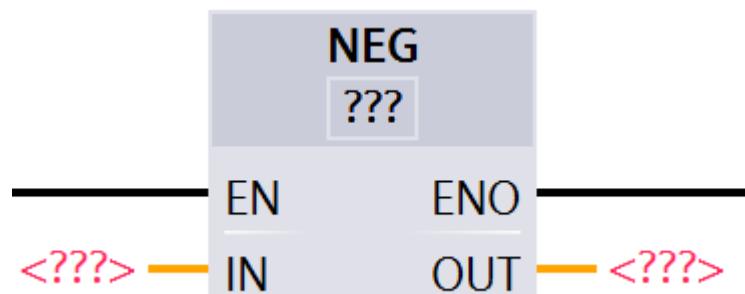
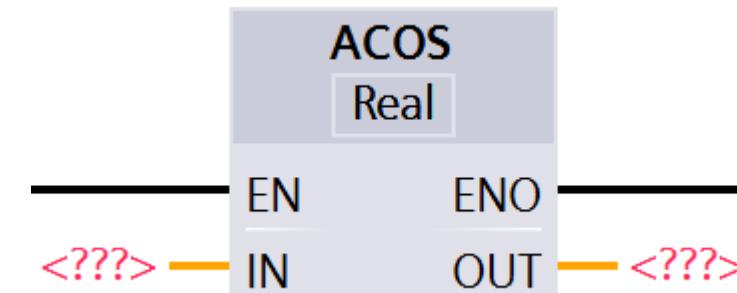
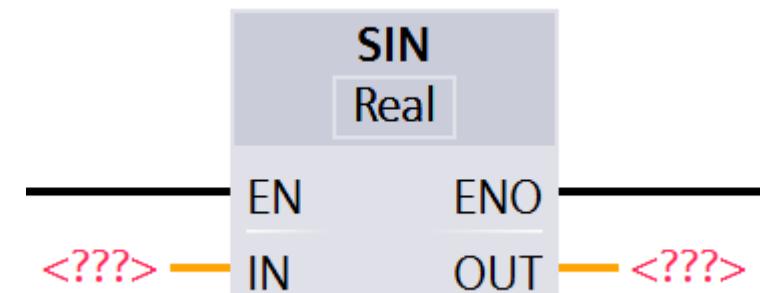
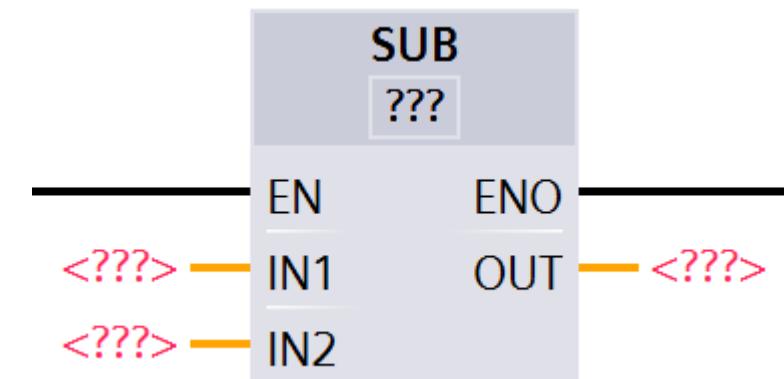
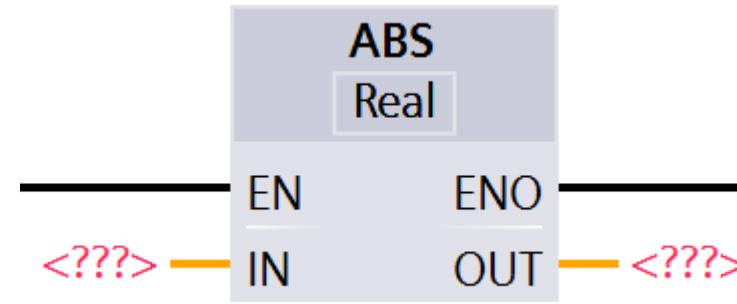
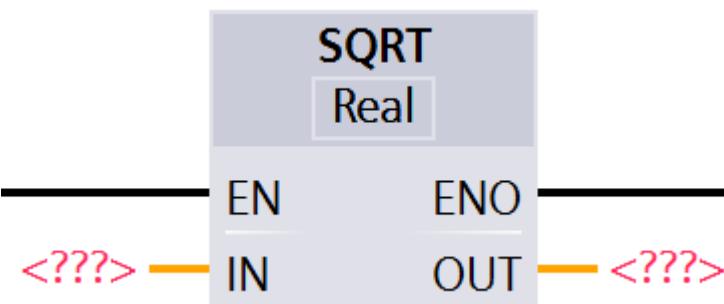
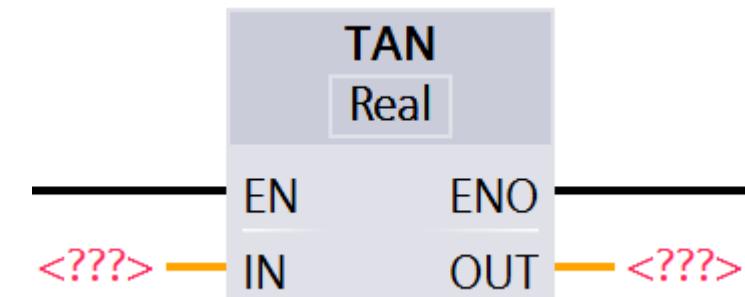
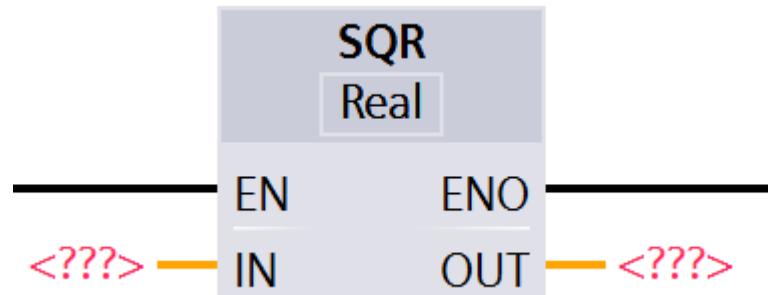
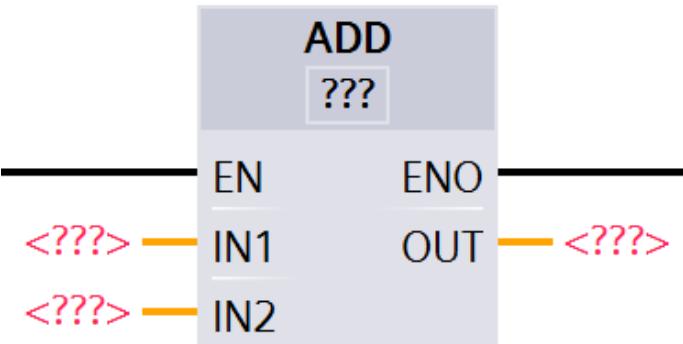


Math Functions

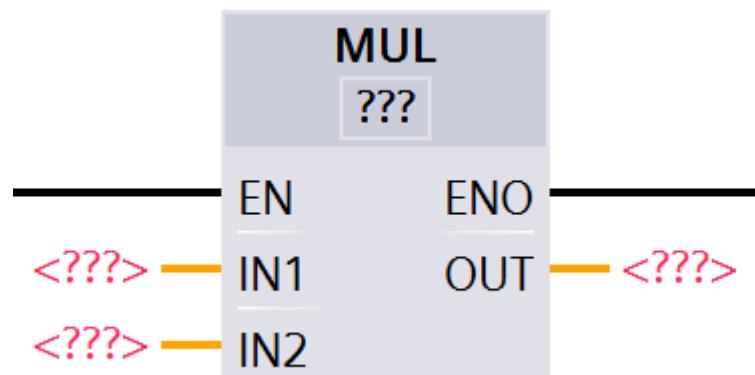
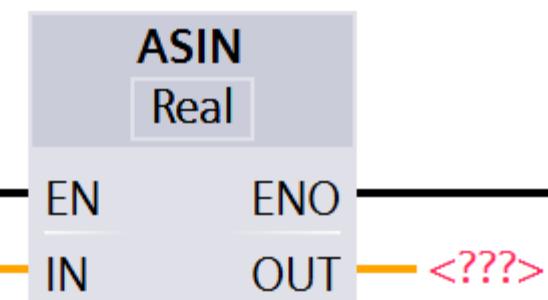
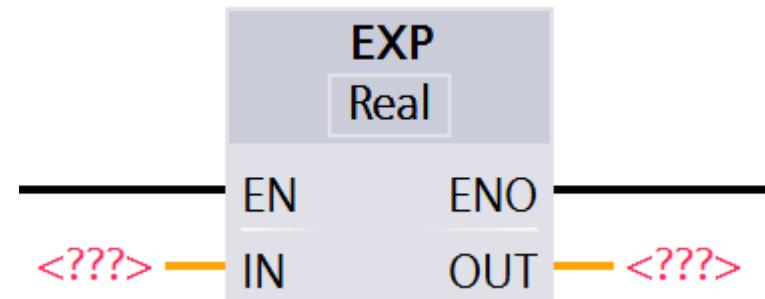
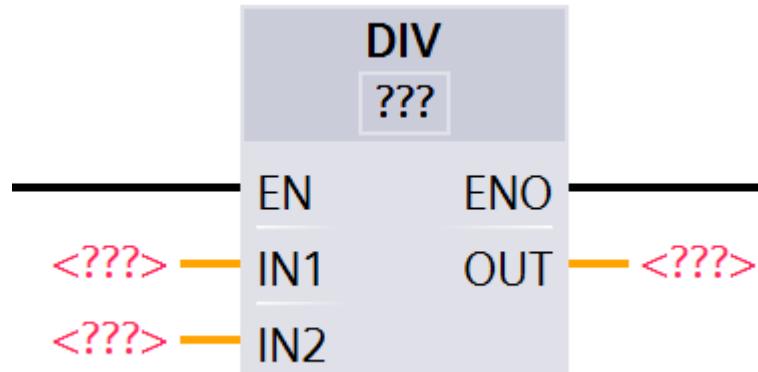
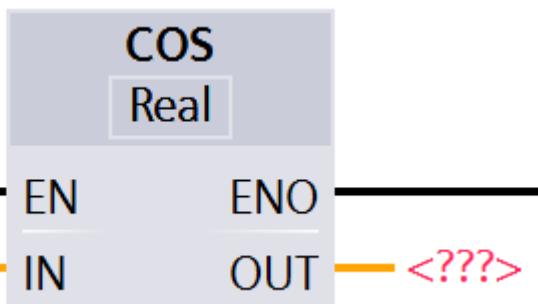
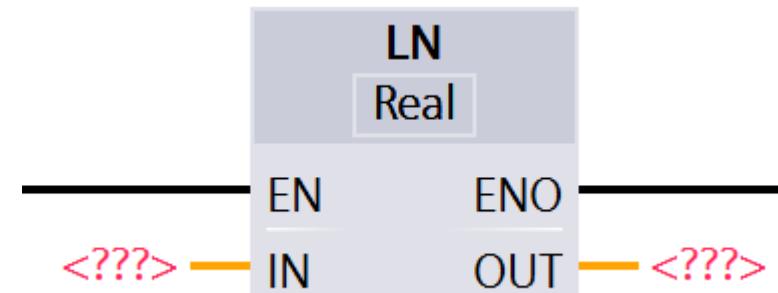
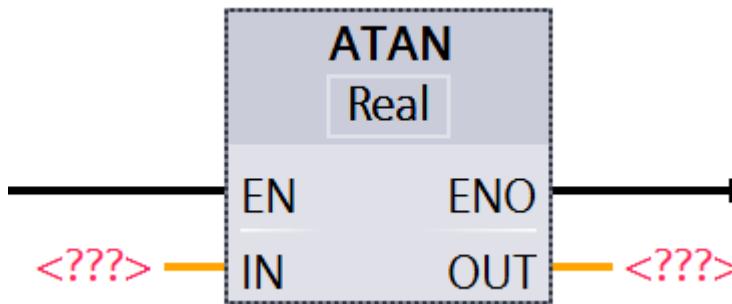
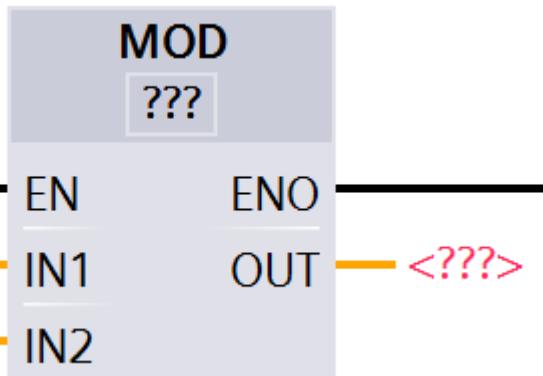
توابع ریاضی



