

The extended-reach robot

ABB's new IRB 2600
Per Löwgren

The industrial robot has at times been referred to as "the extended arm of man." Robots have extended human abilities by making productivity feasible in hazardous environments, or where levels of repeatability or throughput are required that humans cannot match. However, the "extended arm" additionally has a less metaphorical and more practical meaning. In many situations a robot's usefulness depends on its physical reach. For

example a workpiece need not be turned or repositioned if the robot can simply stretch over to a given point. Alternatively, in some situations one long-reach robot can do the work of two shorter-reach ones.

While the working range of a robot should be large, the space needed for the robot itself should be as small as possible. Ideally a robot should further reduce its space demands by

permitting mounting on shelves, walls or even on the ceiling.

ABB's new IRB 2600 – with its long reach yet compact construction and flexible mounting – fulfills all of these demands. Furthermore, it is the fastest, most accurate and best protected robot for the 12 to 20 kg payload range on the market.



times and simpler integration and is easier to set up, modify, replace and maintain. Most notably it does not compromise reliability when compared to the electromechanical switch solution.

Applications

Typical applications for the IRB 2600 include:

- Machine tending
- Material handling
- Arc welding
- Process applications

Machine tending

An example of a machine tending application is the extraction of plastic moldings from an injection-molding machine. Typically, the robot is mounted on a shelf **6** beside the machine, from where it must reach down below its own base to extract the workpiece. A large working range in the area below the robot's base is thus essential. The IRB 2600 can reach 993 mm below its shelf (1,174 mm in the case of the IRB 2600-12/1.85).

Furthermore, material handling cycles are often a significant factor limiting throughput and hence the productivity of injection-molding lines. The IRB 2600's short cycle times, enabled

by its high acceleration, make it well suited for such work.

Path accuracy means the controller takes the complete load case into account when directing the robot's movements – ABB was the first company to provide such functionality.

Material handling

One area of application at which the IRB 2600 is targeted is the manufacturing of photovoltaic panels. The combined effects of environmental awareness, concerns over carbon dependency, government-backed incentives and the resulting advances in technology and economies of scale are leading to a rapid growth in photovoltaics.⁴⁾ With photovoltaic electricity moving toward price parity (the point at which its production costs equal those of conventional sources) and large photovoltaic arrays being planned in areas with high levels of insolation, the demand for photovoltaic cells will continue to see

elevated growth rates. Among the tendencies in the photovoltaics market is the demand for larger panels. The IRB 2600 is well suited for this as its working range permits it to manufac-

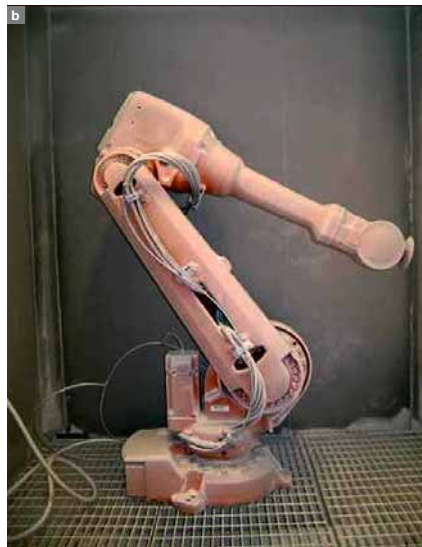
- 5** Cable protection for hostile environments such as foundries



- 6** The IRB 2600 can reach far below its base, making it suited for shelf mounting.



- 4** Meeting the IP67 ingress protection standard. Submerged in water **a** and resisting dust **b**. The robot in **b** is painted orange like the others illustrated in this article, but this is hard to recognize under the dust.



Footnote

⁴⁾ For more information on ABB's activities in the photovoltaics sector, see "From light to power" on pages 22–24 of this edition of *ABB Review*. For a broader look at ABB and solar energy, see also "New power under the sun" on pages 16–21.

Innovation in production

Path accuracy means that:

- The robot can be successfully deployed in applications where accurate paths are required by the process.
- The robot can easily be programmed to follow the path.
- The programmed path is correctly followed, with a very small tolerance and independently of speed.

The user only needs to enter the correct payload and armload data. Path accuracy was invented by ABB and is an illustration of the company's leadership in robotics motion-control technology.

Protection

Protection is an important element of many robot applications. Protection

can be about adequately protecting a robot from the hostile environment in which it is working, for example, moisture, corrosion or abrasive particles. It can also be about protecting the product being manufactured from possible contamination by the robot, for example flaking or droplets. As the IRB 2600 is targeted at a broad palette of applications ranging from extremely hostile environments such as foundries to extremely sensitive areas such as food handling or even electronics manufacturing in clean rooms, the robot comes with a variety of protection options tailored for the specific application.

One important protection aspect fulfilled by all IRB 2600 robots is that

they meet the IP67²⁾ ingress protection classification **4**.

In foundries, molten particles and water-borne release agents can cause degradation of the robot. Measures therefore include a rust-protected mounting flange and protection guards for cables **5** as well as specially resistant paints. Protection options for other environments include resilience to aggressive detergents, high pressures and high temperatures.

