

# Programmable Logic Controller

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# Course description

## Overview

### CH1 Introduction to PLCs

CH2 CP1 PLC

**2 session Quiz**

CH3 Instructions

**3 sessions**

CH4 PLC programming

**3 sessions**



# Ch2

## Introduction to CP1



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➤ Features of CP1

➤ PLC Addressing



# 2.1 Features of CP1

## 2.1.1 CP1 family

- 3 models: CP1H, CP1L, CP1E
  - CP1H: High-performance PLC
  - CP1L: Standard PLC
  - CP1E: Economy class PLC



CP1H



CP1L



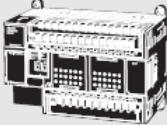
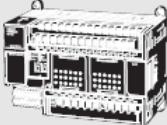
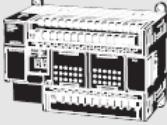
CP1E



# 2.1 Features of CP1

- CPU units:
  - 10 to 60 I/O points, expandable to 320 I/O points
  - Power supply: AC or DC
  - Output method: relay, transistor (sinking), transistor (sourcing)

## ■ CPU Units

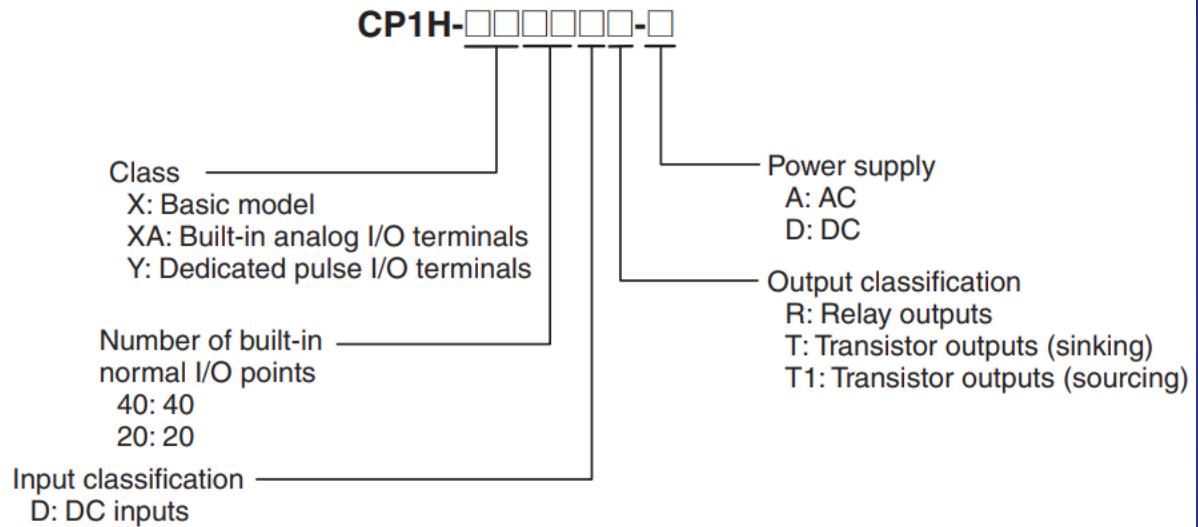
CPU Unit	Specifications					Model
	CPU type	Power supply	Output method	Inputs	Outputs	
<b>CP1H-X CPU Units</b> 	<b>Memory capacity: 20K steps</b> <b>High-speed counters:</b> 100 kHz, 4 axes <b>Pulse outputs: 100 kHz, 4 axes</b> (Models with transistor outputs only)	AC power supply	Relay output	24	16	CP1H-X40DR-A
		DC power supply	Transistor output (sinking)			CP1H-X40DT-D
			Transistor output (sourcing)			CP1H-X40DT1-D
<b>CP1H-XA CPU Units</b> 	<b>Memory capacity: 20K steps</b> <b>High-speed counters:</b> 100 kHz, 4 axes <b>Pulse outputs: 100 kHz, 4 axes</b> (Models with transistor outputs only) <b>Analog inputs: 4</b> <b>Analog outputs: 2</b>	AC power supply	Relay output	24	16	CP1H-XA40DR-A
		DC power supply	Transistor output (sinking)			CP1H-XA40DT-D
			Transistor output (sourcing)			CP1H-XA40DT1-D
<b>CP1H-Y CPU Units</b> 	<b>Memory capacity: 20K steps</b> <b>High-speed counters:</b> 1 MHz, 2 axes 100 kHz, 2 axes <b>Pulse outputs: 1 MHz, 2 axes</b> 100 kHz, 2 axes	DC power supply	Transistor output (sinking)	12 + line-driver input, 2 axes	8 + line-driver output, 2 axes	CP1H-Y20DT-D



# 2.1 Features of CP1

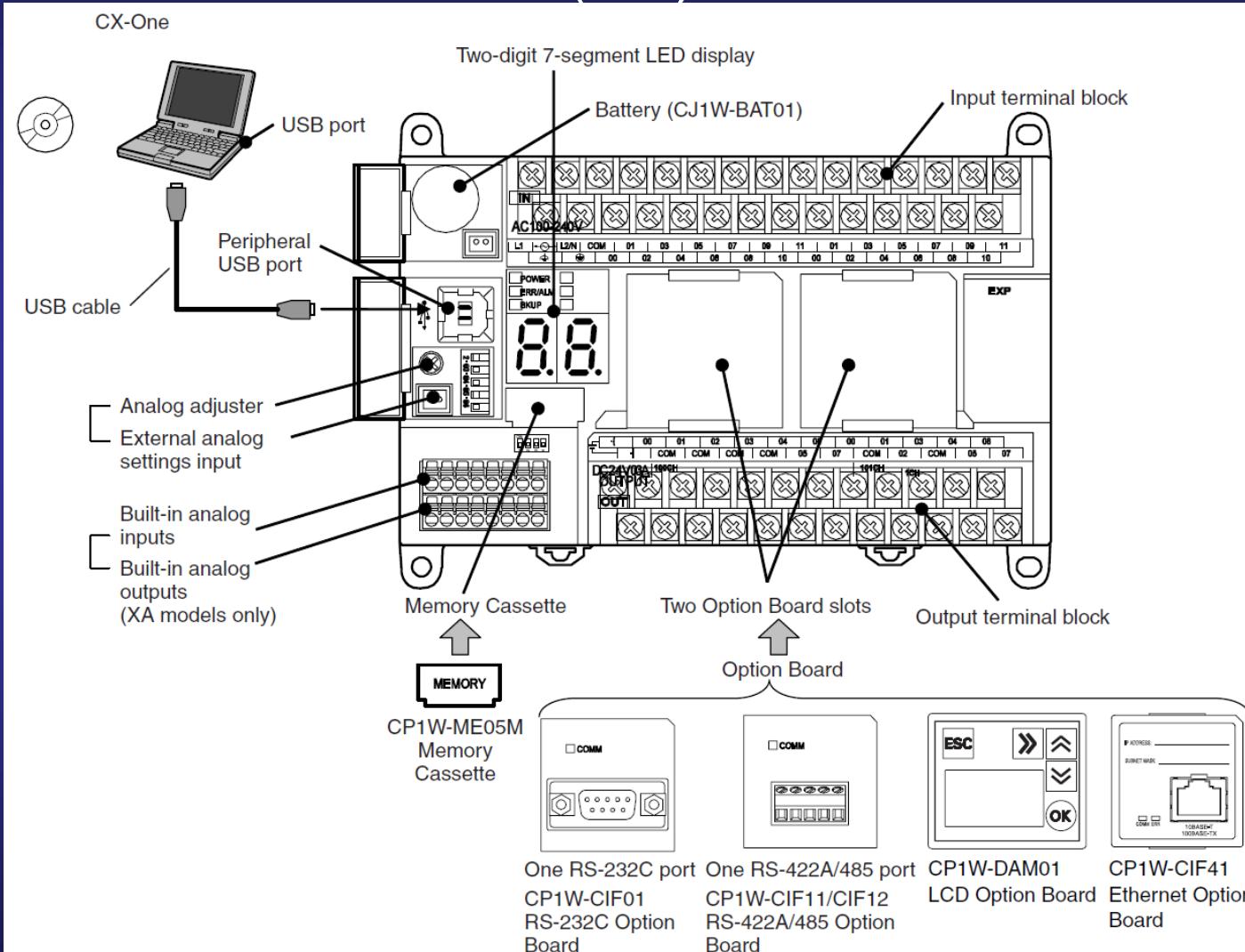
- CPU units:

## Interpreting CP1H CPU Unit Model Numbers



# 2.1 Features of CP1

## ➤ Basic CP1H CPU Unit (XA):

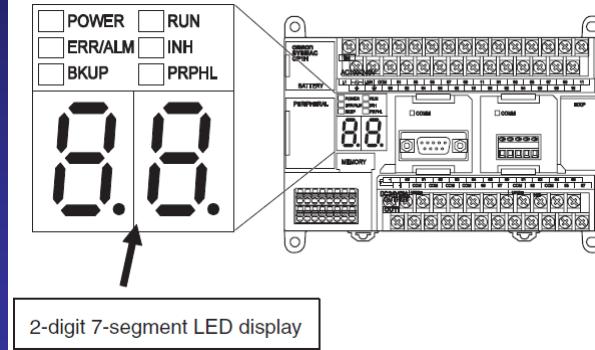


# 2.1 Features of CP1

## ➤ Basic CP1H CPU Unit (XA):

### Operation Indicators:

- Show CP1H operation status.



<b>POWER (Green)</b>	Lit	Power is ON.
	Not lit	Power is OFF.
<b>RUN (Green)</b>	Lit	The CP1H is executing a program in either RUN or MONITOR mode.
	Not lit	Operation is stopped in PROGRAM mode or due to a fatal error.
<b>ERR/ALM (Red)</b>	Lit	A fatal error (including FALS execution) or a hardware error (WDT error) has occurred. CP1H operation will stop and all outputs will be turned OFF.
	Flashing	A non-fatal error has occurred (including FAL execution). CP1H operation will continue.
	Not lit	Operation is normal.
<b>INH (Yellow)</b>	Lit	The Output OFF Bit (A500.15) has turned ON. All outputs will be turned OFF.
	Not lit	Operation is normal.

<b>BKUP (Yellow)</b>	Lit	A user program, parameters, or Data Memory are being written or accessed in the built-in flash memory (backup memory). The BKUP indicator also lights while user programs, parameters, and Data Memory are being restored when the PLC power supply is turned ON. <b>Note</b> Do not turn OFF the PLC power supply while this indicator is lit.
	Not lit	Other than the above.
<b>PRPHL (Yellow)</b>	Flashing	Communications (either sending or receiving) are in progress through the peripheral USB port.
	Not lit	Other than the above.