Math Functions

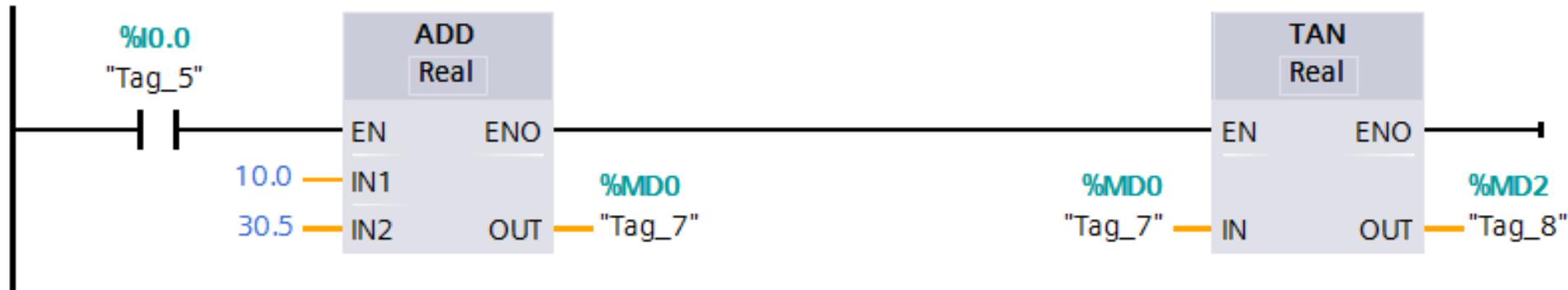


Math Functions



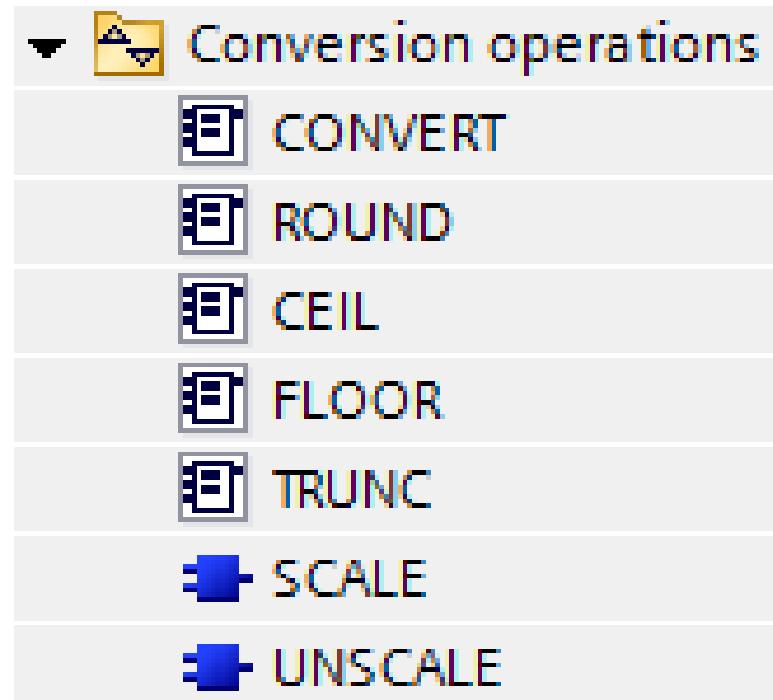
PROJECTS: PROJECT 1

برنامه ای بنویسید که با فعال شدن ورودی با آدرس **I0.0**، عدد **10.0** با **tan** آن عدد محاسبه گردد.

