KV Sensor Network

Connect. View. Expand your applications.

Connect to over 280 devices

CCD laser micrometers

Laser markers

Photoelectric sensors /
TOF laser sensors

Fibre optic sensors /
Laser sensors

As a comprehensive manufacturer of factory automation equipment, KEYENCE has extensive experience with various sensors to help solve a wide range of problems.

KEYENCE offers connectivity to a wide variety of devices, including general-purpose sensors used for target presence detection, displacement sensors for a variety of measurements, vision systems for controlling equipment, equipment-monitoring devices such as pressure and flow rate sensors, and product traceability devices such as laser markers and code readers.

Vision systems

Laser profilers

Contact-type displacement sensors

Vision sensors

Laser displacement sensors

Code readers

Programmable Logic Controller

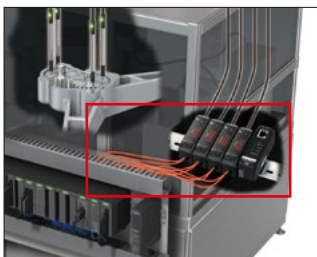**KV-8000**
SERIES

50% less time required for wiring

Drastically reduce the time spent wiring individual sensors
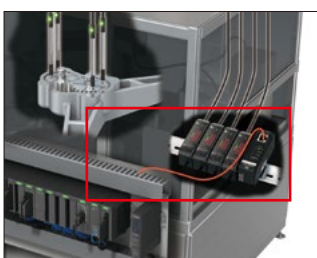
Faster wiring

Using a higher number of sensors means more time needed for wiring and equipment startup. With the KV sensor network, wiring is done with just a single LAN cable.

Conventional models Each sensor requires wiring work.

A lot of wires

KV Sensor Network Wiring can be done with just one LAN cable.

Just one LAN cable

Quick I/O checks

With the KV sensor network, various operations—including essential post-wiring I/O checks—can be performed simply by viewing the touch panel. Check screens can also be set beforehand, eliminating the need for users to create their own.

Conventional models Individual sensor I/O checks require dedicated screens or a tester.

Significant work for I/O checks

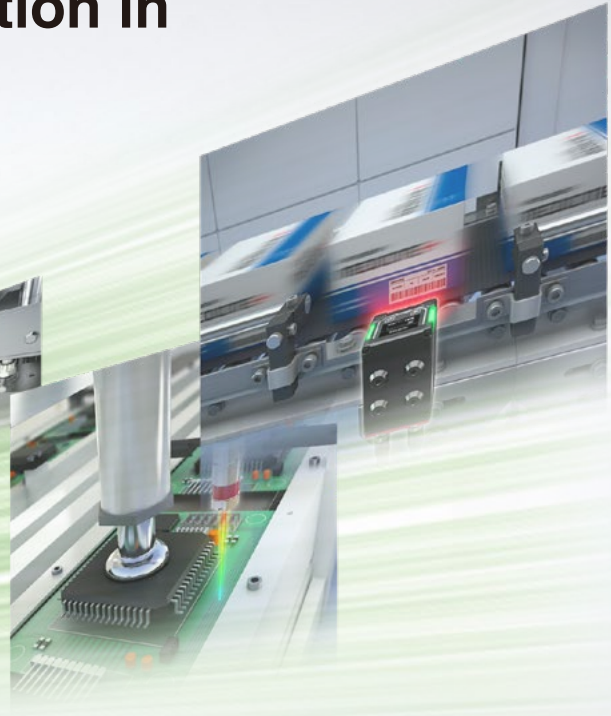KV Sensor Network Sensor I/O status can be easily viewed on the dedicated touch panel screen.

Easy checking with no screen creation needed

Sensor ON/OFF statuses are shown in a single list.

* An Ethernet connection is required for the VT5 Series.

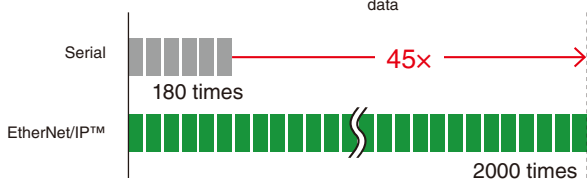# High-speed communication in as little as 0.5 ms

Fast sensor responsiveness for near real-time communication
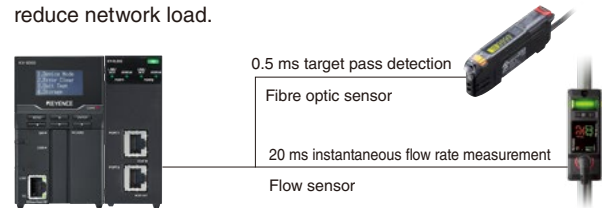
High-speed responses comparable to hardwired systems

The KV sensor network uses EtherNet/IP™ for high-speed communication (as fast as 0.5 ms), comparable to direct sensor input to a PLC.

Number of data updates per second
* When transmitting 128 bytes of data

Serial
180 times

45×

EtherNet/IP™
2000 times

Network load factor visualisation

The state of the network load can be checked on a dedicated screen. Just by changing the communication cycle, the network load is automatically calculated. This makes it possible to verify the optimal communication cycle setting in advance.

Calculate cyclic(I/O) messages load factor

Entire unit Ladder factor/band

Unit load factor	Entire unit		Receive		
	(pps)	(Mbps)	Number of multicast settings	(pps)	(Mbps)
27.67%	8300	27.2160	0	4150	16.1208

Adapter Ladder factor/band condition(A)

Unit load factor details	Node	Node name	Adapter load factor	Connection	Receive from adapter			
					RPI (ms)	Inhibit time(ms)	Multi cast	(pps)
13.33%	6	KV-EP02	66.67%	Monitor Dat..	0.5	-	☐	2000
-	6-1	KV-NC16EX*	-	-	-	-	☐	-
-	6-2	KV-NC16ET*	-	-	-	-	☐	-
-	6-3	KV-NC4AD	-	-	-	-	☐	-
0.67%	3	CV-X400 Series	50.00%	Class1 [IN..	10.0	-	☐	100
0.33%	4	SR-1000 Series	2.94%	Class1 [IN..	20.0	-	☐	50

Automatic calculation of unit or adapter load factor

Device-based communication cycle settings

Independent communication cycles for each device

The communication cycle can be set on each sensor to match the application. Set to as short as 0.5 ms for high-speed responses, or delay communication cycles for other sensors to reduce network load.

0.5 ms target pass detection
Fibre optic sensor

20 ms instantaneous flow rate measurement
Flow sensor

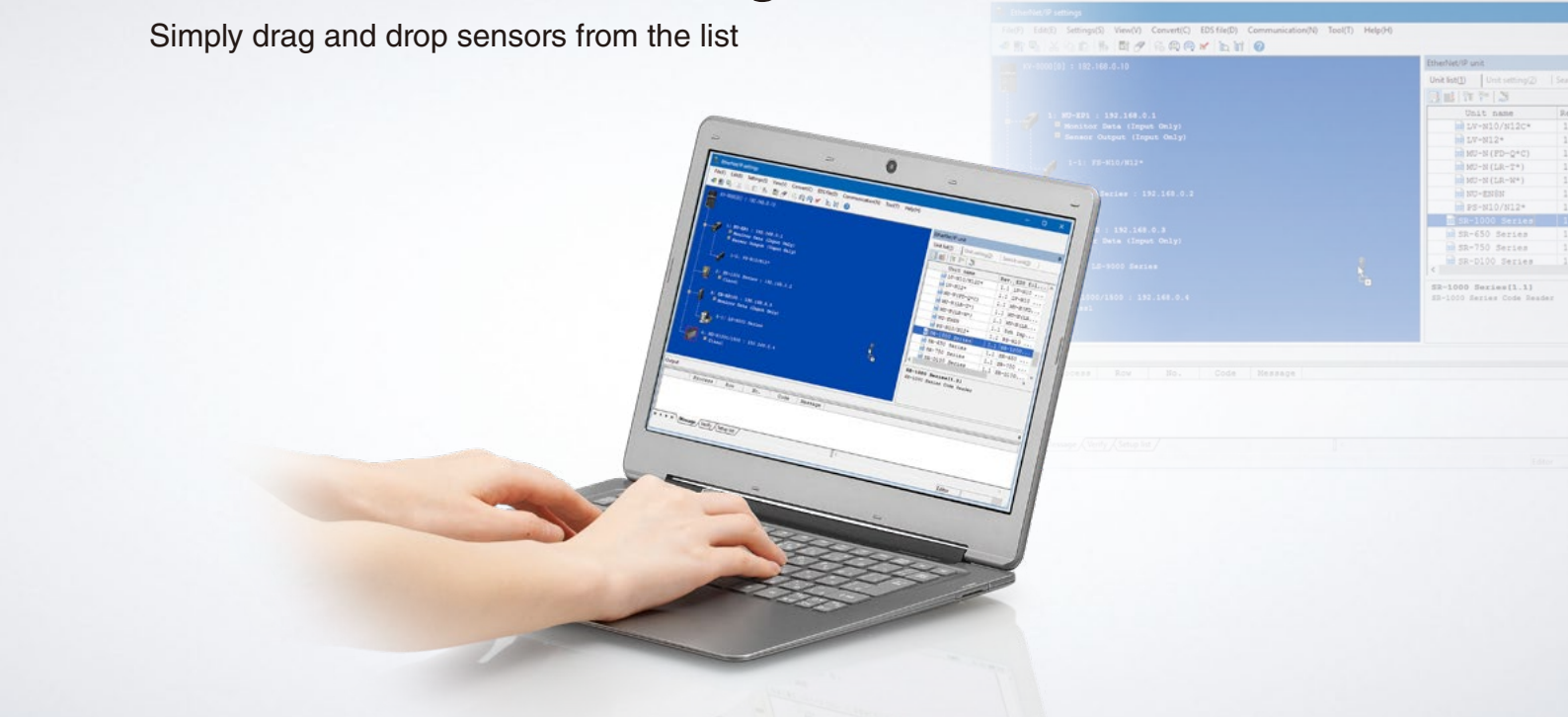## Automatic recovery for disconnected devices

