YAMATAKE

IEC 61499 Test System

Yamatake Corporation

H. Tsunematsu

Purpose of Our Project

- Study IEC 61499 and its ITA using physical controlled target
- Study how to design machine control application using IEC 61499

Features

- Editor and runtime
  → FBDK
- Platform
  → WindowsNT/98
- Device management (configuration)
  → original tool
- Test machine
  → LEGO set

Platform

- Prototype controller
- Windows NT/98 + Java
- Interface
  - Digital input (8 ports)
  - Digital output (8 ports)
- FBDK (FBRT) for middle ware
  - “DEV_MGR” + “SERVER_1_2”

Device Management

- Original tool (prototype)
  - Java
  - “DM_CLT” + “CLIENT_2_1”
- Load IEC 61499 system file (XML)
- Send “CREATE” and “START” commands according to ITA

Test Machine

- LEGO set
- Input
  - Proximity Sensors
  - Photoelectric Controls
- Output
  - Motors

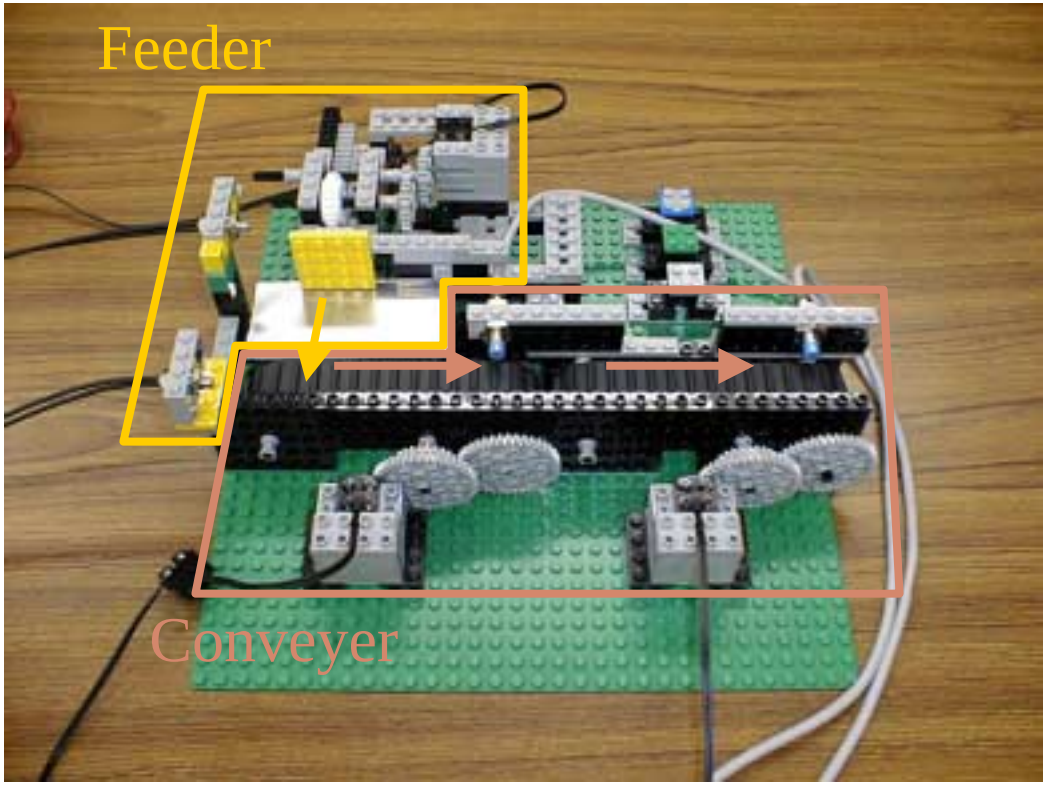
Use of Test System

- Verify IEC 61499 is executable
- Study IEC 61499 application and machine control
- Research for extension and modification desired for IEC 61499
- Research for effective application

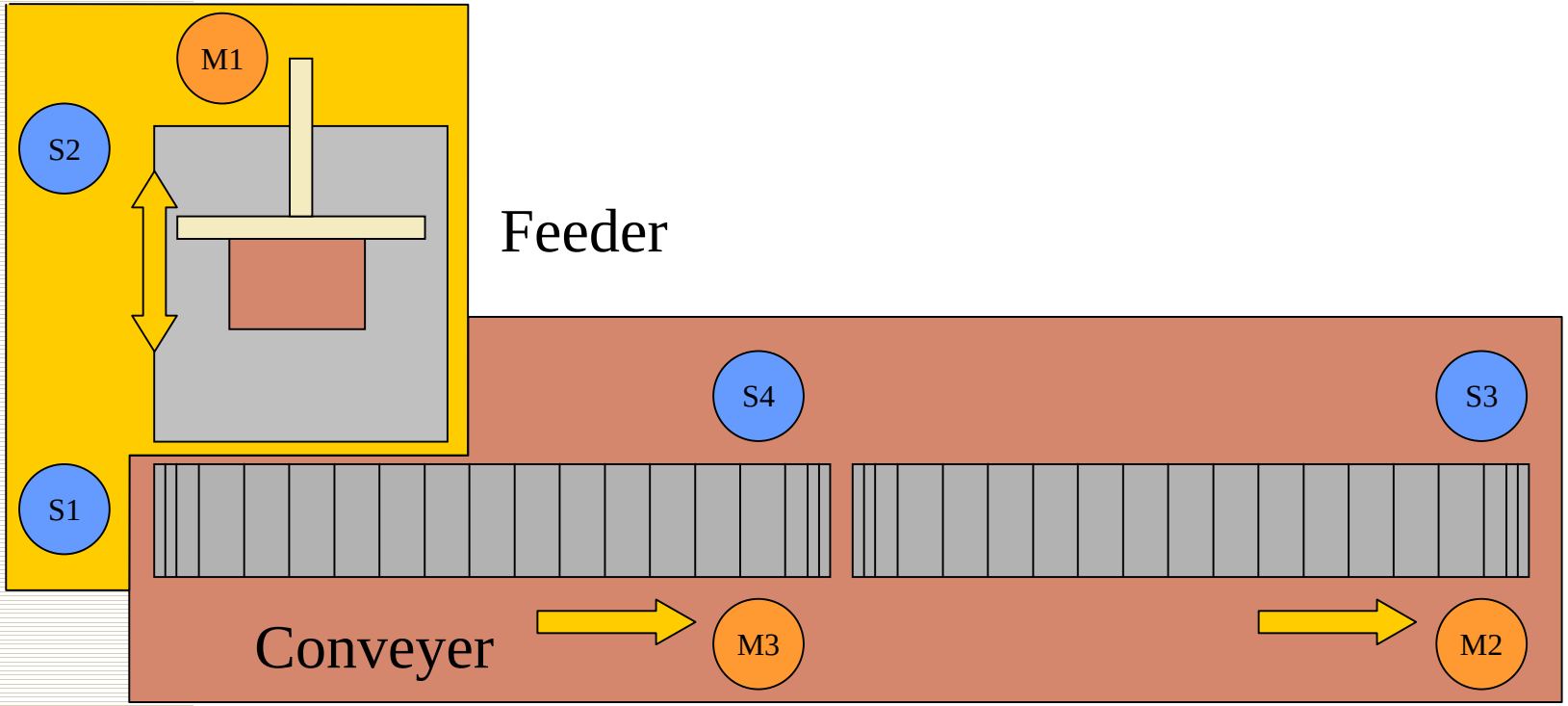
Test System

(Hardware and System overview)