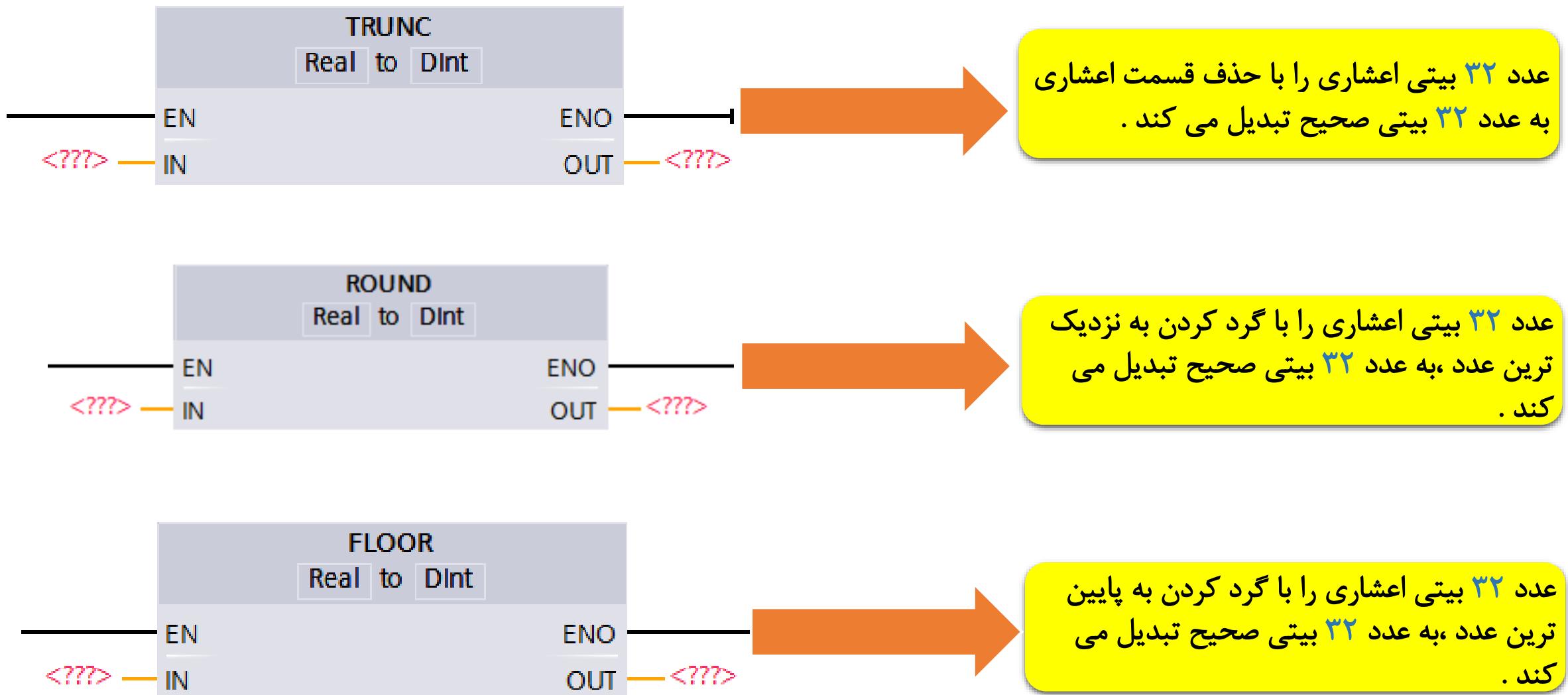


Conversion Operations

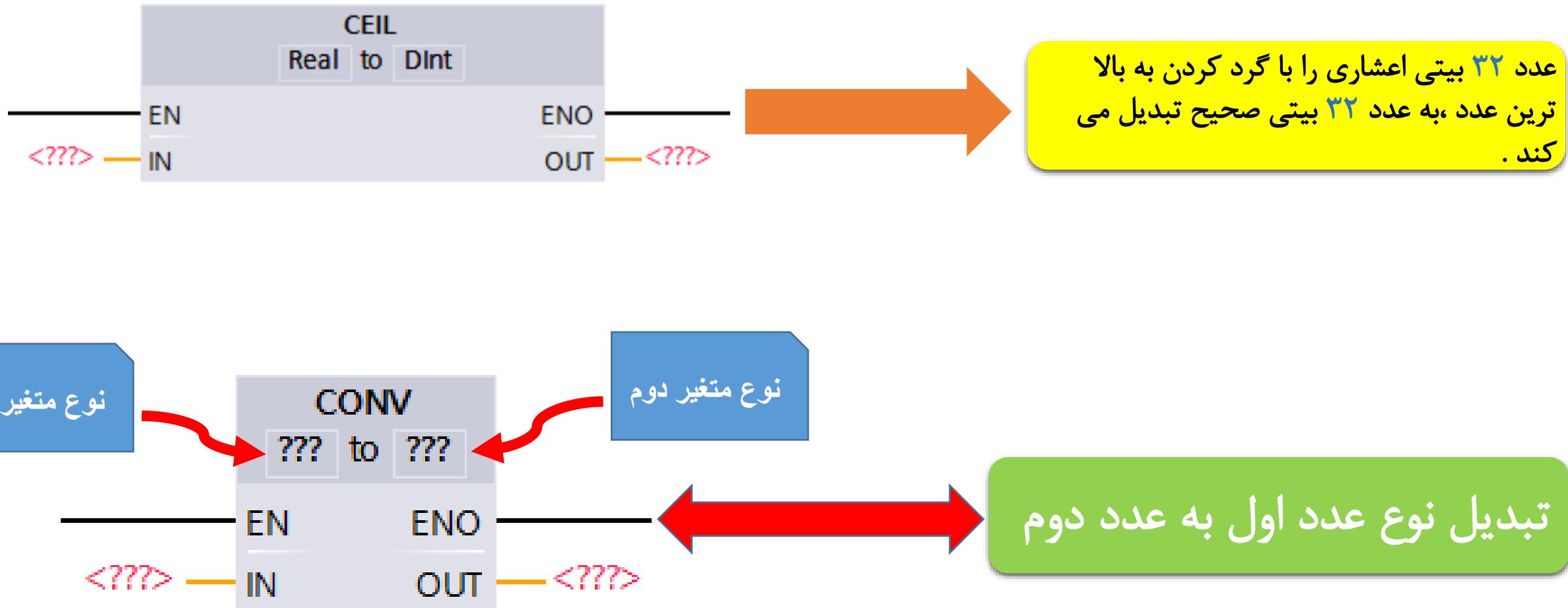
عملگرهای گرد کننده



Conversion Operations



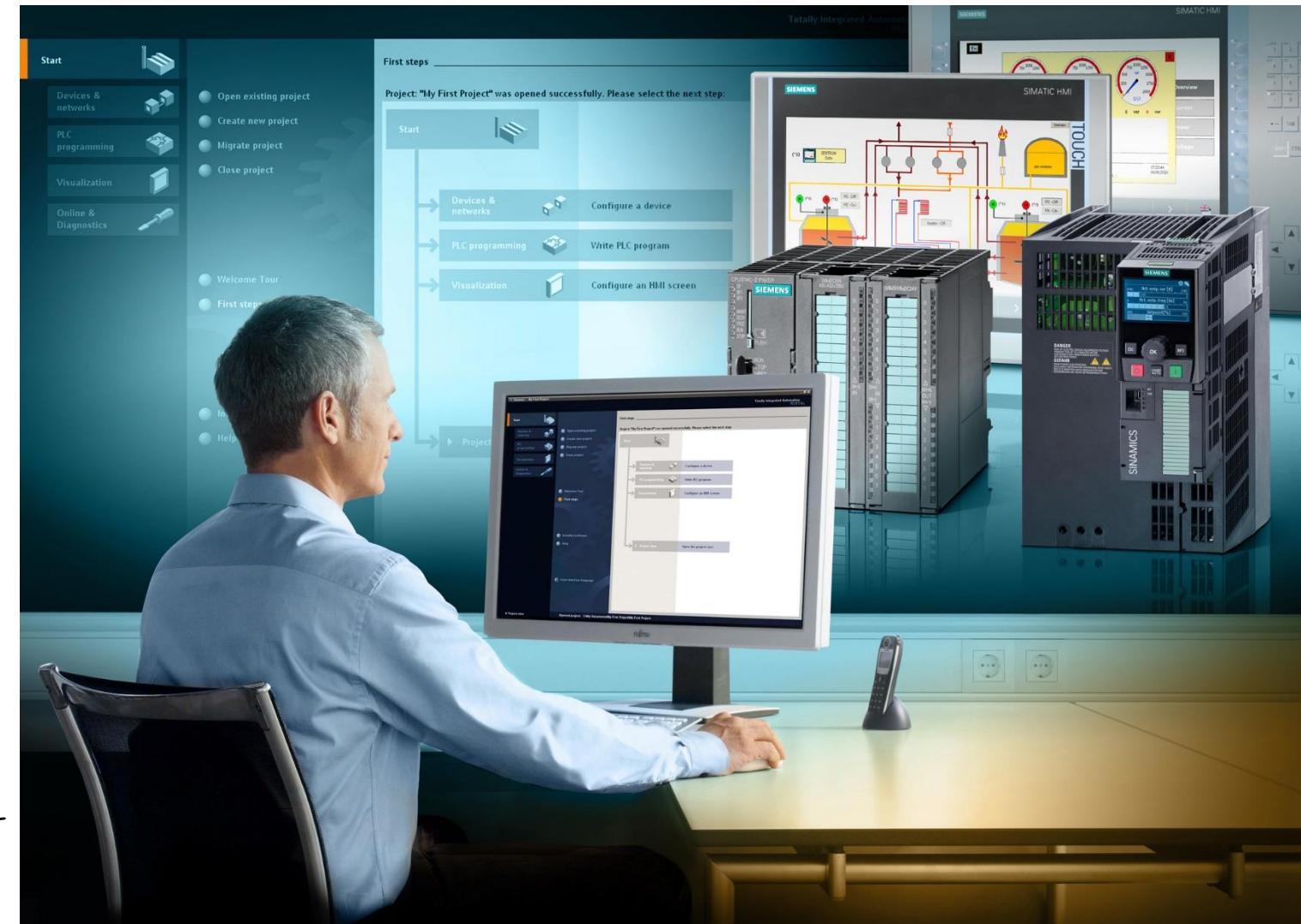
Conversion Operations



بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِيْمِ

PLC COURSE

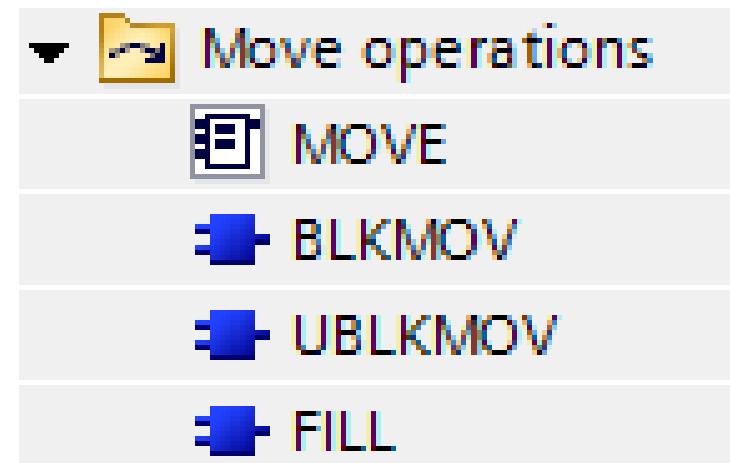
LECTURE : 5



AHMAD KHEIRANDISH

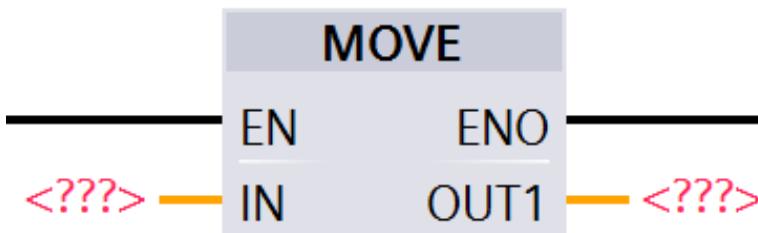
Move Operations

عملگرهای انتقال



Move Operations

MOVE VALUE ;



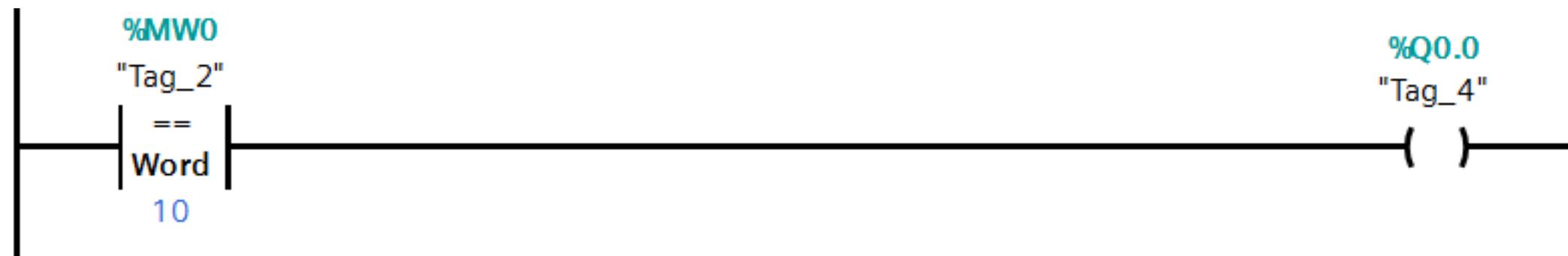
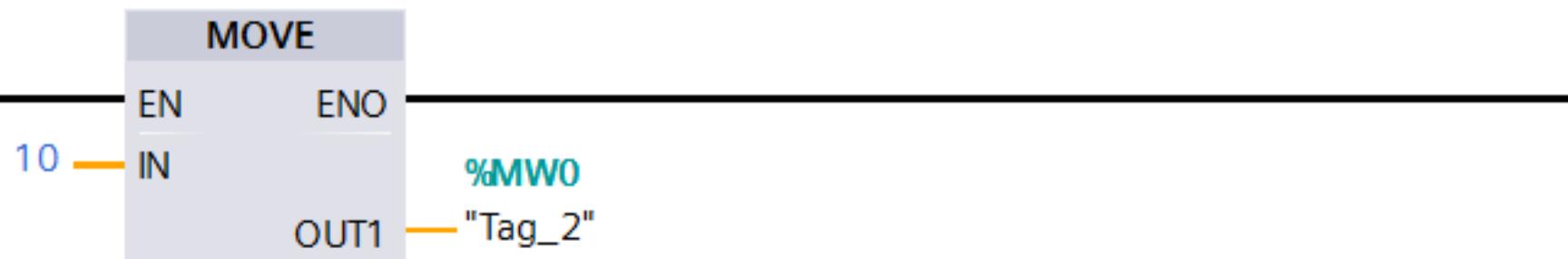
با فعال شدن پایه **EN** مقدار عددی و یا پارامتری
موجود در پایه **IN** به خروجی پارامتری **OUT1** منتقل می شود .

Move Operations

| Source (IN) | Destination (OUT1) | |
|-------------|--------------------|---|
| | With IEC check | Without IEC check |
| BYTE | BYTE, WORD, DWORD | BYTE, WORD, DWORD, INT, DINT, TIME, DATE, TOD, CHAR |
| WORD | WORD; DWORD | BYTE, WORD, DWORD, INT, DINT, TIME, S5TIME, DATE, TOD, CHAR |
| DWORD | DWORD | BYTE, WORD, DWORD, INT, DINT, REAL, TIME, DATE, TOD, CHAR |
| INT | INT | BYTE, WORD, DWORD, INT, DINT, TIME, DATE, TOD |
| DINT | DINT | BYTE, WORD, DWORD, INT, DINT, TIME, DATE, TOD |
| REAL | REAL | DWORD, REAL |
| TIME | TIME | BYTE, WORD, DWORD, INT, DINT, TIME |
| S5TIME | S5TIME | WORD, S5TIME |
| DATE | DATE | BYTE, WORD, DWORD, INT, DINT, DATE |
| TOD | TOD | BYTE, WORD, DWORD, INT, DINT, TOD |
| CHAR | CHAR | BYTE, WORD, DWORD, CHAR |
| COUNTER | INT, WORD, COUNTER | WORD, DWORD, INT, UINT, DINT, UDINT |
| TIMER | INT, WORD, TIMER | WORD, DWORD, INT, UINT, DINT, UDINT |

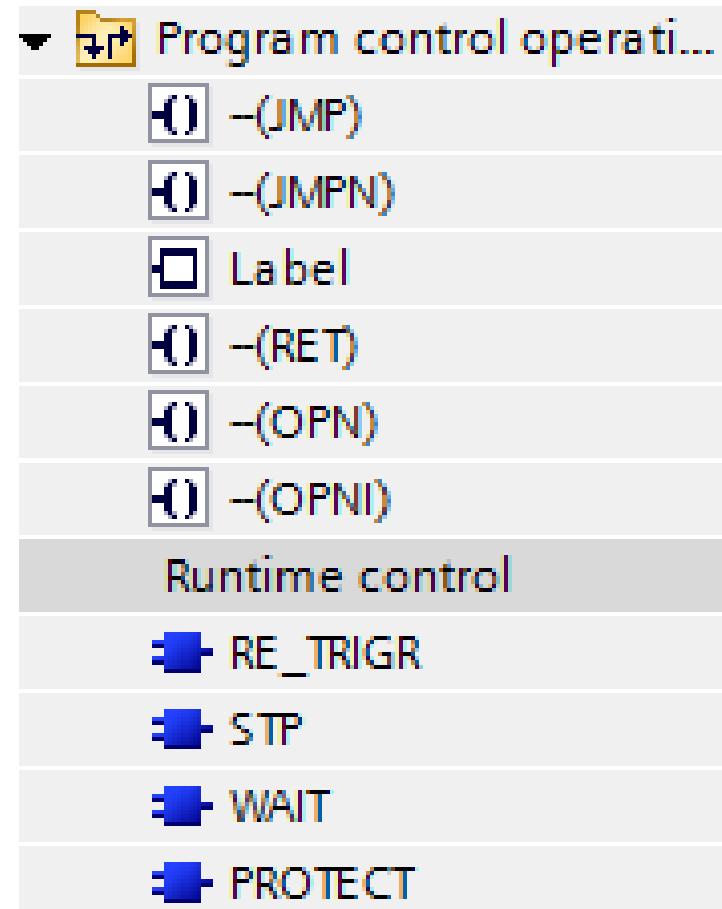
PROJECTS: PROJECT 1

برنامه ای بنویسید که با فعال شدن ورودی با آدرس I0.0 ، عدد ۱۰ به حافظه ای MW0 منتقل شود و اگر این حافظه با عدد ۱۰ برابر بود ، خروجی Q0.0 فعال شود .



