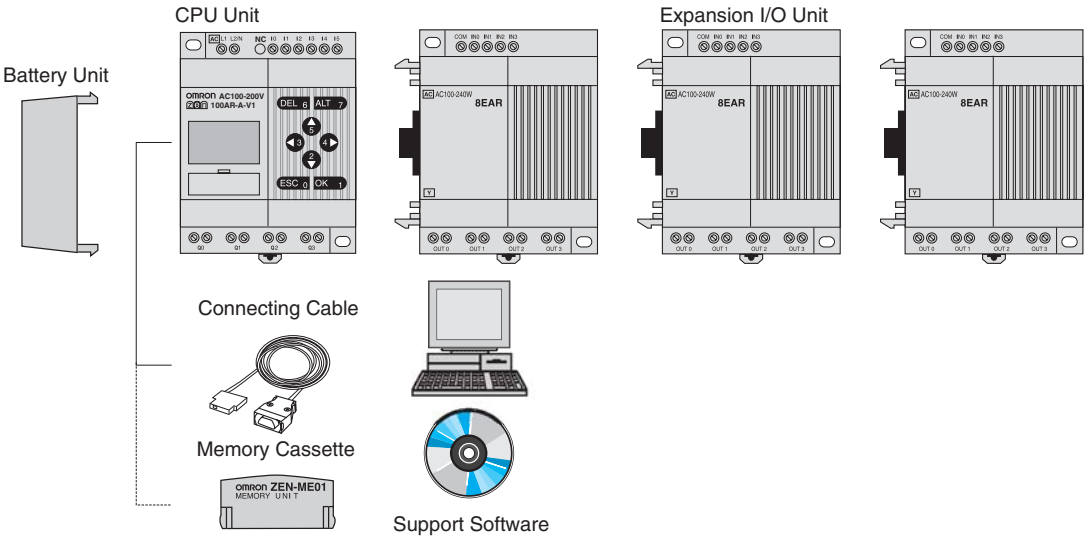
Nano Programmable Controller
ZEN

The ZEN has the features and functions of both a programmable controller and smart relay to allow simple yet powerful control. Apply the ZEN to small-scale control applications where simple functionality and low cost are critical. Control programs can be created using a 32-bit Windows-based ZEN support software or by using the operation buttons on the front panel (LCD models only). The ZEN is also flexible with many CPU types, multiple expansion options, and a wide selection of accessory options.

- 10-point or 20-point CPUs available
- Flexible expansion with up to 44 I/O points (24 Inputs and 20 Outputs)
- NPN/PNP inputs
- Analog inputs
- 100-240 VAC or 24 VDC supply voltages
- Easy programming with use of ZEN support software
- Extremely compact, with both DIN rail and bolt-on that allows installation in most locations
- Real Time Clock (RTC) and Daylight Savings Time (DST)
- Display user-set character strings, times, timer/counter preset values, or analog-converted values with user defined messages
- Memory Back-up using EEPROM or Battery
- Password protection

Basic Configuration

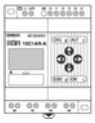
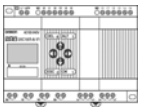
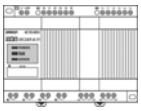


Up to 3 Expansion I/O modules can be connected, regardless of the I/O specifications or module type.

Ordering Information

■ CPU

Stock Note: Shaded models are normally stocked.

