KEYENCE

Cat No KV-KA-C

Compact Programmable Logic Controller with Built-in Access Window

Visual KV Series

An Industry First

Visual PLC SM

World's Smallest

CE

User-Friendly Design

Designed with the user in mind, the Visual KV is a high-speed compact unit. It features the industry's first built-in access window and includes an AC power supply model and operator interface panel.

Ultra Small Size

High Speed Scan Time of 140 □s

Complete Product Line

AC or DC Powered
Transistor or Relay Outputs
12 base units / 8 expansion units

Built-in Access Window

Up to 1 ft away for installation flexibility

Operator Interface

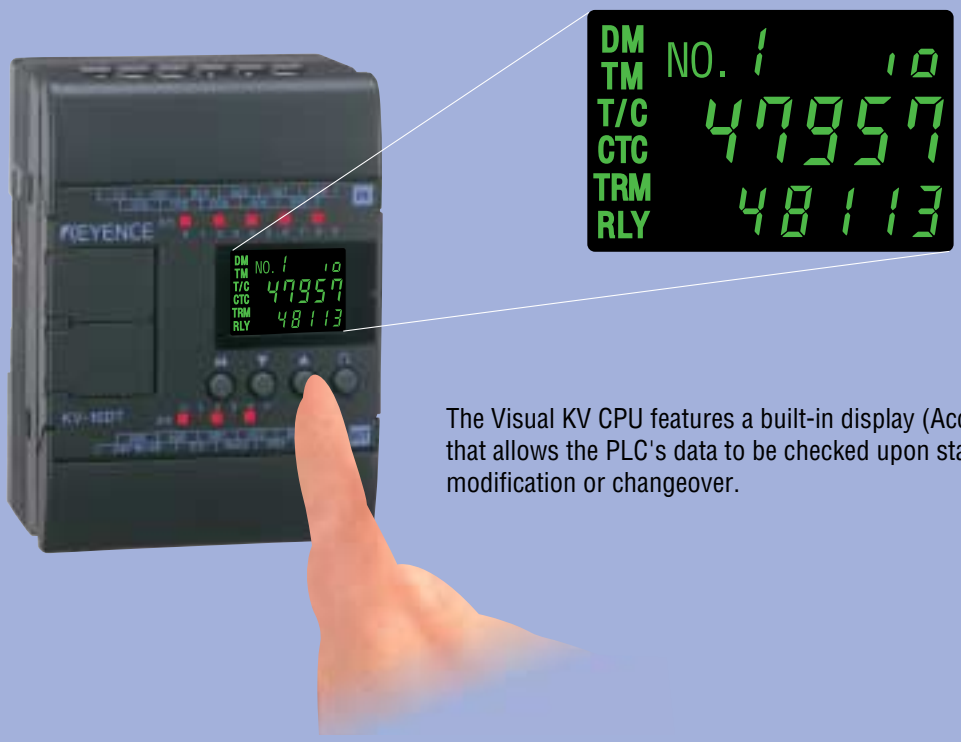
External Display

Expansion Units

16 to 152 I/O's

Built-in Access Window

No PC or Handheld Programmer Required to Monitor Operation or Make Minor Changes



The Visual KV CPU features a built-in display (Access Window) that allows the PLC's data to be checked upon start-up, and during modification or changeover.

Access Window Allows Information to be Conveniently Available

When checking or changing some device values the PLC does not need to be connected to either a PC or handheld programmer.

When making precise on-line adjustments to internal devices, such as a timer, while the PLC is operating.

When you need to stop the PLC and check the program without connecting to a PC or handheld programmer.

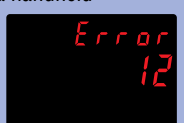
Other Functions

Key Lock Function

The Visual KV features a key lock function to prevent accidental changes to the settings.

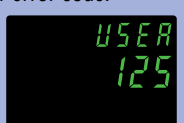
Error Message Function

Error codes are immediately displayed on the LCD. With a conventional PLC, the PLC had to be connected to a handheld programmer in order to determine the error code.



User Message Function

With a simple ladder program, a flashing LED display message (No.0 to 255) can appear, indicating a user error code.



User Friendly Operator Interface

Ladder Comment Display
Allows you to easily check, change or detect abnormalities.

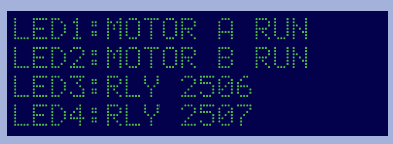
In addition to having the same functions as the Visual KV PLC's Access Window, the operator interface displays comments generated by a ladder program. This easy to use display features a variety of functions.

Displays operational instruction messages.

The Operator Interface Provides Features of a Full Scale Display

The on-screen feedback digital trimmer allows workers to make adjustments without stopping the production line.

At a glance, the status of registered customized switches F1 to F4 and lamps 1 to 4 can be confirmed.



Input and output status of the I/O terminals can be monitored.

Built-In Operator Convenience Functions

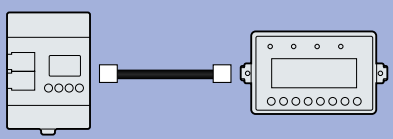
Beep function

The KV-D20 features a beep function to provide audio cues to workers.