# 2.1 Features of CP1

- Expansion units:
- Basic I/O units

Expansion I/O Units			
			
<b>CP1W-8ED</b> DC inputs: 8	<b>CP1W-16ER</b> Relay outputs: 16	<b>CP1W-20EDT</b> DC inputs: 12 Transistor outputs (sinking): 8	<b>CP1W-32ET1</b> Transistor outputs (sourcing): 32
<b>CP1W-8ER</b> Relay outputs: 8	<b>CP1W-16ET</b> Transistor outputs (sinking): 16	<b>CP1W-20EDT1</b> DC inputs: 12 Transistor outputs (sourcing): 8	<b>CP1W-40EDR</b> DC inputs : 24 Relay outputs: 16
<b>CP1W-8ET</b> Transistor outputs (sinking): 8	<b>CP1W-16ET1</b> Transistor outputs (sourcing): 16	<b>CP1W-32ER</b> Relay outputs: 32	<b>CP1W-40EDT</b> DC inputs: 24 Transistor outputs (sinking): 16
<b>CP1W-8ET1</b> Transistor outputs (sourcing): 8	<b>CP1W-20EDR1</b> DC inputs: 12 Relay outputs: 8	<b>CP1W-32ET</b> Transistor outputs (sinking): 32	<b>CP1W-40EDT1</b> DC inputs: 24 Transistor outputs (sourcing): 16



# 2.1 Features of CP1

- Expansion units:
  - Analog I/O and temperature sensor units

## Analog I/O Units



### Analog Input Unit

#### CP1W-AD041

Analog inputs: 4  
(resolution: 6,000)

#### CP1W-AD042

Analog inputs: 4  
(resolution: 12,000)

### Analog Output Unit

#### CP1W-DA021

Analog outputs: 2  
(resolution: 6,000)

#### CP1W-DA041

Analog outputs: 4  
(resolution: 6,000)

#### CP1W-DA042

Analog outputs: 4  
(resolution: 12,000)



### Analog I/O Unit

#### CP1W-MAD11

Analog inputs: 2 (resolution: 6,000)  
Analog outputs: 1 (resolution: 6,000)

#### CP1W-MAD42

Analog inputs: 4 (resolution: 12,000)  
Analog outputs: 2 (resolution: 12,000)

#### CP1W-MAD44

Analog inputs: 4 (resolution: 12,000)  
Analog outputs: 4 (resolution: 12,000)

## Temperature Sensor Unit



### CP1W-TS001

Thermocouple inputs: 2

### CP1W-TS002

Thermocouple inputs: 4

### CP1W-TS003

Thermocouple inputs: 4

Analog inputs: 2

(instead of 2 thermocouple inputs)  
12,000 resolution

### CP1W-TS004

Thermocouple inputs: 12

### CP1W-TS101

Platinum-resistance  
thermometer inputs: 2

### CP1W-TS102

Platinum-resistance  
thermometer inputs: 4



# 2.1 Features of CP1

## ➤ Expansion units: others

### Optional Boards



**CP1W-CIF01**  
RS-232C  
(15 m max.)



**CP1W-CIF11**  
RS-422A/485  
(50 m max.)



**CP1W-CIF12-V1**  
RS-422A/485 (Isolated-type)  
(500 m max.)



**CP2W-CIFD1**  
2 x RS-232C \*1



**CP2W-CIFD2**  
RS-232C, RS-485  
(Isolated-type) \*1



**CP2W-CIFD3**  
2 x RS-485  
(Isolated-type) \*1



**CP1W-CIF41**  
Ethernet \*2



**CP1W-DAM01**  
Display 4 rows,  
12 characters \*2



**CP1W-ADB21**  
2 analog inputs,  
0-10 V, 0-20 mA



**CP1W-DAB21V**  
2 analog outputs, 0-10 V



**CP1W-MAB221**  
2 analog inputs 0-10 V, 0-20 mA &  
2 outputs 0-10 V

### Memory Cassette



**CP1W-ME05M \*2**  
512K words  
(upload/download program)

### Battery Set



**CP2W-BAT02**  
(for CP2E)



**CJ1W-BAT01**  
(for maintenance  
of CP1L/CP1H)

### CJ Unit Adapter



**CP1W-EXT01**  
CJ Unit adapter for use with  
CP1H. Includes CJ endplate.

### I/O Connecting Cable



**CP1W-CN811**  
Length: 80 cm

CP1W Expansion Units include I/O Connection Cables (in lengths of approx. 6 cm) for side-by-side connection.

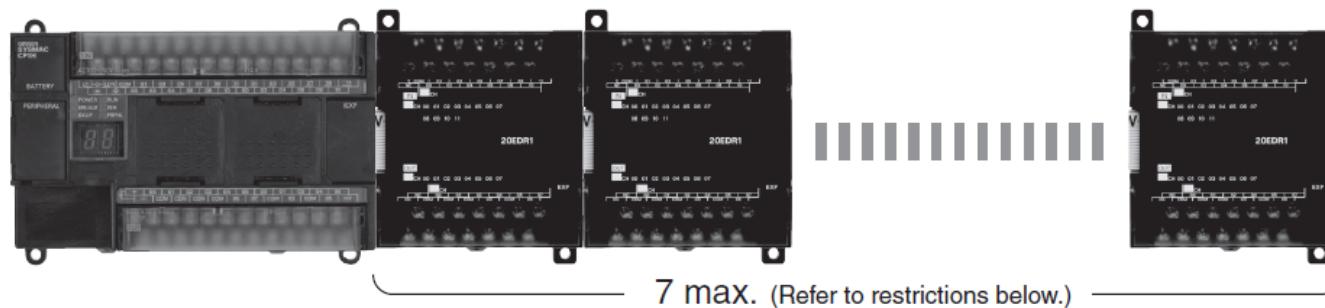


# 2.1 Features of CP1

- Expansion units:
- Maximum number of expansion units

## ■ Maximum Number of CP1W Expansion Unit and Expansion I/O Units

### ● CP1H CPU Unit



## ■ Restrictions on the Number of CP1H Expansion Unit and I/O Unit Connections

Up to seven Expansion Units and Expansion I/O Units can be connected when a CP1H CPU Unit is used, but the following restrictions apply.

Observe these restrictions when using the models in the shaded areas in the following tables. A maximum total of 15 input words is allocated for Expansion Units and a maximum total of 15 output words is allocated for Expansion Units and Expansion I/O Units.



# 2.1 Features of CP1

## ➤ Input specifications of CP1H:

Input terminals of CP1H(X/XA, AC power supply)

- 24 input points, 2 channels
- Channel 0: 12 bits, 0.00-0.11
- Channel 1: 12 bits, 1.00-1.11

### Terminal Block Arrangement

Upper Terminal Block (Example: AC Power Supply Models)

L1	L2/N	COM	01	03	05	07	09	11	01	03	05	07	09	11
			00	02	04	06	08	10	00	02	04	06	08	10

Inputs (CIO 0)

Outputs (CIO 1)

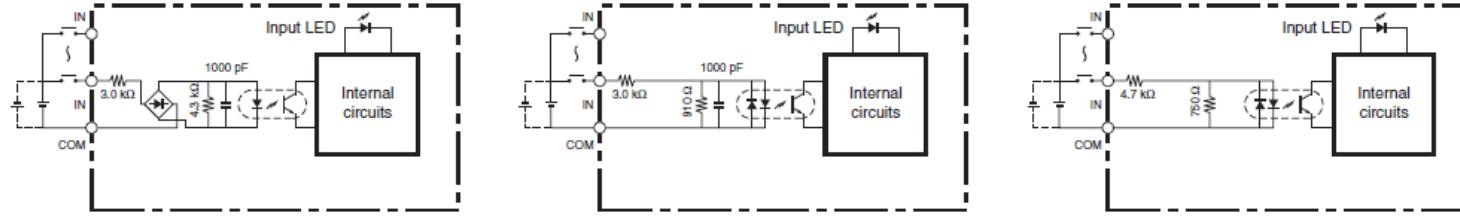
Normal input terminals



# 2.1 Features of CP1

## ➤ Input specifications:

### ■ Input Specifications

ITEM	Specifications		
	High-speed counter inputs (phases A and B)	Interrupt inputs and quick-response inputs	Normal inputs
CP1H-XA/X CPU Units	CIO 0.04 to CIO 0.11	CIO 0.00 to CIO 0.03 and CIO 1.00 to CIO 1.03	CIO 1.04 to CIO 1.11
CP1H-Y CPU Units	CIO 0.04, CIO 0.05, CIO 0.10, CIO 0.11	CIO 0.00, CIO 0.01 and CIO 1.00 to CIO 1.03	CIO 1.04, CIO 1.05
Input voltage	24 VDC +10%/-15%		
Applicable sensors	2-wire sensors or 3-wire sensors		
Input impedance	3.0 kΩ		
Input current	7.5 mA typical		
ON voltage	17.0 VDC min.		
OFF voltage/current	1 mA max. at 5.0 VDC		
ON delay	2.5 µs max.	50 µs max.	1 ms max.
OFF delay	2.5 µs max.	50 µs max.	1 ms max.
Circuit configuration			

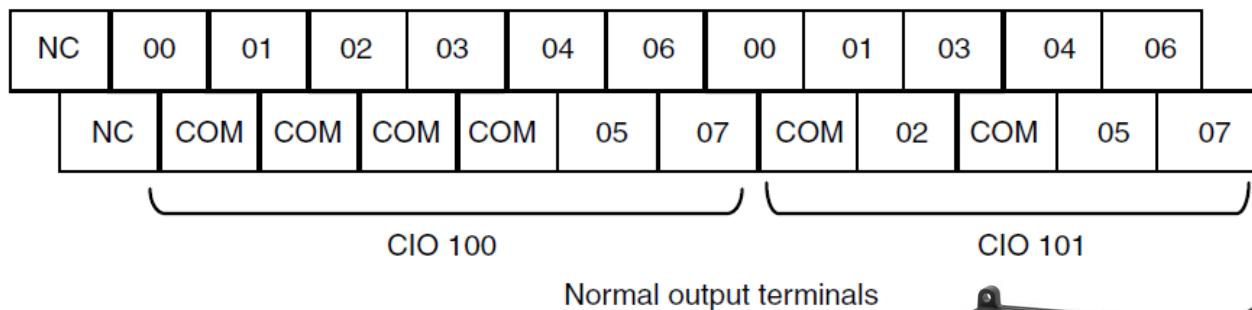


## 2.1 Features of CP1

- Output specifications of CP1H:  
Output terminals of CP1H(X/XA, transistor)
  - 16 output points, 2 channels
  - Channel 100: 8 bits, 100.00-100.07
  - Channel 101: 8 bits, 101.00-101.07