The KV sensor network allows for quick restoration of disconnected or broken wiring through simple rewiring. This eliminates the time spent reconfiguring sensors.

No need to reconfigure controllers for recovery

# Program-less configuration of communication settings

Simply drag and drop sensors from the list

Reduced programming work

Conventional systems require a device map with sensors assigned to specific device numbers followed by PLC programming. With the KV sensor network, device number and communication settings can be configured with just one click, and automatic input of comments and other settings significantly reduce the amount of work required.

Drag-and-drop communication setting configuration

Drag & drop
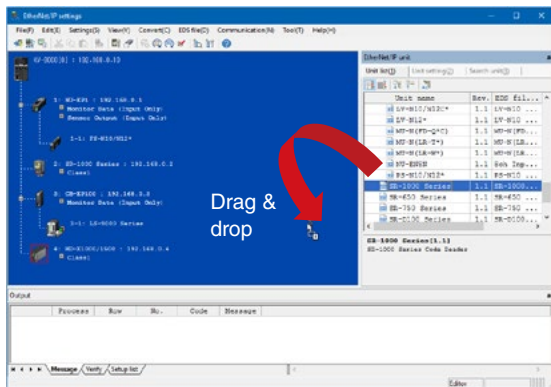
STEP 1

Drag and drop sensors from the list.
Simply drag and drop the desired sensor. The automatic configuration function can be used to automatically import information from connected sensors at the click of a button.

STEP 2

Set the sensor's IP address.
Device searching can be used to automatically search for the IP addresses of connected sensors and to set the IP address from the detected devices. IP addresses can also be set manually.

STEP 3

Transmit the settings to the PLC.
This completes the configuration! It's surprisingly easy to connect to sensors.
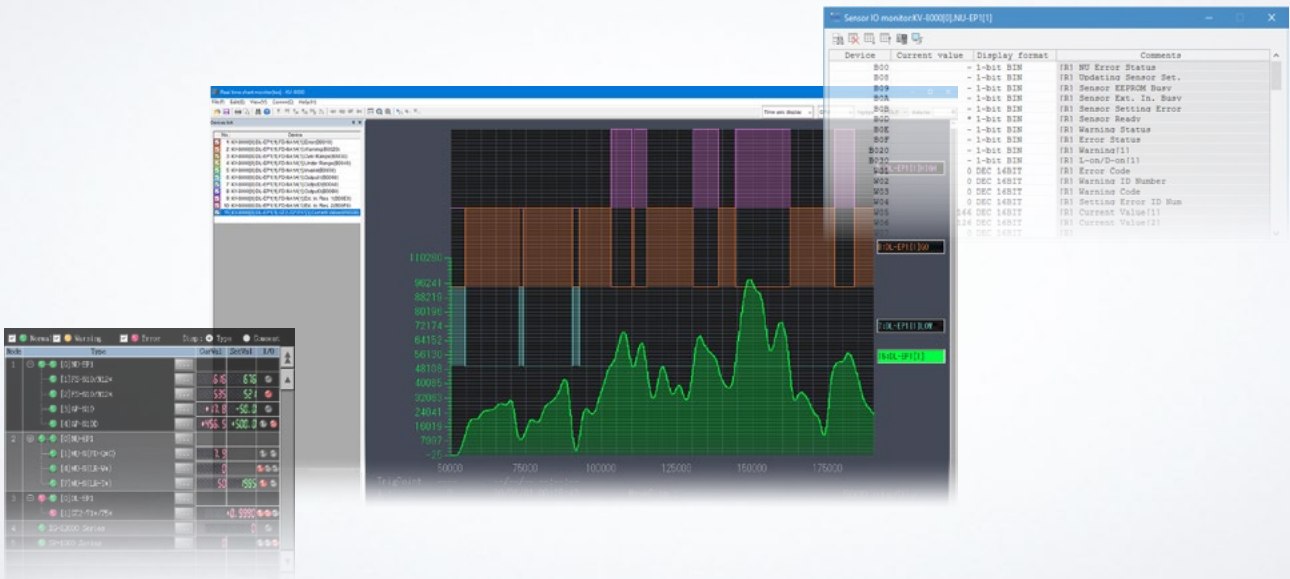
Automatic sensor data assignment
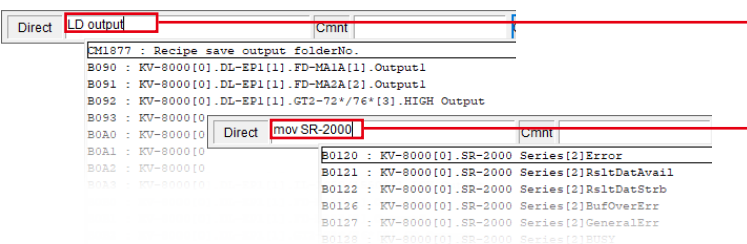
Comments are registered automatically, so programming can be done by simply searching in the ladder.

Filtering by model name means programming can go ahead without having to worry about device assignment.

Sensor status visualisation

Check not only the ON/OFF status but also values and waveforms

Several monitoring functions available

A variety of sensor monitoring functions are available to use from a PC or a touch panel. Check ON/OFF status as well as current values and settings that otherwise could not be checked without communication. These functions are also useful for debugging and troubleshooting.

Sensor I/O monitor function (KV STUDIO)
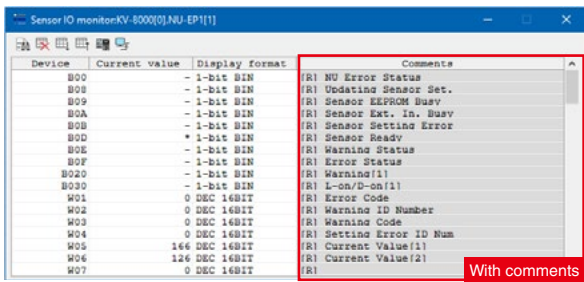
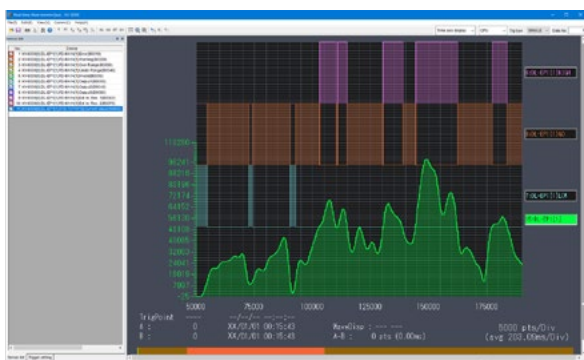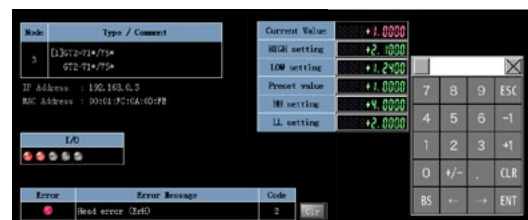Sensor ON/OFF status and current value monitoring

Real-time chart monitor (KV STUDIO)