Connectivity

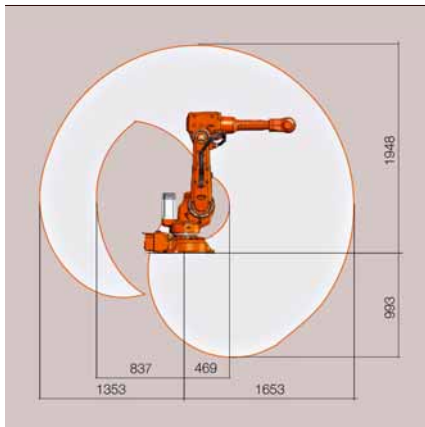
To be able to control complex process equipment, tooling, grippers, etc., the IRB 2600's upper arm integrates connectors for the PROFINET, EtherNet/IP and DeviceNet fieldbus standards. This simplifies cabling and interfaces and so contributes to increased reliability.

One factor setting self-mounted robots apart from strictly floor-mounted ones is the need for the working range to extend down below the robot's base plate.

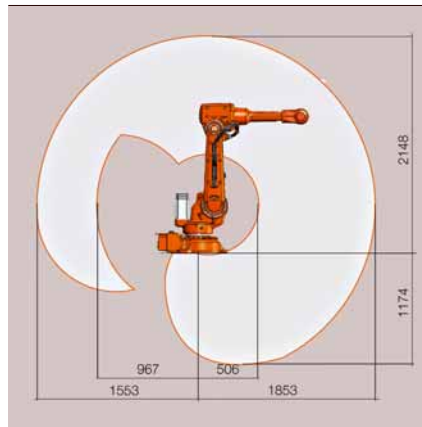
Electronic position switches

Sometimes it is necessary to limit the working range of a robot, for example for safety reasons or to avoid collisions with adjacent robots or other machinery. Usually this is achieved with electromechanical switches preventing axes from being turned beyond a given point. The IRB 2600 no longer requires these as this safety is assured through electronic position tracking and in coordination with ABB's SafeMove functionality³⁾. This means that no physical adjustments need to be made to the robot. The solution leads to faster commissioning

2 Working range of the IRB 2600

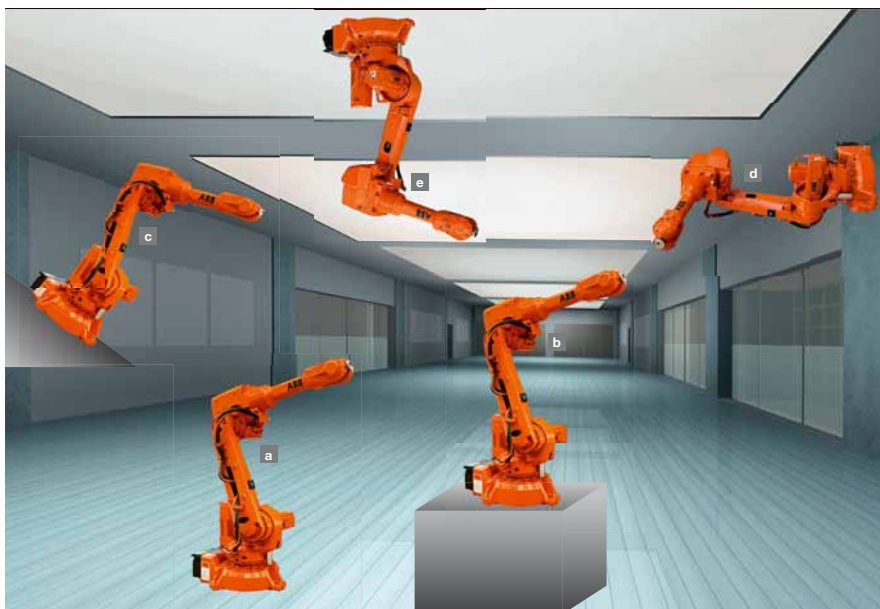


IRB 2600-12/1.65 and IRB 2600-20/1.65



IRB 2600-12/1.85

3 Mounting variants of the IRB 2600: floor **a**, shelf **b**, tilted **c**, wall **d** and inverted **e**



Footnotes

²⁾ The IP classification system expresses ingress protection using two figures. The first describes protection against solid particles and the second against liquids. IP67 states that the device is totally protected against dust (class 6) and that it is protected against the effects of immersion at depths of up to 1 m (class 7).

³⁾ See also "Taming the robot: Better safety without higher fences" in *ABB Review* 4/2006, pages 11–14.

The 20 kg payload range has a long history with ABB: It goes back 35 years to ABB's first-ever robot – the IRB6. The IRB 2600 represents the fourth generation of ABB robots to cover this category **Factbox**.

Features

The IRB 2600 comes in three variants **1**. Besides the basic variant, which has a payload of 12 kg and an arm reach of 1.65 m, the extended variants offer an increased payload of 20 kg or an increased reach of 1.85 m.

