

AML application examples

Roll forming machine, Winding machine, Servo motor injection machine

Development of AML (object oriented SERCOS interface language) for several application is reported

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1. Background of AML development

- 1, The time required for development was to be kept as short as possible, using a simple control language.**
- 2, The international standard SERCOS interface would be used for the motion bus. AML can be used without knowing protocol of SERCOSⁱ communication system.**
- 3, An object-oriented command system would be used.**
- 4, Synchronizing operations would be controlled by position rather than by velocity, requiring a language capable of defining the rotary coordinate system.**

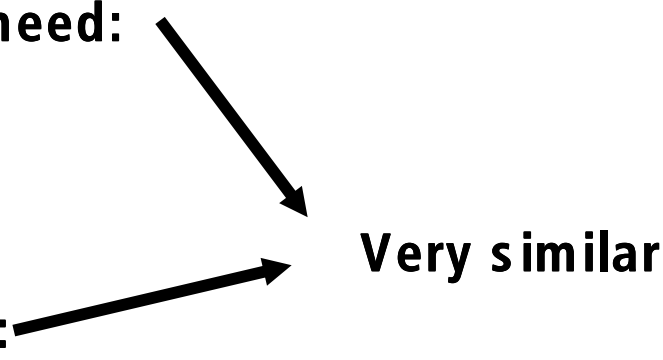
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1. Background of AML development

- 5, Interpolation would be done by software rather than by hardware (motion cards).
- 6, An external sequencer would not be used. Software PLC would be used.
- 7, For error correction, the recipe method used by the metal forming machine controller (software correction) was preferred to the overriding method (hardware correction) used by the cutting machine controller.

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1. Background of AML development

- **Cutting machine need:**
 - Override method
 - Easy to make the program
 - **Packaging machine need:**
 - Recipe method
 - Synchronizing
 - Electronic cam
 - **Plastic forming need:**
 - Recipe method
 - Synchronizing
 - Data base
- Very similar**
- 
- Two black arrows originate from the text 'Packaging machine need:' and 'Plastic forming need:'. One arrow points from 'Packaging machine need:' to the text 'Very similar'. The other arrow points from 'Plastic forming need:' to the same text 'Very similar'.

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2. AML is best solution for many application

- **Because**
 - **Object oriented**
 - **Full software motion**
 - **Recipe method**
 - **Electronic gear**
 - **Electronic cam**
 - **Vertual axis**
 - **Synchronized by SERCOS interface**
 - **SRX(SERCOSⁱ Runtime eXecutive)**

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3. Requirements for roll forming machines

- **Control of the rotation speed and approach speed**
 - Traditional dual rolling machine are controlled by PLC
- **Control by PLC**
 - Parameters can not be changed while in process
 - Short service life of the dice
 - Long tact time