Waveform-based sensor ON/OFF status and measured value display

Sensor monitor function (VT5 Series)

Batch monitoring of all sensor statuses

Sensor setting value rewriting

Fast support for problems

Recall statuses as needed for quick recovery

Review status history using the machine operation recorder function

The KV-8000 can record and play back all equipment information from both before and after problems, allowing users to review measured sensor values and ON/OFF statuses from a PC. Camera images can also be used to check sensor and target statuses at the time the problem occurred.
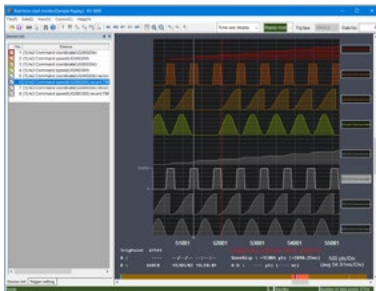
Normal and abnormal waveform comparison
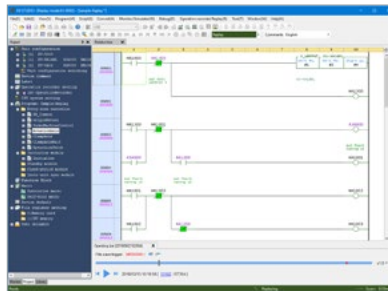
Ladder monitor status checking as the problem occurred

Video-based sensor and target information review

Backup function for quick recovery

Setting values and parameter information for each sensor can be backed up or recovered at any time.
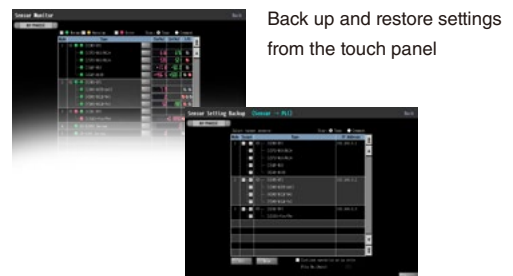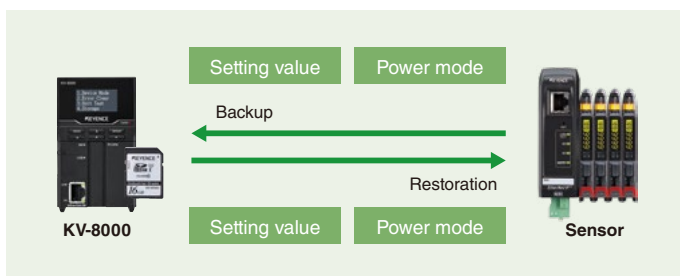
Back up and restore settings from the touch panel

KV Sensor Network

SERIES INDEX

Digital Fiber Optic Sensor
FS-N → **P. 10**
Series

Self-Contained Full-Spectrum Sensor
LR-W → **P. 11**
Series

All-Purpose Laser Sensor
LR-T → **P. 11**
Series

High-Accuracy Digital Contact Sensor
GT2 → **P. 12**
Series

CMOS Multi-Function Analog Laser Sensor
IL → **P. 12**
Series

Vision Sensor
IV → **P. 13**
Series

Customizable Vision System
XG-X → **P. 14**
Series

Intuitive Vision System
CV-X → **P. 14**
Series

1D/2D Code Reader
SR-2000 → **P. 15**
Series

3-Axis Hybrid Laser Marker
MD-X → **P. 16**
Series

High-speed 2D Laser Profiler
LJ-V7000 → **P. 17**
Series

Confocal Displacement Sensor
CL-3000 → **P. 17**
Series

**Communication unit
NU-EP1**

Up to 16 FS-N Series
units can be connected to
a single device.

**PoE function-
compatible Ethernet
switch
NE-Q05P**

Power can be supplied to
up to 16 FS-N Series
units from each port
(2 ports available).

Typical parameters (cyclic communication)

- Current amount of received light
- Setting value
- Output/high-speed output
- External input response

Typical parameters (message communication)

- Power mode
- L-on/D-on
- Timer function/time
- Preset input
- Attenuate (light intensity adjustment)
- Power save
- Key lock

PLC-linked applications

Detecting sensor dirtiness

The PLC acquires not just on/off signals but also the amount of light received by the sensor. This makes it possible to detect the dirtiness of the sensor and develop a preventative maintenance system. This is a brand new function that was previously not available.

Amount of light received → Displays fluctuations in the amount of received light →

FS-N Series + NU-EP1   **KV-8000+KV-XLE02**   **VT5 Series**

Automatic tuning enables stable detection

Sensors can be tuned from the PLC. Settings can be changed to the optimal values corresponding to reductions in light intensity due to the sensors being dirty, which enables stable detections that are not affected by situational changes.

There is no need to periodically clean sensors.

Indicators for immediately identifying sensors

Controlling the indicator status directly from the PLC allows users to immediately identify applicable sensors even for systems with multiple sensors. This makes it possible to reduce downtime caused by sensor problems.
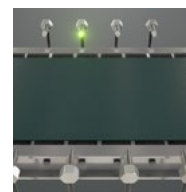
The corresponding sensor flashes, so it can be identified immediately.

Remote adjustment of sensors

Even in situations where the sensor amplifier is installed in a difficult-to-reach location (such as a clean room or a control panel deep within a device), it can be checked and adjusted easily using the sensor monitor function.

Batch writing of setting values just by selecting their settings file

The sensor setting backup function can be used to overwrite all the setting values as a batch just by selecting a saved settings file. This is useful when replacing sensors and during changeover.

Write the backed up settings file to the sensor.

Sensing using RGB ratios

In addition to performing pass/fail judgements, the PLC can also acquire the RGB ratio match percentage compared to the master workpiece. This makes it possible to set thresholds that keep in mind the variations between workpieces, which enables stable detection.
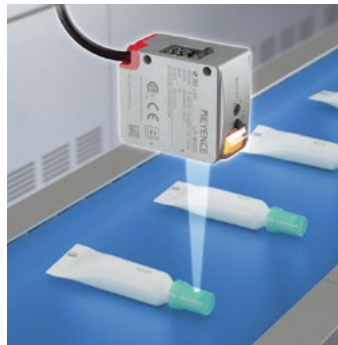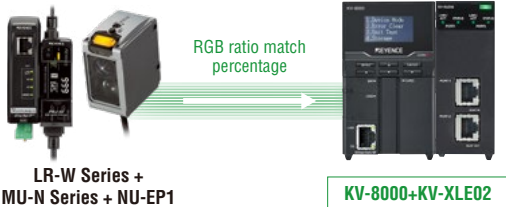
RGB ratio match percentage

**LR-W Series +
MU-N Series + NU-EP1**

KV-8000+KV-XLE02

Related products

**Communication unit
NU-EP1**

Up to 4 LR-W Series units can be connected (through the MU-N) to a single device.

Typical parameters (cyclic communication)

- Current value • Setting value
- Output/high-speed output
- External input response

Typical parameters (message communication)

- RGB received light ratios
- Detection mode
- Timer function/time
- Master tuning setting value
- Sensor indicator flashing
- LED on/off • Key lock
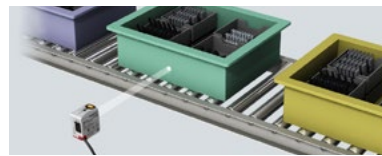
Checking quality with RGB ratio logging

The RGB ratios for each workpiece can be logged by the PLC and saved in CSV format. This makes it possible to quantitatively monitor changes in the surface status, which leads to stable quality.

Save the data in CSV format to an SD card or to the CPU's memory.

Differentiation between 16 colours with a single sensor

It is possible to differentiate between 16 colours by registering settings in 16 different banks. This is used in facilities that handle multiple product models. It is easy to switch between banks using sensor-specific commands.

Remote monitoring using digital data

Current values obtained by the LR-T Series can be transmitted over the network for remote monitoring of sensors. The transmitted data is also digital, eliminating the possibility of conversion errors and allowing for high-precision monitoring.

Presence of target
Current value

**LR-T Series +
MU-N Series + NU-EP1**

KV-8000 + KV-XLE02

Related products

Communication unit NU-EP1
Up to 4 LR-T Series units can be connected (through the MU-N) to a single device.

Typical parameters (cyclic communication)

- Current value
- Setting value
- Output / high-speed output
- External input response

Typical parameters (message communication)

- Light Intensity
- N.O./N.C.
- Reference plane distance
- Timer function / time

Performing tooling changes in the sensor settings

The sensor setting batch transfer function can be used to change the sensor settings as a batch from the PLC. This eliminates the hassle of changing settings individually when a target change occurs, which reduces the labour required.

