KEYENCE

Programmable Controller

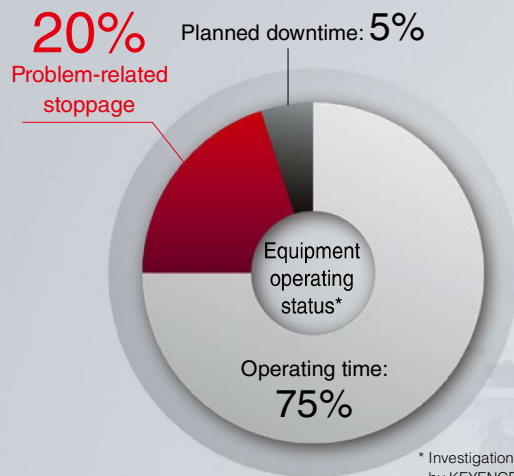## KV-8000 Series

Identify the cause of problems. Ensure quick recovery.

The World's First Built-In

Machine Operation Recorder Function

KV-8000
SERIES

Fact: 20% of the day is spent stopped due to problems

20%
Problem-related stoppage

Planned downtime: 5%

Equipment operating status*

Operating time: 75%

* Investigation performed by KEYENCE

[Human Factor]

Incorrect parameter settings

Improper workpiece loading

[Mechanical Factor]

Motor overload and mechanical wear

False sensor detection

Know the cause of problems with the Machine Operation Recorder function

[Program Factor]

Signal timing error

Incorrect interlock

Quick recovery by knowing the cause of problems and performing fundamental countermeasures

Recording

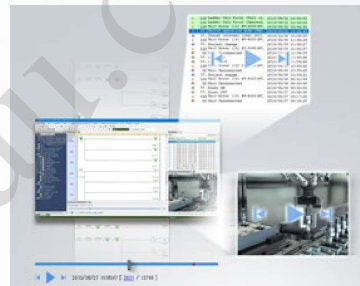### Recording of all data

Records all devices, cameras, and events. All equipment data is recorded automatically.
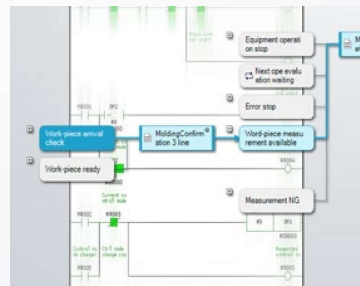
Playback

Replays

View linked playback of various data sources recorded from the moment a problem occurred.

Analysis

Relation mapping

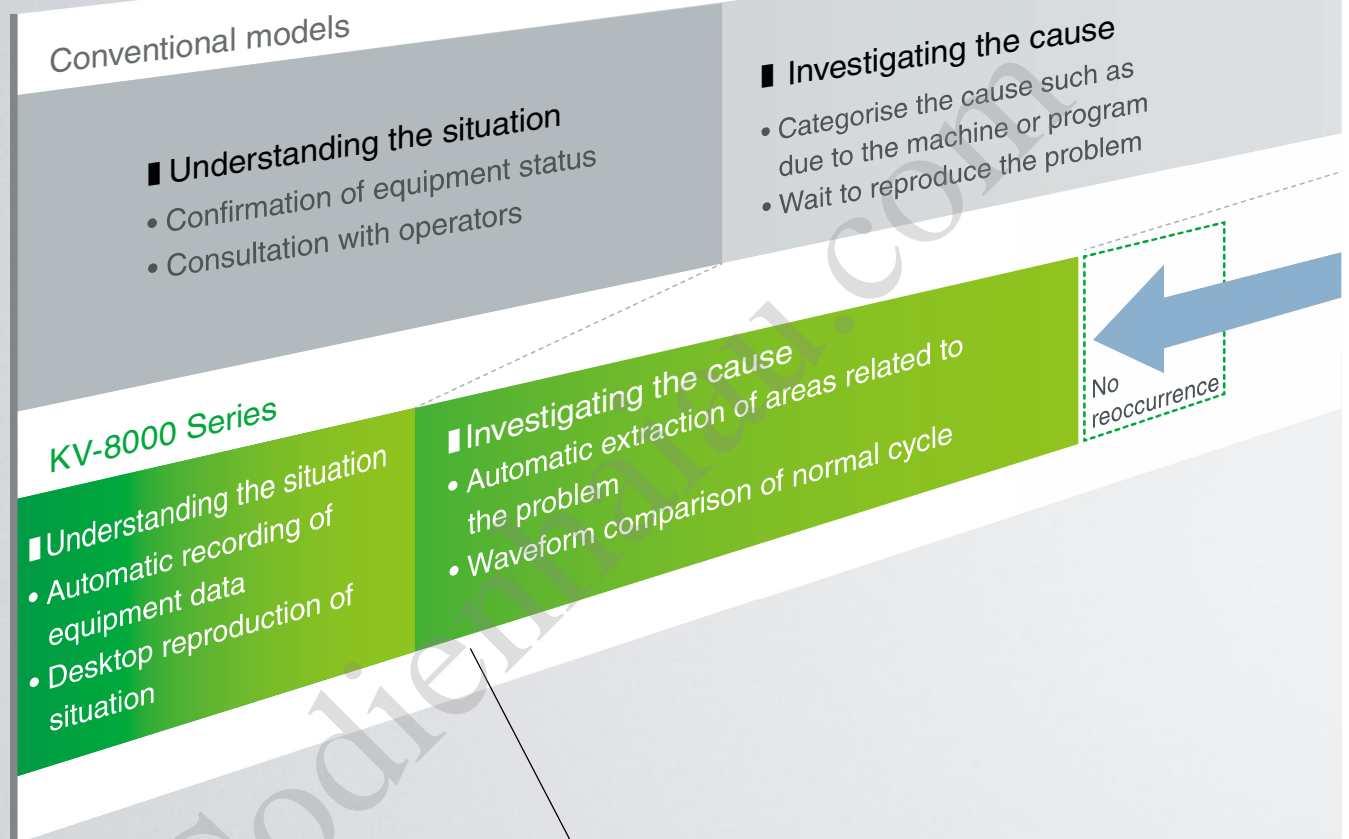Automatically analyse ladder programs and view tree-diagrams of related devices.

Programmable Controller
KV-8000 Series

# Significantly reduce downtime with on-site machine operation recorder PLCs

Overview of time from equipment stop to recovery

Conventional models

▌ Understanding the situation
- Confirmation of equipment status
- Consultation with operators

▌ Investigating the cause
- Categorise the cause such as due to the machine or program
- Wait to reproduce the problem

KV-8000 Series

▌ Understanding the situation
- Automatic recording of equipment data
- Desktop reproduction of situation

▌ Investigating the cause
- Automatic extraction of areas related to the problem
- Waveform comparison of normal cycle

No reoccurrence

Reasons to reduce downtime

Quicker understanding of the situation

Collecting accurate information is essential for knowing the status of equipment. The KV-8000 automatically records data both before and after stoppage, allowing users to quickly and accurately track statuses.

Automatic recording

- Equipment and workpiece appearance
- Program behaviour
- Operator actions
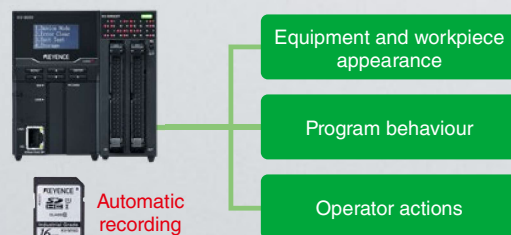
▊ Reoccurrence of problem
Determine the situation and investigate the cause again
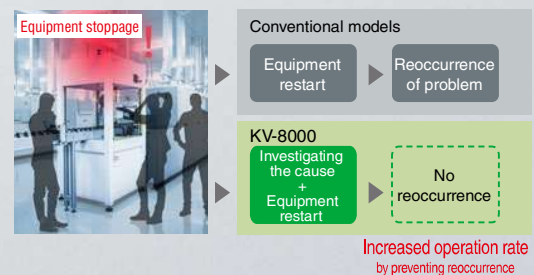
Using the Machine Operation Recorder function

Fast investigation of causes

Isolating the cause of a problem is necessary for solving the problem quickly. The KV-8000 features a variety of functions for analysing mechanical, human, or program factors, which make up the majority of problems—ensuring quick troubleshooting investigation.

Various problem analysis functions available

Camera-based initial checking when a problem occurs
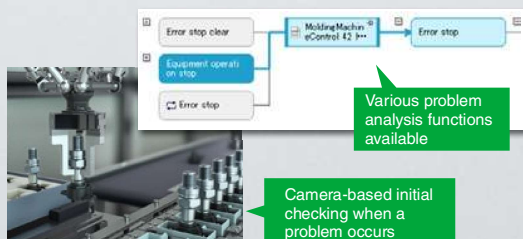
Prevent reoccurrences

If the cause of a problem is not understood and proper countermeasures are not implemented, reoccurrence will be likely. Identifying the underlying cause of a problem with the KV-8000's Machine Operation Recorder function can help prevent problems from happening again.

Equipment stoppage

Conventional models

Equipment restart ▶ Reoccurrence of problem

KV-8000

Investigating the cause + Equipment restart ▶ No reoccurrence

Increased operation rate
by preventing reoccurrence

Lineup

CPU unit **KV-8000**

CPU unit **KV-8000**

Basic performance

LD instruction execution speed	0.96 ns
Program capacity	1500 k steps max.

Functions

Machine Operation Recorder function	FTP client/ Server
Logging/trace	

Communication port

EtherNet/IP®	USB

Camera

Compact standard camera **KV-CA1H**

Camera input unit **KV-CA02**

Compact standard camera **KV-CA1H**

Basic performance

Resolution	640 (H) × 480 (V)
Frame rate	10/30/120 fps
Viewing angle	Horizontal viewing angle: Approx. 60°/ Vertical viewing angle: Approx. 47°

Wide field and high-resolution camera **KV-CA1W**

Wide field and high-resolution camera **KV-CA1W**

Basic performance

Resolution	1280 (H) × 960 (V)
Frame rate	10/30 fps
Viewing angle	Horizontal viewing angle: Approx. 180°/ Vertical viewing angle: Approx. 150°

Camera input unit **KV-CA02**

Basic performance

Maximum number of connected units	4
Number of ports	2
Cable length	5/10/20 m

KV STUDIO Ver. 11

Supported modes

- Editor
- Monitor
- Online Edit
- Simulator
- Simulator Edit
- Replay   NEW

KV REPLAY VIEWER

Supported modes

- Replay

*Downloadable for free from KEYENCE website

I/O

Input

16-point
Screw Terminal Block

Input Unit
KV-B16XC

32-point Connector

Input Unit
KV-C32XC

64-point Connector

Input Unit
KV-C64XC

Output

Screw Terminal Block

16-point Relay
Output Unit
KV-B16RC

8-point Relay Output
(Independent Common
Point) Unit
KV-B8RC

16-point Screw Terminal Block

Transistor (sink)
Output Unit with
Overcurrent Protection
KV-B16TD

Transistor (source)
Output Unit
KV-B16TCP

32-point Connector

Transistor (sink)
Output Unit with
Overcurrent Protection
KV-C32TD

Transistor (source)
Output Unit
KV-C32TCP

64-point Connector

Transistor (sink)
Output Unit with
Overcurrent Protection
KV-C64TD

Transistor (source)
Output Unit
KV-C64TCP

**Input/
Output
Hybrid**

64-point Connector

32-point Input + 32-point
Transistor (sink) Output
High-speed I/O Unit
KV-SIR32XT

S-Unit

16-point Screw Terminal Block

8-point Input +
8-point Transistor
(sink) Output Unit
KV-B8XTD

32-point Connector

16-point Input +
16-point Transistor
(sink) Output Unit
KV-C16XTD

Analogue

4 ch
High-speed
Analogue
Input Unit
KV-SAD04

S-Unit

4 ch
High-speed
Analogue
Output Unit
KV-SDA04

S-Unit

2 ch Analogue
Input +
2 ch Analogue
Output Unit
KV-AM40V

4 ch
Temperature
Control Unit
KV-TF40

4 ch Temperature/
Analogue
Multi-input Unit
KV-TP40

Positioning/Motion

4-axis
MECHATROLINK-III
Positioning/Motion Unit
KV-XH04ML

X-Unit

16-axis
MECHATROLINK-III
Positioning/Motion Unit
KV-XH16ML

X-Unit

4-axis Pulse Train
High-speed
Positioning Unit
KV-SH04PL

S-Unit

High-speed counter

2 ch
High-speed
Counter Unit
KV-SSC02

S-Unit

Communication

Ethernet
Unit
KV-XLE02

X-Unit

Serial
Communication Unit
KV-XL202

X-Unit

Serial
Communication Unit
KV-XL402

X-Unit

Power supply

AC Power Supply Unit
with Error Output
KV-PU1

Network

CC-Link
Master/Local Unit
KV-CL20

DeviceNet®
Unit
KV-DN20

KL Master
Unit
KL-N20V

Bus Connection

Bus Connection
Unit
KV-7000C

Recording

Recording of various data

Records all devices, cameras, and events.
All equipment data required for solving problems is recorded in chronological order.

