Siemens S7-1200

CPU 1212C AC/DC/Relay

Introduction to PLC

- Understanding PLC hardware
- How Processor Works?
- Wiring the Inputs/ Outputs
- Summary

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Siemens S7-1200 CPU 1212 AC/DC/RLY

6ES7 212-1BE40-0XB0
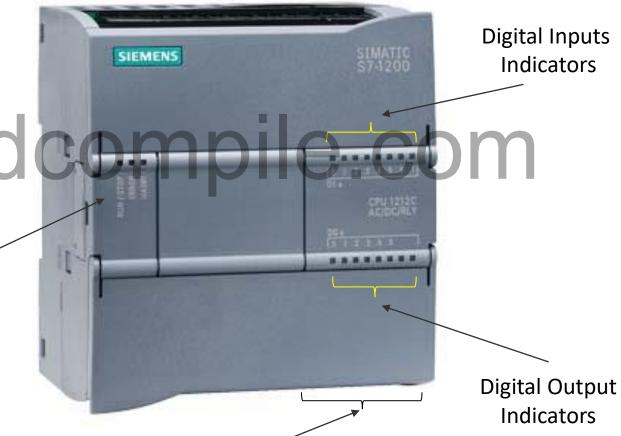
Power Supply
120/220 AC

Digital Inputs: 8

Digital Inputs Indicators

PLC Status Indicators

➡ **RUN**/**STOP**

➡ **ERROR**

➡ **MAINT**

Digital Output Indicators

Digital Output: 6 (Relay)

Power Supply 120/220 AC

24 VDC Output

Digital Inputs (8)

Analog I/P (2)

Memory Card Slot

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How Processor Works?

START UP MODE	RUN MODE

START UP MODE

A Process Image Input Memory 'I' is **cleared**

B **Output** are initialized with last value

C Any **start up-logic** is executed

D State of **Physical Input** is copied To **'I' Memory**

E Any **interrupts** presents are **queued** to execute

F Writing of Process Memory 'Q' to phy. O/p is enabled

RUN MODE

1 'Q' memory is written to Physical Output

2 State of Physical Input is written to 'I' memory

3 **Logic** is executed

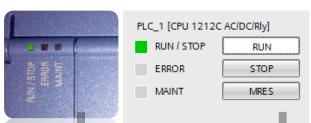**4** **Self-test diagnostic** is performed

Interrupts and communication are processed during any part of cycle

Operation mode of CPU

The CPU has three modes of operation: STOP mode, STARTUP mode, and RUN mode. Status LEDs on the front of the CPU indicate the current mode of operation

In RUN mode, the scan cycle is executed repeatedly. Interrupt events can occur and be processed at any point within the program cycle phase.

In STOP mode, the CPU is not executing the program, and you can download a project.

In STARTUP mode, the CPU executes any startup logic (if present). Interrupt events are not processed during the startup mode.

DID YOU KNOW ?

You can download your project only when the CPU is in STOP mode.

Use the button on the operator panel to change the operating mode (STOP or RUN). The operator panel also provides an MRES button for resetting the memory.
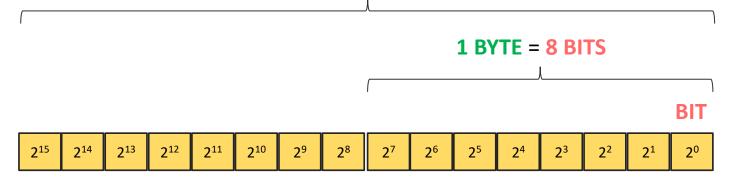
Data Storage in PLC

 The smallest unit of information in a digital system is known as a "bit" (for "binary digit"). A bit stores one of two possible states, **either a "0" (false or not true)** or **"1" (true).**

*A light switch is an example of a "binary" system with only two states. The light switch determines either a "**light on**" or a "**light off**" state, and this "value" can be stored in one bit. The digital value of the light switch answers the question: "Is the light on?" **If the light is switched on ("true"), then the value is 1**. **If the light is switched off ("false"), then the value is 0.***

-32768 to +32767

1 WORD = 16 BITS = 2 BYTES

1 BYTE = 8 BITS

BIT

2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

DID YOU KNOW ?

