OMRON

New 20-point Type

Input from NPN Sensors

Twice as many timers, counters, and display instructions
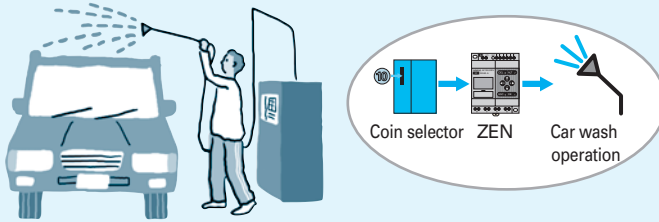
ZEN Programmable Relays

ZEN

Greater flexibility for automatic control.

Just a few examples of what the ZEN can do: Enormous added value in automating everyday facilities
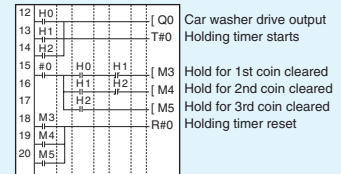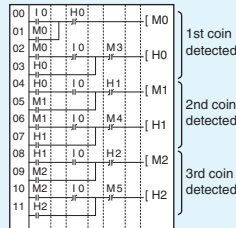
■ Fan and Pump Control

Coin-operated Car Wash

The ZEN can be used to change the operating time depending on the number of coins inserted.

If a holding timer (#) is used with holding bits (H) in self-holding programming, the remaining time will not be reset even if there are unexpected power interruptions.

Coin selector → ZEN → Car wash operation

Application of Bit Logic and Timer Functions

■ Example Program

```
00  I0   H0            [ M0    1st coin
01  M0                          detected
02  M0   I0   M3      [ H0
03  H0
04  H0   I0   H1      [ M1    2nd coin
05  M1                          detected
06  M1   I0   M4      [ H1
07  H1
08  H1   I0   H2      [ M2    3rd coin
09  M2                          detected
10  M2   I0   M5      [ H2
11  H2
```

```
12  H0                [ Q0    Car washer drive output
13  H1                 T#0    Holding timer starts
14  H2
15  #0   H0   H1      [ M3    Hold for 1st coin cleared
16       H1   H2      [ M4    Hold for 2nd coin cleared
17       H2           [ M5    Hold for 3rd coin cleared
18  M3                 R#0    Holding timer reset
19  M4
20  M5
```
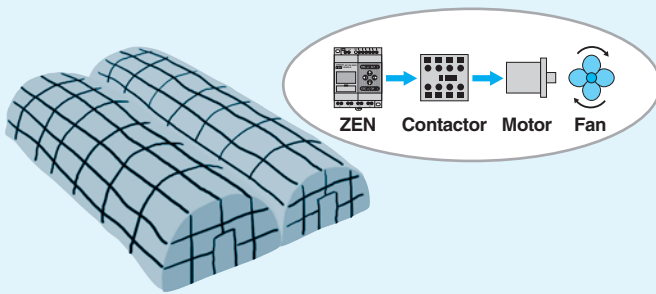
The car wash operates for 3 minutes for one coin, 6 minutes for two coins, and 9 minutes for 3 coins.

■ Parameter Settings

Holding Timer #0
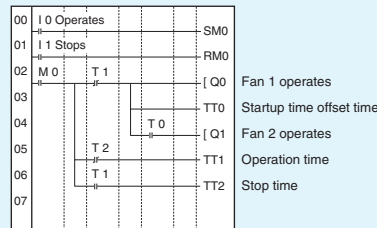
```
#0      X   M:S  A
TRG
RES      03.00
```

Set to 3 min.

Greenhouse Air Circulator Control

ZEN → Contactor → Motor → Fan

The ZEN can be used to circulate carbon dioxide or warm air. Two circulation fans can be operated at regular intervals. Startup current can also be reduced by staggering operation of the two fans.

Application of Bit Logic and Timer Functions

■ Example Program

```
00  I0 Operates                SM0
01  I1 Stops                   RM0
02  M0        T1        [ Q0    Fan 1 operates
03                       TT0    Startup time offset time
04                 T0   [ Q1    Fan 2 operates
05            T2         TT1    Operation time
06            T1         TT2    Stop time
07
```

When the operation switch is pressed, fan 1 starts and 30 seconds later fan 2 starts. The fans repeat a cycle of 1 hour operating, 1 hour 30 minutes stopped.

■ Parameter Settings

Time Offset Startup Time Setting T0

```
T0      X   S    A
TRO
RES      30.00
```

Set to 30 s.

Time Offset Startup Time Setting T1

```
T1      X   H:S  A
TRG
RES      01.00
```
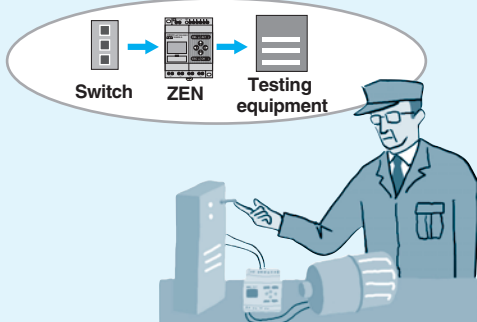
Set to 1 h.

Time Offset Startup Time Setting T2

```
T2      X   H:S  A
TRG
RES      01.30
```

Set to 1 hour 30 min.

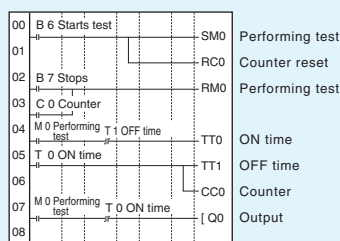## ■ Research and Development Devices

Testing Equipment

Switch → ZEN → Testing equipment

ON/OFF switching can be performed for durability and other tests in R&D.

Application of Bit Logic, Timer Functions, and Counter Functions

■ Example Program

```
00  B6 Starts test
01                       SM0    Performing test
02  B7 Stops             RC0    Counter reset
03  C0 Counter           RM0    Performing test
04  M0 Performing  T1 OFF time
         test            TT0    ON time
05  T0 ON time           TT1    OFF time
06                       CC0    Counter
07  M0 Performing  T0 ON time
         test         [ Q0    Output
08
```

When the operation switch is pressed, the device repeats a sequence of 2-minutes-ON, 3-minutes-OFF for a total of 100 times before automatically stopping.

■ Parameter Settings

T0, Output ON Time

```
T0      X   M:S  A
TGS
RES      02.00
```

Set to 2 minutes.

T1, Output OFF Time

```
T1      X   M:S  A
TRG
RES      03.00
```

Set to 3 minutes.

C0, Number of Times Output Turns ON

```
C0               A
CNT
RES      0100
DIR
```

Set to 100 times.

Easier small-scale automatic control. That is what the ZEN from OMRON provides. The ZEN can be used almost as easily as wiring materials. The ZEN enables quick automation of small machines or facilities. Add to this the LCD screen and 8 buttons on the front panel for easy ladder program input. You want a more compact control panel or reduced assembly or wiring? AC inputs, easier circuit design, or multiple-timer control? The OMRON ZEN gives you these, and more, to fill all your automation requirements. Increase system convenience and added value using the automation excellence provided by the ZEN.

■ Factories (Jigs, Operator Error Prevention, Small Equipment)

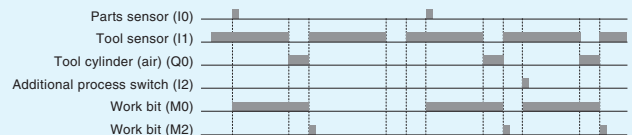### Preventing Assembly Omissions and Other Mistakes
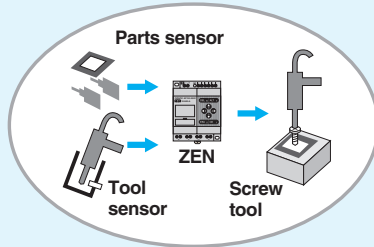
If the part required for assembly does not pass through the sensor, the screw tool will not be supplied with air to prevent mistakes.

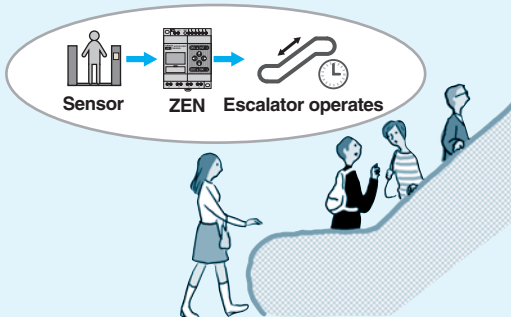#### Application of Bit Logic and Timer Functions

■ Example Program

00	I 0 Parts sensor	M 1		M 0
01	I 2 Additional process switch			
02	M 0			Tool cylinder (air) Q 0
03	I 1 Tool sensor	M 0		
04	Q 0 Tool cylinder (air)	M 2	Q0 upward differentiation	M 1
05	Q 0 Tool cylinder (air)			M 2
06				Q0 upward differentiation
07				

] M2 turns ON for 1 scan after Q0 turns ON.