Device

Record all device changes every scan `WORLD FIRST`

All device changes and ladder programs are recorded every scan time.
Recording is performed just as if the ladder programs were being captured in real time.

Record all signal behaviours
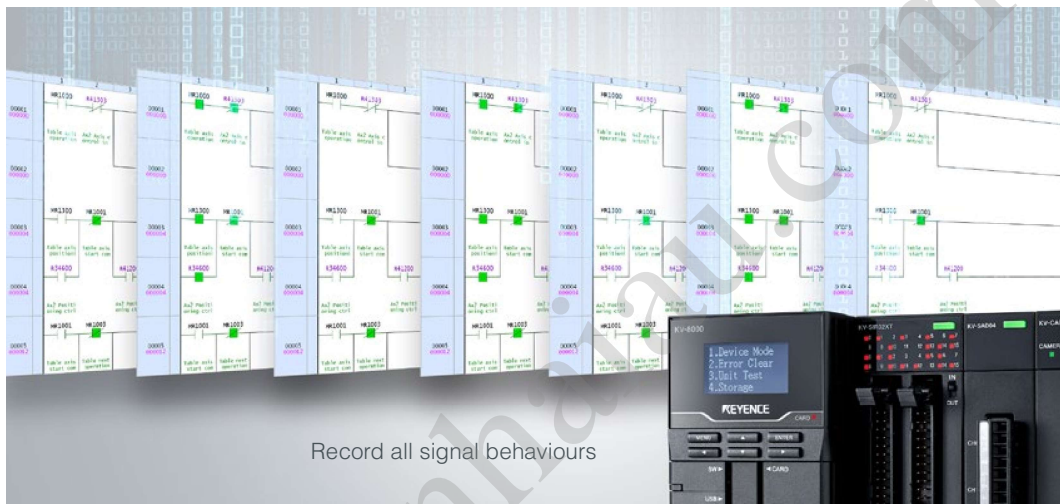
Camera

Record all mechanical, workpiece, and human movements `WORLD FIRST`

The statuses of all equipment, workpieces, and mechanisms are recorded both before and after the problem occurred. Because the device is connected to the PLC, the ladder program status and the image captured by the camera are recorded in sync.

Compact standard camera
KV-CA1H

Application: Workpiece and mechanism monitoring

Wide field and high-resolution camera
KV-CA1W

Application: Overall equipment monitoring

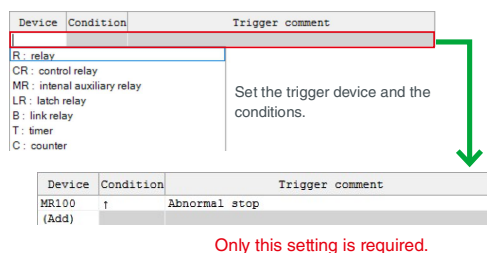# Record external input history   WORLD FIRST

In addition to PLC error and alarm information, touch panel operation history and all inputs from upstream/downstream PLCs and from the host PC are recorded. This ensures all history related to problems caused by hard-to-notice incorrect operations or external factors is retained.

Operator actions

Upstream/downstream PLCs

Host system/PC

Recording of equipment changes

One-step configuration of settings for solving various problems
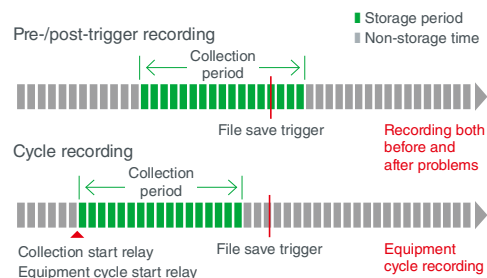
One-step trigger setting

Recording a problem is as easy as setting a trigger. Whenever a trigger is input, all preceding and following device changes are automatically recorded. This eliminates the need to select and register a target device.

Device	Condition	Trigger comment

R : relay
CR : control relay
MR : intenal auxiliary relay
LR : latch relay
B : link relay
T : timer
C : counter

Set the trigger device and the conditions.

Device	Condition	Trigger comment
MR100	↑	Abnormal stop
(Add)		

Only this setting is required.

WORLD FIRST

Ensure reliable recording of stoppages without alarms

Configuring a fixed recording time based on equipment cycle start is possible for any device that has stopped without an alarm being generated.

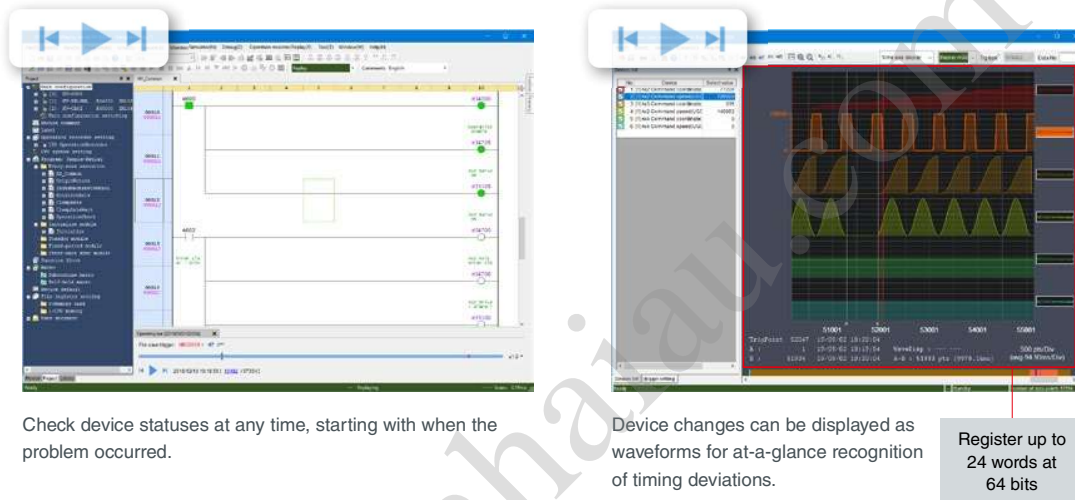■ Storage period
■ Non-storage time

Pre-/post-trigger recording

Collection period

File save trigger

Recording both before and after problems

Cycle recording

Collection period

Collection start relay
Equipment cycle start relay

File save trigger

Equipment cycle recording

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Playback

Linked playback of all recorded data

Records all devices, cameras, and events.
Recorded data can be played back in sync.

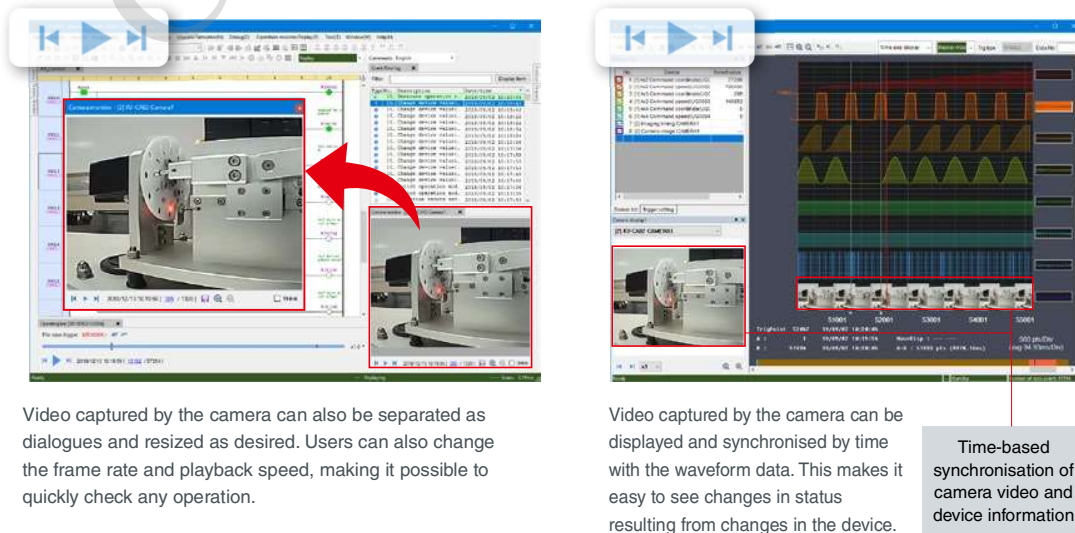
Tracked monitoring of the time axis

All recorded ladder programs can be played back at will.
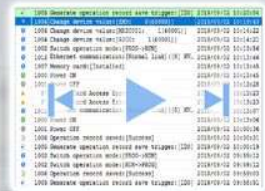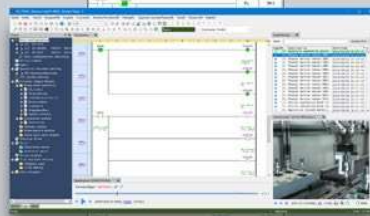With all device changes being recorded, various monitoring functions can be used to check device statuses.

Check device statuses at any time, starting with when the problem occurred.

Device changes can be displayed as waveforms for at-a-glance recognition of timing deviations.

Register up to 24 words at 64 bits

Camera

Linked video playback and ladder monitoring

Video captured both before and after a problem can be played back in sync with device changes.
Having an accurate understanding of the situation makes understanding the cause of the problem much easier.
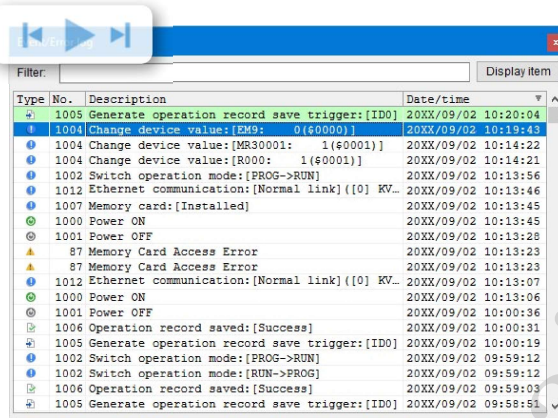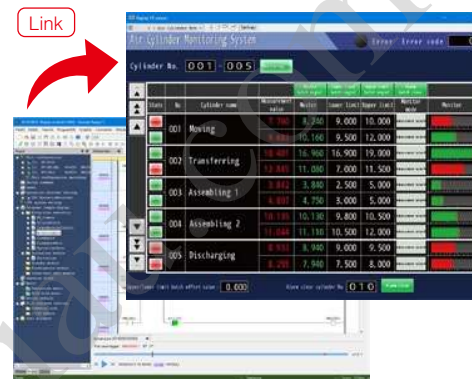

Video captured by the camera can also be separated as dialogues and resized as desired. Users can also change the frame rate and playback speed, making it possible to quickly check any operation.

Video captured by the camera can be displayed and synchronised by time with the waveform data. This makes it easy to see changes in status resulting from changes in the device.

Time-based synchronisation of camera video and device information

Time-based external input and operation history checking

The event/error history can be used to check changes in device values not resulting from programs.
Easily identify incorrect operations from the touch panel or PC as well as incorrect settings.

This makes it possible to see changes in chronological order.

Device value changes (touch panel/PC/PLC)		
Communication status	SD memory card insertion/removal	Program rewriting

Checking device value changes is possible on a PC using the same screen data as the touch panel.
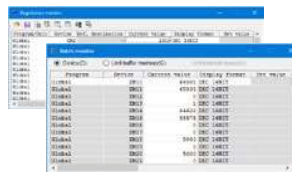
Various monitoring functions available
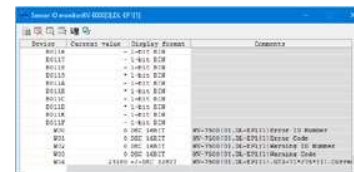
Unit monitor
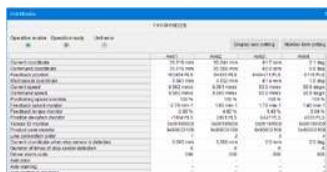
Recording the buffer memory of positioning units and other units enables close monitoring of unit statuses.

Registration monitor / Batch monitor

Monitor any specific device or batch monitor any specific device types.

Sensor I/O monitor

Monitor the current values and setting values for each KEYENCE sensor connected to the KV Sensor Network.

