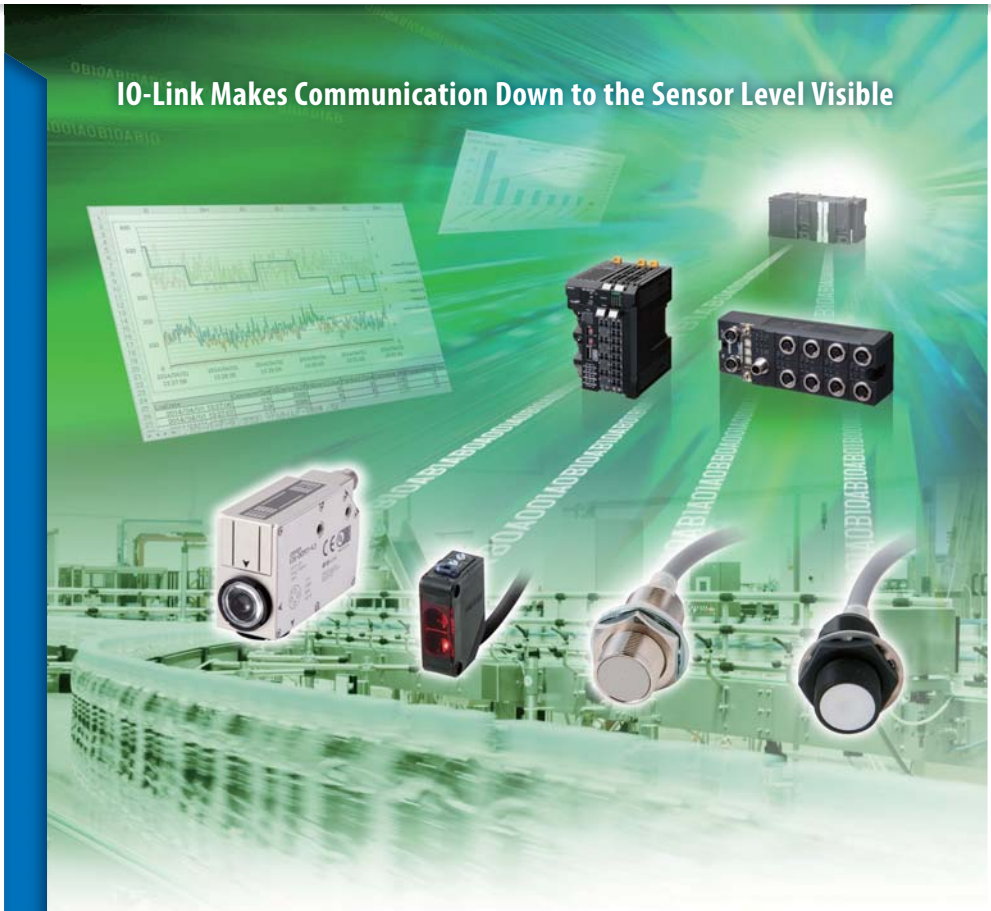
Using IoT to Bring Innovation to Manufacturing Sites.

OMRON

IO-Link Series



Using IoT to enhance the value of manufacturing

- "Abnormality detection" for shortest recovery
- "Condition monitoring" for predictive maintenance
- "Individual identification" for reduction of man hours

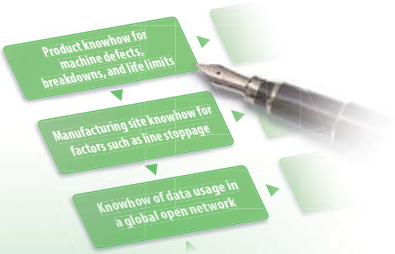
IO-Link

Using IoT to Bring Innovation to Manufacturing Sites.