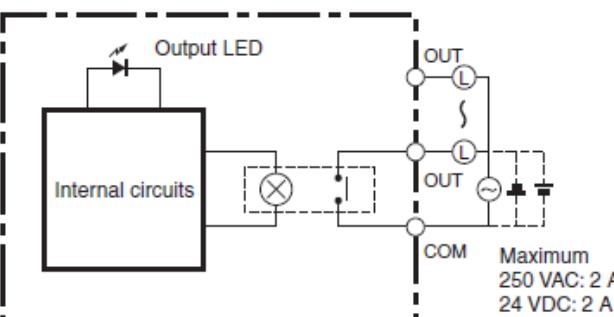
### Terminal Block Arrangement

Lower Terminal Block (Example: Transistor Outputs)



## 2.1 Features of CP1

### ➤ Output specifications:

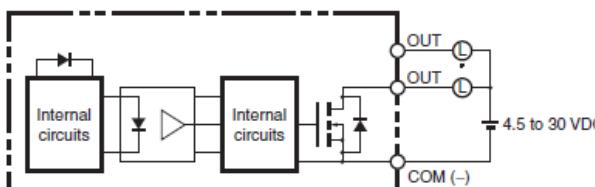
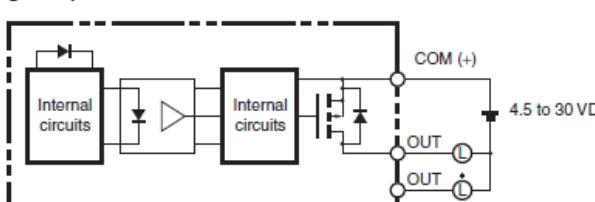
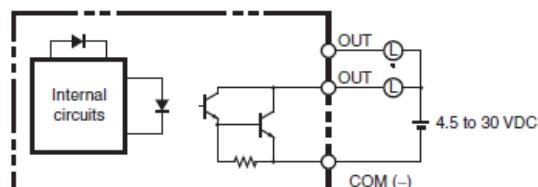
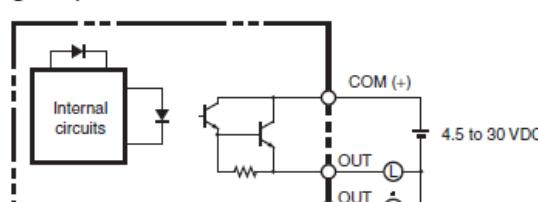
■ Output Specifications		
● CPU Units with Relay Outputs		
Item		Specifications
Max. switching capacity		2 A, 250 VAC ( $\cos\phi = 1$ ), 2 A, 24 VDC 4 A/common)
Min. switching capacity		5 VDC, 10 mA
Service life of relay	Electrical	Resistive load 100,000 operations (24 VDC)
		Inductive load 48,000 operations (250 VAC, $\cos\phi = 0.4$ )
	Mechanical	20,000,000 operations
ON delay		15 ms max.
OFF delay		15 ms max.
Circuit configuration		 <p>Output LED</p> <p>Internal circuits</p> <p>OUT</p> <p>L</p> <p>COM</p> <p>Maximum 250 VAC: 2 A, 24 VDC: 2 A</p>



# 2.1 Features of CP1

## ➤ Output specifications:

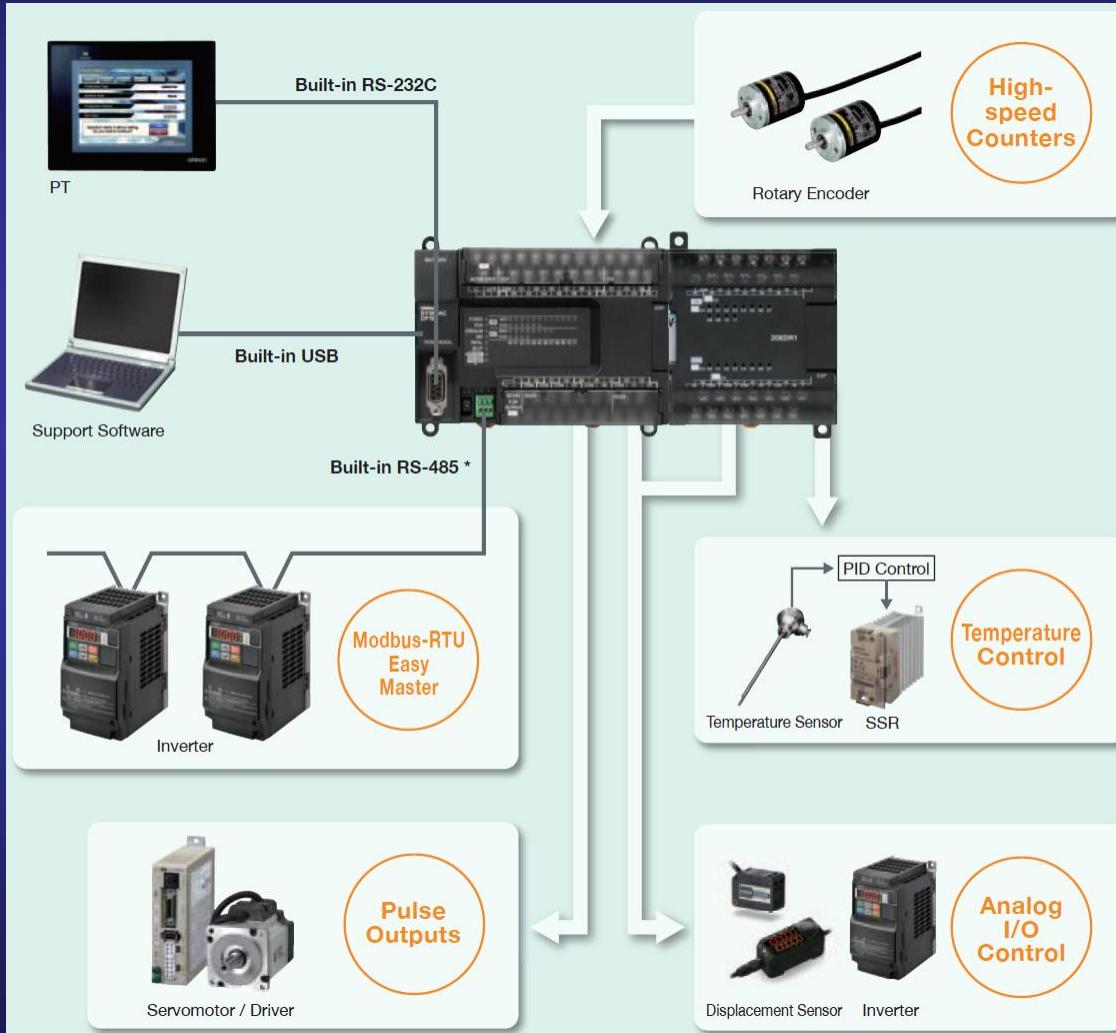
### ● CPU Units with Transistor Outputs (Sinking/Sourcing)

Item	Specifications		
CP1H-XA/X CPU Units	CIO 100.00 to CIO 100.07	CIO 101.00, CIO 101.01	CIO 101.02 to CIO 101.07
CP1H-Y CPU Units	CIO 100.04 to CIO 100.07	CIO 101.00, CIO 101.01	CIO 101.02, CIO 101.03
Max. switching capacity	4.5 to 30 VDC: 300 mA/point, 0.9 A/common, 3.6 A/Unit *1*2		
Min. switching capacity	4.5 to 30 VDC, 1 mA		
Leakage current	0.1 mA max.		
Residual voltage	0.6 V max.	1.5 V max.	
ON delay	0.1 ms max.		
OFF delay	0.1 ms max.		1 ms max.
Fuse	1/common *3		
Circuit configuration	Sinking Outputs		Sinking Outputs
	Sourcing Outputs		Sourcing Outputs
			
			



# 2.1 Features of CP1

## ➤ External interfaces:



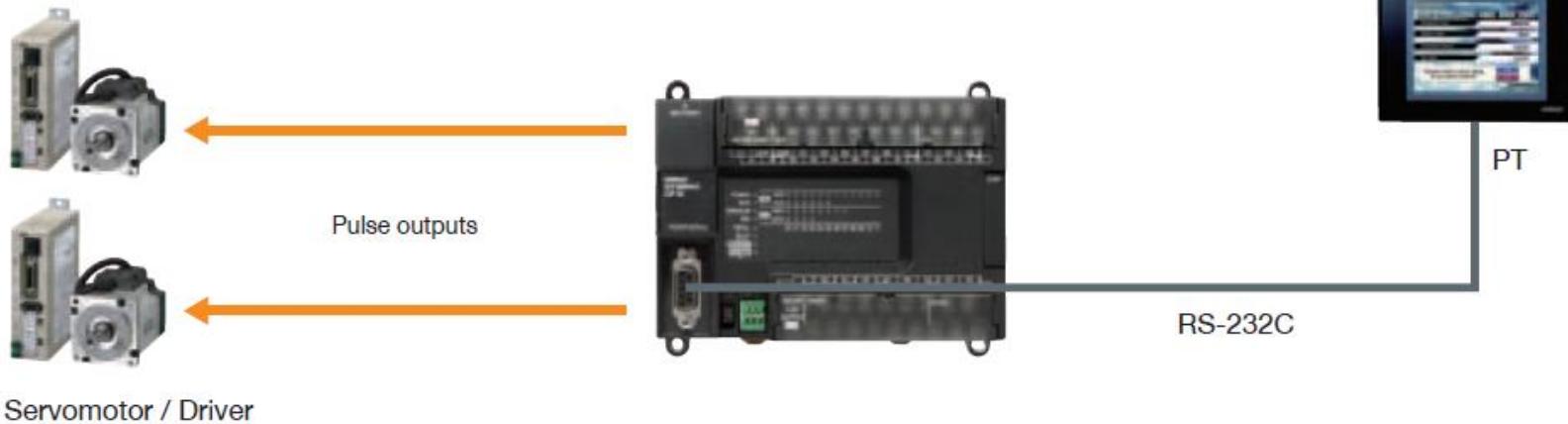
# 2.1 Features of CP1

- External interfaces:

## Pulse Outputs

### Models with transistor Output

Two 100kHz pulse outputs for high-precision position control.



