Bringing IoT innovation to the plant floor

IO-Link series

IO-Link enables communication down to the sensor level

• Fault detection for fast and easy troubleshooting
• Condition monitoring for predictive maintenance
• Component identification for easy replacement and maintenance
Omron solutions:

Bringing IoT innovation to the plant floor

IO-Link enabled devices bring factory floor data to the enterprise

Omron’s unique position: practical IoT innovation

Omron’s unmatched experience and expertise in complete automation solutions provide a unique insight into the integration of manufacturing systems from the sensor to the enterprise. Our long history of providing industry leading technology in everything from industrial components and sensors to safety and robotics allows us to help you implement the factory of the future today.

Machine and product level expertise

Plant and line integration

Global enterprise level data
IoT down to the component level
It is common for discussions about the adoption of IoT to be centered around the Controller, HMI and IT systems. In reality, however, some of the most important information about a plant or enterprise is found within the machine level sensors.

IO-Link for communication down to the sensor level
Omron’s initial offering of IO-Link products includes photoelectric sensors, color mark sensors, proximity sensors and IO-Link masters. By connecting sensors and controllers via IO-Link, all necessary information for stable sensor operations, such as incident light levels, are visible. Now, monitoring and error detection at the sensor level is possible; reducing downtime, aiding in predictive maintenance and decreasing commissioning time.
IO-Link is
Communication down to the sensor level

An open international standard
As of December 2015, over 100 companies, including major sensor manufacturers, have joined the IO-Link Consortium. IO-Link, 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 from the sensor/actuator through the IO-Link Master via a fieldbus network into the host controller. IO-Link enables communication within the whole system and reduces time required for commissioning and maintenance.

Third party compatibility
All IO-Link Sensors have an IODD (Input Output Data Description) file that lists the component type and what parameters need to be set. IODD files are a global standard, so IO-Link components can be used interchangeably with any IO-Link manufacturer.

Information beyond on and off
IO-Link sends and receives not only ON/OFF signals, but also sensor information. Omron’s IO-Link components are compatible with COM 2 and COM 3, and are capable of high speed communications.

*1. Baud rates are as follows: COM 1: 4.8 kbps, COM 2: 38.4 kbps, COM 3: 230.4 kbps
**Standard 3-wire unshielded cable**
No dedicated communication cables required

**No special cabling required**

IO-Link works with a conventional 3-wire unshielded cable - no dedicated communication cable is required. IO-Link has both an IO-Link Mode which communicates digitally and Standard I/O (SIO) Mode which uses conventional contact input/output.

**Mix IO-Link and conventional sensors**

Add IO-Link devices to existing trouble spots where additional data or troubleshooting is required - you can even have standard and IO-Link devices on the same master.
Masters and sensors to match your application

Omron provides two types of IO-Link Masters, push-in clamp terminal blocks and M12 Smartclick connectors.

**IO-Link Masters**

- NX-series IO-Link Master Unit
  - NX-ILM400
  - 4-port/push-in clamp terminal block

**IO-Link Sensors**

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

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

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

Reduce wiring time with optional push in clamp terminal blocks.

Value Design for Panel

Part of our Panel Design concept for optimized panels.
IO-Link

The IO-Link Master with M12 Smartclick connectors for wet and dusty environments

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

Sensors with M12 connectors

Color Mark
Photoelectric Sensor
E3S-DCP21-IL
M12 Pre-wired Smartclick Connector

Photoelectric Sensor
E3Z-□-IL
M12 Pre-wired Smartclick Connector

Proximity Sensor
E2E-□-IL
M12 pre-wired Smartclick connector

Spatter-resistant
Proximity Sensor
E3Z-□-IL
M12 pre-wired Smartclick connector

Smartclick is a registered trademark of Omron.

Just plug in and turn 1/8 of a rotation
Enhanced manufacturing solutions
through fault detection, condition monitoring and part identification

Improving equipment operation is a universal goal for manufacturers. OEE (overall equipment effectiveness) is a common metric that identifies the percentage of manufacturing time that is truly productive. It is one of the best metrics for identifying losses, benchmarking progress, and improving the productivity of manufacturing equipment.

Overall equipment effectiveness = Availability (planned and unplanned stops) × Performance (slow cycles and small stops) × Quality (defects)

These three losses are further divided into the Six Big Losses - the most common causes of equipment-based productivity loss in manufacturing.