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Analysis

## Impressive cause investigation time

Equipped with a mechanism that minimises time spent investigating the cause of problems.
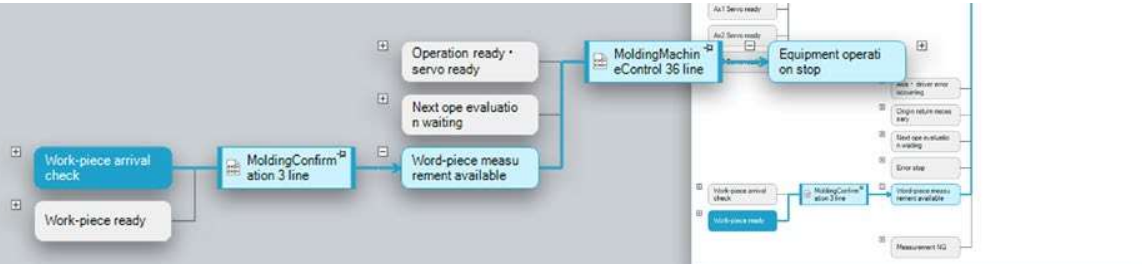
Conventional problem analysis

Analysis using incredibly large ladder programs

The ladder programs of PLCs that control equipment are complexly related to a wide variety of other programs, including motor control, communication control, and error processing.
Because of this, finding the cause of a problem can take a lot of effort.
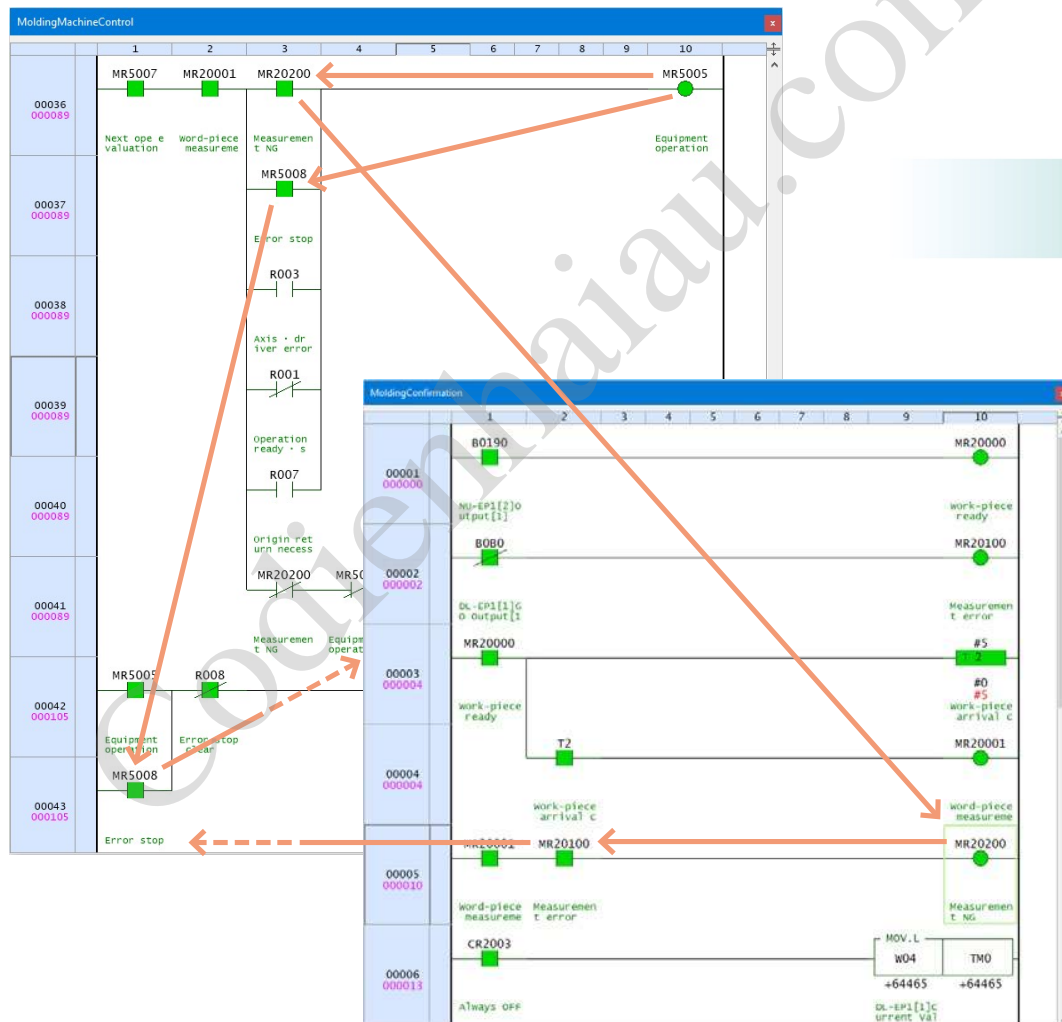
Automatic tree diagramming of locations related to the problem

WORLD FIRST

Search/extract not only device and configuration changes related to the problem but also device rewrites from the touch panel, and create a tree diagram automatically.
Causes can be investigated early just by following the block.
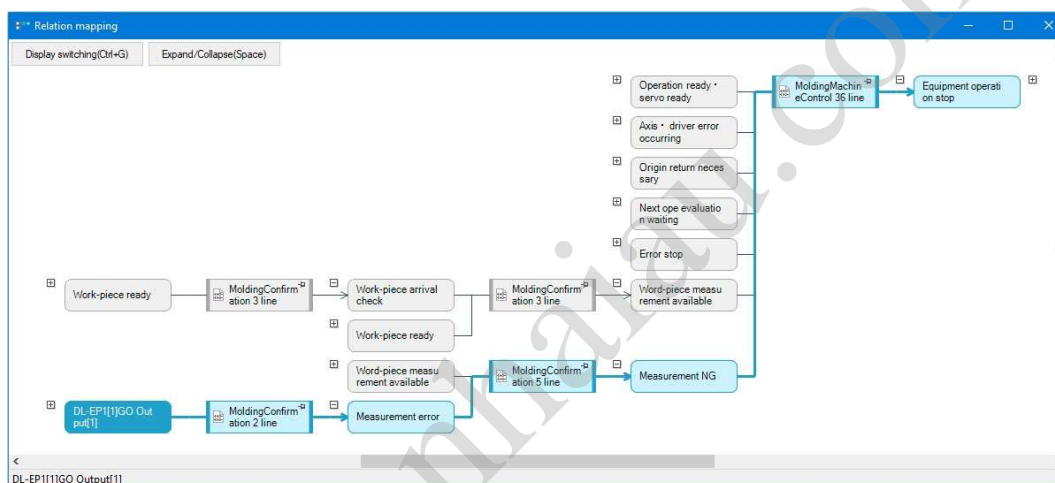
Relation mapping block information

Device blocks

Abnormal stop clear

R008

Displays the devices used in the ladder block diagram. Switch freely between the device comment display and the device display.

Ladder blocks

Axisdrivererrori nprog 42 line

Displays the line number and module name where the specified device is being used.

Flow blocks

[3]Flow

Displays the target unit number for specified devices used in unit programs (flows).

Setting blocks

[3]PLC Link

[0]EtherNet/IP scanner

[1]PROTOCOL STUDIO

Displays the unit number and name of the unit setting being used by the specified device.

Settings List
• PLC link • PROTOCOL STUDIO
• Industrial Ethernet
• Simple PLC link
• FL refresh settings
• Serial PLC link
• Default device value settings
• Inter-unit synchronisation refresh

Device value change blocks

[0]Device value change

Displays when the device values for the specified device are changed from the touch panel or access window.
*Only in monitor/online edit/replay mode.

Efficient cause analysis

Utilise a variety of analysis tools to investigate causes in various ways.

Relation mapping

Automatic ladder extraction WORLD FIRST

Automatically extract related ladder programs by selecting a block within the relation mapping.
This eliminates the need to search through large ladder programs, making it easier to find causes quickly.

Click ⊞ to expand related blocks

Automatic extraction and collation of related ladder programs
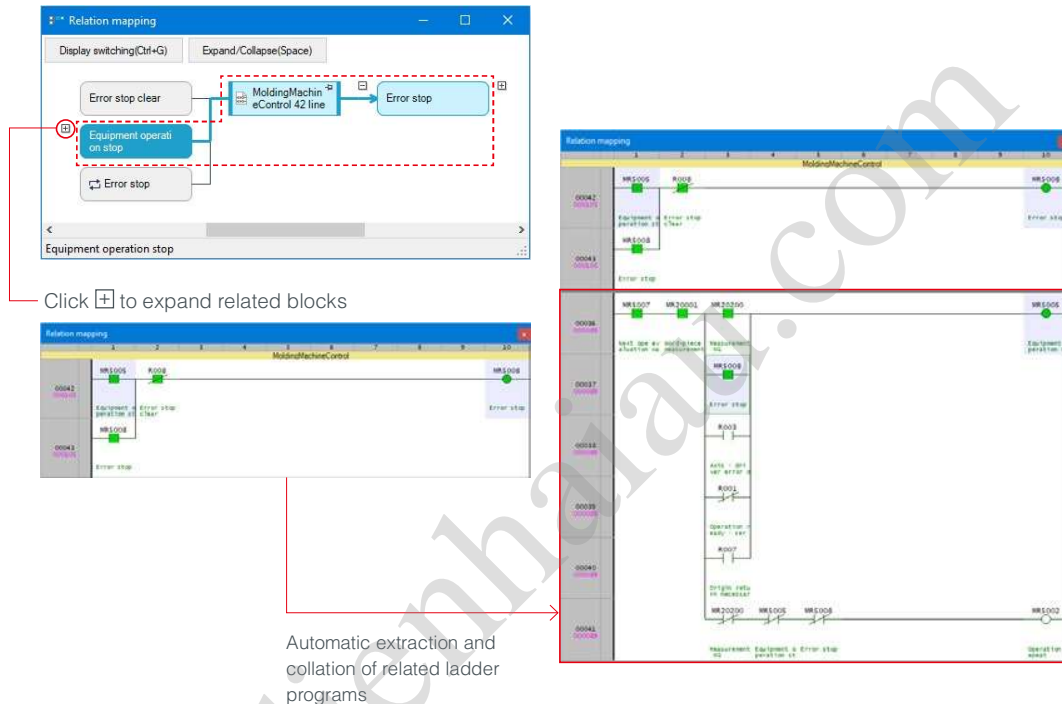
Reduce debugging times

Relation mapping is also a useful tool in editor mode. See at a glance the scope to which the device being changed will be affected during debugging to help prevent programming errors.

Impact of device change
(Blocks located on the right)
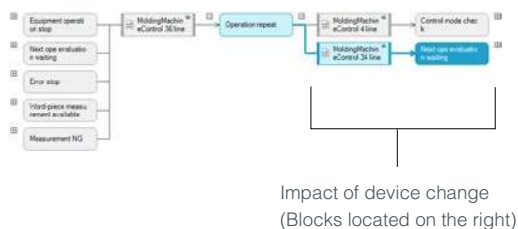
One-click startup

In replay mode, one-click launching is possible from the icon in the operation bar. The interface ensures ease of use when investigating causes.
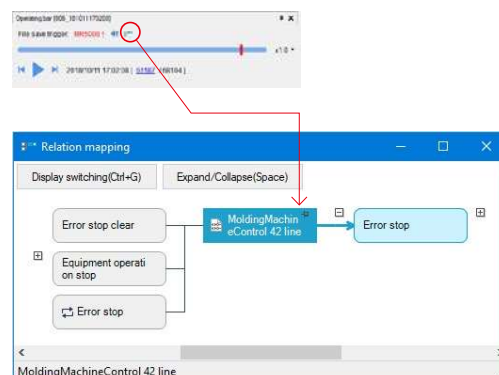
# Visual comparison of differences with normal operation status

When determining the cause of a problem is difficult, such as with sudden stops, waveform comparison makes it easy to visually identify causes by superimposing a normal waveform.
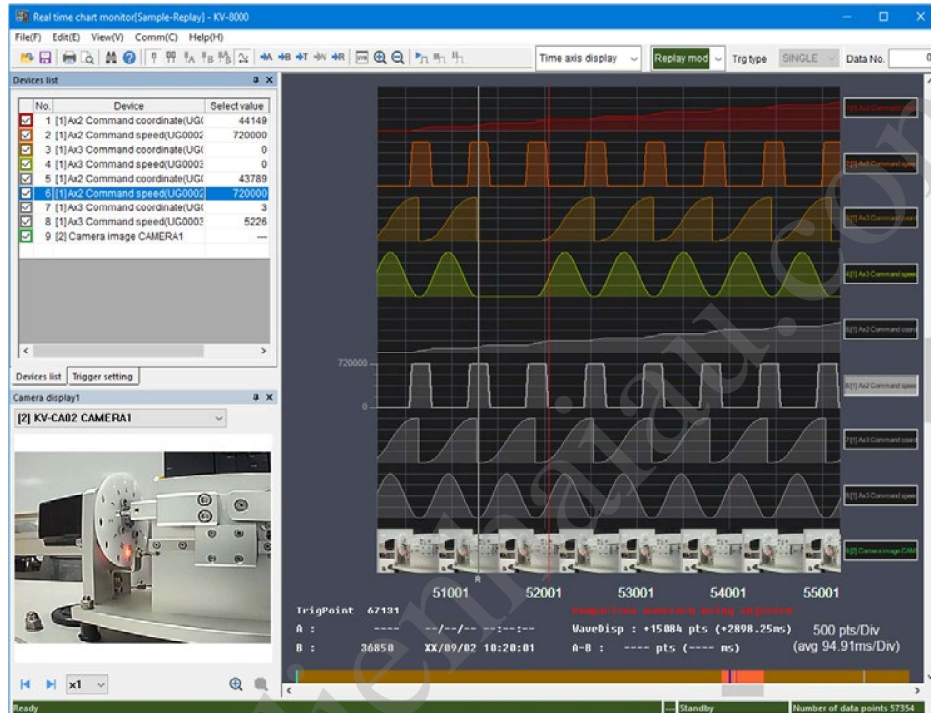
Simply load a file to compare the waveforms on the same screen.

