

STARDOM Wireless I/O: A Smart Product to Unwire Small-scale Distributed Facilities

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Yokogawa has developed STARDOM Wireless I/O, a field wireless product that is ideal for monitoring and controlling small-scale facilities distributed across wide areas. This product facilitates the introduction of a field wireless system, which complies with the ISA100.11a wireless communication standard for industrial automation, to the field quickly and at reasonable cost. Without expert knowledge of wireless network design and wireless gateway setting, users can introduce a field wireless system that complies with ISA100 Wireless and enjoy its benefits with the same time and effort as for wired instrumentation using 4–20 mA DC or other signals. This paper describes the development background, system configuration, and advantages of STARDOM Wireless I/O.

INTRODUCTION

With the increasing use of wireless systems in industrial fields, there is also an increasing need for solutions to facilitate the use of wireless systems in plants. Under these circumstances, Yokogawa is actively developing wireless products that comply with the ISA100.11a wireless communication standard for industrial automation.

For the purpose of increasing and promoting the use of wireless field systems, we have developed a small low power consumption wireless field product that facilitates the deployment of wireless systems in applications for monitoring and controlling facilities distributed across a wide area (Figure 1). This paper first describes the product development background and then the system configuration and the features of the product.

NEED FOR WIRELESS SOLUTIONS FOR SMALL-SCALE FACILITIES

The ISA100 Wireless is an excellent field wireless standard that enables building a large-scale, high-speed and high-reliable wireless network ⁽¹⁾. However, its deployment requires a certain level of expert knowledge and engineering work, such as for wireless network design and wireless gateway setting.

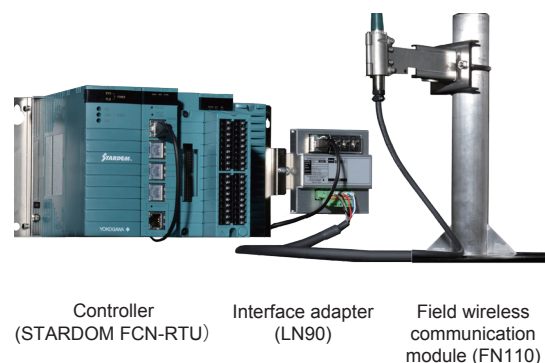


Figure 1 External view of simple field wireless I/O

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However, there is still a limited number of engineers who have adequate knowledge about the ISA100 Wireless standard and have the skills for wireless network design and engineering. People recognize the wireless benefits for small-scale facilities but still hesitate to deploy the field wireless system in many facilities.

To enable the efficient deployment of the ISA100 Wireless field wireless system in small-scale facilities, there is a need for an instrumentation scheme that solves the above issues and facilitates deployment at lower cost. Based on these circumstances, we have developed the simple field wireless I/O, which is presented in this paper.

SYSTEM CONFIGURATION OF SIMPLE FIELD WIRELESS I/O

The following describes each of the components that comprise the product (Figure 2).

This product consists of a field-installed controller (FCN-RTU), a field wireless communication module (FN110), an interface adapter (LN90) that connects FCN-RTU and FN110, and their related software.

By storing the controller and the interface adapter in a metal cabinet with protection class IP54 or higher of the Ingress Protection (IP) standard, they can be installed along with the field wireless communication module in a location classified as Zone 2 hazardous area in the explosion-proof guide for electrical facilities in plants (IECEx Type n).

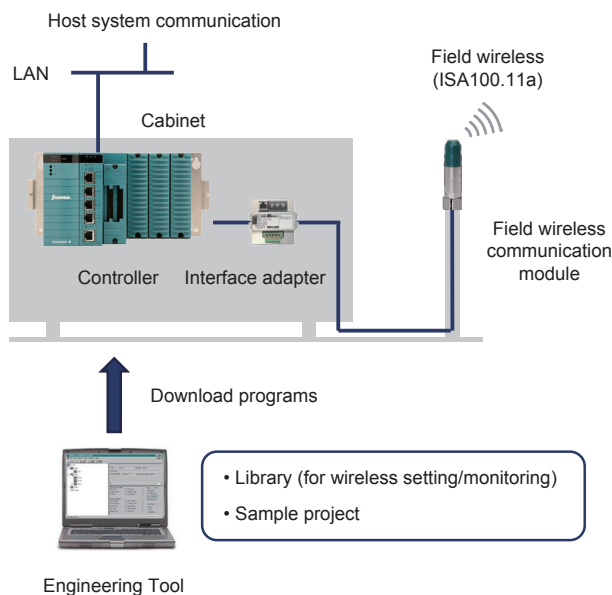


Figure 2 System configuration of simple field wireless I/O

Wireless Communication Management Controller

The controller runs the monitoring/control application created by the user (Figure 3).

