

# High-speed Analog Input Unit

NX Series NX-HAD401/402



## Analog inspection without PC

- PLC systems can acquire analog data at high speeds
- Easy system configuration and maintenance

# High-speed analog inspection with PLC system

## —No special devices and no PC required

Improving quality in parts inspections requires as detailed analog data as possible. Most automotive and other manufacturers use special measuring devices such as data loggers for measurements.

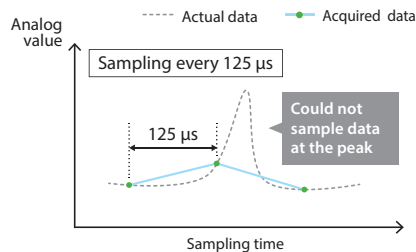
Being among the first to work on IoT at manufacturing sites, Omron now offers the High-speed Analog Input Unit that can easily acquire synchronized analog data. It will help you improve quality.

## Reliable

**Industry's fastest\*<sup>1</sup> sampling speed of 5  $\mu$ s to catch every minute change**

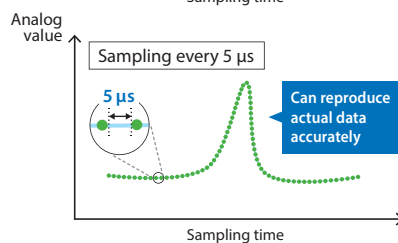
### Conventional PLC

Some data could not be obtained when an error occurred



### NX-HAD

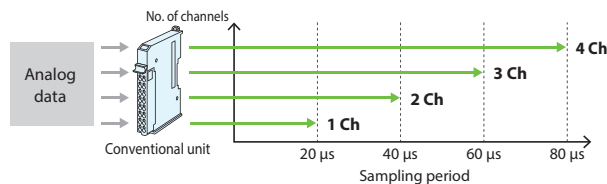
Sampling **as fast as every 5  $\mu$ s** catches all changes in behavior



**Industry's fastest sampling speed\*<sup>1</sup>: Same speed\*<sup>2</sup> regardless of the number of channels**

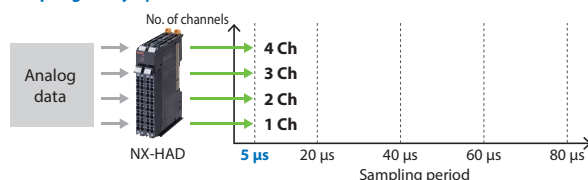
### Conventional PLC

Sampling period becomes longer as data is obtained from multiple channels



### NX-HAD

**Achieves high-speed sampling every 5  $\mu$ s from 4 channels at the same time**



\*1. Based on Omron's surveys as of January 2018. \*2. When using 4 channels.

## Precise

**Fully insulated channels to obtain precise data without mutual interference**

### Conventional PLC

Mutual interference occurred between channels

### NX-HAD

**Precise data** can be obtained from multiple channels

**Easy comparative analysis of data obtained synchronously from multiple channels**

### Conventional PLC

Difficult to compare data obtained at different times

### NX-HAD

**Precise data** can be obtained from multiple channels

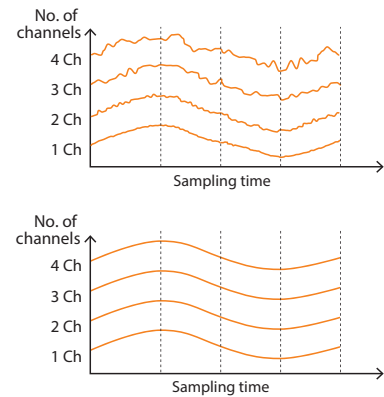
Furthermore, the Time-Stamp function in EtherCAT® ensures accurate synchronization between units



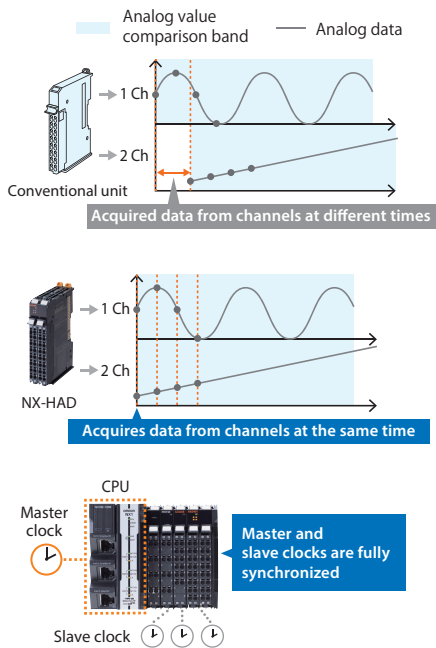


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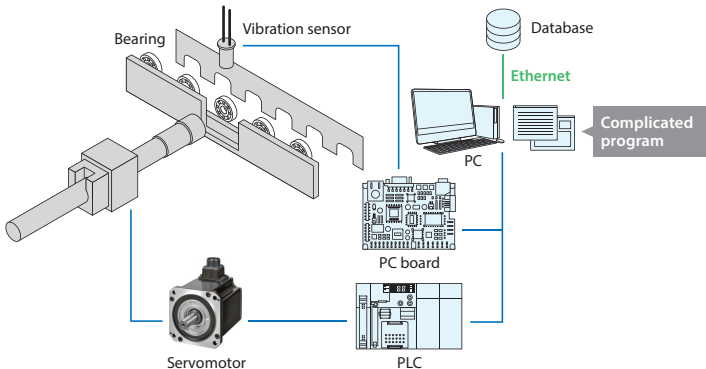