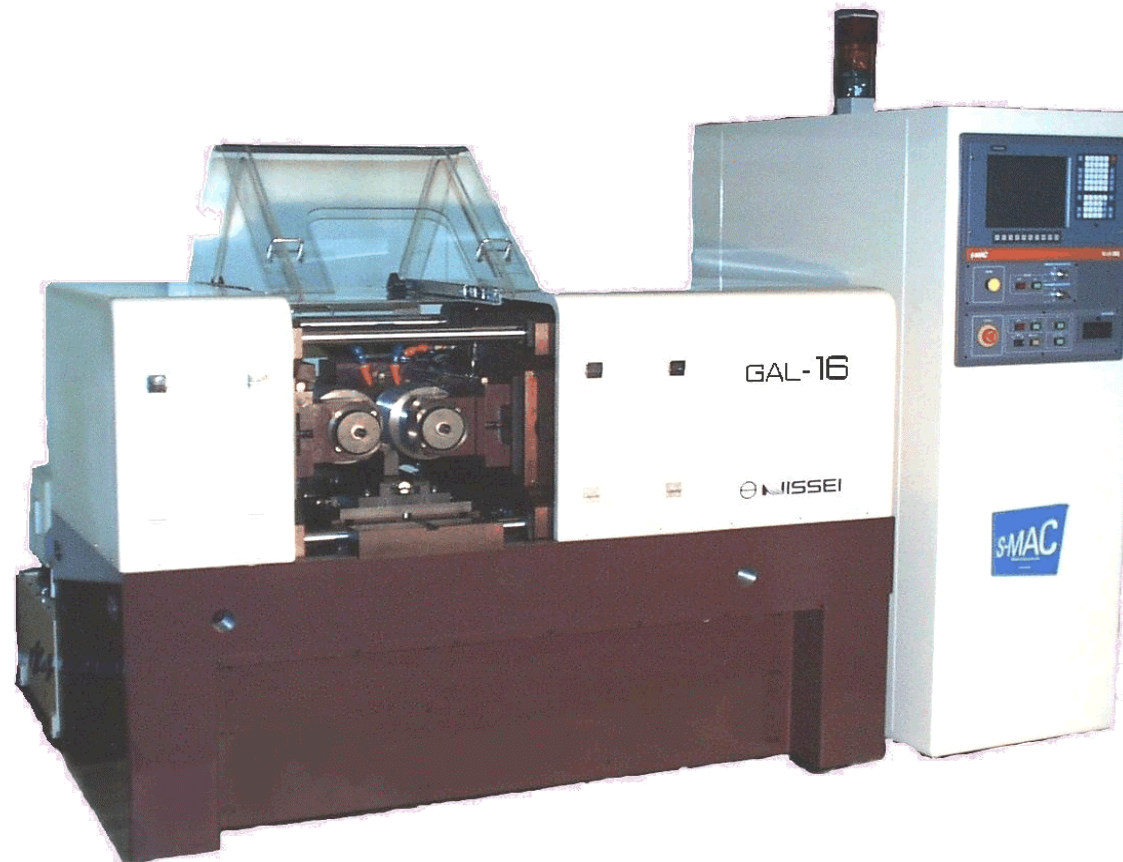
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3. Requirements for roll forming machines

- **Control by AML**
 - **Parameters can be changed while in process**
 - **Long service life of the dice**
 - **Short tact time**
 - **Enable products of hitherto-unmachinable shapes**

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4. Roll forming machine - Overview of machine



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- 4.1 Introduction

- Sanyo Denki's "S-MAC " Type C does not use a motion control card. It is a full-software controller based on the combination of a controller with an object-oriented motion control language AML.
- This presentation outlines a typical application of an "S-MAC " Type C as a controller for rolling machine with round dice.
- The rolling machine with round die is used for plastic forming without producing chips.

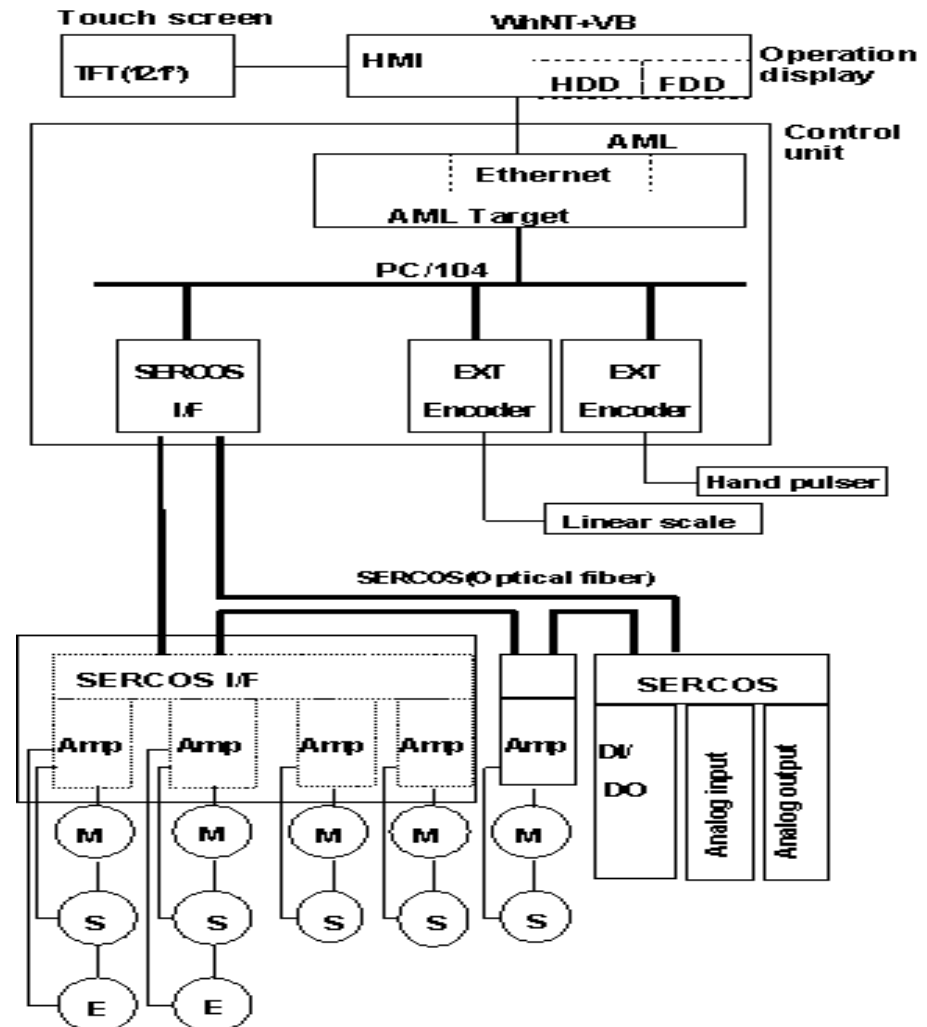
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- 4.2 Hardware configuration