Parts sensor (I0)	
Tool sensor (I1)	
Tool cylinder (air) (Q0)	
Additional process switch (I2)	
Work bit (M0)	
Work bit (M2)	

■ Energy Conservation and Automation of Building Facilities

Automatic Escalator

An escalator can operate continuously between specified days and times. It can also be set to conserve energy by operating outside those times only when a person approaches the escalator.

Application of Bit Logic, Timer Functions, and Weekly Timers

■ Example Program

00	I 1 Operates			SM0
01	I 2 Stops			RM0
02	@0	M 0		[Q0]
03	@1			
04	T 0			
05	I 0 Person detected			TT0
06				

Escalator operates

OFF-delay timer starts
Times for 3 minutes after detecting person.

Two weekly timers are used to operate the escalator between 7:00 and 10:00 am and 5:00 and 10:00 pm on weekdays.
Outside those times, the escalator uses the OFF-delay timer to operate for 3 minutes after a person has been detected.

■ Parameter Settings

Weekly Timer @0
(Mon to Fri: 7:00 to 10:00)

```
@0      MD – FR  A

        ON  0 7 : 0 0
RES OFF 1 0 : 0 0
```
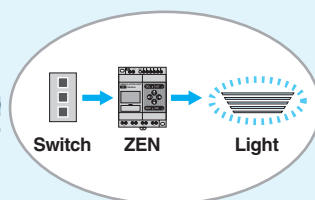
Weekly Timer @1
(Mon to Fri: 17:00 to 22:00)

```
@1      MO – FR  A

        ON  1 7 : 0 0
RES OFF 2 2 : 0 0
```

OFF-delay Timer T0

```
T 0     ■    M : S  A
TRG
RES       0 3 . 0 0
```

Lighting Pattern Control

Set the required light patterns and change between patterns with the flick of a switch to save energy by improving lighting efficiency.

Application of Bit Logic

■ Example Program

00	I 0 All lights ON	SQ0	Group 1 lit
01		SQ1	Group 2 lit
02		SQ2	Group 3 lit
03		SQ3	Group 4 lit
04	I 1 Pattern 1	SQ0	Group 1 lit
05		RQ1	Group 2 not lit
06		SQ2	Group 3 lit
07		RQ3	Group 4 not lit

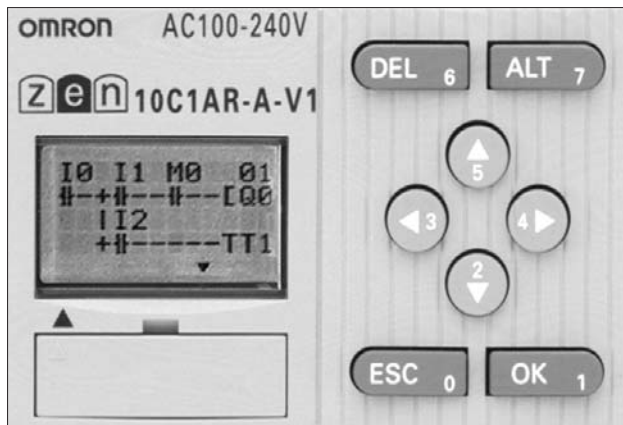| 08 | I 2 Pattern 2 | SQ0 | Group 1 lit |
09		SQ1	Group 2 lit
10		RQ3	Group 3 not lit
11		RQ3	Group 4 not lit
12	I 3 All lights OFF	RQ0	Group 1 not lit
13		RQ1	Group 2 not lit
14		RQ2	Group 3 not lit
15		RQ3	Group 4 not lit

Switch 1 (I0) turned ON, all lights turn ON.
Switch 2 (I1) turned ON, light groups 1 and 3 turn ON.
Switch 3 (I2) turned ON, light groups 1 and 2 turn ON.
Switch 4 (I3) turned ON, all lights turn OFF.

The Main Features of the Lightweight and Easy-to-use ZEN
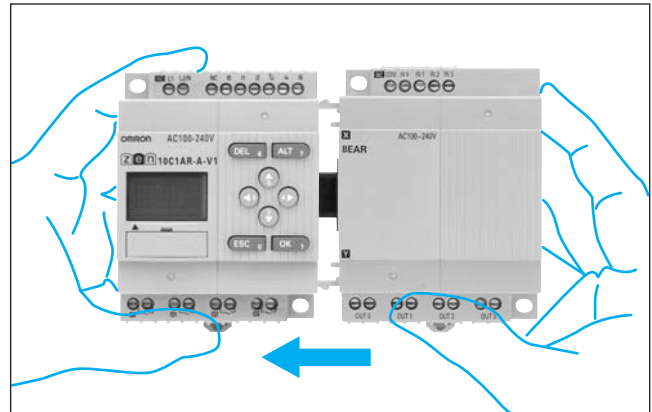
Easy Programming*

The LCD screen comes with 8 operation buttons on the front panel to enable programming in ladder view format. The LCD screen also has a backlight, making it easier to see when the ZEN is used in dark locations.

*For LCD-type CPU Units only.

Hold Functions for Peace of Mind

The ZEN has holding timers and holding bits to give peace of mind against unexpected power failures. These functions hold the previous status so that operation can continue with the same status after power has been restored. You can also mount a Battery Unit (optional) to back up the calendar and clock functions for 10 years or more. Ladder programs and parameter settings can be backed up to the CPU Unit's internal EEPROM, ensuring no data will be lost even if a Battery Unit is not installed.

Operations Determined after Wiring

Hardware relays or timers can normally be selected only after operations have been decided. The ZEN is different. You can wire the ZEN first and then carefully consider operating details later. This makes programming and maintenance after wiring a simple matter.

Flexible Expansion

The ZEN can be used effectively for lighting and other applications requiring many output points. Expansion I/O Units can be added easily if there are not enough I/O points. The compact ZEN takes up little space.

Memory Cassettes

Optional Memory Cassettes have a wide range of uses - programs can be easily saved or downloaded, or copied to other ZEN.
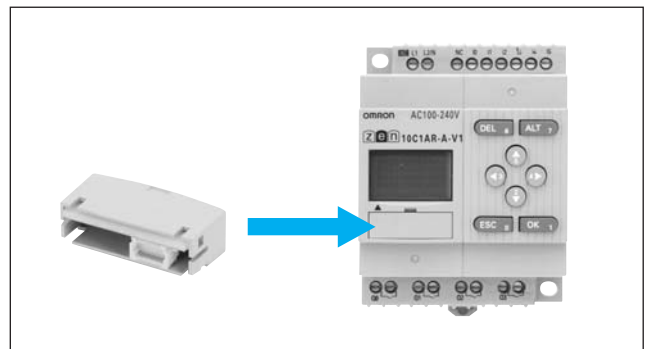
Many Other Functions

● Standard Functions on All CPU Units

- Two types of power supply specifications: 100 to 240 VAC or 24 VDC
- Input filters to prevent noise-related malfunctions
- Analog inputs
- Outputs have a large switching capacity (8 A at 250 VAC).
- Up to 44 I/O points if Expansion I/O Units added.
- Password protection.
- Conforms to EC Directives. Scheduled for conformance to UL/CSA in the future.
- Programming using ZEN Support Software on Windows 95, 98, 2000, ME, XP, or NT 4.0 Service Pack 3

● Functions Unique to LCD-type CPU Units

- Displays in 6 languages (Japanese, English, German, French, Spanish, and Italian)
- Calendar and clock functions.
- Display user-set messages or converted values.