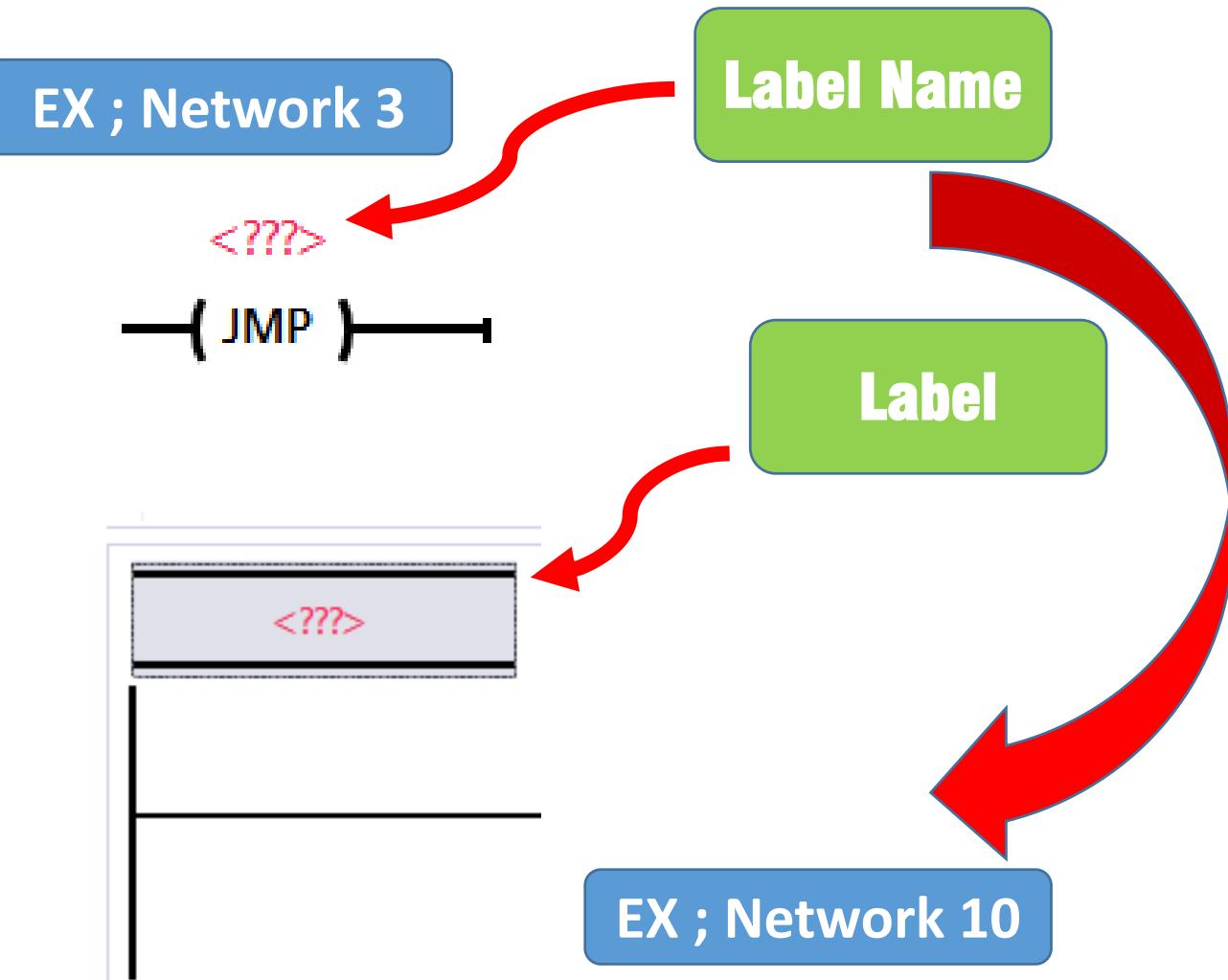
Program Control Operations

عملگرهای کنترل برنامه



Program Control Operations

JUMP IF RLO=1;

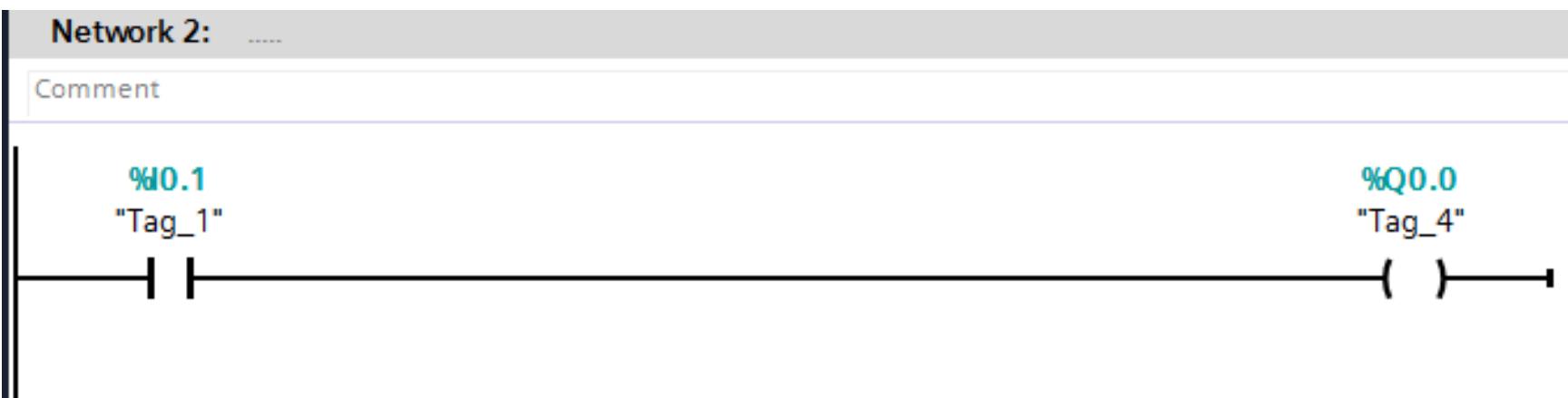
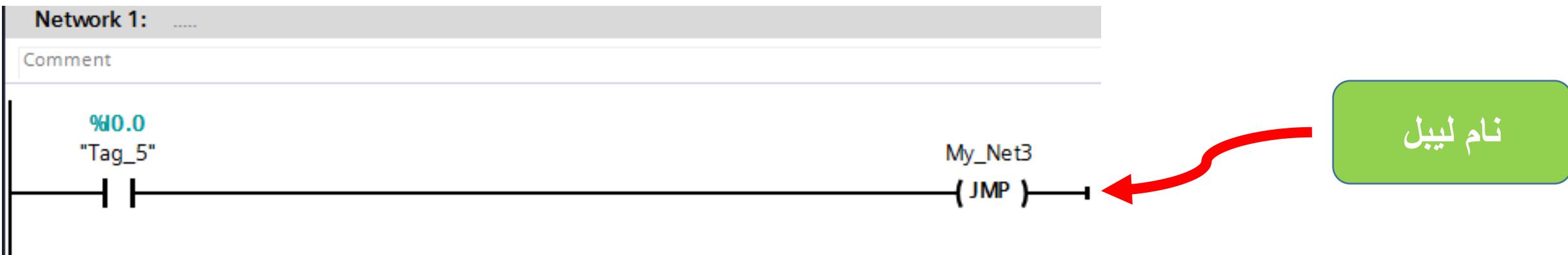


با تبدیل وضعیت بیت **RLO** آن از صفر به یک ، ادامه برنامه در آن **Network** متوقف شده و برنامه به ای که در آن **Label** مورد نظر وجود دارد پرش می کند .

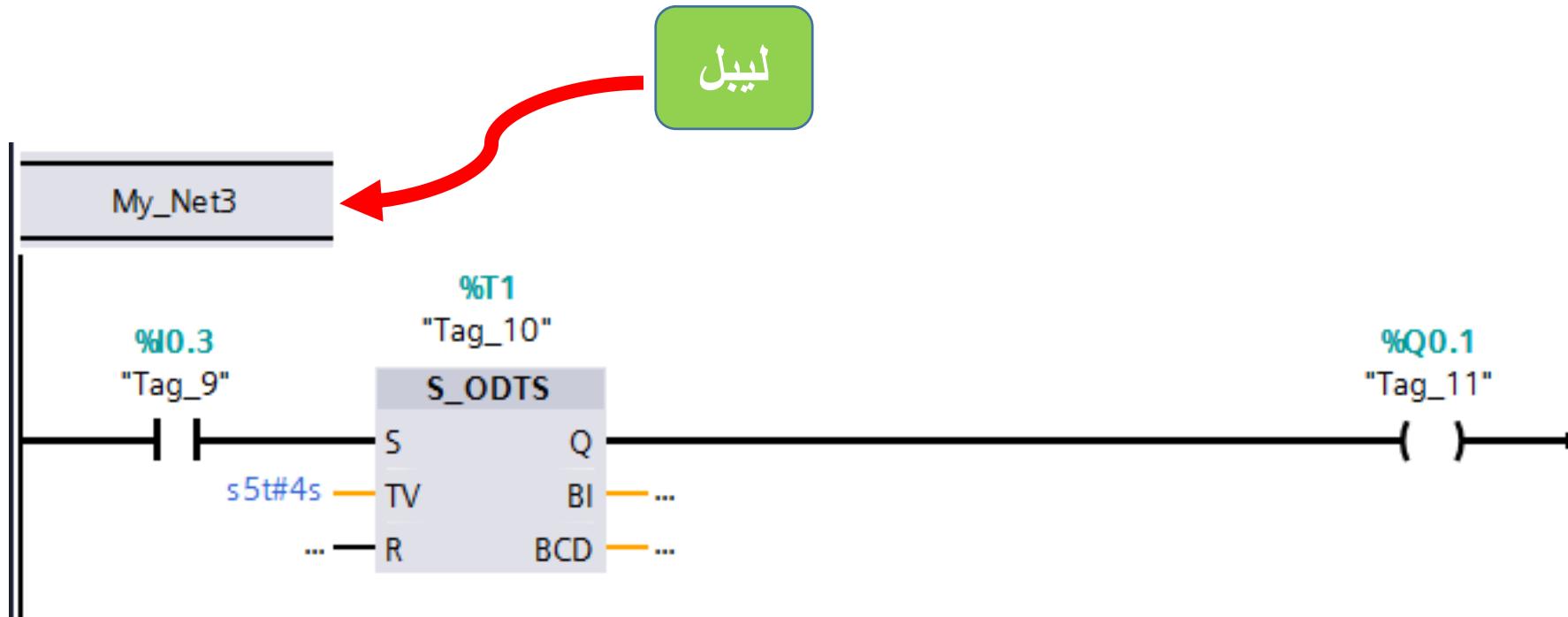
پرش ها می توانند به **Network** بالایی و یا پایینی باشند و در هر حداکثر یک **Jump** می تواند قرار بگیرد .

