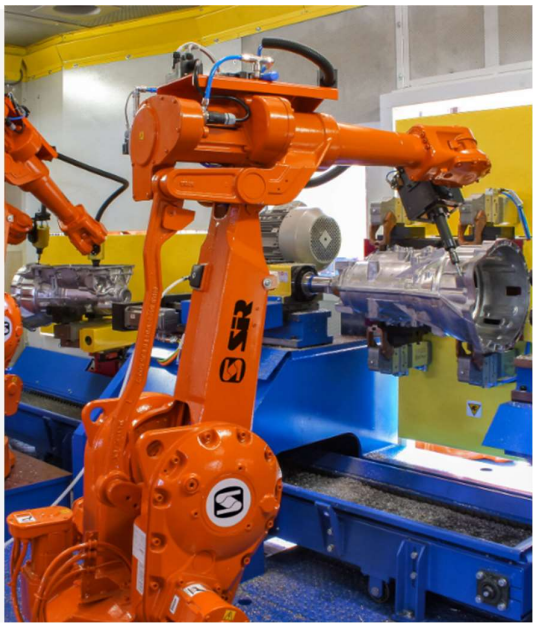
Industrial Robots for Die-Casting Tasks

Product Specifications		
Arm Length	Full length	600 mm
	First arm	325 mm
	Second arm	275 mm
Working Envelope	Axis 1	±140 °
	Axis 2	±152 °
	Axis 3 (Z-axis)	0 ~ 210 mm
	Axis 4 (Z-axial rotation)	±360°
Maximum Speed *1	Axis 1	457 °/sec
	Axis 2	672 °/sec
	Axis 3 (Z-axis)	2,000 mm/sec
	Axis 4 (Z-axial rotation)	2,359 °/ssec
	Composite (Axis 1 and 2 composite)	8.017 mm/sec
Standard Cycle Time *2	(With 2 Kg load)	0.31 sec
Load	Maximum payload mass *1	12 kg
	Allowable moment of inertia *1	0.25 kg·m2 *2
Position Repeatability *3	X-Y	±0.01 mm
	Axis 3 (Z-axis)	±0.01 mm
	Axis 4 (Z-axial rotation)	±0.005 °
Hand control signal		8 inputs and 8 outputs
User wiring		16 lines
Hand neumatic tubes		6x4 tubes
Position Detection		Absolute
Robot Controller Cable		3.5 m
Power Supply		4.3 kVA
Mass		31 kg



How Manufacturers Use Robots for Die-Casting Tasks

Die-casting is a process that has multiple steps and tasks. Interestingly, many can be automated with the right robotic systems. Here's how robots can help in those various applications:

Sprue Picking

One of the most common tasks for die-casting robots is sprue picking. Robots can remove excess material from the casting by cutting or breaking off the sprue.

Once the casting is complete, the robot can use a cutting tool or a gripper to remove the sprue–the excess material that connects the casting to the runner system. The robot can cut or break the sprue in a controlled manner, ensuring the part is not damaged.

Ladling

Ladling is an essential and hazardous task in the die-casting process. Robots can pour molten metal into the die cavity using a ladle or other dispensing system.

The robot can control the speed and flow rate of the metal, ensuring that the cavity is filled uniformly and avoiding defects such as porosity, voids, or cold shuts. Additionally, automating this process limits the risk to human operators.

Die Spraying

The robot can spray the die cavity with a lubricant or a release agent to prevent sticking and improve the surface finish of the casting. In addition, the robot can apply the spray in a consistent and controlled manner, ensuring that the die is coated evenly.

Extracting

After the casting is complete, the robot can remove it from the die cavity using a gripper or a vacuum suction cup. The robot can ensure that the part is extracted without damage, and it can place it in a designated location for further processing or inspection.

Trimming

Trimming the casting using a cutting tool or a grinding wheel is often necessary to remove any excess material, flash, or burrs. The robot can perform the trimming operation with high precision and consistency, ensuring that the part meets the required specifications.

Sorting and Inspection

Robots can sort and inspect castings based on their dimensions, surface finish, and other quality criteria. The robot can use sensors, cameras, or other measurement devices to check the part for defects such as cracks, porosity, or dimensional deviations. Then, it can sort the pieces into different categories based on their quality.