Zen Provides a Broad Selection of 10-point to 20-point Models

■ CPU Units with 10 I/O Points

• LCD Type (with liquid crystal display)

• LED Type (without liquid crystal display)

ZEN-10C1AR-A-V1 (AC type, relay outputs)
ZEN-10C1DR-D-V1 (DC type, relay outputs)
ZEN-10C1DT-D-V1 (DC type, transistor outputs)

ZEN-10C2AR-A-V1 (AC type, relay outputs)
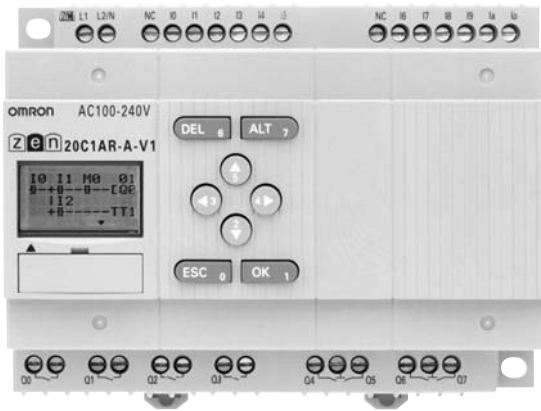ZEN-10C2DR-D-V1 (DC type, relay outputs)
ZEN-10C2DT-D-V1 (DC type, transistor outputs)

■ Expansion I/O Units

ZEN-8EAR (4 AC inputs, 4 relay outputs)
ZEN-8EDR (4 DC inputs, 4 relay outputs)
ZEN-8EDT (4 DC inputs, 4 transistor outputs)
ZEN-4EA (4 AC inputs)
ZEN-4ED (4 DC inputs)
ZEN-4ER (4 relay outputs)

■ CPU Units with 20 I/O Points   NEW

• LCD Type (with liquid crystal display)

ZEN-20C1AR-A-V1 (AC type, relay outputs)
ZEN-20C1DR-D-V1 (DC type, relay outputs)
ZEN-20C1DT-D-V1 (DC type, transistor outputs)

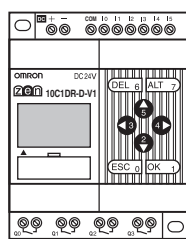• LED Type (without liquid crystal display)   NEW

ZEN-20C2AR-A-V1 (AC type, relay outputs)
ZEN-20C2DR-D-V1 (DC type, relay outputs)
ZEN-20C2DT-D-V1 (DC type, transistor outputs)

■ Input from NPN- or PNP-output Sensors (DC power supply: V1 CPU Units)   NEW

NPN output
PNP output

V1 CPU Unit

■ Twice the Timers and Counters (V1 CPU Units Only)   NEW

	Pre-V1 Units	V1 Units
Timers (T)	8 points ▶	16 points
Holding timers (#)	4 points ▶	8 points
Counters (C)	8 points ▶	16 points
Weekly timers (@)	8 points ▶	16 points
Calendar timers (∗)	8 points ▶	16 points
Displays (D)	8 points ▶	16 points

# The More You Get to Know It, the Better It Is — The Amazing ZEN

■CPU Units and Expansion I/O Units

Name	Type	Model number	No. of I/O points	Power supply voltage		Inputs		Outputs		LCD and buttons	Calendar and clock	Analog input
CPU Units	LCD	ZEN-10C1AR-A-V1	10	100 to 240 VAC	6	100 to 240 VAC	4	Relays		Yes	Yes	No
	LED	ZEN-10C2AR-A-V1								No	No	No
	LCD	ZEN-10C1DR-D-V1		24 VDC	6	24 VDC	4	Relays		Yes	Yes	Yes
	LED	ZEN-10C2DR-D-V1								No	No	Yes
	LCD	ZEN-10C1DT-D-V1		24 VDC	6	24 VDC	4	Transistors		Yes	Yes	Yes
	LED	ZEN-10C2DT-D-V1								No	No	Yes
	LCD	ZEN-20C1AR-A-V1	20	100 to 240 VAC	12	100 to 240 VAC	8	Relays		Yes	Yes	No
	LED	ZEN-20C2AR-A-V1								No	No	No
	LCD	ZEN-20C1DR-D-V1		24 VDC	12	24 VDC	8	Relays		Yes	Yes	Yes
	LED	ZEN-20C2DR-D-V1								No	No	Yes
	LCD	ZEN-20C1DT-D-V1		24 VDC	12	24 VDC	8	Transistors		Yes	Yes	Yes
	LED	ZEN-20C2DT-D-V1								No	No	Yes
Expansion I/O Units		ZEN-8EAR	8	—	4	100 to 240 VAC	4	Relays		—	—	—
		ZEN-8EDR		—	4	24 VDC	4	Relays		—	—	—
		ZEN-8EDT		—	4	24 VDC	4	Transistors		—	—	—
		ZEN-4EA	4	—	4	100 to 240 VAC	—	—		—	—	—
		ZEN-4ED		—	4	24 VDC	—	—		—	—	—
		ZEN-4ER		—	—	—	4	Relays		—	—	—

■Optional Units

Name	Model number	Specifications	Remarks		
Memory Cassette	ZEN-ME01	EEPROM	Enables programs and parameter settings to be saved or copied to another ZEN (See note.)		
				LCD Type	LED Type
			Transfer from ZEN to Memory Cassette	Supported	Not supported
			Transfer from Memory Cassette to ZEN	Supported	Supported (Automatic transfer when power turned ON)
			Memory Cassette initialization	Supported	Not supported
Connecting Cable	ZEN-CIF01	2-m RS-232C (9-pin D-sub connector)	—		
Battery Unit	ZEN-BAT01	10 year min. battery life (at 25˚C)	The program and parameter settings are backed up in the CPU Unit's internal EEPROM and will not be lost. Use the Battery Unit to prevent loss of calendar/clock, holding bits, holding timer present values, counter present values, and other data when the power is turned OFF for an extended time (for 2 days or more at 25˚C). This data is otherwise backed up using RAM and a super-capacitor.		
ZEN Support Software	ZEN-SOFT01-V3	Runs on Windows 95, 98, 2000, ME, XP, or NT 4.0.	Specifically designed for the ZEN (CD-ROM).		

■System Configuration

CPU Unit

Expansion I/O Unit

Battery Unit

Connecting Cable

Memory Cassette

Support Software
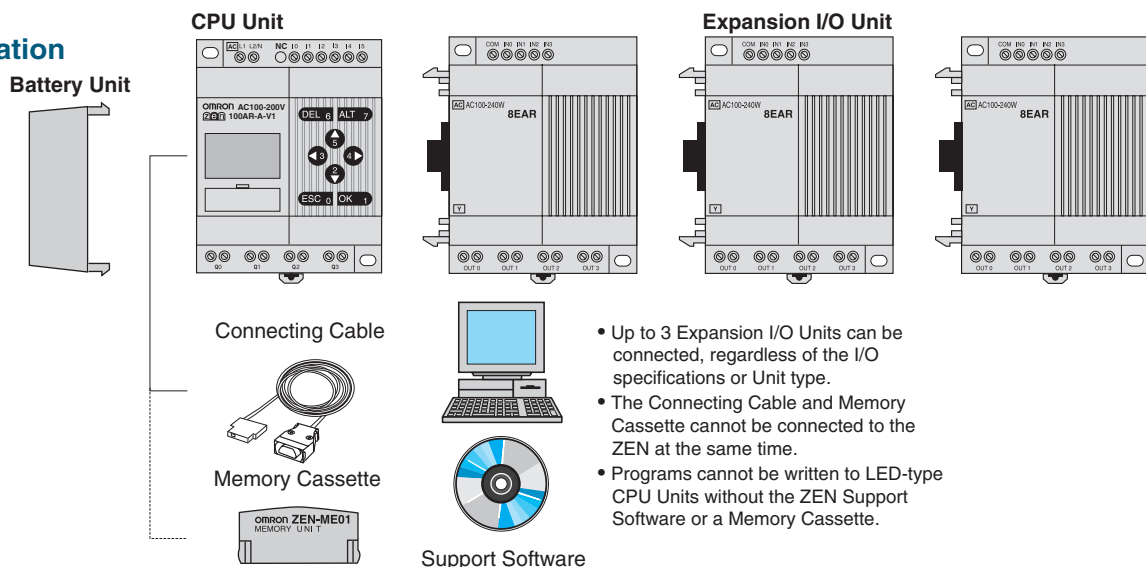
- Up to 3 Expansion I/O Units can be connected, regardless of the I/O specifications or Unit type.
- The Connecting Cable and Memory Cassette cannot be connected to the ZEN at the same time.
- Programs cannot be written to LED-type CPU Units without the ZEN Support Software or a Memory Cassette.

Note: Memory Cassettes created using the CPU Unit can be read to the CPU Unit, regardless of which model is used, however the following points must be taken into consideration.
- When using a Memory Cassette created with a V1 CPU Unit for a Pre-V1 CPU Unit, use the Memory Cassette within the ranges for the Pre-V1 CPU Unit's timers, holding timers, counters, weekly timers, calendar timers, and displays.
- When using a Memory Cassette created with a CPU Unit with 20 I/O points for a CPU Unit with 10 I/O points, use only up to 6 inputs and 4 outputs for the I/O bit area.

