Features of New Industrial Robot "SD and SQ" Series

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1. Introduction

Robot controller mounted on the sequencer base!

Mitsubishi Electric's technologies and product series created this innovative approach.

This article introduces the SQ and SD series, new models among Mitsubishi Electric's industrial robot products.

2. SQ/SD Series

In spring 2006, Mitsubishi Electric announced a new concept of "Integrated Platform," which promotes coordination and optimization on the production floor. The SQ series are designed based on this concept.

2.1 Features of SQ series

2.1.1 Lower system cost

In contrast to conventional robots, which are connected to a sequencer at the I/O level, the Integrated Platform has a robot controller mounted on a sequencer, and thus eliminates the need for an I/O unit and reduces the system cost (Fig. 1).

2.1.2 High-speed communications with sequencer

Using the multi-CPU high-speed transmission function of the Integrated Platform, the time taken to transmit data between a sequencer CPU and robot is almost halved. This feature is most effective when frequent communications with the sequencer are programmed, and the higher the proportion of communications in the program, the shorter the cycle time.

2.1.3 Improved control performance

A high-speed CPU improves the control performance to about twice the conventional level. This feature is particularly effective for programs that include many complicated numerical operations and positional data calculations. Combined with the high-speed communications capability, the cycle time is about 10% shorter in some cases. (Fig. 2)

2.1.4 Wealth of extended functions

Unification with the sequencer brings a wealth of extended functions, allowing flexible support for the various requirements of manufacturing facilities. In addition, the SQ series can be easily connected with Mitsubishi's Factory Automation (FA) products including GOT and general-purpose servo amplifiers, allowing total solutions for manufacturing facilities to be easily created.

The SQ series offer the features of FA products, while the SD series offer robotic features such as real-time operability and various interfaces. Both the SD series and SQ series have a dedicated architecture for the Integrated Platform.

2.2 Features of SD Series

2.2.1 Improved control performance

The chassis design for effective heat dissipation allows a faster CPU speed, thus improving the control performance to about three times the conventional level. This feature is particularly effective for programs that