Setting value
345 → 2355

Visualisation through sensor indicator control

Even if target detection is still possible, if there is no operating margin, the sensor indicator can be made to flash green with a command from the PLC. This allows for predictive maintenance without having to stop the device.

Green
(flashing)

Indicators make it possible to identify sensors even from far away.

Related products

Communication unit DL-EP1
Up to 15 GT2 Series units can be connected to a single device.

Typical parameters (cyclic communication)

Current value, HIGH/GO/LOW output

Typical parameters (message communication)

Judgement value (P.V. value), current value (R.V. value), detection mode, catch check function

PLC-linked applications

One-touch changeover

Conventionally, changeover required settings be changed on each sensor individually. However, this can now be performed from a touch panel, which greatly reduces the man-hours required.

Measured data · Change the settings on multiple sensors.

Setting change

**GT2 Series +
DL-EP1**

**KV-8000+
KV-XLE02**

VT5 Series
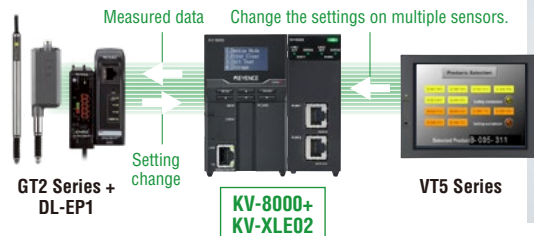
Adding production models from the touch panel

The PLC data folder function can be used to add and switch between products with the touch panel. And there's no need to perform programming on the PLC.

A touch panel is all that's needed to perform changeover.

Preventative maintenance of spindle wear

Preventative maintenance can be performed on spindle operations by monitoring the status such as the catching position and the bound conclusion timing.

Normal	Abnormal
Fully extended	Not fully extended

CMOS Multi-Function
Analog Laser Sensor

IL Series

Related products

Communication unit DL-EP1
Up to 8 IL Series units can be connected to a single device.
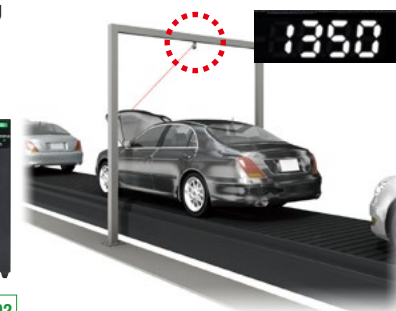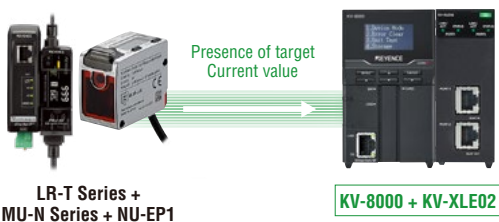
Typical parameters (cyclic communication)

Measured value (P.V. value), HIGH/GO/LOW output

Typical parameters (message communication)

Internal measured value (R.V. value), setting value, high pass filter

Preventing false detection of workpieces

False detection correlated to the rattling of the conveyor belt can be eliminated by setting a high pass filter. The filter value can easily be set to an appropriate value from the touch panel by viewing the detection situation.

Setting change data · Filter value (frequency) change

**IL Series +
DL-EP1**

KV-8000+KV-XLE02

VT5 Series
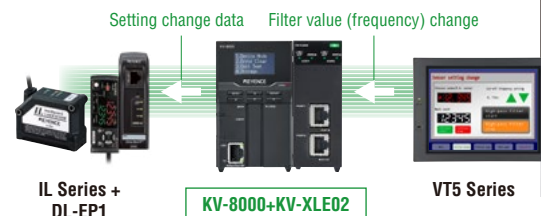
Dimension correction from the touch panel

Even when there is an error in the internal measured value (R.V. value) compared to the actual dimensions, the dimensions can be corrected by rewriting the sensor's target value from the touch panel. There is no need for bothersome calculations.

← Target value correction

Dimension correction →

Preventing operation mistakes with the batch key lock function

The keys on multiple sensors can be locked all at once from a PLC. This eliminates unexpected setting changes caused by erroneous button operations, which prevents short-term breakdowns.

The sensor amplifier displays information but cannot be operated.

Cycle time improved with 16 judgement outputs

Conventionally, these tools only had a maximum of 4* judgement outputs, but networking them together expands the number of outputs to 16. There is no need to switch between programs or recapture images to output the judgement of each tool, which leads to improvements in processing time.

* 8 outputs for the IV-G/IV-HG Series

Pass

Fail

16 judgement outputs

Tool 1: Pass
Tool 2: Fail
Tool 3: Fail
Tool 4: Pass
.
.
Tool 16: Pass

IV Series

KV-8000+KV-XLE02
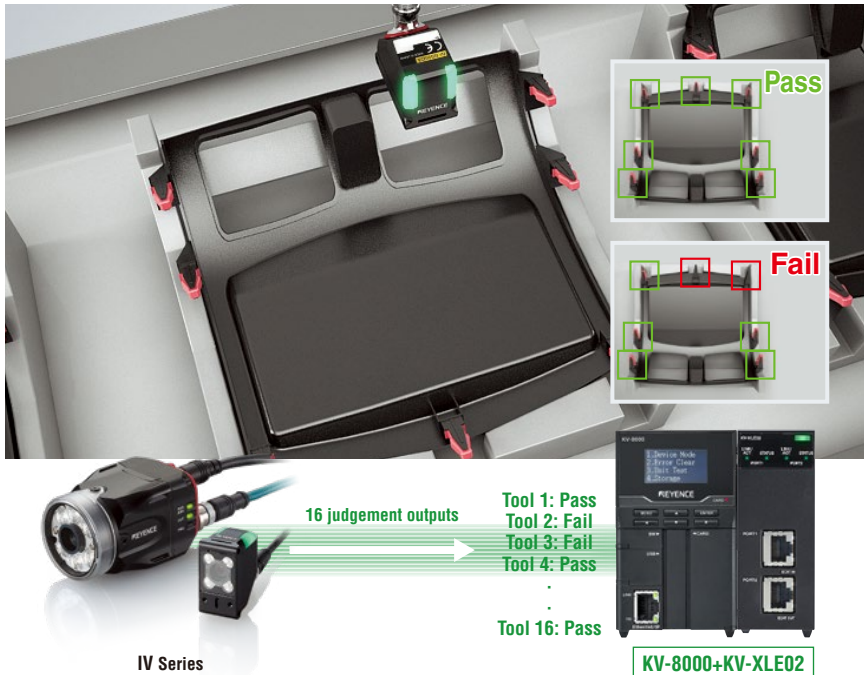
- Trigger request
- Overall judgement
- Ready
- Busy
- Processing time
- Position correction score
- Tool 1 to tool 16 judgement
- Tool 1 to tool 16 score
- Program number
- Threshold
- Error/warning
- Readable characters
  (When using OCR tool)
- Master character/date change
  (When using OCR tool)

Check the matching level for each tool

Conventionally, it was not possible to know the score (matching level) for each tool, but this can be acquired by the PLC without using a program which makes it possible to easily perform operations such as analysis of failing workpieces.

Tool 1: 95
Tool 2: 80
Tool 3: 60
Tool 4: 75
.
.
Tool 16: 40

Display image data on the VT5

The image data captured by the vision sensor can be displayed on the VT5. This is the optimal function when it is necessary to check the advanced detection details of a failing workpiece.

BMP display

File renaming and FTP upload

FTP upload

Image data
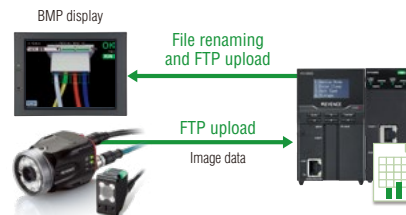
Faster investigations of the causes of problems

By saving an image of an unacceptable product to the PLC via FTP, the KV-8000's machine operation recorder function can be used to monitor equipment statuses even from before problems occur, reducing the time required to investigate causes.

Automatic recording just before and after problems   **Problem**
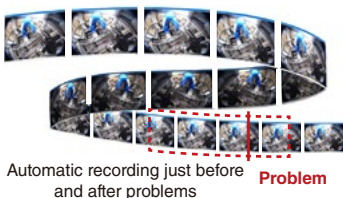
Accurately saving images with the automatic retry function

When the FTP client function of the KV-8000 is used, the file transmission is automatically retried until it is successfully completed. This makes it possible to accurately save the image data on a server or PC.
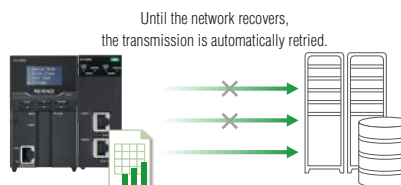
Until the network recovers, the transmission is automatically retried.