Appearance	Power Supply	Inputs		Outputs		Calendar and clock function	Model
LCD type With LCD and operation buttons 	100 to 240 VAC, 50/60 Hz	100 to 240 VAC	6 inputs	Relays	4 outputs	Yes	**ZEN-10C1AR-A-V1**
	(Not isolated)						
	24 VDC	24 VDC					**ZEN-10C1DR-D-V1**
	(Not isolated)						
	24 VDC	24 VDC		Transistors			**ZEN-10C1DT-D-V1**
	(Not isolated)						
LED type No LCD nor operation buttons 	100 to 240 VAC, 50/60 Hz	100 to 240 VAC		Relays		No	**ZEN-10C2AR-A-V1**
	(Not isolated)						
	24 VDC	24 VDC					**ZEN-10C2DR-D-V1**
	(Not isolated)						
	24 VDC	24 VDC		Transistors			**ZEN-10C2DT-D-V1**
	(Not isolated)						
LCD type With LCD and operation buttons 	100 to 240 VAC, 50/60 Hz	100 to 240 VAC	12 inputs	Relays	8 outputs	Yes	**ZEN-20C1AR-A-V1**
	(Not isolated)						
	24 VDC	24 VDC					**ZEN-20C1DR-D-V1**
	(Not isolated)						
	24 VDC	24 VDC		Transistors			**ZEN-20C1DT-D-V1**
	(Not isolated)						
LED type No LCD nor operation buttons 	100 to 240 VAC, 50/60 Hz	100 to 240 VAC		Relays		No	**ZEN-20C2AR-A-V1**
	(Not isolated)						
	24 VDC	24 VDC					**ZEN-20C2DR-D-V1**
	(Not isolated)						
	24 VDC	24 VDC		Transistors			**ZEN-20C2DT-D-V1**
	(Not isolated)						

■ Power Supply

Stock Note: Shaded models are normally stocked.

Appearance	Power Ratings	Input Voltage	Output Voltage	Output Current	Model
	30W	100 to 240 VAC	24 VDC	1.3 A	**ZEN-PA03024**

■ Expansion I/O

Stock Note: Shaded models are normally stocked.

No. of I/O points/Appearance	Inputs		Outputs		Model
8 I/O 	100 to 240 VAC (isolated)	4 inputs	Relays	4 outputs	**ZEN-8EAR**
	24 VDC (isolated)				**ZEN-8EDR**
			Transistors		**ZEN-8EDT**
4 inputs 	100 to 240 VAC (isolated)		—	—	**ZEN-4EA**
	24 VDC (isolated)				**ZEN-4ED**
4 outputs 	—	—	Relays	4 outputs	**ZEN-4ER**

■ Optional Accessories

Stock Note: Shaded models are normally stocked.

Name and appearance	Functions	Model
Memory Cassette 	EEPROM Used to save and copy programs	**ZEN-ME01**
Battery Unit 	Uses a battery to back up programs and data. Mount a Battery Unit if the loss of calendar, clock, holding bit, holding timer, and counter present values will cause problems in systems with long power interruptions. (Battery life: 10 years minimum)	**ZEN-BAT01**
Personal Computer Connecting Cable 	Connects the computer and ZEN when the ZEN Support Software is used. (Cable length: 2 m)	**ZEN-CIF01**

■ Support Software

Stock Note: Shaded models are normally stocked.

Name and appearance	Functions	Model
ZEN Support Software 	Runs on Windows 95, 98, ME, 2000, XP, or NT4.0 Service Pack 3 (CD-ROM) Used for offline programming, all parameter settings, program transfers, and printing.	**ZEN-SOFT01-V_**

■ Manuals

Product	Description	Model
Operation Manual	ZEN Programmable Relay Operation Manual	**Z183**
Operation Manual	ZEN Support Software Operation Manual	**Z184**

Specifications

■ CPU and Expansion Modules

Item		Specifications	
Model numbers	LCD type	ZEN-10C1AR-A-V1 ZEN-10C2AR-A-V1	ZEN-10C1DR-D-V1 ZEN-20C1DR-D-V1 ZEN-10C1DT-D-V1 ZEN-20C1DT-D-V1
	LED type	ZEN-10C2AR-A-V1 ZEN-20C2AR-A-V1	ZEN-10C2DR-D-V1 ZEN-20C2DR-D-V1 ZEN-10C2DT-D-V1 ZEN-20C2DT-D-V1
Power supply voltage		100 to 240 VAC, 50/60 Hz	24 VDC
Allowable power supply voltage		85 to 264 VAC, 47/63 Hz	20.4 to 26.4 VDC
Power consumption (CPU Unit + 3 Expansion I/O Units)		30 VA max.	6.5 W max.
Inrush current		40 A max.	20 A max.
Insulation resistance		20 MΩ (at 500 VDC) min. between power supply AC external terminals and all input terminals, and relay or transistor outputs.	
Dielectric strength		2300 VAC, 50/60 Hz for 1 min (leakage current 1 mA max.) between power supply AC external terminals and all input terminals, and relay or transistor outputs.	
Noise immunity		Conforms to IEC61000-4-4,2 kV (power supply line)	
Vibration resistance		Conforms to JISC0040, 10 to 57 Hz, amplitude 0.075 mm 57 to 150 Hz, acceleration 9.8 m/s^2 80 min in X, Y, and Z directions (Sweep time 8 min x 10 sweeps = 80 mins total.)	
Shock resistance		Conforms to JIS C004, 147 m/s^2 3 times in X, Y, and Z directions	
Ambient temperature		LCD type (with LCD and operation buttons): 0° to 55°C LED type (no LCD/operation buttons): -25° to 55°C	
Ambient humidity		10% to 90% (with no condensation)	
Environmental conditions		No corrosive gases	
Storage temperature		LED type (with LCD and operation buttons): -20° to 75°C LED type (no LCD/operation buttons): -40° to 75°C	
Terminal block		Solid-wire terminal block	
Power supply holding time		10 ms min.	2 ms min.
Weight		300 g max.	
Enclosure rating		IP20 (Mounted inside a control panel)	