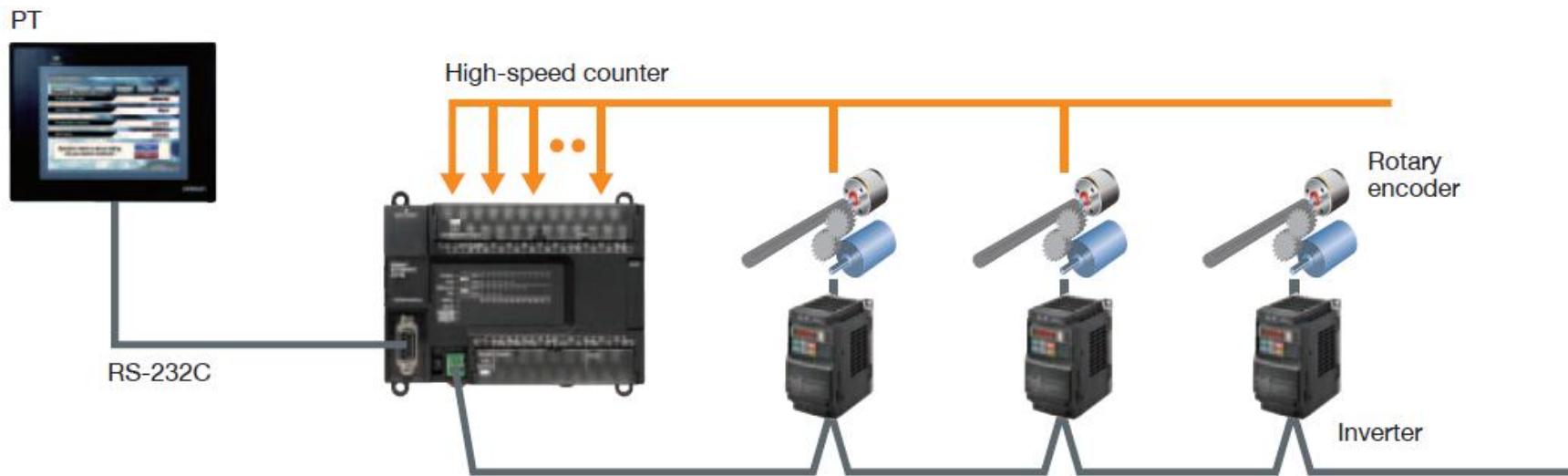
# 2.1 Features of CP1

## ➤ External interfaces:

### High-speed Counters\*

Control multiple axes with one PLC using the two 100kHz and four 10kHz, single-phase high-speed counters.

\* The Basic Models are equipped with six 10kHz, single-phase high-speed counters.

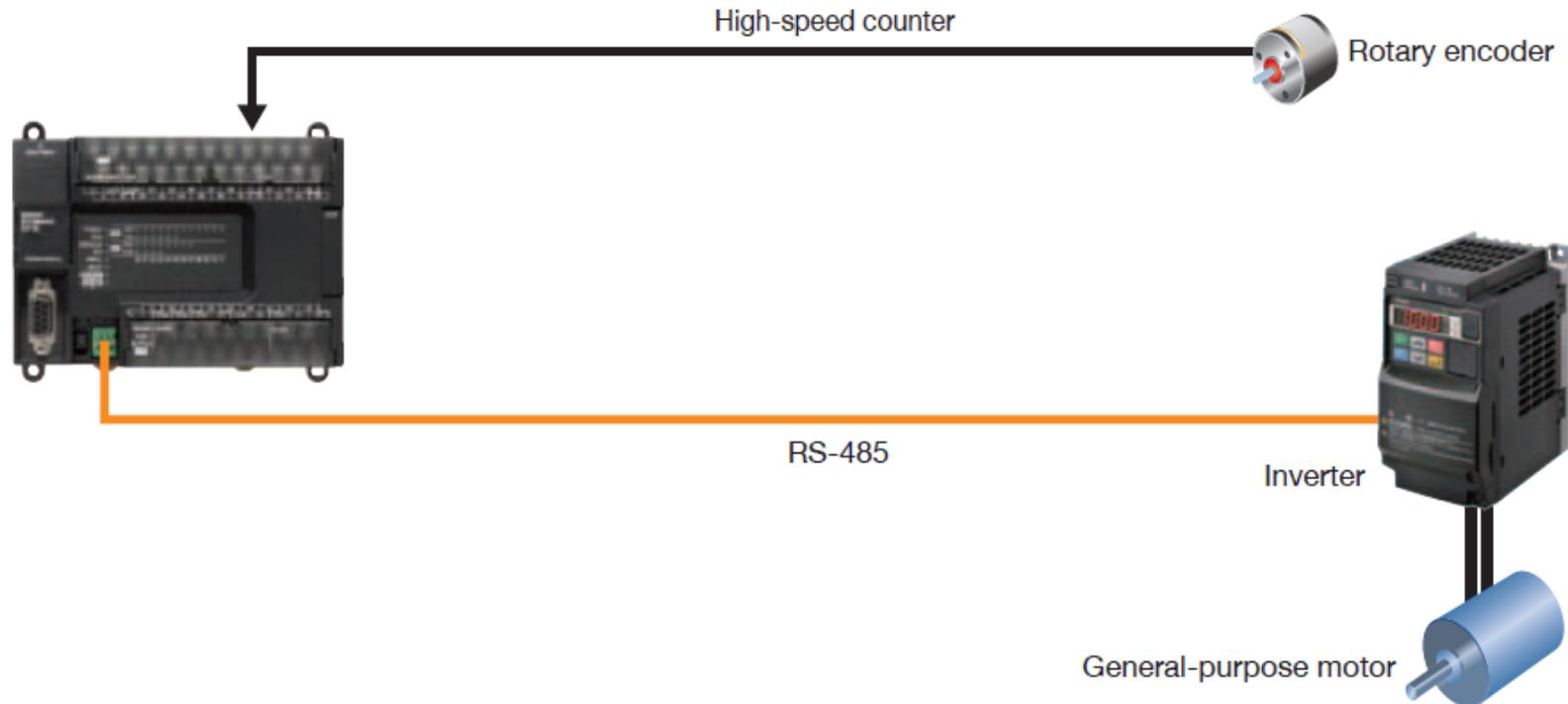


## 2.1 Features of CP1

- External interfaces:

### Modbus-RTU easy master

Specify Inverter speeds via RS-485



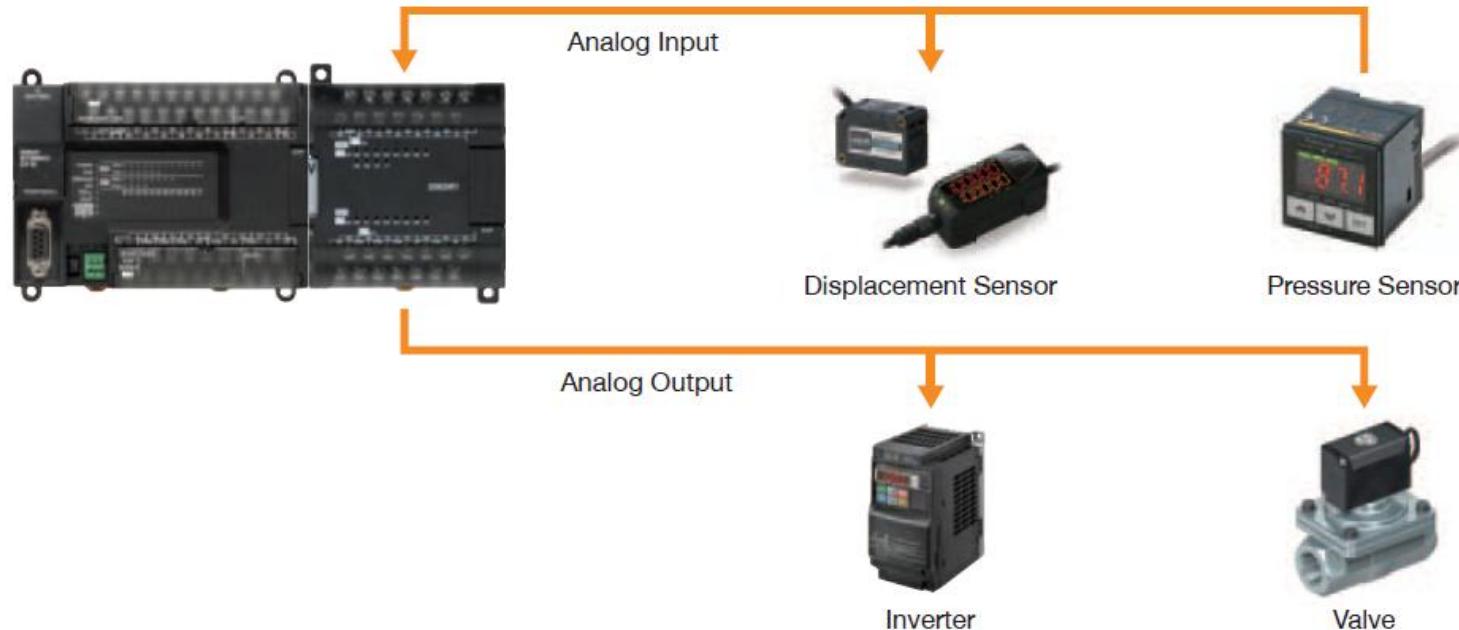
# 2.1 Features of CP1

## ➤ External interfaces:

### Analog I/O Control

High-accuracy analog I/O control with a resolution 1/12,000.

You can add up to 4 analog I/O by mounting an Analog Option Board and up to 24 analog I/O by connecting Expansion Units.