Hardware

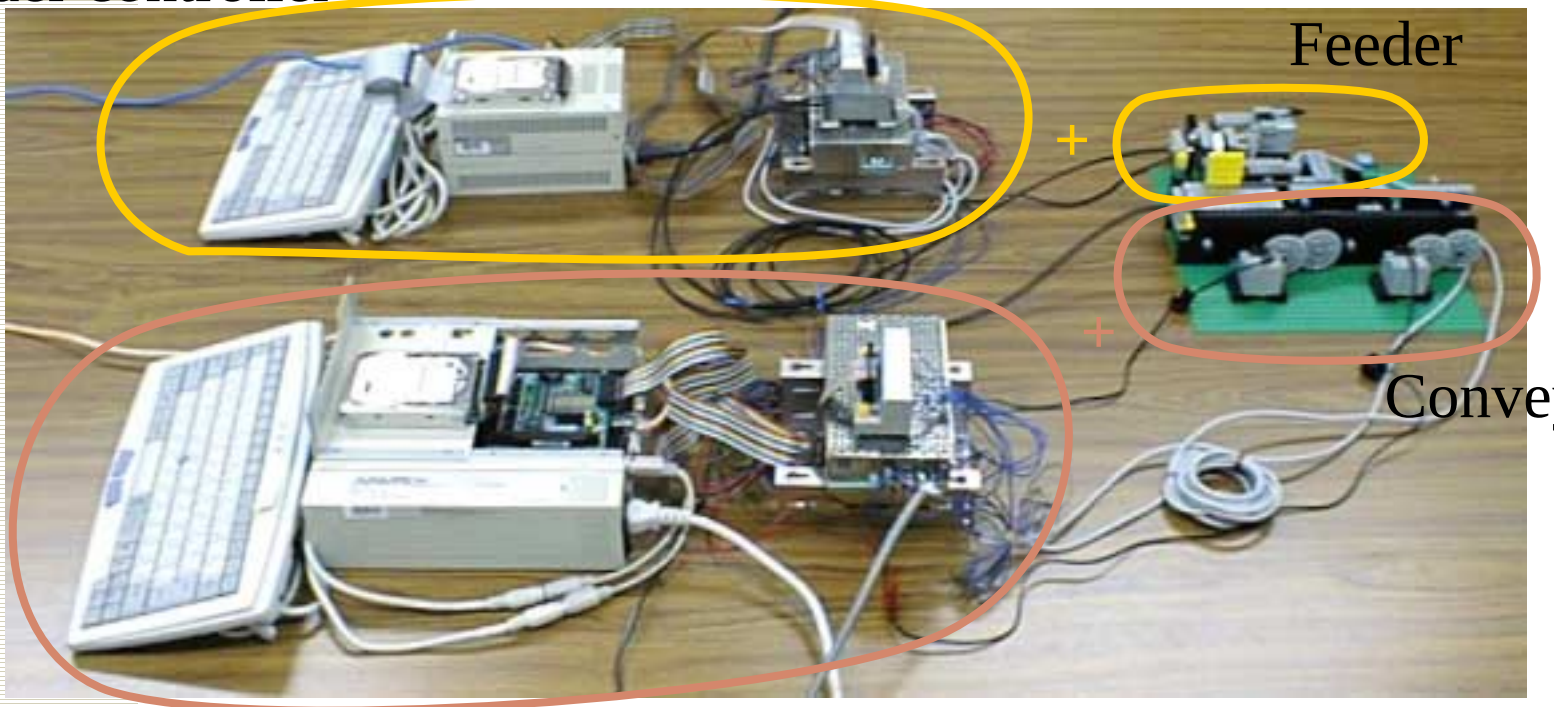


Hardware



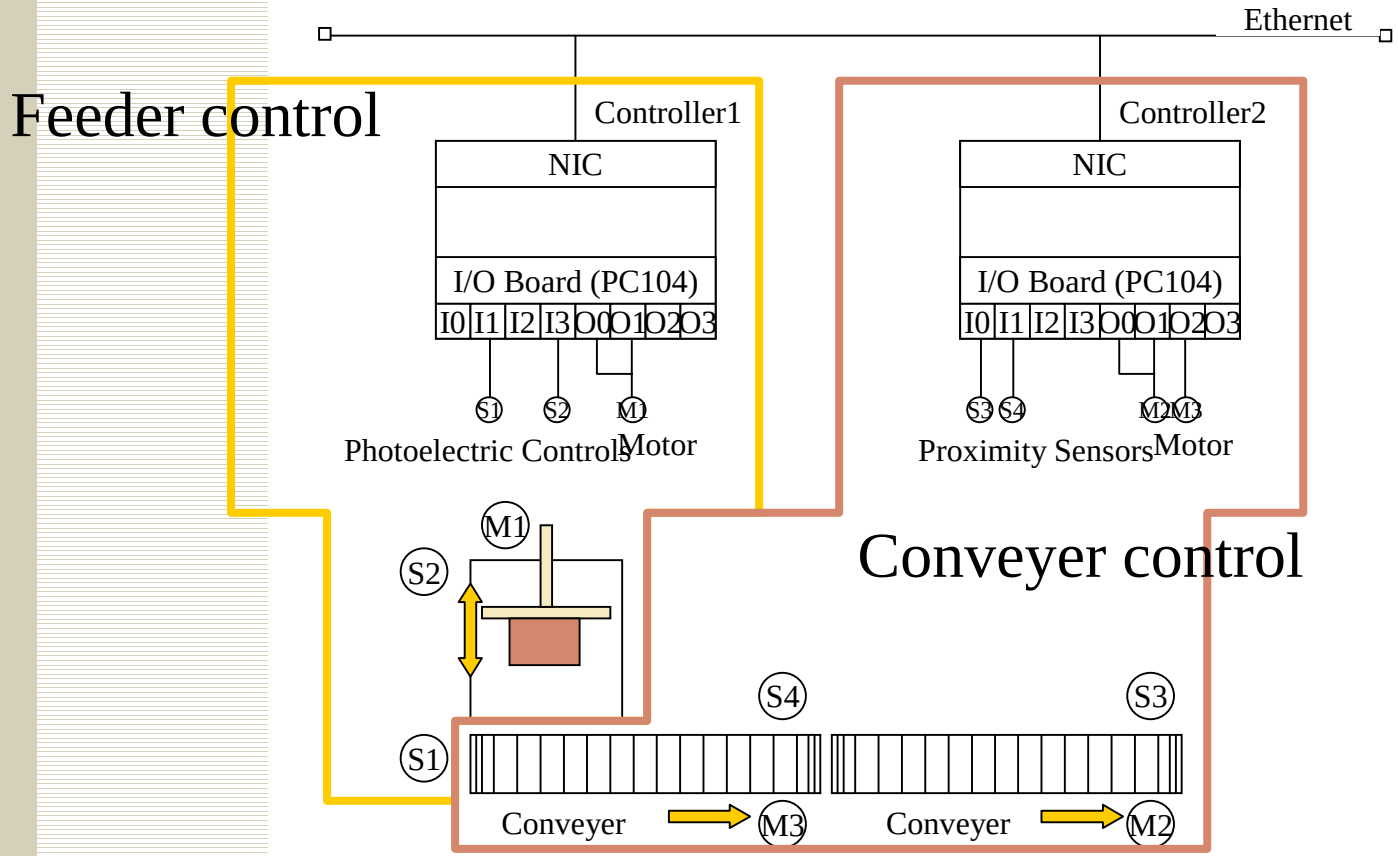
H/W Overview

Feeder controller

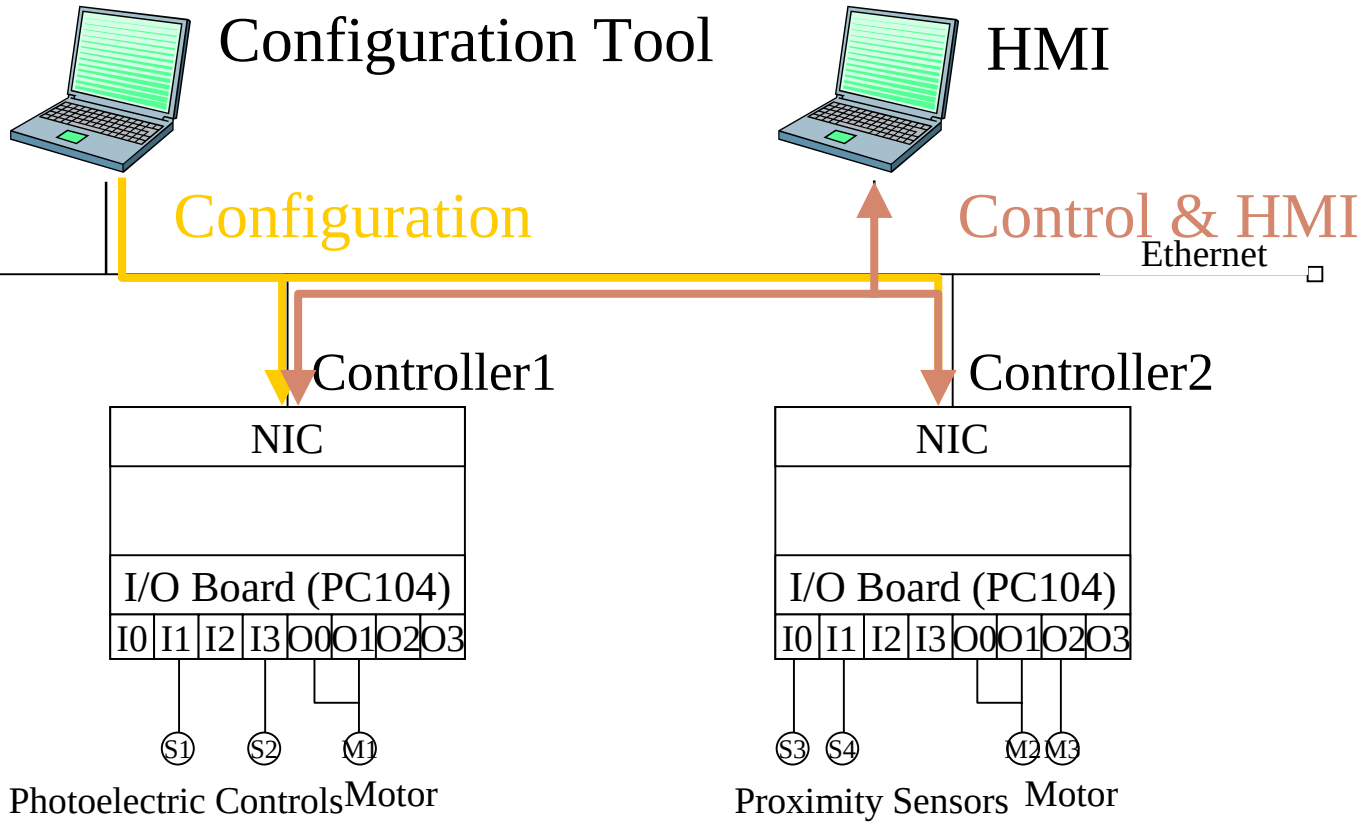


Conveyer controller

Mapping of Interface



System Overview



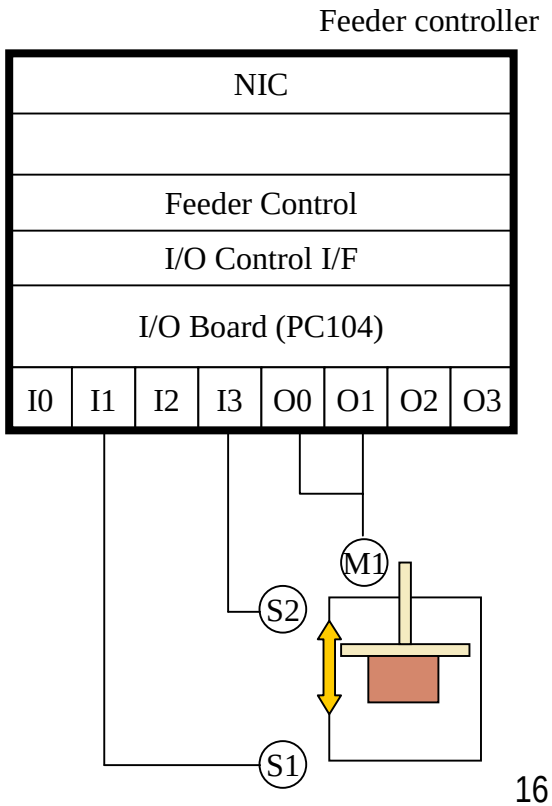
Devices

Devices

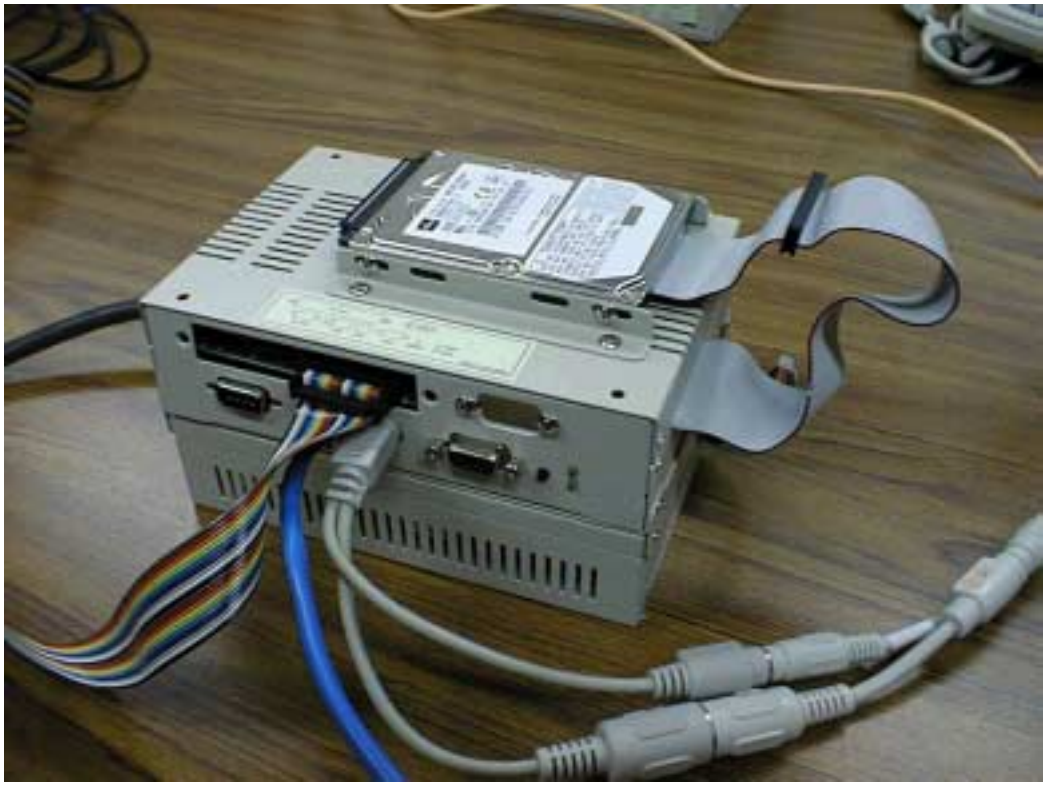
- **Feeder device**
- Conveyer device
- HMI device