Programming Is Even Easier with ZEN Support Software

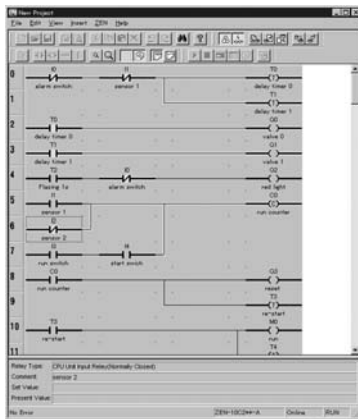## ZEN Support Software Functions

● Creating Ladder Programs

ZEN ladder programs can be created with ease.
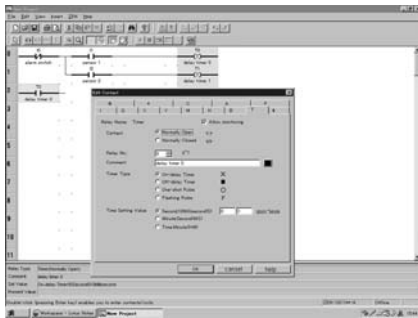
Note: The Edit Input Dialog Box is displayed when an input bit is inserted. Timer, counter, and other parameter settings are also set in the Edit Input Dialog Box. They cannot be set in the Edit Output Dialog Box.

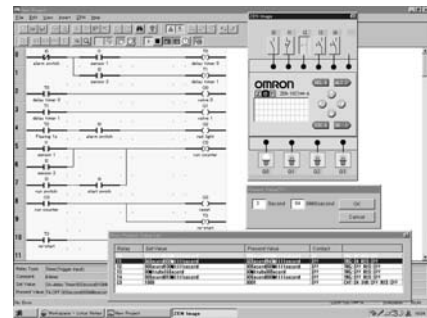### ● Simulating Ladder Programs

The simulation function makes it possible to check whether correct operation is performed without connecting to the ZEN.

Note: The simulation function is supported by ZEN-SOFT01-V2 and later versions.

● Monitoring Ladder Programs

The operating status can be monitored from the Support Software by connecting to the ZEN using a Connecting Cable (ZEN-CIF01).

● Printing Ladder Programs

Ladder programs and I/O comments, as well as timer, counter and other parameter settings can be printed.

● The Support Software can also be used to save files and edit comments.
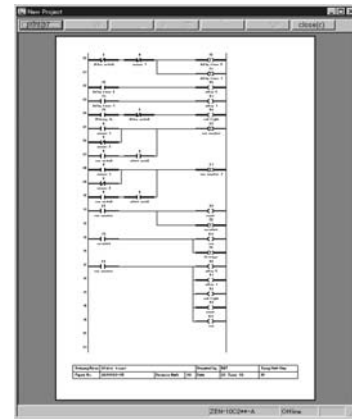
ZEN Support Software and CPU Unit Versions

Use ZEN-SOFT01-V3 ZEN Support Software Ver. 3.0 or later when using CPU Units with 20 I/O points.

CPU Unit	ZEN Support Software	SOFT01 (Ver. 1.0)	SOFT01-V2 (Ver. 2.0)	SOFT01-V3 (Ver. 3.0)
Pre-V1 Unit		○	○	○
V1 Unit	10 I/O points	△	△	○
	20 I/O points	✕	✕	○

○ : Supported △ : Supported (with limitations) ✕ : Not supported

ZEN-SOFT01 and ZEN-SOFT-V2 ZEN Support Software (versions 1.0 and 2.0) can be used with ZEN-10C□□□-V1 CPU Units (V1 Units with 10 I/O points) but only half of each of the timer, holding timer, counter, weekly timer, calendar timer, and display function areas can be used (i.e., the Pre-V1 bit range).

7

Flexible Control with a Wide Variety of Instructions

Programs can consist of up to 96 lines with 3 program inputs and 1 output per line.

■ Bits

Name	Symbol	Bit addresses	No. of points	Operation	Details
Input bits	I	I0 to Ib*	12	Reflect the ON/OFF status of the input devices connected to the input terminals on the CPU Unit.	—
Expansion input bits	X	X0 to Xb	12	Reflect the ON/OFF status of the input devices connected to the input terminals on the Expansion I/O Units.	
Output bits	Q	Q0 to Q7*	8	The ON/OFF status of these output bits is used to control the output devices connected to the output terminals on the CPU Unit.	**1**
Expansion output bits	Y	Y0 to Yb	12	The ON/OFF status of these output bits is used to control the output devices connected to the output terminals on the Expansion I/O Units.	
Work bits	M	M0 to Mf	16	Work bits can be used only within the ZEN program. I/Os for external devices cannot be made (i.e., all I/O is internal).	
Holding bits	H	H0 to Hf	16	Used the same as the work bits. However, if the power to the ZEN is turned OFF, these bits also maintain the previous ON/OFF status.	
Timers	T	T0 to Tf	16	X: ON-delay timer / ■: (box) OFF-delay timer / O: One-shot pulse timer / F: Flashing pulse timer — Functions are selected from the screen when parameter settings are made. Time units can be selected from the following: 0.01-s unit: 0.01 to 99.99 s / min/s unit: 00 min 01 s to 99 min 59 s / h/s unit: 00 h 01 min to 99 h 59 min	**2**
Holding timers	#	#0 to #7	8	Hold the present value being counted even if the trigger input or power supply is turned OFF and continue timing when the trigger input or power is restored.	
Counters	C	C0 to Cf	16	Reversible counters that can be incremented and decremented.	**3**
Weekly timers	@	@0 to @f	16	Turn ON and OFF during specified times on specified days.	**4**
Calendar timers	*	*0 to *f	16	Turn ON and OFF between specified dates.	**5**
Display bits	D	D0 to Df	16	Display any character string, time, or analog-converted display of timer or counter present values.	**6**
Analog comparator bits	A	A0 to A3	4	Used as program input conditions to output analog comparator comparison results. These bits can be used only for 24-VDC input CPU Units.	**7**
Timer/counter comparator bits	P	P0 to Pf	16	Compare the present values of timers (T), holding timers (#), and counters (C). Comparison can be made between the same two counters or timers, or with constants.	**8**
Button input bits	B	B0 to B7	8	Used as program input conditions and turn ON when operation keys are pressed in RUN Mode. These input bits can be used only with LCD-type CPU Units.	**9**

* CPU Units with 10 I/O points have 6 input bits (I0 to I5) and 4 output bits (Q0 to Q3).

1 Additional Bit Output Functions

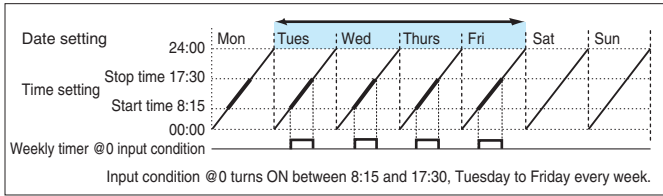| [: Normal	S: Set	R: Reset	A: Alternate
Q0 will turn ON or OFF depending on the ON/OFF status of the execution condition I0.	Q1 will stay ON once the execution condition I1 has turned ON once. A reset is used to turn Q1 OFF.	Q1 is forced OFF when the execution condition I2 is turned ON.	Q2 alternates between turning ON and OFF when the execution condition I3 turns ON.

2 Using Timers and Holding Timers

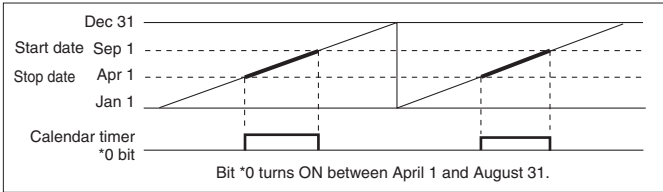| Available timers	Holding timers (#0 to #7)	Timers (T0 to Tf)			
Timer type	X	X	■	O	F
	ON-delay timer only	ON-delay timer	OFF-delay timer	One-shot pulse timer	Flashing pulse timer
Operation	Turns ON after set delay after the trigger input turns ON.	Turns ON after set delay after the trigger input turns ON.	Stays ON while the trigger input is ON and turns OFF after a set delay after the trigger input has turned OFF.	Turns ON for a set period after the trigger input turns ON and regardless of how long the trigger input remains ON.	Repeatedly turns ON and OFF in a set cycle while the switch is ON.
Trigger input / Reset input / Setting / Present value / Timer input condition					
Main applications	To continue operation after momentary power loss or power interruptions. When delayed operation or a time lag is required.		Useful for OFF delay circuits for lights or fans.	Useful for set operations where operation is always required during a regular period only.	Useful for flashing emergency lights or sounding buzzers as the output for an alarm circuit.

3 Counter Operation

The counter bit turns ON when the counter value (present value) reaches the set value (present value ≥ set value). The count returns to 0 and the counter bit turns OFF when the reset input turns ON. Count inputs are not accepted while the reset input is turned ON. The counter present value and counter bit (ON/OFF) are held even if the operating mode is changed or the power supply is interrupted.