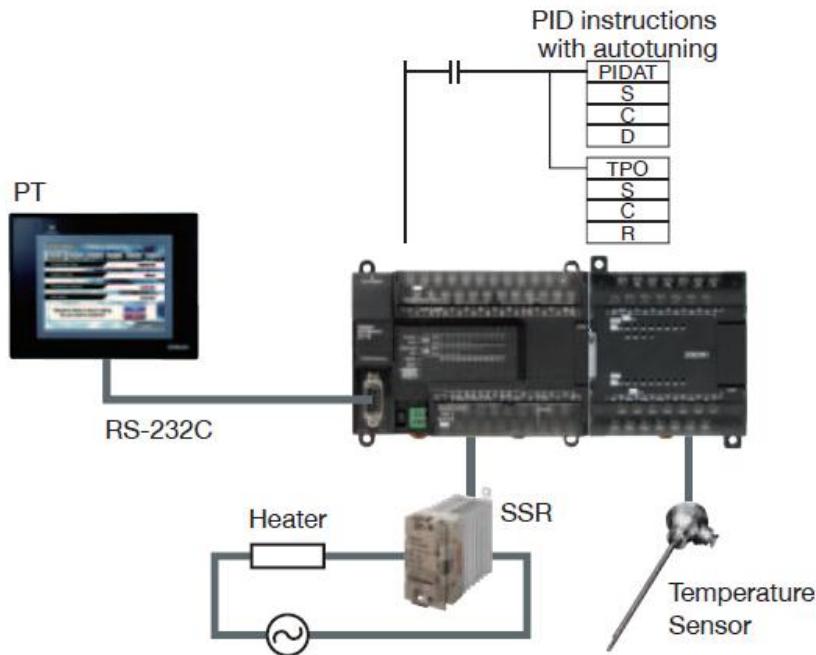


# 2.1 Features of CP1

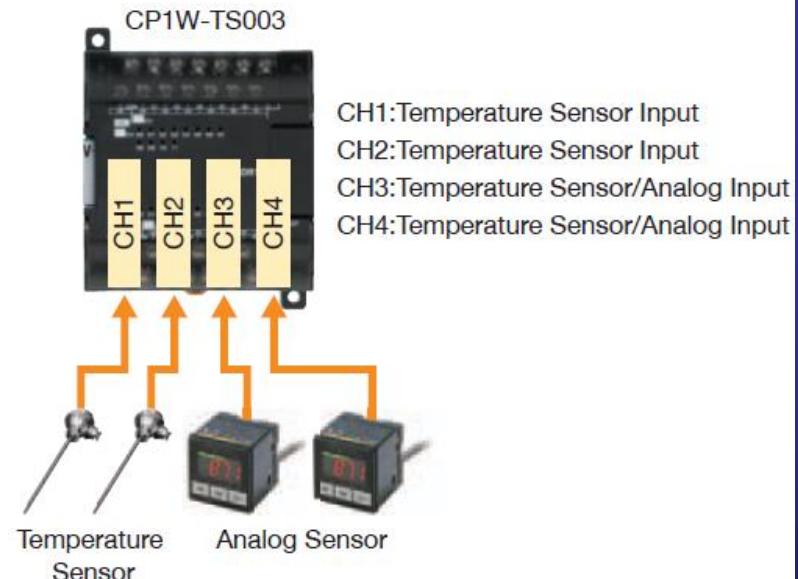
## ➤ External interfaces:

### Temperature Control

The combination of the Temperature Input Unit with the PID instructions enables temperature control.  
Up to 12 thermocouple inputs per Unit for CP1W-TS004.



The CP1W-TS003 has two inputs that can be used for temperature sensor or analog inputs.  
Both temperature sensor and analog inputs can be achieved with only one Unit.

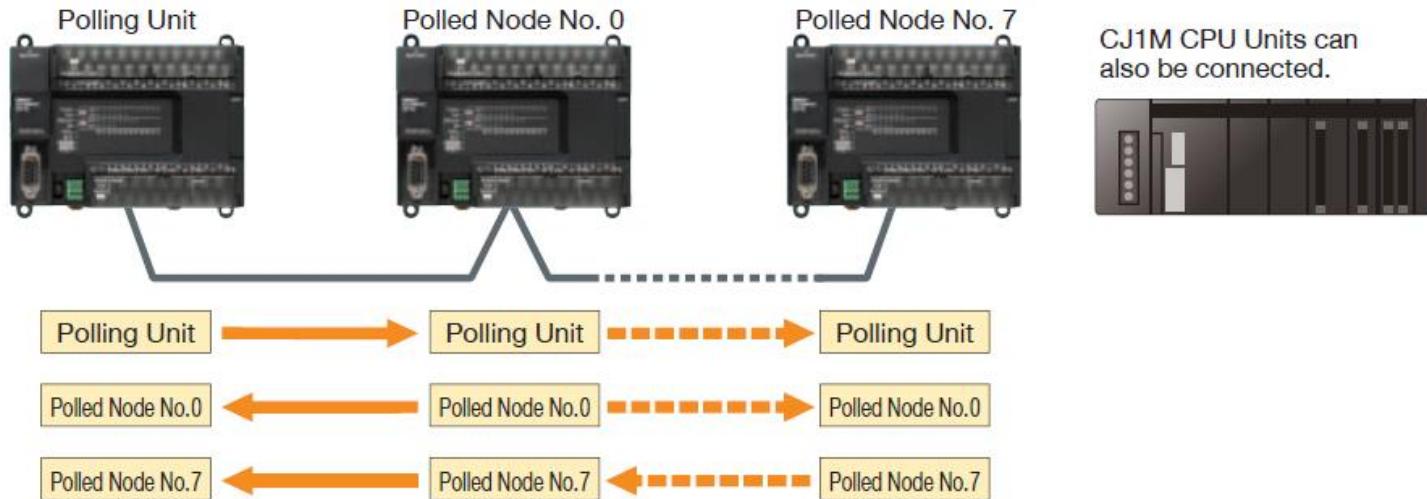


# 2.1 Features of CP1

- External interfaces:

## Serial PLC Links

Link data with up to 10 words between up to nine CP1E-N CPU Units when controlling a device with multiple CP1E-N PLCs.



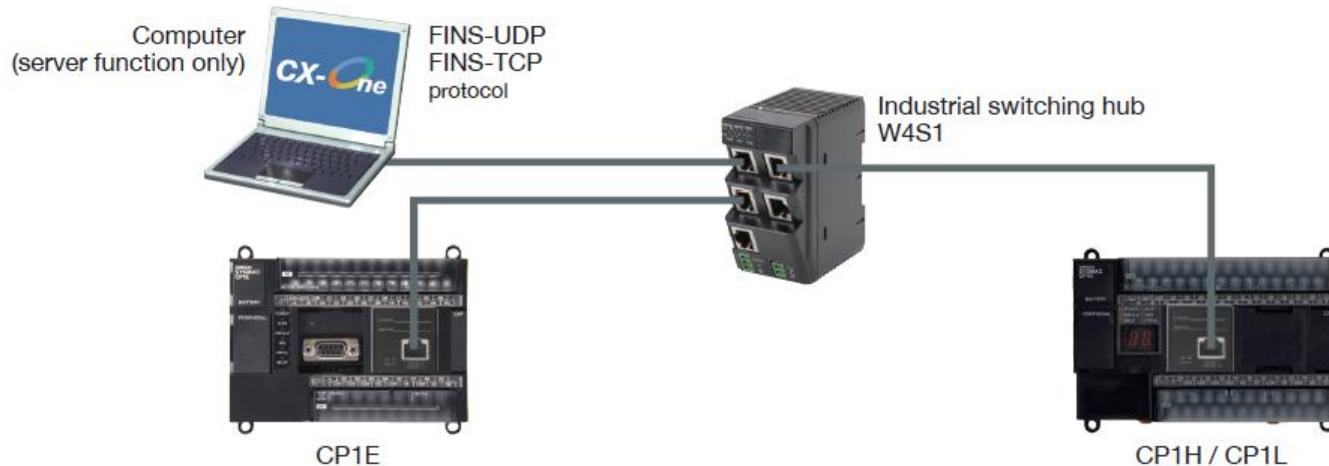
# 2.1 Features of CP1

- External interfaces:

## Ethernet Communications

Mount a CP1W-CIF41 Ethernet Option Board to an option board slot on the CP1E-N/NA type CPU Unit.

Perform monitoring and programming with CX-Programmer, or communicate with a host computer via Ethernet.(server function only)



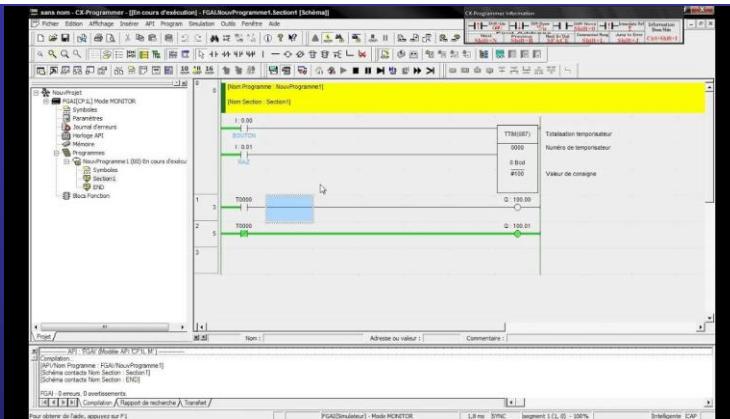
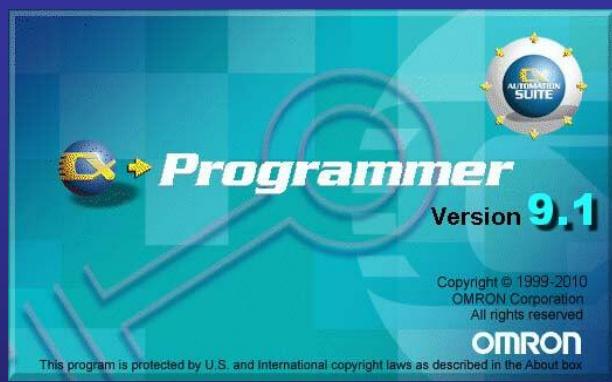
# 2.1 Features of CP1

## ➤ Programming tool:



Support Software

Commercially available USB cable



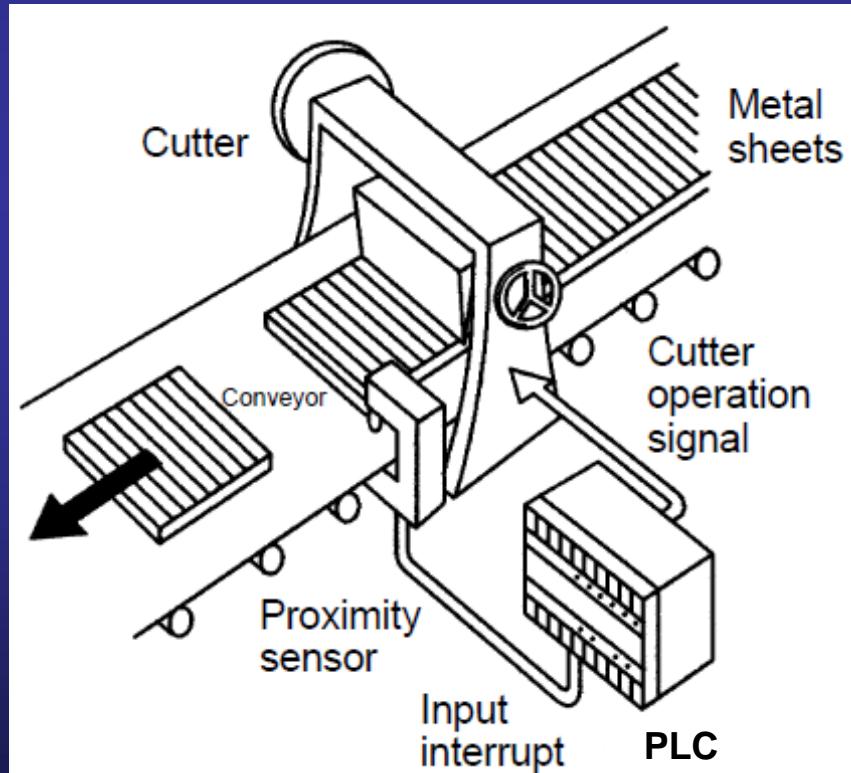
Operating system	Windows 98, Me, 2000, or XP
Support Software	CX-Programmer Ver. 6.1 (CX-One Ver. 1.1)
USB driver	Included with above Support Software.
USB cable	USB 1.1(or 2.0) cable (A connector-B connector), 5 m max.