Working range and mounting options

One factor setting shelf-mounted robots apart from strictly floor-mounted ones is the need for their working range to extend down below the robot's base plate. The full working range of the IRB 2600 is shown in **2**. Alternative mounting options (eg, floor, tilted and inverted¹⁾) are shown in **3**. The obvious advantage of such mounting options is the freeing up of floor space. Other advantages are that cycle times or working patterns can be improved through the optimization of the robot's placement, or that the installation of several robots at different heights in the same cell permits them to work on the same workpiece simultaneously.

Footnote

¹⁾ Inverted mounting is available as an option.

1 The three variants of the IRB 2600:



The basic version IRB 2600-12/1.65



The IRB 2600-20/1.65 with an increased payload of 20kg (instead of 12)



The IRB 2600-20/1.85 with an increased arm reach of 1.85m (instead of 1.65)



Cycle times

The IRB 2600 offers up to 25 percent shorter cycle times than its immediate predecessor, the IRB 2400, and offers the highest accelerations available on the market. Contributing to this is a weight reduction from 380 to 280 kg

(compared with the IRB 2400) and ABB's advanced motion control technology.

ABB introduced the first version of its path accuracy functionality in 1993.

Innovation in production

ture large panels (6 x 12)⁵⁾. Its suitability for such work is further enhanced by its clean-room compliance (up to ISO 14644-1 class 5⁶⁾) and its compact design, which minimizes floor space.

Further material handling applications can be found in the food and beverage industry, for example packaging bread. In such an application the robot is typically wall mounted.

Arc welding

The high accuracy and repeatability of the IRB 2600's movements combined with its short cycle times are among the factors that make this robot highly suited for arc welding applications.

Process applications

Process applications for which the IRB 2600 is suitable include:

- Water-jet cutting
- Laser cutting
- Routing⁷⁾
- Dispensing⁸⁾
- Material removal

To be able to control complex process equipment, tooling, grippers, etc., the IRB 2600's upper arm integrates connectors for the PROFINET, EtherNet/IP and DeviceNet fieldbus standards.

A truly versatile robot

Through its extended working range yet limited space requirements, the IRB 2600 is a flexible workhorse that can fulfill the demands of many industries. Its limited space requirements are further enhanced by its flexibility in mounting solutions, permitting such variants as shelf, wall, incline or inverse mounting contributing to both space saving and flexibility in deployment. The robot's high acceleration and shortened cycle times means it can furthermore boost the productivity and throughput of many production lines. These advantages are further enhanced by its attractive protection solutions and control and connectivity options. The IRB 2600 is a robot that can truly reach out further to meet the application's needs.

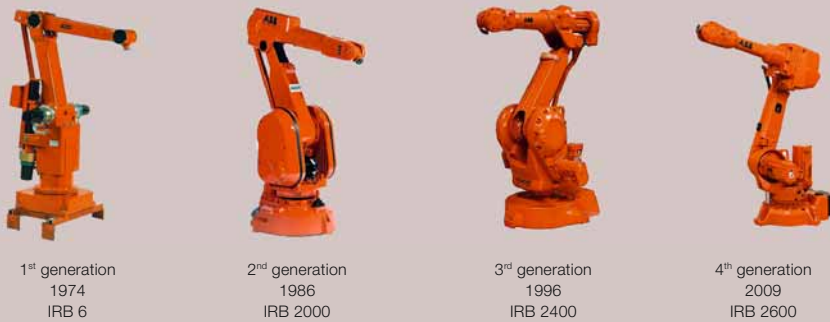
Factbox Four generations of robots

ASEA (one of ABB's predecessor companies) launched its first robot, the IRB6, in 1974. This robot was a milestone in many respects: Not only was it the world's first fully electric industrial robot (earlier types had been hydraulic), but it was also the first microprocessor-controlled robot. In fact it represented the first industrial application of any microprocessor (the processor used was Intel's 8008, a chip that was pivotal in starting the microcomputer revolution and that was a direct predecessor of the later and better-known 8080). A further significant feature of the IRB6 was its anthropomorphic arm configuration. The IRB6 had a

payload capacity of 6 kg and was used in a variety of applications ranging from handling to welding and deburring.

ASEA (from 1988 ABB) continued to offer the IRB6 until 1991, with about 7,000 units being made.

The IRB 2600 is ABB's fourth robot generation in the 6 to 20 kg payload class. Like its ancestor, the IRB 2600 is setting a benchmark: It is the fastest, longest reaching, most accurate and best protected 20 kg-range robot on the market.



For more information on ABB and robotics, please visit www.abb.com/robotics.

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Footnotes

- ⁵⁾ With individual cells typically being 125 x 125 mm, and adding cell spacing, a 6 x 12 panel can have dimensions of 810 x 1580 mm.
- ⁶⁾ ISO class 5 indicates less than 100,000 particles greater than 0.1 µm in 1 m³ of air. For class 6 the figure is 1,000,000 particles.
- ⁷⁾ Routing: cutting plastics with a rotating file
- ⁸⁾ Dispensing: applying material to a surface, eg gluing or sealing