Control System Using FL-net for Communication between Different PLC

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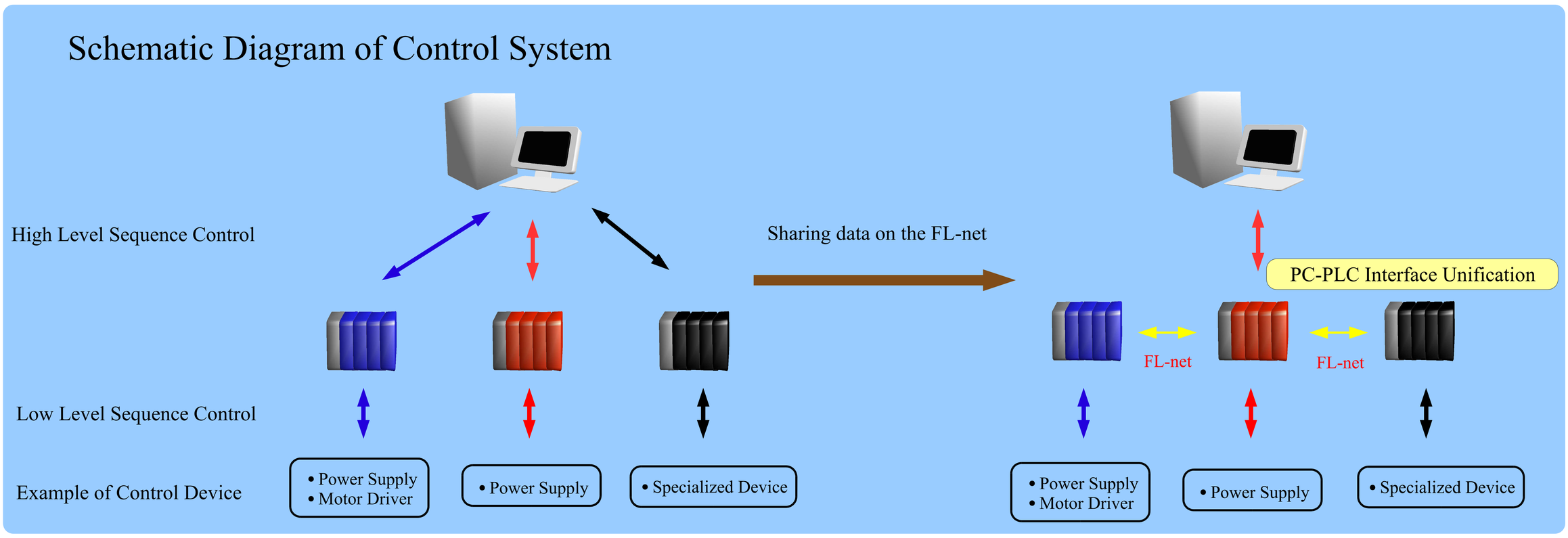
The control system using PLC and LabVIEW on PC is constructed for an FFAG accelerator complex in KURRI (Kyoto University Research Reactor Institute). Considering to build another control system into a current system in future, we contrived the system having two-type PLC (FA-M3 and MELSEC) connected each other through FL-net, which is an open network supporting cyclic data transfer. We introduce a successful example in the case of applying the system to the ion source of the FFAG accelerator.

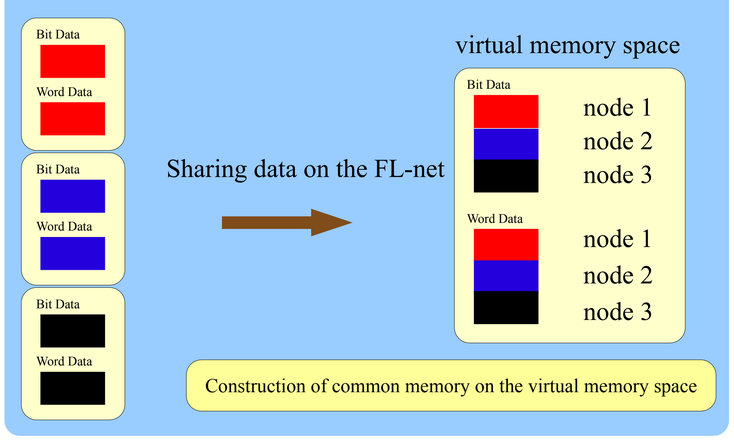
Schematic Diagram of Control System



Features of FL-net

- Open Network, which realizes communication among control device
- Ethernet cables are available as transmission media (10/100BASE-T/TX)
- Master-less and token bus method
- Cyclic transmission is available
- Common memory method

