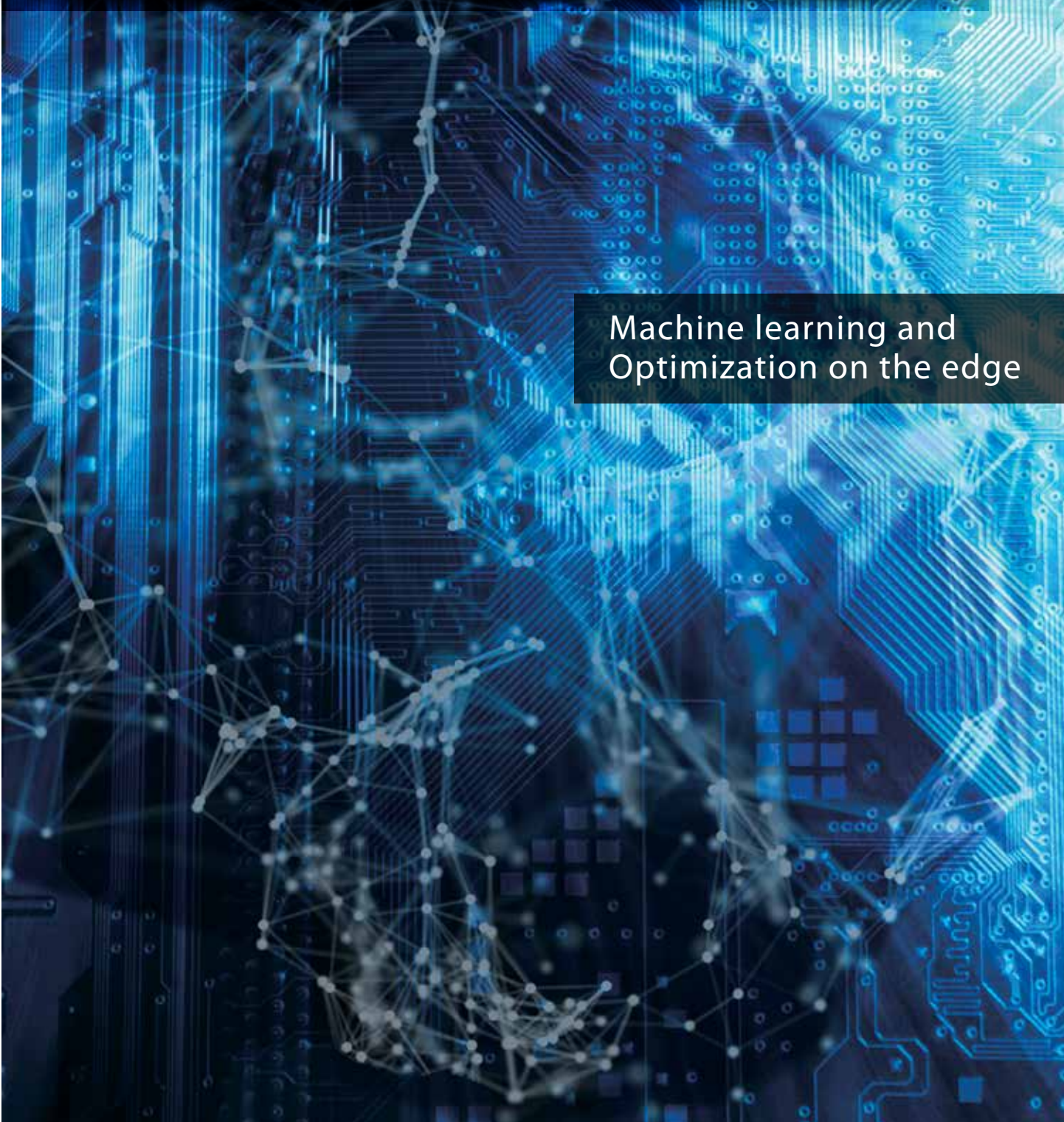



Artificial Intelligence Machine Automation Controller

NX701-Z□00 / NY5□2-Z□00

The background of the page is a complex, abstract image. It features a dark blue and black background with glowing blue lines and patterns. On the right side, there are circuit board traces and components. On the left and bottom, there are network-like structures with nodes and connecting lines, suggesting a data or communication network. The overall theme is technology and automation.