■ CPU Characteristics

Item	Specifications	
Control	Stored program	
I/O control	Cyclic scan	
Programming language	Ladder	
Program capacity	96 lines (up to 3 inputs and 1 output per line)	
Maximum control I/O points	CPUs with 10 I/O points	34 points (with 3 Expansion I/O modules with 8 I/O points each)
	CPUs with 20 I/O points	44 points (with 3 Expansion I/O modules with 8 I/O points each)
Memory areas	CPUs input bits (I)	CPUs with 10 I/O Points: I0 to I5, 6 bits
		CPUs with 20 I/O Points: I0 to Ib, 12 bits
	CPUs outputs bits (Q)	CPUs with 10 I/O Points: Q0 to Q3, 4 bits
		CPUs with 20 I/O Points: Q0 to Q7, 8 bits
	Expansion I/O module input bits (X)	X0 to Xb, 12 bits (See note.)
	Expansion I/O module output bits (Y)	Y0 to Yb, 12 bits (See note.)
	Work bits (M)	M0 to Mf, 16 bits
	Holding bits (H)	H0 to Hf, 16 bits
	Button switches (B)	B0 to B7, 8 bits (LCD-type CPU Unit only)
	Timers (T)	T0 to Tf, 16 timers
	Holding timers (#)	#0 to #7, 8 timers
	Weekly timers (@)	@0 to @f, 16 timers (CPU Units with built-in calendar and clock only)
	Calendar timers (*)	*0 to *f, 16 timers (CPU Units with built-in calendar and clock only)
	Counters (C)	C0 to Cf, 16 counters
	Display bits (D)	D0 to Df, 16 bits (LCD-type CPU Unit only)
	Analog comparator (A)	A0 to A3, 4 comparators (CPUs with DC power supply only)
	Comparator (P)	P0 to Pf, 16 comparators
LCD	12 columns x 4 lines, with backlight (LCD-type CPU only)	
Operation buttons	8 (4 Cursor Buttons, 4 operation buttons) (LCD-type CPU only)	
User program backup	Internal EEPROM, Memory Cassette (optional)	
Power interruption hold	Internal RAM: Super capacitor (or optional battery) for holding bits and timer/counter present values. Calendar and clock: Super capacitor (for optional battery) for date, day, and time. Holding time for super capacitor: 2 days max. (25°C)	
Calendar and clock function	Available for ZEN-❑❑C1❑❑-❑(-V1) only. Precision: ±2 min/month (25°C)	

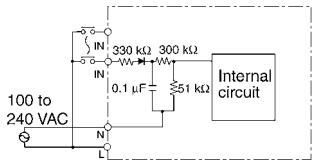
Note: 1. The sizes of some memory areas are smaller for pre-V1 CPUs.

2. Available when an Expansion I/O module is connected.

■ I/O Specifications

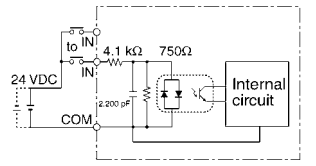
CPU Input

AC Inputs (Not isolated) (V1 and Pre-V1 CPUs)

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.)	