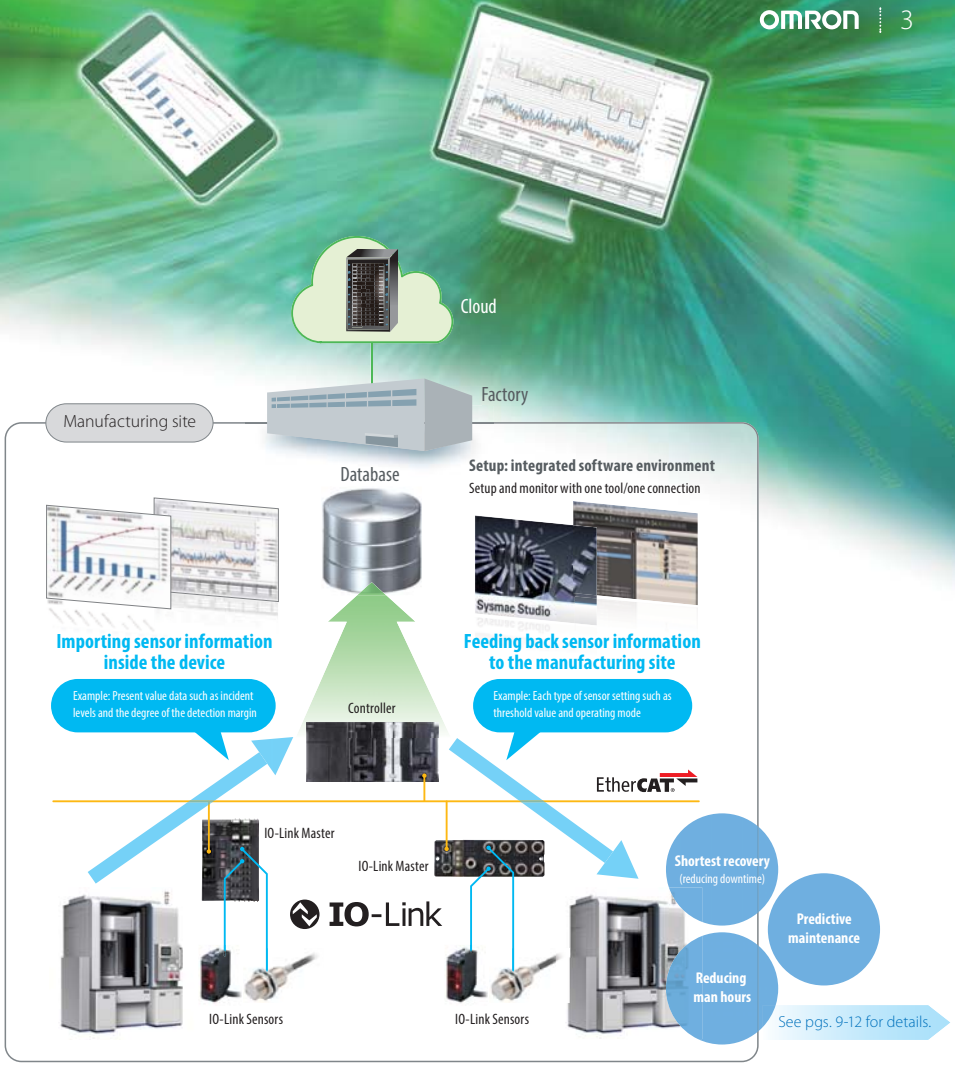
A wide variety of Omron's control components used at manufacturing sites are easy to connect to a network.
We will bring new innovation to the manufacturing sites by utilizing data.

Using Omron's Original Know-how for Adopting IoT

Omron has product know-how from its many years of continually creating control components, manufacturing site know-how as a user from using these products in its production lines, and know-how for responding to open network environments. Using these three unique forms of know-how,
Omron is vigorously promoting the IoT of manufacturing sites.



At Omron Kusatsu Factory and Omron Ayabe factory,
we are working on adopting IoT and have been obtaining big improved results.



See pgs. 9-12 for details.

IoT at the Component Level Is the Issue

At many manufacturing sites, adoption of IoT is being promoted at the controller and HMI levels through EtherNet/IP or EtherCAT, but not at the component level, and the reality is that sensor level information, which is useful for productivity and quality improvement, is not being incorporated.

Using IO-Link to Make Communication Down to the Sensor Level Visible

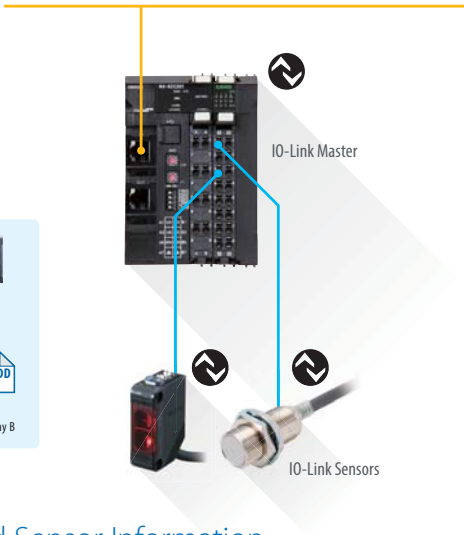
Therefore, at Omron, as our first round of IO-Link products, we provide IO-Link Photoelectric Sensors, Color Mark Photoelectric Sensors, Proximity Sensors, and IO-Link Masters. By connecting Sensors and Controllers via IO-Link Masters, not only ON/OFF signals but also necessary information for stable operation such as light incident levels are made visible. We are making a condition monitoring and abnormality detection of sensors possible and contributing to the shortening of recovery time for devices and equipment, predictive maintenance, and reduction in commissioning time.
We will undertake expansion of the product lineup that makes necessary information visible.