Machine learning and
Optimization on the edge



Get your machine data
out of the cloud



Data-driven decisions help extract the most value from your machines

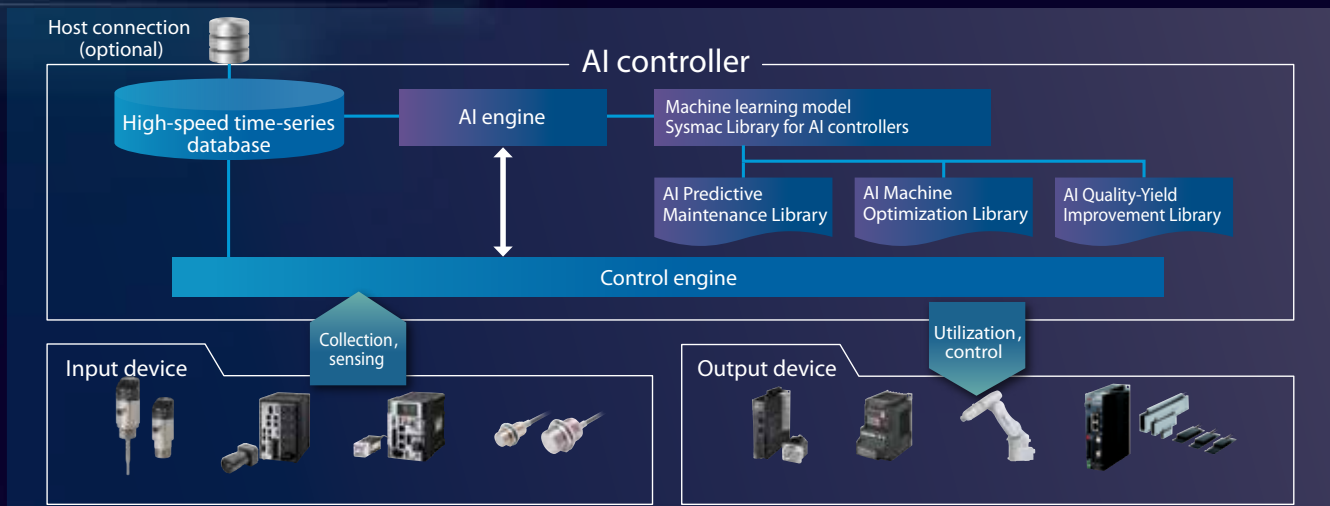
Manufacturing is rapidly advancing, and the world is facing a shrinking labor force and a shortage of skilled workers. Omron is helping to build a factory of the future where people and machines work in harmony by using AI and Machine Learning technologies at the Edge level and migrating tacit knowledge – such as the intuition of experienced operators – into explicit knowledge.