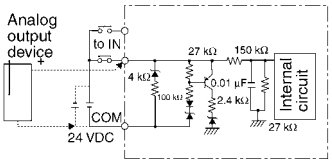
Note: Can be selected using the input filter settings.

DC Inputs I0 to I3 (I0 to I9 for 20 I/O Modules)

Item	Specifications	Circuit drawing
Input voltage	24 VDC + 10%, -15%	
Input impedance	5 kΩ	
Input current	5 mA Typical	
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.

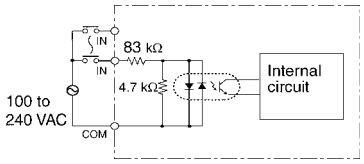
DC Inputs I4 and I5 (Ia and Ib for 20 I/O Modules)

Item		Specifications	Circuit drawing
DC inputs	Input voltage	24 VDC +10%, -15%	
	Input impedance	5 kΩ	
	Input current	5 mA, Typical	
	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°C to 55°C)	10% FS	
	AD conversion data	0 to 10.5 V in 0.1 V increments	

Note: Can be selected using the input filter settings.

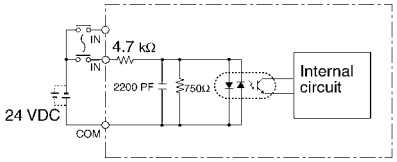
Expansion I/O Specifications

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.)	

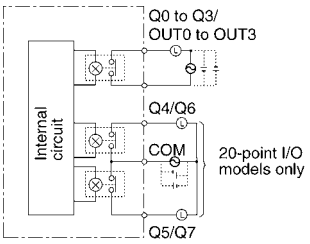
Note: Can be selected using the input filter settings.

DC Inputs (Photocoupler Isolated)

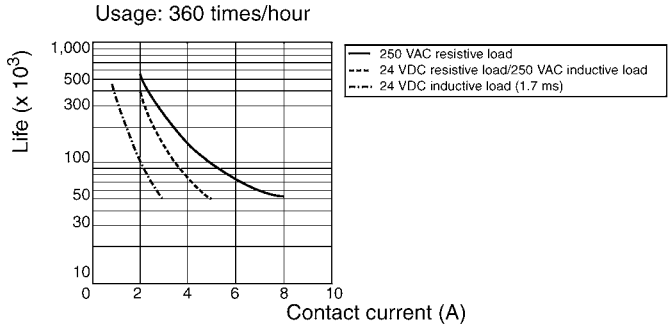
Item	Specifications	Circuit drawing
Input voltage	24 VDC + 10%, -15%	
Input impedance	4.7 kΩ	
Input current	5 mA, Typical	
ON voltage	16.0 VDC min.	
OFF voltage	5.0 VDC max.	
ON response time	15 ms or 50 ms (See note.)	
OFF response time		

Note: Can be selected using the input filter settings.

Relay Output Type (CPU and Expansion I/O Modules)

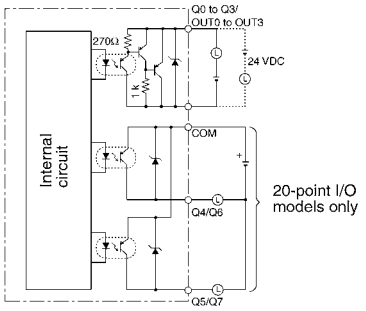
Item		Specifications	Circuit drawing
Max. switching capacity		250 VAC/8 A (cosϕ = 1) 24 VDC/5 A	Each circuit is made up of an independent common circuit.
Min. switching capacity		5 VDC, 10 mA	
Relay life	Electrical	Resistive load: 50,000 times Inductive load: 50,000 times (cosϕ =1)	
	Mechanical	10 million times	
ON response time		15 ms max.	
OFF response time		5 ms max.	

The life under the worse 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 following diagram.