PROJECTS: PROJECT 3

برنامه ای بنویسید که با فعال شدن ورودی با آدرس Q0.0، عدد 10.1 فعال شود و اگر ورودی I0.0 فعال شد، برنامه به Network3 پرس کرده و پس از ۴ ثانیه خروجی فعال گردد.



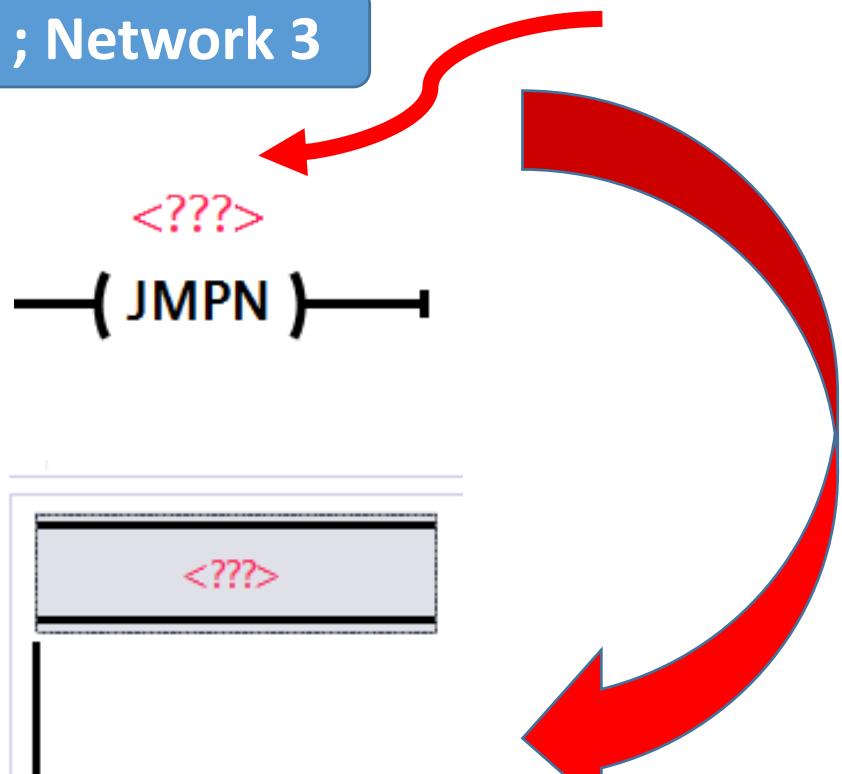
PROJECTS: PROJECT 3



Program Control Operations

JUMP IF RLO=0 ;

EX ; Network 3



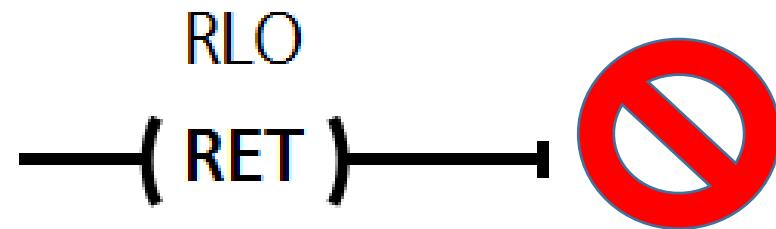
EX ; Network 10

با تبدیل وضعیت بیت **RLO** آن از یک به صفر ، ادامه برنامه در آن **Network** متوقف شده و برنامه به **Label** ای که در آن **Network** مورد نظر وجود دارد پرش می کند .

پرش ها می توانند به **Network** بالایی و یا پایینی باشند و در هر حداکثر یک **Jump** می تواند قرار بگیرد .

Program Control Operations

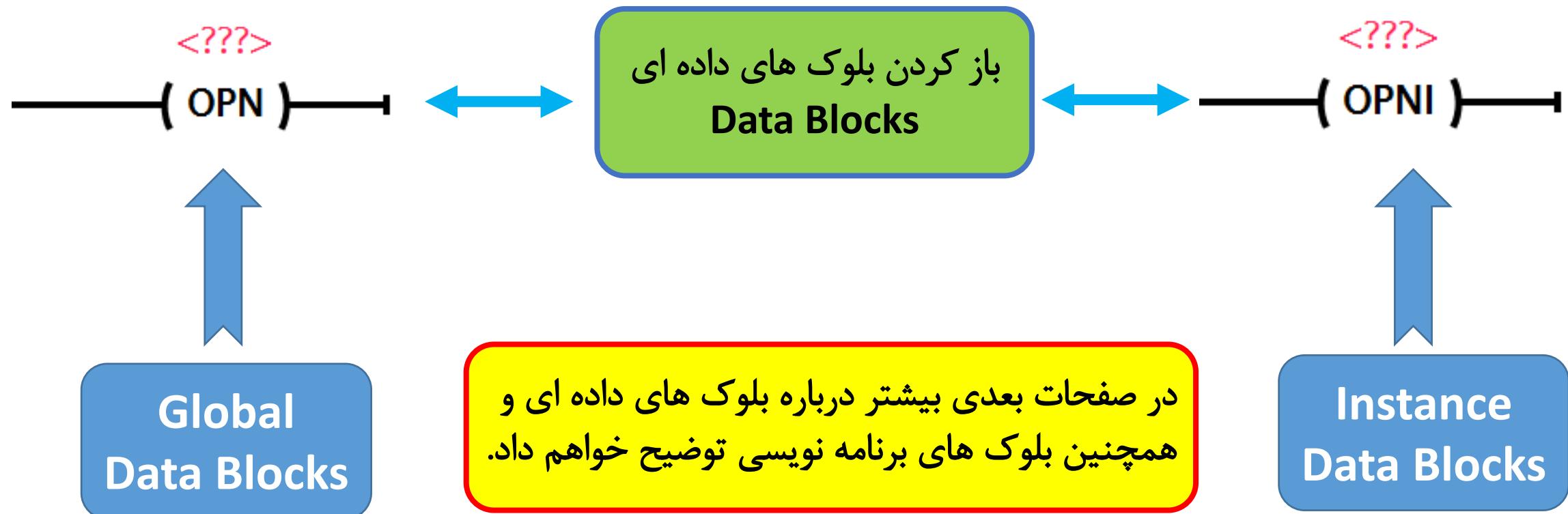
RETURN ;



با تبدیل وضعیت بیت **RLO** آن از یک به صفر ، ادامه برنامه در کل آن بلوک برنامه نویسی متوقف شده و هیچ برنامه ای در آن بلوک اجرا نمی شود . !

Program Control Operations

OPEN GLOBAL DATA BLOCK ;



بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِيْمِ

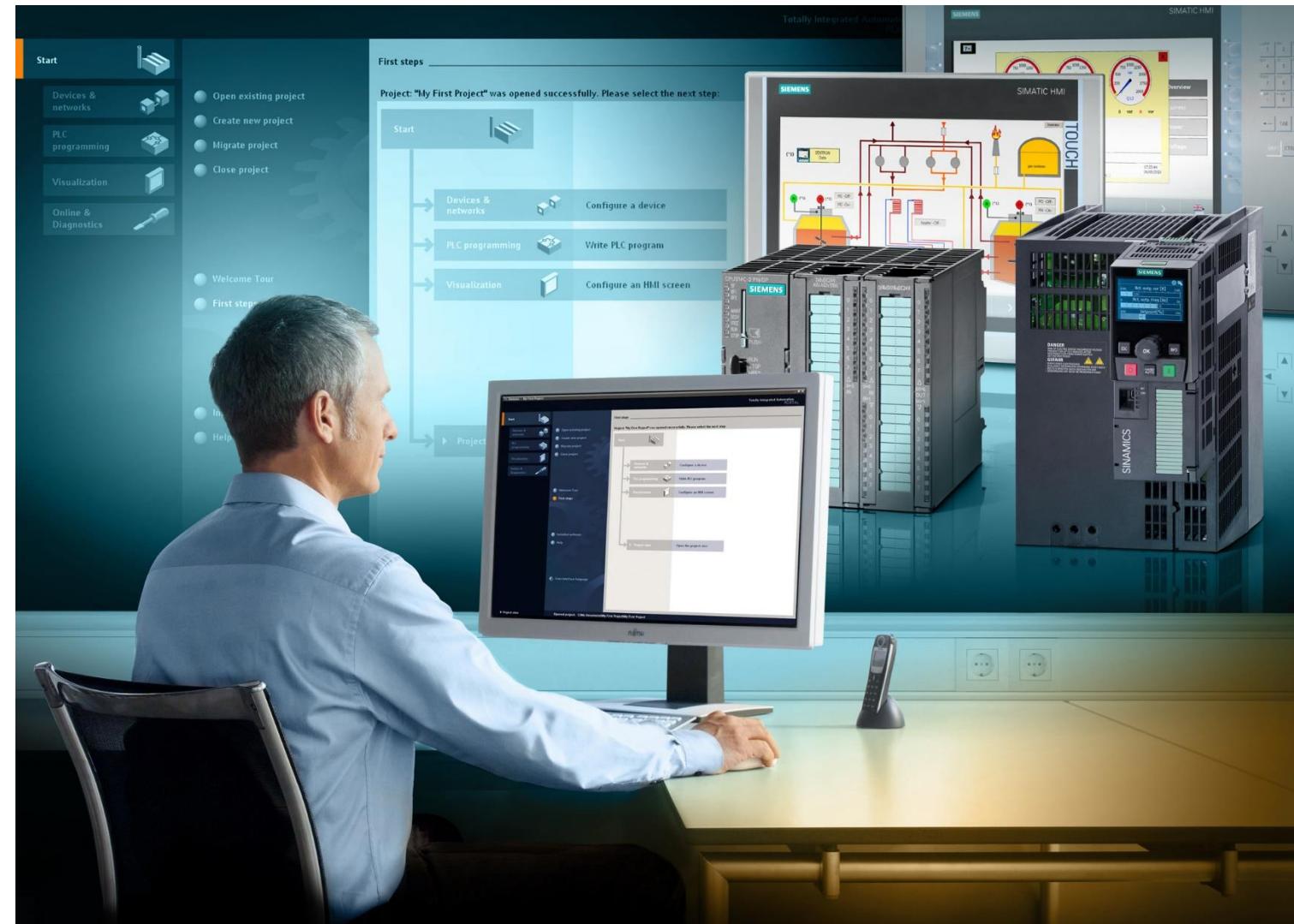
PLC COURSE

LECTURE :

PROJECTS

6 - 7

AHMAD KHEIRANDISH



PLC PROJECTS EXAMPLES

نمونه هایی از پروژه های PLC

PROJECTS: PROJECT 1

فرض کنید کنترل کننده دارای دو سیستم خنک کننده و گرمایشی است ، برنامه ای بنویسید که دارای شرایط زیر باشد :
که در آن **Q0.0** را برای قسمت خنک کننده و **Q0.1** را برای قسمت گرمایشی بکار ببرید .