Feeder Device

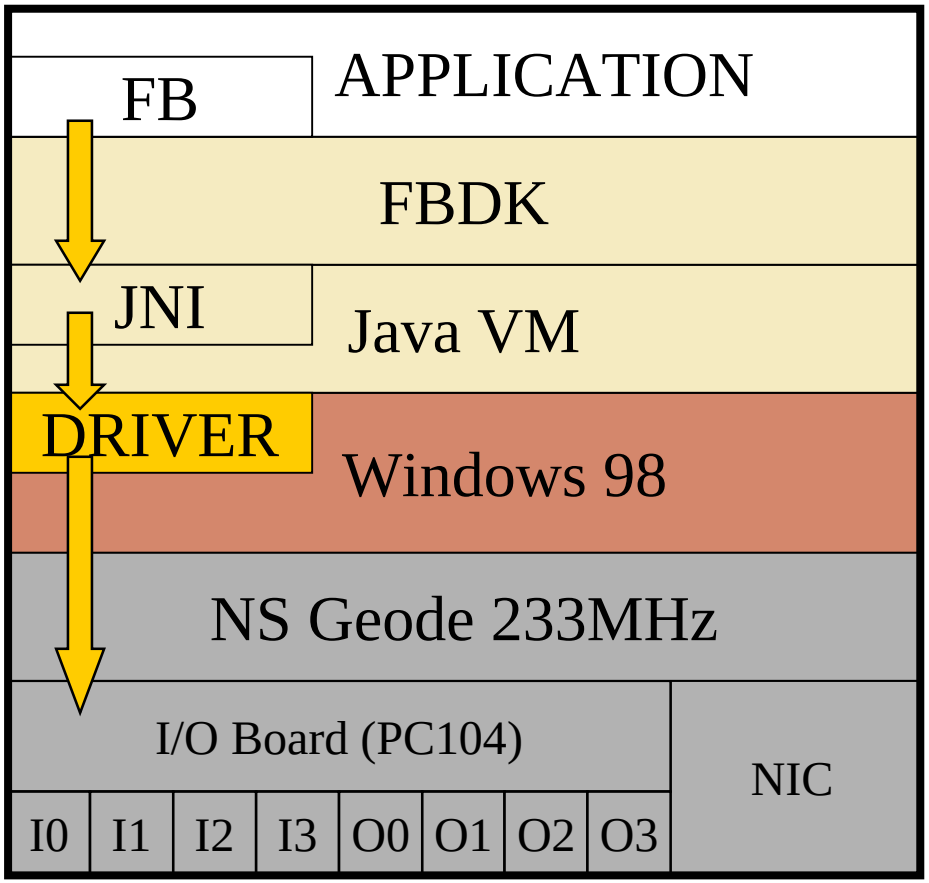
- Extend and retract feeder arm
  - Control a motor
  - Read sensors



Feeder Controller

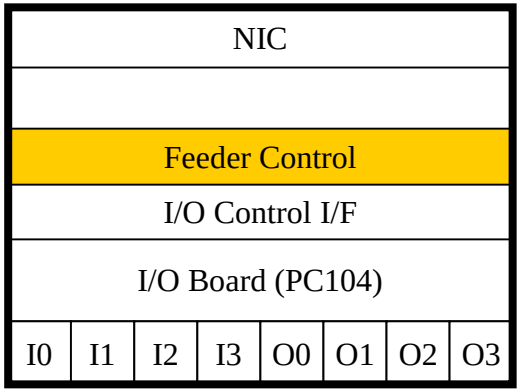


Feeder Controller



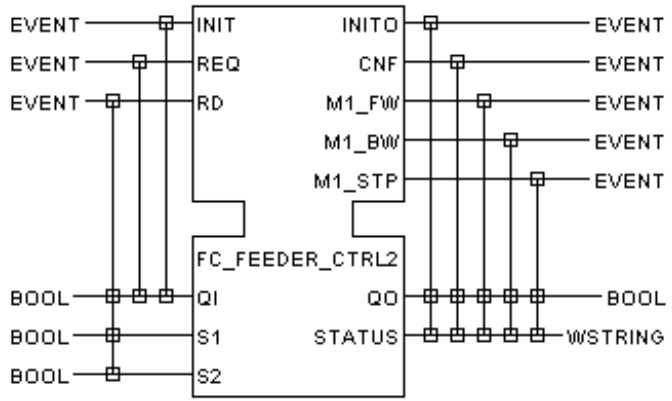
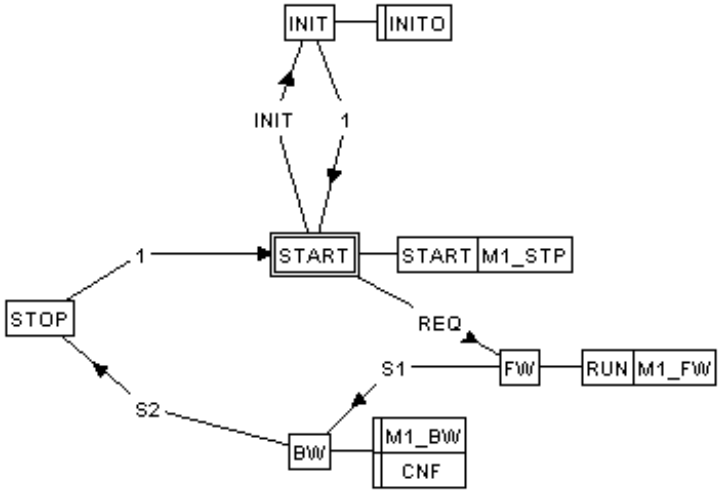
Functions of Feeder Controller

- Feeder control (status, action)
- I/O control
  - Motor control
  - Read sensors



Feeder Control

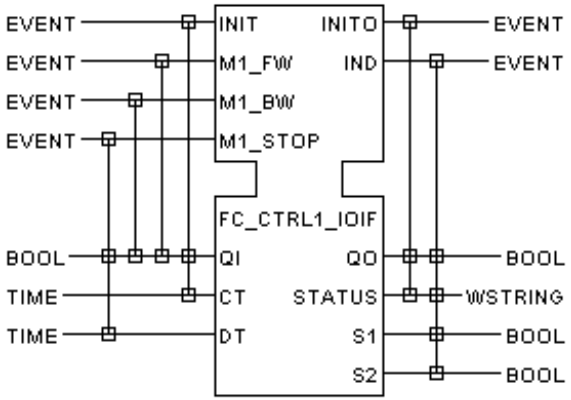
- Supplied by device vendor (feeder developer)
- Decide feeder's action

Interface	ECC
	

I/O Control

- Developed by device vendor
- Provide interface for motors and sensors

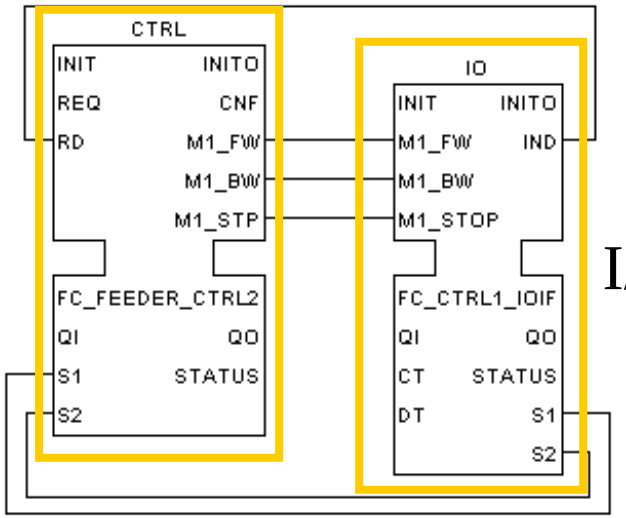
Interface	

	- Motor control
	  – Forward
	  – Backward
	  – Stop
	- Sensor
	  – Indicate sensor's events