Optimize your overall equipment effectiveness

Reduce equipment stops

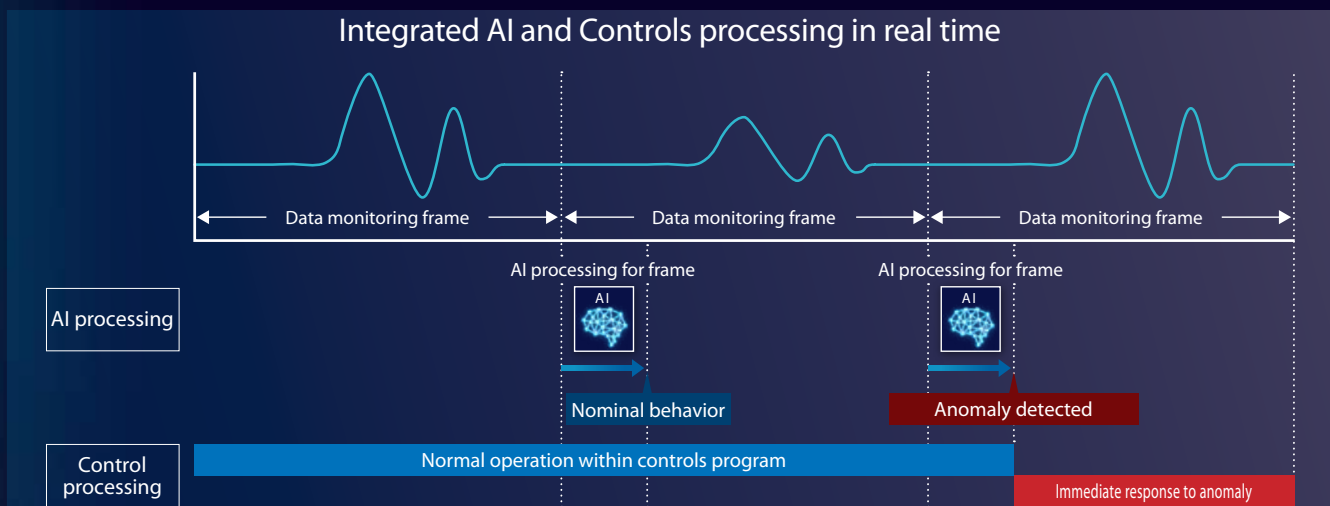
Maximize equipment performance

Ensure product quality



How are you utilizing your machine data?

The artificial intelligence machine automation controller (AI Controller) integrates state-of-the-art machine learning functionality into an Edge level industrial controller, allowing you to leverage machine level information in real time to prolong equipment life and improve product quality. The controller learns the data patterns of nominal machine behavior without being explicitly programmed, so that anomalies can be detected and acted upon immediately.



Leverage the expanding Sysmac Library available from Omron, based on data science and research, avoiding costly development of in-house analytics and optimization capabilities, as well as custom solutions.

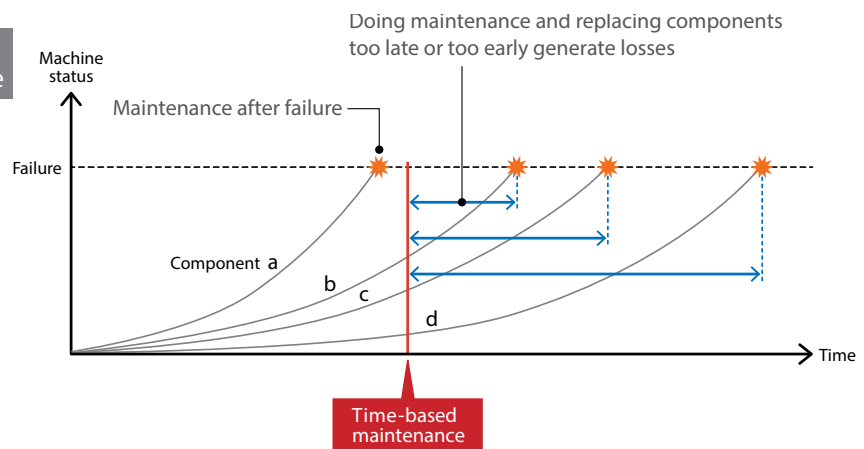
Find the economic optimum point for machine maintenance

Make data-driven maintenance decisions

Each machine is unique and critical to production. The AI Controller learns from each machine to help move from scheduled and reactive maintenance toward status-based maintenance when it is truly necessary.

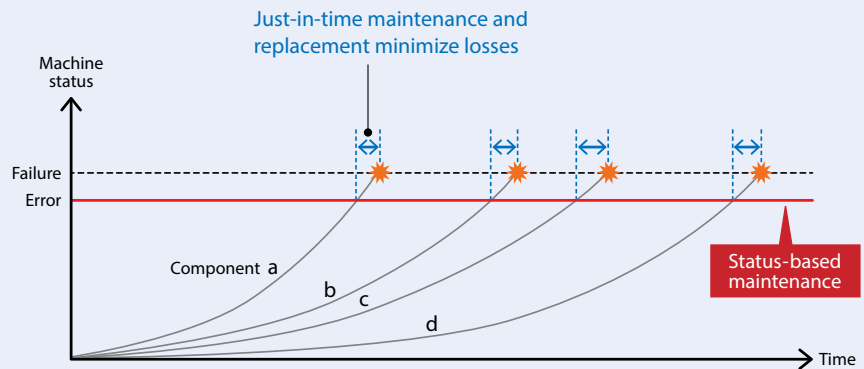
Current : Scheduled and reactive maintenance

Skilled engineers perform maintenance based on their intuition and experience regularly or after failure has occurred (time-based maintenance).