CSV file and waveform comparison

The waveform data to use for comparison can be imported from a CSV file in addition to an RTCM format file and the operation record. This function can be used in a wide variety of applications including comparing waveforms of data logged using KV Series devices.

Operation recording

File import

RTCM

CSV
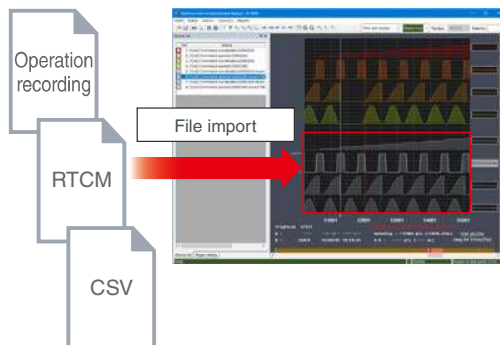
Easy-to-view waveform comparison

Overlapping waveforms for comparison makes it easy to determine differences in shape and to see deviations in timing through side-by-side comparison. The time axis of a waveform can be adjusted as desired for comparison.

Side-by-side waveform comparison

Overlapping waveform comparison
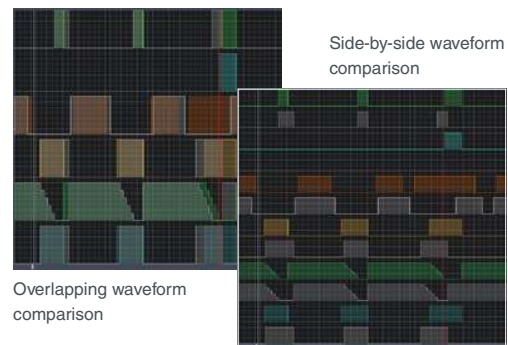
Quick identification of problems

From understanding the situation when a problem occurs to isolating the cause and taking the necessary countermeasures, the time it takes to resolve problems can be greatly reduced.

Problem 01

With no record for reference, it's not possible to know what's going on.

Did it just occur?

It might not happen even if I go...

Should we just wait and see?

Maintenance worker A

Problem details

❚ There's clearly a problem, but the problem doesn't occur during on-site inspection.

❚ Even when checking the device after the problem occurs, the device will have already been restarted, and no record of what happened will be available.

❚ Checking with the on-site operator might not provide a detailed account of the situation.

KV-8000 Solution

Automatic recording makes understanding the situation easy.

Reliable record for reproducing and checking what happened

The KV-8000 records data whenever a problem occurs, allowing users to analyse the occurrence by reviewing the data obtained. This ensures accurate understanding of the situation even for problems that do not occur frequently.

1 Transferring of operation record to PC

Equipment information from both before and after the problem

Operation recording
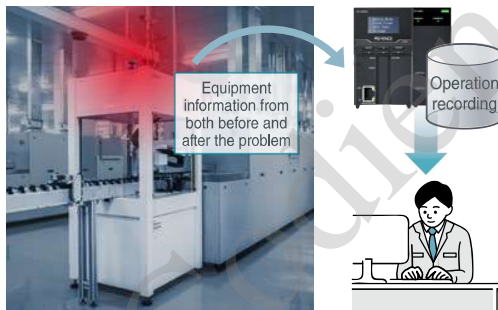
2 Reproducing the problem on a PC
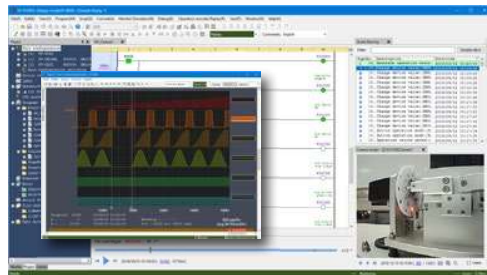
Automatic recording of various problems

Recording data both before and after an error or alarm signal, and recording according to the cycle start whenever the equipment cycle ends, makes it possible to reproduce the exact moment an error stop occurred. This helps in discovering a solution to the problem.

Comparing the situation both before and after the problem
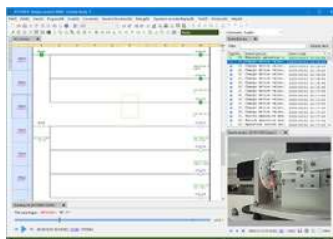
Playing back the recorded data makes it possible to compare how the situation changed.

Equipment cycle comparison
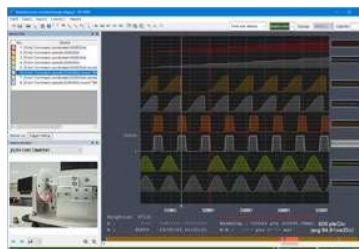
Subtraction comparison is used to compare equipment cycle waveforms.

Problem 02

Understanding programs created by others is difficult.

Problem details
- Every person or vendor has a unique way of writing programs and program rules.
- Tracking down related devices from a large number of programs can be difficult.

KV-8000 Solution

Analysing the cause is possible regardless of who created the program.

Extraction of only related devices

The devices related to an error can be extracted and automatically displayed in a tree diagram based on their relationships for easy visualisation. This makes it possible to track down relevant devices even without understanding each individual program.
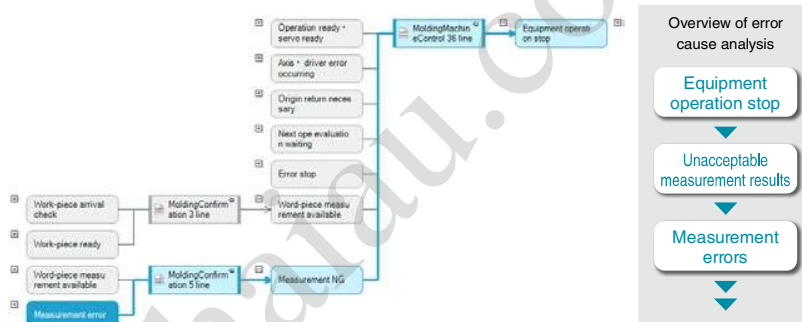

Overview of error cause analysis

Equipment operation stop

Unacceptable measurement results

Measurement errors

Problem 03

Determining the cause requires taking time for analysis.

Problem details
- Checking all of the possible problem points is time-consuming.
- Identifying the cause of the problem is difficult and depends on the skill of the inspector.

KV-8000 Solution

Reduce the time required for determining the cause.

Various functions for quickly narrowing down problems to mechanical, human, or program factors

Using the KV-8000 allows users to go back in time to the moment a problem occurs, review the situation using the camera, check the operation history, and analyse the software, ensuring efficient cause analysis from a single operation record.

1 Check for visible changes using the camera
Problems isolated to machine
Mechanical | Human | Program

2 Operation history event checking
Problems isolated to user
Mechanical | Human | Program

3 Software-based device change analysis
Problems isolated to program
Mechanical | Human | Program
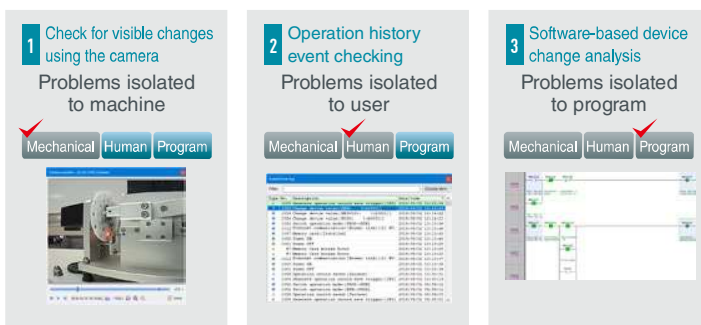
Fast debugging and startup

Efficiently respond to problems that arise in various situations after design, debugging, startup, or installation.

Problem 04

Obtaining accurate information is impossible without going to the site.

Did a machine break?

Did someone mess with it?

Is it a software bug?

Electrical designer B

Problem details

▮ The conditions for the problem are not clear even through consultation with the operator.

▮ The equipment is far away, meaning a business trip is required to analyse the situation accurately.

▮ Being properly prepared before getting to the site is important, but with no way of knowing the situation or any idea of the cause, deciding what preparations are required is impossible.

KV-8000 Solution

The ability to remotely reproduce the situation when the problem occurred improves response efficiency.
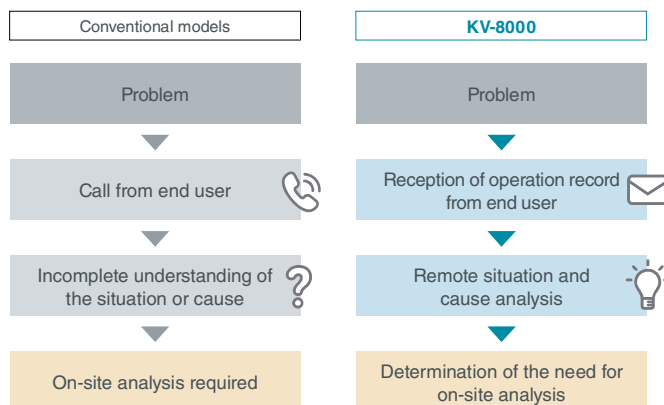
Accurate understanding of the situation without leaving the office

Delivery destinations for equipment are often remote, including overseas, making it difficult to get an accurate grasp of the situation by phone or email information when a problem occurs. The KV-8000 automatically records information from ladder programs, cameras, and events onto an SD card, enabling a thorough understanding of the device status just from the received data.

1 Automatic recording

Automatic recording of ladders, camera videos, and event information

2 Operation record forwarding

Factory → Office

3 Remote reproduction of the problem and situation

Limit the number of required trips, and ensure proper preparedness

The ability to reproduce the situation when the problem occurred without needing to be on site makes it possible to determine whether the situation can be rectified without the need for travel. If travelling to the site is necessary, only the necessary preparations can be made before departing, reducing overall labour hours.

Conventional models	KV-8000
Problem	Problem
Call from end user	Reception of operation record from end user
Incomplete understanding of the situation or cause	Remote situation and cause analysis
On-site analysis required	Determination of the need for on-site analysis

Determine the situation by linking the operation record and touch panel screen data without ever needing to be on-site.

Debugging and startup take time.

An error was generated, but the situation can't be reproduced.

Will the operation change if corrections are made?

Could it be the timing?

Production engineer C

Problem details

▌ Operation is normal when debugging, but problems occur after startup.

▌ Modifying a program could affect other parts, resulting in even more problems and taking even more time.

KV-8000 Solution

## Visualisation makes it possible to quickly investigate causes.

Comparison with a master waveform for fast identification of causes

Device information is recorded automatically, allowing for reduced cause analysis time by comparing a normal operation record during debugging and the operation record when a problem occurs.

1 Advance recording of normal equipment information

Operation recording

2 View differences using waveforms
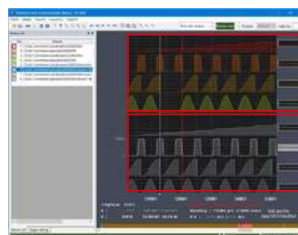
Waveform with problem occurrence

Normal waveform

Reduce correction errors during debugging

Debugging involves many fine modifications to programs, making it difficult to determine the ripple effect of every correction. Reviewing the scope of impact using the tree diagram and recording problems that arise allow users to quickly find the cause of any errors.

Check the impact of changes on the tree diagram

Visualise how much an impact can be expected.
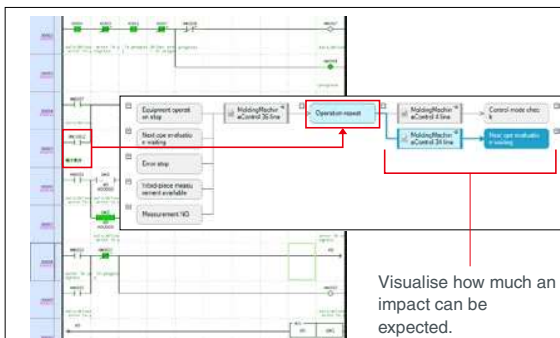
One-touch problem status recording

Trigger input

Recording

Not saved | Saved | Not saved
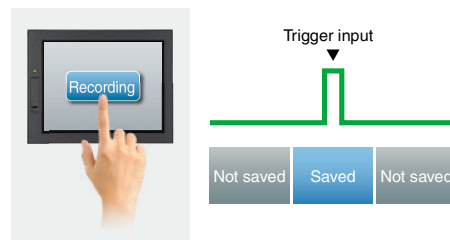
The KV-8000 constantly buffers equipment information, so data can be recorded as soon as the save trigger is input.