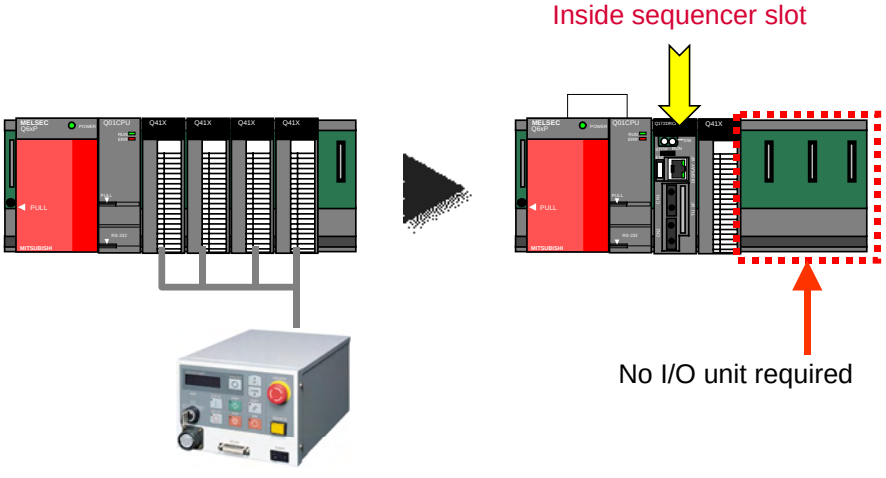

Fig. 1 System cost reduction

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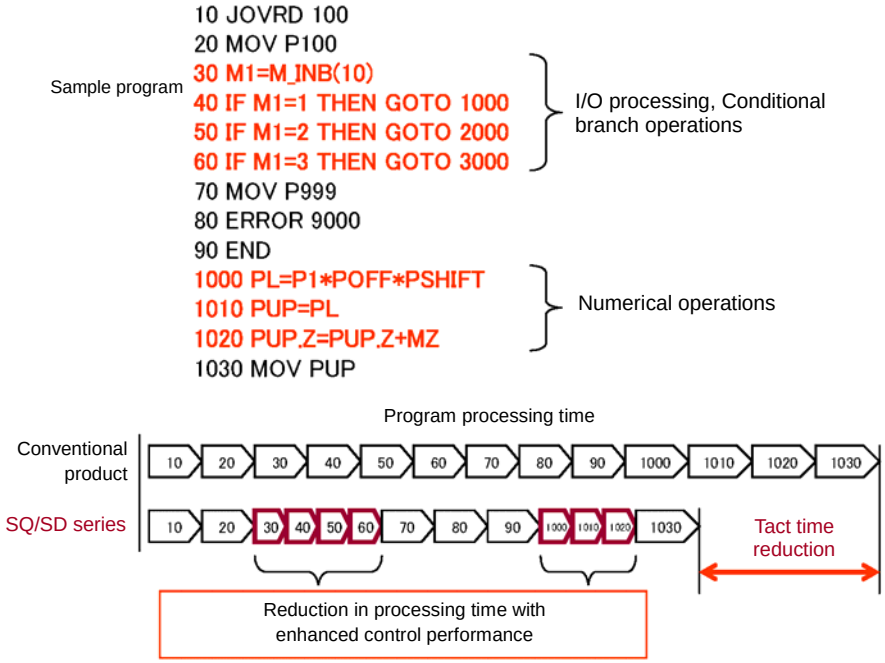

Fig. 2 Pattern diagram of processing time reduction

include many numerical operations and positional data calculations. The cycle time is about 16% shorter in some cases. (Fig. 2)

2.2.2 Enhanced communication capability

Ethernet, an option with conventional models, is now provided as standard. To reduce communication load, a specialized communication module was developed. Communication tasks are processed by this specialized module, and the architecture dedicated to the Integrated Platform (called the "main controller" hereafter) performs pseudo-communications with the specialized module in the background, resulting in better communication capability without increasing the load on the main controller.

3. Improved Robot Functionality

The new products are designed to maximize robot functionality by offering three operation modes. (Figs. 3–5)

(1) Normal mode

Factory setting acceleration/deceleration patterns are the same as conventional products[1]. The new products have a much shorter current-control period, which enables more precise current control and reduces the effective motor current, i.e. lower motor load rate. In other words, by introducing a new robot into existing manufacturing facilities equipped with a conventional robot, more jobs can be done and productivity can be improved. (Figs. 4 and 5)

(2) High-speed positioning mode

Positioning accuracy is improved and motor acceleration/deceleration time is reduced. Motor control gain is optimized in real time. In addition, a new scheme of generating operation commands enables maximum motor torque to be used and boosts high-speed operation. Note that the motor load rate is higher than the normal mode due to greater effective current. (Figs. 4 and 5)

(3) High-precision tracing mode

The tracing accuracy of the tip of the robot arm is given top priority. This mode has the maximum motor control gain among the three modes, so tracking to the command value is enhanced. Furthermore, the command values are filtered to prevent the risk of overshoot, resulting in good tracking and tracing accuracy without overshooting. Note that the cycle time is longer due to the filtering of command values. (Fig. 5)

4. Greater Safety

Mitsubishi Electric has been improving safety ahead of the competition. In particular, all Mitsubishi products in the market, regardless of shipping destination, satisfy the requirements of safety category 3. The SQ/SD series comply with the latest Class-C standards for robots, ISO-10218. These standards cover not only the safety of the robot itself, but the total safety of the customers' facilities. Compliance with these standards will raise the safety of customers' facilities and increase the total added value of facilities.

*1 "Conventional products" refer to Mitsubishi Electric's S series products, whose followers are SQ/SD series. As described above, the two series are categorized by the controller to be connected.