With AI Controller : Status-based maintenance

AI Controller monitors machine status using machine data. Maintenance is performed based on machine status when the data shows leading indicators through Anomaly Detection.

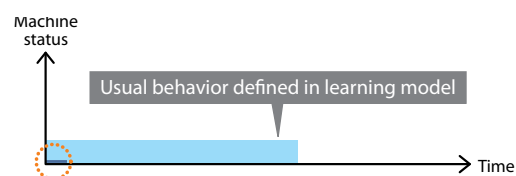


Benefits expected from status-based maintenance

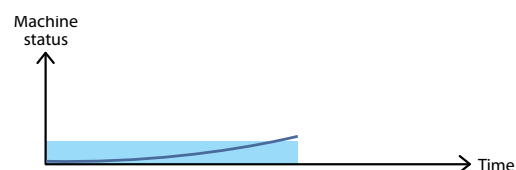
1. Minimized downtime reduces production losses
2. Just-in-time maintenance reduces reactive costs
3. Replacing components only when necessary reduces stock of components
4. Error locations can be identified following leading indicators
5. Maintenance work can be standardized and skilled engineers can create new value

Predictive maintenance procedure using AI

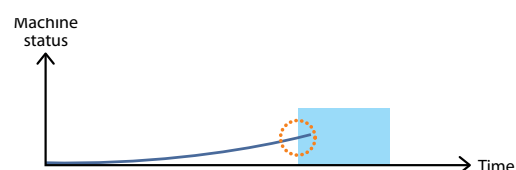
- Step 1** **Generating a learning model**
A learning model including a threshold value is generated from current machine data.
(Nominal machine behavior is learned.)



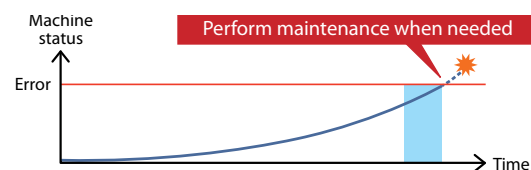
- Step 2** **Monitoring the machine**
Machine data is monitored based on the learning model.
If the specific features exceed the threshold value, a notification is issued.



- Step 3** **Setting a new threshold value**
The machine status is checked.
If no error is found, a new threshold value is set.



- Step 4** **Maintenance performed**
Programmatically determine what maintenance is required, including component replacement.