Transistor Output Type (CPU Expansion I/O Modules)

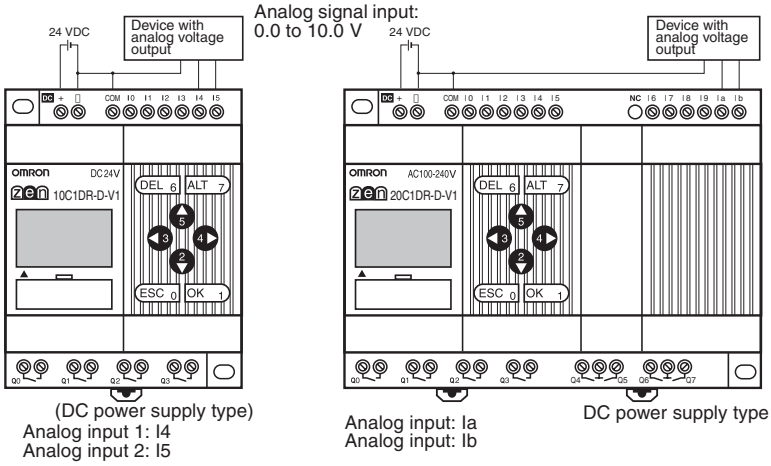
Item	Specifications	Circuit drawing
Max. switching capacity	20.4 to 26.4 VDC 500 mA	Each circuit is made up of an independent common circuit.
Leakage current	0.1 mA max.	
Residual voltage	1.5 V max.	
ON response time	1 ms max.	
OFF response time	1 ms max.	



Analog Inputs (Analog Comparators)

Two analog voltage inputs between 0 and 10 V can be incorporated into the CPUs with a DC power supply. I4 and I5 for CPUs with 10 I/O points and Ia and Ib for CPUs with 20 I/O points can be used as analog voltage inputs.

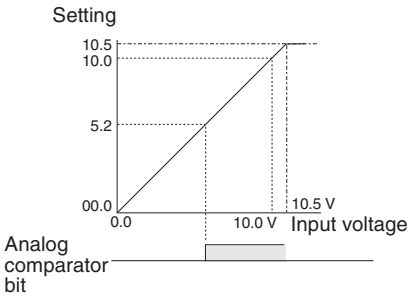
The analog input signal is converted to BCD (00.0 to 10.0). The results can be used with one of the comparators A0 to A3, and the 4 comparison outputs can be used as input conditions in the program.



Note: Must connect the negative side to COM for V1 CPUs. The analog input circuit may be destroyed if the positive side is connected to COM.

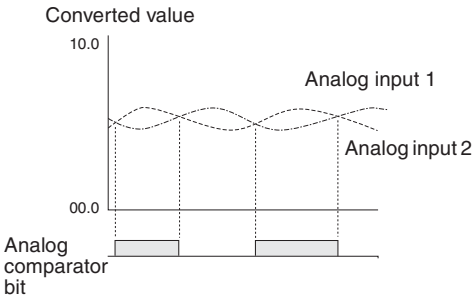
Operation

- Example 1
  (When comparison shows analog input 1 ≥ 5.2 V)



The analog comparator bit turns ON when the analog input voltage reaches is 5.2 V or higher.

- Example 2
  (When comparison shows analog input 1 ≤ analog input 2)



The analog comparator bit turns ON when the analog input 2 voltage is higher than the analog input 1 voltage.

Note: Cannot make negative signal inputs to analog inputs. If negative signals are made, the internal elements may be damaged.

Power Supply Unit

The ZEN-PA03024 offers a compact sized power supply unit to be used with the DC type ZEN CPU.

