Wire EDM MV Series with M800 Controller

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As a new product line in the MV series of wire electrical discharge machines, we have developed the MV D-CUBES series, which has a new control system using IoT technology and supports a wide range of applications including high-precision die machining and component machining. We have also introduced IQ Care Remote4U, a remote service option that supports productivity improvement.

1. Introduction

Since its release in 2012, the MV wire electrical discharge machine series has accounted for about 90% of the total global sales of wire electrical discharge machines. The cumulative number of MV units sold worldwide has exceeded 5,000. The series has been popular not only in Japan but also in overseas markets. However, customers' needs have changed over time. Higher performance of electronic devices, automobile components, and mobile devices requires that dies and components manufactured and machined for these products be of higher precision, low cost, delivered more quickly, and provide other improvements to make the products more competitive in the global market.

To meet these needs, we have developed the new D-CUBES control system by optimizing our M800W computerized numerical controller for use in electrical discharge machining, to be integrated with the MV series (Fig. 1). D-CUBES delivers excellent operability and functionality that improves productivity thanks to a navigation function, real-time detection function for remaining wire electrodes, etc.

Another of our initiatives was to apply e-F@ctory, our solutions program since 2003 for optimizing production operations, to the field of electrical discharge machining using IoT. In order to launch the e-F@ctory service for electrical discharge machining, we introduced the iQ Care Remote4U service with two features: the Dashboard function to monitor the status of machine operation and maintenance in real time from a PC or smartphone; and the Remote Diagnosis function to remotely operate the machine and check its status on the screen, thereby reducing machine downtime.

This article describes the features of the new D-CUBES control system and the iQ Care Remote4U remote service.

2. Features of New Control System

2.1 Productivity improvement by enhancing the operability

The new control system was developed to help customers improve their productivity by manufacturing

Model name	MV1200S/MV1200R	MV2400S/MV2400R
Movement amount along axes (X×Y×Z) [mm]	400×300×200	600×400×310
Movement amount along axes (U×V) [mm]	±60 × ±60	±75 × ±75
Maximum dimensions of workpiece [mm]	810×700×215	1050×820×305
Applicable wire electrode diameter [mm]	φ0.1–0.3	φ0.1–0.3
Applicable machining fluid	Water	Water
Installation dimensions (width × depth) [mm]	2025×2760	2687×3030

Fig. 1 MV Series

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quality products more quickly and at lower cost. The key development targets were simplified operation, human error reduction, and connectivity.

Regarding the connection target, data communication with the Dashboard and the Remote Diagnosis of iQ Care Remote4U have been achieved as described later. In addition, the Dashboard can be directly viewed on the new control system.

2.2 Simplified operation and human error reduction

The new control system has a screen that is 15 to 19 inches wider than the screens of existing models, with a touch panel that allows users to operate the system in the same manner as a smartphone or tablet. The increased screen size makes it possible to add the HOME screen on which users can view the machining progress, machining stability, and status of consumables at a glance. Also, a newly developed function allows the user to call up other functions from the HOME screen with one touch (Fig. 2).

Electrical discharge machines involve many manual operations including those that require sophisticated skills. It takes time to train the operators and human errors are likely to occur, resulting in poor machining quality. To solve these problems, a new operation navigation function has been developed to clarify the operation procedures and prevent the omission of a procedure. Along with this, the screen switchover, determination of inputs, etc. of previous models were modified for each procedure. The number of screen operations was reduced by approx. 40% from that of the

previous models, raising work efficiency (Fig. 3).

In addition, an operation procedure function using a procedure checklist has been provided to reduce human errors such as poor machining quality caused by operators who omit a procedure. (Conventionally, each customer creates and uses their own procedure checklist.) In the case of a procedure that is unchecked on the list, the safety interlock will be activated to stop the machining before the next procedure to prevent the omission of a procedure.

The Manual Operation Box frequently used in the setup work has been renewed as well. A liquid crystal display is used, and a function has been added to override the Z-axis soft limit for preventing interference

The screen can be opened from each panel with one touch.