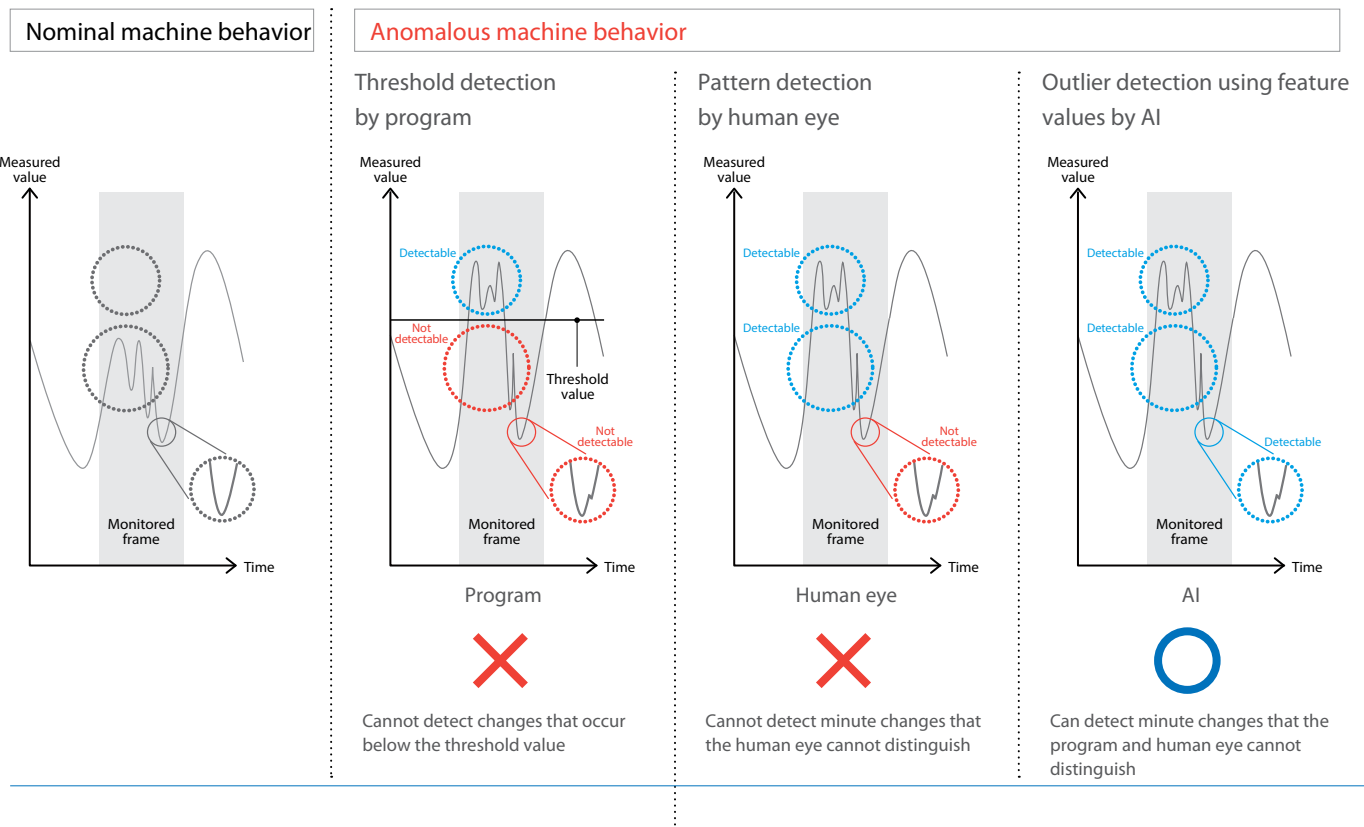
- Step 5** **Generating a learning model with new components**
A new learning model including the threshold value is generated based on the previous error level after components are replaced. Repeating these steps makes status-based maintenance more reliable.



Detect machine anomalies quickly and accurately

By integrating the machine learning engine within the machine controller, the AI Controller enables the highest speed and security of data processing. Anomalies can be accurately detected in milliseconds.

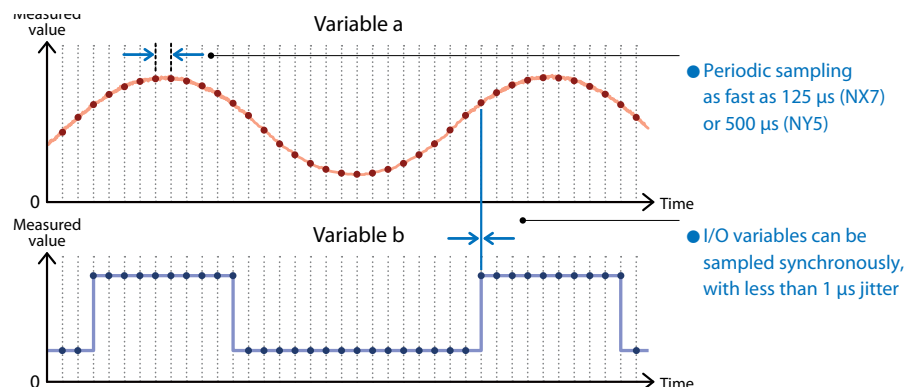
Detection comparison between AI and conventional method (time-series data such as voltage and current)



Functions to detect quickly and accurately

High-speed Time Series Database Function

Collection and storage of time-series data are fully synchronized with the control cycle. The periodically sampled data is used to understand machine behavior, enabling creation of accurate learning models and judgment. Moreover, data can optionally be saved to external Host, feeding enterprise level IoT systems and advanced analysis.