Feeder Device Control

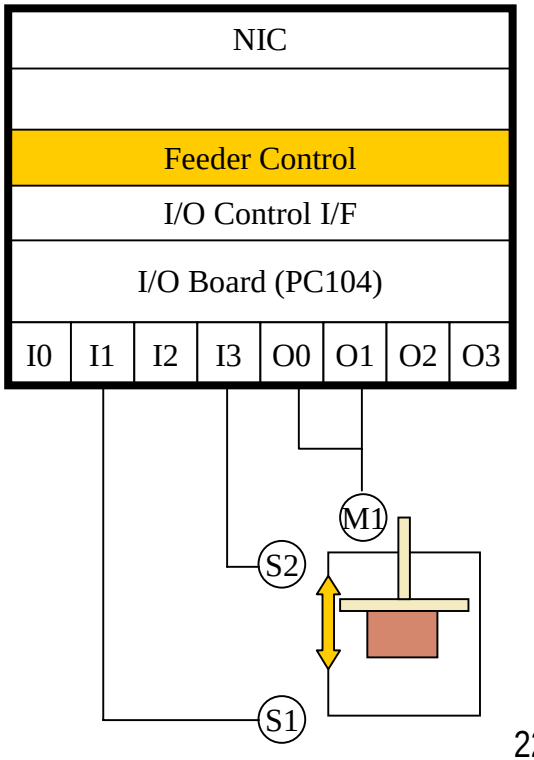
- Control actions of feeder device

control



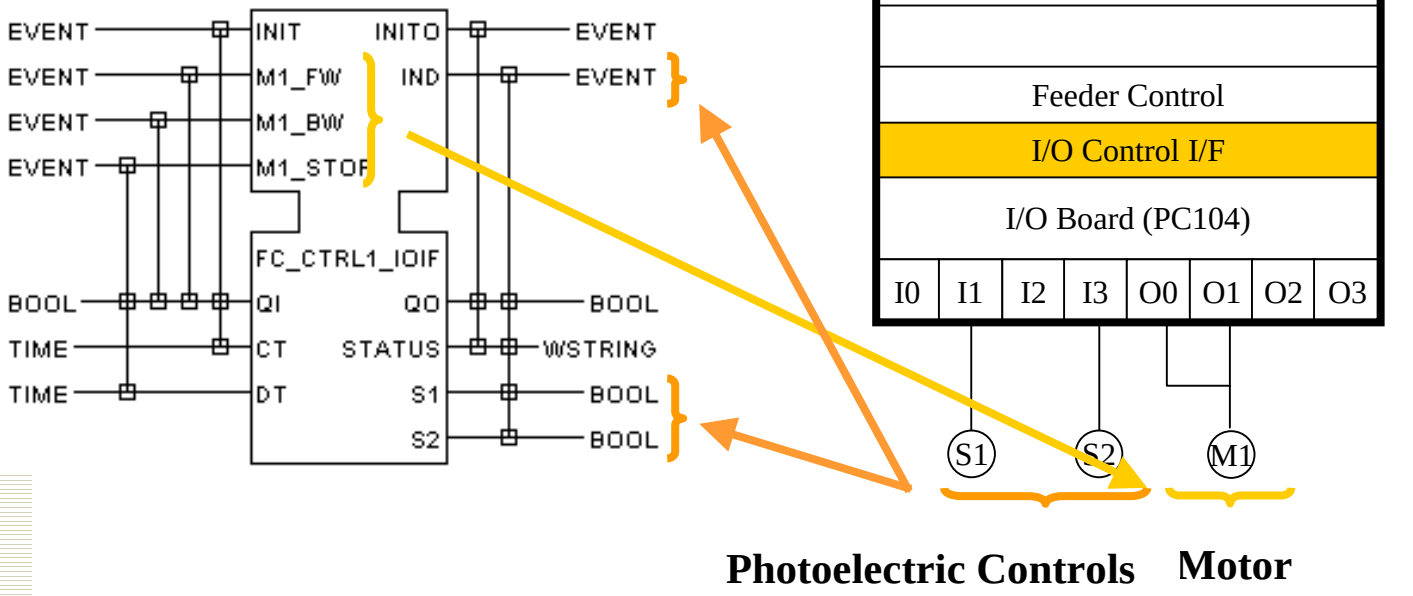
I/O

Feeder controller



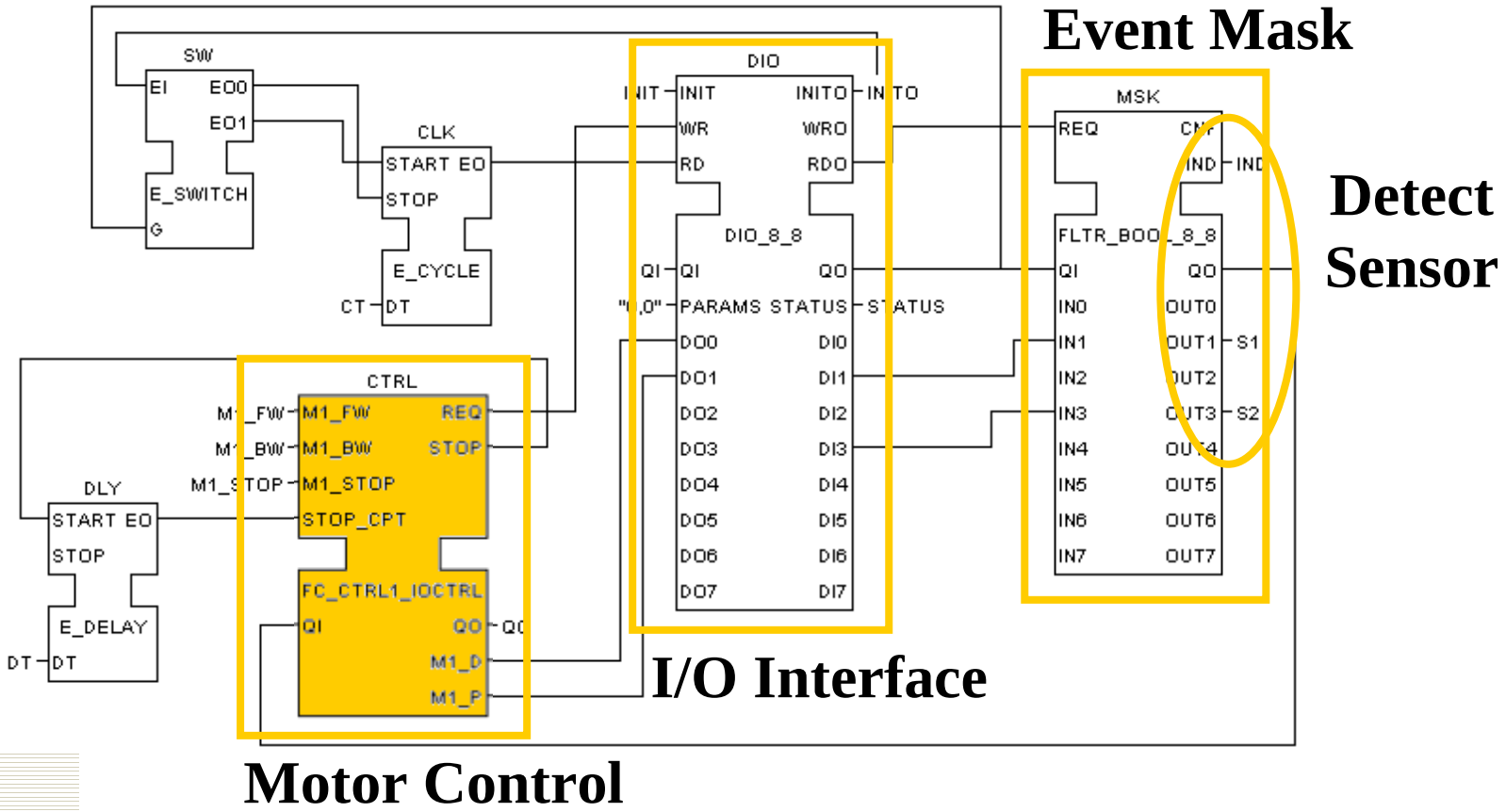
I/O Control I/F of Feeder

- Access to motors and sensors
- Developed by device vendor



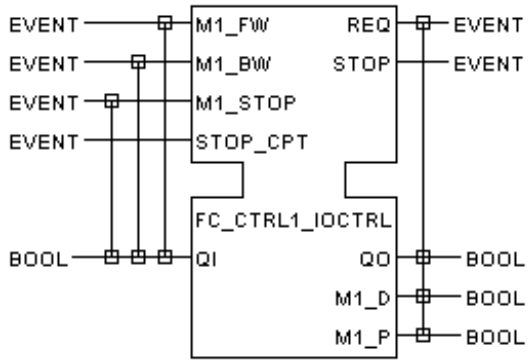
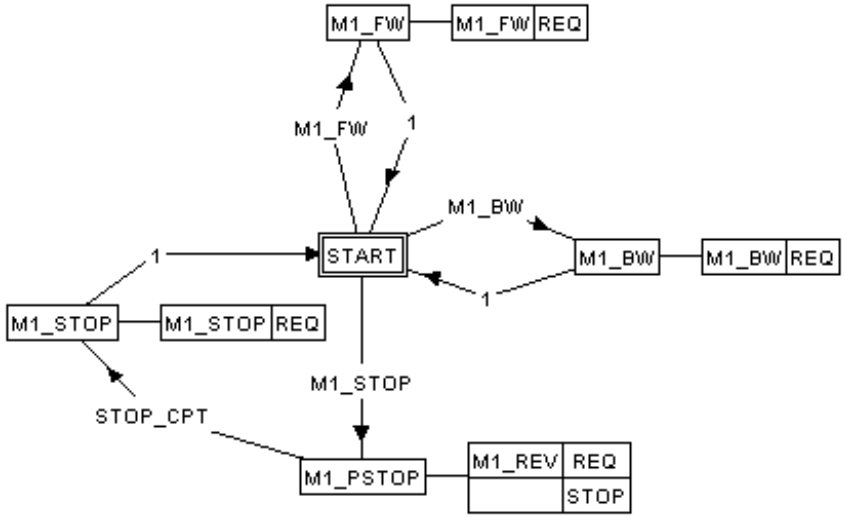
I/O Control I/F of Feeder Controller (cont.)

- Inside of feeder I/O Control -



Motor Control

- Developed by device vendor
- Control motor via digital I/O

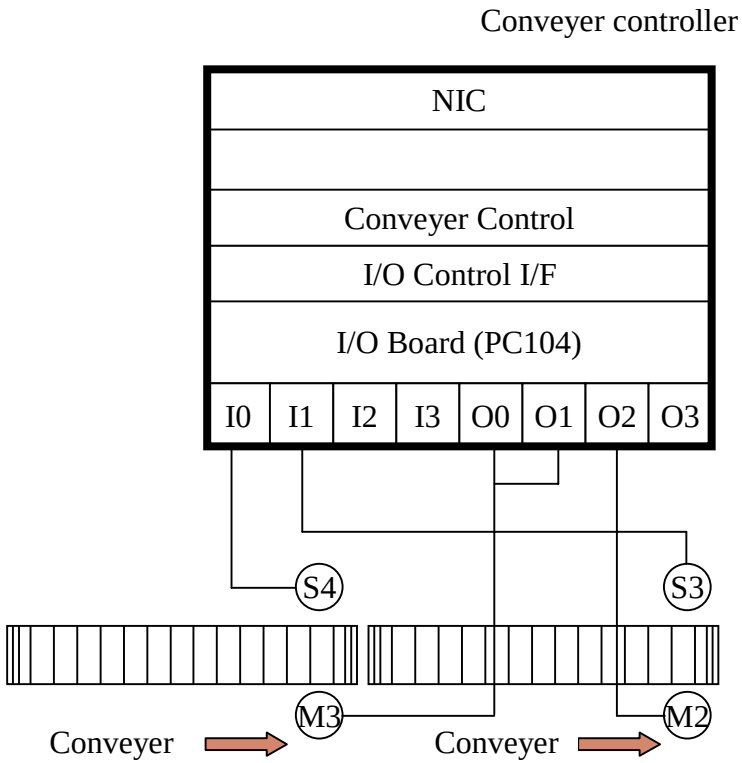
Interface	ECC
	

Devices

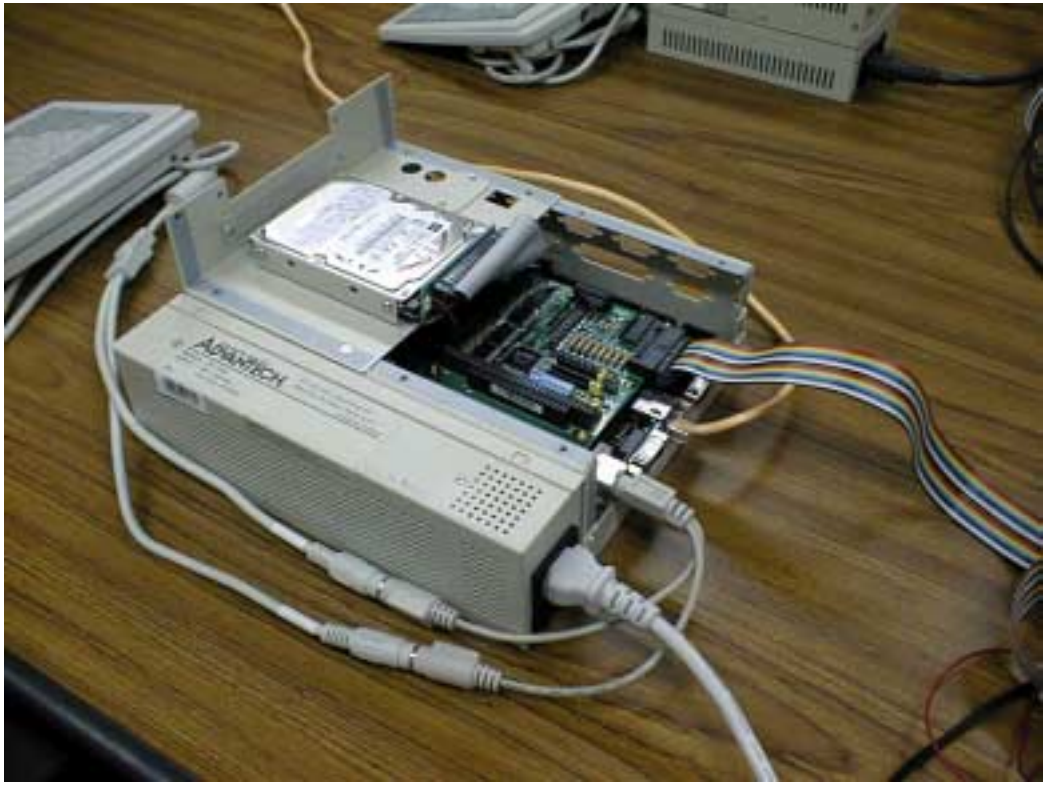
- Feeder device
- **Conveyer device**
- HMI device

Conveyer Device

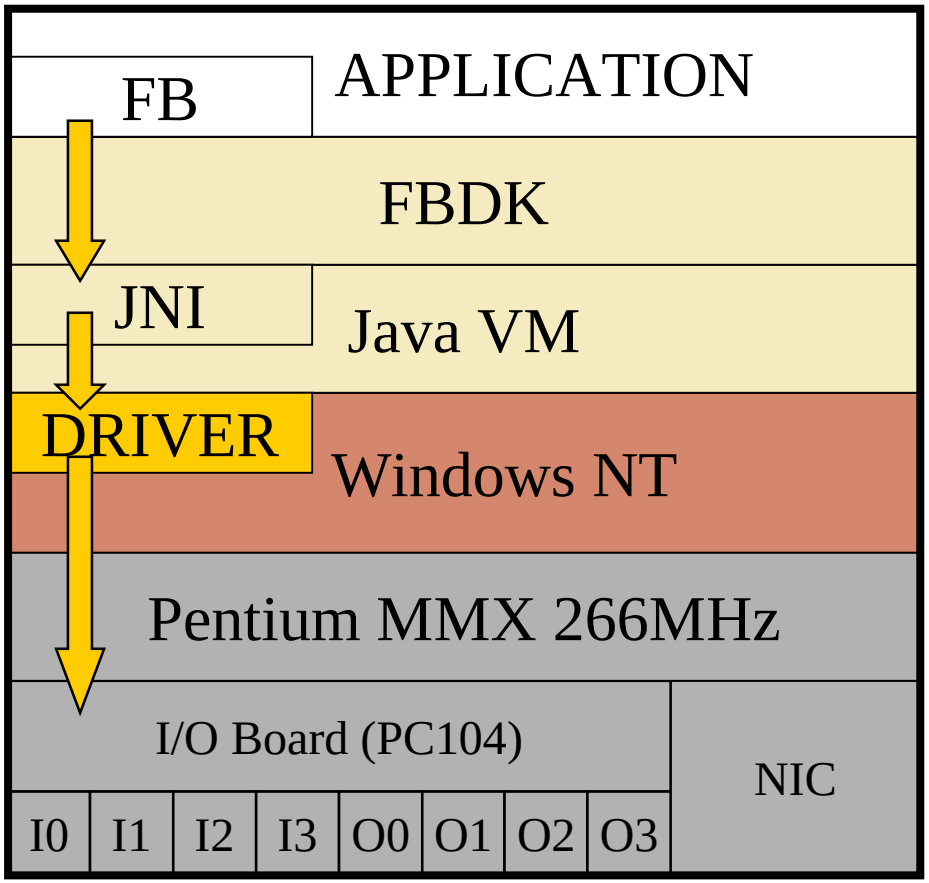
- Carry works with two conveyers
  - Control two motors
  - Detect works arrival