<table>
<thead>
<tr>
<th>Overall Equipment Effectiveness</th>
<th>Recommended Six Big Losses</th>
<th>Traditional Six Big Losses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability Loss</td>
<td>Unplanned Stops</td>
<td>Equipment Failure</td>
</tr>
<tr>
<td></td>
<td>Planned Stops</td>
<td>Setup and Adjustments</td>
</tr>
<tr>
<td>Performance Loss</td>
<td>Small Stops</td>
<td>Minor and Minor Stops</td>
</tr>
<tr>
<td></td>
<td>Slow Cycles</td>
<td>Reduced Speed</td>
</tr>
<tr>
<td>Quality Loss</td>
<td>Production Rejects</td>
<td>Process Defects</td>
</tr>
<tr>
<td></td>
<td>Startup Rejects</td>
<td>Reduced Yield</td>
</tr>
<tr>
<td>OEE</td>
<td>Fully Productive Time</td>
<td>Valuable Operating Time</td>
</tr>
</tbody>
</table>

Omron’s IO-Link compliant components solve stop loss issues while improving equipment operation rates

Fault detection for quick recovery makes reduced downtime possible

P. 9

Condition monitoring for predictive maintenance makes the reduction of equipment failure possible

P. 10

Component identification for reduced man-hours makes improved set-up and adjustments possible

P. 12

Note: Based on Omron’s survey, January 2016.
Fault detection for quick recovery

Detect and troubleshoot connection issues

Traditional challenges:
· A fault is displayed on an HMI or panel, but it is difficult to identify the actual problem on the machine
· Maintenance personnel are required to investigate the cause of the downtime; lost production can last several hours to several days

With IO-Link enabled devices, sensor status and fault conditions reported in real time
When a sensor fault occurs, IO-Link allows you to see which sensor faulted and the cause of the error. With this information, you can determine the required action and quickly bring the equipment back online. IO-Link also detects disconnected or broken wires on both the output and the input/power.

Wire disconnection detected. Wire disconnection occurred at sensor No.12

Sensor fault occurred
Provides identification information and fault details. The sensor part number is displayed.

Quick repair
Without extensive troubleshooting to find the reason for the error, the root cause as well as the replacement parts and tools required are known instantly.
Reduce downtime
with enhanced data

Traditional challenges:
∙ The location of the target object changes over time due to wear and vibration and can result in false detection and collision

With an IO-Link proximity sensor, you are notified if the target distance is changing, providing early warning before a fault occurs.
Constantly monitoring the position of the target object and notifying of excessive remoteness or proximity is useful for predictive maintenance.
Monitor sensor performance
to reduce downtime

Traditional challenges:
- Debris or dust accumulated on the lens of the through-beam photoelectric sensor leads to a decline in the incident light level, causing the sensor to fault and the process to stop
- Water drops stick to the sensing surface of a reflective sensor causing reflected light to enter

With an IO-Link photoelectric sensor, monitoring incident light level prevents false detection
The photoelectric sensor offers several instability settings, allowing you to monitor the incident light level and easily determine when maintenance must be performed.

Debris and dust accumulate on the sensing surface (Through-beam)
Paint adheres to the sensing surface (Through-beam)
Water drops collect on the sensing surface (Through-beam)

The incident level decreases when the level is higher than the detection threshold.

The incident level increases when the level is lower than the detection threshold.

Output

Incident level decreases
False detection

Incident level increase
False detection

Detection threshold

Light receiving instability threshold

Five possible levels for light receiving instability threshold settings

Time

Two possible levels for non-light receiving instability threshold settings

Time
Enhanced troubleshooting
for reduced downtime

Traditional challenges:
- During system commissioning or changeover, operators had to perform an I/O check for each of the thousands of sensors installed on the line, taking an enormous amount of time.
- Lost production and downtime caused by installation errors.

IO-Link pinpoints problems and speeds commissioning
By checking the sensor identification (manufacturer, sensor type, model number), you can easily detect mistakes such as misconnected or unconnected sensors and installation errors. Also, because it is possible to program multiple sensors at once, it is also possible to significantly reduce commissioning time.

Automatic setup
Program all devices at once to reduce commissioning time and inconsistent settings.