Typical parameters (cyclic communication)

- Command execution
- Trigger input
- Command execution result acquisition
- Measured result data
- Custom command number writing
- Custom command argument writing
- Variable synchronisation

Typical parameters (message communication)

- Total count
- Failure count
- Program ID

Typical parameters (cyclic communication)

- Command execution
- Trigger input
- Per-tool judgement result
- Measured result data

Typical parameters (message communication)

- Total count
- Failure count
- Program ID

PLC-linked applications

High-speed communication for fast alignment

Setting the data communication trigger to COS (Change Of State) makes it possible to output obtained data at high speed to the PLC. That coordinate data can then be used for positioning control to perform high-speed alignment.

Coordinate data

XG-X Series

KV-8000 + KV-XLE02 + KV-XH16ML

COS transmission and reception possible

COS transmission and reception can be performed with a KV-XLE02 Ethernet unit. The high-speed image capture trigger input and data acquisition output can help reduce processing time.

■ Data transfer speed comparison

COS reception only — **8.68 ms**

COS transmission and reception — **1.40 ms**

Approximately **6** times faster
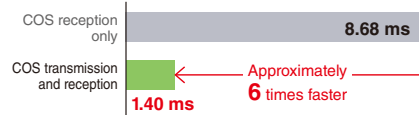
Measurement conditions: 100 bytes transmitted and received using KV-XLE02 and XG-X2000 with a 10 ms RPI (using unit interrupts)

Monitoring changes in light intensity

Registering the light intensity of the lighting as a variable allows for data monitoring and trend tracking with a PLC. This makes it possible to prevent problems caused by the deterioration of the LEDs over time.

Light intensity

Improving processing time with high-speed communication

Connecting a KV Series device via EtherNet/IP™ allows for faster acquisition of measurement data from a CV-X compared with a PLC link connection. This makes it possible to meet stricter equipment processing requirements.

Measured result data

CV-X Series

KV-8000 + KV-XLE02
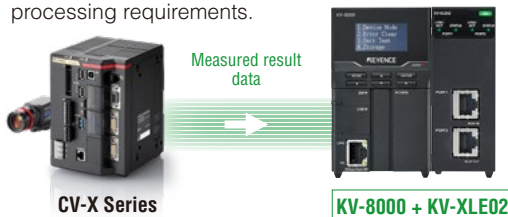
Faster investigations with failure judgements

The machine operation recorder function can be used to reproduce conditions before and after a failure judgement, helping to determine whether the problem is in the ladder, the target positioning during inspection, or the CV-X settings.

Equipment image and ladder review both before and after image capture

Quad-screen display on the VT5

It is possible to display the captured image screen on the VT5 over Ethernet. There is no need to use a dedicated monitor or a video converter, which reduces costs.

Full-screen display

Quad-screen display

Constructing a traceability system with a PLC

The marking data read by the code reader and the manufacturing data of each process can be transmitted to the host PC as a CSV file. The PC is not constantly accessed which reduces the load on the network.

SR-2000 Series → Read data → **KV-8000+KV-XLE02** → Associated with the manufacturing data → **PC**
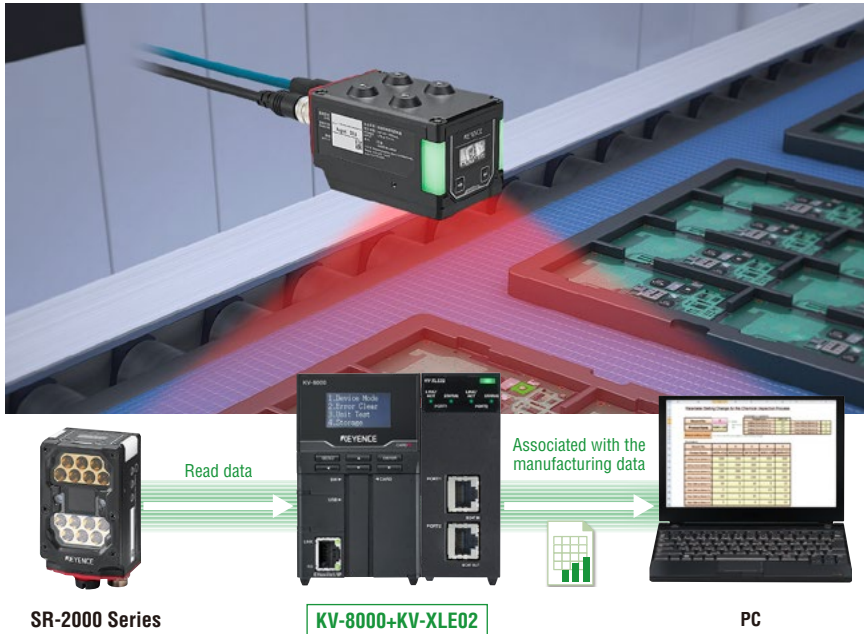
- Read data
- Reading start/stop instruction
- Reading OK/ERROR result
- Matching level (ease of reading)
- Code verification grade
- Settings file change

- Matching level threshold
- Tuning instruction

Checking quality with matching level logging

Logging the matching level (ease of reading) together with the read marking data makes it possible to check the constantly marking quality.

Product **A**
Marking data: AB001
Matching level: 75

Product **B**
Marking data: AB002
Matching level: 92
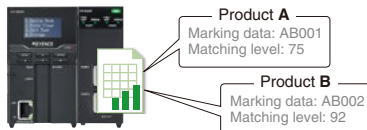
This can be used to investigate the causes of problems and to prove that good products are being produced.

Displaying images in real time on the VT5

The VNC client function can be used to display image data on the VT5 in real time. This can be used in situations such as magnifying the details of the read image in order to check it.

KEYENCE · 1234567890

The marking quality can be checked on the touch panel.

Switching the settings file from the PLC

The settings file backed up within the code reader can be switched over the network, which enables hassle-free Changeover.

In operation with setting A → **Reading condition change** → Change to setting B

A A B B
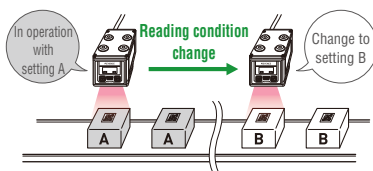
Comparing marking data as character strings

Using KV Script makes it possible to compare marking data as character strings. There is no need to convert the data into ASCII code, which makes it possible to reduce the man-hours required.

■ KV Script program example
(comparison and judgement of character strings)

```
IF DM1000.T = "ProductABC" THEN       'Compare the data from barcode reader
   DM2000.T = "Match"                  'Judgment display
   SET(R500)                           'Match output = OK
ELSE
   DM000.T = "Mismatch"                'Judgment display
   RES(R500)                           'Match output = OFF
END IF
```

PLC-based marking quality control

In addition to the marking data, the score (match percentage) read with the MD-X's built-in camera can be monitored from the PLC for identifying incomplete or incorrectly positioned marking.

Marking data
Marking score

MD-X Series

KV-8000 + KV-XLE02

Typical parameters (cyclic communication)

- Marking data
- Current count value
- Marking score display
- Ready status display
- Marking start request
- Marking complete
- 2DC reading request
- Character string change request
- Busy status display
- Operating information (Operation time, shutter count, laser power, head temperature, cumulative print count)

Automatic laser power measurement and adjustment

Measuring the output power and lens contamination status—two important factors for laser marker maintenance—is essential for management. These two factors can be used for adjustment to ensure stable marking quality.

Laser lens

Power monitor
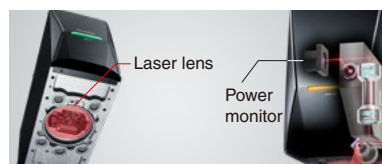
Touch panel marking display

Marking images captured by the MD-X and processed with the KV-8000 can be displayed on the VT5. This simplifies maintenance work by eliminating the need to use an office PC to check the marking.

BMP display

File renaming and FTP upload

FTP upload

Image data
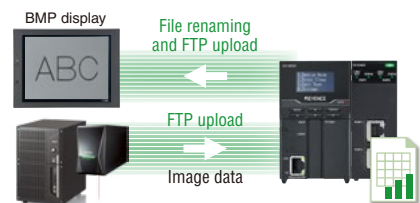
Touch panel-based management of maintenance tasks

Operation time, shutter count, cumulative print count, and other operating information can be reviewed over the network. In systems with a PLC, this means maintenance timing management can be handled directly on the touch panel.