Machine learning for anomaly detection

Data collection

Time-series data collection, feature value creation

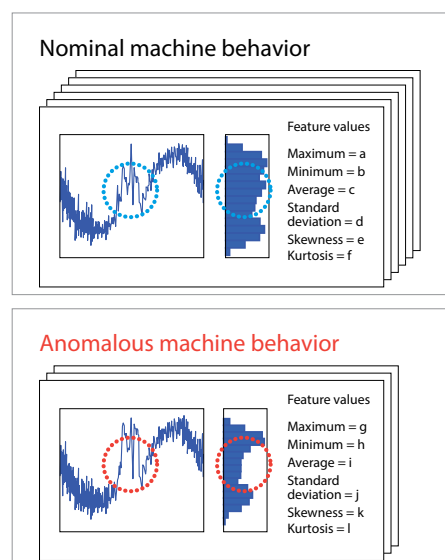
Data analysis

Mining, machine learning

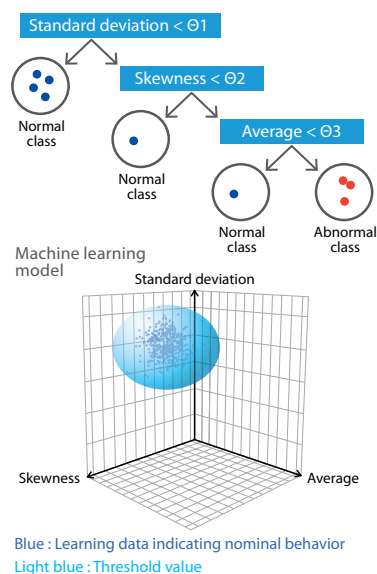
Data utilization

Real-time monitoring and action

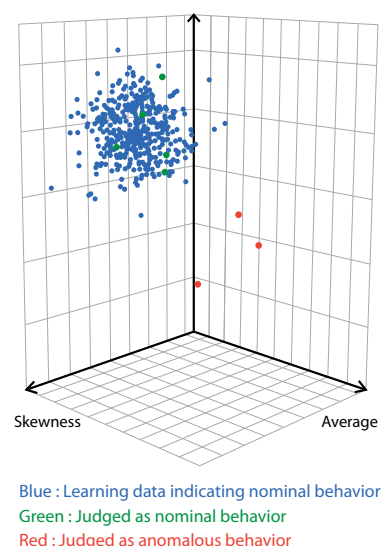
Features values are generated from data gathered from the real-world machine in production



Features with highest correlation to anomalies are extracted. A machine learning model is generated from the analysis results

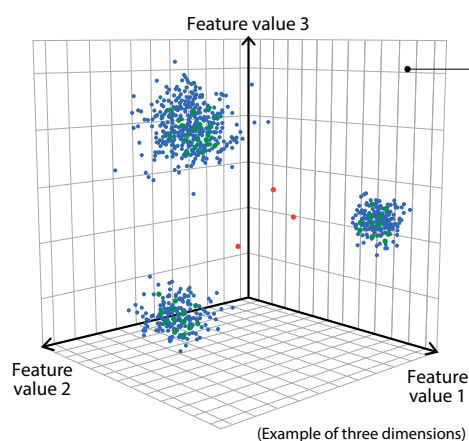


The machine learning model is transferred to the AI controller. Machine status is monitored in real time.



Ultra-high-speed Machine Learning engine

The AI Machine Learning engine provides both speed and accuracy. Omron developed this unique technology based on the Isolation Forest machine learning engine, which is ideal for real-time processing, and fine-tuned it to increase detection accuracy. The algorithm is applicable to multimodal data and can be used for high-mix production lines where two or more operating modes are required.