Fig. 2 HOME screen
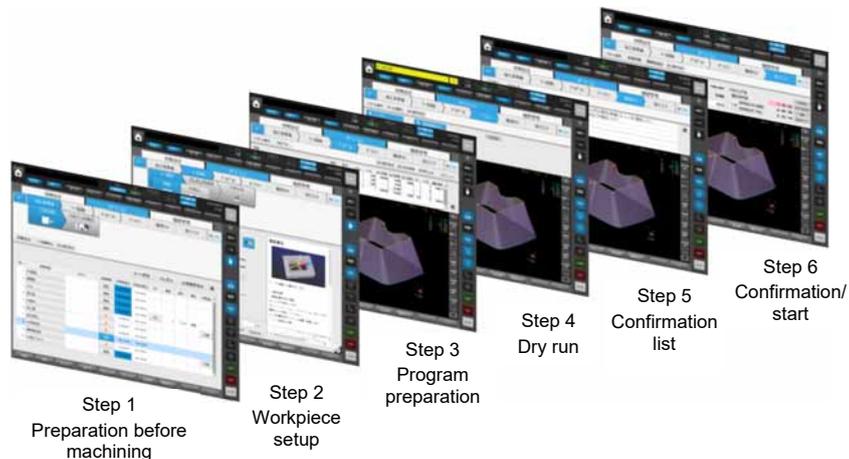
Following the menu items in sequence from the left guides the operator through the machining process.

Fig. 3 Navigation function

with the workpiece or a jig and to override the axis moving speed during a dry run. This has improved the work efficiency.

3. Features of the iQ Care Remote4U Remote Service

3.1 Dashboard function

The Dashboard function allows customers to check machine operation information, estimated machining time, power consumption, replacement time for consumables, etc. at any time from a PC, smartphone or tablet. Operators can reduce the time it takes to stop a machine by being notified of the completion of work, alarm information, remaining wire electrode information, etc. by e-mail. Managers can collect information on the operation rate and cost for each machine on the IoT platform and retain the data under integrated control for analysis. Analysis results of the data can be used for improving the production process and reducing the running costs (Fig. 4).

In addition to obtaining operation information on the electrical discharge machines, the ability to visualize the operating status allows customers to identify time-consuming tasks in the setup work including setting the flatness and parallelism and determining the reference positions for workpieces. This in turn allows the customers to eliminate time-consuming factors in skills improvement training for operators and in manufacturing the setup jigs, thus improving the operation ratio (Fig. 5). If multiple machines are controlled by an operator, there may be one or more machines left idle. When a machine in a lengthy idle state is detected on the Dashboard, the standby power of the machine can be minimized using the power saving mode, thereby reducing the power cost.

3.2 Remote Diagnosis function

The Remote Diagnosis function directly connects a terminal installed at our service center to an electrical discharge machine at the customer's site through a virtual private network (VPN), and remotely checks the machine status. Checking alarm details and machining conditions from the service center and sharing information on the electrical discharge machine on the screen with the production site allows a quick diagnosis to minimize the machine downtime, and makes it possible to give the customer advice on ways to improve operation based on the obtained machining data, as well as improve their operation ratio and productivity. For information security, in addition to safety by encryption, there is a Remote Diagnosis switch on the machine side to prevent connection to the machine without permission from the customer.

Conclusion

This article described the features of the new D-CUBES control system and the recently launched iQ Care Remote4U remote service. We will continue helping customers to improve productivity by developing products that meet their needs.

Fig. 4 Dashboard
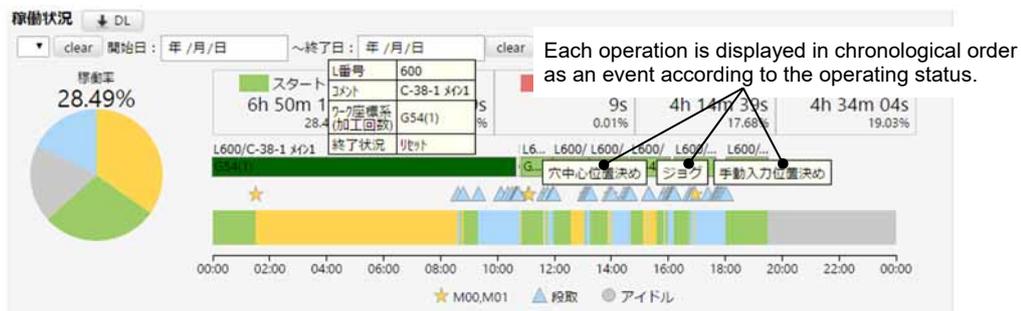
Visualization of operating status

Automatic mode to perform automatic operation and manual mode to perform setup work.

Information provided by the input of axis movement commands from the manual operation box and by screen operation including positioning menu, etc. are used by the control system to automatically determine the operating status of the operator, and to output the operating status.

Fig. 5 Visualization of operating status

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