The CPU also supports a grouping of 8 bytes that form a "long real" data type (LReal) for storing very large or very precise values. The range for the LReal is: +/-2.23 x 10^{-308} to +/-1.79 x 10^{308}

Data Type Supported by S7-1200

Few are some of the widely used data type supported in S7-1200.

Data Type	Size	Range
Bool	1 bit	0 ~ 1
Byte	8 bits	16#00 ~ 16#FF
Word	16 bits	16#0000 ~ 16#FFFF
DWord	32 bits	16#00000000 ~ 16#FFFFFFFF
Char	8 bits	16#00 ~ 16#FF
Int	16 bits	-31768 ~ 32767
DInt	32 bits	-2,147,483,648 ~ 2,147,483,647
Real	32 bits	+/- 1.18 x 10^{-38} ~ +/- 3.40 x 10^{38}

Memory area in S7-1200

Memory Area	Description
I- Process Image Input	The CPU copies the state of the physical inputs to I memory at the beginning of the scan cycle.
Q- Process Image Output	The CPU copies the state of Q memory to the physical outputs at the beginning of the scan cycle.
M Bit memory	The user program reads and writes the data stored in M memory. Any code block can access the M memory. You can configure addresses within M memory to retain the values of the data after a power cycle
L "Temp" memory	Whenever a code block is called, the CPU allocates the temporary, or local, memory (L) to be used during the execution of the block. When the execution of the code block finishes, the CPU reallocates the local memory for the execution of other code blocks.
DB Data block	Use the DB memory for storing various types of data, including intermediate status of an operation or other control information parameters for FBs, and data structures required for many instructions such as timers and counters. You can specify a data block to be either read/write or read only. You can access data block memory in bits, bytes, words, or double words.

DID YOU KNOW ?

Whether you use a tag (such as "Start" or "Stop") or an absolute address (such as "I0.3" or "Q1.7"), **a reference to the input (I) or output (Q) memory areas accesses the process image and not the physical output**. **To immediately access** *or force the physical (peripheral) input or output in your user program, append the reference with* **":P" (such as "Stop:P" or "Q0.3:P").**

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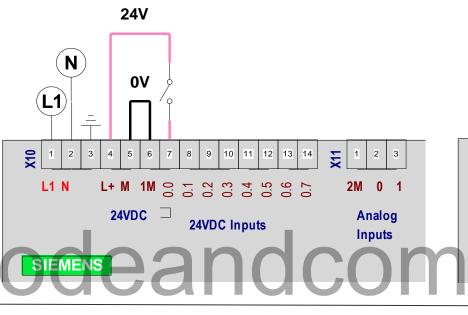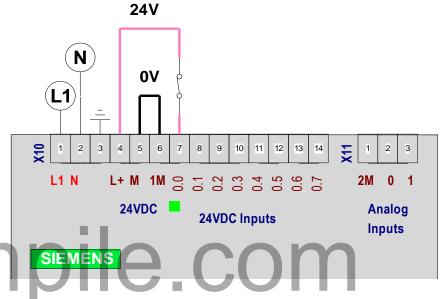- How Processor Works?
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Wiring the S7-1200

6ES7 212-1BE40-0XB0

Digital Input

8 x 24VDC 6mA/pt

Analog Input

0 ~ 10VDC

R: 2 x 10 Bit

X10

1	2	3	4	5	6	7	8	9	10	11	12	13	14

L1 N   **L+ M 1M**   0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7

120-240 VAC   24VDC   24VDC Inputs

X11

1	2	3

2M 0 1

Analog Inputs

SIEMENS

SIMATIC
S7-1200

Relay Outputs

Digital Output

6 x Rly

V: 30VDC/250VAC

A: 2A/pt

X1 P1

**Profinet (LAN)
Ethernet Port**

1L 0.0 0.1 0.2 0.3 2L 0.4 0.5

X12

1	2	3	4	5	6	7	8

DID YOU KNOW ?