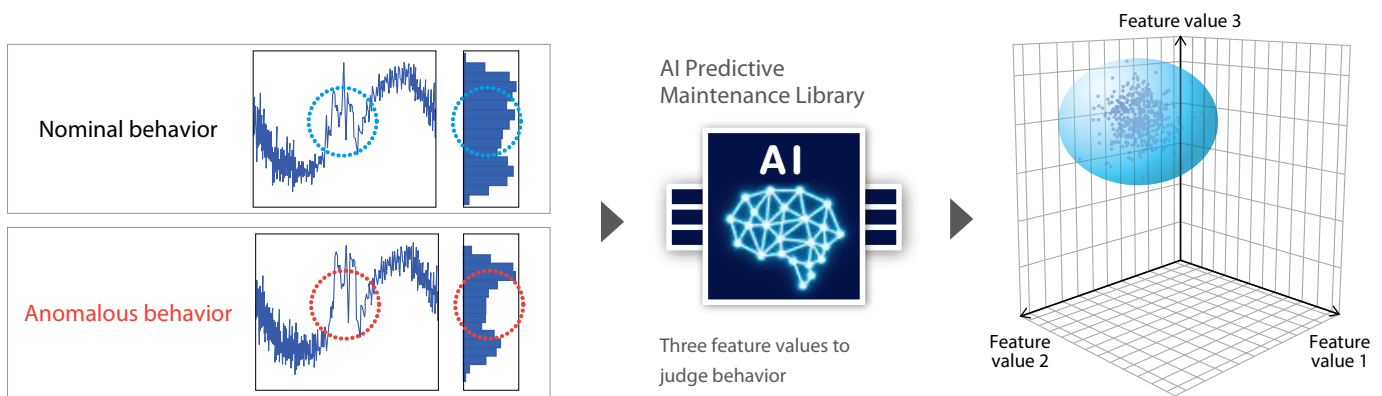


- Ultra-high-speed AI engine can calculate in several milliseconds
- One machine learning model can discriminate multiple operating modes
- Up to 16 feature dimensions

The AI Predictive Maintenance Library

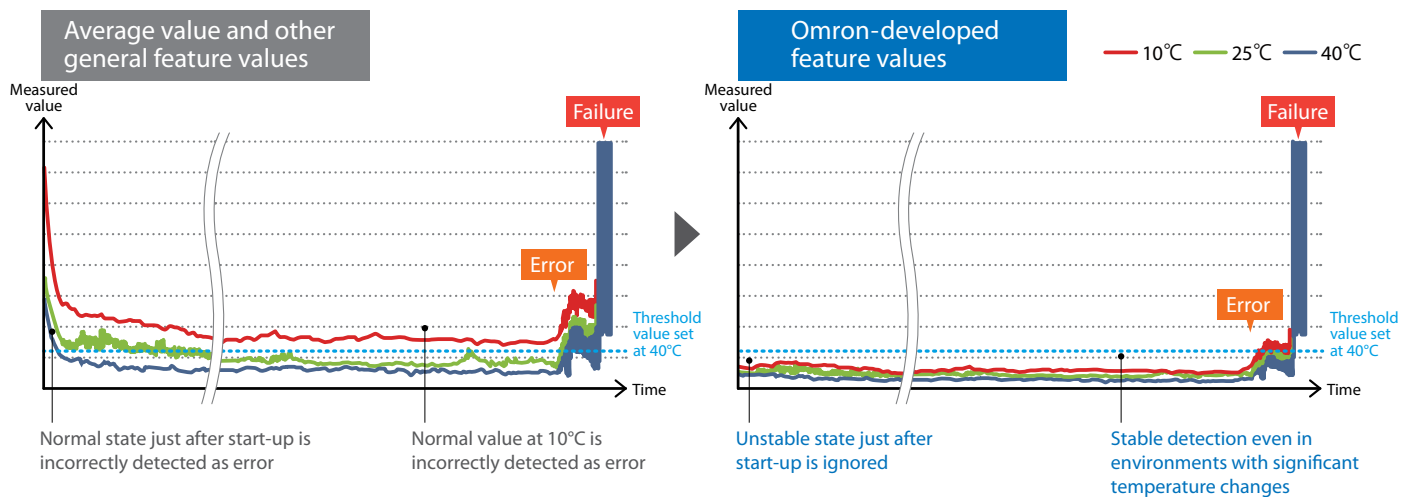
Pre-made machine learning models to detect anomalous machine behavior

The AI Predictive Maintenance Library, a collection of Omron developed Function Blocks specific to the AI Controller, calculates optimal feature values to judge real-world machine mechanism behavior.