Display customization

Workers can choose from various display options to create a customized, easy-to-see display.

A modular cable completes the connection.

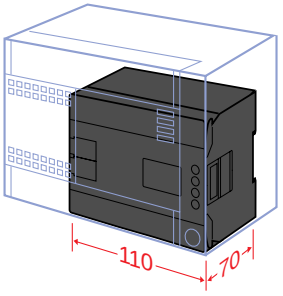


World's Smallest Design*

2/3rd the size of conventional AC type PLCs

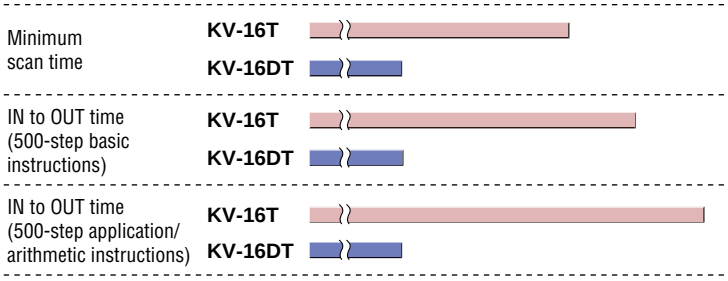
The new AC version 40 I/O KV is 2/3rd the size of conventional PLCs. The slender design not only saves mounting space, but allows the entire system including the distribution panel and the control box to be downsized.

(*For AC types that use screw-type terminal blocks)



World's Fastest in its Class

The fastest processing among products of this class. The minimum scan time is 140 μs and the minimum instruction execution time is 0.7 μs.



The processing time is **decreased by 50%** compared to that of our conventional product.

Industry First Design Patent pending

The PLC has a 2-color backlit LCD(5 digits x 3), that is used for display functions.

Typical Applications

Displays the current and preset values of the counter or timer.

Serves as a handheld programmer when changing the preset value.

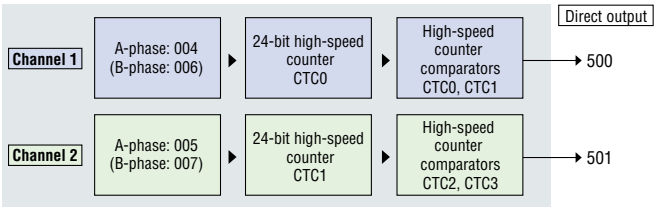
Displays the error code.

Practical Functions

2-Channel High Speed Counters

Incorporates a 30kHz, 2 phase, 24-bit counter and eliminates the need for an additional high-speed counter.

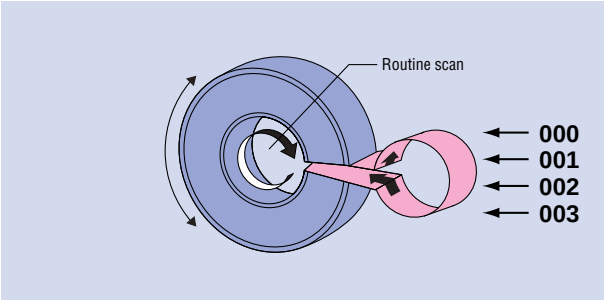
The Visual KV base unit incorporates 2-channel, 2 phase high-speed counters and high-speed counter comparators. This allows direct connection with a rotary encoder and counting input from the encoder. The Visual KV can be used for various applications, such as speed measurement and high speed interval counting; by utilizing the input capture functions, that automatically saves input values to the 4 interrupt inputs during high-speed counting.



4 High Speed Interrupt Inputs

Incorporates 4 high-speed interrupt inputs with a maximum speed of 10 μs.

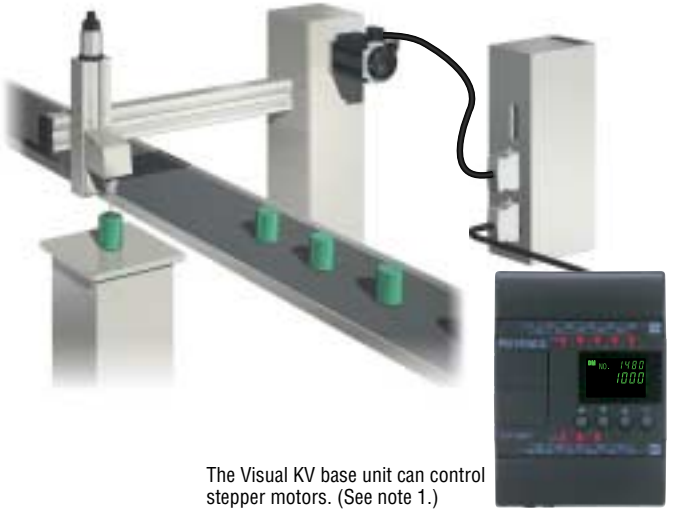
When an interrupt input occurs, the routine scanning is suspended and the interrupt inputs are immediately processed with a response time of only 10 μs.The Visual KV is optimal for fast sensor input on high-speed lines.