ZEN-PA03024 Power Supply Unit Specifications

Ratings/Characteristics

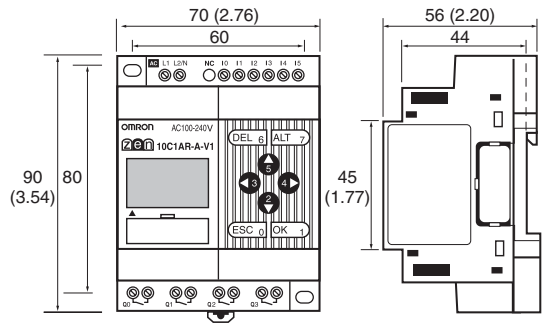
Efficiency (typical)			80% min.
Input	Voltage		100 to 240 VAC(85 to 264 VAC), 95 to 350 VDC (see note 1.)
	Frequency		50/60 Hz (47 to 450 Hz)
	Current	100 V input	0.8 A max.
		200 V input	0.45 A max.
	Power factor		—
	Limits for harmonic current emissions		—
	Leakage current	100 V input	0.4 mA max.
		200 V input	0.75 mA max.
	Inrush current	100 V input	25 A max.
	(see note 2.)	200 V input	50 A max.
Output	Voltage adjustment range (see note 3.)		-10 to 15% (with V. ADJ) of rated output voltage
	Ripple		2% (p-p) max. (-25 to -10 C: 4% max.)
	Input variation influence		0.5% max.
	Load variation influence (rated input voltage)		1.5% max.
	Temperature variation influence		0.05%/C max.
	Start up time (see note2.)		1,000 ms max. (100 VAC or 200 VAC, at rated output voltage)
	Hold time (see note 2.)		15 ms min., 20 ms (typical) (100 VAC or 200 VAC, at rated output voltage)
Additional functions	Over load protection (see note 2.)		105% to 135% of rated load current, inverted L drop, intermittent, automatic reset
	Parallel operation		Yes (2 units max. 10 C derating. For details, refer to the derating curve in Engineering Data. 110 to 350 VDC is available with DC input.
	Series operation		No
Others	Ambient temperature		Operating: Refer to the derating curve in Engineering Data. (with no icing or condensation) Storage: -25° to 65° C (with no icing or condensation)
	Ambient humidity		Operating: 10 to 90%
	Dielectric strength		2.0 kVAC for 1 min. (between all inputs and exposed non-current-carrying metal parts; detection current: 10 mA max.) 3.0 kVAC for 1 min. (between all inputs and all outputs; detection current: 20 mA max.) 1.0 kVAC for 1 min. (between all outputs and non-current-carrying metal parts; detection current: 10 mA max.)
	Insulation resistance		100 M ohm min. (between all outputs and all inputs/exposed non-current-carrying metal parts) at 500 VDC
	Vibration resistance		10 to 55 Hz, 0.375-mm single amplitude for 8 min. each in X, Y, and Z direction
	Shock resistance		300 m/s^2, 3 times each in +-X, +-Y, +-Z directions
	Output indicator		Yes (color: green)
	EMI	Conducted Emissions	Conforms to EN61000-6-3
		Radiated Emissions	Conforms to EN61000-6-3
	Approved standards		UL: UL508 (Listing, Class 2), 60950, 1604 cUL: CSA C22.2 No. 14 (Class 2), No. 60950, No. 213 EN60950(VDE0806), EN50178(VDE0160). Conforms to VDE0106/P100 (Finger protection)
	Weight		240g max.

Note: DC inputs not included in safety standard.

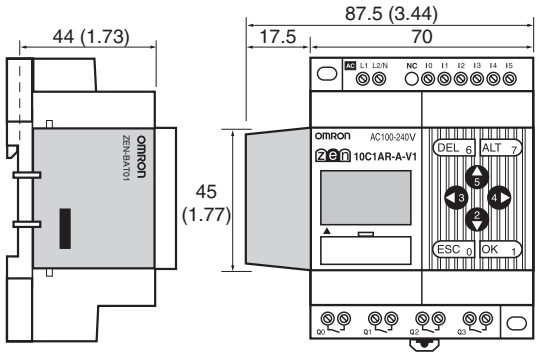
Dimensions

Unit: mm (inch)

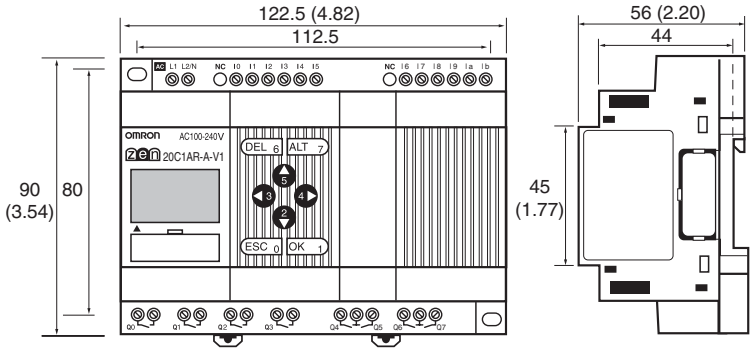
■ CPUs with 10 I/O Points (LCD/LED Types)