Robustness minimizes effects of environmental changes

Through research and data science, Omron machine learning models have been designed to minimize the effects of environmental change using specific feature values, helping to stabilize predictive maintenance activities.



※The above results were obtained under Omron's test conditions. The same results are not guaranteed for all conditions.

System configuration

AI Controller Software utilities

Configuration tool



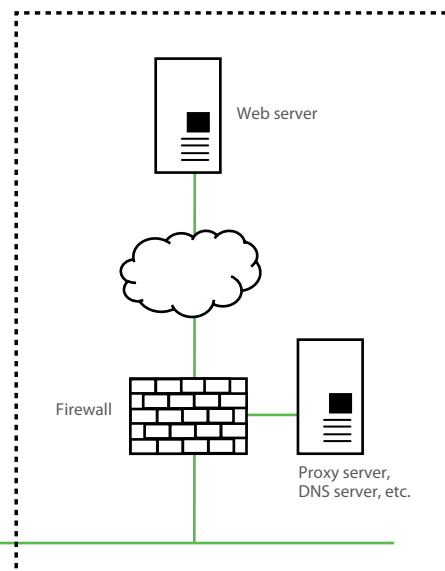
AI Operator

Visualization tool



AI Viewer

Optimal web server connection
for additional analysis

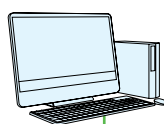


[NX Series]

Install the AI controller software
utilities on the host computer

• AI Operator • AI Viewer

NA
Machine interface



EtherNet/IP™

[NY Series]

AI Controller software utilities are
pre-installed in Windows on the
NY Series

• AI Operator
• AI Viewer



AI controller

• Time Series Database Function
• Feature Value/Machine Learning Function
• WebAPI Connection Function

AI Predictive Maintenance Library



EtherCAT®

EtherCAT slaves



Ordering Information

NX-series AI Controller

Product Name	Specifications			Current (Power) consumption	Model
	Program capacity	Memory capacity for variables	Number of motion axes		
NX701 CPU Units with AI function	80MB	4 MB : Retained during power interruption	256	40 W (including SD Memory Card and End Cover)	NX701-Z700
		256 MB : Not retained during power interruption	128		NX701-Z600

NY-series AI Controller

Product Name	Specifications						Model
	Operating system	CPU type	Number of motion axes	RAM memory (non-ECC type)	Storage size	Interface option	
Industrial Box PC with AI function	Windows Embedded Standard 7-64bit	Intel®Core™ i7-4700EQ	64	16GB	128GB×2 SSD iMLC/pSLC	RS-232C	NY512-Z500-1XX214T1X
			32				NY512-Z400-1XX214T1X
			16				NY512-Z300-1XX214T1X
			64			DVI-D	NY512-Z500-1XX214T2X
			32				NY512-Z400-1XX214T2X
			16				NY512-Z300-1XX214T2X
Industrial Panel PC with AI function	Windows Embedded Standard 7-64bit	Intel®Core™ i7-4700EQ	64	16GB	128GB×2 SSD iMLC/pSLC	RS-232C	NY532-Z500-112214T10
			32				NY532-Z400-112214T10
			16				NY532-Z300-112214T10
			64			DVI-D	NY532-Z500-112214T20
			32				NY532-Z400-112214T20
			16				NY532-Z300-112214T20

AI Controller Services (Americas)

Services are required to allow customers to get best results from Sysmac AI Controller solution. These services are scheduled when the controls machinery is sufficiently ready to produce and establish a normal baseline. Startup Service will include any necessary AI Controller software utilities, licenses, and AI Predictive Maintenance Library files required for the application and expected user outcomes.

Service Part Numbers	Service Description
AIC-STARTUPSUPPORT	Required multi-day Service includes group training on concepts, technology, and hands-on work to start data collection, feature extraction, model creation, AI Controller Predictive Maintenance Library installation, and utilization within machine controls program.
AIC-RELEARNINGSUPPORT	Optional Service for re-training additional members after initial Startup Service, as well as assistance with feature extraction, model creation, and threshold setting with the AI Controller software utilities provided during Startup.

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