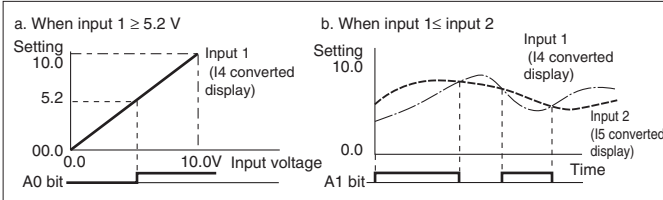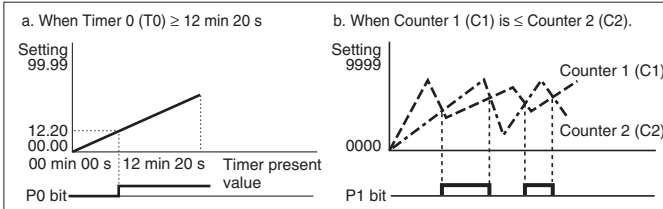I0(DIR) / I1(CNT) / I2(RES) / Setting / Present value / 0000 / Counter C0 bit

4 Weekly Timer Operation

| Date setting | | Mon | Tues | Wed | Thurs | Fri | Sat | Sun |

Time setting:
- 24:00
- Stop time 17:30
- Start time 8:15
- 00:00

Weekly timer @0 input condition

Input condition @0 turns ON between 8:15 and 17:30, Tuesday to Friday every week.

5 Calendar Timer Operation

- Dec 31
- Start date Sep 1
- Stop date Apr 1
- Jan 1

Calendar timer *0 bit

Bit *0 turns ON between April 1 and August 31.

7 Analog Comparator Operation Example

a. When input 1 ≥ 5.2 V

Setting
- 10.0
- 5.2
- 00.0
- 0.0   10.0V Input voltage

Input 1 (I4 converted display)

A0 bit

b. When input 1≤ input 2

Setting
- 10.0
- 0.0

Input 1 (I4 converted display)

Input 2 (I5 converted display)

Time

A1 bit

8 Timer/Counter Comparator Operations

a. When Timer 0 (T0) ≥ 12 min 20 s

Setting
- 99.99
- 12.20
- 00.00

00 min 00 s   12 min 20 s   Timer present value

P0 bit

b. When Counter 1 (C1) is ≤ Counter 2 (C2).

Setting
- 9999
- 0000

Counter 1 (C1)
Counter 2 (C2)

P1 bit

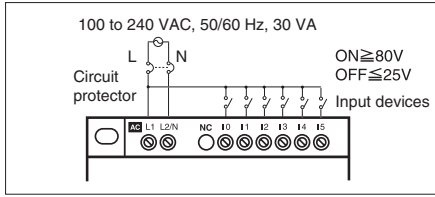## 6 Display Settings

Backlight Terminal mode switching	L0: Backlight does not turn ON (ignored if already ON). L1: Backlight turns ON L2: Terminal mode switching (backlight not ON) L3: Terminal mode switching (backlight ON)
Display start position	X (digit): 00 to 11 Y (line): 0 to 3

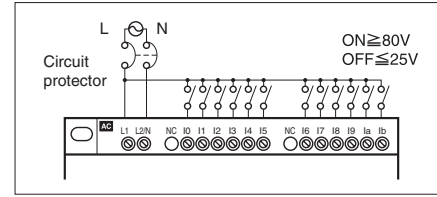| Display object	CHR	Characters (up to 12 characters - English, numerals, symbols)
	DAT	Month/day (5 digits □□/□□)
	CLK	Hour/minute (5 digits □□:□□)
	I4 to I5	Analog-converted value (4 digits □□:□)
	T0 to Tf	Timer present value (5 digits □□.□□)
	#0 to #7	Holding timer present value (5 digits □□.□□)
	C0 to Cf	Counter present value (4 digits □□□□)
Monitoring		A: Can read settings during operation. D: Cannot read settings during operation.

9 Specifications for Button Input Bits

ALT — Button input 7 (B7)

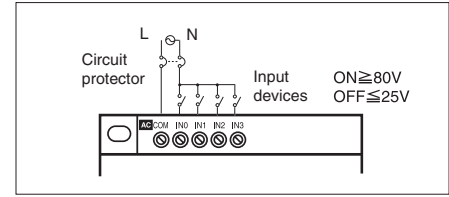DEL — Button input 6 (B6)

Button input 5 (B5)
Button input 4 (B4)
Button input 3 (B3)
Button input 2 (B2)

OK — Button input 1 (B1)

ESC — Button input 0 (B0)

OMRON AC100-240V
zen 10C1AR-A-V1
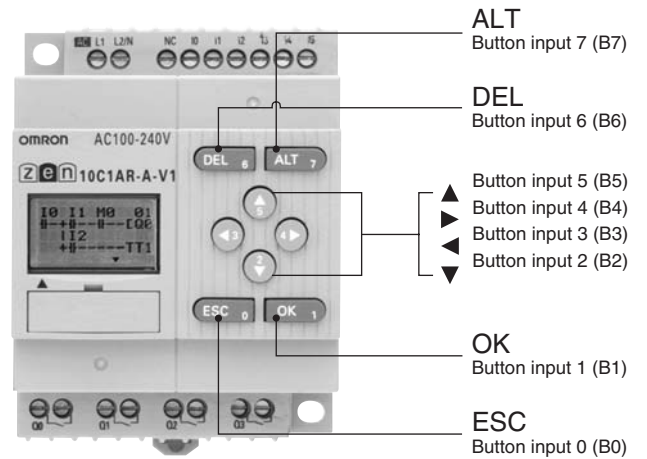
■ Units with AC Power Supply

● CPU Units with 10 I/O Points (V1 and Pre-V1 Units)

100 to 240 VAC, 50/60 Hz, 30 VA
Circuit protector
L N
ON≧80V
OFF≦25V
Input devices
AC L1 L2/N NC I0 I1 I2 I3 I4 I5

● CPU Units with 20 I/O Points

L N
Circuit protector
ON≧80V
OFF≦25V
AC L1 L2/N NC I0 I1 I2 I3 I4 I5 NC I6 I7 I8 I9 Ia Ib

● Expansion I/O Units

L N
Circuit protector
Input devices
ON≧80V
OFF≦25V
AC COM IN0 IN1 IN2 IN3

■ Units with DC Power Supply

● CPU Units with 10 I/O Points

• For connections to negative (–) common (V1 Units)

24 VDC, 6.5 W
ON≧16V
OFF≦5V
Input devices
DC + – COM I0 I1 I2 I3 I4 I5
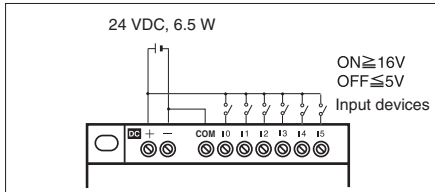
Note: Provide power to the COM and power supply terminals at the same time.

• Input terminal I4/I5 analog input device connections (input range: 0 to 10 V)
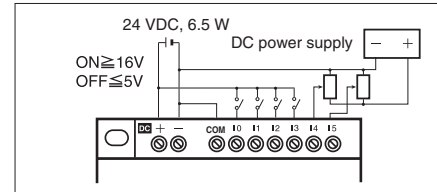
24 VDC, 6.5 W
DC power supply
ON≧16V
OFF≦5V
DC + – COM I0 I1 I2 I3 I4 I5

Note: Always connect analog input devices to the negative (–) COM terminal.

• For connections to positive (+) common (V1 Units)

24 VDC, 6.5 W
ON≧16V
OFF≦5V
Input devices
DC + – COM I0 I1 I2 I3 I4 I5
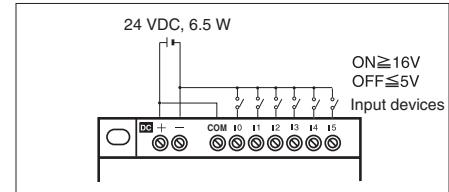
Note: I4/I5 cannot be used as analog input terminals with a positive (+) common terminal connection.

■ CPU Units with 20 I/O points

• For connections to negative (–) common

24 VDC, 6.5 W
ON≧16V
OFF≦5V
Input devices
DC + – COM I0 I1 I2 I3 I4 I5 NC I6 I7 I8 I9 Ia Ib
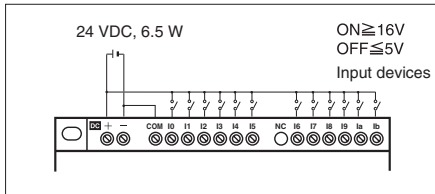
Note: Provide power to the COM and power supply terminals at the same time.

