

DEVELOPMENT OF THE EVENT NOTICE FUNCTION FOR PLC

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Abstract

A lot of equipments which control in J-PARC accelerator composition machinery using PLC (Programmable Logic Controller) exist. The transmitting method to upper control systems, such as interlock information on accelerator composition apparatus, state changes information, and information on the right of control operation, is not performed by polling.

The event notice function is used and it transmits to the upper control system. In the case of polling, information is transmitted to the upper control system to a number "msec" order. In the case where the event notice function is used, an event can be interrupted at the time of event generating, and information can be transmitted to a target to the upper control system at it.

By the J-PARC control system, it makes it possible to transmit the information on state change (event) to the upper control system immediately from PLC by using the ladder sequence program which the ladder sequence program for apparatus control detected change of a state, and mounted the event notice by using this event notice function. The J-PARC control system which mounted the event notice function is reported.

INTRODUCTION

J-PARC 3GeV RCS is an important ring accelerator to carry a beam supply to MR and MLF. A machine that composes RCS, there is a large pulse power supply. Machine controls remotely and smoothly cause a beam to be more reliable.

The data communication is done through EPICS to an accelerator component machine and the upper control

system of the J-PARC control system. There are accelerator component machines that provide sequence control using FA-M3 PLC. These machines are provided operation (run, parameter setting etc...) and monitor (machine status, parameter etc ...) from the upper control system.

There is a large pulse power supply in 3GeV RCS components machine; this machine is possibility of becoming noise source. It is necessary to reduce the network traffic to sidestep machine error. As one of the measures, it's just conceivable that to be length the polling cycle for the upper control system. In case of length the polling cycle, this measure may generate problems that operator may response to interlock later. In case of necessity, it is necessary that event information send from machines to the upper control system. PLC FA-M3 Ethernet-module Type "F3LE01-5T" made by YOKOGAWA ELECTRIC has the event notice function [1]. In case of necessity, it is possible to send event information from machines to the upper control system.

J-PARC CONTROL SYSTEM USING PLC

Data transmission between machine and upper control system is done through EPICS. A ladder sequence program for machine control is mounted program to cooperate with upper control system which epitomizes machine information to Data resistor. So, this program makes it possible to be operation and monitor from upper control system. A consolidated data is monitored by a PLC driver which be mounted on an Input Output Controller for EPICS. Figure 1 shows the J-PARC control system using PLC.

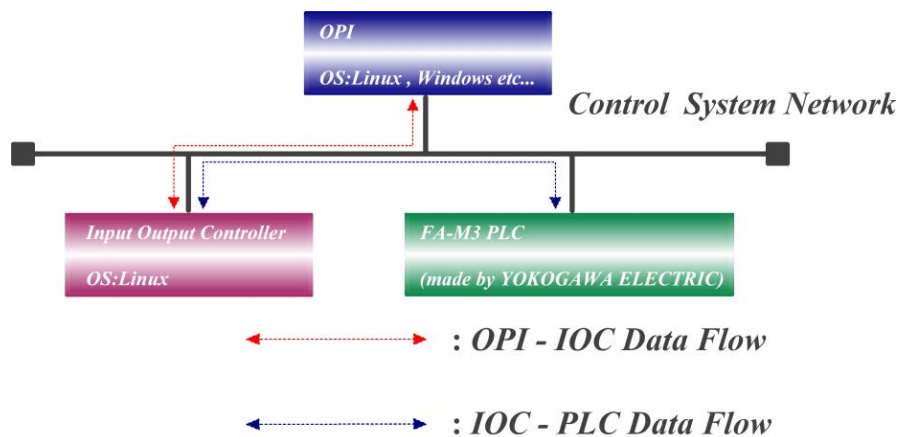


Figure 1: J-PARC Control System using PLC.

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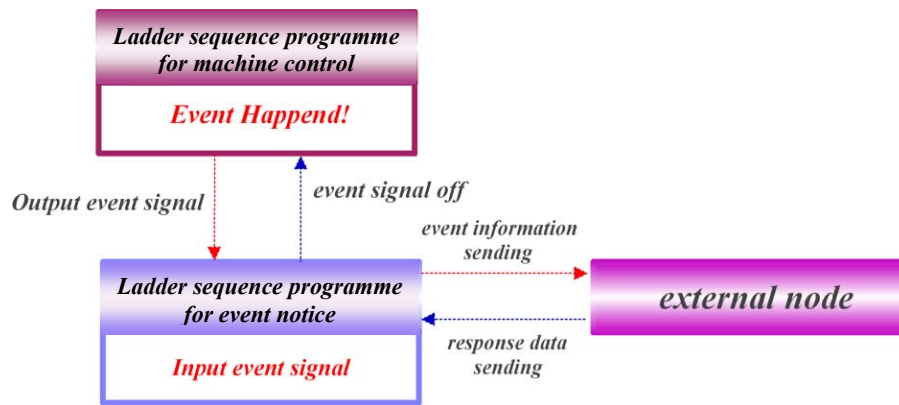


Figure 2: Event Notice Operate.

AVERSION TO RISK OF PLC REMOTE CONTROL

An Ethernet module that communicates to external node by TCP/IP or UDP/IP is in one of the module groups of PLC. By using this module, it is possible to control machine using PLC remotely.

But machine control using PLC is developed a ladder sequence program for local control; remote control is not supported in many cases. In the case that remote control is supported, it is possible to be remote control coordinate with local control. In the case of using EPICS, it is not an exception to use Ethernet module. In the case of control system component in Figure 1, it is possible to control remotely from various upper computers that PLC does not accept.

Some risk is caused when provide remote control for PLC using Ethernet module.

- Although machine operation provide local, operation provide remote.
- Machine operation provides other than machine object.