Packaging and Palletizing

After the castings are inspected and sorted, the robot can pack them into boxes or pallets, preparing them for shipping or further processing.

Finally, the robot can stack the boxes or pallets in a designated location, ensuring they are correctly aligned and secured.

The Types of Robots Used for Die-Casting Applications

Manufacturers have some flexibility when choosing the type of robot for their die-casting applications. The most common types of robots used for die-casting tasks include:

- Six-axis robots
- Cartesian robots
- SCARA robots
- Collaborative robots

Six-Axis Robots

Six-axis robots are versatile and can perform complex and precise movements, making them suitable for various tasks in die-casting applications. These robots are typically a more expensive option but offer a good balance of speed, payload capacity, reach, and flexibility.

Cartesian Robots

These robots have three axes of motion and move in a straight line along each axis. **Cartesian robots** are well-suited for tasks that require high-speed, high-thrust, and high-precision movements, such as sprue picking and part extraction.

SCARA Robots

These robots have a vertical axis of motion and can move in a circular motion in the horizontal plane. **SCARA robots** are often used for tasks that require high-speed and precise movements, such as ladling and die spraying.

SCARA robots have a small footprint and are unsuitable for larger applications. However, they are an affordable option when available.

Collaborative Robots

These robots are designed to work alongside human workers and can perform a wide range of tasks, including those related to die-casting applications. Collaborative robots (cobots) are often used for tasks that require dexterity and sensitivity, such as trimming and polishing.

Cobots are suitable for most six-axis robot tasks as they have the same general mechanics and construction. However, cobots will be more limited in size, speed, and payload capacity.

The type of robot used in die-casting applications depends on the specific needs and requirements of the production process, including factors such as speed, precision, and load capacity.

Controller Specifications

	TS5000 Controller - TS5000-EMS (EU), TS5000-MS (Outside EU, non-CE)
Series	THE
Teach Pendant	TP1000, TP5000
Power Supply	Single phase 190-240VAC @ 50/60Hz
Max Power Capacity	4.3kVA
Dimensions	365W x 161H x 350D
Mass	11kg
Storage	512 programs 2.5mil points 2.5mil steps
CE Version	Available Q4:2020
USER I/O Count	8/8
SYSTEM I/O Count	13/9
SYSTEM INPUTS	Alarm reset, strobe, program reset, step reset, cycle reset, output reset, start, external servo on, stop, cycle mode, break, low speed, servo off
SYSTEM OUTPUTS	Servo ready, battery alarm, acknowledge, auto/manual mode, system ready, autorun, alarm, cycle end, low speed on
Fieldbus SLAVE options	Available Q4:2020
Extended I/O Options	Internal module, factory installed. Add 21in/17/Out
Communications	Ethernet (TCP/IP, UDP), SD Card
Standard SCOL Functions	SCOL2, torque control (individual axis), gain control (individual axis), interrupt functions, SPURT function, coordinate calculations, payload command, multi-tasking, AREA output function, NCBOY additional axis control, self-diagnostics, pulse output control, conveyor tracking, vision+conveyor tracking.
Optional SCOL Functions	Tbc.
External Control Standard Functions	HOST Protocol

Metric	Average Improvement	Source
Production Rate	+15% to 40%	Robotic Industries Association (RIA)
Labor Productivity	+20% to 50%	McKinsey & Company
Product Quality	+10% to 30%	International Federation of Robotics (IFR)
Material Waste	-5% to 15%	Boston Consulting Group (BCG)
Downtime	-10% to 30%	Deloitte
Employee Safety	+20% to 50% (Reduced injuries)	Occupational Safety and Health Administration (OSHA)

Year	Initial Investment	Annual Savings (Operations)	Annual Savings (Labor)	Return on Investment (ROI)
Year 1	$1,000,000	$200,000	$300,000	-
Year 2		$250,000	$350,000	10%
Year 3		$300,000	$400,000	35%
Year 4		$350,000	$450,000	70%
Year 5		$400,000	$500,000	120%