Automatic measurement and inspection results display

Automatic marking data switching

Changing settings and rewriting marking data such as the serial number and date data is possible from a PLC. Data can be obtained and rewritten from a server or PC, helping to reduce the time spent on management.

Marking data switching per production instructions

Shape differentiation with high accuracy

The profile data from a measurement system can be obtained with a PLC. The data is transferred over the network, so there are no data errors. This makes it possible to perform high-accuracy shape differentiation.

Profile data

LJ-V7000 Series + CB-EP100

KV-8000 + KV-XLE02

Displaying profile data on the VT5
Storing profile data in a large-capacity file register makes it possible to display this data on the VT5, so it is easy to check the data on site.

Using KV socket communication to read storage data
When it is necessary to perform high-speed sampling of the measured data, KV socket communication can be used to read the storage data on the measurement system.

* A connection with the LAN port on the LJ-V7000 Series main unit is required.

Related products

Communication unit CB-EP100
1 LJ-V7000 Series unit can be connected to a single device.

Typical parameters (cyclic communication)

Measured value, HIGH/GO/LOW output, program switching

List of typical message communication functions

Setting value writing/reading, profile data reading

Constant monitoring of variations in measured values

Measured displacement data imported into the PLC can be used for constant monitoring for data variations. This allows users to monitor processes for stability or large variations in the data.

Measurement data

CL-3000 Series

KV-8000 + KV-XLE02

High-accuracy differentiation in 1 ms cycles

Transferring measured displacement data to a PLC is possible in cycles as short as 1 ms. Combined with target surface scanning at a detailed pitch, this allows for calculation of surface roughness and warpage.
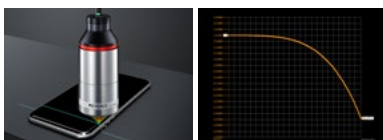
Simultaneous logging of encoder values and measurements

Identifying the source point of a failure when measuring the thickness of a lithium-ion battery, for example, is easy if both the thickness measurement result and the target measurement position are logged simultaneously.

Typical parameters (cyclic communication)

- Measured value
- Pulse count (encoder value) acquiring/clearing
- Program switching
- Setting value reading
- Measurement start/stop
- Illumination start/stop
- Storage start/stop

KV Sensor Network Related Products

Ethernet units that can be connected to various PLCs and factory automation equipment from all over the world

KV-XLE02

Ethernet unit

KV-XLE02

EtherNet/IP™

EtherCAT®

CC-Link IE Field

PROFINET®

Hardware	Functions			
Ethernet	EtherNet/IP™	PROFINET*³	Sensor application	KV socket
Communication speed: 1 Gbps	EtherCAT®*¹	PLC link	Modbus/TCP client/server	Host link
2 ports	CC-Link IE Field*²	PROTOCOL STUDIO	FTP client FTP server	MC protocol/ SLMP

*1 Slave *2 Intelligent device station *3 Device

EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

Program-less communication with over 100 types of new and old PLCs

Communication can be established with PLCs from various vendors without programming. A wide range of industrial Ethernet networks, which vary from one manufacturer to the next, are also supported. This makes it possible to collect and visualise data from new and old devices.

PLC link function
- Ethernet
- Serial*

KV-X COM

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

Any supported PLC

Any supported PLC

* KV-XL202/XL402 functions

Gigabit support for high-speed, large-capacity Ethernet communication

Gigabit support enables high-speed and large-capacity communication, with three times the communication bandwidth of standard EtherNet/IP™ and sufficient communication bandwidth for other Ethernet functions.

■ Number of connectable NU-EP1 units

Conventional models **15** units

3×

KV-XLE02 **46×**

* With the NU-EP1 default settings
(monitor data: 10 ms, high-speed output: 2 ms)

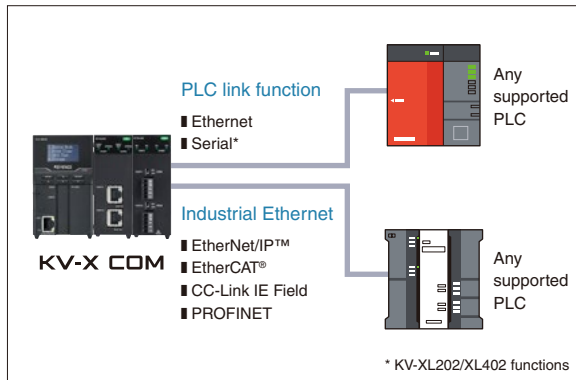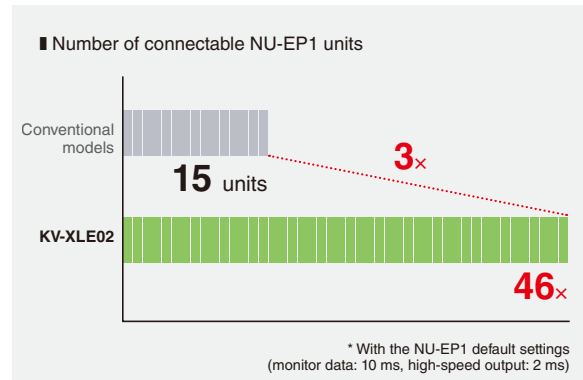## ■ EtherNet/IP™ communication specifications — KV-XLE02/KV-8000

Model				KV-XLE02	KV-8000
Supported transmission rates				1000BASE-T, 100BASE-TX, 10BASE-T	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 (refreshing line data at a set frequency regardless of the number of nodes)	
		Transmission trigger	Output to adapter	Cyclic / Change Of State*²	Cyclic*²
			Input from adapter	Cyclic / Change Of State*²	Cyclic / Change Of State*²
		Allowable band for cyclic communication*⁴	(At 504 bytes)	30000 (pps)*³	10000 (pps)*³
			(At 1444 bytes)	15000 (pps)*³	5000 (pps)*³
		Maximum number of refresh words		24k words	16k words
		Maximum data size for 1 connection*⁵		504 bytes or 1444 bytes	
		Multicast filtering function*⁶		Available (IGMP client function)	
	Message communication	Class 3 (connection type)	Server	Number of connections: 256*⁷	
		UCMM (non-connection type)	Client	Number of simultaneous actions: 32	
			Server	Number of simultaneous actions: 256	Number of simultaneous actions: 96
EtherNet/IP™ conformance test				Compliant with CT13	Compliant with CT15
MDI/MDI-X automatic switching function				Supported	Supported

*1 The total number of connections is 256, including connections used by the Class 3 (connection type) message communication function.
*2 Can communicate with devices that output data using the Change Of State method (data is sent when a change occurs).
*3 Abbreviation of "packets per second", indicating the number of sent/received packets processed per second.
*4 If the communication bandwidth is more than 100 Mbps, use a 1000 Mbps compatible Ethernet switch.
*5 Data synchronisation in a connection is guaranteed. If 505 bytes or more are used, the device used should support Large Forward Open (CIP option specification).
*6 Because the Ethernet unit has an IGMP client function, unnecessary multicast packets can be filtered by using an Ethernet switch that supports IGMP Snooping.
*7 The total number of connections is 256, including connections used by the cyclic communication function.

Plug-and-play remote I/O systems with EtherNet/IP™ support

KV-EP02

EtherNet/IP™ compatible
communication unit

KV-EP02

EtherNet/IP™

KV Nano Series expansion units
can be used as remote I/O
devices.

Hardware			
EtherNet/IP™	Communication speed: 100 Mbps	2 ports (built-in switching hub function)	Max. number of connectable units: 15*

* With a KV-8000/7000/5000/3000 Series scanner.
(The maximum number of analogue units is 7.)

Single-touch device setup

After wiring and powering the devices, just click the Auto
Configuration button to finish configuring the settings. The
settings can be configured as a batch, significantly reducing
the required work hours, even in large-scale facilities.
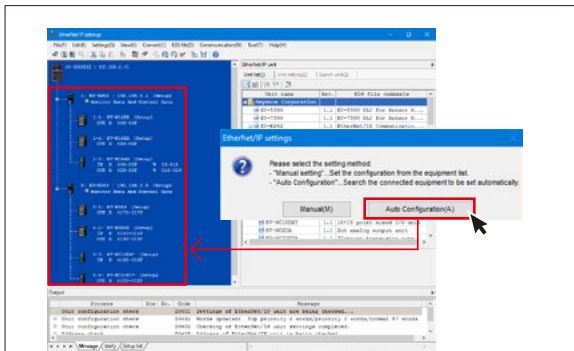
Supports line-type and star-type wiring

Both line-type and star-type wiring are possible, allowing for
highly flexible wiring. Empty ports can also be used in place
of switching hubs, which helps reduce costs.