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Increase operation rate

Reducing equipment downtime is a key aspect to improving the rate of operations at a manufacturing site. Nevertheless, eliminating equipment stoppage all together is very difficult. This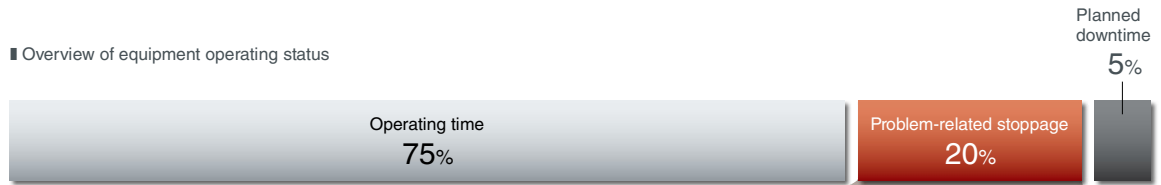 means predictive maintenance for preventing problems before they occur, and appropriate responses whenever a problem does occur (follow-up maintenance), have become important.

❚ Overview of equipment operating status

Planned downtime
5%

| Operating time 75% | Problem-related stoppage 20% | |

Main causes of equipment stoppage

Mechanical Factor   [Typical Problems]
- ❚ Wear of mechanical mechanisms
- ❚ False detection due to sensor deterioration
- ❚ Variations in workpiece shape

Human Factor   [Typical Problems]
- ❚ Incorrect workpiece loading
- ❚ Incorrect parameter settings
- ❚ Unexpected operation

Program Factor   [Typical Problems]
- ❚ Signal timing error
- ❚ Incorrect interlock
- ❚ Calculation error

Reducing equipment stoppage time

At manufacturing sites, problems generally fall under two categories: situations that can be prevented (advance handling) or events that cannot be prevented (follow-up handling). For events requiring follow-up handling, resolving the issue as quickly as possible is essential.

Advanced
Monitor signs to prevent problems beforehand

Follow-up
Solve problems that occur as quickly as possible

Predictive maintenance solutions

With the fastest processing speed in its class, the KV-8000 Series enables predictive maintenance by collecting large amounts of data for use in advanced analysis.

❚ Solution examples

Multivariate analysis (MT method)
- Analysis of abnormal situations
- Visualisations of items with greater influence

Frequency (FFT) analysis
- Bearing wear detection
- Cutting tool deterioration analysis

Waveform monitoring (guard band)
- Temperature profile monitoring
- Time-based monitoring of press pressure

Machine Operation Recorder function for reducing problem response time

The Machine Operation Recorder function can record and play back equipment information from both before and after a problem occurs, making it easy for all users to resolve the situation.

❚ Equipment information recording and linked playback

Ladder program

Camera

Waveform
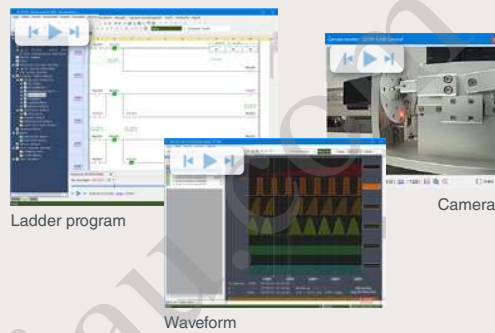
❚ Reduced work for improved efficiency and flexibility
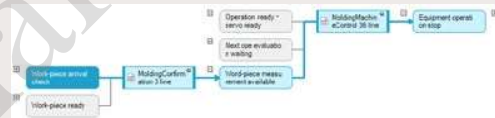
Mechanism for simplified analysis even of programs written by third parties

Application for visualising operation rate

The KV-8000 enables visualisation of the equipment's overall efficiency, operating status, and equipment stoppage factors from an on-site touch panel. This allows users to check changes in the operation rate quickly and easily.

Production Record

OEE / Loss analysis

Pareto alarm chart

Various functions to assist in problem-solving

Support for various applications with up to four configurations

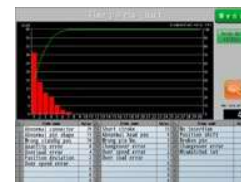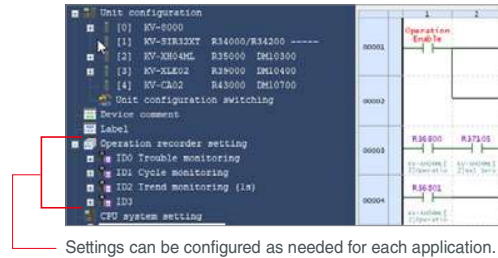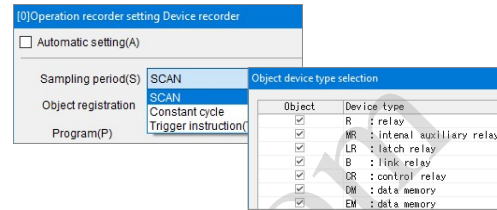Up to four IDs can be used with the Machine Operation Recorder function. This enables not only data recording before and after a problem occurs but also various applications, such as cycle monitoring or trend monitoring with longer sampling cycles.

Settings can be configured as needed for each application.

Highly reliable industrial SD card

KEYENCE offers high-reliability SLC-type SD cards. These cards are ideal for use with the Machine Operation Recorder function, as the equipment information recorded when a problem occurs, which tends to be excessive and indispensable.

KV-M16G

KV-M4G

What is SLC?

SLC is the abbreviation for single-level cell, where 1 bit of data is stored in a single cell. This ensures data is saved at a high quality.

Customisable recording settings

With the ability to change the sampling cycle timing as desired, to narrow down the number of recording devices, to extend the recording time, and to change recording settings as desired, the KV-8000 can be used in a wide variety of applications.

Freely split and save operation records

The operation record can be saved not only as separate files with a specified file sized but also for any specific period of time. Data can be sent to equipment designers as an e-mail attachment directly after a problem occurs.
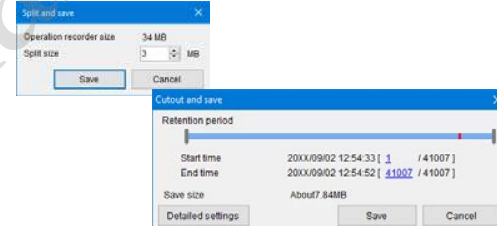
KV REPLAY VIEWER software for replay mode

KV REPLAY VIEWER is special software that enables playback and analysis of the operation record even without using KV STUDIO. With no risk of programs being rewritten, the software is ideal for maintenance work.

∎ Supported modes

Editor	Monitor	Online Edit
Simulator	Simulator Edit	**Replay**
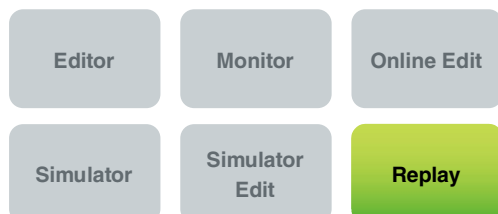
Replay linking with touch panel screens

With linking in replay mode, device changes and bit ON/OFF statuses can be viewed as touch panel screen data. The availability of a screen for confirming startup operation makes it easier to understand the situation faster.

Replay VT Viewer

Replay mode
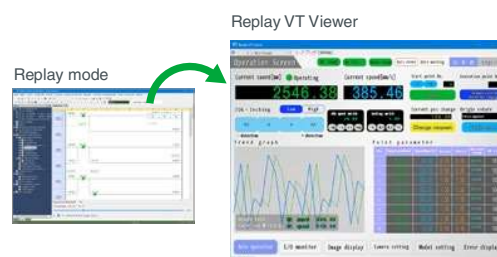
Device change-point searching

Search for device changes in chronological order. In addition, because the replay position can be changed from the search results for the change point, factor analysis can be performed with greater efficiency.

▌ Bit device

▌ Word device
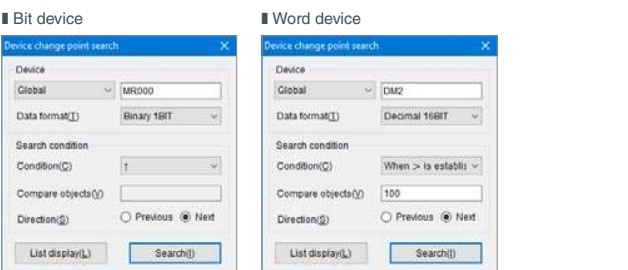
FTP uploading of operation record

Using preset function blocks allows the operation record to be uploaded to a PC via FTP. This enables immediate analysis whenever a problem occurs without ever having to be on-site.

▌ Parameter setting

▌ FTP transmission (by folder)
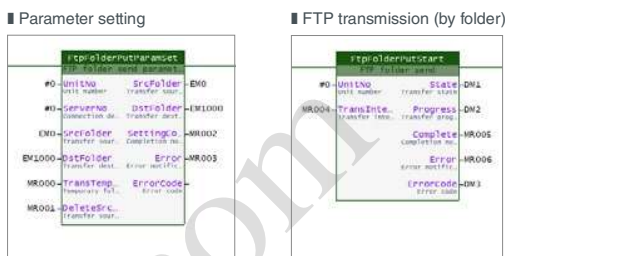
Camera

Strong global shutter for capturing moving objects

The adoption of a global shutter enables exposure and capturing of all pixels at the same time. This ensures the high-speed movement of mechanical mechanisms can be captured with no blurring, eliminating the possibility of missing momentary changes.

Support for hot-swapping during operation

Cameras can be removed freely from the camera input unit even while power is being supplied. In addition, because the unit remains powered, any camera installed later can also be used immediately just by connecting it to the unit.

Video adjustment from the touch panel

Video adjustments such as quality and exposure can be performed not only from KV STUDIO but also from VT5 Series devices. A dedicated screen ready for use without drafting ensures adjustments can be made efficiently at startup.

[Video adjustment settings]
▌ Exposure
▌ White balance
▌ Image quality
▌ Contrast
▌ Sharpness
▌ Screen orientation
 (180° rotation)

IP65F rating

The IP65F rating signifies a waterproof and oilproof construction. This device can be used with peace of mind even in the harshest production environments.

File saving of camera data

Convert recorded camera data into video files or image files. These files can be used when contacting remote users and for reporting problems.

Camera data

Save any information at any size

avi

jpg

High-performance PLC for improved equipment performance
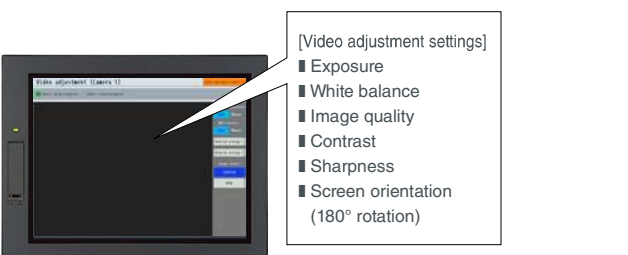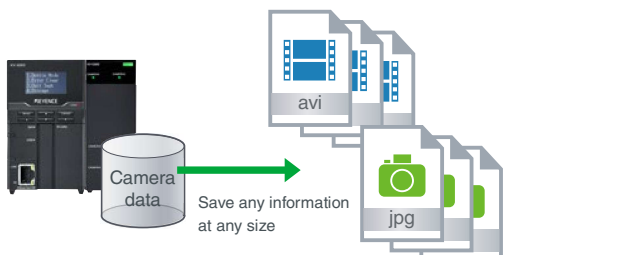
KEYENCE's high-performance PLC system is ideal for a variety of equipment control situations.

S-Unit   **X-Unit**

KV-X MOTION

High-speed and high-accuracy control that is the best in the industry

X-Unit

Positioning/motion unit with
MECHATROLINK-III compatibility

**KV-XH16ML/
KV-XH04ML**

MECHATROLINK

SV2 SERIES

AC servo system with
MECHATROLINK-III support

SV2-xxxL2

MECHATROLINK

FASTEST IN CLASS

▌ Motion control period of 125 µs for five axes

With a motion control–dedicated Dual Core CPU and
MECHATROLINK-III compatibility, KV-X MOTION
ensures the fastest control period in its class.

Internal SoC

Dual Core CPU

1 GHz Core	Parallel Processing	1 GHz Core
• Axis control calculation processing • Parameter management		• Axis control calculation processing • Unit program processing

CPU inner bus slave
• High-speed communication with the CPU unit
• Buffer memory access

MECHATROLINK-III master
• High-speed communication with the servo amplifier

▌ High-speed response

Start motors at high speed through
autonomous decentralised control with the
unit, and with high-speed bus
communication with the CPU.