This model of PLC has inbuilt Power Supply which converts AC (120 ~ 240VDC) voltage into 24 VDC

Wiring the S7-1200 – Input Wiring Type
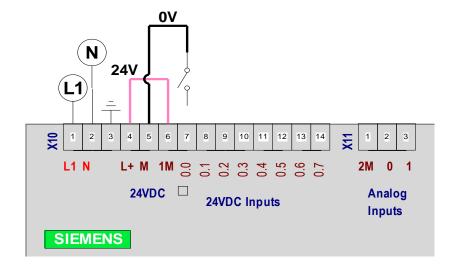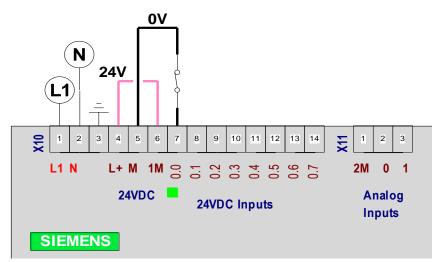
SINKING INPUT

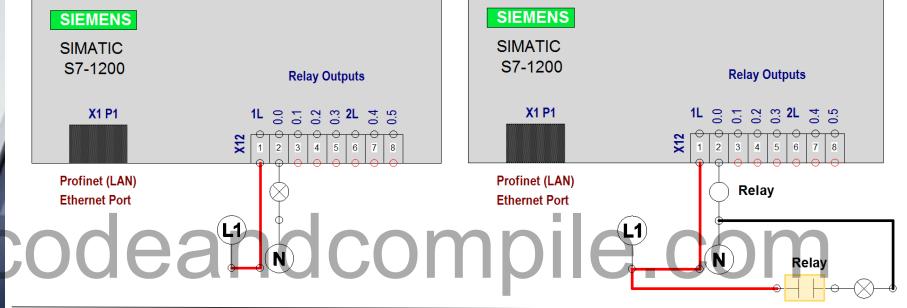## SOURCING INPUT
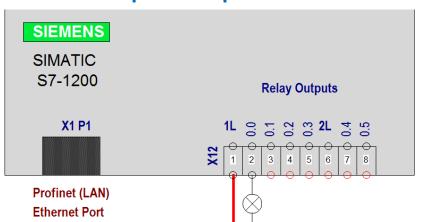
Wiring the S7-1200 – Output Wiring Type
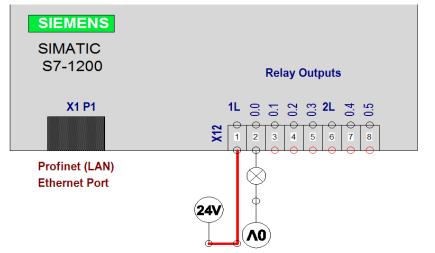

AC LOAD – upto 2 Amp

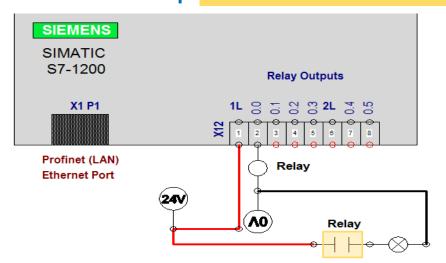**AC LOAD > 2 Amp**   Relay Ampere rating > Load current
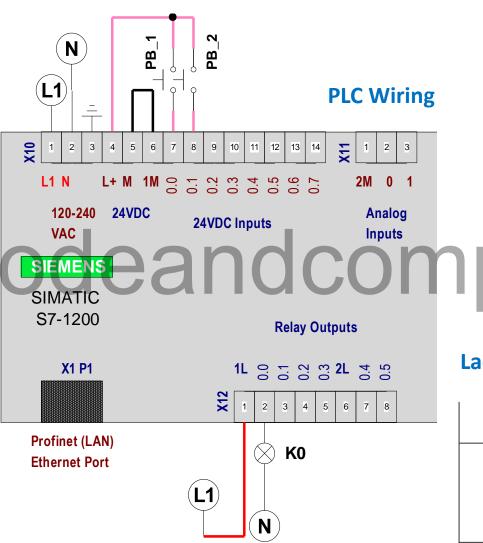
DC LOAD – upto 2 Amp