Two can be follow a method of avoiding risk.

- Wrong operation is avoided in a ladder sequence program.
- Wring operation is avoided by Input Output Controller.

J-PARC control system using EPICS driver for PLC has function to deny access to internal register from external node. J-PARC control system using EPICS driver for PLC has function to deny access to internal register from external node.

It is possible to get around wrong operation to install this driver in Input Output Controller. This driver has a function which assigns Read/Write area in data resistor. It is possible to get around that external node access another resistor.

This drive has event notification. It is possible to check event information and error code of event from PLC.

EVENT NOTICE FUNCTION FLOW

Event Notice Function

Event notice is a function that event information sends from a ladder sequence program to the upper control system, via Ethernet module. To adoption of this function, it is possible to send event information from PLC to the upper control system.

By J-PARC control system, in the case of event happened, PLC sends event information to the upper control system by event notice function at once.

Event Notice Operate

In a manner to be described, event notice operates.

1. A ladder sequence program for machine control detects event information.
2. Output event happened signal.
3. A ladder sequence program for event notice detects event happened signal.
4. Event information is transmitted to an external node by a ladder sequence program for event notice thought Ethernet module.
5. An external node sends response data to PLC.
6. A ladder sequence program for event notice receives response data.
7. Event notice finishes.

Figure 2 shows the event notice operate.

EVENT NOTICE FOR J-PARC CONTROL SYSTEM

It is necessary that EPICS driver for PLC operation is understood to development of event notification for J-PARC control system. This section contains driver for the case of implement EPICS driver for PLC.

- Non-event

The driver reads data to control and monitor.

- Event happened

If an event happens, driver does not read data to use event notification. The upper control system gobbles down information from PLC.

Should errors do happened, driver resumes reading; it is necessary that a ladder sequence program write error code to specific address. In case of error, a driver checks specific address all the time. A driver does not read data, but it checks right and wrong.

Figure 3 shows driver and event notification operation.

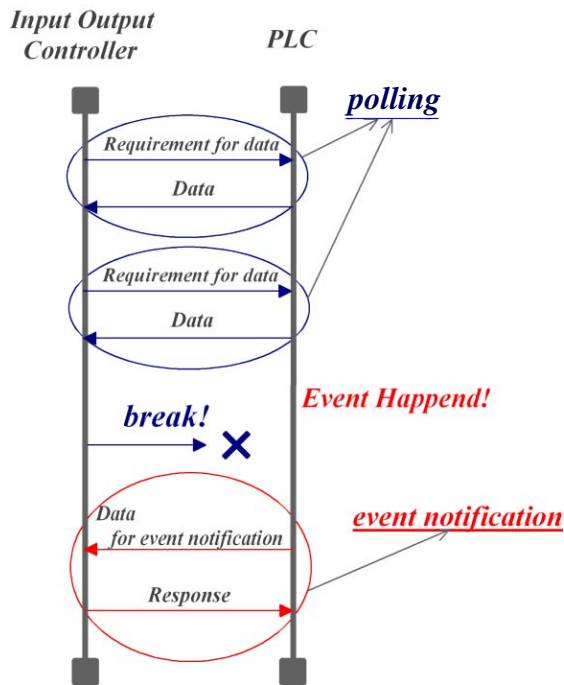


Figure 3: EPICS driver for PLC and event notification operations.

IMPROVE IN THE QUALITY OF THE EVENT NOTIFICATION

To use interrupt signal which event signal from a ladder sequence program for machine control, event notification processing runs. But, in case that next event happens during event notification processing, event interrupt happens one after another. To improve in the quality of event notification, it is necessary that event signal is maintained during event notification processing finishes. Figure 4 shows the process for event signal keeping.

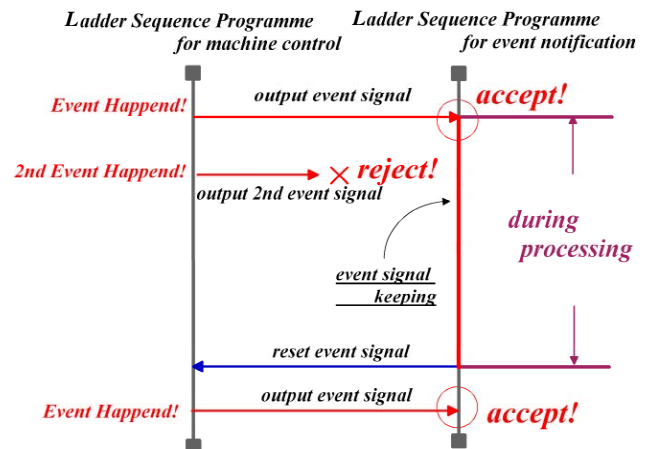


Figure 4: Processing for event signal keeping.

To improve in the quality of event notification, this process makes out of next event signal. By processing for mask, it is possible to reject next event signal. After event notification finished, this process accepts to interrupting next event signal.

Processing for event notification ends when the response is received from an external node.

To communicate protocol using TCP/IP; it is because of the idea as the normal processing by the thing that PLC received the response.

To event signal is reset, a ladder sequence program for event notification stops. This program stands by until next event signal is detected.

CONCLUSION AND FUTURE PLAN

In the case of that one PLC controls more machine, it is possible to make effective use of event notice function. In the case of polling, data have been read from upper address to lower address; there are a lot of times reading all data by increase in the number of data. In the case of event happened after polling address that interlock information, it is not possible to send interlock information while next polling. In the case of event notice function using, it is possible to send interlock information from PLC to the upper control system earlier than polling.

To confirm effectiveness of the event notification, this program is installed on PLC that controls more machines.

REFERENCES

- [1] FA-M3 PLC made by YOKOGAWA ELECTRIC Ethernet module manual.