# Application Example

## Cutting Metal Sheets to Specified Lengths

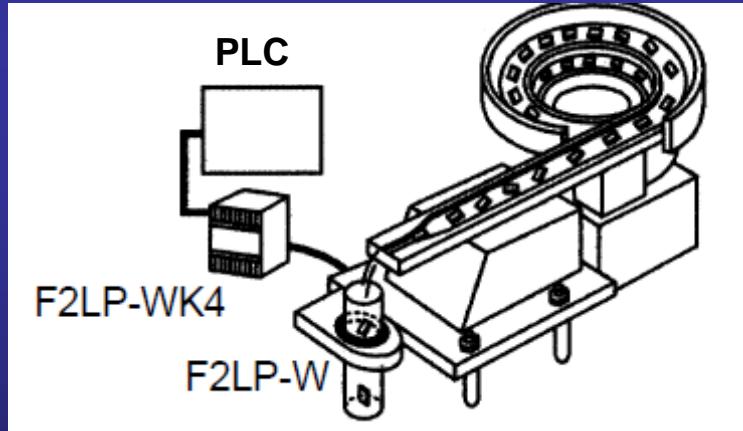
The proximity sensor detects the edge of a metal plate to operate the cutter. Metal sheets can be cut continuously to the specified lengths at a high speed.



# Application Example

## Calculating the Number of Chips

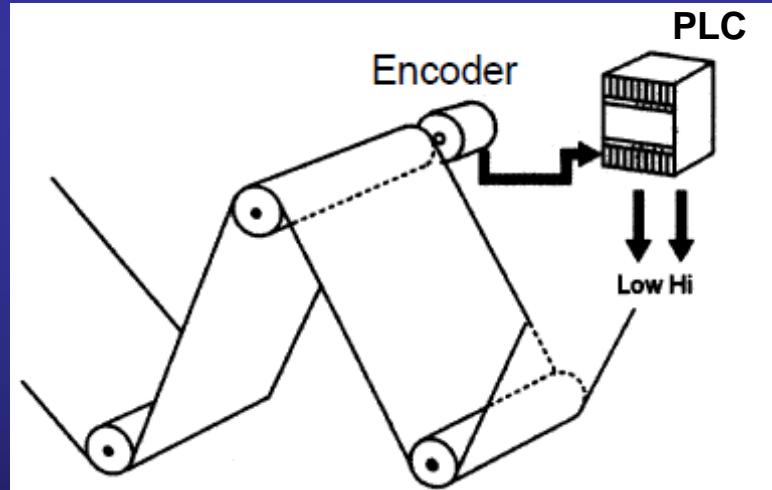
The metal sensor counts the number of parts that have passed. Steady counting can be achieved even when the input-ON time is short.



# Application Example

## Computing the Sheet Speed

The number of pulse inputs is computed in the interrupt mode at a fixed time to calculate the speed.

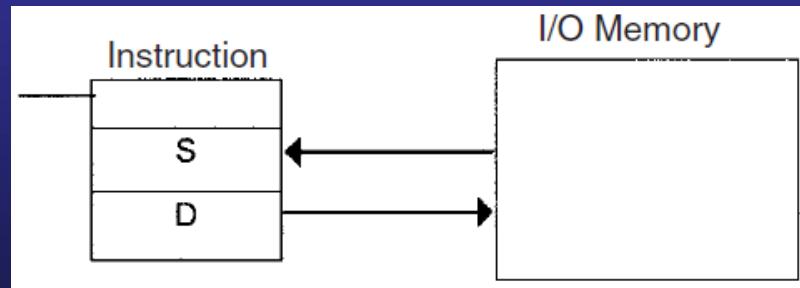


# 2.2 PLC Addressing

## 2.2.1 I/O memory area

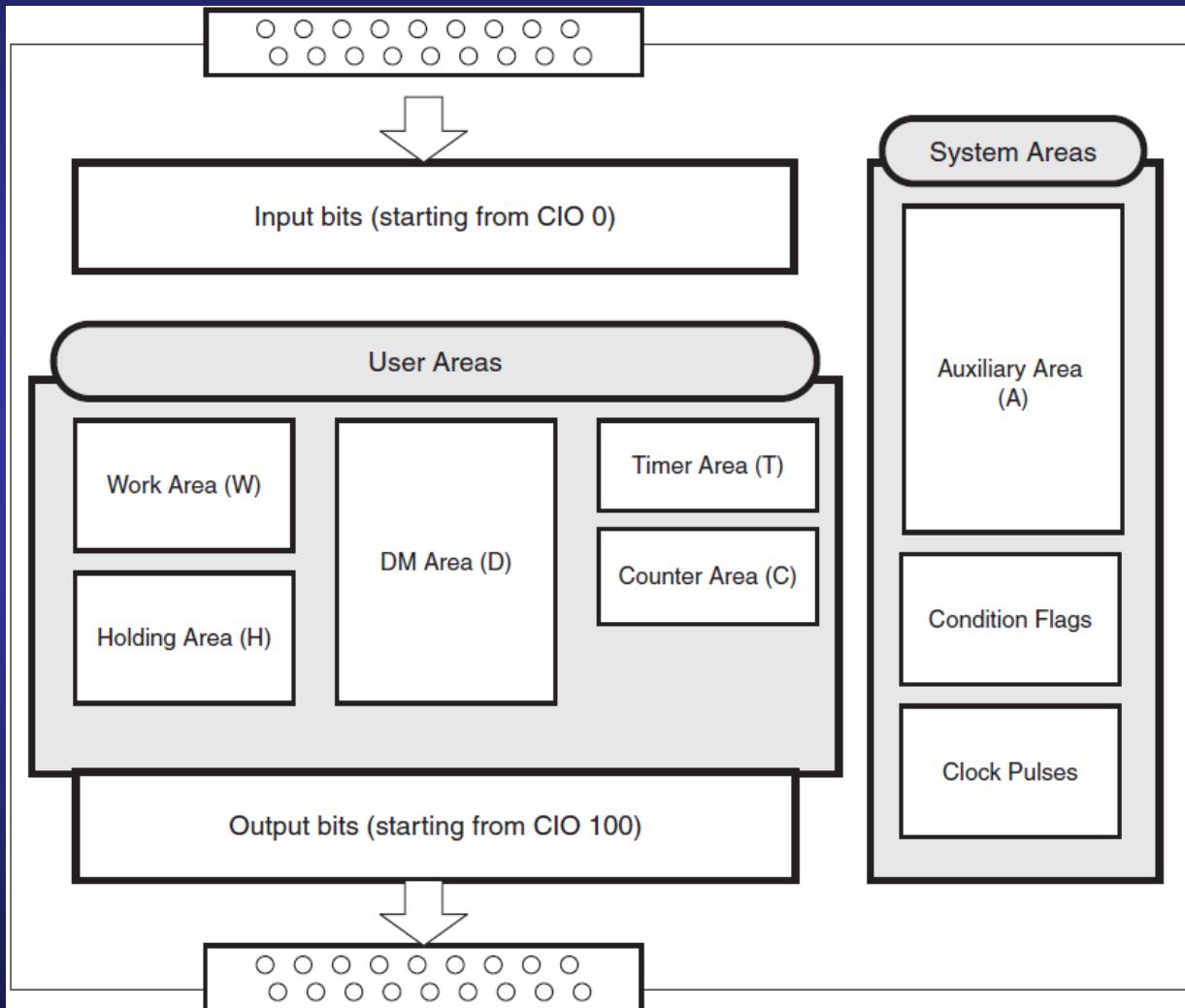
This region of memory contains the data areas that can be accessed as **instruction operands**, including:

- CIO Area (CIO)
- Work Area (W)
- Holding Area (H)
- Auxiliary Area (A)
- Temporary Relay Area (TR)
- Data Memory Area (D)
- Timer Area (T)
- Counter Area (C)
- Task Flag Area (TK)
- Data Registers (DR)
- Index Registers (IR)
- Condition Flag Area
- Clock Pulse Area



# 2.2 PLC Addressing

## 2.2.1 I/O memory area



# 2.2 PLC Addressing

## 2.2.2 Address of relay

Method: Word address . bit address

Represented by 4 numbers, each word has 16 bits, also called “channel”

Represented by 2 numbers, i.e. 00-15

E.g: address of a relay is **3800.04**

Word  
address

Bit  
address



# 2.2 PLC Addressing

Area		Size	Range
CIO Area	I/O Area	Input Area	272 bits (17 words) CIO 0 to CIO 16
		Output Area	272 bits (17 words) CIO 100 to CIO 116
	Built-in analog I/O Areas (XA CPU Units only)	Built-in Analog Input Area	4 words CIO 200 to CIO 203
		Built-in Analog Output Area	2 words CIO 210 to 211
	Data Link Area		3,200 bits (200 words) CIO 1000 to CIO 1199
	CPU Bus Unit Area		6,400 bits (400 words) CIO 1500 to CIO 1899
	Special I/O Unit Area		15,360 bits (960 words) CIO 2000 to CIO 2959
	Serial PLC Link Area	1,440 bits (90 words)	CIO 3100 to CIO 3189
	DeviceNet Area		9,600 bits (600 words) CIO 3200 to CIO 3799
	Work Area		4,800 bits (300 words) 37,504 bits (2344 words) CIO 1200 to CIO 1499 CIO 3800 to CIO 6143

Work Area	8,192 bits (512 words)	W000 to W511
Holding Area	8,192 bits (512 words)	H000 to H511 (Note 1)
Auxiliary Area	15,360 bits (960 words)	A000 to A959

Area	Size	Range
TR Area	16 bits	TR0 to TR15
Data Memory Area	32,768 words	D00000 to D32767
Timer Completion Flags	4,096 bits	T0000 to T4095
Counter Completion Flags	4,096 bits	C0000 to C4095
Timer PVs	4,096 words	T0000 to T4095
Counter PVs	4,096 words	C0000 to C4095
Task Flag Area	32 bits	TK0 to TK31
Index Registers	16 registers	IR0 to IR15
Data Registers	16 registers	DR0 to DR15