• Input terminal Ia/Ib analog input device connections (input range: 0 to 10 V)
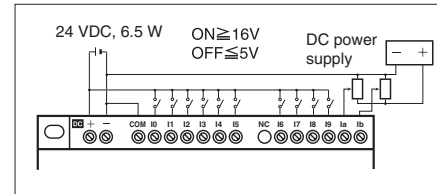
24 VDC, 6.5 W
ON≧16V
OFF≦5V
DC power supply
DC + – COM I0 I1 I2 I3 I4 I5 NC I6 I7 I8 I9 Ia Ib

Note: Always connect analog input devices to the negative (–) COM terminal.

• For connections to positive (+) common

24 VDC, 6.5 W
ON≧16V
OFF≦5V
Input devices
DC + – COM I0 I1 I2 I3 I4 I5 NC I6 I7 I8 I9 Ia Ib
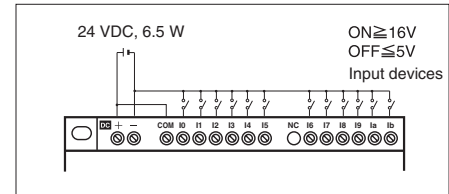
Note 1. Ia/Ib cannot be used as analog input terminals with a positive (+) common terminal connection.
2. Provide power to the COM and power supply terminals at the same time.

● Expansion I/O Units

• Expansion I/O Units (DC input type)

24 VDC, 6.5 W
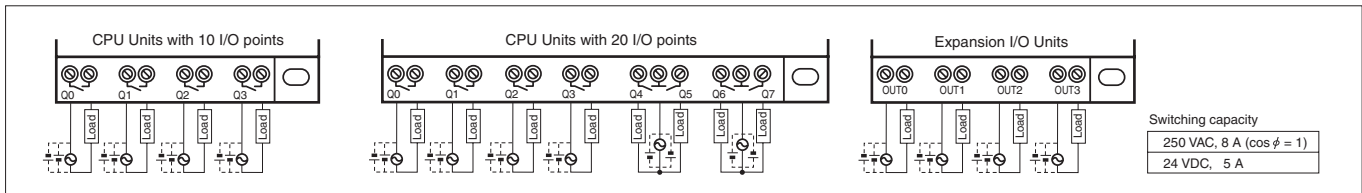ON≧16V
OFF≦5V
Input devices
DC COM IN0 IN1 IN2 IN3
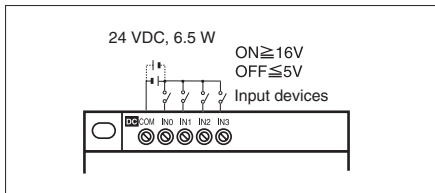
Note: Expansion I/O Units can be connected to either the positive (+) or negative (–) common terminal.
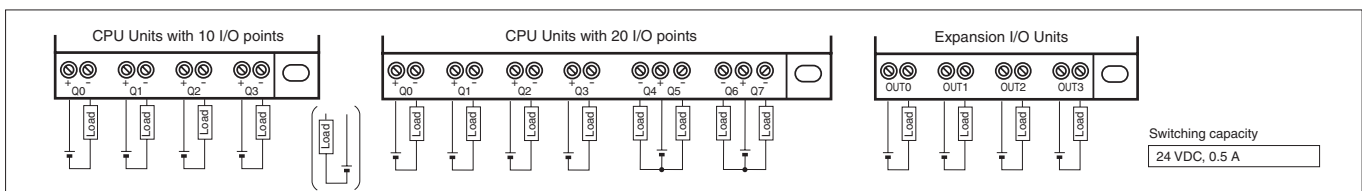
■ Output Circuit Wiring

● Units with Relay Outputs

All four relay output circuits in both CPU Units with 10 I/O points and Expansion I/O Units have independent contacts. CPU Units with 20 I/O points have 4 independent contacts (Q0 to Q3) and the remaining four (Q4 to Q7) have 2 points/common. There are no restrictions for polarity.

CPU Units with 10 I/O points
Q0 Q1 Q2 Q3
Load

CPU Units with 20 I/O points
Q0 Q1 Q2 Q3 Q4 Q5 Q6 Q7
Load

Expansion I/O Units
OUT0 OUT1 OUT2 OUT3
Load

Switching capacity

| 250 VAC, 8 A ($\cos \phi = 1$) |
| 24 VDC, 5 A |

● Transistor Output Type

All four transistor output circuits in both CPU Units with 10 I/O points and Expansion I/O Units have independent contacts. CPU Units with 20 I/O points have 4 independent contacts (Q0 to Q3) and the remaining four (Q4 to Q7) have 2 points/common. The terminals have polarity, but the power supply and load connections can be swapped.

CPU Units with 10 I/O points
Q0 Q1 Q2 Q3
Load

CPU Units with 20 I/O points
Q0 Q1 Q2 Q3 Q4 Q5 Q6 Q7
Load

Expansion I/O Units
OUT0 OUT1 OUT2 OUT3
Load

Switching capacity

| 24 VDC, 0.5 A |

■Input Specifications

●CPU Unit

• AC Inputs (Not Isolated)

Item	Specifications	Circuit drawing
Input voltage	100 to 240 VAC +10%, −15%, 50/60 Hz	
Input impedance	680 kΩ	
Input current	0.15 mA/100 VAC, 0.35 mA/240 VAC	
ON voltage	80 VAC min.	
OFF voltage	25 VAC max.	
ON response time	50 ms or 70 ms at 100 VAC (See note.)	
OFF response time	100 ms or 120 ms at 240 VAC (See note.)	

Note: Can be selected using the input filter settings.

• DC Inputs I0 to I3 (I0 to I9 for Units with 20 I/O points), V1 Units (Photocoupler Isolated)

Item	Specifications	Circuit drawing
Input voltage	24 VDC +10%, −15%	
Input impedance	5 kΩ	
Input current	5 mA (typ.)	
ON voltage	16.0 VDC min.	
OFF voltage	5.0 VDC max.	
ON response time	15 ms or 50 ms (See note.)	
OFF response time		

Note: Can be selected using the input filter settings.

• DC Inputs I14 and I15 (Ia and Ib for Units with 20 I/O points), V1 Units (Not Isolated)

	Item	Specifications	Circuit drawing
DC inputs	Input voltage	24 VDC +10%, −15%	
	Input impedance	5 kΩ	
	Input current	5 mA (typ.)	
	ON voltage	14.0 VDC min.	
	OFF voltage	4.5 VDC max.	
	ON response time	15 ms or 50 ms (See note.)	
	OFF response time		
Analog inputs	Input range	0 to 10 V	
	External input impedance	150 kΩ min.	
	Resolution	0.1 V (1/100 FS)	
	Overall accuracy (−25 to 55°C)	10% FS	
	AD conversion data	0 to 10.5 V (in increments of 0.1 V)	

Note: Can be selected using the input filter settings.

●Expansion I/O Unit

• AC Inputs (Photocoupler Isolated)

Item	Specifications	Circuit drawing
Input voltage	100 to 240 VAC +10%, −15%, 50/60 Hz	
Input impedance	83 kΩ	
Input current	1.2 mA/100 VAC, 2.9 mA/240 VAC	
ON voltage	80 VAC min.	
OFF voltage	25 VAC max.	
ON response time	50 ms or 70 ms at 100 VAC (See note.)	
OFF response time	100 ms or 120 ms at 240 VAC (See note.)	

Note: Can be selected using the input filter settings.

• DC Inputs (Photocoupler Isolated)

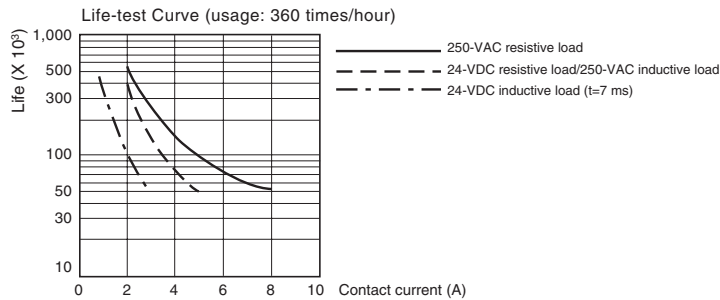| Item	Specifications	Circuit drawing
Input voltage	24 VDC +10%, −15%	
Input impedance	4.7 kΩ	
Input current	5 mA (typ.)	
ON voltage	16.0 VDC min.	
OFF voltage	5.0 VDC max.	
ON response time	15 ms or 50 ms (See note.)	
OFF response time		

Note: Can be selected using the input filter settings.

■ Output Specifications (CPU Unit/Expansion I/O Unit)

• Relay Output Type

Item		Specifications	Circuit drawing
Maximum switching capacity		250 VAC/8 A (Resistive load: $\cos\phi = 1$) 24 VDC/5 A (Resistive load)	
Minimum switching capacity		5 VDC/10 mA (Resistive load)	
Relay life	Electrical	Resistive load: 50,000 times ($\cos\phi = 1$) Inductive load: 50,000 times ($\cos\phi = 0.4$)	
	Mechanical	10 million times	
ON response time		15 ms max.	
OFF response time		5 ms max.	