Conveyer Controller

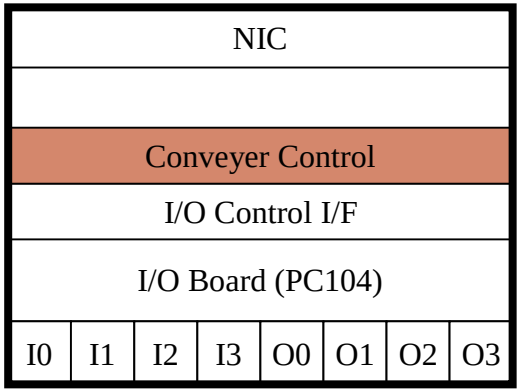


Conveyer Controller



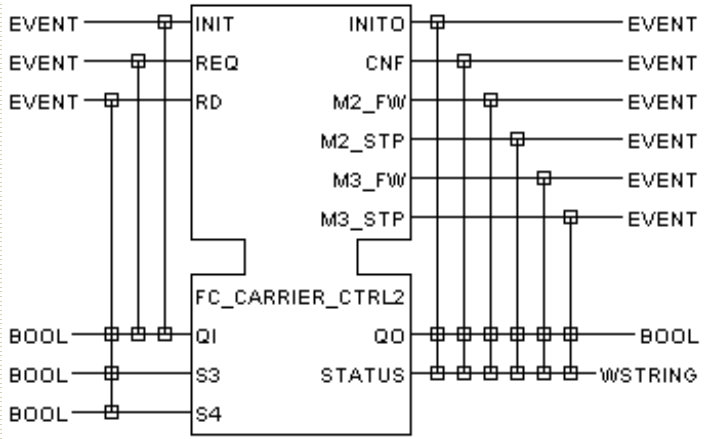
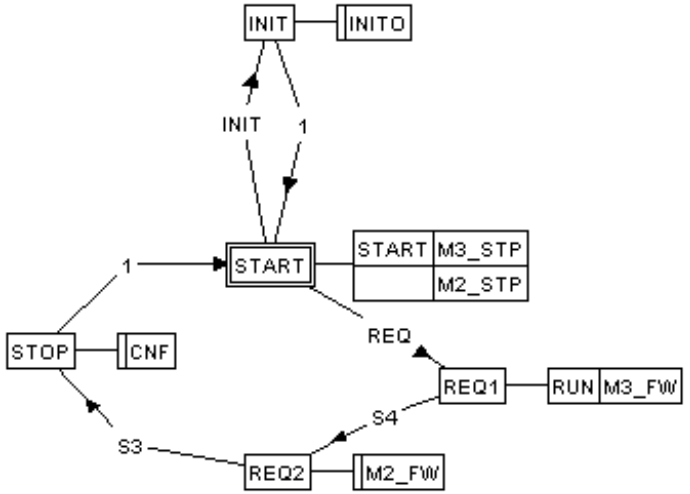
Functions of Conveyer Controller

- Conveyer control (status, action)
- I/O control
  - Motor control
  - Read sensors



Conveyer Control

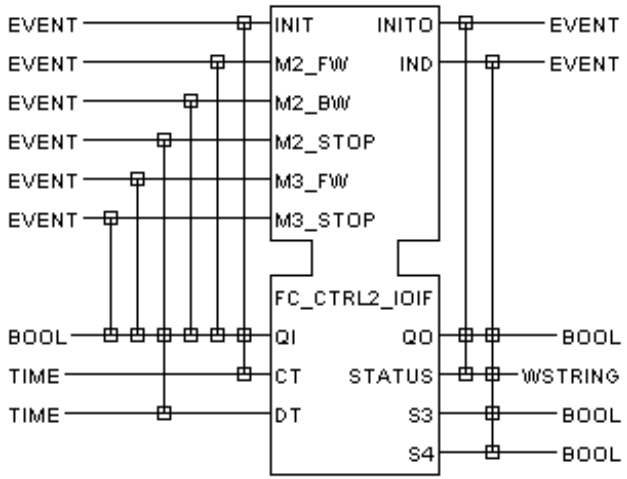
- Supplied by device vendor (conveyer developer)
- Decide actions of conveyers

Interface	ECC
	

I/O Control

- Developed by device vendor
- Provide interface for motors and sensors

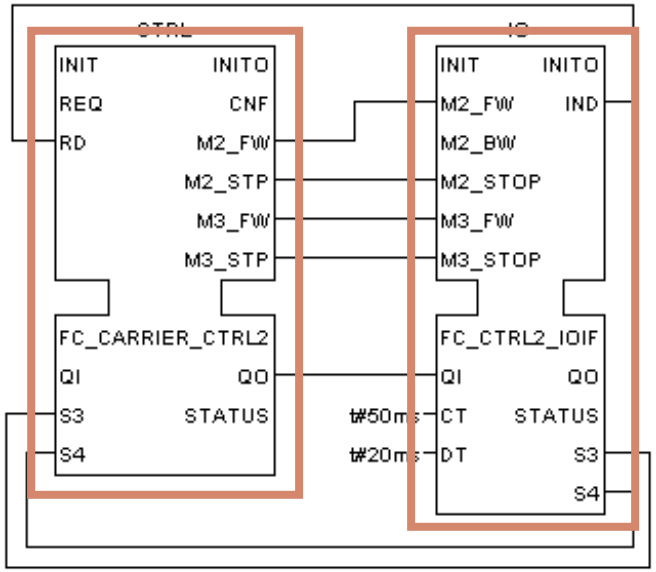
Interface	

	- Motor 2 control
	  – Forward
	  – Backward
	  – Stop
	- Motor 3 control
	  – Forward
	  – Stop
	- Sensor
	  – Indicate sensor's events