IO-Link Is

Communication Technology That Realizes the Informationization of Sensor Levels

IO-Link

IO-Link, which is specified as international standard IEC 61131-9,
is an open information technology (interface technology) between the Sensor/Actuator and the I/O Terminal.
It collects information held by the sensor/actuator through the IO-Link Master and via a fieldbus network into the host controller.
The IO-Link enables communication within the whole system and reduce time required for commissioning and maintenance.

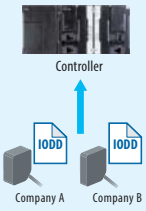


An Open International Standard

As of December 2015, over 100 companies,
including major sensor manufacturers, have joined the IO-Link Consortium.

Responding to Global Development

All IO-Link Sensors have an IODD (IO Data Description) file that lists what kind of instrument they are and what parameters need to be set for them. IODD files are globally common, so IO-Link Sensors can be used in the same way with any manufacturer.

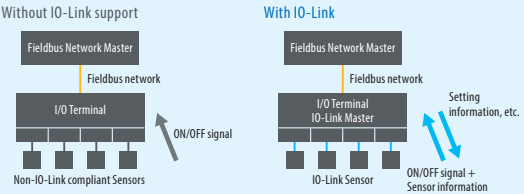


Communications of the ON/OFF Signals and Sensor Information

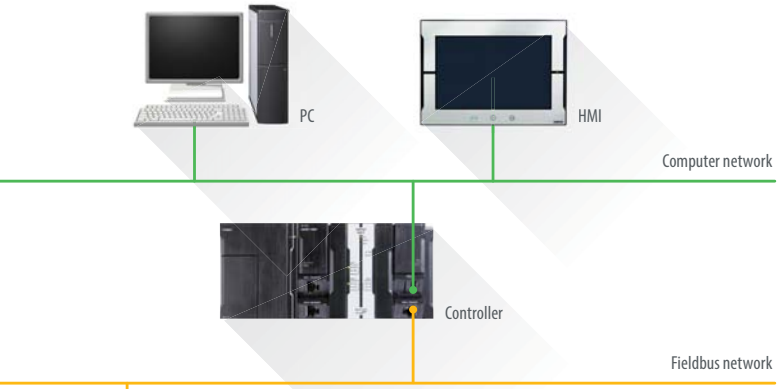
IO-Link can send and receive in both directions not just ON/OFF signals but also sensor information.
The IO-Link baud rates*1 of COM 1, 2, and 3 are specified in the IO-Link specifications.
Omron's IO-Link components are compatible with COM 2 and COM 3, and are capable of high speed communications.

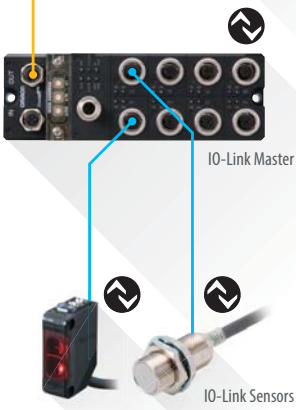
Condition Monitoring/Batch Data Input is Available

The IO-Link master has multiple ports and an IO-Link Sensor is connected to each port. Unlike a fieldbus network, communication is one-to-one.



*1. Baud rates are as follows. COM 1: 4.8 kbps, COM 2: 38.4 kbps, COM 3: 230.4 kbps





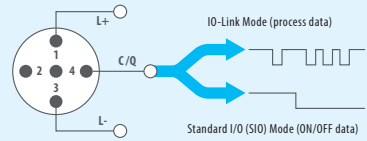
Uses 3-wire Unshielded Cable

No dedicated communication cable required. A communication system that can be used both as an ON/OFF line and a communication line.