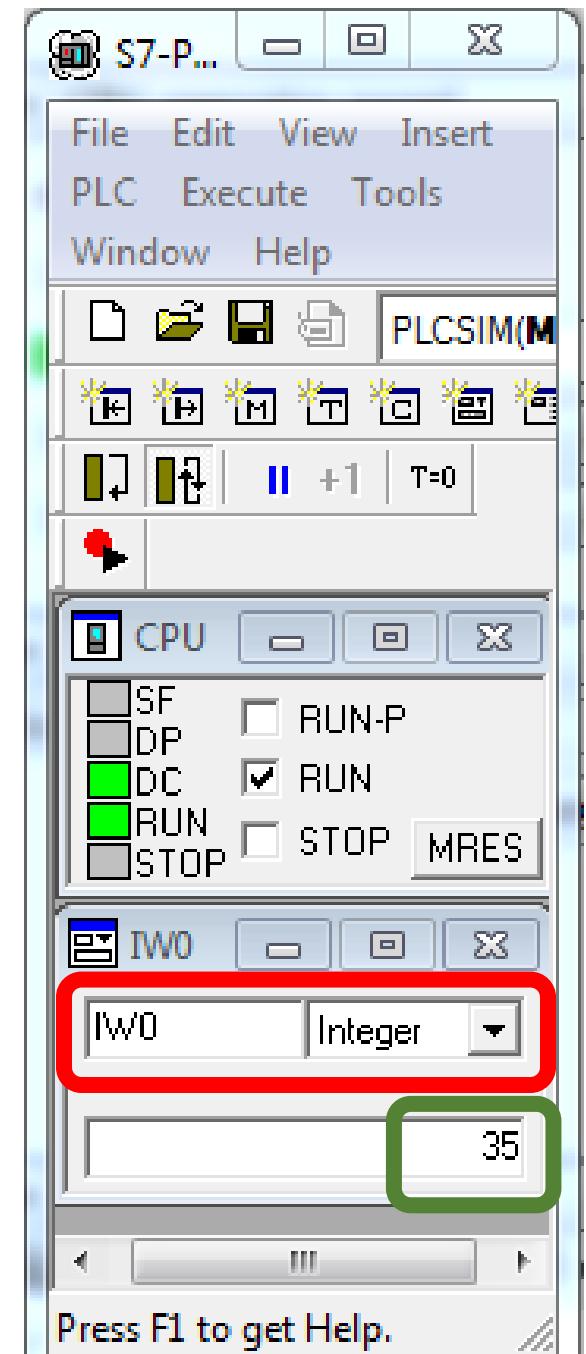
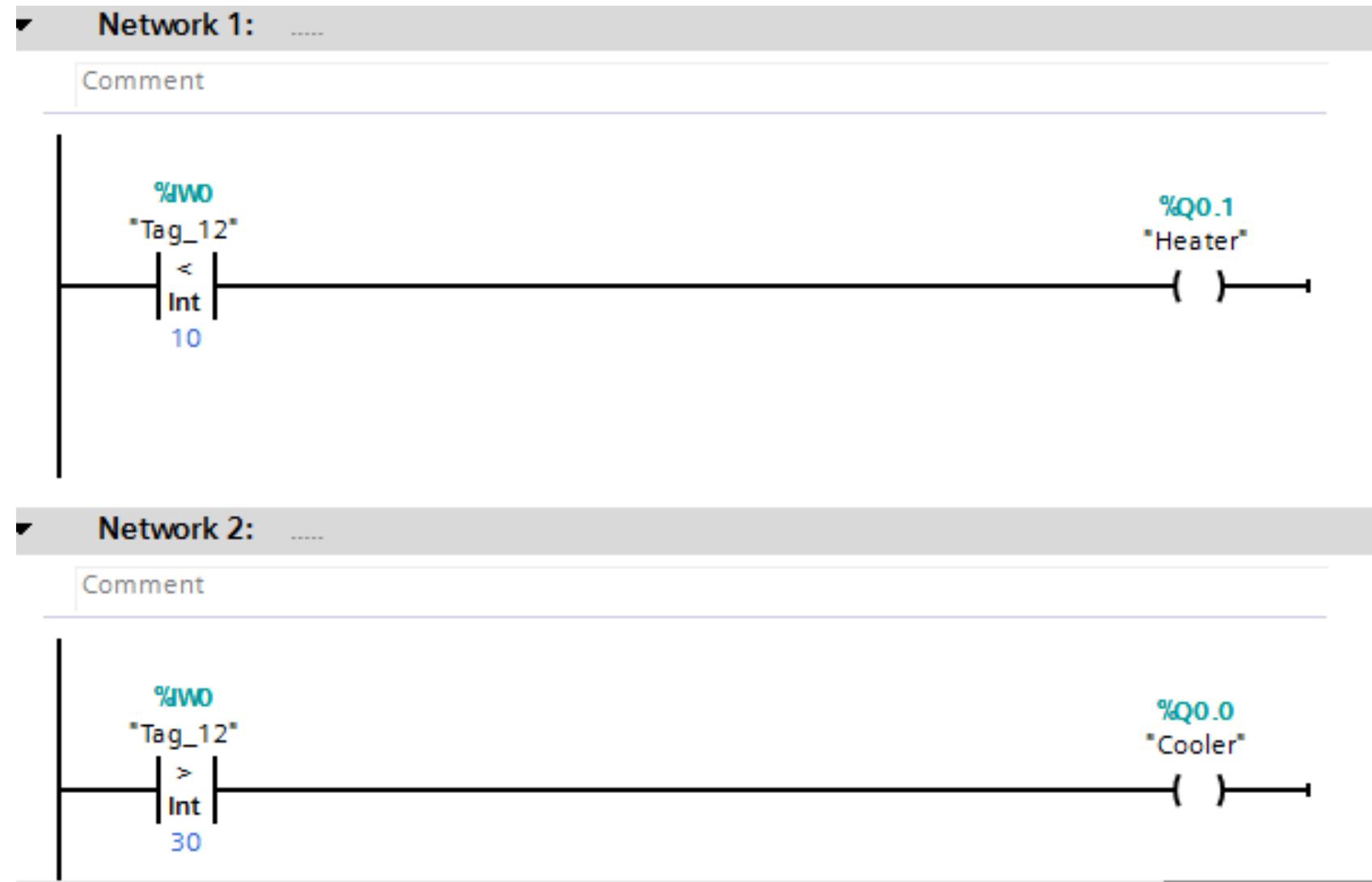
IF : **T < 10** **Q0.1 ON**

IF : **10 < T < 30** **Q0.0 & Q0.0 OFF**

IF : **T>30** **Q0.1 ON**

دماي محبيط = **T**

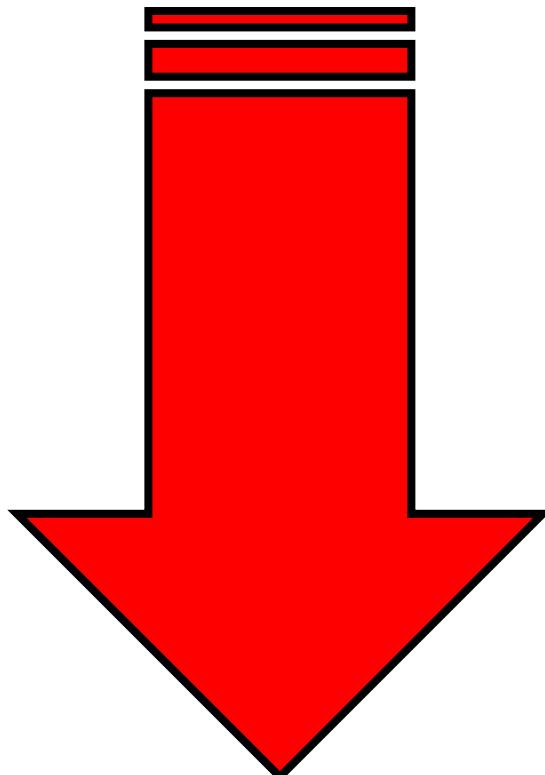
PROJECTS: PROJECT 1



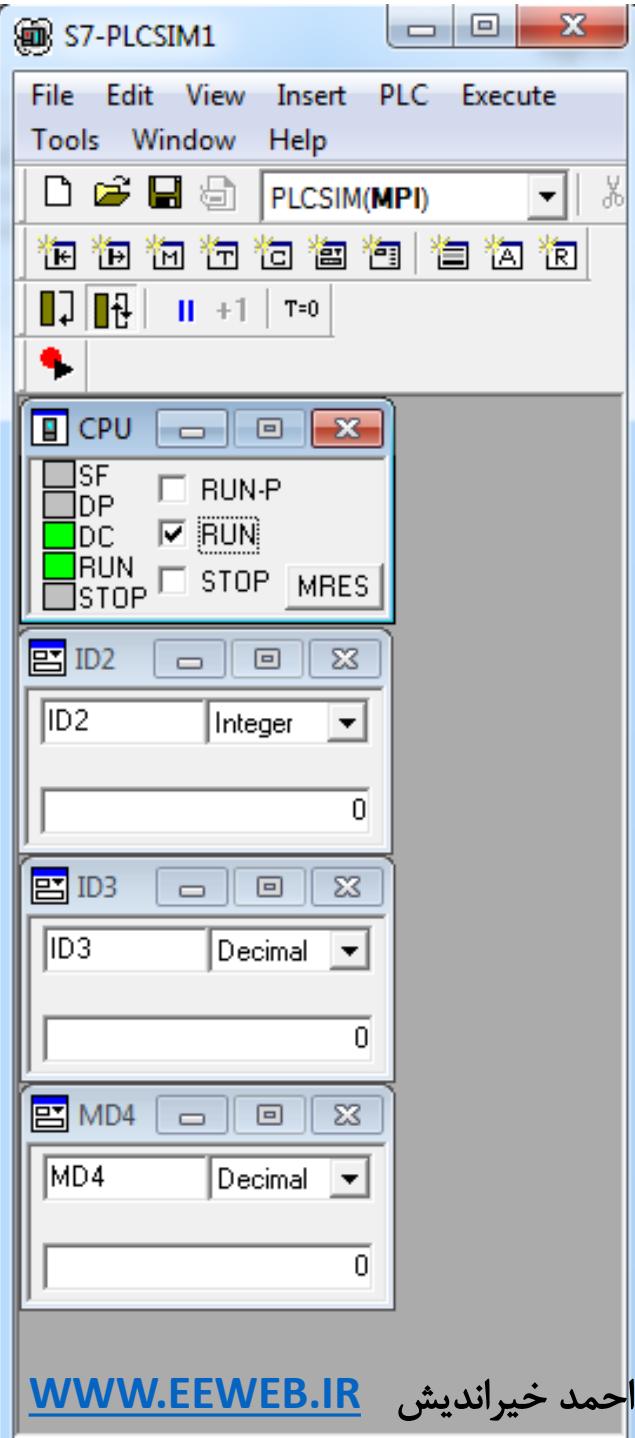
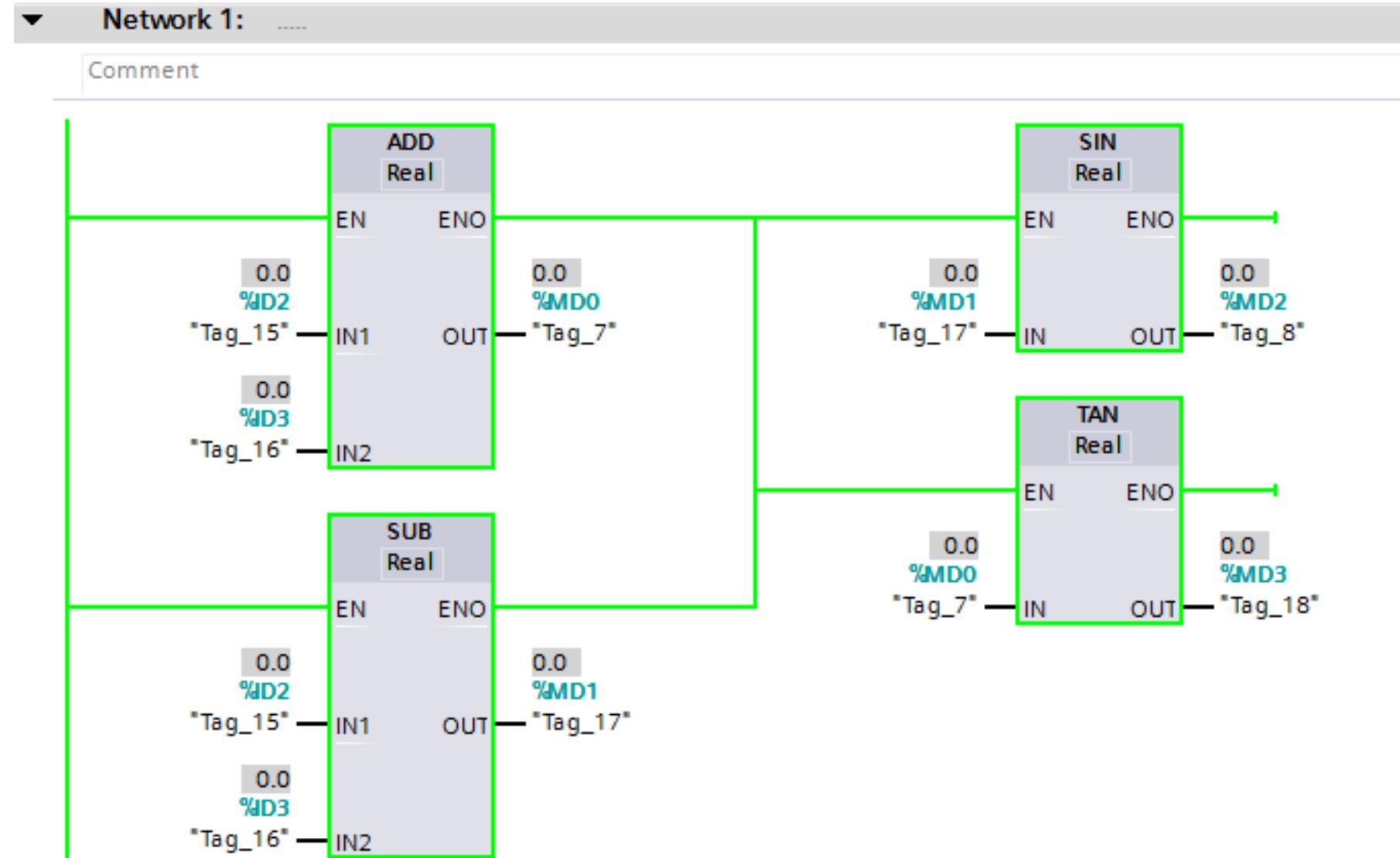
PROJECTS: PROJECT 2