I/O check
Use identification checks to automatically detect installation errors before commissioning.
Overview of IO-Link compliant devices

**IO-Link Masters**

<table>
<thead>
<tr>
<th>Product name</th>
<th>Number of IO-Link ports</th>
<th>External connection terminal</th>
<th>Environment tolerance</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>NX Series IO-Link Master Unit</td>
<td>4</td>
<td>Push-in clamp terminals</td>
<td>IP20</td>
<td>NX-ILM400</td>
</tr>
<tr>
<td>GX Series IO-Link Master Unit</td>
<td>8</td>
<td>M12 Smartclick Connector</td>
<td>IP67</td>
<td>GX-ILM08C</td>
</tr>
</tbody>
</table>

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

**IO-Link Sensors**

**Photoelectric Sensor**

<table>
<thead>
<tr>
<th>Product name</th>
<th>System</th>
<th>Model</th>
</tr>
</thead>
</table>
| E3Z-□-IL□    | Through-beam | Pre-wired Models (2m) - E3Z-T81-IL□ 2M  
Predrain 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  
Prerain 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  
Predrain Smartclick Connector Models (0.3m) - E3Z-D82-M1TJ-IL□ 0.3M  
Standard M8 Connector Models - E3Z-D87-IL□ |
|              | Narrow-beam | Pre-wired Models (2m) - E3Z-L81-IL□ 2M  
Predrain Smartclick Connector Models (0.3m) - E3Z-L81-M1TJ-IL□ 0.3M  
Standard M8 Connector Models - E3Z-L86-IL□ |

**Color Mark Photoelectric Sensor**

<table>
<thead>
<tr>
<th>Product name</th>
<th>System</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>E3S-DCP21-IL□</td>
<td>Diffuse-reflective</td>
<td>M12 Connector Models - E3S-DCP21-IL□</td>
</tr>
</tbody>
</table>

**Standard Proximity Sensor (DC 3-wire Shielded Model)**

<table>
<thead>
<tr>
<th>Product name</th>
<th>System</th>
<th>Model</th>
</tr>
</thead>
</table>
| E2E-□-IL□    | M12    | Pre-wired Models (2m) - E2E-X3B4-IL□ 2M  
Predrain Smartclick Connector Models (0.3m) - E2E-X3B4-M1TJ-IL□ 0.3M |
|              | M18    | Pre-wired Models (2m) - E2E-X7B4-IL□ 2M  
Predrain Smartclick Connector Models (0.3m) - E2E-X7B4-M1TJ-IL□ 0.3M |
|              | M30    | Pre-wired Models (2m) - E2E-X10B4-IL□ 2M  
Predrain Smartclick Connector Models (0.3m) - E2E-X10B4-M1TJ-IL□ 0.3M |

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

<table>
<thead>
<tr>
<th>Product name</th>
<th>System</th>
<th>Model</th>
</tr>
</thead>
</table>
| E2EQ-□-IL□   | M12    | Pre-wired Models (2m) - E2EQ-X3B4-IL□ 2M  
Predrain Smartclick Connector Models (0.3m) - E2EQ-X3B4-M1TJ-IL□ 0.3M |
|              | M18    | Pre-wired Models (2m) - E2EQ-X7B4-IL□ 2M  
Predrain Smartclick Connector Models (0.3m) - E2EQ-X7B4-M1TJ-IL□ 0.3M |
|              | M30    | Pre-wired Models (2m) - E2EQ-X10B4-IL□ 2M  
Predrain Smartclick Connector Models (0.3m) - E2EQ-X10B4-M1TJ-IL□ 0.3M |

**Software**

<table>
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<tr>
<th>Product name</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sysmac Studio*</td>
<td>SYSMAC-SE2□□</td>
</tr>
</tbody>
</table>

*2. Configurator FDT for IO-Link sensor setup is included in Sysmac Studio.
Controllers & I/O
- Machine Automation Controllers (MAC) • Motion Controllers
- Programmable Logic Controllers (PLC) • Temperature Controllers • Remote I/O

Robotics
- Industrial Robots • Mobile Robots

Operator Interfaces
- Human Machine Interface (HMI)

Motion & Drives
- Machine Automation Controllers (MAC) • Motion Controllers • Servo Systems
- Frequency Inverters

Vision, Measurement & Identification
- Vision Sensors & Systems • Measurement Sensors • Auto Identification Systems

Sensing
- Photoelectric Sensors • Fiber-Optic Sensors • Proximity Sensors
- Rotary Encoders • Ultrasonic Sensors

Safety
- Safety Light Curtains • Safety Laser Scanners • Programmable Safety Systems
- Safety Mats and Edges • Safety Door Switches • Emergency Stop Devices
- Safety Switches & Operator Controls • Safety Monitoring/Force-guided Relays

Control Components
- Power Supplies • Timers • Counters • Programmable Relays
- Digital Panel Meters • Monitoring Products

Switches & Relays
- Limit Switches • Pushbutton Switches • Electromechanical Relays
- Solid State Relays

Software
- Programming & Configuration • Runtime