Simple Ramping Control Function

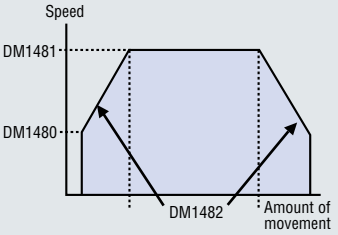
Incorporates a single-axis stepper motor control independent of the high-speed counter function that allows stepper motor control up to 50kHz.

The Visual KV incorporates a positioning control function similar to expensive units for application practicality and cost reduction.



The Visual KV base unit can control stepper motors. (See note 1.)

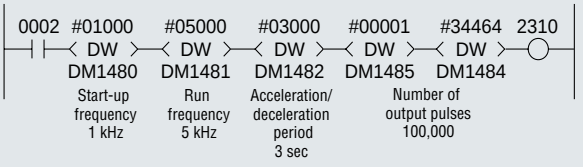
The simple positioning control stepper function can be activated by just inputting the setting values into the specific data memories.



Setting items for the positioning control function (x-axis)

Start-up frequency (Hz) : DM1480
Run frequency (Hz) : DM1481
Acceleration/deceleration period (ms) : DM1482
Number of output pulses
(high order): DM1485
(low order): DM1484
Operation start relay : 2310
Forced slowdown stop relay : 2308
Emergency stop relay : 2309

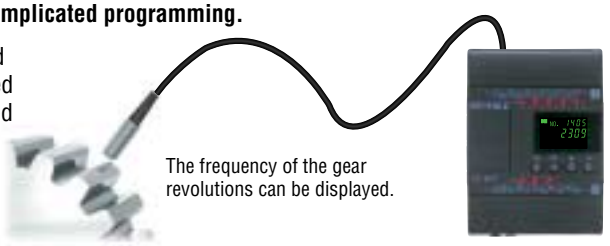
Only 1-line of ladder logic is needed to create the positioning control function.



Frequency Counter Function

Measures the rotational frequency of a gear or rotary encoder without complicated programming.

To achieve this measurement, simply input the frequency counting period into the specified data memory using a real number in "ms". The measured result is automatically input into the specified data memory, and displayed on the Access Window.



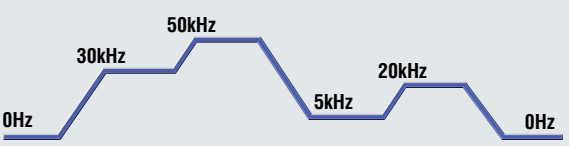
Specified Frequency Pulse Output Function

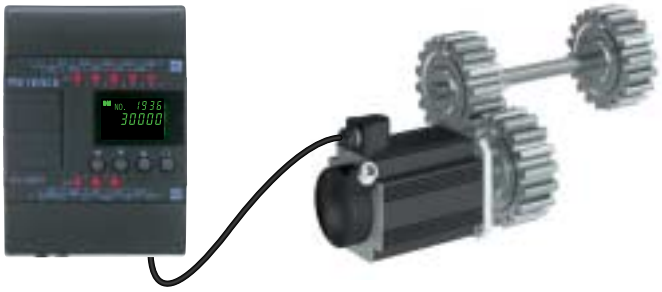
Easily controls motor speed.

Without complicated programming, pulses with a specified frequency (16 to 50000Hz) can be output. Just input the frequency (Hz) into the specified data memory using a real number. The pulses with the specified frequency are then output from the PLC. This function allows multi-step speed control, as shown to the right.

The preset speed of a motor can be manually changed by simply using the Access Window. This feature is ideal for systems that require frequent setting changes or fine adjustments.

Complicated multi-step ramp up-and-down control is possible.



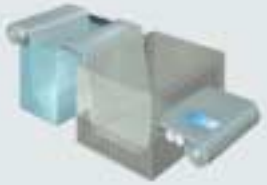


The Visual KV can be used as a simple stepper motor controller by setting the output frequency on the Access Window (see note 1.)

Applications

Tension adjustment of hoop material

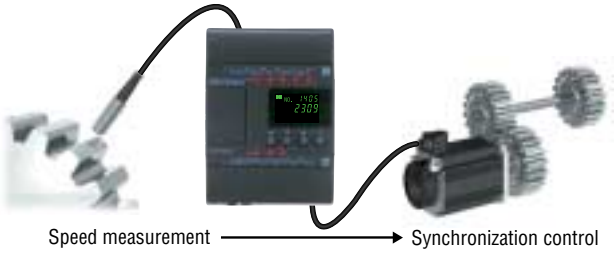
Time adjustment of sheet immersion in a treatment bath



Synchronization Control Function

A single Visual KV unit enables synchronization control.

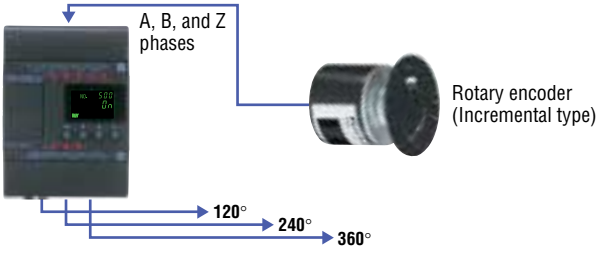
Pulses with a measured frequency can be output (See note 1) by combining the frequency counter function with the specified-frequency pulse output.