برنامه ای بنویسید که حاصل معادله زیر را محاسبه کند.

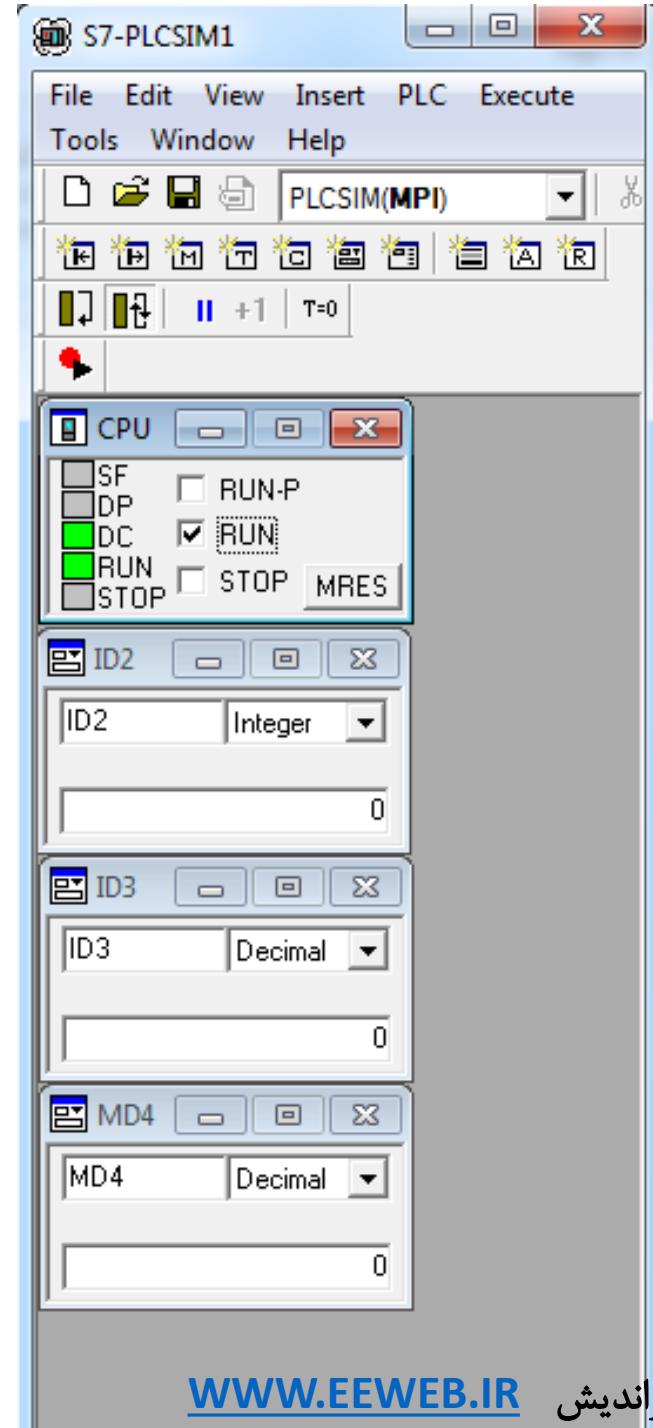
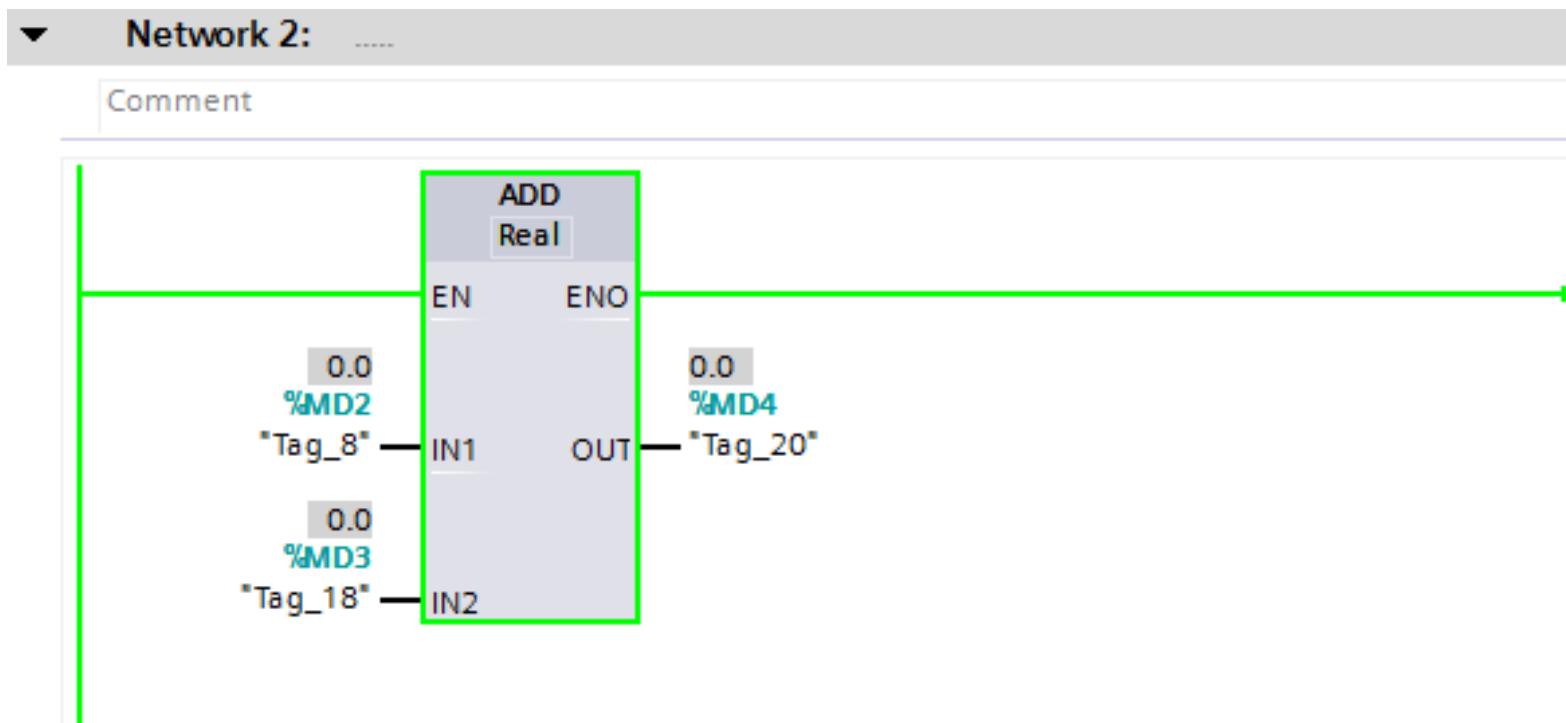
$$K = \tan(\text{IN1} + \text{IN2}) + \sin(\text{IN1} - \text{IN2})$$