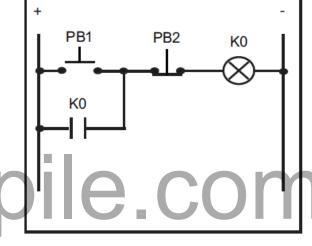**DC LOAD > 2 Amp**   Relay Ampere rating > Load current
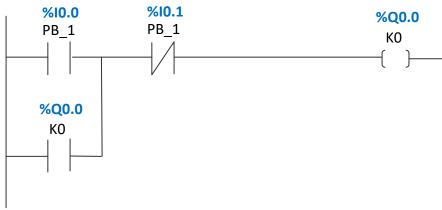
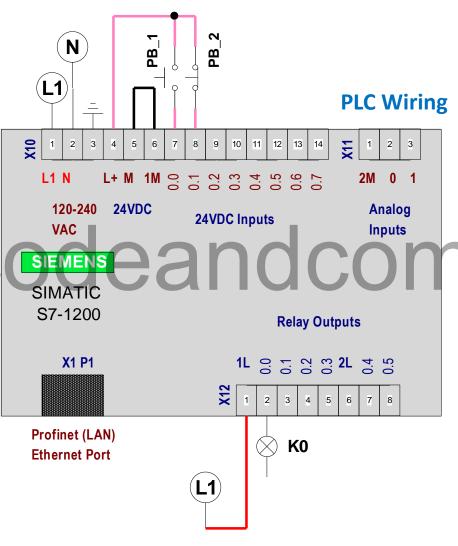# Case 1: Converting Schematic to Ladder Logic
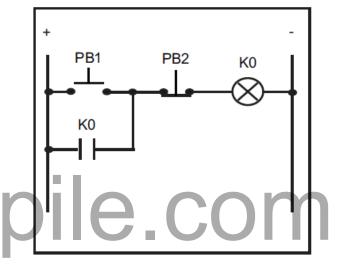
PLC Wiring

Schematic Diagram

Ladder Diagram

Case 2: Converting Schematic to Ladder Logic

PLC Wiring

N
L1
PB_1
PB_2

X10	1	2	3	4	5	6	7	8	9	10	11	12	13	14	X11	1	2	3

L1 N   L+ M 1M   0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7   2M   0   1

120-240   24VDC   24VDC Inputs   Analog
VAC   Inputs

SIEMENS

SIMATIC
S7-1200   **Relay Outputs**

X1 P1   1L   0.0 0.1 0.2 0.3 2L 0.4 0.5

X12	1	2	3	4	5	6	7	8

Profinet (LAN)
Ethernet Port

K0

L1

Schematic Diagram

+   -
PB1   PB2   K0

K0

Ladder Diagram

%I0.0   %I0.1   %Q0.0
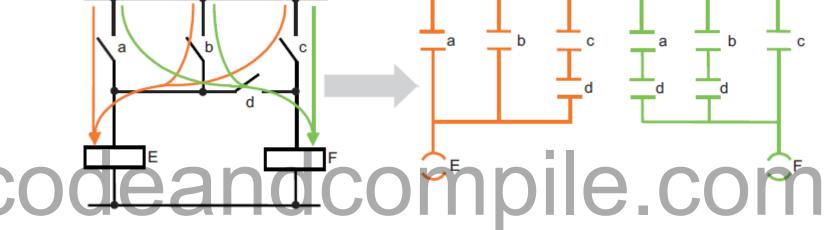PB_1   PB_1   K0

%Q0.0
K0
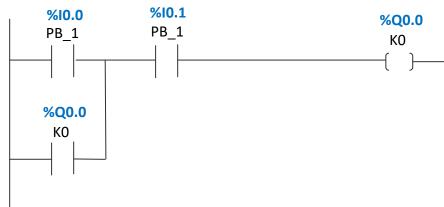
Basic Electrical Circuit - Fundamentals
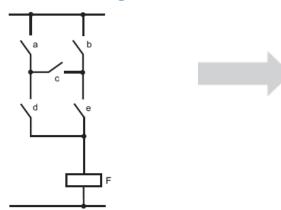
Simple Bridge Circuit