Can Be Used with a Conventional 3-wire Unshielded Cable or Integrated I/F Connector

3-wire unshielded cable
Maximum length 20 m

A dedicated communication cable is unnecessary and a conventional 3-wire unshielded cable can be used for the IO-Link, because the IO-Link has both an IO-Link Mode which performs a digital communication and Standard I/O (SIO) Mode which uses conventional contact input/output.

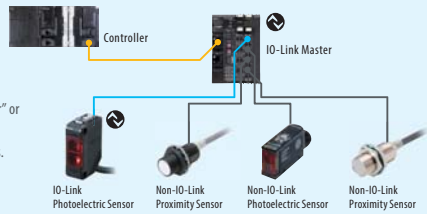


Capable of Intermixing IO-Link Sensors and Sensors That Are Not Compliant with IO-Link

You can connect an IO-Link Sensor and a Sensor/Actuator that is not compliant with IO-Link to a single IO-Link Master.

A Part of the Existing Equipment Can Be Replaced with the IO-Link

In situations where you want to improve only one part of your existing equipment, such as when "errors often occur" or "I want to import sensor information," IO-Link Sensors can be mixed with non-supported sensors.



Omron's IO-Link Compliant Equipment

Masters and Sensors Can Be Chosen to Match Your Setup Situation

Omron provides two types of Masters, a Master Unit with screw-less clamp terminal blocks and a Master Unit for M12 Smartclick connectors, as IO-Link compliant devices and Sensors for connecting to the screw-less clamp terminals or to the M12 connector terminals that support each Master.

Value Design for Panel

Corresponding to our shared **Value Design for Panel** concept for the specifications of products.

IO-Link Masters

The Unit with Screw-less Clamp Terminal Blocks Allows Wiring Man-hours to be Reduced

EtherCAT Coupler

NX-series IO-Link Master Unit
NX-ILM400
4-port/screw-less clamp terminal block

Note: Four sensors can be connected to one device.

IO-Link

IO-Link Sensors

Screw-less Clamp Terminals Connection Devices

Photoelectric Sensor
E3Z-☐-IL☐
Pre-wired Models

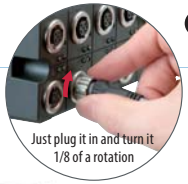
Proximity Sensor
E2E-☐-IL☐
Pre-wired Models

Color Mark
Photoelectric Sensor
Models for M12 Connector
E3S-DCP21-IL☐

Note: When using a connector with a cable (M12 two-sided connector), the connector can also be connected to environment-resistant unit type GX-ILM08C

Photoelectric Sensor
E3Z-☐-IL☐
Models for M8 Connector

Spatter-resistant
Proximity Sensor
E2EQ-☐-IL☐
Pre-wired Models



Smartclick

Note: Smartclick is a registered trademark of Omron.

The Unit for M12 Smartclick Connector Can Be Used in Watery, and Dusty Environments

Environment-resistant Unit IP67 Type
GX-ILM08C
8-port/M12 Smartclick connector

Note: Eight sensors can be connected to one device.

IO-Link

M12 Connector Connection Devices

Proximity Sensor
E2E-☐-IL☐
Models with M12 Pre-wired
Smartclick Connector

Photoelectric Sensor
E3Z-☐-IL☐
Models with M12 Pre-wired
Smartclick Connector

Spatter-resistant
Proximity Sensor
E2EQ-☐-IL☐
Models with M12 Pre-wired
Smartclick Connector

Value Provided by IO-Link

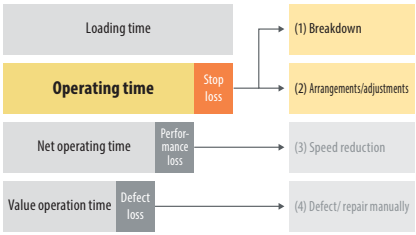
Supporting Solutions to Management Issues in the Manufacturing Industry through Abnormality Detection/Condition Monitoring/Individual Identification

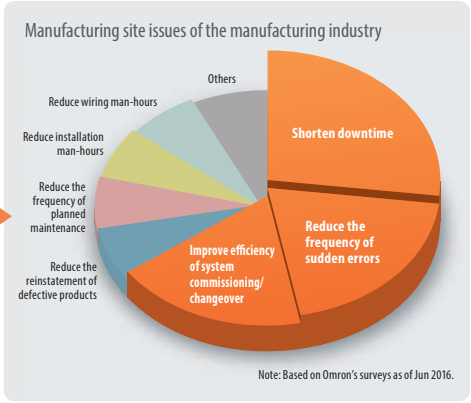
"Improving an equipment operation rate" is a universal management issue at manufacturing sites. As the calculation formula below shows, an overall equipment operation rate is determined by how stops, drops in speed and defects are avoided.