Cam Switch Function

Serves as a simple cam switch.

An operation similar to that of a Cam can be achieved by combining an inexpensive rotary encoder with the Visual KV. Connect the rotary encoder to the Visual KV and input the desired angles into the specified data memories. The relays can then be turned on or off at the specified angles (up to 32 points, in increments of 1 degree.) This Function of the Visual KV can be utilized as an alternative to an expensive Cam switch in order to reduce overall costs.



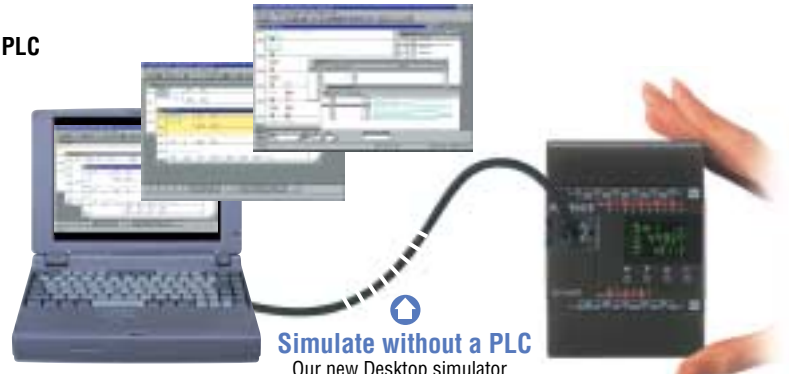
Note 1: A motor driver is required separately.

Software

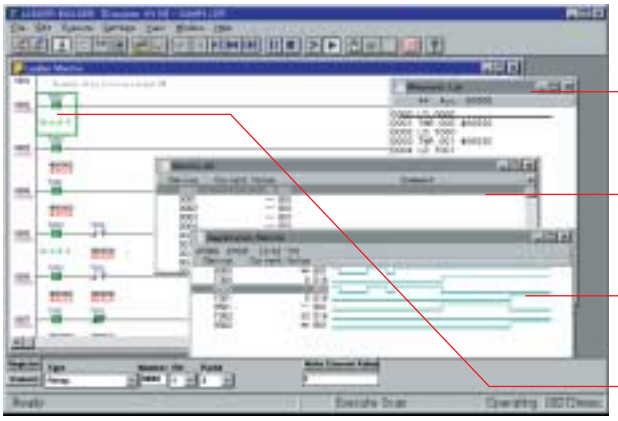
"Ladder Builder for KV" ensures fast, easy programming and efficient desktop debugging.

Simulator **Quick debugging without a PLC**

The KV Ladder Builder can simulate program execution even without a PLC connected. Providing a single step execution (forward and reverse) in addition to a regular scan execution function increases debugging efficiency.



Simulate without a PLC
Our new Desktop simulator, simulates a program in operation before you connect your PLC



Forward / Reverse Single Step Execution
Checking the operation process one step at a time can easily identify complex operation problems.

Monitor All Function
Timers, counters and data memories can be checked simultaneously in multiple windows. For effective debugging, you can check all devices at once, even those that don't appear in the ladder diagram.

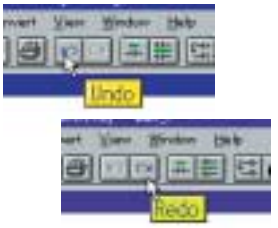
Registration Monitor
The Ladder Builder simultaneously displays multiple timing charts of any devices, conveniently allowing all on/off timing elements to be checked.

Ladder Simulator Allows Verification of Diagram Execution
By clicking an element in the ladder diagram, the simulator quick screen appears allowing the elements to set or reset.

Editor **Easy Editing Using Windows® Functions**

Instruction Selection Window
The user-friendly design allows data to be entered from a keyboard or mouse. You can specify a device or command from a drop down menu, eliminating errors.
For programming purposes you can also enter the symbol directly by typing the command.

Usage List
When creating Ladder diagrams the usage list automatically tracks and displays addresses that have been used.



UNDO Function
The Ladder Builder for KV enables efficient editing. If you accidentally delete an instruction, you can undo the action simply by clicking the "undo" button.

Auto-Save Function
The Ladder Builder automatically backs-up the program at pre-determined intervals. This protects the data from being lost due to a power loss or system crash.

Monitor **Real time monitoring without machine stoppage**

Ladder diagram and element on/off status can be monitored in real time.
In addition, timing charts can also be monitored simultaneously.

System Variations

Base Units

Fully equipped with Access Windows, 12 types of base units with various special functions, such as positioning control and high-speed counters, are available.

	I/O 16 (10 inputs 6 outputs)	I/O 24 (16 inputs 8 outputs)	I/O 40 (24 inputs 16 outputs)
AC Relay	KV-16AR	KV-24AR	KV-40AR
AC Transistor	KV-16AT	KV-24AT	KV-40AT
DC Relay	KV-16DR	KV-24DR	KV-40DR
DC Transistor	KV-16DT	KV-24DT	KV-40DT

Expansion Units

An expansion unit can be mounted up to 300mm away from the adjacent unit. 8 types of I/O expansion units permit a flexible layout.

