Model NX-SVG: An IoT Gateway for Multi-vendor Communication

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1. Introduction

In light of end users' need for smart factories, there is an increasing demand for equipment manufacturers to make their products IoT-compatible. In an effort to satisfy this demand, the workload and time required to develop communication programs has become a problem. In addition, since IoT data is collected from a wide variety of devices and networks, there is an increasing need for an IoT gateway that supports various communication protocols from multiple vendors.

To meet this demand, we have developed the model NX-SVG gateway (fig. 1). The NX-SVG is compact and can be incorporated into equipment that must be small. In addition, it requires no communication (ladder) programs and is capable of communicating with a wide variety of devices.
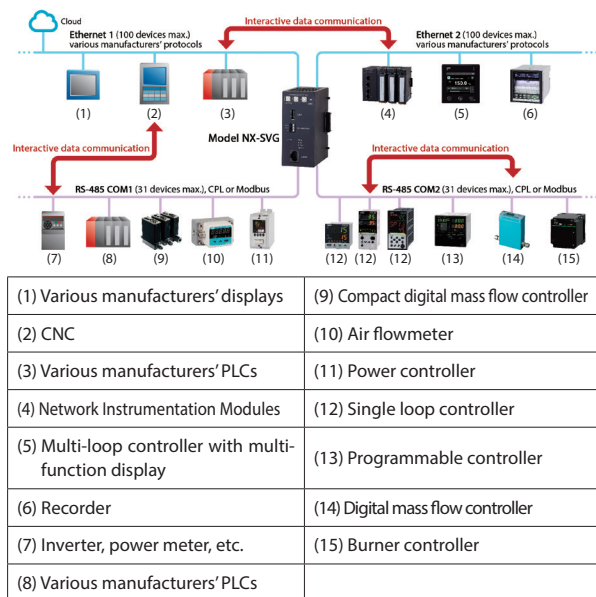

(1) Various manufacturers' displays	(9) Compact digital mass flow controller
(2) CNC	(10) Air flowmeter
(3) Various manufacturers' PLCs	(11) Power controller
(4) Network Instrumentation Modules	(12) Single loop controller
(5) Multi-loop controller with multi-function display	(13) Programmable controller
(6) Recorder	(14) Digital mass flow controller
(7) Inverter, power meter, etc.	(15) Burner controller
(8) Various manufacturers' PLCs	

Fig. 1. Model NX-SVG

2. Product Overview

All the functions implemented in the NX-SVG are intended to minimize the workload of equipment development. The features are described below.

2.1 Features

2.1.1 Easy Data Transfer Setup, Data Register to Data Register

The NX-SVG supports the communication protocols of Azbil-made devices, programmable logic controllers (PLCs) and computerized numerical controllers (CNCs) from various manufacturers, Modbus, etc. The NX-SVG does not use the concept of sending messages to communicate. Instead, communication is set up by simply specifying the data registers of the source and destination devices (fig. 2). The engineering concept of "data register to data register" also applies to data transmission between devices with different communication protocols, so the user does not need to create communication (ladder) programs at all. This feature can dramatically reduce engineering time.

Fig. 2. Data register to data register

2.1.2 Communication History Function Helps to Identify the Cause of Communication Errors

The NX-SVG automatically saves errors in communication with devices when they occur. The communication history includes the time of the error, identification of the slave device with which the error occurred, the error code received from the slave device, read/write identification, and the value that could not be read or written. The saved history can be displayed on a PC as time-series data (fig. 3), facilitating tracing, which is very useful not only for debugging during development of equipment, but also for analysis of the cause of communication errors after product shipment. There is a great difference in the time required to solve a communication problem between products that allow users to analyze the cause of the problem and those that do not.

Fig. 3. Communication error history data

2.1.3 High Product Reliability and Many Communication Connections

Since the NX-SVG does not incorporate aluminum electrolytic capacitors, changes in the ambient temperature will not affect its service life. In addition, data in its internal memory can be retained without a battery in the case of a power failure, and there are no components that require regular replacement.

The NX-SVG is equipped with four communication ports: two LAN ports and two RS485 ports. LAN1 and LAN2 can connect 128

devices in total (if Modbus TCP master nodes are included: 136) and the RS485 ports can connect 62 devices in total, meaning that a single NX-SVG unit can connect up to 198 devices. This robust communication function is realized in spite of the unit's compact hardware.

The high reliability and performance of the product greatly improve the work efficiency of engineers.

2.2 Application Example

In an industrial furnace such as a continuous carburizing furnace, many measurement and control devices are used: PLCs for overall equipment management, burner controllers, temperature controllers, CP (carbon potential) calculators, mass flow controllers, mass flow meters, inverters for controlling conveyor belts, and gas analyzers. Previously, only some of these devices were linked by I/O, namely those that required mutual interlock. Now, when an equipment IoT is desirable, much more information is necessary, and operator proficiency is required for decision making.

In an equipment IoT, devices and sensors can freely exchange information through the IoT gateway (fig. 4). Collecting more valuable information from devices for calculation by each device will bring the following advantages:

- Proper control of air ratio
- Visualization of burner combustion status
- Proper control of process gas flow rate
- Early detection of problems and identification of causes
- Detection of conveyor belt problem warning signs
- Detection of flame failure warning signs

As more and more devices are interrelated in an IoT, the equipment itself will be able to diagnose process status, combustion status, and energy use, or predict component service life, tasks which previously only skilled operators could perform through acquired experience. In an equipment IoT, the NX-SVG plays the role of collecting more data from each measurement or control device and sending it to PLCs, displays, and storage devices.
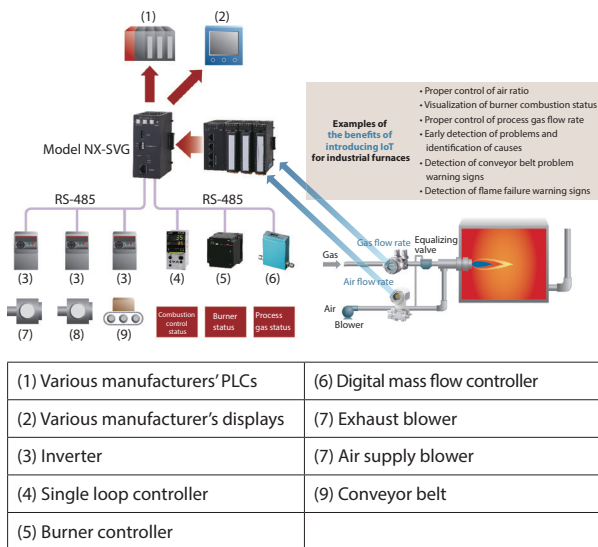

(1) Various manufacturers' PLCs	(6) Digital mass flow controller
(2) Various manufacturer's displays	(7) Exhaust blower
(3) Inverter	(7) Air supply blower
(4) Single loop controller	(9) Conveyor belt
(5) Burner controller	

Fig. 4. IoT for industrial furnaces

3. Conclusion

This overview introduced the NX-SVG and gave an application example. We are planning to support OPC UA and EtherNet/IP, which will be in high demand, and to support more PLC models (more communication protocols). A wider variety of communication connections will allow users to incorporate more devices into their equipment without creating communication programs.

Moreover, we will add special calculation functions to the NX-SVG to develop it into an edge controller in order to meet users' industrial IoT (IIoT) needs.

<u>Trademarks</u>
Ethernet is a trademark of Fuji Xerox Co., Ltd.
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OPC UA is a trademark of OPC Foundation.

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