Technical Note

Sysmac Modular Solution

The Sysmac modular solution highlights the integration of flexible and user-friendly hardware and software, allowing for pre-implementation system simulation and customization for diverse applications.

This document explains how to:

- Manage safety with OMRON's safety CPU, which oversees safety functions and monitors real-time conditions to ensure the safety of the system.
- Execute pick and place operations efficiently, with adjustable settings through the HMI for speed and motion attributes.
- Perform precise dispensing tasks using a sequential control feature for the creation of multiple paths, selectable via the HMI.

Table of Contents:

Table of Figures

1. Introduction

The modular solution concept is based on a single cell platform that can be configured in various ways. It allows for the addition of cells as per your application's demands. In terms of functionality, diverse setups are at your disposal. Beginning with the primary motion apparatus, the options include a gantry or a robotic arm. Conversely, the system can be adapted for pick and place operations, screw driving, or dispensing. The program's modular design greatly simplifies customization for a variety of applications.

2. Core Functionality

2.1. Safety

The OMRON safety CPU oversees the safety function, with each cell inherently representing a single safety zone. Standard configurations include an E-Stop circuit and a guarding circuit, which can be enhanced with additional devices such as light curtains, area scanners, or safety mats. The NX safety controller provides the advantage of real-time monitoring, simplifying the system commissioning process. It generates a safety signature that verifies the absence of unauthorized alterations to the system.

2.2. Pick and Place

One setup within the solution’s configurations enables the seamless execution of pick and place tasks. Accessing and adjusting the pick and place position is feasible through the HMI. Users possess authority over speed settings, and when necessary, motion attributes and position details can be easily modified through a model-based selection in a recipe.

2.3. Dispense

Dispensing is a widely utilized procedure in automation applications across various industries. Within the solution, there's a sequential control feature designed to accomplish this task. It allows the creation of multiple paths, which can be chosen via the HMI. Should your application demand it, OMRON provides an optional G-Code solution that can be seamlessly integrated into your system.

2.4. Screw Driving

The solution presents an intuitive approach for incorporating a screwdriving process. The Sysmac platform is adaptable and can readily accommodate a wide range of screwdriver systems with minimal adjustments. The HMI provides users with the choice to easily fine-tune the screw positions based on their requirements.

2.5. Vision Inspection

High-quality products result from robust processes and effective inspections that can consistently identify defects. OMRON provides a wide range of vision solutions, and the solution comes equipped with the FHV smart sensor, which stands as one of the most advanced vision systems available in the market.

3. Architecture

The Sysmac environment provides a modular approach, extending from the CPU to individual devices and sensors. Utilizing Sysmac allows for the effortless integration of an EtherCAT® node into your system. It provides access to a comprehensive list of OMRON devices that can be seamlessly integrated through a drag-and-drop interface. Additionally, third-party hardware can be added to the devices library, allowing them to be used in the same way as OMRON

devices. Tailoring your system to specific requirements, you can enable or disable devices as needed. This functionality extends to entire machine modules, allowing you to activate or deactivate them, should they be absent from your current system configuration. Notably, all Sysmac PLCs offer support for both Ethernet/IP and EtherCAT®. The Ethernet/IP network facilitates communication with platforms from other manufacturers, enabling data sharing through IoT and more. In addition to the inherent modularity ensured by OMRON hardware, this section will delve into the program architecture, which adds an additional layer of adaptability to your application.

3.1. Code Modularity

The Sysmac project is constructed using numerous programs or modules, categorized into three distinct types: Cells, Stations, and Devices. These modules can be employed as necessary within the application and can be readily duplicated and modified to serve different objectives.

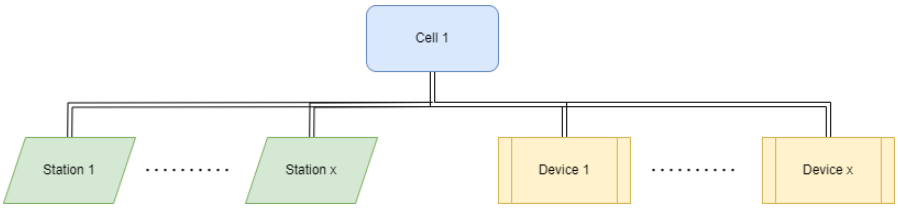

Figure 1: Program Layout

3.2. Cell Module

A Cell module is a program designed to manage the comprehensive supervision of a cell. One of its primary roles is to oversee the safety of the entire system. Each individual cell corresponds to a distinct safety zone, and if multiple zones are necessary, several cell modules can be employed. Additionally, the cell program addresses the operational aspects of the machinery, including mode selection and the START, STOP, and resetting of cycles. The cell program has the capacity to regulate as many stations and devices as needed in accordance with the system's requirements.

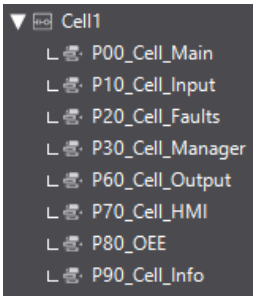

Figure 2: Cell Program Subroutines

3.3. Device Module

The device module assumes the task of managing a designated device, enabling seamless interaction with said device from either the cell or stations modules. Its role encompasses ensuring the correct functioning of the device by monitoring its status and overseeing its preparedness to carry out requested operations. Notably, the device module exclusively responds to work requests originating from the stations or cell modules.

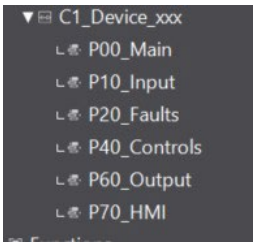

Figure 3: Device Program Subroutines

3.4. Station Module

A station module functions as the program overseeing task execution at a specific station. The cycle of a station operates autonomously, distinct from the cycles of other stations within the system. These station modules govern the determination of whether a task is necessary for a product and subsequently update the product's status during task execution. To accomplish the designated tasks, a station can use any number of available devices. Conversely, a device can be under the control of multiple stations.

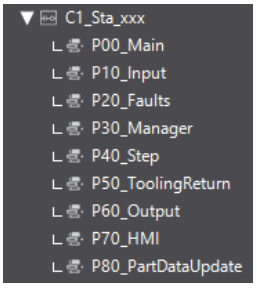

Figure 4: Station Program Subroutines

4. Conclusion

The Sysmac modular solution, showcases the remarkable flexibility and user-friendliness inherent in the Sysmac platform. By seamlessly integrating hardware and software components, Sysmac empowers users to create, simulate, and optimize systems before physical implementation.

The Sysmac environment offers a 3D simulation platform that helps users identify design issues early, ensuring a smoother development process. Its primary goal is to simplify and streamline the integration of components from various suppliers while leveraging OMRON's diverse offerings. This application note highlights customization capabilities, modularity, and ease of implementation inherent in the Sysmac modular solution.

Key functionalities include robust safety features managed by OMRON's safety CPU, which defines safety zones and monitors real-time conditions. The system's adaptability is evident in its various configurations, supporting tasks such as pick and place operations, dispensing, screw driving, and advanced vision inspection.

The architectural framework of the Sysmac environment is inherently modular, using cells, stations, and devices as modular building blocks provides the flexibility needed to adapt to different requirements. Whether it's overseeing the safety of the entire system, managing specific devices, or executing tasks at individual stations, the modular structure facilitates efficient development and customization.