# Easy

Simple system configuration ideal  
for global manufacturing

## Conventional system

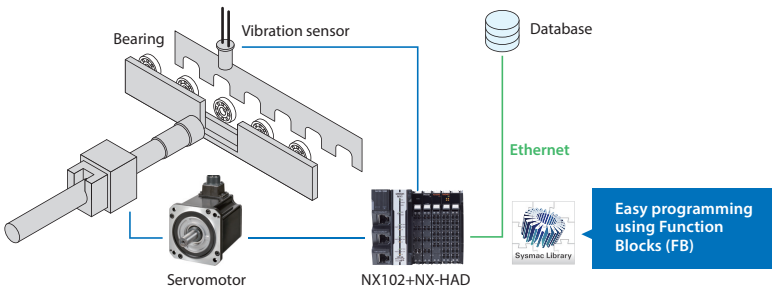
- Special measuring devices don't have flexibility in configuration
  - PC requires programming skills in C
  - Difficult to change programs concealed in dedicated controllers
  - Some technical skills are required to configure PC that is connected to database
- Characteristic inspection of rotator



## NX-HAD

- PLC system **reduces initial costs**
- Programs can be created without any special knowledge** of PC
- Programs can be changed** for additional inspection items
- Database connection controller\*3 brings **IoT** into manufacturing sites **without connecting PC**

● Characteristic inspection of rotator



\*3. When using the NJ/NX Machine Automation Controller Database Connection CPU Unit or the Industrial PC Platform NY IPC Machine Controller.

# High-speed Analog Input Unit

## Ordering Information

Product name	Analog input section					Trigger input section		Model
	Number of points	Input range	Resolution	Input method	Conversion time	Number of points	Internal I/O common	
High-speed Analog Input Unit	4 points	Voltage: • -10 to 10 V (-32000~32000) • -5 to 5 V (-32000~32000) • 0 to 10 V (0~32000) • 0 to 5 V (0~32000) • 1 to 5 V (0~32000) Current: • 0 to 20 mA (0~32000) • 4 to 20 mA (0~32000)	• Input range of -10 to 10 V or -5 to 5 V 1/64000 (full scale) • Other input range 1/32000 (full scale)	Differential input	5 $\mu$ s/4 Ch	4 points	NPN	NX-HAD401
						4 points	PNP	NX-HAD402

## Combination Table

Model	Unit version	
	CPU Unit or Industrial PC	EtherCAT® Coupler Unit
NX-HAD401 Ver.1.0 NX-HAD402 Ver.1.0	NX701-□□□□ Ver.1.18 or later	NX-ECC203 Ver.1.0 or later
	NX102-□□□□ Ver.1.30 or later	
	NJ501-□□□□ Ver.1.18 or later	
	NJ301-□□□□ Ver.1.18 or later	
	NJ101-□□□□ Ver.1.18 or later	
	NX1P2-□□□□□□(1) Ver.1.18 or later	
	NY5□□-1 Ver.1.18 or later	

# Collection of software functional components Sysmac Library

Please download it from following URL and install to Sysmac Studio.  
[http://www.ia.omron.com/sysmac\\_library/](http://www.ia.omron.com/sysmac_library/)

## Ordering Information

Product	Features	Model
High-Speed Analog Inspection Library	The High-speed Analog Inspection Library records analog input values acquired by the NX series High-speed Analog Input Units in time. This library provides functions required for product inspections during production processes, including calculation of feature values (e.g., maximum, minimum, and mean), comparison with master data, and data file storage.	SYSMAC-XR016

## Function Block (FB) Specifications

Name	FB name	Description
Device Output Data Binding	DeviceVariableToArray_***	Reads analog input values of one task period from the NX High-speed Analog Input Unit, and joins them into a single array variable.
Scale Transformation for NX-series High-speed Analog Input Unit	ScaleTrans_HAD	Performs scale transformation of data from the NX High-speed Analog Input Unit.
Upper/lower Alarm for NX-series High-speed Analog Input Unit	LimitAlarm_HAD	Monitors input data from the NX-series High-speed Analog Input Unit and issues alarms in terms of the top upper limit, upper limit, lower limit, and bottom lower limit.
Trigger Control	TrigControl	Generates trigger information, which allows the DataRecorder FB to start data logging.
Data Recorder	DataRecorder	Joins specified elements of array data into a single array variable every task period, and creates log data in chronological order.
Upper and Lower Limit Test	LimitTest	Checks whether each element value in the data array is within the allowable range of the test standard data.
Feature Values Calculation	CalcFeatureValues	Calculates the mean, standard deviation, skewness, kurtosis, maximum value, and minimum value for the test target data array.
Log Data CSV File Write	LogDataToCSV	Outputs the log data created in the DataRecorder FB as a CSV file (*.csv) to an SD memory card.
Log Data CSV File Read-Out	CSVToLogData	Reads out the log data recorded in the SD memory card from a CSV file to the LogData[] array variables as the test standard data for the LimitTest FB.