The life, under the worst conditions, of the output contacts used in ZEN relay outputs is given in the above table. Guidelines for the normal life of the relays are shown in the diagram on the right.

Life-test Curve (usage: 360 times/hour)

— 250-VAC resistive load
- - - 24-VDC resistive load/250-VAC inductive load
-·-·- 24-VDC inductive load (t=7 ms)

• Transistor Output Type

Item	Specifications	Circuit drawing
Maximum switching capacity	24 VDC +10%, −15%, 500 mA	
Leakage current	0.1 mA max.	
Residual voltage	1.5 V max.	
ON response time	1 ms max.	
OFF response time	1 ms max.	

Each circuit is composed of an independent common circuit.

■ General Specifications

| Item	Specification	
	ZEN-□0C□AR-A-V1	ZEN-□0C□D□-D-V1
Power supply voltage	100 to 240 VAC	24 VDC
Rated power supply voltage	85 to 264 VAC	20.4 to 26.4 VDC
Power consumption	30 VA max. (With 3 Expansion Units connected)	6.5 W max. (With 3 Expansion Units connected)
Inrush current	40 A max.	10 A max.
Insulation resistance	Between power supply AC external and input terminals, and relay output terminals: 20 MΩ min. (at 500 VDC)	
Dielectric strength	Between power supply AC external and input terminals, and relay output terminals: 2,300 VAC, 50/60 Hz for 1 minute with leakage current of 1 mA max.	
Noise immunity	Conforms to IEC61000-4-4, 2 kV (power supply line)	
Vibration resistance	Conforms to JIS C0040, 10 to 57 Hz, amplitude 0.075 mm, 57 to 1,500 Hz, acceleration: 9.8 m/s² 80 minutes in X, Y, and Z directions (sweep time: 8 min (No. sweeps: 10 = 80 min.))	
Shock resistance	Conforms to JIS C0041. 147 m/s², 3 times in X, Y, and Z directions.	
Ambient temperature	LCD-type CPU Unit (operation panel and calendar/clock function): 0 to 55°C LED-type CPU Unit (no operation panel or calendar/clock function): −25 to 55°C	
Ambient humidity	10% to 90% (with no condensation)	
Ambient conditions	No corrosive gases	
Ambient storage temperature	LCD-type CPU Unit (operation panel and calendar/clock function): −20 to 75°C LED-type CPU Unit (no operation panel or calendar/clock function): −40 to 75°C	

■ Performance Specifications

| Item	Specification
Control method	Stored program control
I/O control method	Cyclic scan
Programming language	Ladder diagram
Program capacity	96 lines (3 input conditions and 1 output per line)
Max. No. of control I/O points	44 points CPU Unit: 12 inputs and 8 outputs Expansion I/O Units: 4 inputs and 4 outputs each, up to 3 Units.
LCD display	12 characters x 4 lines, with backlight (LCD-type CPU Unit only)
Operation keys	8 (4 cursor keys and 4 operation keys) (LCD-type CPU Unit only)
Memory backup	●Internal EEPROM (or optional Memory Cassette) • User programs • Parameter settings ●Internal RAM, super-capacitor hold (or optional Battery Unit) • Holding bits • Holding timer and counter values ●Super capacitor hold (or optional Battery Unit) • Calendar and clock
Super-capacitor holding time	2 days min. (25°C)
Battery life (ZEN-BAT01)	10 years min. (25°C)
Time function (RTC)	ZEN-□0C1□□-□ only, accuracy: 1 to 2 min/month (at 25°C)
Terminal block	Solid-line terminal block (Use solid lines or fine wiring terminals.)
Power supply holding time	ZEN-□0C□AR-A: 10 ms min. ZEN-□0C□D□-D: 2 ms min.
Weight	300 g max.

■ Dimensions (Unit: mm)

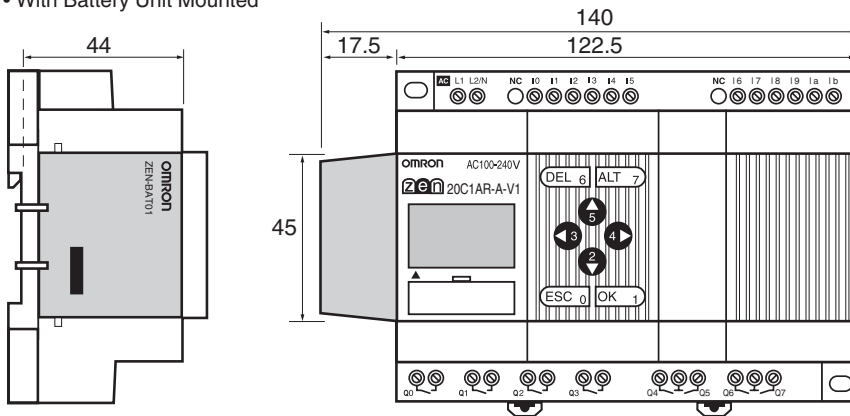• CPU Units with 10 I/O Points (LCD/LED Types)

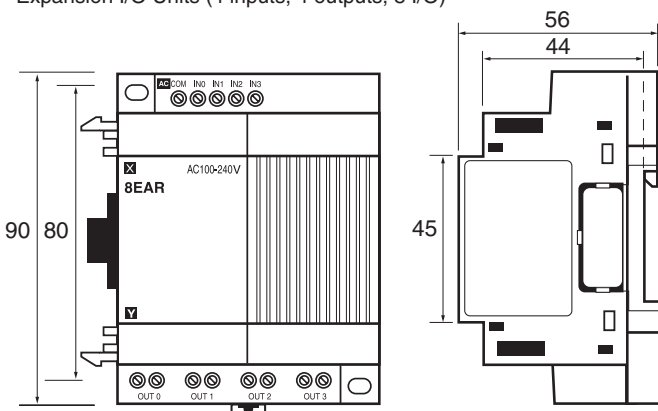• With Battery Unit Mounted
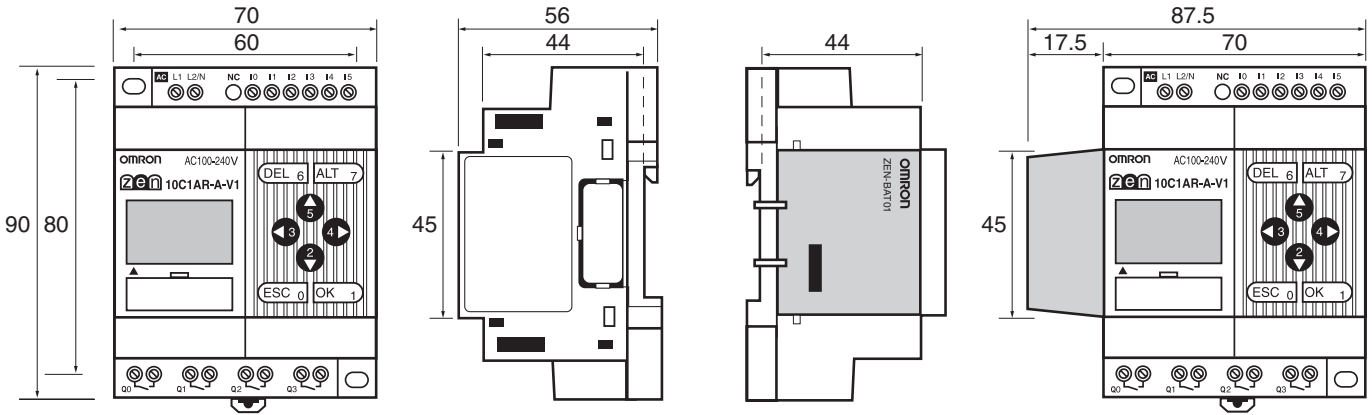
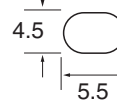• CPU Units with 20 I/O Points (LCD/LED Types)
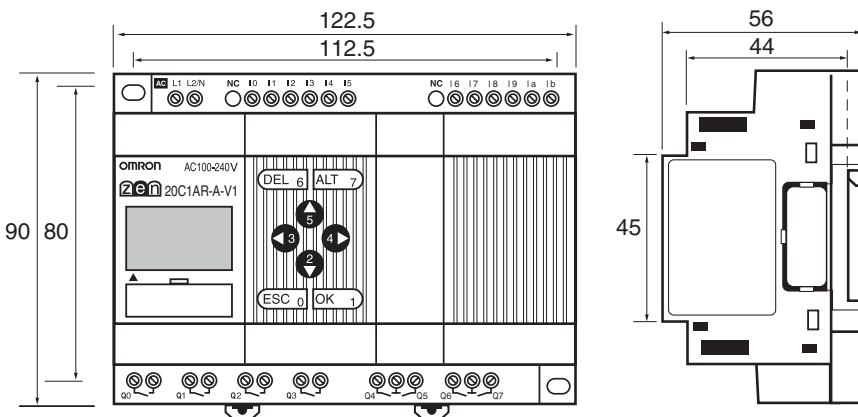
• With Battery Unit Mounted