Concept of Common Memory



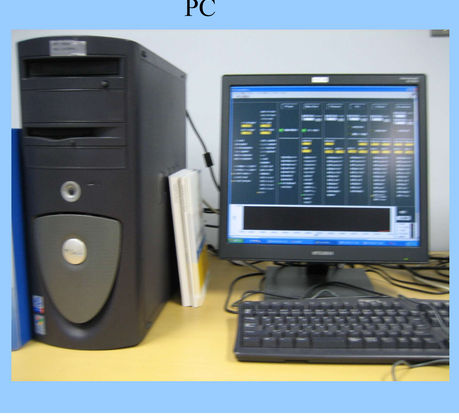
Example of Register Allocation

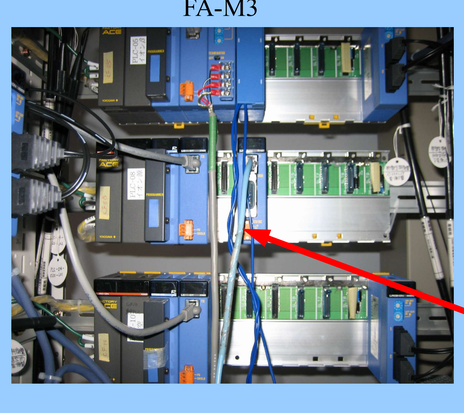
node2(Bit) FA-M3 ← MELSEC	buffer memory (MELSEC)	link relay (FA-M3)	D register (FA-M3)
node1(Bit) FA-M3 → MELSEC	buffer memory (MELSEC)	link relay (FA-M3)	D register (FA-M3)
H2 valve open	0x1C00(01)	L0001	D2001(01)
mass-flow remote	0x1C00(11)	L0011	D2001(11)
50kV output on	0x1C01(01)	L0017	D2002(01)
Arc output on	0x1C01(11)	L0027	D2002(11)
Arc mode auto	0x1C01(13)	L0029	D2002(13)
master start	0x1C02(01)	L0033	D2003(01)
master stop	0x1C02(02)	L0034	D2003(02)
master reset	0x1C02(03)	L0035	D2003(03)
100kV output on	0x1C02(11)	L0043	D2003(11)
bias remote	0x1C03(01)	L0049	D2004(01)
bias output on	0x1C03(03)	L0051	D2004(03)

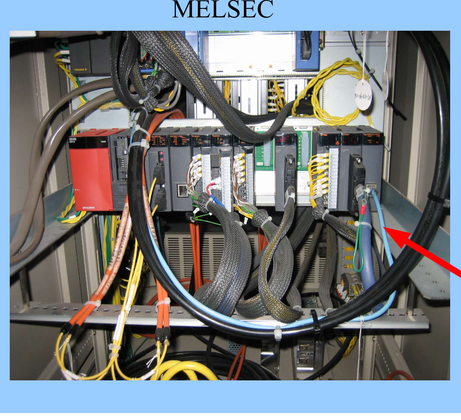
node2(Word) FA-M3 ← MELSEC	buffer memory (MELSEC)	link register (FA-M3)	D register (FA-M3)
node1(Word) FA-M3 → MELSEC	buffer memory (MELSEC)	link register (FA-M3)	D register (FA-M3)
mass-flow set ($0\sim20cm^3$)	0x2000	W0001	D2101
	0x2001	W0002	D2102
Filament current set ($0\sim100A$)	0x2002	W0003	D2103
	0x2003	W0004	D2104
Arc voltage set ($0\sim294.1V$)	0x2006	W0007	D2107
	0x2007	W0008	D2108
50kV voltage set ($0\sim50kV$)	0x2008	W0009	D2109
	0x2009	W0010	D2110
100kV voltage set ($0\sim100kV$)	0x2010	W0017	D2117
	0x2011	W0018	D2118
100kV current set ($0\sim6mA$)	0x2012	W0019	D2119
	0x2013	W0020	D2120

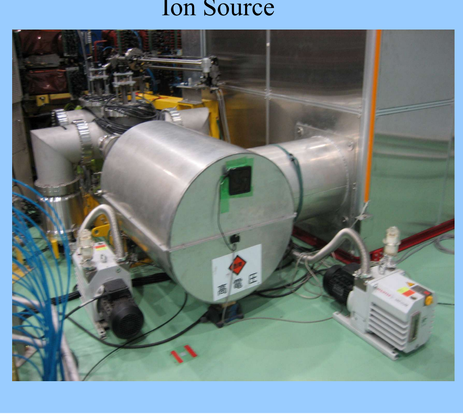
Buffer memory (FA-M3) and link relay/register (MELSEC) are used as common memories.

Implementation of the System Control through FL-net









Capture of Control Monitor

LabVIEW is used as a software for communication with PLC and high level sequence control. Cyclic period for reading data is set 200ms on LabVIEW. System works good under this circumstance.

Summary

The control system using FL-net has been easily installed (and it is still applied to operation of the ion source). This will help unification of interfaces at high level sequence without any changes at low level sequence.This achievement could allow flexibly to build system that is independant of PLC vendor.