Comparison of time between CPU unit input
and servo motor movement

Conventional models

| (1) 1 ms | (2) 1 ms | (3) 3 ms | (4) 1 ms | 6.3 ms |

(5) 0.3 ms

KV-XH16ML

| (1) 1 ms | 1.5 ms | ← **4× faster than conventional models** |

0.5 ms for (2) to (5) [0.125 ms per step]

(1) Scan time (2) Control period
(3) Unit internal processing
(4) Communication time
(5) Servo internal processing

▌ High accuracy

With the fastest control period among
similar products, KV-X MOTION boasts
powerful control required for position
instruction accuracy.

Position instruction accuracy comparison

Conventional models — Control period — 1 ms → Time

▼ **8× faster than conventional models**

KV-XH16ML — Control period — 0.125 ms → Time

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KV-X COM

X-Unit

Ethernet unit
KV-XLE02

EtherNet/IP **EtherCAT**
CC-Link IE Field **PROFINET**

▌Program-less communication with over 100 PLC models INDUSTRY FIRST

KV-X COM is compatible with PLC link functionality for use with PLCs from various vendors, and with four major global industrial Ethernet technologies. Easily link data and utilise visualisations with new and old equipment alike.

PLC link function
▌Ethernet
▌Serial

PLCs from various vendors

KV-X COM

Industrial Ethernet
▌EtherNet/IP®
▌EtherCAT®
▌CC-Link IE Field
▌PROFINET

PLCs from various vendors
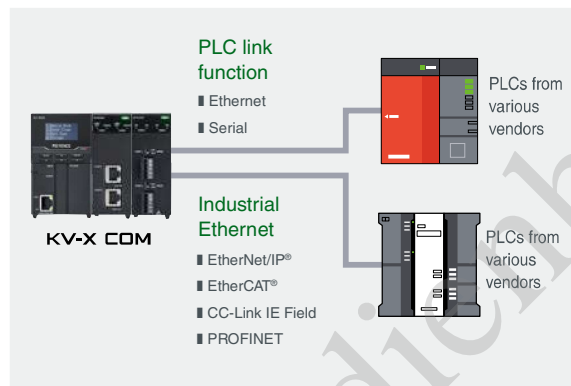
X-Unit

Serial communication unit
**KV-XL202 /
KV-XL402**

**RS-232C
RS-422A/RS-485**

▌Ladder-less communication with everything from measurement systems to robots

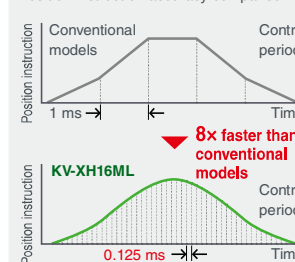Communicate with third-party devices without the need for bothersome communication programs, including for command definition and for processing when sending/receiving commands. This drastically reduces the amount of time needed for communication setting work.

▌Devices that support presets with Ethernet communication

Category	Vendor/protocol name
Sensor/displacement sensor/ measurement system	KEYENCE
Image processing system	
2D code/barcode reader	
Laser marker/inkjet printer	
Recorder	
Temperature adjuster	RKC Instrument
	Yokogawa
	Azbil
Inverter	Mitsubishi
Industrial robot	YASKAWA
	FANUC
	EPSON
	YAMAHA
	DENSO
General-purpose protocol	Modbus/TCP
	SLMP

CPU KV-8000

▌PLC-specific SoC for higher performance
FASTEST IN CLASS

By speeding up the core clock as well as simultaneous execution of multiple instructions, basic instruction execution speeds of 0.96 ns—the fastest among similar products—are possible.

High-speed performance

Ladder execution engine

Ultra-high-speed CPU inner bus

Dedicated control CPU

Responsiveness

Stability

PLC-specific SoC
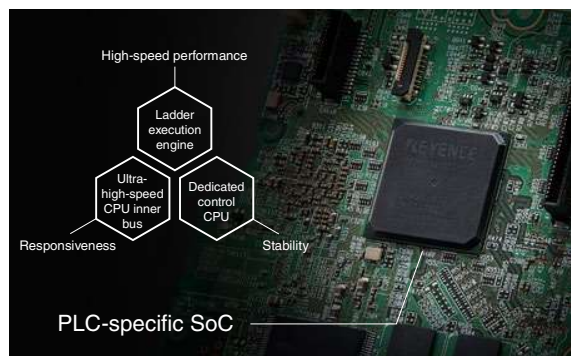
▌Bus system that enables both high-speed performance and synchronisation

The CPU inner bus ensures large-capacity bus communication and responsiveness such as unit interrupt, enabling high-speed and high-accuracy control.

Highly accurate synchronisation between units

Ultra-high-speed CPU inner bus
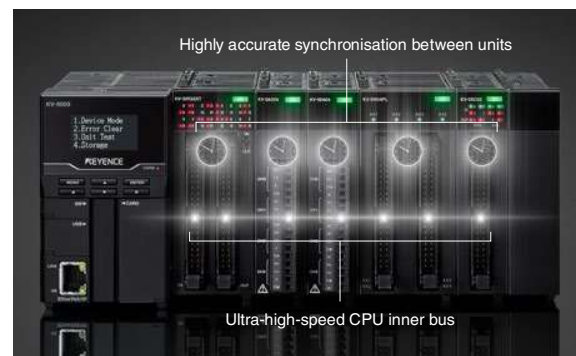
System configuration diagram

∎ Unit configuration

CPU unit	KV-8000/7000 Series expansion unit	Bus-connected unit	KV-5000/3000 Series expansion unit
KV-8000	**KV-CA02**	**KV-7000C**	

Industrial SD card
KV-M16G (16 GB)
KV-M4G (4 GB)

Compact standard camera
KV-CA1H

Wide field and high-resolution camera
KV-CA1W

Camera cable
KV-C5 (5 m)
KV-C10 (10 m)
KV-C20 (20 m)

∎ Related products

CPU unit

Calendar clock retention battery
KV-B1

AC power supply unit with error output
KV-PU1

Camera

Mounting adapter
OP-88386

Adjustable bracket
OP-88387

Used for mounting on a stand.
(Stand must be separately prepared.)

Adjust the orientation vertically or horizontally as desired.
(Separately prepare a support pole with a diameter of 12 mm.)

∎ Camera field of view

Compact standard camera
KV-CA1H

Wide field and high-resolution camera
KV-CA1W

Horizontal field of view

232 mm
200 mm

Vertical field of view
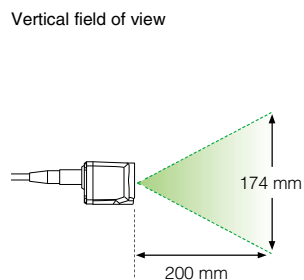
174 mm
200 mm

Horizontal field of view

Approx. 180°

Vertical field of view

Approx. 150°
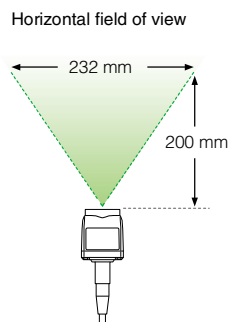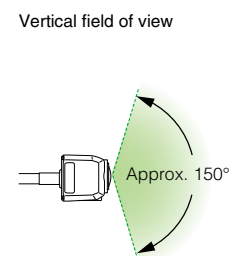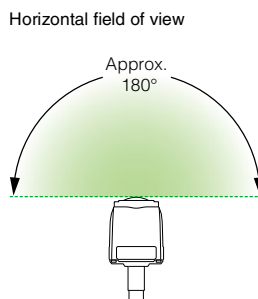
KV-8000 Specifications

■ General specifications

Item	Specifications	
System configuration	System configuration using an expansion unit for KV-5000/3000 Series	System configuration using an only expansion unit for KV-8000/7000 Series
Power voltage	24 VDC (±10%)	24 VDC (-15% +20%)
Operating ambient temperature	0 to +50°C*1 *2 (no freezing)	0 to +55°C*1 *2 (no freezing)
Operating ambient humidity	10 to 95% RH*1 (no condensation)	5 to 95% RH*1 (no condensation)
Ambient storage temperature	-20 to +70°C*1	-25 to +75°C*1
Ambient storage humidity	10 to 95% RH*1 (no condensation)	5 to 95% RH*1 (no condensation)
Operating environment	No dust or corrosive gas	
Operating altitude	2000 m or less	
Pollution degree	2	
Overvoltage category	I (II when using KV-PU1)	
Noise immunity	1500 Vp-p or more; pulse duration: 1 μs, 50 ns (based on noise simulator); IEC standard-compliant (IEC61000-4-2/3/4/6)	
Withstand voltage	1500 VAC for one minute (between the power terminals and the I/O terminals, and between the external terminals and the case)	
Insulation resistance	50 MΩ or more (between the power terminals and the I/O terminals and between the external terminals and the case, with 500 VDC megohmmeter)	

Vibration resistance		Intermittent vibration			Scan times
	Compliant with JIS B 3502 and IEC61131-2	Frequency	Acceleration	Half amplitude	10 times in each of X, Y, and Z directions (for 100 min.)
		5 to 9 Hz	–	3.5 mm	
		9 to 150 Hz	9.8 m/s²	–	
		Continuous vibration			
		Frequency	Acceleration	Half amplitude	
		5 to 9 Hz	–	1.75 mm	
		9 to 150 Hz	4.9 m/s²	–	

Shock resistance	Acceleration: 150 m/s², Application time: 11 ms, 2 times in each of the X, Y, and Z directions
Internal current consumption*3	400 mA or less
Weight	KV-8000: Approx. 340 g, KV-B1 (battery): Approx. 10 g

*1 Guaranteed range in which the system can be used.
*2 Specified according to the temperature in the control panel on the lower side of the unit.
*3 The maximum current consumption is 3.2 A when using the expansion unit.

■ Performance specifications

Model		KV-8000
Calculation control method		Program storage method
I/O control method		Refresh method
Programming language		Expanded ladder, KV Script, mnemonic
Number of commands	Basic instruction	80 classes, 181 instructions
	Application instruction	50 classes, 67 instructions
	Calculation instructions	125 classes, 318 instructions
	Expansion instructions	77 classes, 132 instructions
	Total	332 classes, 698 instructions
Instruction execution speed	Basic instruction	Min. 0.96 ns
	Application instruction	Min. 5.75 ns
	Double precision floating-point instruction	Min. 58 ns
CPU memory capacity		64 MB
Program capacity		Approx. 1500 k steps
Maximum number of units to be installed		16 units (KV-8000/7000 Series expansion unit only), 48 units (KV-8000/7000 Series expansion unit, KV-5000/3000 Series expansion unit (when extension unit (KV-EB1) is used))
Maximum number of I/O points		Maximum 3072 points for expansion (KV-EB1S/KV-EB1R: 2 units used, 64-point unit used)

Bit device	Input relay	R	Total 32000 points 1 bit
	Output relay		
	Internal auxiliary relay		
	Link relay	B	32768 points 1 bit
	Internal auxiliary relay	MR	64000 points 1 bit
	Latch relay	LR	16000 points 1 bit
	Control relay	CR	1280 points 1 bit
Word device	Timer	T	4000 points 32 bits
	Counter	C	4000 points 32 bits
	Data memory	DM	65535 points 16 bits
	Expansion data memory	EM	65535 points 16 bits
	File register — Current bank	FM	524288 points 16 bits
	File register — Dial mode	ZF	
	Link register	W	32768 points 16 bits
	Temporary memory	TM	512 points 16 bits
	Index register	Z	12 points 32 bits
	Control memory	CM	7600 points 16 bits

Number of comments/labels stored in main unit	Device comment	Approx. 224000
	Label	Approx. 285000
Power off hold function	Program memory	Flash ROM can be written 10000 times
	Device	Nonvolatile RAM
	Calendar clock	Backup capacitor lasts approx. 15 days (at 25°C) (Approx. 5 years with KV-B1 (battery) (at 25°C))
Self-diagnosis function		CPU error, RAM error, and other problems

■ Functional socket

Model	No. of sockets		Port number
	TCP	UDP	
PC application*1	16	0	8500 (set within the range of 1 to 65535)
Upper link communication*2*3	Total	1	8501 (set within the range of 1 to 65535)
MC protocol communication*2*3	15	1	5000 (set within the range of 1 to 65535)*4
VT connection	0	1	8502 (set within the range of 1 to 65535)
FTP server	4	–	20, 21
Automatic clock data adjustment	–	1	123
E-mail transmission (SMTP, POP3)	2	–	25, 110
DNS	–	1	53
FTP client	2	–	20, 21 (set within the range of 1 to 65535)
EtherNet/IP® cyclic communication function	Total	1	2222
EtherNet/IP® message communication function	320	1	44818
KV socket communication	Total 16		Arbitrary value (set within the range of 1 to 65535)

*1 Camera monitoring via KV STUDIO, KV COM+, or VT5   *2 TCP socket and UDP socket can be used simultaneously.
*3 Up to 15 TCP sockets can be used.   *4 Port numbers can be set to TCP socket and UDP socket individually.