# 2.2 PLC Addressing

## 2.2.3 Input/output relay

**Input Bits:** CIO 0.00 to CIO 16.15 (17 words)

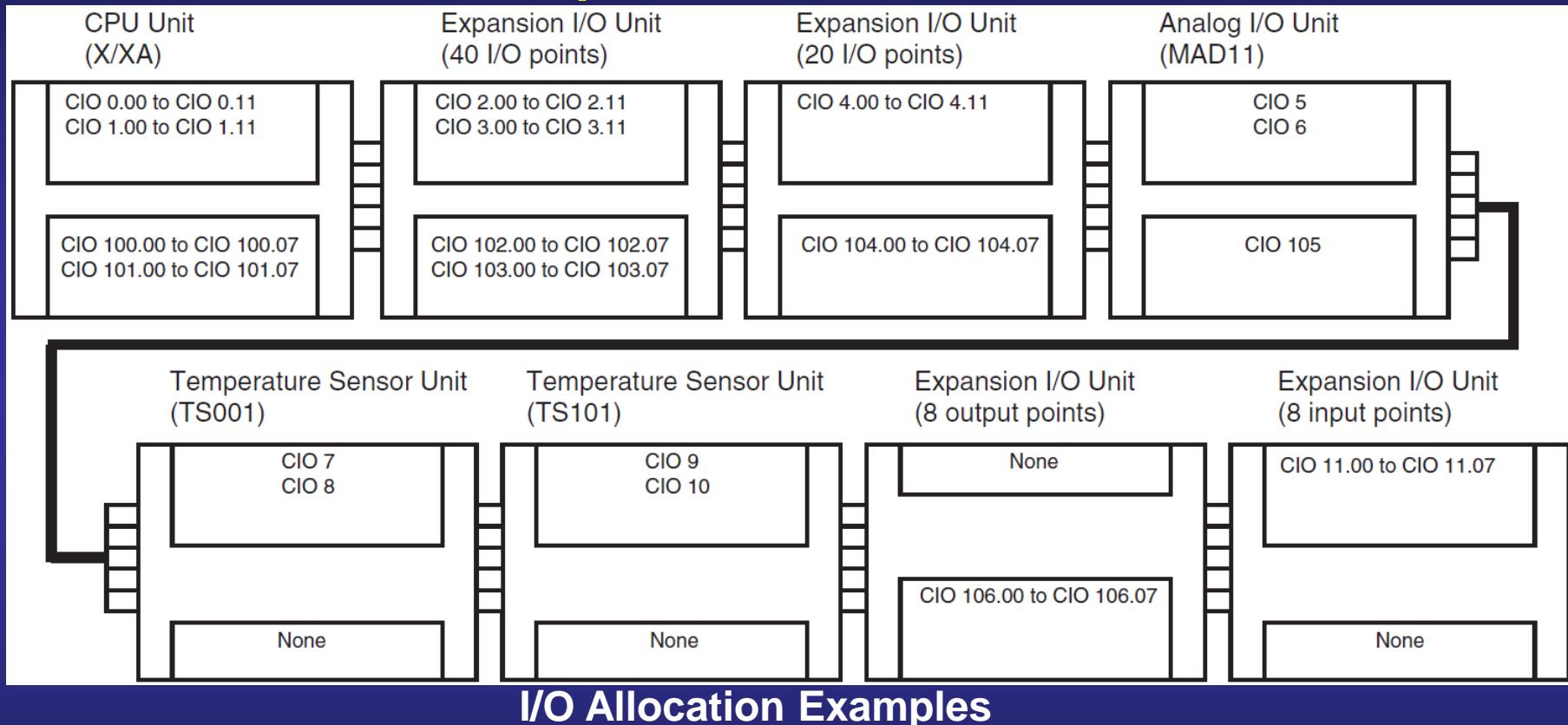
**Output Bits:** CIO 100.00 to CIO 116.15 (17 words)

- It is not necessary to use the “**CIO**” acronym when specifying an address in the CIO Area
- Input bits in **CIO 0** and **CIO 1** and output bits in **CIO 100** and **CIO 101** are automatically allocated to the **built-in I/O**
- **Expansion Units** are automatically allocated input bits in words starting from **CIO 2** and output bits in words starting from **CIO 102**.



# 2.2 PLC Addressing

## 2.2.4 I/O expansion



### Restrictions:

1. A maximum of up to 7 Units can be connected.
2. A maximum of 15 input and output words can be allocated.



## 2.2 PLC Addressing

### 2.2.5 Internal I/O (Work) Area (W)

Contains **512 words**, addresses: **W0 to W511**, used in programming as work words.

- ✓ Unused words in the CIO area may also be used as work words and work bits in the program.

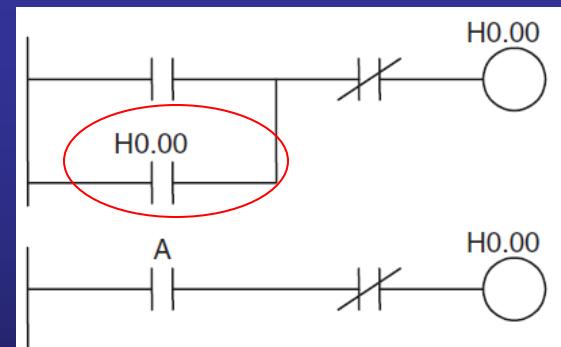


# 2.2 PLC Addressing

## 2.2.6 Holding Area (H)

Contains **512 words**, addresses: **H0 to H511 (bits H0.00 to H511.15)**, used in programming.

- ✓ Data in the Holding Area is **not cleared** when the power is cycled.
- ✓ When a **self-maintaining bit** is programmed with a Holding Area bit, the self-maintaining bit won't be cleared even when the power is reset.



## 2.2 PLC Addressing

### 2.2.7 Auxiliary Area (A)

Contains **960 words**, addresses: **A0 to A959**, preassigned as flags and control bits to monitor and control operation.

- ✓ A0 through A447 are read-only
- ✓ A448 through A959 can be read or written from the program or the CX-Programmer.



## 2.2 PLC Addressing

### 2.2.8 TR (Temporary Relay) Area

Contains **16 bits**, addresses: **TR0 to TR15**, temporarily store the **ON/OFF status** of an instruction block for branching and are used only with mnemonics.

- ✓ The TR bits can be used as many times as required and in any order required as long as the same TR bit is not used twice in the same instruction block.



# 2.2 PLC Addressing

## 2.2.9 Timer Area (T)

- **4096 timer numbers, T0000 to T4095**
- ✓ shared by the TIM, TIMX, TIMH, TIMHX, TMHH, TIMHHX, TTIM, TTIMX, TIMW, TIMWX, TMHW, and TIMHWX instructions.
- ✓ Do not use the same timer number in two timer instructions.
- ✓ Timer **Completion Flags** and present values (**PVs**) for these instructions are accessed with the timer numbers.
- ✓ When used in an operand that requires **bit data**, the timer number accesses the Completion Flag of the timer.
- ✓ When used in an operand that requires **word data**, the timer number accesses the PV of the timer.



## 2.2 PLC Addressing

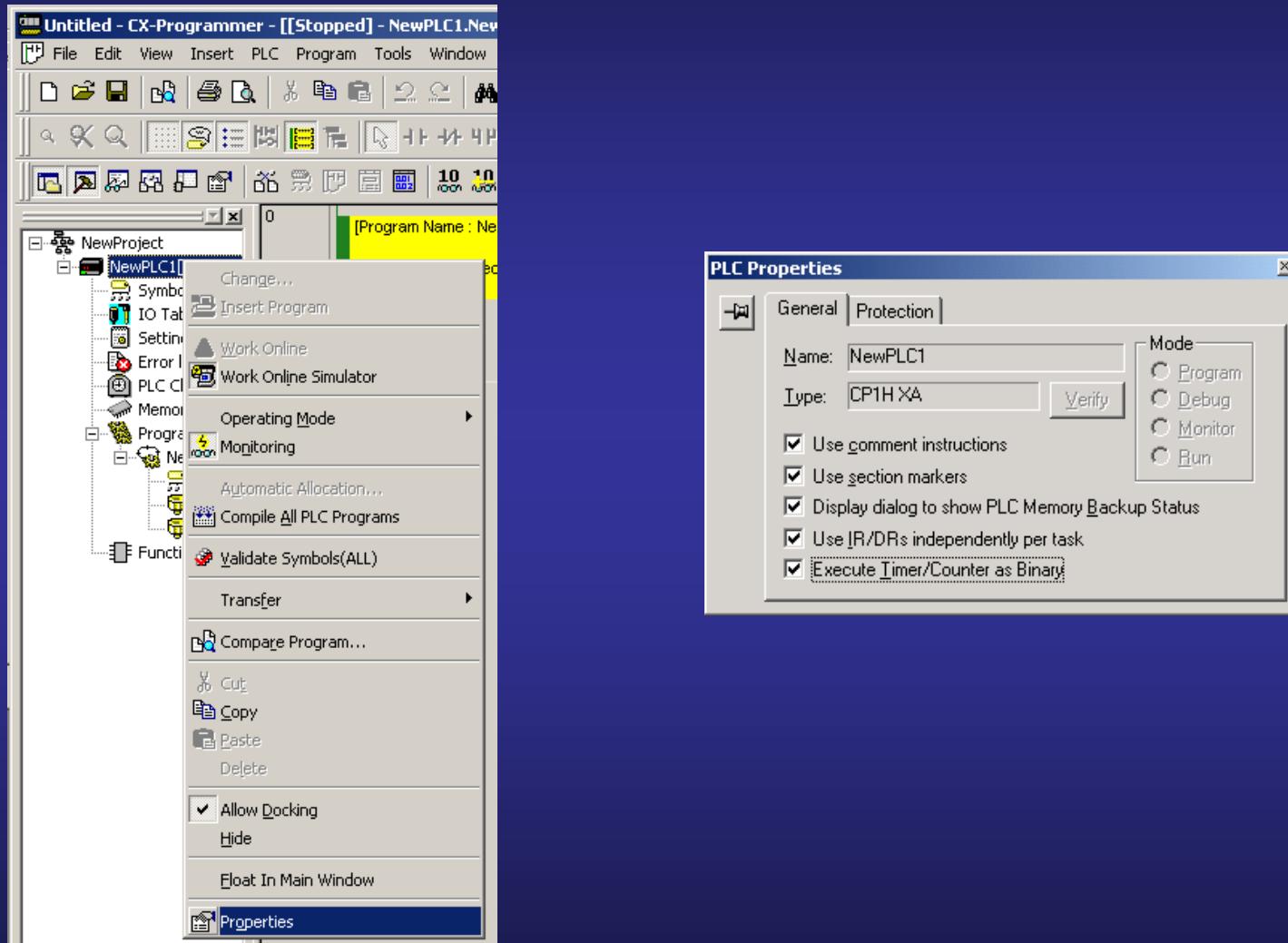
### 2.2.10 Counter Area (C)

- **4096 counter numbers, C0000 to C4095**
- ✓ **shared** by the CNT, CNTX, CNTR, CNTRX, CNTW, and CNTWX instructions.
- ✓ Do not use the same counter number in two counter instructions.
- ✓ Counter **Completion Flags** and present values (**PVs**) for these instructions are accessed with the counter numbers.
- ✓ When used in an operand that requires **bit data**, the counter number accesses the Completion Flag of the counter.
- ✓ When used in an operand that requires **word data**, the counter number accesses the PV of the counter.