PROJECTS: PROJECT 2

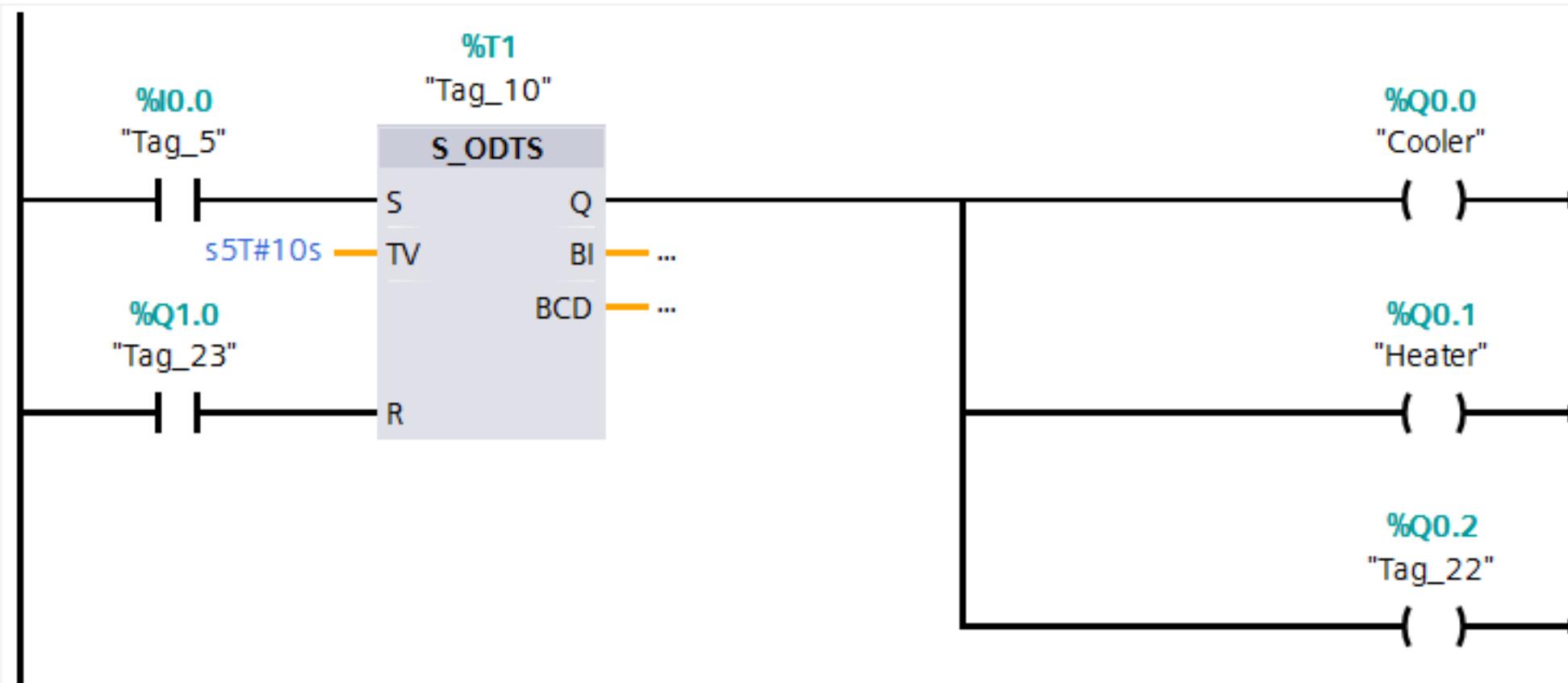


PROJECTS: PROJECT 2

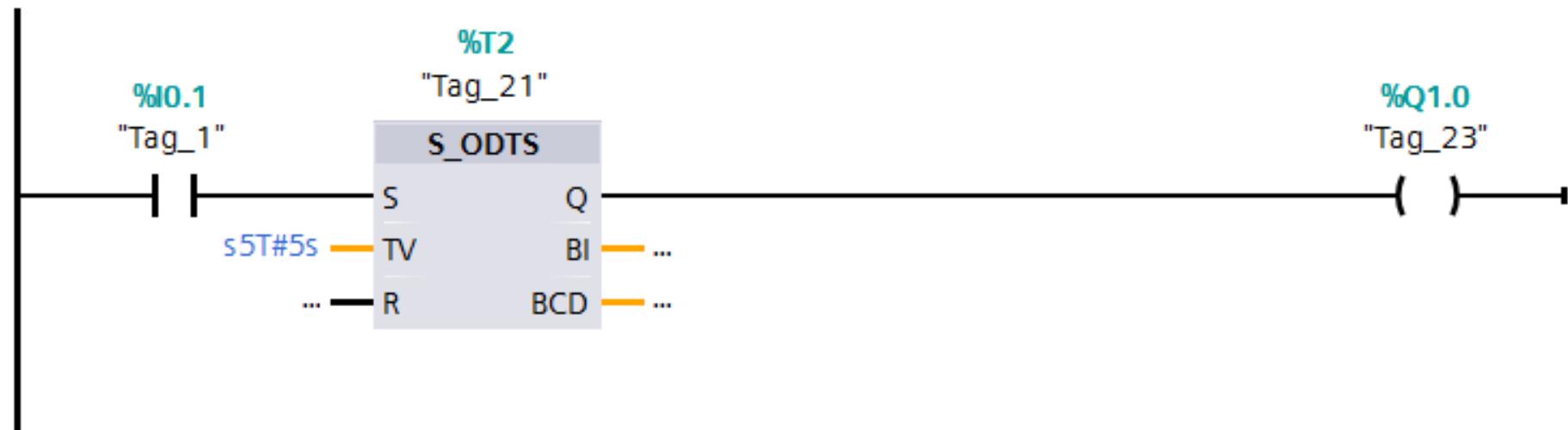


PROJECTS: PROJECT 3

در پروژه ای ، ۳ خروجی داریم که شامل $Q0.0$ و $Q0.1$ و $Q0.2$ می باشد، اگر ورودی $I0.0$ فعال شد همه ی خروجی ها پس از مدت ۱۰ ثانیه روشن شود و اگر ورودی $I0.1$ فعال شد ، همه ی خروجی ها پس از ۵ ثانیه خاموش شود.

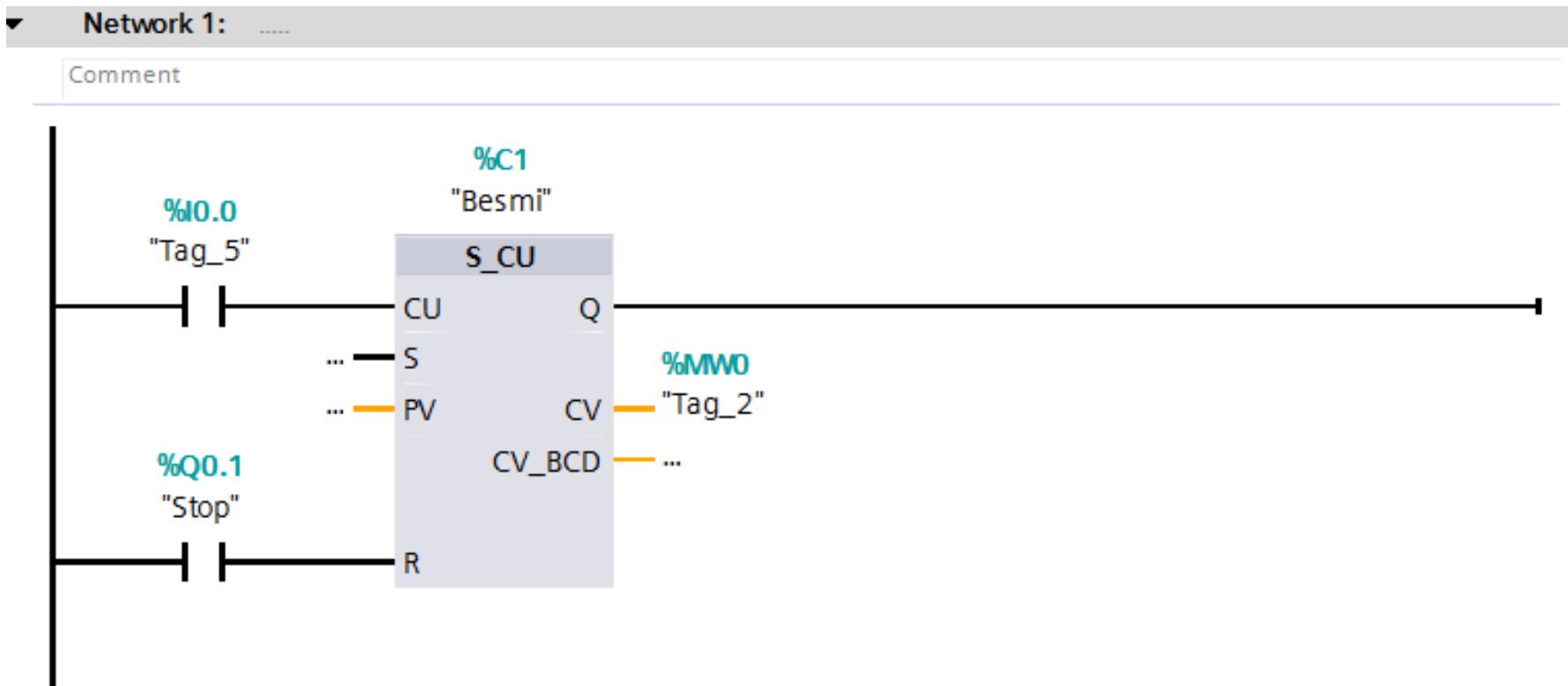


PROJECTS: PROJECT 3

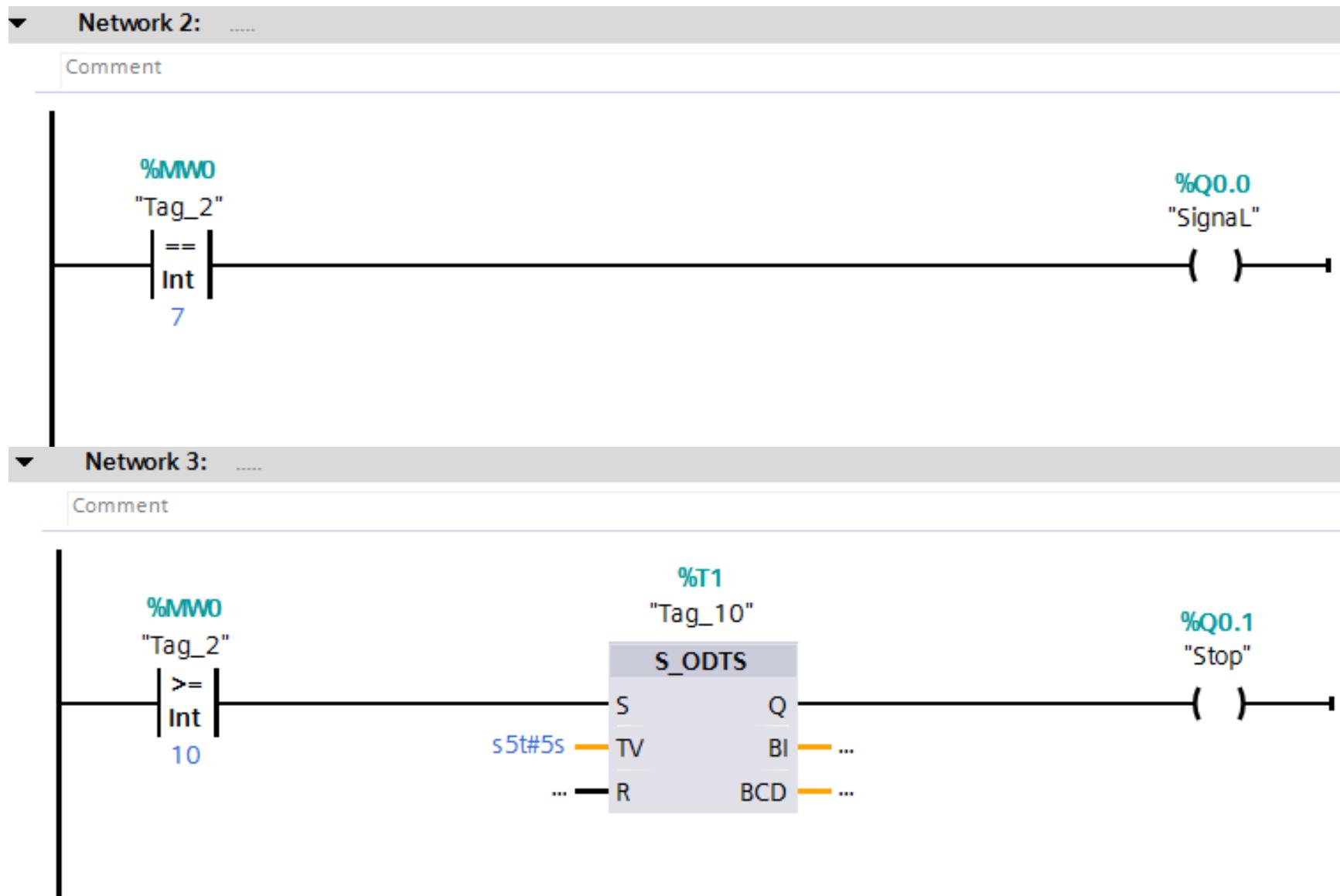


PROJECTS: PROJECT 4

برنامه ای بنویسید که وقتی تعداد کالاهای خروجی خط تولید که توسط سنسور الکتریکی **I0.0** کنترل می شود، به عدد **7** رسید ، چراغ سیگنال **Q0.0** روشن شود و اگر تعداد به **12** رسید کل پروسه شمارش کالا پس از **5** ثانیه خاموش شود .



PROJECTS: PROJECT 4



PROJECTS: PROJECT 4

برنامه ای بنویسید که وقتی ورودی **I0.0** فعال شد خروجی **Q0.0** فعال شد خروجی به طور دائم پس از **7** ثانیه غیرفعال شود.