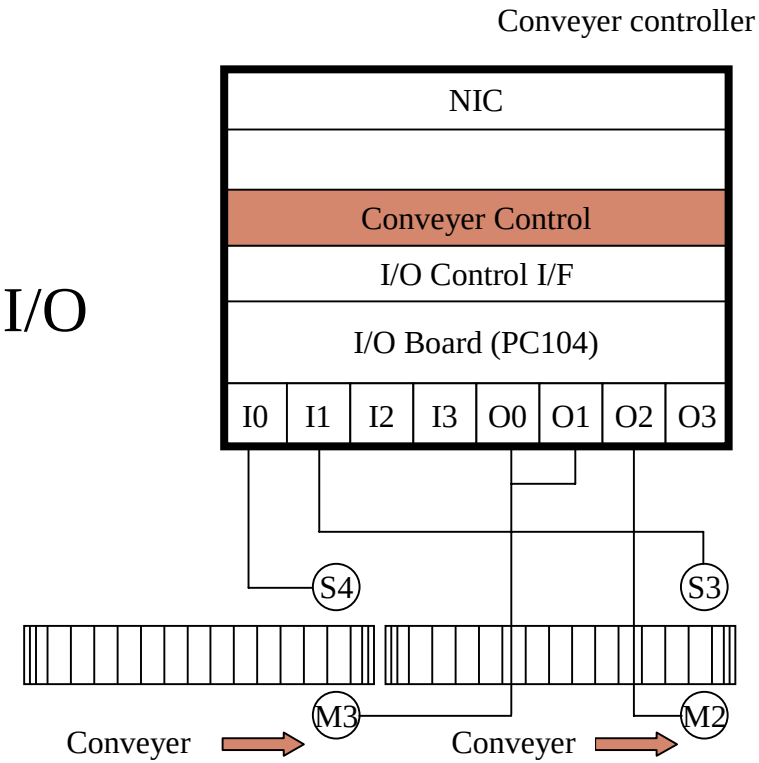
Conveyer Device Control

- Control actions of conveyer device

control

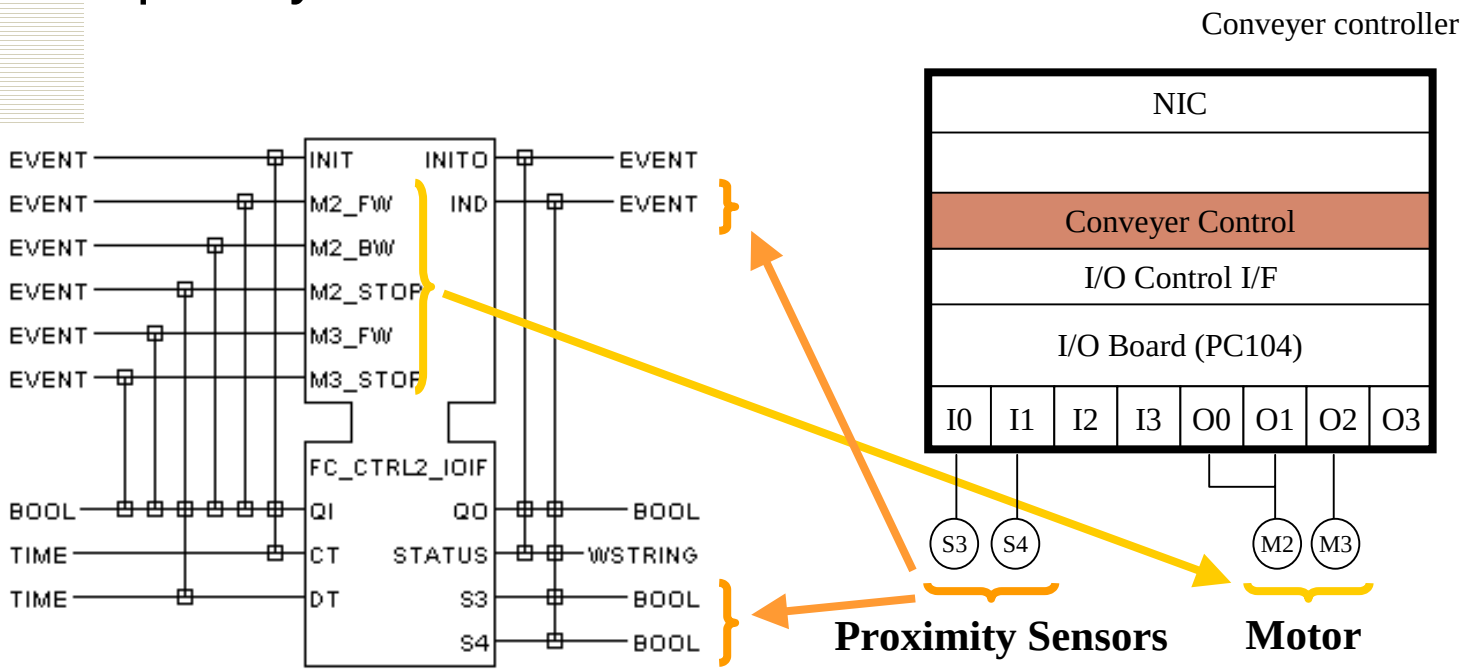


I/O



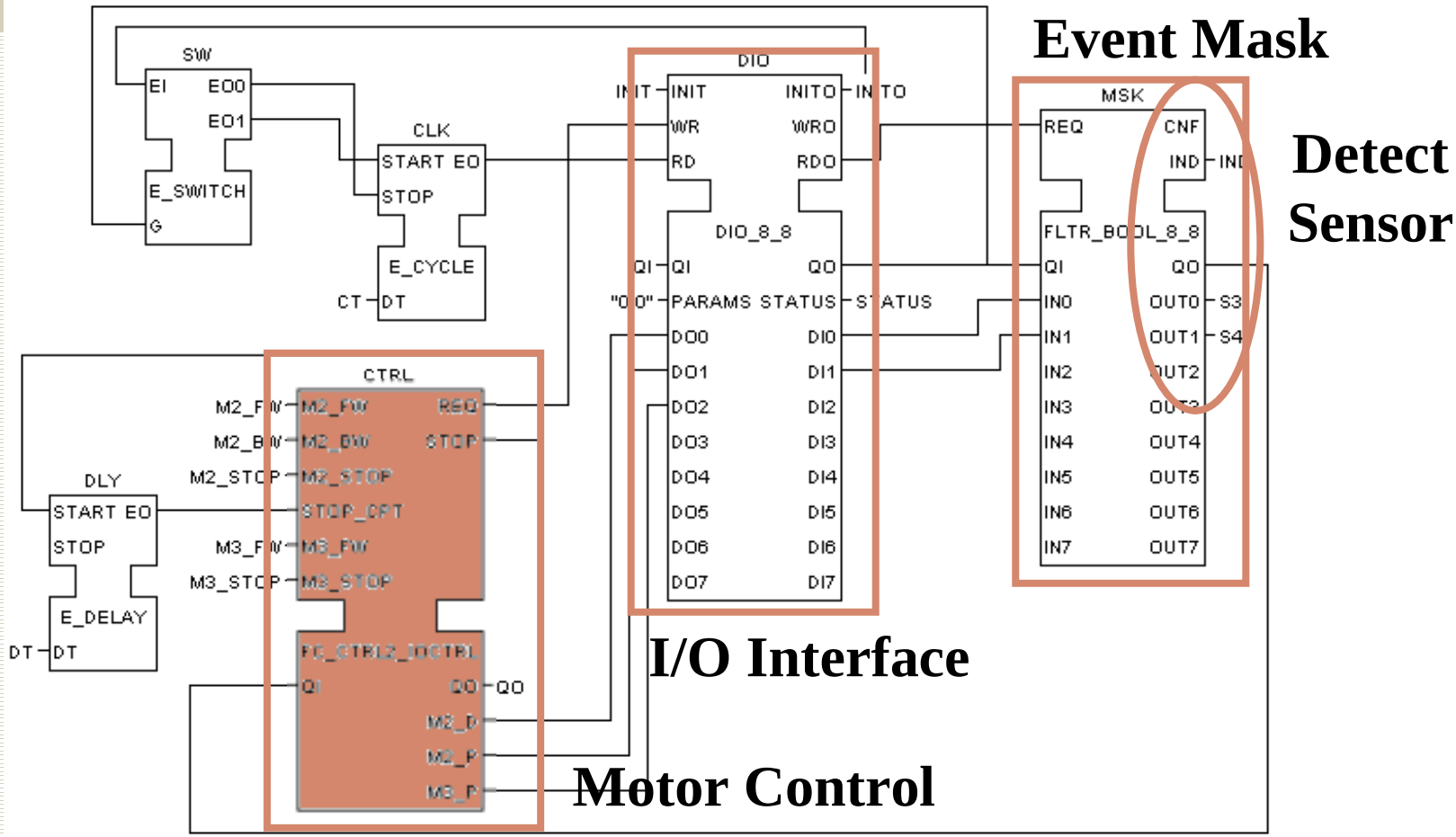
I/O Control I/F of Conveyer

- Access to motors and sensors
- Developed by device vendor



I/O Control I/F of Conveyer Controller (cont.)

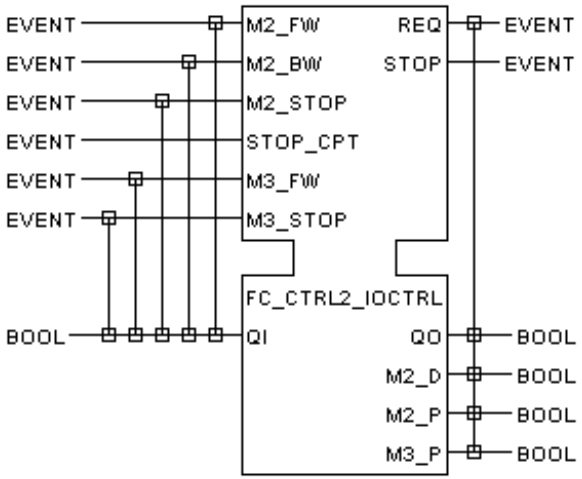
- Inside of conveyer I/O Control -



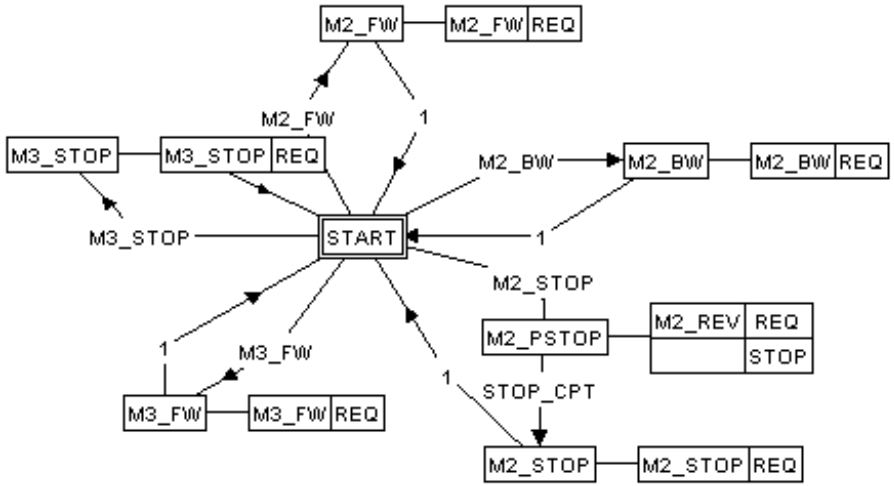
Motor Control

- Developed by device vendor
- Control motor via digital I/O

Interface

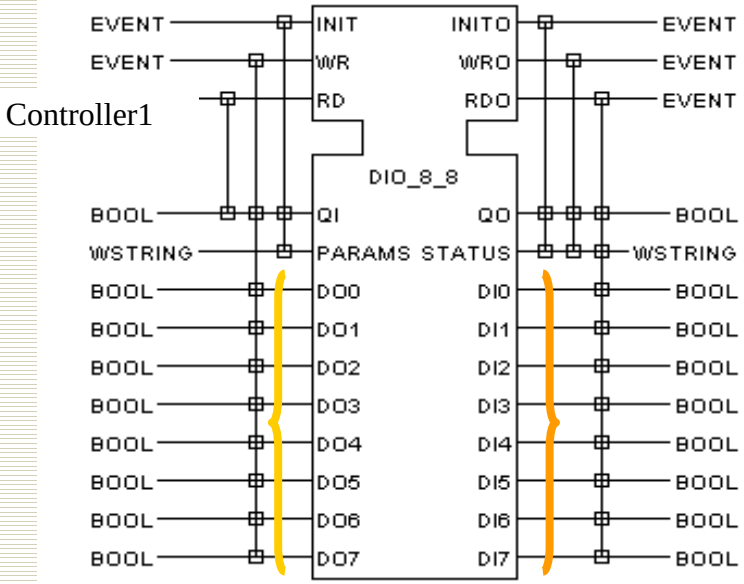


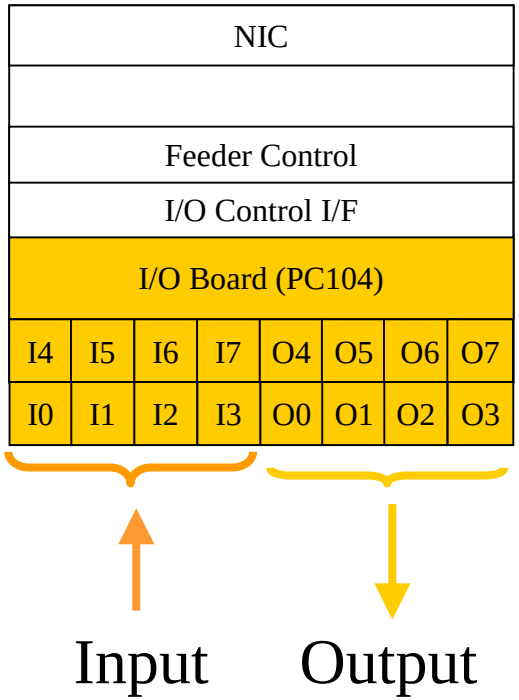
ECC



I/O Board Control (Common)

- Access to digital I/O
- Designed by parts supplier
- Used in I/O control I/F





Devices

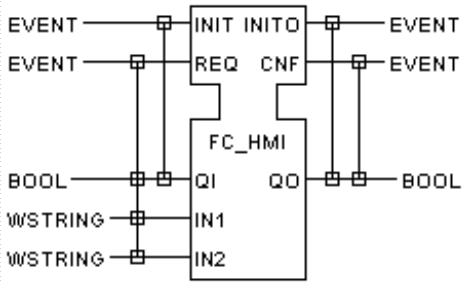
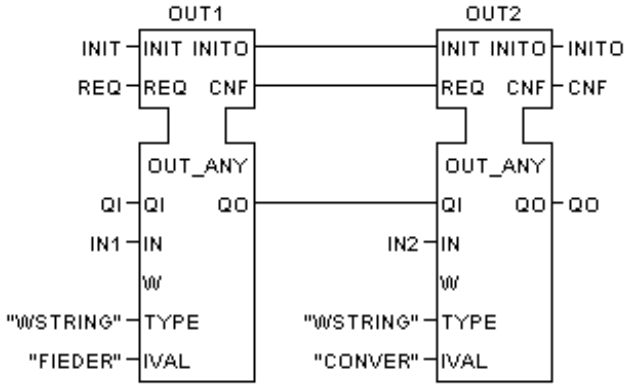
- Feeder device
- Conveyer device
- **HMI device**

HMI Device

- PC + network
  - Occur “START” event
  - Monitoring devices status

HMI Component

- One FB for one GUI component
- Designed by end-user or system integrator

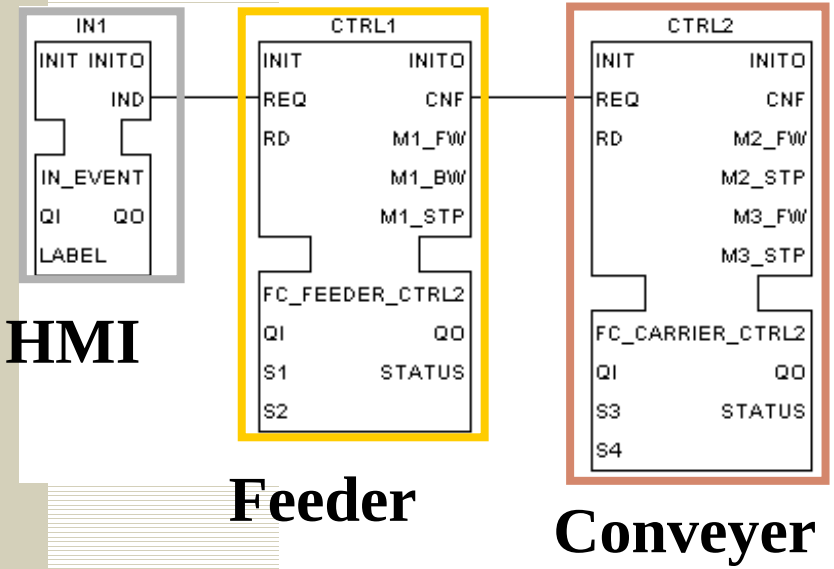
Interface	Body
	

Application

(Machine Control Using IEC 61499)