Overall Equipment Effectiveness*1 = Availability (stop loss) × speed performance (performance loss) × quality (defect loss)

*1. OEE: overall equipment effectiveness. An index that stratifies the effectiveness of production equipment developed and advocated by the Japan Institute of Plant Maintenance.

These three loss occurrence factors are divided into the following (1) to (4). Of these, the occurrence factors for stop loss are the same as for the three major issues (right diagram) at the manufacturing sites, and it can be seen that the issue happening at a site becomes a stop loss factor.





Omron's IO-Link Compliant Components Solve "Stop Loss" Issues and Improve Equipment Operation Rate.

What makes the shortening of downtime possible is...
"Abnormality detection" for the shortest recovery P. 9

What makes the reduction of the frequency of sudden errors possible is...
"Condition monitoring" for predictive maintenance P. 10

What makes the improvement of setup change efficiency possible is...
"Individual identification" for the reduction of man-hours P. 12

To those in charge of maintenance "Abnormality detection" for the shortest recovery

Shortest Recovery

Detects Wiring Cable Disconnections and Errors and Improves Equipment Operation Rate through Quick Maintenance

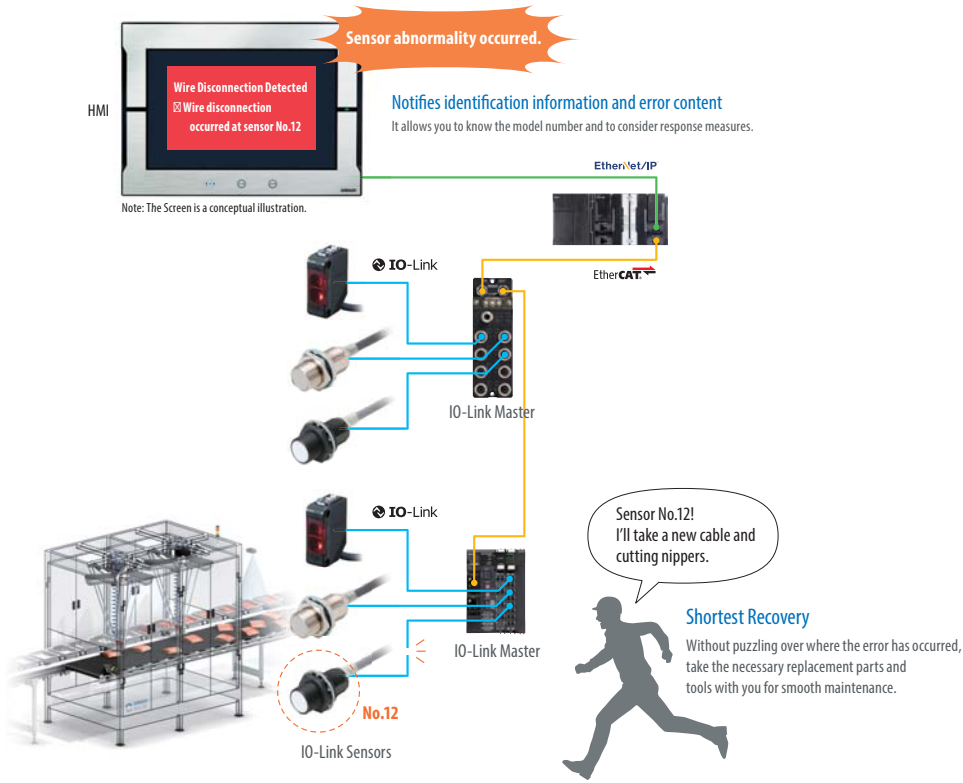
Past problems

- An abnormality was displayed on the abnormality display screen, but upon going to look at the equipment, no external error was detected and the cause of the stop was not understood...
- Those responsible for maintenance investigated the cause of the abnormality from the activity of the stopped equipment, but because the maintenance person relied on the skill he or she has to identify the abnormality and replace the failed sensor, stoppages from 2 hours to several days occur...

With an IO-Link Photoelectric Sensor/Proximity Sensor

Abnormal area and phenomenon of sensors are reported in real time

When an abnormality occurs in a sensor, because you can see where the abnormality occurred and the factors estimated for it, you can go to where the abnormality occurred and recover the equipment in the shortest amount of time.
Also with wire disconnection detection, not only output wires, but also power lines can be detected unconditionally.