■ EtherNet/IP® communication specifications

Item				Specifications
Supported transmission rates				100BASE-TX
CIP service	Cyclic communication	Number of connections		256*1
		RPI (communication cycle)		0.5 to 10000 ms (0.5 ms unit); Can be set by connection. (Refresh line data at a set frequency regardless of the number of nodes)
		Transmission trigger	Output to adapter	Cyclic
			Input from adapter	Cyclic/Change Of State*2
		Allowable band for cyclic communication	(at 504 bytes)	10000 (pps)*3
			(at 1444 bytes)	5000 (pps)*3
		Maximum number of refresh words		16 k words
		Maximum data size for 1 connection*4		504 bytes or 1444 bytes
		Multicast filtering function*5		Provided (IGMP client function)
	Message communication	Class 3 (connection type)	Server	Number of connections: 256*6
		UCMM (non-connection type)	Client	Number of simultaneous actions: 32
			Server	Number of simultaneous actions: 96
EtherNet/IP® conformance test				Compliant with CT15

*1 In total, the number of connections used for the message communication function in Class 3 (connection type) should be a maximum of 256.   *2 Can communicate with devices that output data using the Change Of State (Send data when any change occurs) method.   *3 Abbreviation of "packet per second", indicating the number of sent/received packets processed per second.   *4 Data synchronism in connections is guaranteed. Also, when using 505 bytes or more, the device used must support Large Forward Open (an optional CIP specification).   *5 The included IGMP client function allows the KV-8000 to filter out unnecessary multicast packets by using an Ethernet switch that supports IGMP snooping.   *6 In total, the number of connections used for the cyclic communication function should be a maximum of 256. The KV-8000 supports Class 3 (connection type) tag specifications.

Specifications

▌General specifications - KV-CA02 -

Item	Specifications	
System configuration	System configuration using an expansion unit for KV-5000/3000 Series	System configuration using an only expansion unit for KV-8000/7000 Series
Power voltage	24 VDC (±10%) *3	24 VDC (-15% +20%) *3
Operating ambient temperature	0 to +50°C (no freezing)*1 *2	0 to +55°C (no freezing)*1 *2
Operating ambient humidity	10 to 95% RH (no condensation)*1	5 to 95% RH (no condensation)*1
Ambient storage temperature	-20 to +70°C*1	-25 to +75°C*1
Ambient storage humidity	10 to 95% RH (no condensation)*1	5 to 95% RH (no condensation)*1
Operating environment	No dust or corrosive gas	
Operating altitude	2000 m or less	
Pollution degree	2	
Noise immunity	1500 Vp-p or more; pulse duration: 1 µs, 50 ns (based on noise simulator); IEC standard-compliant (IEC61000-4-2/3/4/6)	
Withstand voltage	1500 VAC for one minute (between the power terminals and the I/O terminals, and between the external terminals and the case)	
Insulation resistance	50 MΩ or more (between the power terminals and the I/O terminals and between the external terminals and the case, with 500 VDC megohmmeter)	

Vibration resistance:

		Intermittent vibration		Scan times
Compliant with JIS B 3502 and IEC61131-2		Frequency	Acceleration	Half amplitude	10 times in each of X, Y, and Z directions (for 100 min.)
	Frequency	Acceleration	Half amplitude	
	5 to 9 Hz	–	3.5 mm	
	9 to 150 Hz	9.8 m/s²	–	
	Continuous vibration			
	Frequency	Acceleration	Half amplitude	
	5 to 9 Hz	–	1.75 mm	
	9 to 150 Hz	4.9 m/s²	–	

Shock resistance	Acceleration: 150 m/s², Application time: 11 ms, 2 times in each of the X, Y, and Z directions

*1 Guaranteed range in which the system can be used.
*2 Specified according to the temperature in the control panel on the lower side of the unit.
*3 Supplied via the CPU unit or expansion unit.

▌General specifications - KV-CA1H/CA1W -

Item	Specifications
Operating ambient temperature	0 to +50°C (no freezing)
Operating ambient humidity	35 to 85% RH (no condensation)
Ambient storage temperature	-20 to +60°C (no freezing)
Ambient storage humidity	35 to 85% RH (no condensation)
Pollution degree	3
Vibration resistance	10 to 500 Hz Power spectral density: 0.033 G²/Hz, Directions of X, Y, and Z
Enclosure rating	IP65F*1 *2

*1 The enclosure rating is evaluated with the camera cable connected.
*2 "F" signifies evaluation as oilproof per JIS C 0920.

▌Performance specifications - KV-CA02 -

Model	KV-CA02
Connectable CPU unit	KV-8000
Maximum number of connected units	4
Number of ports	2
Supported camera models	KV-CA1H (Compact standard camera) KV-CA1W (Wide field and high-resolution camera)
Cable length	5/10/20 m*1
Recording time	Approx. 3 minutes*2
Internal current consumption	260 mA or less*3
Weight	Approx. 190 g

*1 Lengths of the KV-C5/C10/C20 camera cables.
*2 Record time for one KV-CA1H with the following configuration of settings (initial value).
The actual recording time varies depending on the number of devices, the frame rate, and the image quality settings. Frame rate: 30 fps / Quality: 3
In addition, the recorded video is cleared when the power is turned off.
*3 Internal current consumption for the KV-CA02 only. Connecting a camera adds the internal current consumption of the connected camera.

▌Performance specifications - KV-CA1H/CA1W -

Model	KV-CA1H	KV-CA1W
Installation distance	200 mm to ∞	100 mm to ∞
Focal distance	3.8 mm (fixed)	1.05 mm (fixed)
Field of view	Horizontal viewing angle: Approx. 60° Vertical viewing angle: Approx. 47°	Horizontal viewing angle: Approx. 180° Vertical viewing angle: Approx. 150°
Image receiving element	1/2.9 inch colour CMOS	
Resolution	640 (H) × 480 (V)	1280 (H) × 960 (V)
Frame rate	10/30/120 fps	10/30 fps
Internal current consumption*1	70 mA or less	
Weight	Approx. 90 g	Approx. 140 g

*1 Maximum current consumption inside the camera when the power supplied to the CPU unit is 24 VDC (-15%/+20%). The maximum current consumption inside the camera is 120 mA when the unit power supplied to the camera is 12 to 24 VDC (-10%/+20%).

Dimensions

Unit: mm

▌CPU unit
KV-8000
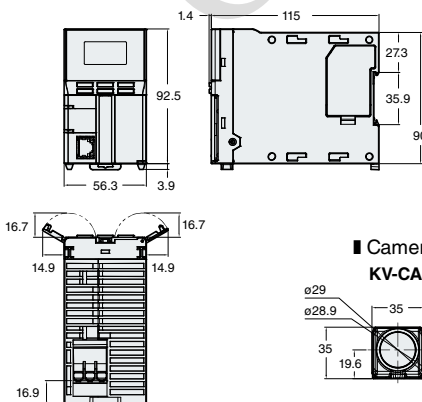
▌Camera input unit
KV-CA02

▌Camera
KV-CA1H

KV-CA1W

List of Component Devices

■ KV-8000 Series

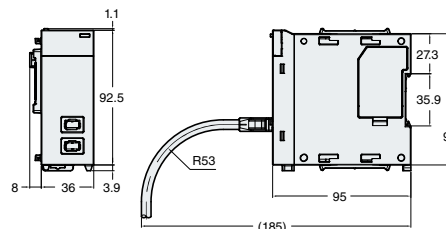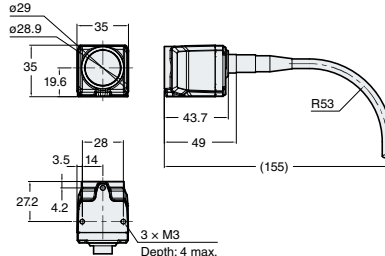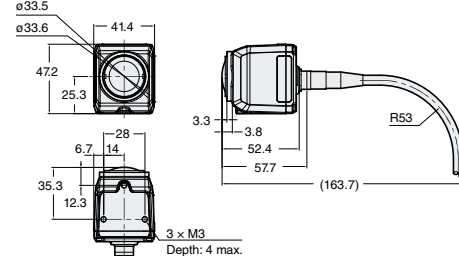| Category	Item name	Model	Functions/Specifications	KV-7000C required
CPU	CPU unit	**KV-8000**	Program capacity: 1500 k steps, LD command processing speed: 0.96 ns Machine Operation Recorder function EtherNet/IP® port, USB port (USB 2.0), CPU inner bus	–
Camera	Camera input unit	KV-CA02	2 ports, for use with KV-CA1x	–
	Compact standard camera	KV-CA1H	Colour camera, Resolution: 640 (H) × 480 (V), Frame rate: 10/30/120 fps	–
	Wide field and high-resolution camera	KV-CA1W	Colour camera, Resolution: 1280 (H) × 960 (V), Frame rate: 10/30 fps	–
	Camera cable	KV-C5	Cable length: 5 m	–
		KV-C10	Cable length: 10 m	–
		KV-C20	Cable length: 20 m	–
	Mounting adapter	OP-88386	Mounting stand	–
	Adjustable bracket	OP-88387	For pole-mounting	–
I/O	Input Unit	KV-B16XC	16 points, 24/5 VDC switchable, screw terminal block	✓
		KV-C32XC	32 points, 24/5 VDC switchable, 34-pin MIL connector × 1	✓
		KV-C64XC	64 points, 24 VDC, 34-pin MIL connector × 2, compatible with 2-wire sensor	✓
	Output Unit	KV-B8RC	8 points, relay (independent common), screw terminal block	✓
		KV-B16RC	16 points, relay, screw terminal block	✓
		KV-B16TC	16 points, transistor (sink), screw terminal block	✓
		KV-B16TD	16 points, MOSFET (sink), with overcurrent protection function, screw terminal block	✓
		KV-B16TCP	16 points, transistor (source), screw terminal block	✓
		KV-C32TC	32 points, transistor (sink), 34-pin MIL connector × 1	✓
		KV-C32TD	32 points, MOSFET (sink), with overcurrent protection function, 34-pin MIL connector × 1	✓
		KV-C32TCP	32 points, transistor (source), 34-pin MIL connector × 1	✓
		KV-C64TC	64 points, transistor (sink), 34-pin MIL connector × 2	✓
		KV-C64TD	64 points, MOSFET (sink), with overcurrent protection function, 34-pin MIL connector × 2	✓
		KV-C64TCP	64 points, transistor (source), MIL connector 34 pins × 2	✓
	High-speed I/O Unit	KV-SIR32XT	32 inputs + 32 outputs, 24/5 VDC switchable, 40-pin MIL connector ×2 Unit interrupt, inter-unit synchronisation, with overcurrent protection function	–
	I/O unit	KV-B8XTD	8 inputs + 8 outputs, MOSFET (sink), with overcurrent protection function, screw terminal block	✓
		KV-C16XTD	16 inputs + 16 outputs, MOSFET (sink), with overcurrent protection function, 34-pin MIL connector × 1	✓
Analogue	High-speed analogue input unit	KV-SAD04	Voltage, current input 4 ch; conversion speed: 10 μs/ch; Resolution: 1/20000; conversion precision: 0.1% (at 25°C ±5°C), unit interrupt, inter-unit synchronisation	–
	High-speed analogue output unit	KV-SDA04	Voltage, current output 4 ch; conversion speed: 10 μs/ch; Resolution: 1/20000; conversion precision: 0.1% (at 25°C ±5°C), unit interrupt, inter-unit synchronisation	–
	Analogue I/O unit	KV-AM40V	Voltage, current input 2 ch + Voltage, current output 2 ch; conversion speed: 80 μs/ch; Resolution: 1/8000, conversion precision: ±0.2% of F.S. (at 25°C)	✓
Temperature	Multi-input unit	KV-TP40	Thermocouple and platinum resistance thermometer, voltage, current input: 4 ch; conversion speed: 50 ms/4 ch; insulation between channels	✓
	Temperature control unit	KV-TF40	Thermocouple and platinum resistance thermometer input: 4 ch; PID automatic calibration	✓
Positioning/ Motion	Simplified wiring type Positioning/motion unit	KV-XH16ML	MECHATROLINK-III communication, 16 axes Position control, speed control, torque control, linear interpolation, arc interpolation, helical interpolation, and synchronous control, unit interrupt, inter-unit synchronisation, application package	–
		KV-XH04ML	MECHATROLINK-III communication, 4 axes Position control, speed control, torque control, linear interpolation, arc interpolation, helical interpolation, and synchronous control, unit interrupt, inter-unit synchronisation, application package	–
Positioning/ High-speed counter	High-speed positioning unit	KV-SH04PL	Pulse train, 4-axis, position control, linear interpolation, unit interrupt, and inter-unit synchronisation	–
	Communication positioning unit	KV-LH20V	Modbus RTU communication, max. 8 axes Manufacturers of compatible devices: KEYENCE; IAI Corporation; ORIENTAL MOTOR Co., Ltd.; SMC Corporation	✓
	High-speed counter unit	KV-SSC02	2 ch, Max. input frequency: 16 MHz (2 phases quadruple), unit interrupt, inter-unit synchronisation	–
Network	Ethernet Unit	KV-XLE02	2 ports; support for EtherNet/IP®, EtherCAT® (slave), CC-Link IE Field (intelligent device station), and PROFINET (device); 1000BASE-T/100BASE-TX/10BASE-T; PLC link function; PROTOCOL STUDIO mode; FTP client/server function; KV sensor network compatibility; KV socket communication; unit interrupt; inter-unit synchronisation	–
	Serial Communication Unit	KV-XL202	2 ports (RS-232C), PLC link Function, PROTOCOL STUDIO mode, Modbus master/slave	–
		KV-XL402	2 ports (RS-422A/485), PLC link Function, PROTOCOL STUDIO mode, Modbus master/slave	–
	KL-LINK unit	KL-N20V	Communication speed 5 Mbps, remote I/O mode, PLC link mode	✓
	CC-Link unit	KV-CL20	CC-Link Ver. 2.0, communication speed: 10 Mbps, master unit, master unit (duplex), standby master unit, local station	✓
	DeviceNet® unit	KV-DN20	Communication speed 500 kbps, master mode, slave mode, master & slave mode	✓
	FL-net unit	KV-FL20V	FL-net (OPCN-2) Ver. 2.00 compatible, 100BASE-TX/10BASE-T	✓
	High-speed multi-link unit	KV-LM21V	High-speed multi-link (for connection to VT Series), serial PLC link	✓
Network related	EtherNet/IP® support Communication unit	NU-EP1	N-bus supported, PoE supported	–
		DL-EP1	D-bus supported	–
	EtherNet/IP® support Ethernet switch	NE-Q05P	5 ports, 24 VDC, QoS function, PoE function	–
		NE-Q05	5 ports, 24 VDC, QoS function	–
Power supply	AC power supply unit with error output	KV-PU1	Output capacity: 1.8 A; Relay output: rated load of 24 VDC, 0.5 A	–
Bus extension	Extension unit	KV-EB1	3 layers (when 1 m extension cable is used, max. 48 units are connectable) 2 layers (when 2 m extension cable is used, max. 32 units are connectable)	✓
	Extension cable	OP-42141	2 m, can use 1 per system	–
		OP-42142	1 m, can use 2 per system	–
Connection conversion	Bus-connected unit	KV-7000C	For connection of a KV-5000/3000 Series expansion unit, with end unit	–
Related products	Battery	KV-B1	For calendar clock saving, mounted to battery case on front of CPU	–
	SD memory card	KV-M16G	SDHC standard, industrial specification, 16 GB	–
		KV-M4G	SDHC standard, industrial specification, 4 GB	–