Application

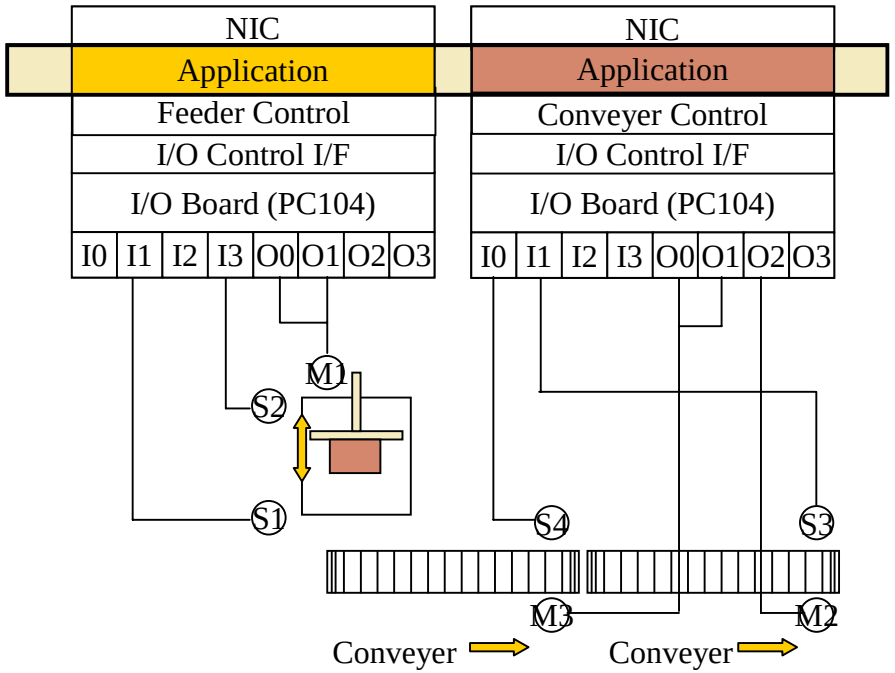
- Designed by system integrator
- Select controls and connect