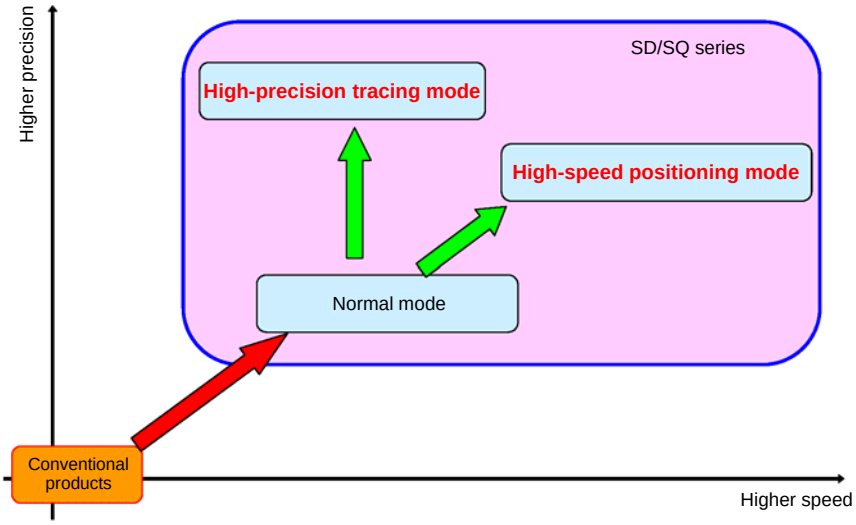

Fig. 3 Improved functionality of SQ/SD series - Pattern diagram 1

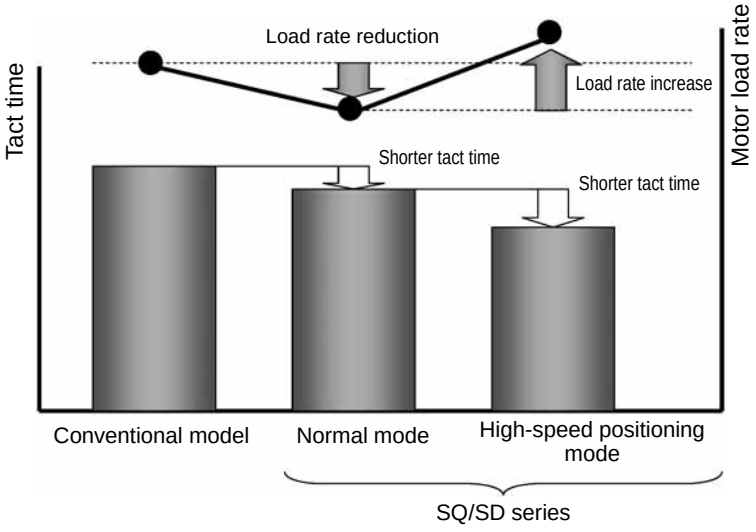

Fig. 4 Improved functionality of SQ/SD series - Pattern diagram 2

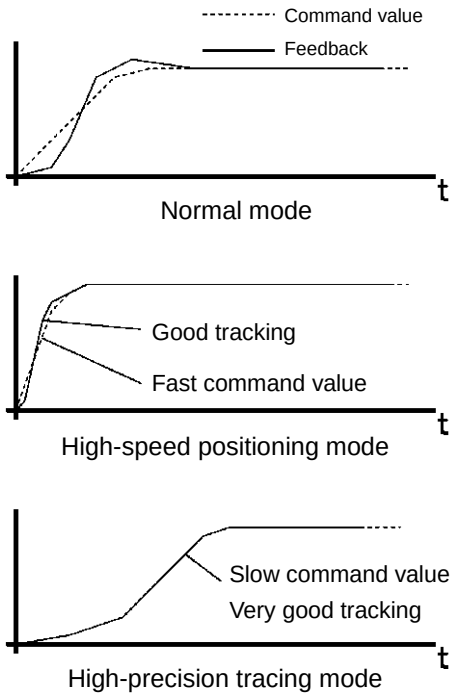

Fig. 5 Improved functionality of SQ/SD series - Pattern diagram 3

5. Conclusion

The SQ/SD series introduced in this article, with their significantly improved performance, will form the core of Mitsubishi's robot business, and lead the market with their characteristic two controller types. To use the full potential of the devices' high performance, we will develop humanized robotic items including various sensor interfaces with the external world, multiple arm control, and intelligent hands.