	8	16	4+4
Input	8 Inputs **KV-E8X**	16 Inputs **KV-E16X**	
Output	8 transistor outputs **KV-E8T** 8 relay outputs **KV-E8R**	16 transistor outputs **KV-E16T** 16 relay outputs **KV-E16R**	4 inputs/ 4 outputs (Relay) **KV-E4XR** 4 inputs/ 4 outputs (Transistor) **KV-E4XT**

The "Special Mini Display" provides basic display functions at a low cost.

KV-D20 Operator Interface

4 function switches and 4 indicators can be customized and preset as desired. Comments on the ladder diagram can be displayed. The KV-D20, with practical functions, is a cost saving system component.

Ladder Builder Software

KV-H6WE2 (Windows)

Ladder programming created for the conventional KV Series can be utilized with the Visual KV.

Handheld programmer with a memory card slot

KV-P3E

The handheld programmer can be used to easily transfer and save ladder diagrams. (The M-2 and M-3 memory cards are available separately.)

Specifications

General specifications

Power supply		AC type KV-16AT/AR KV-24AT/AR KV-40AT/AR	DC type KV-16DT/DR KV-24DT/DR KV-40DT/DR
AC power input voltage	Base unit	100 to 240 VAC (±10%)	24 VDC (±10%)
AC power current consumption	Base unit	KV-16AT/AR: 0.5 A KV-24AT/AR: 0.6 A KV-40AT/AR: 0.7 A	—
AC power factor	Base unit	60%	—
Output voltage	Base unit	24 VDC (±10%)	—
Output capacity (Including the internal current consumption and current consumption of expansion units.)	Base unit	KV-16AT/AR: 0.6 A KV-24AT/AR: 0.6 A KV-40AT/AR: 0.7 A	—
Allowable instantaneous interruption time	Base unit	40 ms max.	2 ms max.
Internal current consumption (converted into 24 VDC value)	Base unit	KV-16AR/DR: 120 mA max. KV-16AT/DT: 90 mA max. KV-24AR/DR: 140 mA max. KV-24AT/DT: 100 mA max. KV-40AR/DR: 180 mA max. KV-40AT/DT: 120 mA max.	
	Expansion units	KV-E8X: 25 mA max. KV-E16X: 35 mA max. KV-E8T: 40 mA max. KV-E16T: 60 mA max. KV-E8R: 70 mA max. KV-E16R: 110 mA max. KV-E4XR: 45 mA max.	
	Others	KV-D20 Operator panel: 60 mA max. KV-P3E Handheld programmer: 65 mA max.	
Ambient temperature		0 to +50°C, 0 to +45°C (KV-P3E)	
Relative humidity		35 to 85%	
Ambient storage temperature		-20 to +70°C	
Withstand voltage		1,500 VAC for 1 minute (Between power terminal and I/O terminals, and between external terminals and housing)	
Noise immunity		1,500 Vp-p min., pulse width: 1 µs, 50 ns (by noise simulator) Conforming to EN standard (EN55011-2/-3/-4/-6)	
Shock		150 m/s^2 (15 G), working time: 11 ms, in X, Y and Z directions, 2 times respectively	
Vibration		10 to 55 Hz, 1.5 mm max. double amplitude in X, Y and Z directions, 2 hours respectively (1 G max. when attached to DIN rail)	
Insulation resistance		50 MΩ min. (Between power terminal and I/O terminals, and between external terminals and housing, measured with 500 VDC megohmmeter)	
Environmental restrictions		No excessive dust or corrosive gases	
Weight		KV-16DT: Approx. 180 g, KV-24DT: Approx. 210 g, KV-40DT: Approx. 280 g, KV-16DR: Approx. 190 g, KV-24DR: Approx. 240 g, KV-40DR: Approx. 330 g, KV-16AT: Approx. 280 g, KV-24AT: Approx. 330 g, KV-40AT: Approx. 410 g, KV-16AR: Approx. 300 g, KV-24AR: Approx. 350 g, KV-40AR: Approx. 450 g	