# Function Block (FBs)\* in the High-Speed Analog Inspection Libraryreduce programming time and allow PLC systems to be used for analog inspection machines

\* The Sysmac Library is a collection of software functional components that can be used in programs for the NJ/NX Machine Automation Controllers or Industrial PC Platform NY IPC Machine Controller. Please download it from following URL and install to Automation Software Sysmac Studio.  
[http://www.ia.omron.com/sysmac\\_library/](http://www.ia.omron.com/sysmac_library/)

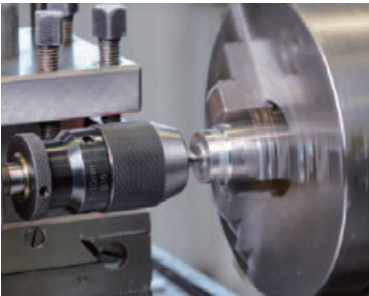
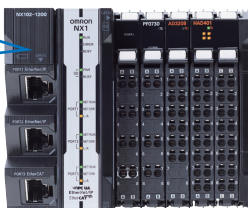


## Collect: Data Recorder FB

Joins acquired analog data into a single array variable and creates log data in chronological order.

TimeStamp	CH1	CH2	CH3
375539985418	0	24	36
375540005418	20	21	14
375540025418	40	30	34
375540045418	60	12	8
375540065418	80	8	0
375540085418	100	6	18
375540105418	120	0	30
375540125418	140	1	35
375540145418	160	-4	13
375540165418	180	-6	23
375540185418	200	-1	18
375540205418	220	-10	2
375540225418	240	-12	13
375540245418	260	-8	30

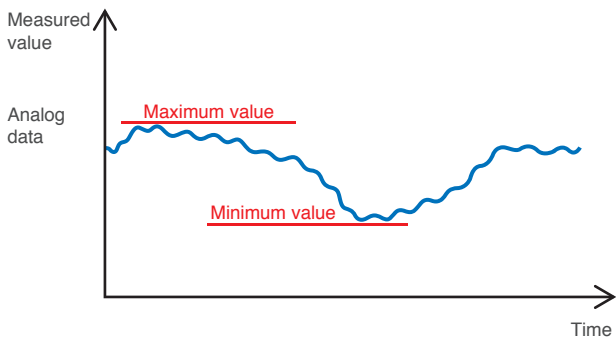
Measured data



<Machine condition inspection>  
In order to perform predictive maintenance of a machine, all control data is acquired, and data during normal operation is compared with data during abnormal operation.

## Calculate: Feature Values Calculation FB

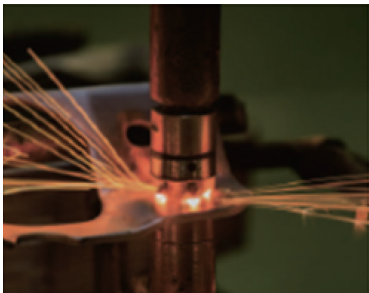
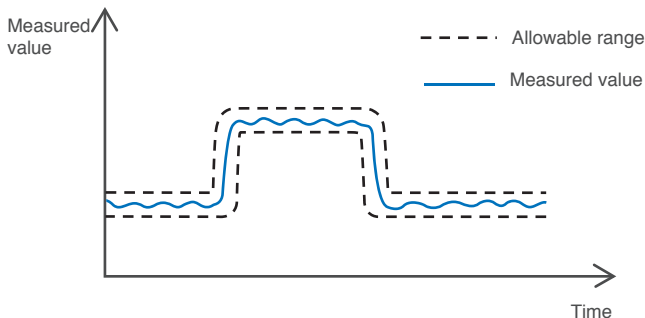
Calculates not only maximum values, minimum values, and other feature values but also standard deviations used for analog inspections.



<Characteristic inspection of rotator>  
Rotators (e.g., motors and bearings) are inspected whether future values including maximum and minimum rotation speeds satisfy the specifications.

## Judge: Upper and Lower Limit Test FB

Checks whether measured values are within the allowable range of the test standard data. The measurement data of good products can be set as test standard data, and the allowable range can be set as desired.



<Welding quality inspection>  
Welding voltage and current values are measured, and the waveforms are monitored to check if welding failure occurred.

Powerful functionality in a compact design

Machine Automation Controller

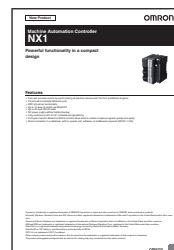
**NX1**



The NX1 in combination with the high-speed analog unit can control quality through high-speed inspections and collect information while at the same time providing high-speed, high-precision control.



NX1 Catalog  
P129



NX1 Datasheet  
P130

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