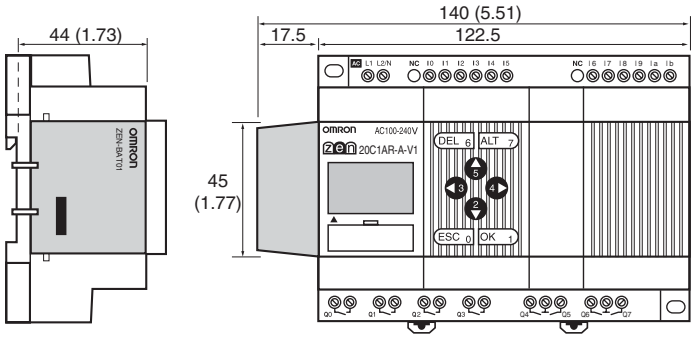
■ With Battery Unit Mounted



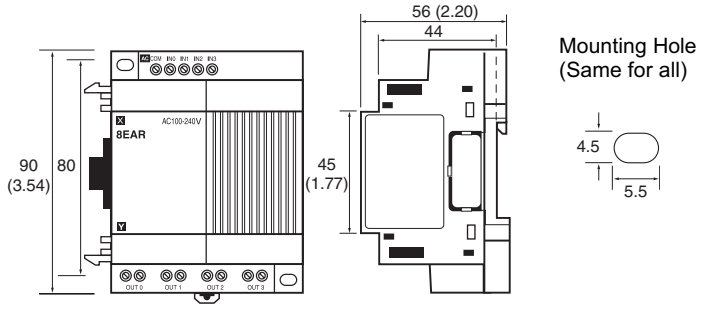
■ CPUs with 20 I/O Points (LCD/LED Types)



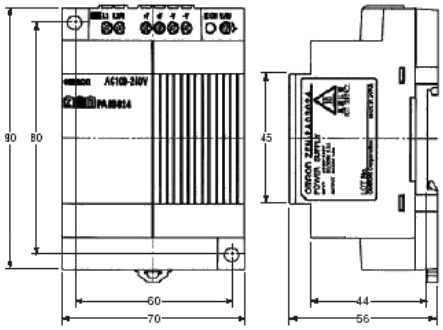
■ With Battery Unit Mounted



■ Expansion I/O Modules (4 inputs, 4 outputs, 8 I/O)



■ Power Supply Unit (ZEN-PA03024)



Features and Functions

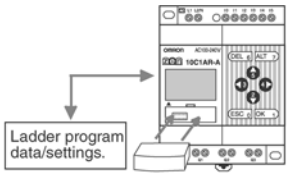
■ Memory Cassette

Simply download the program from a PC to the ZEN via a front panel port.

Use the compact memory cassette if you need to transfer the same program to multiple ZEN controllers. * It makes it the ideal transfer medium for:

- Repeating programs during machine manufacturing.
- Downloading recipe settings for fast product changeovers.
- Distributing standardized updates to customers to reflect new capabilities.

* Please look in the ZEN Operation Manual for the differences in the memory cassette functions between CPUs.



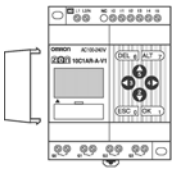
Memory Cassette

■ Battery Unit

Ladder programs and all settings are saved to the CPU's EEPROM; but the calendar, clock, holding timer bits and holding timer/counter preset values are held by a capacitor.

If the power supply is interrupted for an extended amount of time (2 days or more at 77° F), the capacitor held data will be reset.

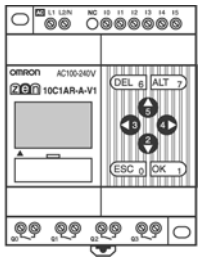
Use the battery unit with the ZEN CPUs to prevent any loss of data upon an extended power loss.



Battery Unit

■ LCD-Type CPU Features

- Simple button-operated programming.
- Highly visible, backlit LCD.
- Adjustable automatic cutout time for the backlight.
- Adjustable contrast for the LCD screen.
- Six-language display.
- Display function for user-set messages (4 lines x 12 characters), time, or timer, counter, or analog-converted value displays.
- Button switches allowing operation buttons to be used as input contacts.
- Built-in weekly and calendar timers to allow simple seasonal, daily, or time-based operation.



LCD-type CPU