To those in charge of maintenance "Condition monitoring" for predictive maintenance (1)

Predictive maintenance

The Proximity Sensor Indicates an Excessive Proximity to the Sensing Object. Understand the Changes in Device Condition in Advance and Reduce Sudden Stops

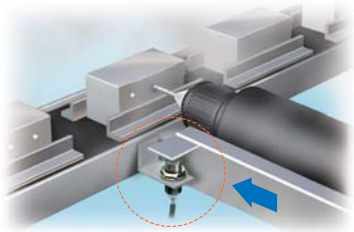
Past problems

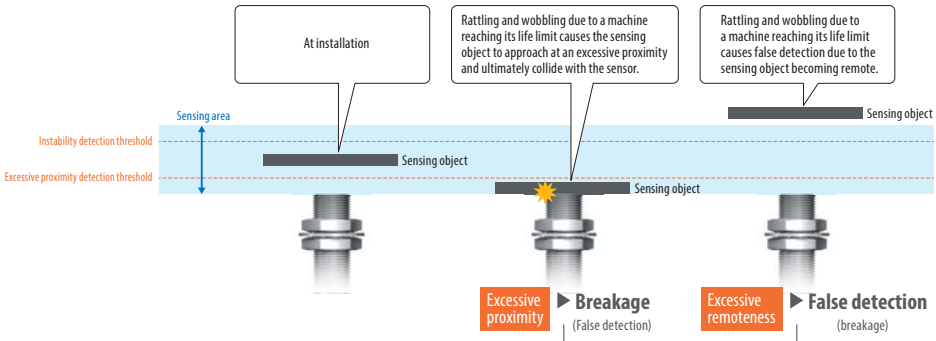
The detection position changes due to wear and vibration in the device's mechanical parts and as a result, false detection and collision with the sensor have a negative impact on the device...

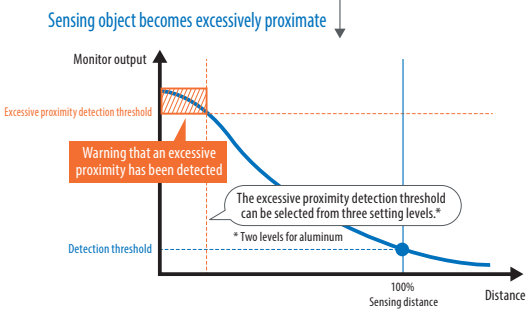
With an IO-Link Proximity Sensor

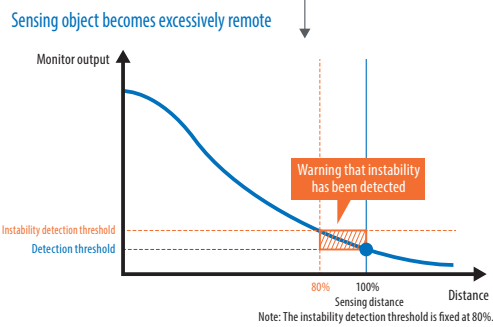
You are notified of excessive remoteness or proximity, and the occurrence of sudden defects is greatly reduced.

Constantly monitoring the position of the sensing object and notifying of excessive remoteness or proximity can be used for predictive maintenance of the device.









Note: The instability detection threshold is fixed at 80%.

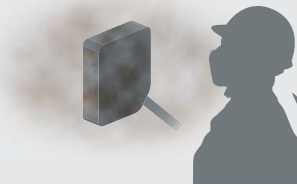
To those in charge of maintenance "Condition monitoring" for predictive maintenance (2)

Predictive maintenance

Understand Unstable Situations in the Incident Level of the Photoelectric Sensor in Advance and Reduce Sudden Stops

Past problems

- In a conveyance process operating for 24 hours, debris or dust accumulated on the detection surface of the through-beam photoelectric sensor, leading to a decline in the light incident level that causes the sensor to make false detection and the device to stop...
- Water drops stick to the sensing surface of the reflective sensor causing reflected light to enter...

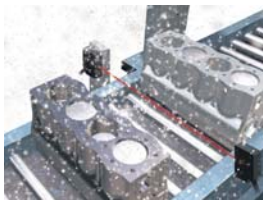


With an IO-Link Photoelectric Sensor

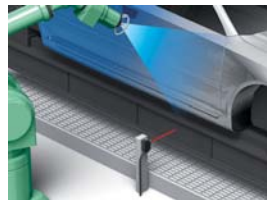
A light incident level monitor prevents false detection

With a response time of 1 ms, Photoelectric Sensor's light incident level is output for monitoring. It is output when the light incident level exceeds the instability detection threshold, so you can check the site before false detection occurs and perform predictive maintenance.