# 2.2 PLC Addressing

## ➤ Changing the BCD or Binary Mode for Counters and Timers



## 2.2 PLC Addressing

### 2.2.11 Data Memory Area (D)

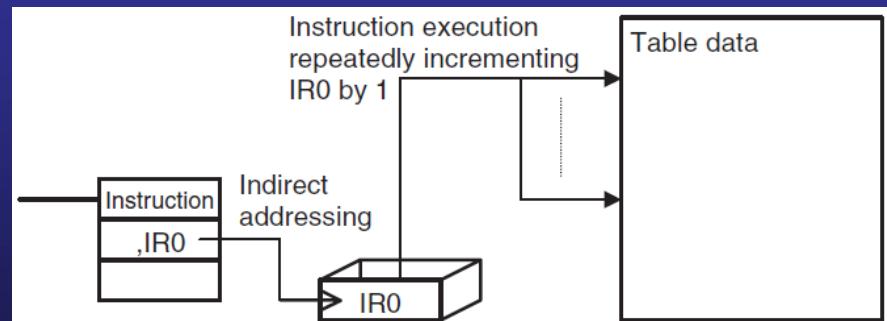
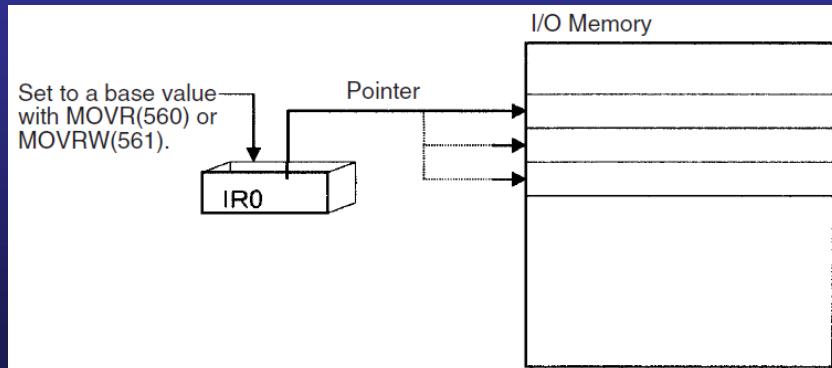
- contains **32,768 words**, addresses: **D0 to D32767**, used for general data storage and manipulation, **accessible only by word**.
- ✓ Data in the DM Area is retained when the PLC's power is cycled.
- ✓ Although bits in the DM Area cannot be accessed directly, the status of these bits can be accessed with the BIT TEST instructions, TST and TSTN.



# 2.2 PLC Addressing

## 2.2.12 Index Registers (IR)

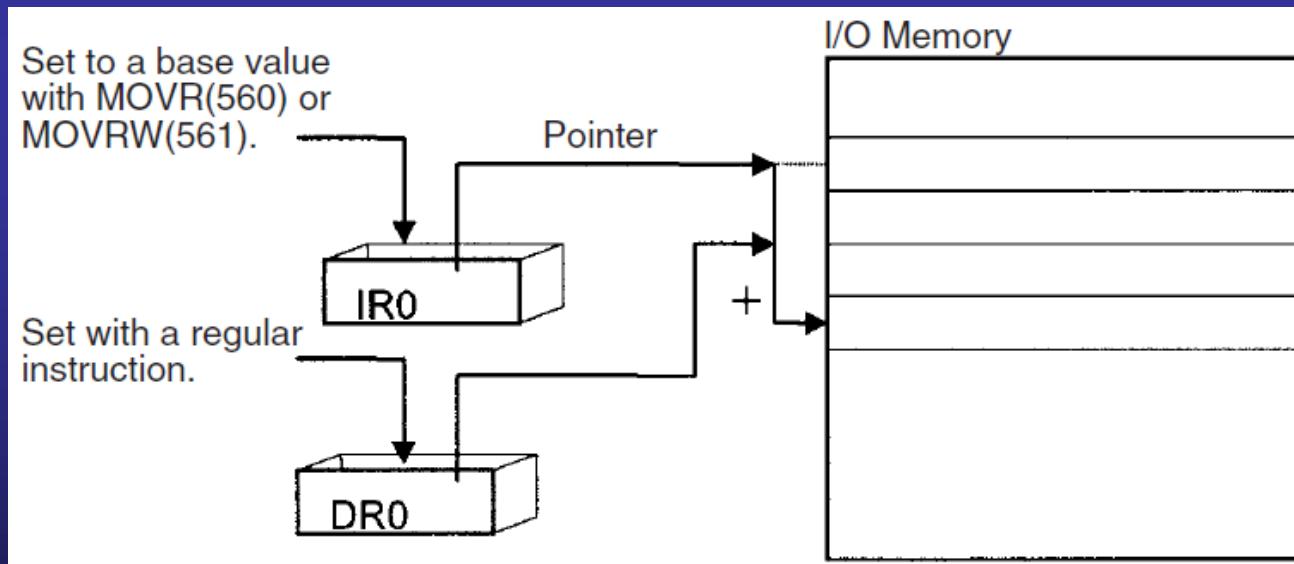
- **16 Index Registers (IR0 to IR15), used for indirect addressing.**
- ✓ Each IR can hold a single PLC memory address, which is the absolute memory address of a word in I/O memory.
- ✓ Use MOVR to convert a regular data area address to its equivalent PLC memory address and write that value to the specified IR.



# 2.2 PLC Addressing

## 2.2.13 Data Registers (DR)

- **16 Data Registers (DR0 to DR15)** are used to offset the PLC memory addresses in IR when addressing words indirectly.



## 2.2 PLC Addressing

### 2.2.14 Task Flags (TK)

- **32 Task Flags range from TK00 to TK31 and correspond to cyclic tasks 0 to 31.**
- ✓ will be ON when the corresponding cyclic task is in executable (RUN) status and OFF when the cyclic task hasn't been executed (INI) or is in standby (WAIT) status.



# 2.2 PLC Addressing

## 2.2.15 Condition Flags

- specified with **symbols**, such as P\_CY and P\_ER, rather than addresses.
- indicate the results of instruction execution.
- read-only.

Name	Symbol	Function
Error Flag	P_ER	<p>Turned ON when the operand data in an instruction is incorrect (an instruction processing error) to indicate that an instruction ended because of an error.</p> <p>When the PLC Setup is set to stop operation for an instruction error (Instruction Error Operation), program execution will be stopped and the Instruction Processing Error Flag (A29508) will be turned ON when the Error Flag is turned ON.</p>
Access Error Flag	P_AER	<p>Turned ON when an Illegal Access Error occurs. The Illegal Access Error indicates that an instruction attempted to access an area of memory that should not be accessed.</p> <p>When the PLC Setup is set to stop operation for an instruction error (Instruction Error Operation), program execution will be stopped and the Instruction Processing Error Flag (A429510) will be turned ON when the Access Error Flag is turned ON.</p>



# 2.2 PLC Addressing

## 2.2.15 Condition Flags

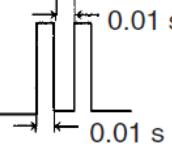
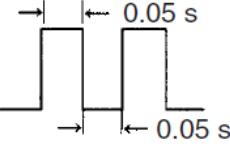
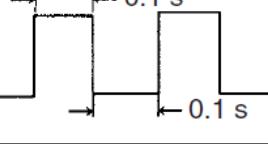
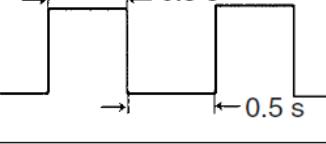
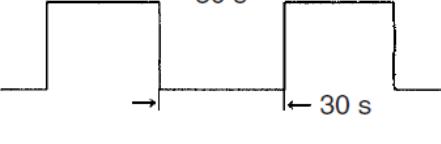
Name	Symbol	Function
Carry Flag	P_CY	Turned ON when there is a carry in the result of an arithmetic operation or a “1” is shifted to the Carry Flag by a Data Shift instruction. The Carry Flag is part of the result of some Data Shift and Symbol Math instructions.
Greater Than Flag	P_GT	Turned ON when the first operand of a Comparison Instruction is greater than the second or a value exceeds a specified range.
Equals Flag	P_EQ	Turned ON when the two operands of a Comparison Instruction are equal the result of a calculation is 0.
Less Than Flag	P_LT	Turned ON when the first operand of a Comparison Instruction is less than the second or a value is below a specified range.
Negative Flag	P_N	Turned ON when the most significant bit (sign bit) of a result is ON.
Overflow Flag	P_OF	Turned ON when the result of calculation overflows the capacity of the result word(s).
Underflow Flag	P_UF	Turned ON when the result of calculation underflows the capacity of the result word(s).
Greater Than or Equals Flag	P_GE	Turned ON when the first operand of a Comparison Instruction is greater than or equal to the second.
Not Equal Flag	P_NE	Turned ON when the two operands of a Comparison Instruction are not equal.
Less Than or Equals Flag	P_LE	Turned ON when the first operand of a Comparison Instruction is less than or equal to the second.
Always ON Flag	P_On	Always ON. (Always 1.)
Always OFF Flag	P_Off	Always OFF. (Always 0.)



# 2.2 PLC Addressing

## 2.2.16 Clock Pulses

- flags that are turned ON and OFF at **regular intervals** by the system.
- specified with **symbols** rather than addresses.

Name	Symbol	Operation
0.02 s Clock Pulse	P_0_02_s	 ON for 0.01 s OFF for 0.01 s
0.1 s Clock Pulse	P_0_1s	 ON for 0.05 s OFF for 0.05 s
0.2 s Clock Pulse	P_0_2s	 ON for 0.1 s OFF for 0.1 s
1 s Clock Pulse	P_1s	 ON for 0.5 s OFF for 0.5 s
1 min Clock Pulse	P_1min	 ON for 30 s OFF for 30 s



# References

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- CP1H CPU Unit Operation Manual, OMRON, 2014