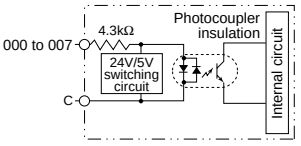
Performance specifications

Arithmetic operation control method		Stored program method
I/O control method		Refresh method
Programming language		Ladder diagram and expanded ladder diagram
Instruction types		Basic instruction: 28, Application instruction: 22, Arithmetic instruction: 26, Interrupt instruction: 4
Minimum scan time		140 µs min.
Instruction processing time		Basic instruction: 0.7 µs min., Application instruction: 6.4 µs. min.
Program capacity		2,000 steps (KV-16□□) 4,000 steps (KV-24□□, KV-40□□)
Maximum number of expansion units		8 (7 for KV-40□□)
Number of I/O points (including 16 to 40 I/O points of basic unit)		16 to 152 points (when expansion units are connected)
Internal utility relay		2,560 points: 1000 to 1915 and 3000 to 17915
Special utility relay		160 points: 2000 to 2915
Data memory (16 bits)		2,000 words: DM 0000 to DM1999
Temporary data memory (16 bits)		32 words: TM00 to TM31
Timer/counter		0.1-s timer: TMR (0 to 6553.5 s), 0.01-s timer: TMH (0 to 655.35 s), 0.001-s timer: TMS (0 to 65.535 s), UP counter: C, Up/down counter: UDC
Digital trimmer		2 trimmers (set in access window)
High-speed counter		2 counters of 30 kHz, 2-phase high-speed counter (0 to 65535 count) *1
High-speed counter comparator		4 comparators (2 for each high-speed counter) Direct output allowed
Positioning control function		Independent 1 axis, 50 kHz max.
Memory switch		16
Memory backup	**Program memory**	Flash ROM, rewritable 100,000 times or more
	Data memory, counter, internal utility relay (Retention devices are set by MEMSW instruction.)	Data retained for 2 months min. with electrical double-layer capacitor (at 25°C), Data can be backed up with EEPROM in all models.
Self-diagnosis		CPU and RAM errors
Number of contact comments		1,000 max. contact comments can be saved.

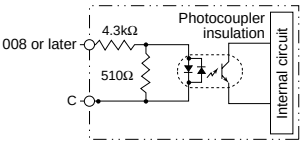
*1. 24-bit setting is available.

Input/output circuit of base unit

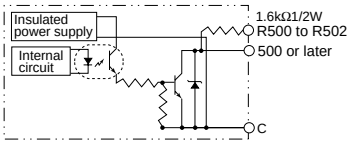
Input 000 to 007



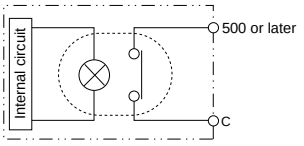
Input 008 or higher



KV-□□DT/AT



KV-□□DR/AR



Input specifications of base unit

Model	KV-16□□	KV-24 □□	KV-40 □□
No. of inputs	10	16	24
Input common	COM is connected internally.		
Maximum input rating	26.4 VDC		
Input voltage *1	24 VDC, 5.3 mA/5 VDC, 1.0 mA		
Input time constant	10 ms (Typical) 10 µs when HSP instruction is used Variable in 7 steps from 10 µs to 10 ms while special utility relay 2813 is ON (Set by DM1940)		
Interrupt input response	10 µs (Typical)		
High-speed counter input response	30 kHz (24V±10%)		

*1. Inputs 000 to 007 can be changed to 5 V input.

Output specifications of basic unit

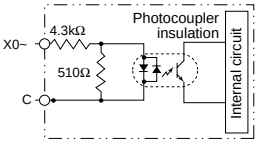
Model	KV-16□T	KV-24□T	KV-40□T	KV-16□R	KV-24□R	KV-40□R
No. of outputs	6	8	16	6	8	16
Output common	1 common			Each common terminal is independent.		
Output type	Transistor output			Relay output		
Rated load	30 VDC 0.3 A (503 and other) 0.1 A (500 to 502)			250 VAC/30 VDC 2 A (Inductive load) 4 A (Resistive load)		
Peak load current	0.2 A (500 to 502) 1 A (Other)			5 A		
Relay service life	—			Electrical service life: 100,000 times or more (20 times/min) Mechanical service life: 20-million times or more		
Relay replacement	—			Not allowed		
Output frequency	50 kHz (500 to 502)			—		
Built-in serial resistance	1.6 kΩ 1/2W (R500 to R502)			—		

Input/output specifications of expansion unit

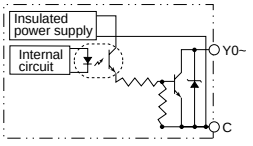
Input/output	Input		Output				Input/output
External connection method	Terminal block						
Model	KV-E8X	KV-E16X	KV-E8T	KV-E16T	KV-E8R	KV-E16R	KV-E4XT/R
Number of inputs	8	16	—				4
Input common	4 points/common		—				4 points/common
Maximum input rating	26.4 VDC		—				26.4 VDC
Input voltage	24 VDC, 5.3 mA		—				24 VDC, 5.3 mA
Minimum ON voltage	19 V		—				19 V
Maximum OFF current	2 mA		—				2 mA
Input impedance	4.3 kΩ		—				4.3 kΩ
Input time constant (Changed in two steps by special utility relays 2609 to 2612)	For both rising (OFF → ON) and falling (ON → OFF) operations, 10 ms: 10 ms±20%, 10 µs: 10 µs±20%		—				For both rising (OFF → ON) and falling (ON → OFF) operations, 10 ms: 10 ms±20%, 10 µs: 10 µs±20%
Number of outputs	—		8	16	8	16	4
Output type	—		Transistor (NPN)		Relay		Transistor (NPN)/Relay
Output common	—		COM is connected internally.		4 points/common		4 points/common
Rated load voltage	—		30 VDC		250 VAC/30 VDC, 2 A (Inductive load), 4 A (Resistive load)		30 VDC/, 250 VAC/30 VDC, 2 A (Inductive load), 4 A (Resistive load)
Rated output current	—		0.5 A/point		2 A/point (Inductive load), 4 A/point (Resistive load), 4 A/common		0.5 A/point/, 2 A/point (Inductive load), 4 A (Resistive load), 4 A/common
ON resistance	—		—		50 mΩ or less		50 mΩ or less (relay only)
Leakage current at OFF	—		100 µA max.		—		100 µA max. (transistor only)
Residual voltage at ON	—		0.8 V max.		—		0.8 V max. (transistor only)
Rising operation time (OFF → ON)	—		50 µs max.		10 ms max.		50 µs max./10 ms max.
Falling operation time (ON → OFF)	—		250 µs max.		10 ms max.		250 µs max./10 ms max.
Relay service life	—		—		Electrical: 100,000 times or more (20 times/min), Mechanical: 20-million times or more		Electrical: 100,000 times or more (20 times/min) (relay only) Mechanical: 20-million times or more (relay only)
Relay replacement	—		—		Not allowed		Not allowed (relay only)
Weight	Approx. 100 g	Approx. 130 g	Approx. 100 g	Approx. 130 g	Approx. 130 g	Approx. 190 g	Approx. 100 g/Approx. 120 g