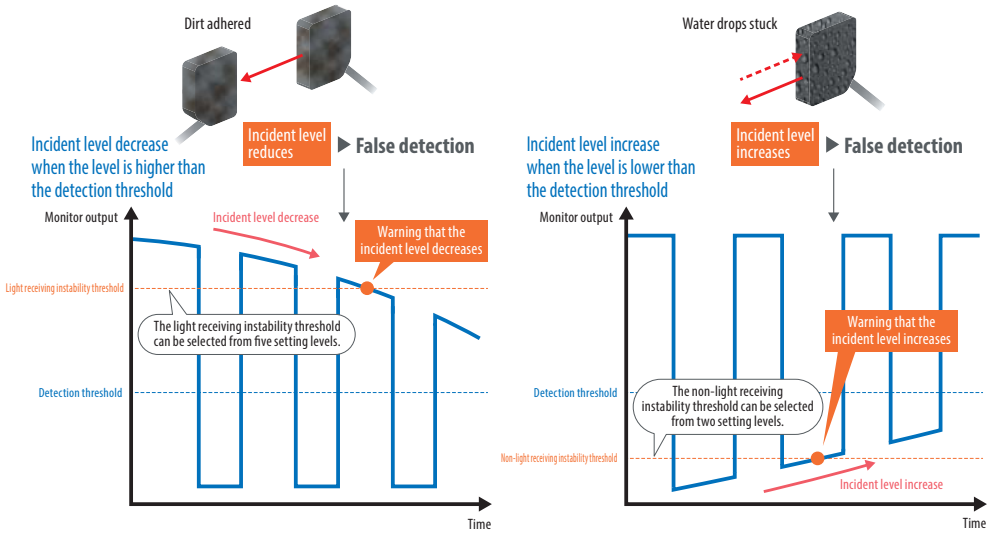
Debris and dust accumulate on the sensing surface (Through-beam)



Paint adhered to the sensing surface (Through-beam)



Water drops adhered to the sensing surface (Through-beam)



To those in charge of production engineering "Individual identification" for the reduction of man-hours

Reducing Man-hours

Improving System Commissioning and Changeover Efficiency by Checking Identifications in Batches

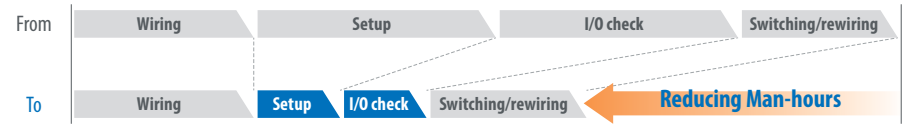
Past problems

- During system commissioning or changeover, operators have to perform the I/O check for each of the thousands of sensors installed on the line, and it took an enormous amount of time...
- When a sensor is installed wrong or an error occurs, wasteful work occurred that would normally be unnecessary...

With an IO-Link Photoelectric Sensor/Proximity Sensor

Without going to the site, you can check individual sensor identifications in batches, resulting in a sharp reduction of commissioning time

By checking the sensor identification (manufacturer/sensor type/model number), you can easily check mistakes such as misconnected or unconnected sensors and installation mistakes. Also, because it is possible to program multiple sensors at once using the command language used only for the controller, it is also possible to reduce commissioning time sharply.

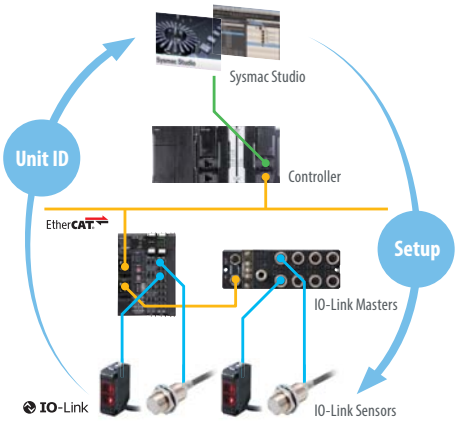


Note: The graph above is a conceptual illustration.