HMI

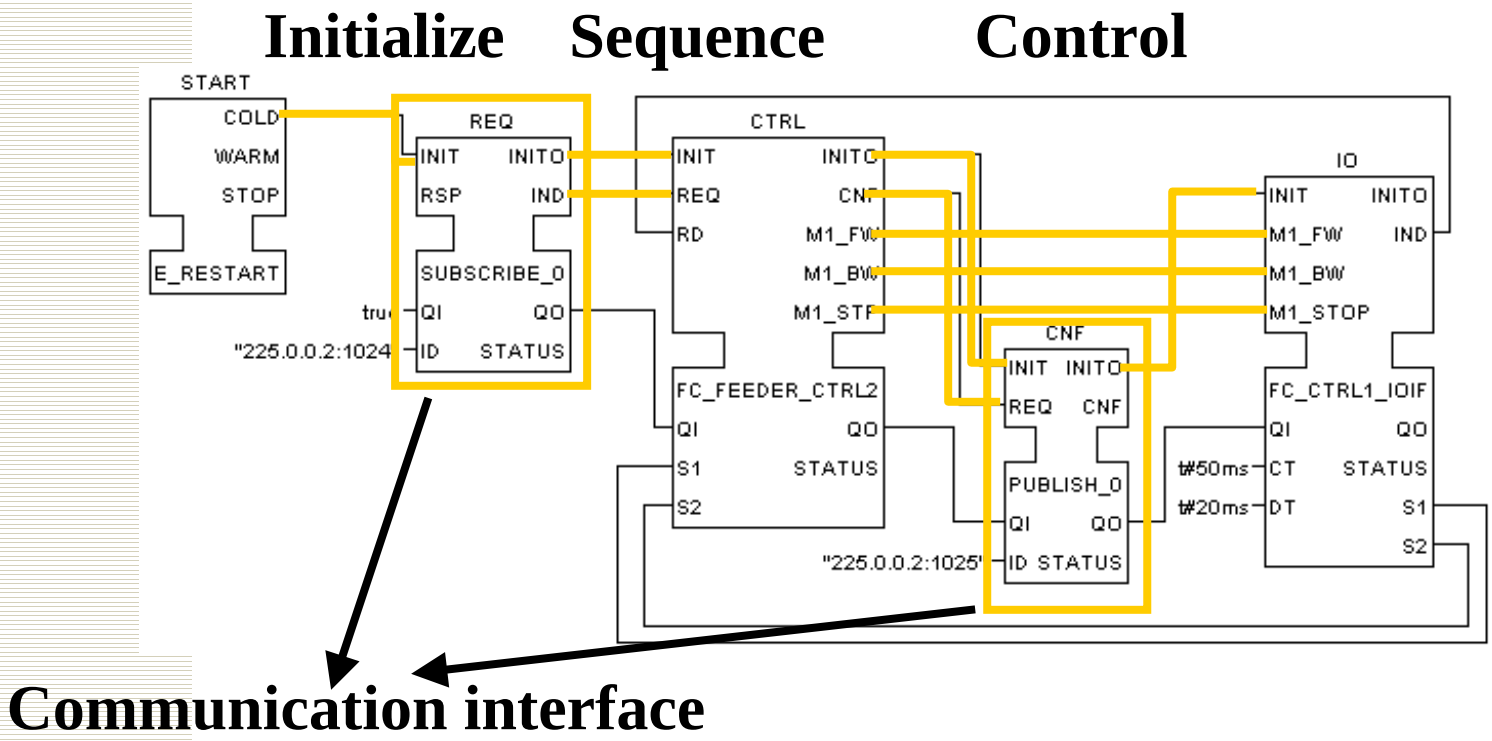
Feeder

Conveyer



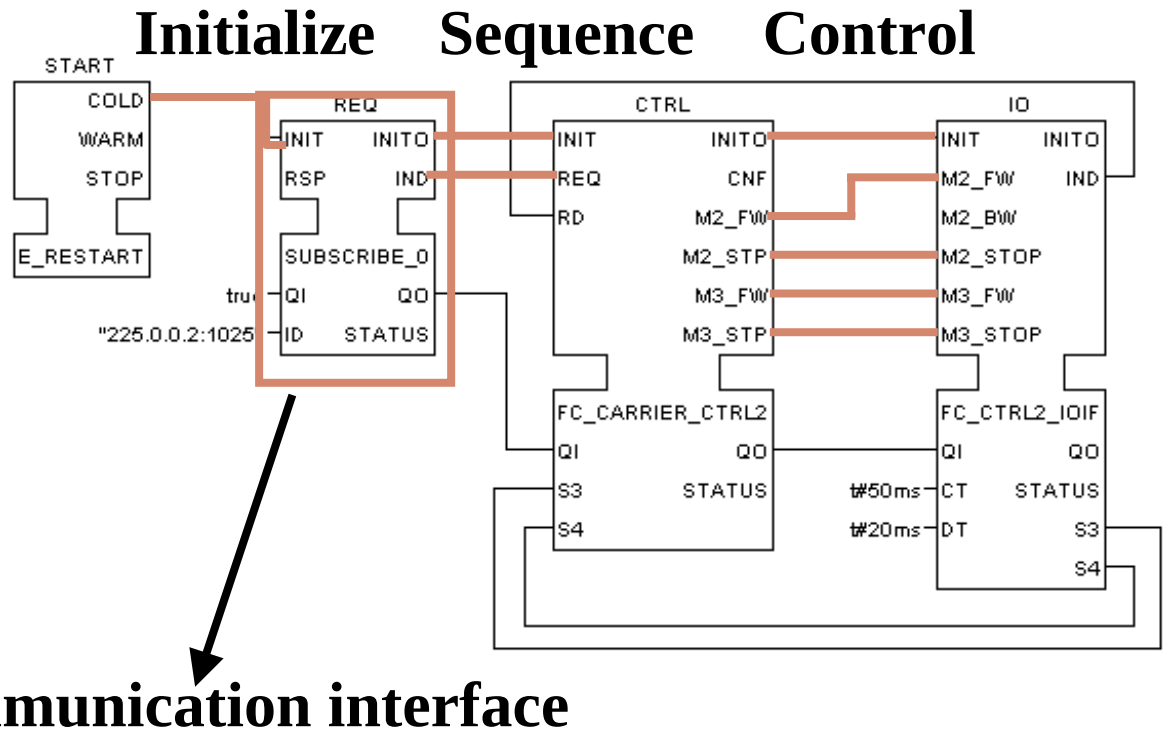
Local Application in Feeder

- Designed by system integrator

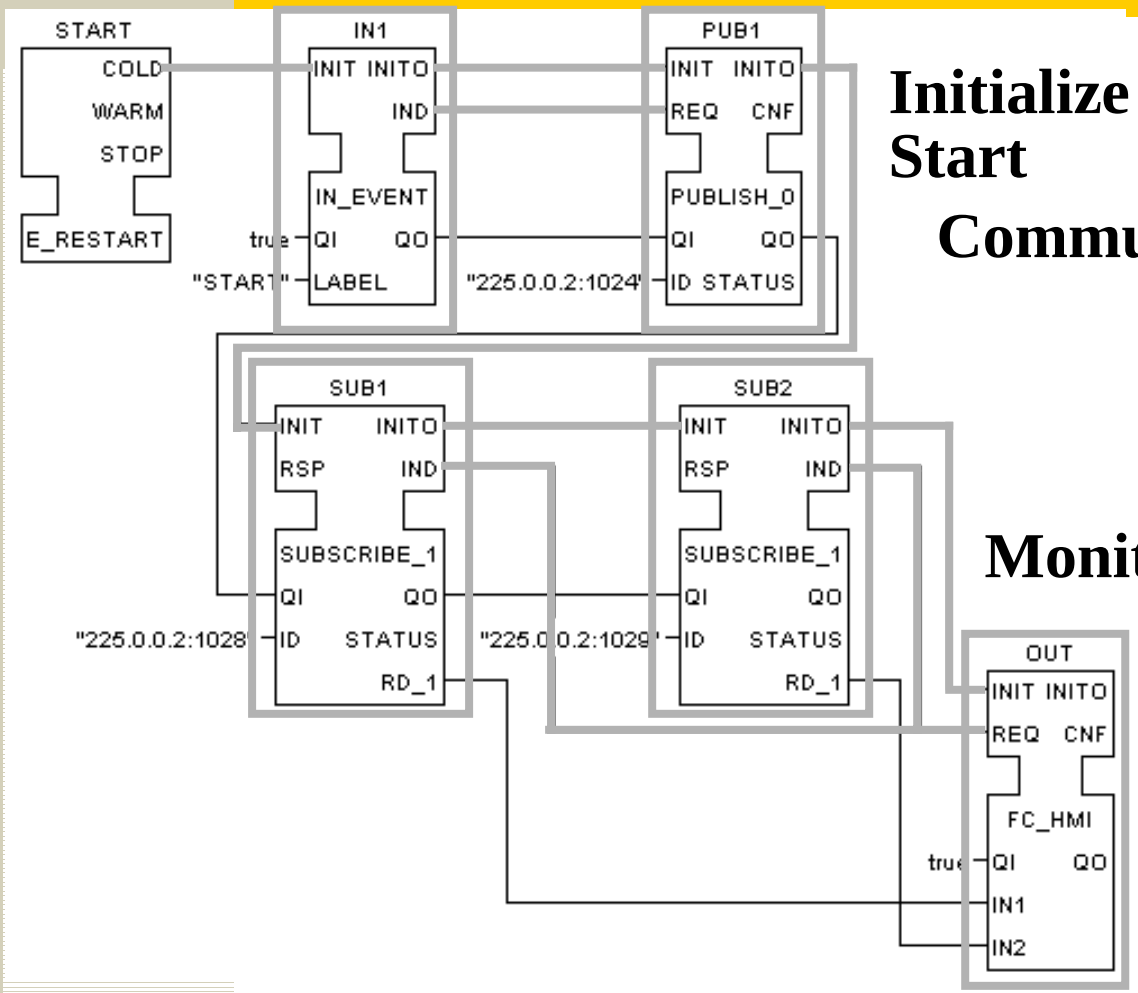


Local Application in Conveyer

- Designed by system integrator



Local Application in HMI



Initialize
Start

Communication interface

Monitoring

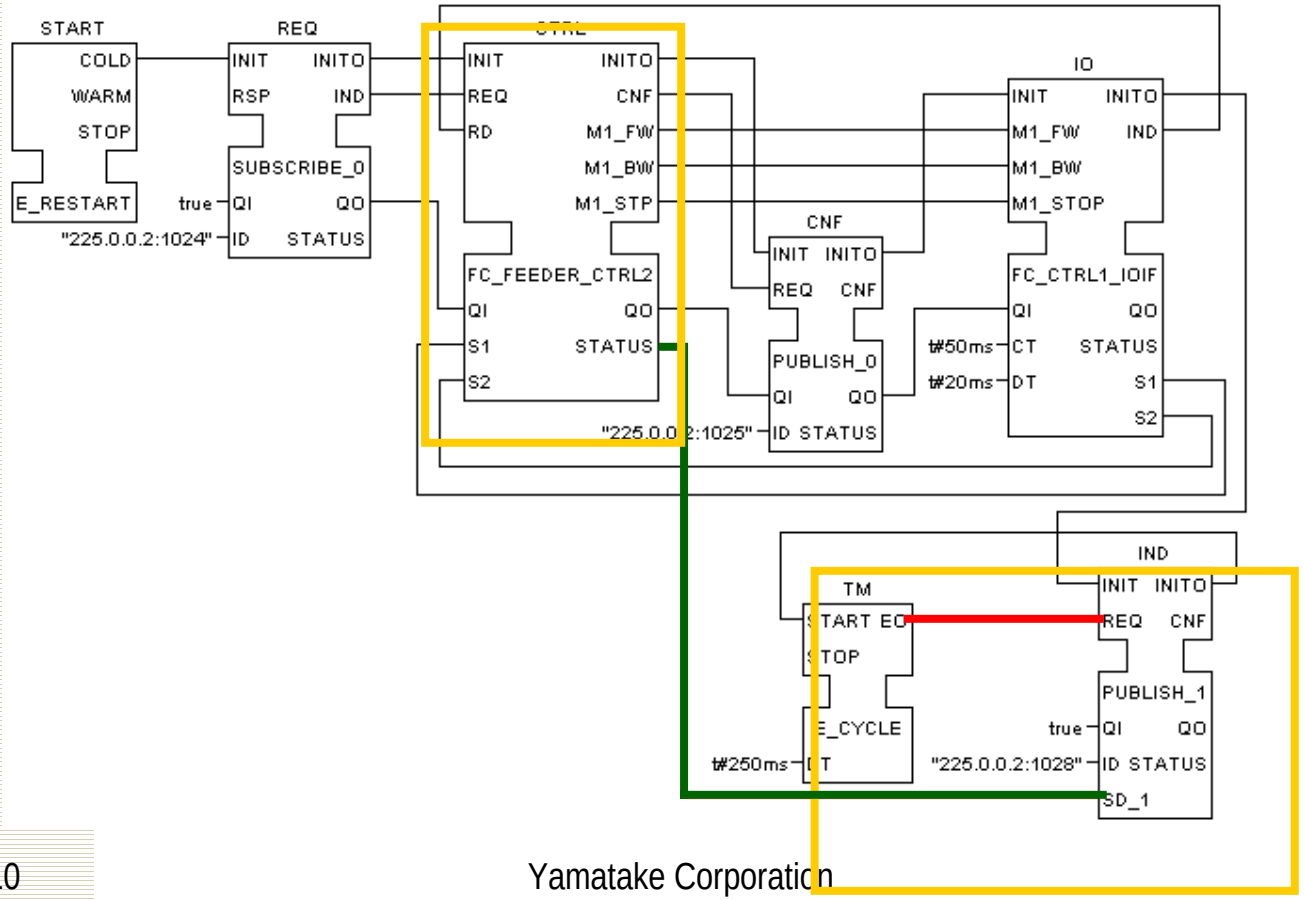
HMI

Extend Devices for HMI

- Receive “START” event from HMI
- Publish status of devices

Extend Feeder Device

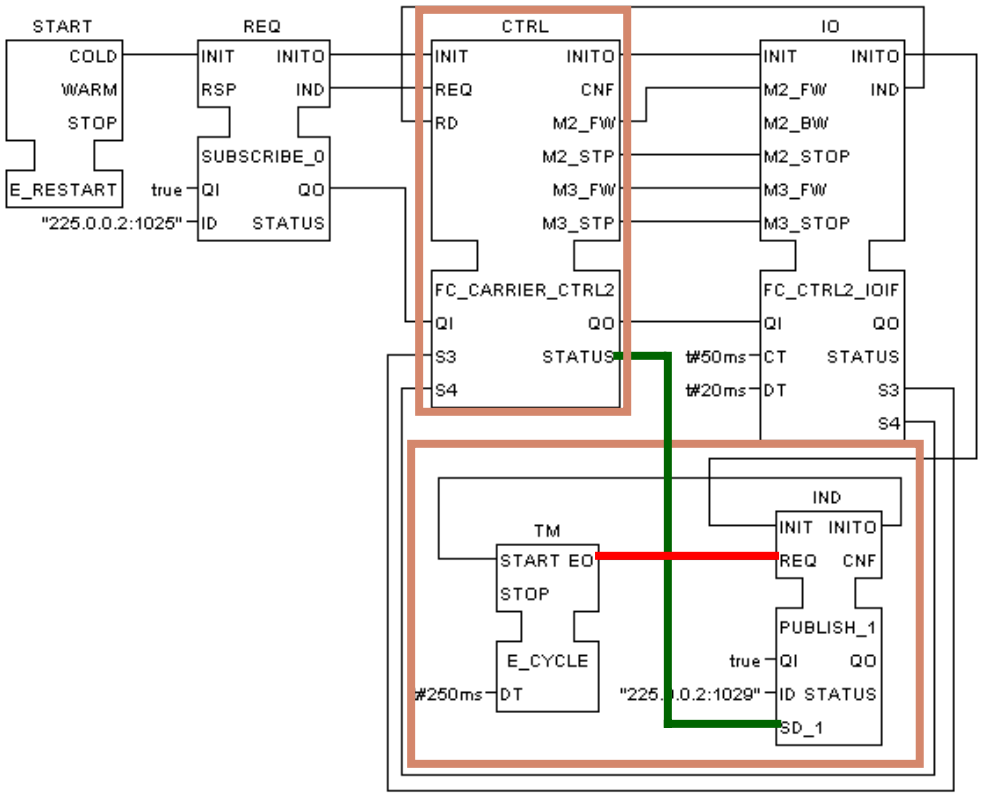
- Publish status of feeder control FB cyclically



Send status cyclically

Extend Conveyer Device

- Publish status of conveyer control FB cyclically

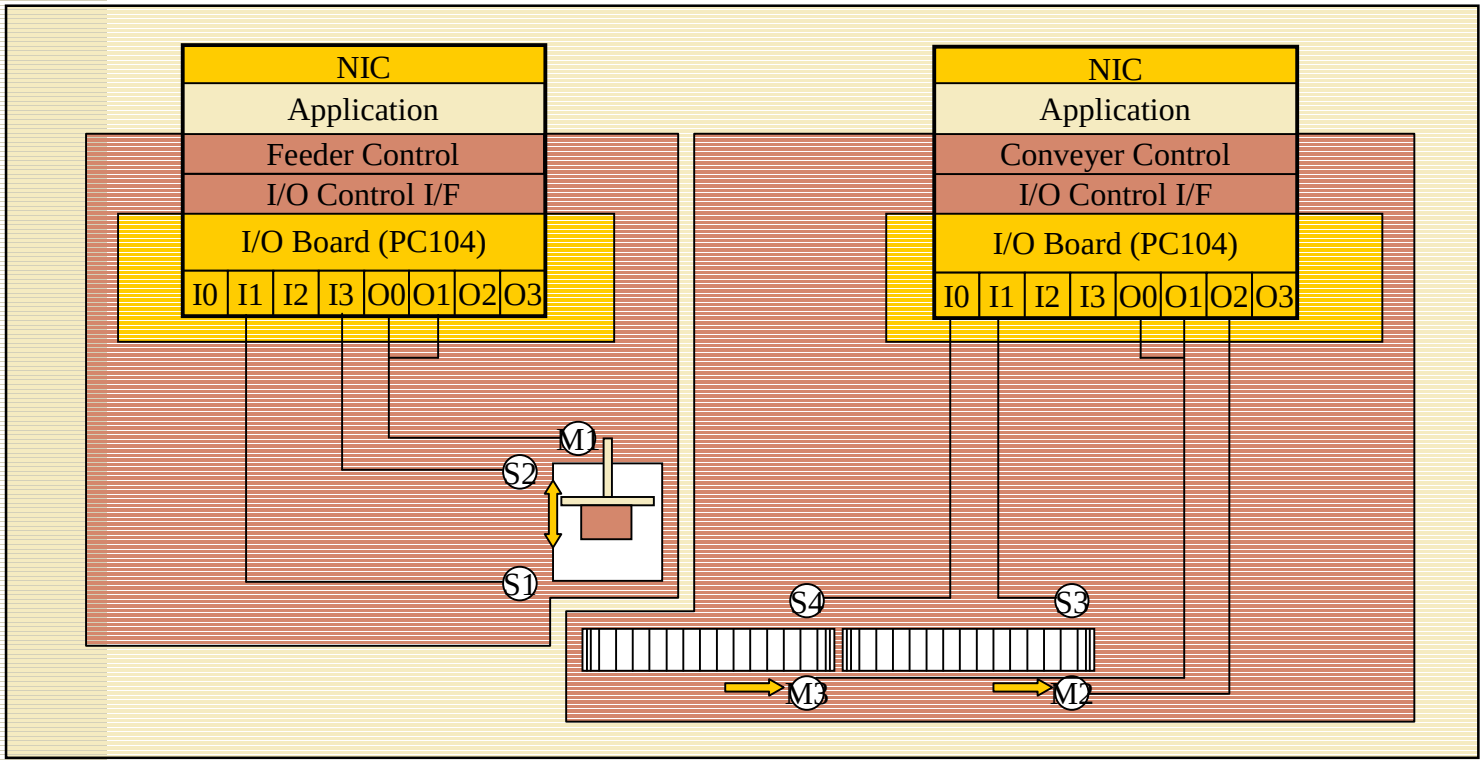


Send status cyclically

Design Method

- Parts supplier (OEM)
  - Supply H/W and S/W (driver FB)
- Device vendor
  - Supply interface FB for I/O (e.g. Sensor, motor)
  - Supply control FB of device (e.g. Feeder, conveyer)
- System integrator
  - Design system combining FBs among devices
  - Configure local applications in devices

Future System Development



System Integrator | Device Vendor | H/W, S/W Supplier