The component called AML target is the controller for the control unit. It is a PC-based controller and incorporates a SERCOS interface board (which interfaces with the servo amplifier and I/O) and an encoder interface (designed to enter encoder signals). In this system a four-axis servo amplifier is used for the main axis (die rotation) and up-and-down inclining axes of main axis. It consists of four-axis worth of servo controls and a power supply integrated for each of them, and it achieves high cost performance per axis. The system can accommodate another single-axis amplifier as an option.

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Motion-card-less, full-software controller. It is based on a PC-based controller compatible with a general PC. The controller, amplifier, and I/O are connected by a SERCOS interface based on an optical fiber. The CPU in the control unit controls the motion and I/O, while the operation display connected via the Ethernet.



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- S E R V O Driver (Multi-Axis Driver)



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PC based controller (industrial PC)



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4.3 Software configuration

The control unit uses AML to perform both motion and DI/DO control.

- **AML is a motion control language that runs on a real-time operating system. It is particularly versatile in electronic gear, electronic cam and other synchronizing control.**
- **The control method used is that of synchronizing control, which synchronizes the right and left dice and synchronizes the approach positions of the dice and other factors.**

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4.3 Software configuration

1. Normal operation mode

The first operation pattern is based on PTP operation. Some points during rolling are specified to determine an operation pattern. This mode is used for general rolling.

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4.3 Software configuration

2. Operation mode of the recipe method

The other operation pattern is a recipe method based on map data. Map data is a database of points specified at specific intervals. The data points can be used to specify a desired operation pattern.

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4.3 Software configuration

3. I/O control

DI/DO performs control according to events stemming from changes in input and other factors. It is called event-driven control.

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4.3 Software configuration

4 Maintenance tool and other tools

The control language AML has various development tools. These are a Configuration Tool (which can easily set the servo motor), a Log Viewer (which records errors, alarms and other information that occurs while on the fly), and SERCOSCOPE (which monitors the operation of the servo motor). This language is therefore useful in developing and analyzing systems.

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5. Summary

Compared with work cutting, which has been developing in linkage with CAD data, the computerization of plastic forming still has much potential. The "S-MAC" Type C is another controller with much potential: i.e. for networking and an open architecture. The authors are confident that the combination of plastic forming, networking, and an open architecture will open up new applications. The authors are optimistic that this system will be of help in such developments.

AML needs further provisions for additional functions such as high speed and high precision circular interpolation for controlling laser cutting machines and a high speed coordinate conversion function required for a multiple joint robot controller.

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5. Summary

However, we are ready to provide sufficient solutions to cover needs that could not be fulfilled by the existing programming languages such as G code or Ladder diagram with the basic functions of our current system. We are committed to further promote the open structuring of AML in coordination with our customers together with the development of multi-platform systems for a target system to make AML the de facto standard in this sector of the industry (packaging, thread rolling and wire winding machines, etc.).