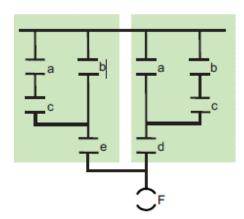### Schematic Diagram

Ladder Diagram

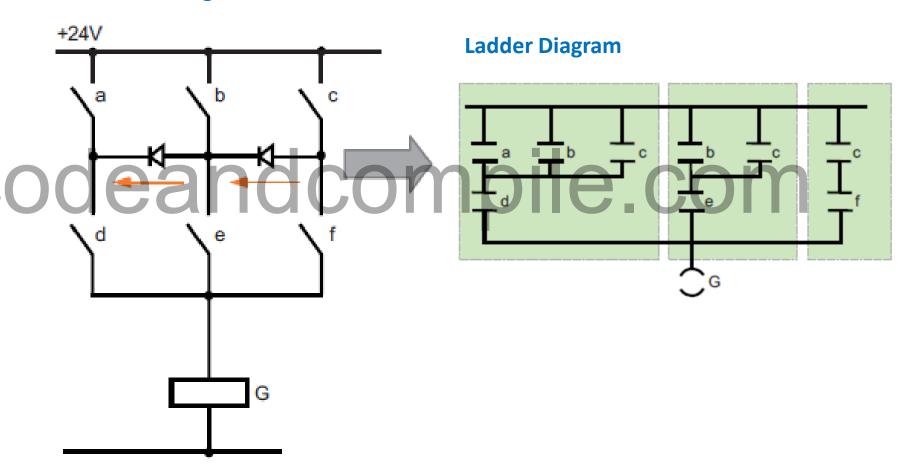## Complex Bridge Circuit

Schematic Diagram

Ladder Diagram

Basic Electrical Circuit - Fundamentals

Diode Circuit

Diodes represent connection lines in principle **but only conduct current in one direction**
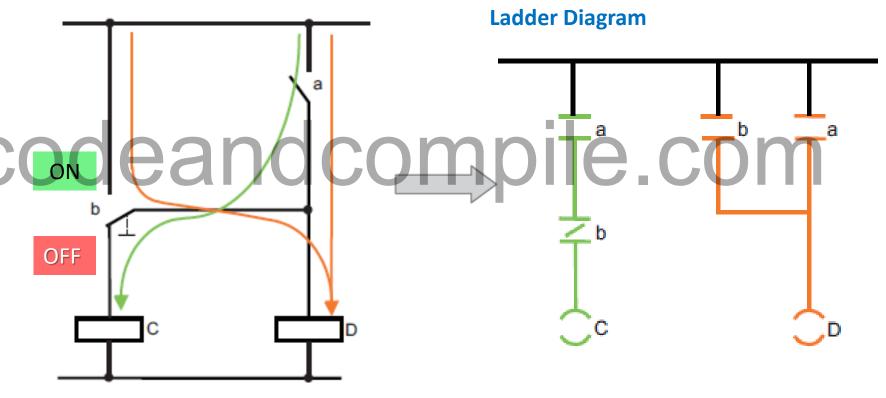
Schematic Diagram

Ladder Diagram

Basic Electrical Circuit - Fundamentals

Change over Switch Circuit

Schematic Diagram

Ladder Diagram

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Summary

What did we learn in this lesson?

- S7-1200 PLC hardware components and architecture

- Introduction to S7-1200 Processor in it's SCAN cycle operation

- PLC wiring for Inputs and Outputs

- Converting Schematics to Ladder diagram for various circuits

Next Lesson !

- Introduction to Siemens TIA- Total Integrated Automation

Thank you

Get copy of this presentation in the course!

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