Line type

Star type
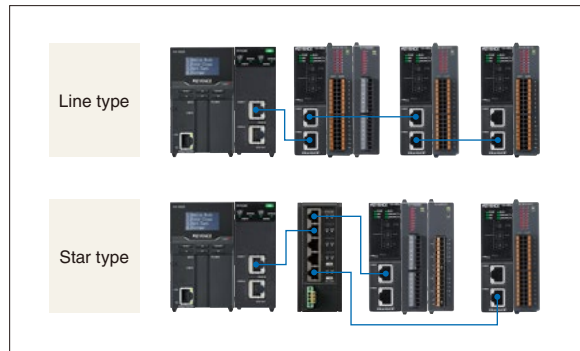
An industrial switching hub that maintains the high speed and reliability of EtherNet/IP™

NE-Q05(P)

NE-Q05(P)

EtherNet/IP™ compatible
Ethernet switch
NE-Q05P
(with PoE function)
NE-Q05
(without PoE function)

* This can also be used as a
  general-purpose Ethernet
  switch.

Specifications — EtherNet/IP™ compatible Ethernet switch

Model	NE-Q05	NE-Q05P
Data transfer speed	10 Mbps/100 Mbps, automatically supports full duplex/half-duplex mode	
Switching function	Store and forward method	
QoS function	Priority control of EtherNet/IP™ cyclic data	
PoE function	—	2-port IEEE 802.3af-compliant; Supplied power: 15.4 W/port (44 to 57 VDC)

QoS supported

QoS (packet priority control) operates without
any settings to guarantee the real-time property
of EtherNet/IP™ control data.

NE-Q05(P)

High-priority data
transmission
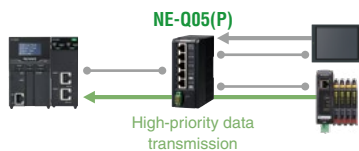
PoE function

Power can be supplied from the communication
cable to devices that support PoE (Power over
Ethernet). This significantly simplifies the wiring.

NE-Q05P

Power
supply

No need for
a 24 V power
supply

PoE-compatible
device
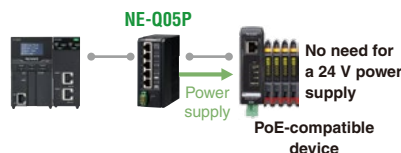
General-purpose cable connection

A general-purpose Ethernet cable is used to
connect to sensor devices. Wiring is simple; with
just a one-touch connection to the connector.

NE-Q05(P)
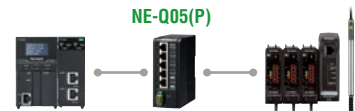
e-CON input unit that makes it possible to even connect proximity sensors and photoelectric switches to the network

NU-EN8N

e-CON input unit
NU-EN8N

* Sensors and switches that use a two-wire system cannot be used. Use three-wire system devices.

Specifications — e-CON input unit

Number of units that can be connected to the NU-EP1		Max. 2 * This does not depend on the number of connected input devices.
I/O	Connector	e-CON connector (4 pin)
	Number of inputs	8
	Input signal	NPN open collector output, contact output
	Input response time	20 µs or less

Obtain sensor input by expanding the system

Photoelectric Sensor

Miniature Photoelectric Sensor

Proximity Sensor
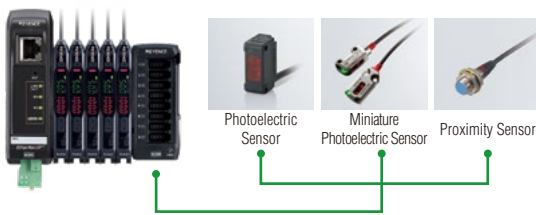
Simple connections using e-CON

Input devices such as sensors that do not support the KV sensor network can also be connected to the PLC with an e-CON connection using the NU-EN8N.

Touch panel with audio prompts that accelerates visibility

VT5 Series

The Touch Panel Display VT5 Series has audio prompts, which is a feature that overturns the conventional wisdom regarding touch panels. The VT5 Series further expands the applications of the KV sensor network. All the user has to do is enter messages in text, so it is easy to create a system that uses audio prompts.

Touch Panel Display
VT5 Series

• Large type VT5-X/small and medium types VT5-W
• Speaker unit VT-SP1

ワークを取り除いて下さい

Please remove the workpiece

请清除工件

워크를 제거해 주세요

Por favor retire la pieza

VT-SP1 performance specifications

Input	ø3.5 mm mini jack
Sound pressure level	Max. 86 dB (at 1 m)*
Volume	10 levels

* The sound pressure level varies depending on the sound source, usage environment, and used voltage.

VT5 Series audio specifications

| Languages	English, Japanese, Chinese, Korean, Spanish
Speaker	Male, female
Audio adjustments	Speed, tone, volume

Audio applications

Eliminating the need to go check the cause of the problem

Problem To check which sensor has caused a short-term breakdown of the equipment, the user has to view the touch panel.

Solution With the audio prompts, the user can understand which sensor is causing the problem and what state the sensor is in without having to check the touch panel.

The sensor's received light intensity has decreased.

Remove the workpiece.

Information is conveyed even at a distance.
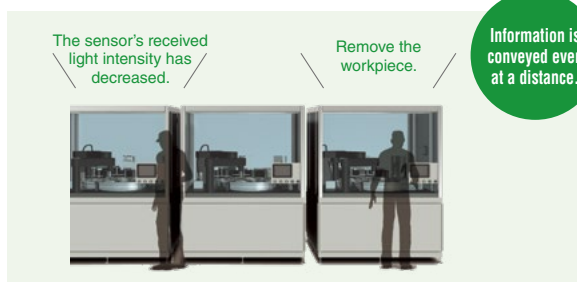
Improving operability with audio guidance

Problem In order to set or replace sensors, the user has to check a manual or an operation procedure, which takes a long time when the user is not familiar with the operation.

Solution The user can proceed with the work by checking the setting method and operation procedure with audio prompts. This makes it possible to improve productivity.

Next, hold down the SET button on the sensor.

Improved productivity
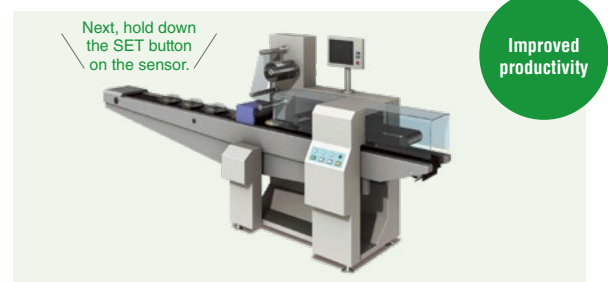
KV Sensor Network System — Configuration Diagram

Communication unit required for each sensor ▶ See P. 22 and 23

NU-EP1 compatible sensors	System configuration diagram

The NU-EP1 is used as the main unit, and various sensors (up to 16) can be connected as expansion units.

Sensor power is supplied via a PoE port connection.

24 V power supply

NU-EP1   Expansion units of various sensors

KV-8000   **KV-XLE02**   **NE-Q05P**

* Lower 2 ports support PoE functionality

No need for a 24 V sensor power supply

MU-N compatible sensors

Mixed connections to MU-N and other N-bus compatible sensors (up to 4) are possible.

Sensor power is supplied via a PoE port connection.

NU-EP1   **MU-N**   **LV-N**

No need for a 24 V sensor power supply

DL-EP1 compatible sensors	System configuration diagram

Because the DL-EP1 is an expansion unit, the sensor requires one main unit.

24 V power supply

Main unit   Expansion units   **DL-EP1**

* Must be connected to far end

KV-8000   **KV-XLE02**   **NE-Q05(P)**

Mixed connections to D-bus compatible sensors (up to 15) are possible.