Input/output circuit of expansion unit

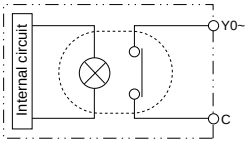
Input



Output (Transistor)



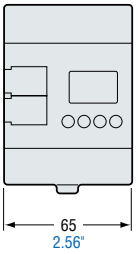
Output (Relay)



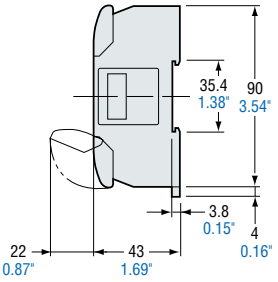
Dimensions

Base Units

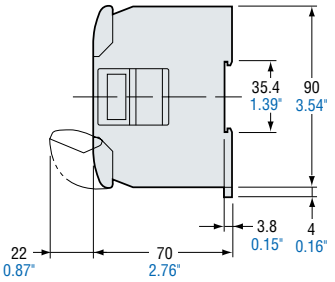
KV-16DT/DR/AT/AR



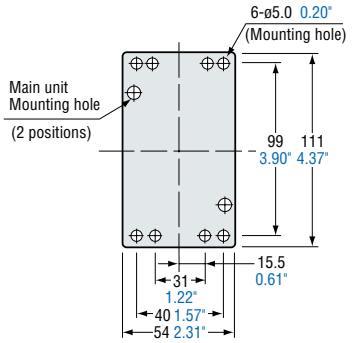
KV-16DT/DR



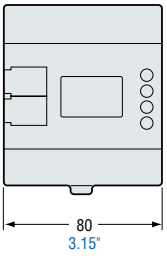
KV-16AT/AR



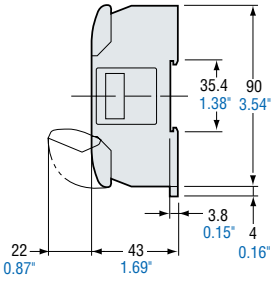
Mounting bracket OP-35346



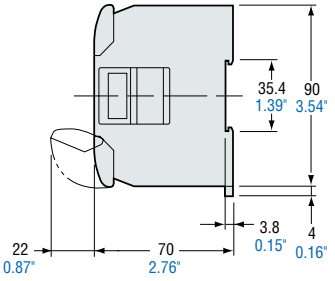
KV-24DT/DR/AT/AR



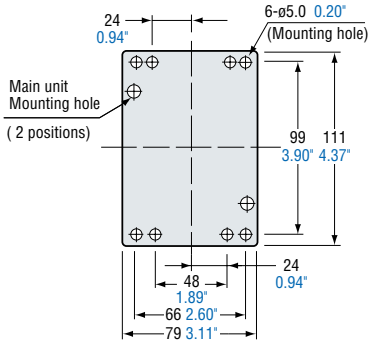
KV-24DT/DR



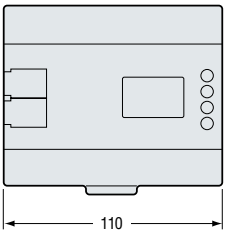
KV-24AT/AR



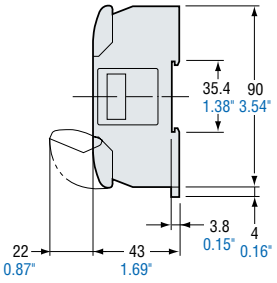
Mounting bracket OP-35347



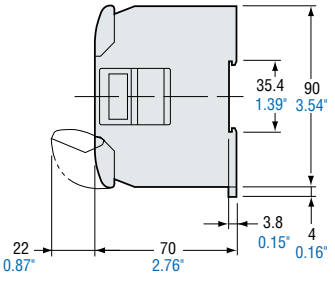
KV-40DT/DR/AT/AR



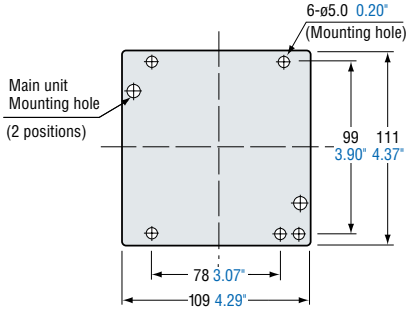
KV-40DT/DR

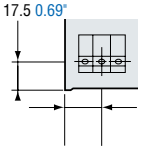


KV-40AT/AR



Mounting bracket OP-35348

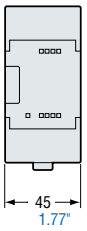




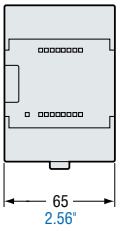
* AC power terminal part detail. Common to all AC types.