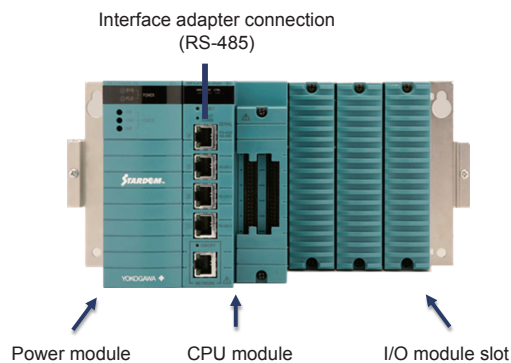


Figure 3 Controller

It is connected with the interface adapter via the RS-485 port of the CPU module. I/O modules can be mounted in the controller and analog/digital signals can be input/output in parallel with field wireless signals.

Interface Adapter for Field Wireless Communication Module

The interface adapter supplies power to the field wireless communication module and relay signals from the controller. It is connected with the field wireless communication module using a dedicated cable. A dedicated cable of up to 20 m is available (Figure 4).

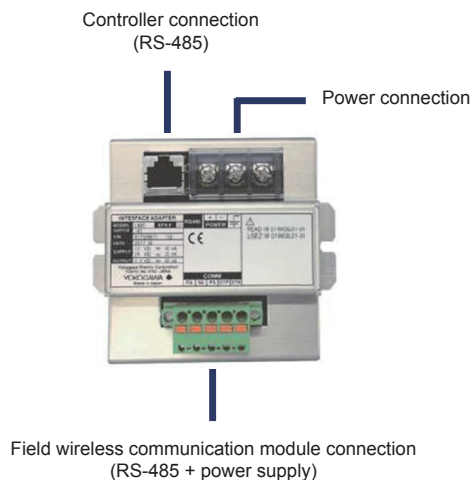


Figure 4 Interface adapter

Field Wireless Communication Module with Gateway Function

The field wireless communication module communicates with wireless field devices. This module can communicate with up to 20 field wireless devices in a star topology (Figure 5).

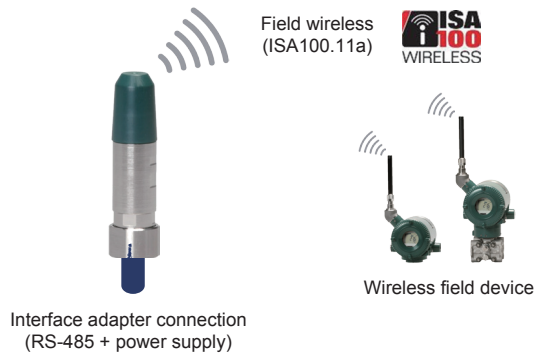


Figure 5 Field wireless communication module

Engineering Tool for Creating Programs

Engineering Tool is software for programming the controller. This tool uses multiple programming languages compliant with the IEC 61131-3 PLC programming standard. Users can create programs in their favorite languages and download them to the controller (Figure 6).

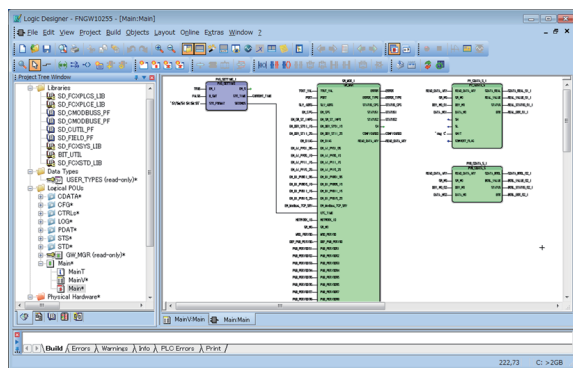


Figure 6 Window of Engineering Tool

Wireless Communication Setting/Monitoring Library

Library is a set of software components for setting/monitoring the field wireless system. It can be used to create controller programs. This library provides the processes necessary to set/monitor the field wireless communication module as programming components compliant with the IEC 61131-3. These components are defined as Program Organization Units (POU) in Engineering Tool (Table 1).

Table 1 Components provided in library

Component	Function
Wireless gateway setting	Set the gateway function of the field wireless communication module.
Wireless data monitoring	Monitor the process data of wireless field devices.
Data type conversion	Convert the data type of collected process data.

Sample Project for Monitoring Applications

Sample Project is a project file for Engineering Tool that can be used as a template for creating an application. This project file contains the settings of the wireless gateway using the library for wireless communication setting/monitoring, the descriptions of wireless data monitoring processes, and the defaults of the wireless gateway settings that can be applied to many applications.

This project allows for easily creating an application that provides the process data of the wireless field devices collected with the field wireless communication module to the host system connected to the network, via the Modbus TCP server function of the controller (Figure 7).