List of Component Devices

▌KV-8000 Series

Category	Category/Item name		Model	Functions/Specifications
Remote I/O	EtherNet/IP®	Communication unit	KV-EP02	2 ports, EtherNet/IP®, 100BASE-TX/10BASE-T
		I/O unit (Connector)	KV-NC16EX	16 points, 24/5 VDC switchable, 20-pin MIL connector × 1
			KV-NC16EXE	16 points, 24/5 VDC switchable, European terminal block
			KV-NC32EX	32 points, 24/5 VDC switchable, 34-pin MIL connector × 1
			KV-NC8ER	8 points, relay output, European terminal block
			KV-NC16ET	16 points, transistor (sink) output, 20-pin MIL connector × 1
			KV-NC16ETP	16 points, transistor (source) output, 20-pin MIL connector × 1
			KV-NC16ETE	16 points, transistor (sink) output, European terminal block
			KV-NC16ETPE	16 points, transistor (source) output, European terminal block
			KV-NC32ET	32 points, transistor (sink) output, 34-pin MIL connector × 1
			KV-NC32ETP	32 points, transistor (source) output, 34-pin MIL connector × 1
			KV-NC16EXT	16 inputs/16 outputs, transistor (sink) output, 34-pin MIL connector × 1
			KV-NC32EXT	32 inputs/32 outputs, transistor (sink) output, 34-pin MIL connector × 2
		I/O unit (Terminal block)	KV-N8EX	8 points, 24/5 VDC switchable, screw terminal block
			KV-N16EX	16 points, 24/5 VDC switchable, screw terminal block
			KV-N8ER	8 points, relay output, screw terminal block
			KV-N8ET	8 points, transistor (sink) output, screw terminal block
			KV-N8ETP	8 points, transistor (source) output, screw terminal block
			KV-N16ER	16 points, relay output, screw terminal block
			KV-N16ET	16 points, transistor (sink) output, screw terminal block
			KV-N16ETP	16 points, transistor (source) output, screw terminal block
			KV-N8EXR	8 inputs/8 outputs, relay output, screw terminal block
			KV-N8EXT	8 inputs/8 outputs, transistor (sink) output, screw terminal block
		Analogue unit (Connector/terminal block)	KV-NC4AD	Voltage, current input 4 ch; conversion speed: 80 µs/ch; Resolution: 1/4000; conversion precision: 0.3% (at 25°C ±5°C); European terminal block
			KV-NC2DA	Voltage, current output 2 ch; conversion speed: 80 µs/ch; Resolution: 1/4000; conversion precision: 0.3% (at 25°C ±5°C); European terminal block
			KV-N3AM	Voltage, current input 2 ch / Voltage, current output 1 ch; conversion speed: 80 µs/ch; Resolution: 1/4000; conversion precision: 0.3% (at 25°C ±5°C); screw terminal block
		Temperature input unit	KV-NC4TP	Thermocouple and platinum resistance thermometer 4 ch, conversion speed: 125 ms/ch, European terminal block
		Connection conversion unit	KV-NC1	For connecting screw terminal block type expansion units
	KL-LINK	I/O unit	KL-8BLX	8 inputs, 24/5 VDC switchable, screw terminal block
			KL-16BX	16 inputs, 24/5 VDC switchable, screw terminal block
			KL-16CX	16 inputs, 24/5 VDC switchable, 26-pin MIL connector × 1 (included)
			KL-32CX	32 inputs, 24/5 VDC switchable, 26-pin MIL connector × 2 (included)
			KL-8BLR	8 outputs, relay, screw terminal block
			KL-8BLT	8 outputs, transistor (sink), screw terminal block
			KL-16BR	16 outputs, relay, screw terminal block
			KL-16BT	16 outputs, transistor (sink), screw terminal block
			KL-16CT	16 outputs, transistor (sink), 26-pin MIL connector × 1 (included)
			KL-32CT	32 outputs, transistor (sink), 26-pin MIL connector × 2 (included)
			KL-8BXR	8 inputs + 8 outputs, relay, screw terminal block
			KL-8BXT	8 inputs + 8 outputs, transistor (sink), screw terminal block
		Analogue unit	KL-4AD	Voltage, current input 4 ch; resolution: 1/4000; with 4-digit 7 segment display
			KL-2DA	Voltage, current output 2 ch; resolution: 1/4000; with 4-digit 7 segment display
			KL-DC1A	Direct current input 1 ch, resolution: 1/200000, with 4-digit 7 segment display
			KL-DC1V	Direct voltage input 1 ch, resolution: 1/200000, with 4-digit 7 segment display
		Temperature control unit	KL-2TF	Thermocouple/platinum resistance thermometer input 2 ch
		Load cell unit	KL-LC1	Load cell input 1 ch, resolution: 1/20000, with 4-digit 7 segment display
		Power unit	KL-WH1	Electricity amount measurement 1 ch, with 4-digit 7 segment display
	CC-Link	I/O unit	KV-RC16BX	16 inputs, 24/5 VDC switchable, screw terminal block
			KV-RC32BX	32 inputs, 24/5 VDC switchable, screw terminal block
			KV-RC16BR	16 outputs, relay, screw terminal block
			KV-RC16BT	16 outputs, transistor (sink), screw terminal block
			KV-RC32BT	32 outputs, transistor (sink), screw terminal block
			KV-RC8BXR	8 inputs + 8 outputs, relay, screw terminal block
			KV-RC8BXT	8 inputs + 8 outputs, transistor (sink), screw terminal block
			KV-RC16BXT	16 inputs + 16 outputs, transistor (sink), screw terminal block
		Analogue unit	KV-RC4AD	Voltage, current input 4 ch; resolution: 1/12000; with 5-digit 7 segment display
			KV-RC4DA	Voltage, current output 4 ch; resolution: 1/12000; with 5-digit 7 segment display

▌Software

Category	Type	Item name	Model	Functions/Specifications
Programming support software	Downloadable	KV STUDIO Ver. 11	KV-H1G-DL	Windows 10/8/7-compatible, site licence*
	Packaged (DVD-ROM)	KV STUDIO Ver. 11	KV-H11G	Windows 10/8/7-compatible, site licence*
Dedicated software for replay mode	–	KV REPLAY VIEWER Ver.2	–	Windows 10/8/7-compatible, downloadable for free from website

* Through user registration, the software can be used by multiple people associated with the office (including factories, business offices, and sales offices) that purchased the software.

▌Software operating environment

Software	Supported OS	Required free space on hard disk
KV STUDIO / KV REPLAY VIEWER	Windows 10/8 (including 8.1)/7 (SP1 or higher)	3200 MB or more

▌ Accessories

Category	Related models	Overview	Model	Functions/Specifications
CPU	KV-8000	USB cable	OP-35331	Cable length: 3 m
I/O	KV-SIR32XT	MIL connector	OP-22184	Equipped with a 40-pin standard contact, vertical type
			OP-51404	Equipped with a 40-pin standard contact, diagonal type
	KV-C32	MIL connector	OP-23139	Equipped with a 34-pin standard contact, vertical type
	KV-C32/C64	MIL connector	OP-42224	Equipped with a 34-pin standard contact, diagonal type
	Common	Contact	OP-22186	For standard AWG22-24, 200 pieces
			OP-30594	For fine line model AWG26-28, 200 pieces
		Pressure welding tool	OP-21734	For MIL connector
Positioning/ High-speed counter	KV-SH04PL/ KV-SSC02	MIL connector	OP-22184	Equipped with a 40-pin standard contact, vertical type
			OP-51404	Equipped with a 40-pin standard contact, diagonal type
		Contact	OP-22186	For standard AWG22-24, 200 pieces
			OP-30594	For fine line model AWG26-28, 200 pieces
		Pressure welding tool	OP-21734	For MIL connector
Temperature adjustment	KV-TF40	Current sensor (CT)	OP-6694	For heater wire breaking alarm
CC-Link	Common	Communication cable	OP-79426	CC-Link Ver. 1.10 compatible, 20 m cable
			OP-79427	CC-Link Ver. 1.10 compatible, 100 m cable
KL-LINK	KL-16C/ KL-32C	MIL connector	OP-30593	Equipped with a 26-pin standard contact
		Contact	OP-22186	For standard AWG22-24, 200 pieces
			OP-30594	For fine line model AWG26-28, 200 pieces
		Pressure welding tool	OP-21734	For MIL connector
	KL-16C/32C/ KL-8BXT/8BXR/ KL-4AD/2DA	Mounting bracket	OP-30588	Space-saving mounting bracket (vertical direction)
			OP-30589	Used for mounting screw
		Series connection cable	OP-30590	Used in situations where multiple slave stations are used in the same location.
	KL-8BXR	Relay for replacement	OP-33011	Relay PCB (8 ch)
	KL-16BR		OP-30595	Relay PCB (16 ch)
	KL-8BL	Series connection cable	OP-32985	Used in situations where multiple slave stations are used in the same location.
	KL-8BLR	Relay for replacement	OP-33010	5 relays, with extraction tool
	KL-2TF	Current sensor (CT)	OP-6694	For heater wire breaking alarm
	KL-DC/LC/WH	Attachment	OP-51667	Panel mounting bracket (2 brackets included)
	KL-WH	Current sensor (CT)	OP-51674	50 A
			OP-51675	100 A
			OP-51676	250 A
	Common	Communication cable	OP-30591	KPEV-SB (1P) 0.75 mm² 20 m
			OP-30592	KPEV-SB (1P) 0.75 mm² 100 m
		Adapter	KL-B1	Adapter for joint cable
		Branch unit	KL-T1	Used with T-branching
Connection conversion	KV-7000C	End unit	OP-84203	Included with KV-7000C

Programmable controller

KV Nano

Package type **KV Nano Series**

High speed and high performance in a compact PLC

❚ Terminal board type and connector type are available
❚ 14-point to 60-point types can be selected according to the application
❚ USB port included as standard
❚ Battery-less

Touch panel display

VT5 SERIES

Touch panel display **VT5 Series**
Large type **VT5-X** / Small, Medium type **VT5-W**

Advanced graphics and usability

❚ Overwhelming display performance with 16 million colours
❚ All sizes use high resolution LCD
❚ Voice output function with multi-language support
❚ Automatic translation into multiple languages

Frequently Asked Questions

?FAQ

www.keyence.com/controlfaq

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