24 V power supply

IB   **IG**   **GT2**   **DL-EP1**

KV Sensor Network Lineup As of January 20, 2021

Category	Series	Model	Communication unit	Sensor monitor function	Sensor setting batch transfer	Sensor setting backup function	Remarks
Digital fiber optic sensor	FS-N	**FS-N40** **FS-N42N/N42P** **FS-N44N/N44P** **FS-N10** **FS-N12N/N12P** **FS-N12CN/N12CP** **FS-N12EN** **FS-N14N/N14P** **FS-N14CP**	**NU-EP1**	✓	✓	✓	Expansion unit, Zero line model Expansion unit, Cable, One output Expansion unit, Cable, Two outputs Expansion unit, Zero line model Expansion unit, Cable, One output Expansion unit, M8 connector, One output Expansion unit, e-CON connector, One output Expansion unit, Cable, Two outputs Expansion unit, M8 connector, Two outputs
Laser sensor	LR-T	**LR-TB5000(C/CL)** **LR-TB2000(C/CL)**	**NU-EP1** (via MU-N)	✓	✓	✓	Detecting distance: 60 to 5000 mm Detecting distance: 60 to 2000 mm
Laser sensor	LV-N	**LV-N10** **LV-N12N/N12P** **LV-N12CN/N12CP**	**NU-EP1**	✓	✓	✓	Expansion unit, Zero line model Expansion unit, Cable, One output Expansion unit, M8 connector, One output
Photoelectric sensor	LR-W	**LR-W500(C)** **LR-W70(C)** **LR-WF10(C)**	**NU-EP1** (via MU-N)	✓	✓	✓	Detecting distance: 30 to 500 mm, White LED Detecting distance: 30 to 70 mm, White LED Fibre unit-connection model, White LED
Photoelectric sensor	PS-N	**PS-N10** **PS-N12N/N12P** **PS-N12CN/N12CP**	**NU-EP1**	✓	✓	✓	Expansion unit, Zero line model Expansion unit, Cable, One output Expansion unit, M8 connector, One output
Pressure sensor	AP-N	**AP-N10** **AP-N10D**	**NU-EP1**	✓	✓	✓	Expansion unit, Zero line model, One output Expansion unit, Zero line model, Two outputs
Displacement sensor	IL	**IL-1000** **IL-1500** **IL-1050** **IL-1550**	**DL-EP1**	✓	✓	✓	Main unit, DIN mounting Main unit, Panel mounting Expansion unit, DIN mounting Expansion unit, Panel mounting
Displacement sensor	IG	**IG-1000** **IG-1500** **IG-1050** **IG-1550**	**DL-EP1**	✓	✓	✓	Main unit, DIN mounting Main unit, Panel mounting Expansion unit, DIN mounting Expansion unit, Panel mounting
Displacement sensor	IB	**IB-1000** **IB-1500** **IB-1050** **IB-1550**	**DL-EP1**	✓	✓	✓	Main unit, DIN mounting Main unit, Panel mounting Expansion unit, DIN mounting Expansion unit, Panel mounting
Contact-type displacement sensor	GT2	**GT2-71N/71P** **GT2-71CN/71CP** **GT2-71MCN/71MCP** **GT2-75N/75P** **GT2-72N/72P** **GT2-72CN/72CP** **GT2-76N/76P** **GT2-100N/100P**	**DL-EP1**	✓	✓	✓	Main unit, Cable, DIN mounting Main unit, Connector, DIN mounting Main unit, Connector, DIN mounting, Analogue output Main unit, Cable, Panel mounting Expansion unit, Cable, DIN mounting Expansion unit, Connector, DIN mounting Expansion unit, Cable, Panel mounting Highly visible display
Contact-type displacement sensor	GT	**GT-71A** **GT-75A** **GT-72A** **GT-76A**	**DL-EP1**	✓	✓	✓	Main unit, Cable, DIN mounting Main unit, Cable, Panel mounting Expansion unit, Cable, DIN mounting Expansion unit, Cable, Panel mounting
Electrostatic sensor	SK	**SK-1000** **SK-1050**	**DL-EP1**	✓	✓		Inline model, Main unit Inline model, Expansion unit
Vision sensor	IV2	**IV2-G30F** **IV2-G30**	—		✓		Sensor amplifier, Learning/standard mode Sensor amplifier, Standard mode
Vision sensor	IV-H (Ultra-compact models)	**IV-HG10** **IV-HG15**	—		✓		Sensor amplifier, Main unit Sensor amplifier, Expansion unit
Vision sensor	IV-H (Amplifier-integrated models)	**IV-H150MA** **IV-H500CA** **IV-H500MA** **IV-H2000MA**	—		✓		Close range, Monochrome, Automatic focus Standard, Colour, Automatic focus Standard, Monochrome, Automatic focus Long range, Monochrome, Automatic focus
Vision sensor	IV (Ultra-compact models)	**IV-G10** **IV-G15**	—		✓		Sensor amplifier, Main unit Sensor amplifier, Expansion unit
Vision sensor	IV (Amplifier-integrated models)	**IV-150MA** **IV-150M** **IV-500CA** **IV-500C** **IV-500MA** **IV-500M** **IV-2000MA** **IV-2000M**	—		✓		Close range, Monochrome, Automatic focus Close range, Monochrome, Manual focus Standard, Colour, Automatic focus Standard, Colour, Manual focus Standard, Monochrome, Automatic focus Standard, Monochrome, Manual focus Long range, Monochrome, Automatic focus Long range, Monochrome, Manual focus

Category	Series	Model	Communication unit	Sensor monitor function	Sensor setting batch transfer	Sensor setting backup function	Remarks
Customizable vision system	XG-X	XG-X2800 XG-X2700 XG-X2500 XG-X2200 XG-X2000 XG-X1500 XG-X1200 XG-X1000	—	✓			Supports 8000-pixel line scan cameras/XR/LJ-V/21-megapixel cameras Supports 21-megapixel cameras Supports 5-megapixel cameras Supports 2-megapixel cameras Supports 0.47-megapixel cameras Supports 5-megapixel cameras Supports 2-megapixel cameras Supports 0.47-megapixel cameras
	XG-8000	XG-8700L XG-8700 XG-8500L XG-8500 XG-8000 XG-8800L XG-8800	—	✓			Supports 8000-pixel line scan cameras/21-megapixel cameras Supports 5-megapixel cameras Supports 2000-pixel line scan cameras Supports 2-megapixel cameras Supports 0.47-megapixel cameras Supports up to four line scan cameras Supports up to eight 2-megapixel cameras
	XG-7000	XG-7700 XG-7500 XG-7000	—	✓			Supports 5-megapixel cameras Supports 2-megapixel cameras Supports 0.47-megapixel cameras
Intuitive vision system	CV-5000	CV-5700 CV-5500 CV-5000	—	✓			Supports 5-megapixel cameras Supports 2-megapixel cameras Supports 0.31-megapixel cameras
1D/2D code reader	SR-2000	SR-2000 SR-2000W	—	✓	✓		Full-range model Ultra-wide field of view model
	SR-1000	SR-1000 SR-1000W	—	✓	✓		Standard model Wide field of view model
	SR-750	SR-750HA SR-750 SR-751 SR-752	—	✓	✓		High-resolution model Close-range model Mid-range model Long-range model
	SR-700	SR-700HA SR-700 SR-710	N-L20	✓			High-resolution model Close-range model Mid-range model
	SR-650	SR-650HA SR-650 SR-651 SR-652	—	✓	✓		High-resolution model Close-range model Mid-range model Long-range model
	SR-D100	SR-D100HA SR-D100H SR-D100 SR-D110	—	✓	✓		Ultra-high-resolution model High-resolution model Standard model Wide field of view model
Handheld mobile computer	BL-1300	BL-1300 BL-1301 BL-1300HA BL-1301HA BL-1350HA BL-1351HA BL-1370 BL-1371	N-L20	✓			Standard model, Single Standard model, Raster High-resolution model, Single High-resolution model, Raster High-resolution side model, Single High-resolution side model, Raster Long-range model, Single Long-range model, Raster
	BL-700	BL-700 BL-701 BL-740 BL-741 BL-780 BL-781	N-L20	✓			High-resolution model, Single High-resolution model, Raster Mid-range model, Single Mid-range model, Raster Long-range model, Single Long-range model, Raster
	BL-180	BL-180 BL-185	N-L20	✓			Front model Side model
Laser marker	MD-X	MD-X2000 MD-X2020 MD-X2500 MD-X2520 MD-X1000(C) MD-X1020(C) MD-X1050 MD-X1500(C) MD-X1520(C)	—	✓			13 W standard area model 13 W wide area model 25 W standard area model 25 W wide area model 13 W standard area model 13 W wide area model 13 W small spot model 25 W standard area model 25 W wide area model
	ML-Z	ML-Z9610 ML-Z9610T ML-Z9620 ML-Z9620T ML-Z9650 ML-Z9650T	—	✓			30 W standard area model 20 W standard area model 30 W wide area model 20 W wide area model 30 W small spot model 20 W small spot model
Displacement sensor/ measurement system	LJ-V7000	LJ-V7000	CB-EP100	✓			Reflective 2D laser profiler, NPN
	CL-3000	CL-3000	—	✓			Confocal displacement sensor
	LK-G5000	LK-G5000(V)	—	✓			Laser displacement sensor, NPN