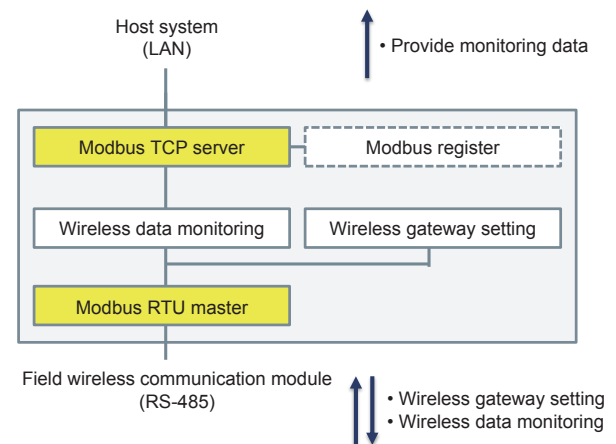


Figure 7 Sample project processing configuration

FEATURES OF THE SIMPLE FIELD WIRELESS I/O

This product provides hardware that withstands harsh environments and software that reduces engineering time and effort, and has some features that facilitate the deployment of ISA100 Wireless field wireless systems in small-scale facilities.

Robust Hardware Withstanding Harsh Environments

The hardware that can be used in a temperature range of -40 to 70°C at an altitude of up to 3,000 m can be used without worry in harsh weather conditions such as those in deserts and cold areas. Furthermore, the hardware that has been certified as IECEx Type n explosion-proof device can be installed in hazardous areas where flammable materials are handled such as oil and natural gas facilities (Table 2).

Table 2 Hardware installation environmental conditions

Item	Specifications
Installation environment	-40 to 70°C , altitude: up to 3,000 m
Explosion-proof	IECEx Type n*
Power consumption	3.5 W or less

*: The hardware must be stored in a metal cabinet with a lock with IP standard protection class IP54 or higher.

Low Power Consumption Operable with Solar Panels

The hardware that can be operated with low power consumption of 3.5 W or less can be used where a power line is not available by drawing power from solar panels and storage battery. Using this product in conjunction with wireless field devices allows for monitoring facilities and processes for which it was impossible to deploy a monitoring system because signal and power lines were not available.

Network Configuration Facilitating the Deployment of Field Wireless Systems

The field wireless communication module can communicate with up to 20 wireless field devices. It is easy to build a wireless network, because communication with field devices can be extended to a distance of up to 500 m where there are no obstacles (Table 3).

Table 3 Communication function of the field wireless communication module

Item	Specifications
Communication protocol	ISA100.11a (IEEE802.15.4)
Frequency band	2.4 GHz
Communication distance	Up to 500 m (with a good line of sight) *
Network topology	Star
Communication data	Input only
Communication redundancy	None
Number of connectable devices	Up to 20
Data update period	1 second to 60 minutes

*: No obstacles on the path of the wireless communication between antennas.

Easy Startup Using Library and Sample Project

Using the library that is provided with the hardware reduces the amount of code of the programs required to create wireless communication applications. Furthermore, using the sample project file allows for easily starting the wireless communication just by setting the wireless network ID and the tags of the wireless field devices, thus reducing the engineering man-hours required for startup.

Maintenance Made More Efficient by Status Information Monitoring

The sample project file also includes the process to collect in the controller the field wireless quality information and the status information of the sensors, batteries, etc. of the wireless field devices.

Thus, the controller collects and monitors the status information on the wireless communication. This enables around-the-clock monitoring from a remote location and reduces the need and frequency of visiting the sites for patrolling and inspection.

Integration of Monitoring and Control Applications for Small-scale Facilities

The controller can run wired applications using the I/O module in parallel with the processing of wireless applications using the field wireless communication module.

This allows for integrating the wireless and wired applications into a single controller and thus meeting various requirements for instrumentation including monitoring and controlling at optimal cost. Furthermore, wireless applications can be added to the existing wired applications with less hardware additions and less program changes.

BENEFITS OF USING THE SIMPLE FIELD WIRELESS I/O

The deployment of ISA100 Wireless field wireless systems using this product provides the following benefits for customers.

Easy Enjoyment of Wireless Benefits

This product allows for deploying a field wireless system at less cost with less man-hours and less knowledge and skills, which is a match for small-scale facilities, and allows for easily enjoying wireless benefits, such as the reduction in the wiring and installation costs, and the increase in the flexibility of sensor layout design and modification.

Increased Efficiency of the Facility Operation

This product enables around-the-clock monitoring of facilities from a remote location, which have been only monitored by periodic patrolling and inspection due to installation environmental conditions, lack of power, etc. The expansion of the real-time monitoring range enables the efficient operation and maintenance of facilities in response to changing circumstances.

CONCLUSION

This product has features to facilitate the deployment of wireless systems in small-scale facilities with less time and effort and is already used for monitoring various facilities such as oil and natural gas well. This product is one of the products that implement the concept of “Wireless Anywhere”⁽²⁾ that Yokogawa promotes and aims to allow customers to be able to enjoy the wireless benefits in a broad range of industries quickly and easily.

REFERENCES

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