

# Compact, portable, simple-type multi-layer welding robot ISHIMATSU

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## 1. Background of the Development

Welding technology plays a key role in manufacturing, but welding is a typical 3D (dirty, dangerous, and demanding) job and is performed in harsh working environments (intense arc light, radiant heat from burned iron plates, and spreading metal fumes). While a need exists for high welding quality that satisfies design specifications, and high levels of skills are required to achieve it, it is difficult to secure experienced, skilled workers today, and young people tend to avoid the job. To improve such situation of welding work sites, we have developed this welding robot based on the following concepts:

- (1) A compact, lightweight, portable device that can be used for general purposes
- (2) An automatic welding system that can be easily operated by even unskilled workers and provides high-quality welds
- (3) Reasonable prices for small businesses



Figure 1. Compact, portable, simple-type multi-layer welding robot

## 2. Features of the Welding Robot

This product consists of a main body of the robot, which has a three-axis straight drive shaft and a rotating shaft; a traveling rail; a controller for setting welding conditions and managing programs; and an operation box. It has the following features:

- (1) The main body of the robot is compact and lightweight (6 kg) and can be carried by hand.
- (2) Welding conditions (e.g., welding heat input, and number of layers) are automatically

computed and generated from the shape data of the area to be welded that have been automatically measured by a touch sensor.

(3) From its start of operation, welding is carried out and completed without operator intervention.

Item (2) is the particularly noteworthy function. The actual shapes of the areas to be welded vary depending on the cutting and/or assembly precision of the members, even based on the same design instructions, due to errors that occur for each time. Therefore, welding conditions that are appropriate for the shape of the area to be welded must be identified for each welding operation. Such conditions have conventionally been determined by skilled workers, relying on their experience and intuition as implicit knowledge. However, this function allows for automatic calculation of the appropriate quantity of heat input, location, and number of layers that are required to achieve the welds in accordance with design instructions, thereby enabling unskilled workers to easily perform welding.

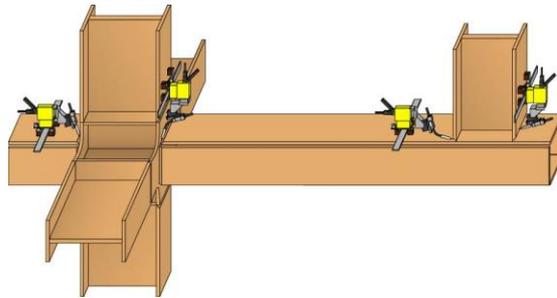


Figure 2. Example of application to a steel-framed structure

As shown in Figure 2, this product can be carried to intended locations by hand and used for various areas to be welded. Installation of the rail requires no extremely careful attention even if the temporary assembly has misalignment or errors to some degree.

At the initial stage of the development, this product had an automatic function only for flat-position welding, which is the basic welding operation. However, we gradually added more difficult-to-achieve automatic functions: those for horizontal-position welding, vertical-position welding, and overhead-position welding. As a result, this product is capable of providing high-quality welds, free of welding defects, for thick plates as shown in Figure 3.

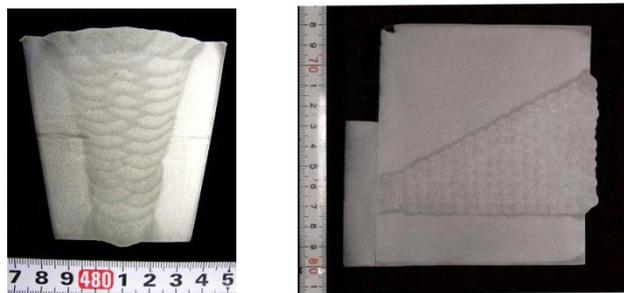


Figure 3. Sections of thick-plate welds

### 3. Actual Applications

This product has been applied mainly to steel frames, bridges, and ships, which are large-sized thick-plate structures, reaching cumulative sales of over 1,000 units to date. Highly portable, and capable of automatic welding through a single touch, this welding robot is used on a multiple-units-per-operator basis to improve work efficiency, as shown in Figure 4. Unlike installed medium- to large-sized welding robot systems, this product requires no space for installation and has been used for general purposes, taking advantage of its portability.



Figure 4. Example of multiple-units-per-operator application

### 4. Conclusion

Although this is a simple product that has been developed by utilizing the basics of mechanical engineering, we will continue to strive to improve its functions so as to satisfy market needs appropriately, thereby supporting manufacturing sites.