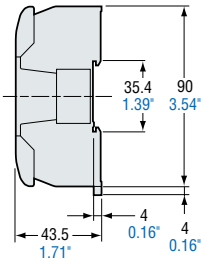
Expansion Units

KV-E8X/8T/8R/4XT/4XR

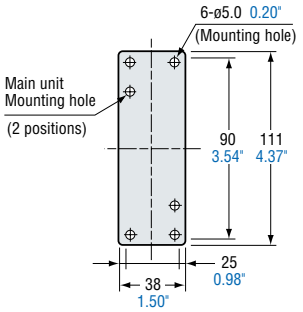


KV-E16X/16T/16R





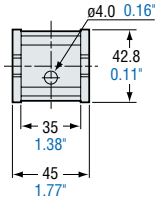
Mounting bracket OP-35349



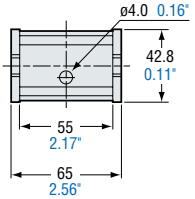
Expansion Unit Spacer

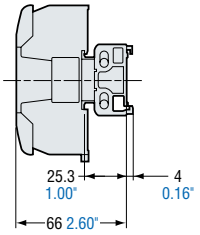
Patent pending

OP-35343 KV-E8X/T/R, KV-E4XT/R



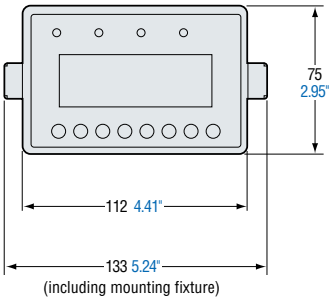
OP-35344 KV-E16X/T/R

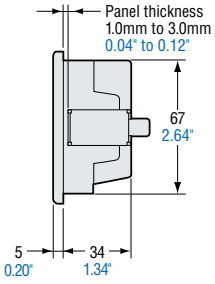




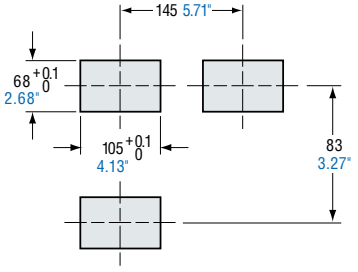
Operator Interface

KV-D20





Panel Cutout



Visual KV Series Model List

Category	Name	Model	Description
Base unit	16-point AC type	KV-16AT	10-point input/6-point transistor output
		KV-16AR	10-point input/6-point relay output
	16-point DC type	KV-16DT	10-point input/6-point transistor output
		KV-16DR	10-point input/6-point relay output
	24-point AC type	KV-24AT	16-point input/8-point transistor output
		KV-24AR	16-point input/8-point relay output
	24-point DC type	KV-24DT	16-point input/8-point transistor output
		KV-24DR	16-point input/8-point relay output
	40-point AC type	KV-40AT	24-point input/16-point transistor output
		KV-40AR	24-point input/16-point relay output
	40-point DC type	KV-40DT	24-point input/16-point transistor output
		KV-40DR	24-point input/16-point relay output
Expansion unit	8-point type	KV-E8X	8-point input
		KV-E8T	8-point transistor output
		KV-E8R	8-point relay output
		KV-E4XT	4-point input/4-point transistor output
		KV-E4XR	4-point input/4-point relay input
	16-point type	KV-E16X	16-point input
		KV-E16T	16-point transistor output
		KV-E16R	16-point relay output
Easy-to-set display	Operator Interface	KV-D20	20 digits x 4 lines with customized switches/lamps (cable included)
Extension cable for expansion unit	For all expansion units and adapters	OP-35361	For 300-mm extension
Expansion unit spacer	Spacer for 8-point expansion unit	OP-35343	Used to make an expansion unit flush with an AC power type basic unit.
	Spacer for 16-point expansion unit	OP-35344	
Metal fixture for screw tightening	For 16-point base unit	OP-35346	Used to directly mount the KV series with screws instead of a DIN rail.
	For 24-point base unit	OP-35347	
	For 40-point base unit	OP-35348	
	For 8- to 16-point expansion unit	OP-35349	
Programming	Handheld programmer	KV-P3E(01)	Memory card slot, cable (OP-26487) included
	Programming support software	KV-H6WE2	Windows version: With simulator function, delivered on two 3.5-inch floppy disks (cable included)
	Cable/connector for PC/AT or compatibles	OP-26487	For D-sub 9-pin, Base unit-to-PC connection.
		OP-26486	
	Memory card	M-2	Saves/reads ladder programs via KV-P3E(01)'s slot or Z-1 card reader/writer. M-2: 24 programs max.,M-3: 48 programs max.
		M-3	

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