Setup

Sensor settings in descending order in batches

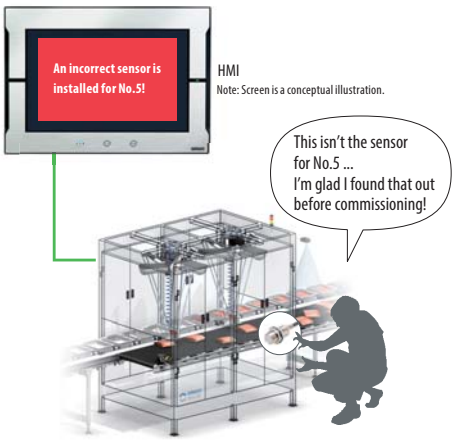
Program all at once to reduce commissioning time and inconsistent settings



I/O check

Use identification checks with HMI to prevent installation mistakes

Makes it possible to check for sensor installation mistakes before commissioning



IO-Link Masters

Product name	Number of IO-Link ports	External connection terminal	Environment tolerance	Model
NX Series IO-Link Master Unit *1 	4	Screw-less clamp terminals	IP20	NX-ILM400
GX Series IO-Link Master Unit 	8	M12 Smartclick Connector	IP67	GX-ILM08C

*1. EtherCAT Communication Coupler Unit NX-ECC2□□ is necessary for the system configuration.

IO-Link Sensors

Photoelectric Sensor

Product name	System		Model
E3Z-□-IL□ 	Through-beam	Pre-wired Models (2m)	E3Z-T81-IL□ 2M
		M12 Pre-wired Smartclick Connector Models (0.3m)	E3Z-T81-M1TJ-IL□ 0.3M
		Standard M8 Connector Models	E3Z-T86-IL□
	Retro-reflective	Pre-wired Models (2m)	E3Z-R81-IL□ 2M
		M12 Pre-wired Smartclick Connector Models (0.3m)	E3Z-R81-M1TJ-IL□ 0.3M
		Standard M8 Connector Models	E3Z-R86-IL□
	Diffuse-reflective	Pre-wired Models (2m)	E3Z-D82-IL□ 2M
		M12 Pre-wired Smartclick Connector Models (0.3m)	E3Z-D82-M1TJ-IL□ 0.3M
		Standard M8 Connector Models	E3Z-D87-IL□
	Diffuse-reflective Narrow-beam	Pre-wired Models (2m)	E3Z-L81-IL□ 2M
		M12 Pre-wired Smartclick Connector Models (0.3m)	E3Z-L81-M1TJ-IL□ 0.3M
		Standard M8 Connector Models	E3Z-L86-IL□

Color Mark Photoelectric Sensor

Product name	System		Model
E3S-DCP21-IL□ 	Diffuse-reflective	M12 Connector Models	E3S-DCP21-IL□

Standard Proximity Sensor (DC 3-wire Shielded Model)

Product name	System		Model
E2E-□-IL□ 	M12	Pre-wired Models (2m)	E2E-X3B4-IL□ 2M
		M12 Pre-wired Smartclick Connector Models (0.3m)	E2E-X3B4-M1TJ-IL□ 0.3M
	M18	Pre-wired Models (2m)	E2E-X7B4-IL□ 2M
		M12 Pre-wired Smartclick Connector Models (0.3m)	E2E-X7B4-M1TJ-IL□ 0.3M
	M30	Pre-wired Models (2m)	E2E-X10B4-IL□ 2M
		M12 Pre-wired Smartclick Connector Models (0.3m)	E2E-X10B4-M1TJ-IL□ 0.3M

Spatter-resistant Proximity Sensor (DC 3-wire Shielded Model)

Product name	System		Model
E2EQ-□-IL□ 	M12	Pre-wired Models (2m)	E2EQ-X3B4-IL□ 2M
		M12 Pre-wired Smartclick Connector Models (0.3m)	E2EQ-X3B4-M1TJ-IL□ 0.3M
	M18	Pre-wired Models (2m)	E2EQ-X7B4-IL□ 2M
		M12 Pre-wired Smartclick Connector Models (0.3m)	E2EQ-X7B4-M1TJ-IL□ 0.3M
	M30	Pre-wired Models (2m)	E2EQ-X10B4-IL□ 2M
		M12 Pre-wired Smartclick Connector Models (0.3m)	E2EQ-X10B4-M1TJ-IL□ 0.3M

Software

Product name	Model
Sysmac Studio *2	SYSMAC-SE2□□□

*2. CX-Configurator FDT for IO-Link sensor setup is included in Sysmac Studio.

MEMO

MEMO

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