• Expansion I/O Units (4 inputs, 4 outputs, 8 I/O)

• Unit Mounting Hole (Same for all Units)

Precautions when Selecting ZEN Programmable Relays

■ Differences between V1 and Pre-V1 CPU Units

● Data Area Comparisons

CPU Unit	V1 CPU Units		Pre-V1 CPU Units
	ZEN-10C□□□-□-V1	ZEN-20C□□□-□-V1	ZEN-10C□□□-□
CPU Unit input bits	I0 to I5 (6 points)	I0 to Ib (12 points)	I0 to 5b (6 points)
CPU Unit output bits	Q0 to Q3 (4 points)	Q0 to Q7 (8 points)	Q0 to Q3 (4 points)
Timers	T0 to Tf (16 points)		T0 to T7 (8 points)
Holding timers	#0 to #7 (8 points)		#0 to #3 (4 points)
Counters	C0 to Cf (16 points)		C0 to C7 (8 points)
Weekly timers	@0 to @f (16 points)		@0 to @7 (8 points)
Calendar timers	*0 to *f (16 points)		*0 to *f (8 points)
Display bits	D0 to Df (16 points)		D0 to D7 (8 points)
Work bits	M0 to Mf (16 points)		
Holding bits	H0 to Hf (16 points)		
Expansion I/O Unit input bits	X0 to Xb (12 points)		
Expansion I/O Unit output bits	Y0 to Yb (12 points)		
Analog comparator bits	A0 to A3 (4 points)		
Comparator bits	P0 to Pf (16 points)		

● Password Function (LCD-type CPU Units Only)

In addition to the password-protected items in existing models, password protection is also provided for the Program All Clear operation in the V1 CPU Units.

Items Protected by Password (0000 to 9999)

V1 Units
- Editing ladder program
- Program all clear
- Ladder monitoring
- Changing/clearing password
- Changing backlight OFF time
- Setting input filter
- Setting node number

Pre-V1 Units
- Editing ladder program
- Ladder monitoring
- Changing/clearing password
- Changing backlight OFF time
- Setting input filter
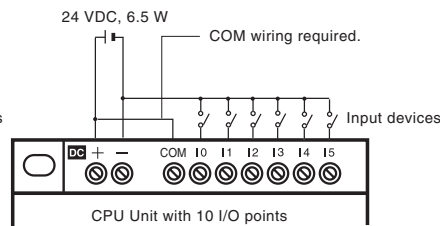- Setting node number

● Input Wiring (DC-type CPU Units Only)

V1 CPU Units

With V1 CPU Units, you can wire to either the negative (−) common or positive (+) common terminal.
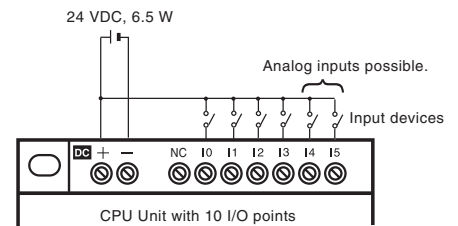
• Negative (−) COM Wiring

CPU Unit with 10 I/O points

• Positive (+) COM Wiring

CPU Unit with 10 I/O points
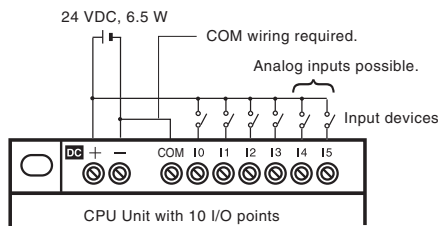
Note: I4 and I5 cannot be used as analog input terminals.

Pre-V1 CPU Units

With Pre-V1 CPU Units, the input circuit common terminal is connected internally to the negative (−) side of the power supply circuit.


CPU Unit with 10 I/O points

■ Support Software and CPU Unit Combinations

CPU Unit	Support Software Version	ZEN-SOFT01 Ver. 1.00	ZEN-SOFT01-V2 Ver. 2.00	ZEN-SOFT01-V3 Ver. 3.00
Pre-V1 Units		Can be used.	Can be used.	Can be used.
V1 Units	10 I/O points	Can be used, with restrictions (See note.)	Can be used, with restrictions (See note.)	Can be used.
	20 I/O points	Cannot be used.	Cannot be used.	Can be used.

Note: Only half of each of the timer, holding timer, counter, weekly timer, calendar timer, and display function areas can be used (i.e., the Pre-V1 bit range).

■ Difference between ZEN Programmable Relays and PLC Ladder Program Execution
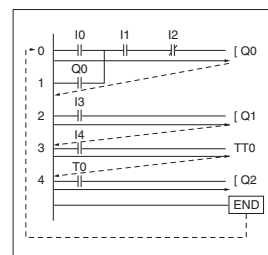
● ZEN Programmable Relays
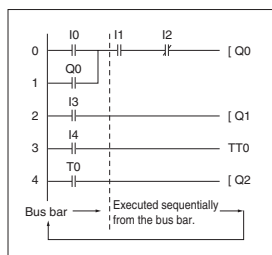
ZEN executes the entire ladder program (up to 96 lines) from the first to last line at one time. Each row is executed in order from left to right starting from the left bus bar.

The ON/OFF status produced by an output contact will not be used as the input contact status in the same cycle, but it can be used in the next cycle.
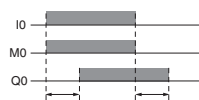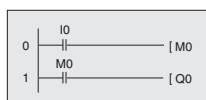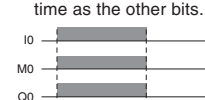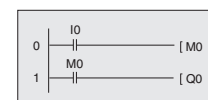

● OMRON SYSMAC PLCs

PLCs execute ladder programs one rung (circuit) at a time, starting with the top rung and executing it in order from the left. When the END instruction is reached, the program is executed again from the first rung.

When the following instructions are executed, Q0 turns ON/OFF at the same time as the other bits.

■Models

Model	Unit name	No. of I/O points	Power supply	Inputs		Outputs		LCD	Calendar/ clock
ZEN-10C1AR-A-V1	CPU Unit	10	AC	6	AC	4	Relay	Yes	Yes
ZEN-10C2AR-A-V1		10	AC	6	AC	4	Relay	No	No
ZEN-10C1DR-D-V1		10	DC	6	DC	4	Relay	Yes	Yes
ZEN-10C2DR-D-V1		10	DC	6	DC	4	Relay	No	No
ZEN-10C1DT-D-V1		10	DC	6	DC	4	Transistor	Yes	Yes
ZEN-10C2DT-D-V1		10	DC	6	DC	4	Transistor	No	No
ZEN-20C1AR-A-V1		20	AC	12	AC	8	Relay	Yes	Yes
ZEN-20C2AR-A-V1		20	AC	12	AC	8	Relay	No	No
ZEN-20C1DR-D-V1		20	DC	12	DC	8	Relay	Yes	Yes
ZEN-20C2DR-D-V1		20	DC	12	DC	8	Relay	No	No
ZEN-20C1DT-D-V1		20	DC	12	DC	8	Transistor	Yes	Yes
ZEN-20C2DT-D-V1		20	DC	12	DC	8	Transistor	No	No
ZEN-8EAR	Expansion I/O Unit	8	—	4	AC	4	Relay	—	—
ZEN-8EDR		8	—	4	DC	4	Relay	—	—
ZEN-8EDT		8	—	4	DC	4	Transistor	—	—
ZEN-4EA		4	—	4	AC	—	—	—	—
ZEN-4ED		4	—	4	DC	—	—	—	—
ZEN-4ER		4	—	—	—	4	Relay	—	—
ZEN-ME01	Memory Cassette								
ZEN-CIF01	Connecting Cable								
ZEN-BAT01	Battery Unit								
ZEN-SOFT01-V3	ZEN Support Software (CD-ROM)								
ZEN-KIT01-EV3	Set containing CPU Unit (ZEN-10C1AR-A-V1), Support Software Connecting Cable, ZEN Support Software, and manual.								
ZEN-KIT02-EV3	Set containing CPU Unit (ZEN-10C1DR-D-V1), Support Software Connecting Cable, ZEN Support Software, and manual.								

Note: Do not use this document to operate the Unit.

Authorized Distributor: