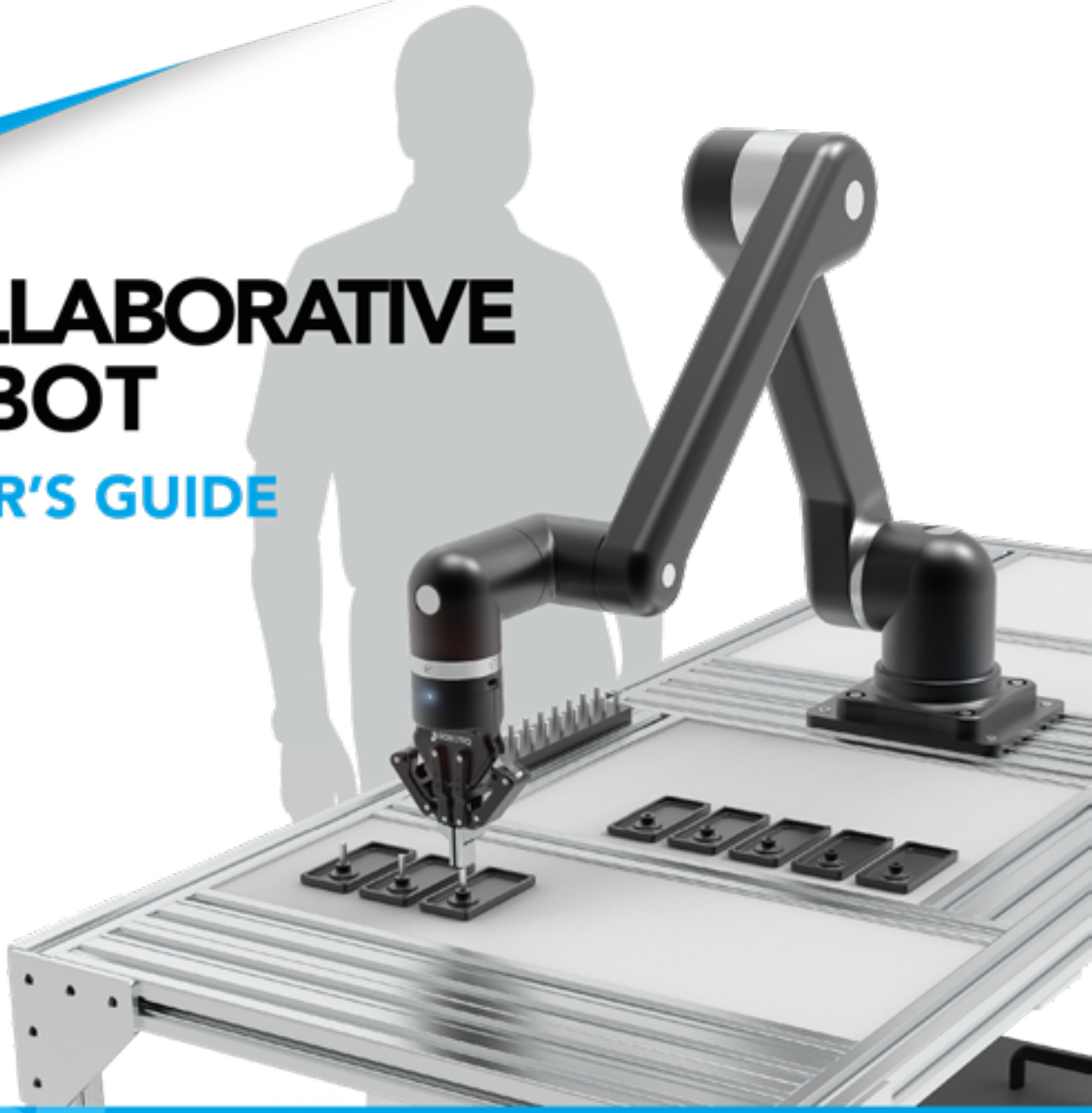
ROBOTIQ

COLLABORATIVE ROBOT

BUYER'S GUIDE



START PRODUCTION FASTER

LEAN ROBOTICS

Version 8.1 January 2020

Introduction

A new kind of robot has made its way into industrial settings, challenging our preconceived notions of robotics. These robots' main feature is the ability to work safely alongside humans, and now it seems human-robot collaboration is the most sought-after characteristic for robots. There's a lot of talk about collaborative robots on the web, but what are they really?

Until now, robots have always been big, strong, robust devices assigned to specific tasks that were designed for them. They've been kept in cages and surrounded by guardrails for safety purposes. Their bright colors warned surrounding workers about the danger they presented. And it took a lot of programming skills just to set up these robots.

Collaborative robots, on the other hand, are designed to work with humans. They're built with safety features such as integrated sensors, passive compliance, and overcurrent detection. The integrated sensors will feel external forces and, if the force is too high, lead the robot to stop its movement. Passive compliance is produced by mechanical components. If an external force acts on a joint, the joint submits to the force. So, in the case of a collision, the joint will move in the opposite direction or stop completely to avoid causing injury.

Most collaborative robots can be easily taught by demonstration, rather than requiring deep programming knowledge. Thanks to their ease of implementation and the fact that no additional safety features are required (like fences or switches), they can be brought on-line much more quickly. Most collaborative robots can also be moved around the factory floor to perform different tasks at other stations. Being more dexterous and flexible, they can perform more tasks and even do whatever a human can do.

In short, collaborative robots are the ideal new coworker. In this eBook, you'll discover all kinds of collaborative robots that are either currently on the market or about to enter it. We've even included a chart comparing their technical features, to help you determine which robot best suits your needs.

Note

Robot manufacturers claim that their robots are safe if they meet the safety requirements for industrial robots stipulated by ISO standard 10218. But even if the robot is safe enough to meet these requirements, that doesn't guarantee that the robot is safe in your particular context. You must consider the operating environment and application—which is why you still need to carry out a complete risk assessment every time.

Start production faster using cobots

When we're talking about introducing a robot in a company, we all face the same problems. Lack of human resources, limited time to implement the solution, limited robotic knowledge, and most important, being able to keep your people working on your product instead of on a robot. Most people give up right there, thinking. "We don't have time to do this." But what if introducing a robot could save you time? In order to save the most time possible you need to get start using cobots in your company to free time in the company.

Design phase

Your team is already hard at work on your product, so you don't necessarily want them to spend much time developing a robotic solution and making sure everything fits together. You want a plug-and-play solution that fits mechanically, electrically and software-wise on your robot. This will greatly simplify the designing part of the process and allow your engineers to get back to their daily routine as soon as possible.

Integrate phase

Once you have received your robot, you have to program it. The person responsible for this step probably has a lot of other tasks and doesn't necessarily have a degree in robotic programming. This is one reason why you want to choose a robot with a simple drag-and-drop interface, software wizard, or corresponding app. Once the program is built, your employee can go back to their normal task.

Operate phase

While the robot is running, you don't have to do much except make sure it's producing good parts. However, you want to make sure it doesn't stand still for long. As soon as the robot stops, someone should be nearby to give it some new parts to work on or debug what just happened. Software that can track these actions and warn you of the state of the robot is crucial to get back to production faster. Check if the robot you're shopping for can fit with such software—it's usually pretty inexpensive compared to what it can save you at the end of the year.

This eBook will give you an idea of which robots will get your production started as fast as possible.

What does "collaborative robot" mean?

Before we get into the details about collaborative robots, let's get up to speed on the different terminology used in the robotics world. It can get confusing (even for us) because people sometimes use certain terms interchangeably, like "force limited robots," "collaborative robots," and "cobots." They may have the same general purpose, but they can be interpreted very differently.

All these terms refer to a robotic device that is made to work in collaboration with humans. Or, more specifically, a robot that helps a human worker execute tasks that are too hard on his or her body, such as lifting heavy weights or doing repetitive movements. The number of applications that can be done by robotic coworkers is virtually unlimited.

Collaborative robots

The term "collaborative robot" is often a misnomer. In fact, although a collaborative robot is designed to work alongside humans, the device itself is not necessarily force limited. This means that the robotic cell is monitored, is safe for human coworkers, and relies on at least one of the four collaborative modes. The term "collaborative robot" is unique in that it describes the fact that humans and robots work with each other, not whether the robots are force limited.

You can see an example of a collaborative robot in this video. These kinds of cells are monitored by lasers, vision systems, or other sensors that reduce or eliminate the need for fencing systems so humans can work right beside the robots.

Force-limited robots

A force-limited robot uses one of the four types of collaboration that can be accomplished with robots. In fact, a force limited robot is a robot that's specially designed to work alongside humans. They have built-in force torque sensors that detect impacts and abnormal forces. The sensors stop the robot when overloaded.

This means that if the robot's arm hits something (...like a human worker), it automatically stops to protect the person. These features aren't present on industrial robots, and they're the reason why force-limited robots can work alongside humans without any fencing. Regular industrial robots must be isolated because they neither feel nor monitor their environment.

Force limited robots also tend to have rounder shapes than regular industrial robots. This means they cause less harm when they collide with something else. A round shape spreads the force over a bigger surface area and reduces the pressure applied to an external object (or person). Some force limited robots even have cushioned shells that absorb shock and reduce the effect of deceleration on a human body part, which results in less harmful impact.

Cobots

"Cobot" is a slang term used to describe a collaborative robot. Once again, the term "cobot" is mostly used when talking about force limited robots. So you can basically say that a force-limited robot is a cobot.

While an industrial robot can be used for collaborative tasks, it's usually not force limited, and these types of robots tend to need supplementary monitoring devices in order to safely execute tasks alongside humans. The misnomer is so widespread that even we sometimes confuse them in our publications! (But not this one, of course.)

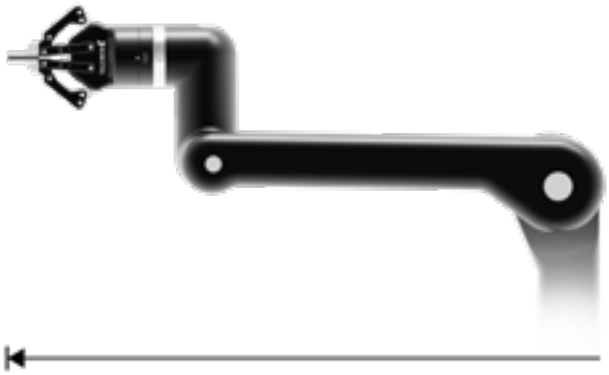
Specifications

In the rest of this eBook, we'll be listing the main specifications of numerous robots. You can find a complete description of the robots on their respective websites, but in this document, just the essential specs are used. You'll find our definitions of these specifications below.

Payload

Payload is the weight that the robot can carry. All robots have a given payload, which is calculated without the weight of the end effector or robot tool. This means that the real payload that can be carried by the robot is the nominal payload minus the weight of the robot's end effector.

Remember, you'll always want to stick to a weight that's less than the nominal maximum payload. How much less depends on other factors, like acceleration and the friction coefficient.



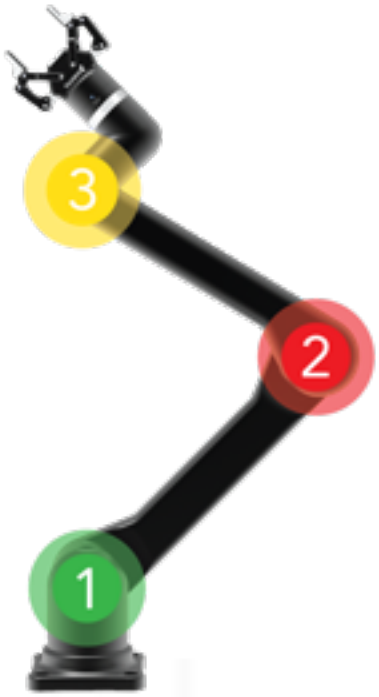
Reach

The robot's reach is the distance that can be reached by the robot's wrist. This measurement is taken from the robot's base.

Many different measurements can be considered in terms of "reach," but in this eBook, we'll be using "the greatest distance robot's wrist can reach" as our reference.

Maximum Speed

The maximum speed is the highest speed at which the robot's end effector can move. This varies depending on the robot's performance specs and size. Be careful, however, because even collaborative robots can go very fast and become unsafe in certain situations. Lots of robots feature a "collaborative mode" where the speed is limited to 250 mm/s, but their actual maximum speed is often much higher.



Degrees of Freedom

Degrees of freedom are the number of axes around which the robot can move. A robot with many degrees of freedom can do a lot of different motions.

Most robots have six degrees of freedom, one for each of the three main axes (X, Y, and Z) and the rotation around them. If a robot has more than six degrees of freedom this indicates that it can achieve a position with two different configurations. In other words, the greater the more degrees of freedom, the greater the possibilities.

Repeatability

People often want to know about the accuracy or precision of a robot —even though in the cobot world, this specification is useless. What you should be asking about is repeatability.

Since cobots are usually programmed by teaching/hand guiding, the robot's ability to recreate the exact same motion is much more valuable than the robot's ability to go to X, Y, Z within half a millimeter. Good news: most robots' spec sheets list their highest repeatability, so if you test the robot you will probably obtain a lower (and hence better) repeatability metric than the one specified.

Price

Price is often one of the first things people look at when searching for the right robot. Some robots are low-priced with limited features, whereas others are costly and come with all sorts of gadgets. Since the price varies depending on where you buy the robot and what other services you get from the seller, we've grouped them in three categories: **inexpensive ($), moderate ($$), and expensive ($$$).**

Weight

The weight is simply the weight of the robot itself, without its controller. Depending on where the robot is to be installed, this could be a factor in your choice of robot.

Mounting Method

While most robots will be mounted on some sort of table or planted on the floor, some people mount their robots on a wall or even the ceiling.

Power Consumption

Power consumption is the average power the robot will use when working. This can help give you an idea of how much it will cost to actually run the robot.

Temperature

This is the maximum temperature of the room where a robot can operate.

Communication

Robots often have many ways to communicate with other components of a robotic cell. Most robots have at least an ethernet-based communication protocol available, such as Ethernet/IP, Modbus TCP, or Profinet. Some robots also have serial communication available for communicating with certain tools. One of the most popular modes of communication is Modbus RTU, which many cobot tool models use to receive commands from and send data to the robot.

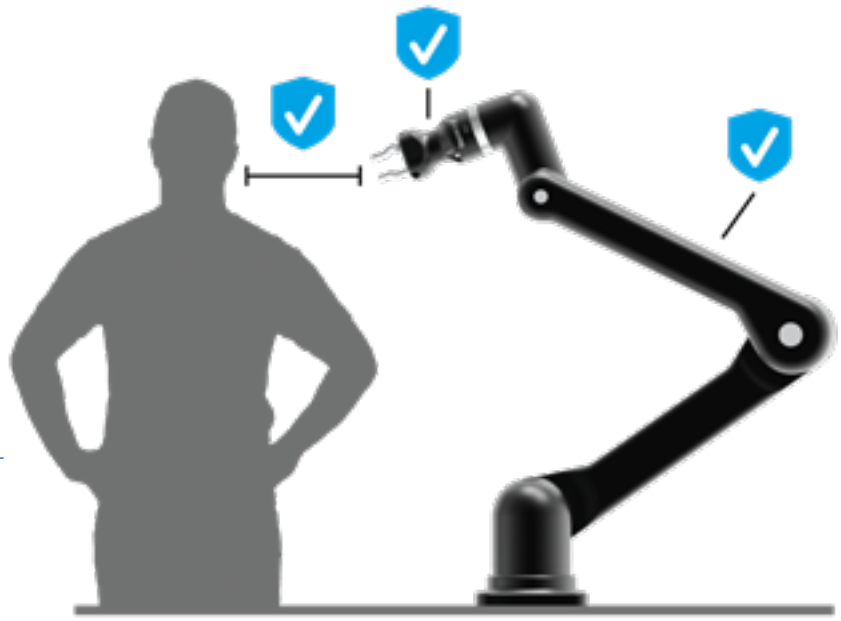
IP Rating

The IP rating tells you how well the robot holds up against dust and liquids. An IP rating consists of two numbers, which respectively indicate the robot's solid particle protection and liquid ingress protection. Depending on your application, you might need a robot with a certain minimum IP rating. Remember to also verify the IP rating of your tools if that's the case.

Certifications

Safety is an incredibly complex subject when it comes to collaborative robots. Third-party certifications let manufacturers talk about their robots' safety level in a way that's easier for customers to understand. Many manufacturers seek to have their robots approved by the **TUV** (Technischer Überwachungsverein, or Technical Inspection Association), which is the agency with the most stringent approval process.

However, there are so many different variables in the "safety" accreditation of a robot that the only thing you need to know is this: Just because your robot is certified safe, doesn't mean your application is. You must always perform a complete risk assessment according to the **ISO/TS 15066**.



Lean Robotics Criteria

Following the Lean Robotics methodology, each collaborative robot has been ranked according to objective criteria. In fact, the three different phases of Lean Robotics allow us to rate the robots more precisely. Each robot is scored according to its performance in each phase. Here's how the different phases are defined.

DESIGN

The design phase is where you map the manual process of the cell you want to automate and translate this manual task into a robotic task. In other words, this is where you make you observe what is done now and translate it into what the robot should be doing.

To perform this phase you need to know which tool is required for the manual task. Since there are a lot of tooling options out there to do a bunch of tasks, you need to identify which one suits the application best. To make your life easier, we've classified the different cobots according to how easy it is to find a great tool for an application.

Design Criteria

	Easy: Comes with built-in tooling like force-torque sensors, grippers, and cameras.
	Medium: Compatible with a library of tools that fit easily on the robot (but are not provided with it).
	Hard: Stand-alone robotic arm.

INTEGRATE

The integrate phase is the part where the robot arrives in and you need to install it, program it, and make everything work. In this phase you want to have a robot that is easy to program so you can get working as fast as possible.

This is usually the most costly part of the process, because it's the time when a machine or a process is stopped in order to introduce the robot. This is why ease of programming is such an important criteria for collaborative robots.

Integrate Criteria

	Easy: You can automate a whole application in a few minutes.
	Medium: A few pre-programmed routines are included.
	Hard: Requires traditional programming with a steep learning curve.

OPERATE

The operate phase is where the robot works its magic. In this final phase, the robot runs autonomously and performs the tasks it was programmed for. The goal here is to deliver a high-quality product and be able to produce more units than before.

To optimize your robotic process, you must first know how productive your robot really is. Some software can sync with your robot to calculate its productivity, alert you when the robot has stopped, and tell you how to enhance its performance.

Operate Criteria

	Easy: Supports remote connection and performance-tracking software.
	Medium: Supports remote connection and the ability to perform basic functions.
	Hard: Difficult or impossible to connect to the robot remotely.

What are the different types of collaborative robots?

This eBook uniquely covers force-limited robots, which fall into four major categories:

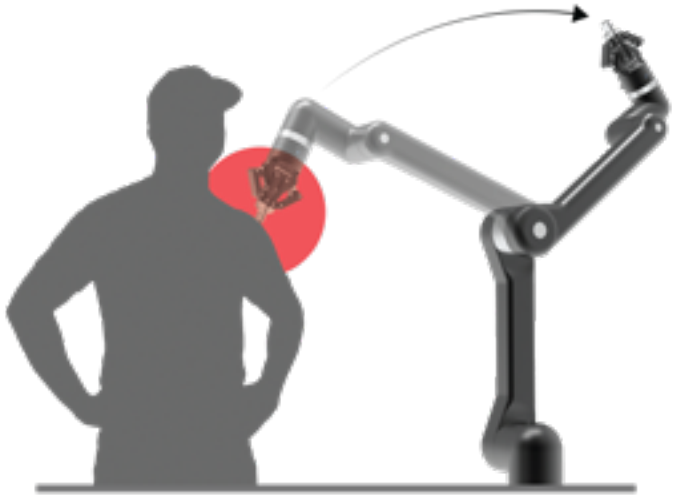
- Inherently safe
- Skin sensing
- Force-sensing base
- Joint sensing

Although most cobots companies market their robots as “inherently safe”, the truth is that most robots will limit their force by using a force sensing method and will limit the impact on their human co-workers. They are actually monitoring their surrounding at a high frequency and can detect a small force rapidly. But if there is a software failure, nothing prevents injuries. The point is that almost all robots have sensors to monitor the external world and they need these sensors to be safe.

Inherently Safe

These robots use all types of sensors, but their main distinction is that they’re incapable of hurting you. Whereas a robot with a 35-kg payload could potentially cause an injury if something goes wrong, the inherently safe robots are simply too weak to hurt you.

We put any robot with a payload lower than 1 kg in this category.



Skin Sensing

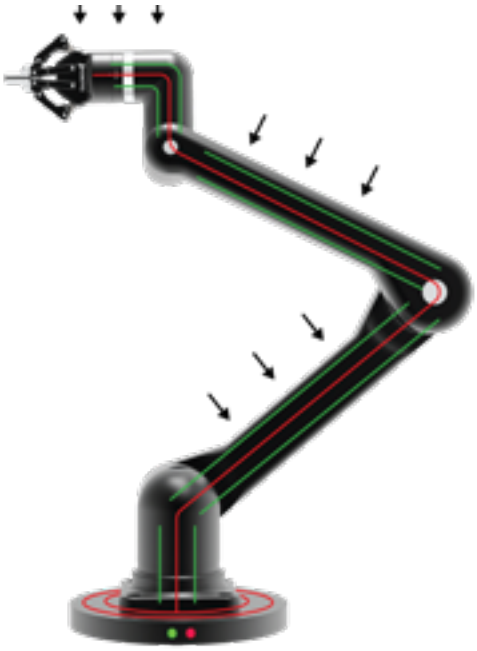
This type of force-limited robot is less wide spread in the industry but it is probably the safest option out there. These robots use various tactile sensing methods to sense impact. The sensor measures the conductivity of the body and stops the robot automatically once it reaches a certain threshold.

This solution is complicated for robot makers to provide, but it results in a robot that’s really safe for the end user.

Force Sensor Base

These types of force-limited robots have a different way of feeling the force applied on their body: a large force-torque sensor at the base of the robot monitors the different forces. So if the robot is programmed to go in a given direction but something (or someone) prevents it from moving, the force sensor will sense an abnormal force vector and will stop the robot. This technique is often used by companies who transform their industrial robots into collaborative robots.

The point of fitting an industrial robot on top of a force-torque sensor and under a soft skin is to allow the robot manufacturer to reuse a well-established robot design to build a collaborative robot. That way, you can work with the same interface you're used to, and you don't need to add any safety fences. The other advantage of this technology is that it lets you use large robots with big payloads and still have very good force (impact) sensitivity.



Joint Sensing

Joint sensing is the most common type of force-limited robot. In fact, this type of cobot uses its joints to monitor the forces applied on its body. Some robots use their motor's power input, and some use force-torque sensors embedded in their joints. This type of sensing is easy for the end user: you only have to set one or two safety settings in the controller, and you are ready to run your safe robot.

COLLABORATIVE ROBOT BUYER'S GUIDE

ABB

IRB 14000 YuMi

This two arm robot is ultra high-tech and uses a wide variety of tools: cameras, a two finger parallel gripper, and a suction cup can all be added to enhance the robot's functionality.

OUR **OPINION**

The robot is easy to program and has a very niche market. When you add in the fact that a lot of tools can be used with it, it's a solid choice for those in the electronics industry.

APPLICATIONS

assembly

> *YuMi will change the way we think about assembly automation.*

https://www.futureportprague.com/meet-yumi-robotic-worker-future-abb/

SPECIFICATIONS

Weight	38 kg
Temperature (C°)	40
Payload	0.5 kg
Reach	559 mm
Joints	14
Price	$$
Repeatability	0.02 mm
Maximum speed	1.5 m/s
Typical Power Consumption	N/A
Robot Mounting	Table
Communication	Ethernet IP, Profitbus, DeviceNet
IP rating	IP 30
Certifications	N/A

DESIGN **INTEGRATE** **OPERATE**

AUBO
i5

Aubo Robotics (previously Smokie Robotics) is a new company in the cobot world, representing a collaboration between researchers from the US and China. Their platform looks a lot like that of Universal Robots but with a different business mindset.

OUR **OPINION**

The **i5** robot is an interesting robot, especially given the price point. It is also compatible with a solid number of third party peripherals, which makes it easy to use and integrate.

APPLICATIONS

research
assembly
machine tending

Aubo Robotics holds several core patents and has strategic cooperation with several public companies leveraging the best of all new technology.

https://www.futureportprague.com/meet-yumi-robotic-worker-future-abb/

SPECIFICATIONS

Weight	24 kg
Temperature (C°)	45
Payload	5 kg
Reach	924 mm
Joints	6
Price	$
Repeatability	0.05 mm
Maximum speed	2.8 m/s
Typical Power Consumption	0.2 kW
Robot Mounting	Floor, wall, ceiling (upside down)
Communication	CANbus
IP rating	IP 45
Certifications	ISO 10218-1: 2011 EN 60204-1:2006+a1:2009 ISO 12100:2010 ISO 13849-1:2008 CE, TUV, KCS, NRTAC

DESIGN *INTEGRATE* **OPERATE**

Bosch
APAS

The APAS assistant is basically a Fanuc lightweight robot covered with a sensitive skin. This means that the robot can instantly feel an abnormal impact and stop itself immediately. It can also be bought with attachments, specifically a 2D or 3D camera, or a 3 finger gripper. To learn more, visit their website.

OUR **OPINION**

There is a real integration gain if you are planning to buy the other devices that can be fitted with the APAS. And thanks to its sensitive skin, there is definitely a safety benefit compared to other robots.

APPLICATIONS

pick & place

APAS was developed to simplify the use of robot technology to such an extent that the average trained worker could use it without expert knowledge.

https://www.bosch.com/research/know-how/success-stories/bosch-apas-flexible-robots-collaborate-in-industry-4-0/

DESIGN INTEGRATE OPERATE

SPECIFICATIONS

Weight	N/A
Temperature (C°)	N/A
Payload	7 kg
Reach	911 mm
Joints	6
Price	N/A
Repeatability	0.03 mm
Maximum speed	0.5 m/s
Typical Power Consumption	N/A
Robot Mounting	Table
Communication	Ethernet IP, EtherCat, E/A Opto-decoupled
IP rating	N/A
Certifications	N/A

Comau
Aura

At a 110-kg payload, the AURA is the cobot with the biggest payload for a collaborative robot. It needs to be backed with a lot of sensors to make sure it can be used alongside humans. The robot is using several safety layers such as: cushioned skin; proximity and tactile sensors, laser scanner and an embedded vision system.

OUR **OPINION**

Comau has done a terrific job ramping up the collaborative level of this robot. With such a big payload, the robot looks safe and ready for workshop integration.

APPLICATIONS

pick & place

Comau's AURA is extending the features of collaborative robots to machines with high payloads.

https://www.comau.com/en/media/news/2016/06/aura

DESIGN **INTEGRATE** **OPERATE**

SPECIFICATIONS

Weight	1615 kg
Temperature (C°)	45
Payload	170 kg
Reach	2790 mm
Joints	6
Price	*$$$*
Repeatability	0.1 mm
Maximum speed	2 m/s
Typical Power Consumption	8 kVA
Robot Mounting	Floor
Communication	N/A
IP rating	N/A
Certifications	TUV SUD ISO 13849-12015

DENSO

Denso Wave **Cobotta**

This small robot is designed to be inherently safe and to perform small repetitive tasks that does not add value to your work. Is there a simple task that takes a lot of your time? COBOTTA is there to help you out.

OUR **OPINION**

COBOTTA is really an all inclusive robot. It's safe, has an embedded gripper, can be fitted with a camera, and has an easy-to-use interface. It is nice to see such a complete robot on the market.

APPLICATIONS

laboratory

assembly

"Anywhere, anytime, hassle-free. A robot that collaborates with everyone.

https://www.densorobotics.com/products/cobotta/

SPECIFICATIONS

Welght	4 kg
Temperature (C°)	N/A
Payload	0.5 kg
Reach	342.5 mm
Joints	6
Price	N/A
Repeatability	0.05 mm
Maximum speed	1.5 m/s
Typical Power Consumption	N/A
Robot Mounting	Table
Communication	TCP IP
IP rating	IP 30
Certifications	ISO 10218.1-2011 ISO/TS 15066 ISO 13849-1:2015 PL d

DESIGN **INTEGRATE** **OPERATE**

DOOSAN
M0609 - M1509

Doosan robots are equipped with torque sensors at their joints to get a better feel for what they are doing. Each robot model is also available in a ''heavy duty" version designed for harsher environments. The robots are equipped with state-of-the art controllers and teach pendants that are easy to use. Tracking software is embedded in the robot controller so you can track your production.

OUR **OPINION**

DOOSAN has come out with a promising product. With a simple interface and the ability to script more complex tasks, these robots are suitable for all levels of complexity.

APPLICATIONS

quality testing | assembly | machine tending | pick & place

Robust platform based on real-time control and high-speed communi-cation technology to ensure stable performance in tough industrial environments

https://www.doosanrobotics.com/en/product/Products/LineupOptions/M0609

DESIGN **INTEGRATE** **OPERATE**

SPECIFICATIONS

	M0609	M1509
Weight	27 kg	32 kg
Temperature (C°)	45	
Payload	6 kg	15 kg
Reach	900mm	900 mm
Joints	6	
Price	$$	
Repeatability	0.1 mm	
Maximum speed	N/A	
Typical Power Consumption	N/A	
Robot Mounting	Floor, wall, ceiling (upside down)	
Communication	Ethernet IP, Modbus TCP	
IP rating	IP 54	
Certifications	N/A	

DOOSAN
M1013 - M0617

Doosan robots are equipped with torque sensors at their joints to get a better feel for what they are doing. Each robot model is also available in a ''heavy duty" version designed for harsher environments. The robots are equipped with state-of-the art controllers and teach pendants that are easy to use. Tracking software is embedded in the robot controller so you can track your production.

OUR **OPINION**

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APPLICATIONS

quality testing | assembly | machine tending | pick & place

"Robust platform based on real-time control and high-speed communi-cation technology to ensure stable performance in tough industrial environments

https://www.doosanrobotics.com/en/product/Products/LineupOptions/M0609

SPECIFICATIONS

	M1013	M0617
Weight	33 kg	34 kg
Temperature (C°)	45	
Payload	10 kg	6 kg
Reach	1300mm	1700 mm
Joints	6	
Price	$$	
Repeatability	0.1 mm	
Maximum speed	N/A	
Typical Power Consumption	N/A	
Robot Mounting	Floor, wall, ceiling (upside down)	
Communication	Ethernet IP, Modbus TCP	
IP rating	IP 54	
Certifications	N/A	

DESIGN | INTEGRATE | OPERATE

FANUC

Fanuc
CR 4iA

The **CR 4iA** uses all the features of an industrial lightweight robot, but in addition it is safe for its human coworkers. In fact, a soft external skin and a force-torque sensor at the base of the robot make it completely safe for collaborative purposes.

OUR **OPINION**

There is no teach-by-demonstration feature. This means that if you're planning for the **CR 4iA** to be your first robot, there might be a steep learning curve.

APPLICATIONS

quality testing

assembly

machine tending

pick & place

The expansion of the "Green robot" lineup, which enables working with operators collaboratively, is sure to contribute to new automatization of manufacturing industries.

https://tech-labs.com/news/new-small-collabrative-robots-fanuc

SPECIFICATIONS

Weight	48 kg
Temperature (C°)	45
Payload	4 kg
Reach	550 mm
Joints	6
Price	$$
Repeatability	0.01 mm
Maximum speed	N/A
Typical Power Consumption	0.5 kW
Robot Mounting	Floor, wall, ceiling (upside down)
Communication	Ethernet IP
IP rating	IP 67
Certifications	N/A

DESIGN **INTEGRATE** **OPERATE**

FANUC

Fanuc
CR 7iA - CR 7iA/L

The **CR 7iA** and **CR 7iA/L** have all the same features as the industrial LR Mate 200iD robot, but in addition they are safe for their human coworkers. A soft external skin and a force torque-sensor make the robots suitable for collaborative purposes.

OUR **OPINION**

There is no teach-by-demonstration feature. This means that if you're planning for the **CR 7iA** to be your first robot, there might be a steep learning curve.

APPLICATIONS

quality testing | assembly | machine tending | pick & place

"The expansion of the "Green robot" lineup, which enables working with operators collaboratively, is sure to contribute to new automatization of manufacturing industries.

https://tech-labs.com/news/new-small-collabrative-robots-fanuc

SPECIFICATIONS

	CR 7iA	CR 7iA/L
Weight	53 kg	55 kg
Temperature (C°)	45	
Payload	7 kg	
Reach	717 mm	919 mm
Joints	6	
Price	$$	
Repeatability	0.01 mm	
Maximum speed	N/A	
Typical Power Consumption	0.5 kW	
Robot Mounting	Floor, wall, ceiling (upside down)	
Communication	Ethernet IP	
IP rating	IP 67	
Certifications	N/A	

DESIGN | **INTEGRATE** | **OPERATE**

FANUC

Fanuc
CR 35iA

The CR **35iA** is one of the biggest collaborative robots on the market, and it has a 35-kg payload. It's built over a traditional industrial robot, but its safety features make it safer than any other big robot out there.

OUR **OPINION**

There is no teach-by-demonstration feature. This means that if you're planning for the **CR 35iA** to be your first robot, there might be a steep learning curve.

APPLICATIONS

quality testing

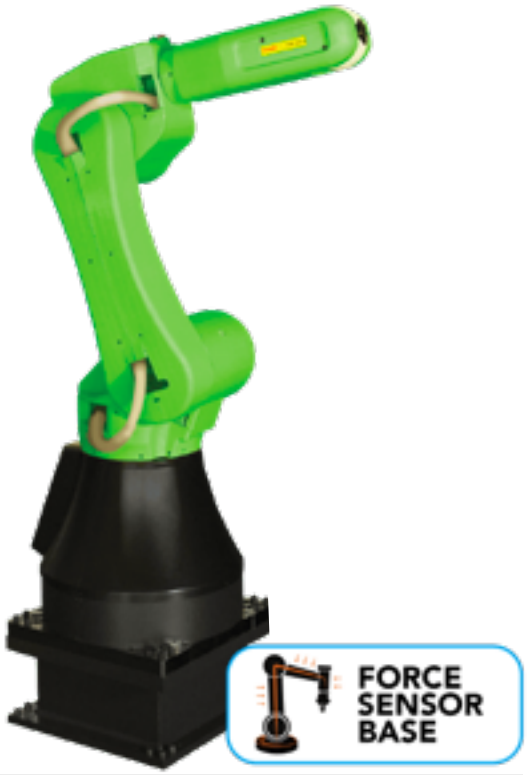
assembly

machine tending

The expansion of the "Green robot" lineup, which enables working with operators collaboratively, is sure to contribute to new automatization of manufacturing industries.

https://tech-labs.com/news/new-small-collabrative-robots-fanuc

DESIGN **INTEGRATE** **OPERATE**



SPECIFICATIONS

Weight	990 kg
Temperature (C°)	45
Payload	35 kg
Reach	1813 mm
Joints	6
Price	*$$$*
Repeatability	0.03 mm
Maximum speed	N/A
Typical Power Consumption	1 kW
Robot Mounting	Floor
Communication	Ethernet IP
IP rating	IP 54
Certifications	N/A

FRANKA
EMIKA

FRANKA
Emika

EMIKA is an all-inclusive collaborative robot. In fact, this robot arm can also be bought with a wrist camera, a two finger gripper and an intuitive PC interface. What more could you want?

OUR **OPINION**

It seems like this robot is part of the next generation of collaborative robots: all-inclusive devices at a very low price. Keep this name in mind, because it appears to have a bright future ahead.

APPLICATIONS

research

machine tending

pick & place

“FRANKA EMIKA is designed for human-robot collaboration, is extremely cost-efficient and lives in the cloud.

https://www.therobotreport.com/franka-emika-everybodys-robot/

DESIGN **INTEGRATE** **OPERATE**

SPECIFICATIONS

Weight	17.8 kg
Temperature (C°)	45
Payload	3 kg
Reach	885 mm
Joints	7
Price	$
Repeatability	0.1 mm
Maximum speed	2 m/s
Typical Power Consumption	0.06 kW
Robot Mounting	Table
Communication	Ethernet IP
IP rating	IP 30
Certifications	N/A

HANWHA ROBOTICS
HCR-3 - HCR-5 - HCR-12

The Hanwha HCR robot series is a new player in the cobot market. It offers a simple icon-based interface that is very different from most cobots. A number of tools can be installed on the robot, as can a vision system.

OUR **OPINION**

Hanwha has made an interesting robot with a simple interface that's perfect for newcomers to the cobot world. We're excited to see how the company will make its mark on the market in the future.

APPLICATIONS

machine tending

pick & place

"This collaborative robot can be applied to any industry, ranging from automotive and electronics to food and pharmaceutical.

https://www.hanwharobotics.com/

DESIGN *INTEGRATE* **OPERATE**

SPECIFICATIONS

	HCR-3	HCR-5	HCR-12
Weight (kg)	13	21	52
Temperature (°C)	50		
Payload (kg)	3	5	12
Reach (mm)	630	915	1300
Joints	6		
Price	$$		
Repeatability (mm)	0.1	0.1	0.1
Maximum speed (m/s)	1		
Typical Power Consumption (kW)	N/A		
Robot Mounting	Floor, wall, ceiling (upside down)		
Communication	Modbus TCP, TCp/IP		
IP rating	IP 64	IP 54	IP 54
Certifications	ISO 13849-1 pl d Cat. 3 ISO 10218-1		

kassow robots
strong · fast · simple

KASSOW
KR810 - KR1205

The KR series robots are well suited for various applications. The shortest one has a fairly large payload of 10 kg, while the longest one has a very large reach of 1.8 m and a payload of 5 kg. The robot's 7 axes also allow it to operate in confined spaces.

OUR **OPINION**

Kassow robots are a very promising product. The various reach and payload options as well as the 7-axis setup, make them suitable for many of different applications.

APPLICATIONS

research | machine tending | quality testing

We have designed our robots to work quickly, precisely and with high payloads – all with outstanding user-friendliness.

https://www.kassowrobots.com/

SPECIFICATIONS

	KR810	KR1205
Weight	23.5 kg	25 kg
Temperature (C°)	50	
Payload (kg)	10 kg	5 kg
Reach	850 mm	1200 mm
Joints	7	
Price	N/A	
Repeatability	0.1 mm	
Maximum speed	N/A	
Typical Power Consumption	N/A	
Robot Mounting	Floor	
Communication	N/A	
IP rating	IP 54	
Certifications	N/A	

DESIGN INTEGRATE OPERATE

KAWASAKI
DuAro1

The **duAro1** from Kawasaki is a double SCARA robot. It is mostly used in planar applications such as pick-and-place tasks. This specific robot has been designed around electronic assembly applications.

OUR **OPINION**

This is one of the only SCARA robots that can be used alongside workers. Since this type is usually quite fast, it is a good addition to the production line for doing repetitive tasks.

APPLICATIONS

assembly | machine tending | pick & place

"The "duAro1" dual-arm collaborative SCARA robot is an innovative robot that works safely and efficiently next to humans in a variety of applications

https://robotics.kawasaki.com/en1/products/robots/dual-arm-scara/duAro1/

DESIGN | INTEGRATE | OPERATE

SPECIFICATIONS

Weight	230 kg
Temperature (C°)	40
Payload	2 kg per arm
Reach	760 mm
Joints	4 per arm
Price	$$
Repeatability	N/A
Maximum speed	2 m/s
Typical Power Consumption	2 kVA
Robot Mounting	Floor
Communication	DeviceNET, CC_Link, Profibus, Profinet, Ethernet IP
IP rating	N/A
Certifications	N/A

KINOVA

KINOVA **GEN3**

The Gen 3 Ultra Lightweight Robot is a lightweight 7-degres-of-freedom robot equipped with a gripper and a 2D/3D camera. It also has its own API and ROS integration.

OUR **OPINION**

The Kinova Gen3 robot is a very interesting robot for research labs. It comes with a great API that can be used to program various applications.

APPLICATIONS

pick & place

research

Extremely versatile and portable, the KINOVA Gen3 Ultra lightweight robot is pathbreaking, built from the ground up to meet the evolving needs of academic and industry research teams.

https://www.kinovarobotics.com/en/products/robotic-arms/gen3-ultra-lightweight-robot

SPECIFICATIONS

Weight	8.2 kg
Temperature	35 °C
Payload	4 kg
Reach	902 mm
Joints	7
Price	N/A
Repeatability	N/A
Maximum speed	N/A
Typical Power Consumption	0.036 kW
Robot Mounting	Floor, wall, ceiling (upside down)
Communication	Ethernet IP
IP rating	IP 33
Certifications	N/A

DESIGN *INTEGRATE* **OPERATE**

KUKA

KUKA
LBR iiwa 7 R800 - 14 R820

With an excellent power to weight ratio, the LBR iiwa are equipped with highly sensitive force-torque sensors at each joint. As opposed to other force-limited robots that read the current in their motor, the LBR has sensors that detect micro impacts.

OUR **OPINION**

The LBR iiwa robots are extremely high-tech and have some interesting safety features. However, they are quite expensive, which could reduce the return on investment of a robotic cell.

APPLICATIONS

quality testing | assembly | palletizing | pick & place

“LBR stands for ‘Leichtbauroboter’ (German for lightweight robot), iiwa for ‘intelligent industrial work assistant’. This signals the beginning of a new era in industrial, sensitive robotics.

https://www.kuka.com/en-hu/products/robotics-systems/industrial-robots/lbr-iiwa

DESIGN | INTEGRATE | OPERATE

SPECIFICATIONS

	7 R800	14 R820
Weight	23.9 kg	29.9 kg
Temperature (C°)	45	
Payload	7 kg	14 kg
Reach	800 mm	820 mm
Joints	7	
Price	*$$S*	
Repeatability	0.1 mm	0.15 mm
Maximum speed	N/A	
Typical Power Consumption	N/A	
Robot Mounting	Floor, wall, ceiling (upside down)	
Communication	EtherCAT	
IP rating	IP 54	
Certifications	N/A	

MOTOMAN YASKAWA
HC10

Unlike with many other large robot manufacturers, Motoman/Yaskawa didn't just produce a regular robot with a protective skin. Instead, they built an entirely new robot that is totally safe for human-robot interactions.

OUR **OPINION**

It's great to see a large robot manufacturer diving head-first into the collaborative world. We've been waiting for a complete collaborative robot from Yaskawa/Motoman, and we are not disappointed.

APPLICATIONS

machine tending

palletizing

> *The Yaskawa human-collaborative robot (HC10) is a new generation of robotics that is capable, affordable, versatile, easy to use*

https://www.motoman.com/en-us/products/robots/industrial/assembly-handling/hc-series/hc10

DESIGN *INTEGRATE* **OPERATE**

YASKAWA
MOTOMAN ROBOTICS

JOINT SENSING

SPECIFICATIONS

Weight	48 kg
Temperature	N/A
Payload	10 kg
Reach	1200 mm
Joints	6
Price	*$$*
Repeatability	0.1 mm
Maximum speed	1 m/s
Typical Power Consumption	1 kVA
Robot Mounting	Floor
Communication	Ethernet IP, DeviceNET, Profibus
IP rating	IP 20
Certifications	N/A

MRK-SYSTEME GMBH

MRK system
KR 5 SI

As with some other collaborative robots, the **KR 5 SI** has industrial robot hardware and is covered with a soft tactile and capacitive skin to sense any abnormal impacts. The robot is monitored by KUKA SafeRobot software.

OUR **OPINION**

This concept is quite unique and is very safe for workers. However, a limited number of robots are produced each year, and they're sold in Germany.

APPLICATIONS

machine tending

pick & place

An industrial robot's high efficiency can be combined with the sensory abilities of the human operator. Alongside the potential for rationalization, the main benefit of these applications is improved ergonomics and an easier workload."

http://www.euroc-project.eu/index.php?id=522

DESIGN *INTEGRATE* **OPERATE**

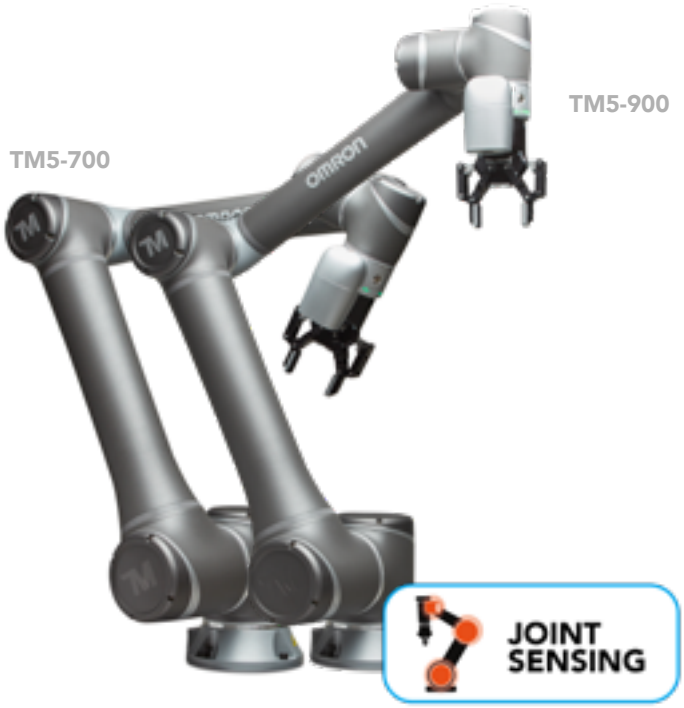
SPECIFICATIONS

Weight	N/A
Temperature (C°)	55
Payload	5 kg
Reach	1423 mm
Joints	6
Price	N/A
Repeatability	0.04 mm
Maximum speed	N/A
Typical Power Consumption	7.3 kVA
Robot Mounting	Floor
Communication	N/A
IP rating	N/A
Certifications	N/A

OMRON

OMRON
TM5-700 - TM5-900

Indeed, Omron's first collaborative robots, the **TM5-700** and **TM5-900**, have an embedded camera at their wrists, a compatible two finger parallel gripper, an intuitive programming method, are inherently safe, and can be programmed directly from your smartphone.



OUR **OPINION**

Omron is an innovative robot maker with a multidisciplinary team, including machinery, electronics, control, software, and vision. It's an all-inclusive solution and we like it!

APPLICATIONS

finishing | packaging | machine tending | assembly

You don't need to worry about how to integrate these complicated vision components by yourself.

http://www.ia.omron.com/products/family/3739/

SPECIFICATIONS

	TM5-700	TM5-900
Weight	22.1 kg	22.6 kg
Temperature (C°)	50	
Payload	6 kg	4 kg
Reach	700 mm	900 mm
Joints	6	
Price	$$	
Repeatability	0.05 mm	
Maximum speed	N/A	
Typical Power Consumption	0.22 kW	
Robot Mounting	Floor	
Communication	Ethernet, Modbus TCP/RTU	
IP rating	IP 54	
Certifications	N/A	

DESIGN | INTEGRATE | OPERATE

OMRON

OMRON
TM12 - TM14

Indeed, Omron's first collaborative robots, the **TM5-700** and **TM5-900**, have an embedded camera at their wrists, a compatible two finger parallel gripper, an intuitive programming method, are inherently safe, and can be programmed directly from your smartphone.

OUR **OPINION**

Omron is an innovative robot maker with a multidisciplinary team, including machinery, electronics, control, software, and vision. It's an all-inclusive solution and we like it!

APPLICATIONS

finishing | packaging | machine tending | assembly

"You don't need to worry about how to integrate these complicated vision components by yourself.

http://www.ia.omron.com/products/family/3739/

DESIGN | INTEGRATE | OPERATE

SPECIFICATIONS

	TM12	TM14
Weight	33.3 kg	32.6 kg
Temperature (C°)	50	
Payload	12 kg	14 kg
Reach	1300 mm	1100 mm
Joints	6	
Price	$$	
Repeatability	0.1 mm	
Maximum speed	1.3 m/s	1.1 m/s
Typical Power Consumption	300 W	
Robot Mounting	Floor	
Communication	Ethernet, Modbus TCP/RTU	
IP rating	IP 54	
Certifications	N/A	

PRECISE AUTOMATION

PRECISE AUTOMATION **PAVP6**

The **PAVP6** is a Denso robot arm frame that has been modified for collaborative operations. The robot has an integrated controller at its base and also has absolute encoders. The robot can be taught by demonstration using a PC or a tablet.

OUR **OPINION**

The **PAVP6** is a very small cobot with a small payload, but it can be used in a lot of different industries.

APPLICATIONS

pick & place

Precise Automation's line of industrial collaborative six-axis articulated robots provides the features, price and repeatability offered by traditional robots with the ease of use of popular collaborative robots.

http://preciseautomation.com/PAVP6-VS6.html

SPECIFICATIONS

Weight	17 kg
Temperature	N/A
Payload	2 kg
Reach	432 mm
Joints	6
Price	N/A
Repeatability	0.02 mm
Maximum speed	N/A
Typical Power Consumption	0.2 kW
Robot Mounting	Floor
Communication	Ethernet IP
IP rating	N/A
Certifications	N/A

DESIGN **INTEGRATE** **OPERATE**

PRECISE AUTOMATION **PF400**

The **PF400** is easy to integrate since it has an embedded controller that can simply be plugged directly into an AC power cord. It can be carried by a single person and installed on a table. The SCARA robot can be programmed using a teaching method and has an embedded vision system.

OUR **OPINION**

We think the idea of a collaborative cartesian robot is super interesting, especially for applications like those found in laboratories or electronic assembly where the collaboration between robots and workers is quite important.

APPLICATIONS

laboratory assembly

This space saving design, together with a novel geometry, allows the PF400 to service many stations in an extremely small workcell.

https://www.robotics.org/content-detail.cfm/Industrial-Robotics-News/Precise-Automation-Announces-the-Acceptance-of-the-PF400-as-the-First-Collaborative-SCARA-Robot/content_id/4154

DESIGN **INTEGRATE** **OPERATE**

SPECIFICATIONS

Weight	20 kg
Temperature	N/A
Payload	1 kg
Reach	576 mm
Joints	6
Price	N/A
Repeatability	0.1 mm
Maximum speed	0.5 m/s
Typical Power Consumption	0.365 kW max
Robot Mounting	Floor
Communication	Ethernet IP
IP rating	N/A
Certifications	N/A

PRECISE AUTOMATION

PRECISE AUTOMATION **PP100**

The **PP100** is easy to integrate, since it has an embedded controller that can simply be plugged directly into an AC power cord. It can be carried by a single person and installed on a table. The cartesian robot can be programmed by a teaching method.

OUR **OPINION**

We think the idea of a collaborative cartesian robot is super interesting, especially for applications like those found in laboratories or electronic assembly where the collaboration between robots and workers is quite important.

APPLICATIONS

pick & place

The PP100 is the world's only collaborative Cartesian robot. Its novel mechanical design offers a price below most collaborative robots and lowers the overall costs of table top applications.

http://preciseautomation.com/PP100.html

DESIGN **INTEGRATE** **OPERATE**

JOINT SENSING

SPECIFICATIONS

Weight	20 kg
Temperature	N/A
Payload	2 kg
Reach	635 mm
Joints	3
Price	N/A
Repeatability	0.1 mm
Maximum speed	1.5 m/s
Typical Power Consumption	0.365 kW max
Robot Mounting	Floor
Communication	Ethernet IP
IP rating	N/A
Certifications	TUV iso/ts 1506

PRODUCTIVE ROBOTICS
OB7

The robot not only has 7 degrees of freedom, but also has a built-in camera, an optional 2-finger gripper, and light indicators. The overall solution is made to integrate fairly easily in terms of programming patterns, as well as in terms of space and flexibility.

OUR **OPINION**

The **OB7** is a versatile and easy-to-use robot with many built-in options. It can definitely be a game-changer for SMEs that may have been considering for big brand robots with less options.

APPLICATIONS

dispensing | machine tending | assembly

Complex functions like grid packaging, machine interfaces, stacking and imported CAD paths are simple due to OB7's learning process.

https://www.productiverobotics.com/ob7-cobot

DESIGN | **INTEGRATE** | **OPERATE**

JOINT SENSING

SPECIFICATIONS

Weight	58 kg
Temperature (C°)	37
Payload	5 kg
Reach	1000 mm
Joints	7
Price	$
Repeatability	0.1 mm
Maximum speed	3 m/s
Typical Power Consumption	0.09 to 0.65 kW
Robot Mounting	Floor, wall, ceiling (upside down)
Communication	Ethernet IP
IP rating	IP 62
Certifications	TUV iso/ts 1506

RETHINK ROBOTICS
Sawyer

Because of its internal design, both **Sawyer** and Baxter are highly safe to use alongside humans. In addition to the peripheral vision system placed on its "head" and the screen that lets you know the state of the robot, there are very few risks to working around this robot.

OUR **OPINION**

Sawyer has an excellent safety concept and a lot of different features. But due to the nature of its programming, you won't be able to get it to do whatever you want immediately.

APPLICATIONS

visual inspection | pick & place | assembly

The human workforce quickly accepts Sawyer, thanks to his friendly design. Sawyer is delivered as an out-of-the-box Cobot solution, equipped with the powerful Intera software and two integrated camera systems.

https://www.rethinkrobotics.com/sawyer

DESIGN | INTEGRATE | OPERATE

SPECIFICATIONS

Weight	N/A
Temperature (C°)	40
Payload	4 kg
Reach	1260 mm
Joints	7
Price	$$
Repeatability	N/A
Maximum speed	15 m/s
Typical Power Consumption	N/A
Robot Mounting	Floor
Communication	Modbus TCP, TCP IP
IP rating	IP 54
Certifications	Iso 10218-1:2011

SIASUN

SIASUN
SCR5

The robot is stand-alone, meaning that it doesn't have optional end-effectors. However, you can add a vision system to the robot.

OUR **OPINION**

The robot is generally shown beside electrical test benches or small machines that fit its compact design. The 7th axis can also be quite practical when used in tight work spaces.

APPLICATIONS

machine tending | finishing | packaging | assembly

> *It is particularly suitable for flexible production lines with a compact design and high precision*

https://www.siasun.cz/en/products/collaborative-robot-scr5-7axis/

SPECIFICATIONS

Weight	33.8 kg
Temperature (C°)	45
Payload	4 kg
Reach	800 mm
Joints	7
Price	N/A
Repeatability	0.02 mm
Maximum speed	1 m/s
Typical Power Consumption	0.4 kW
Robot Mounting	Floor, wall, ceiling (upside down)
Communication	N/A
IP rating	IP 54
Certifications	N/A

DESIGN | INTEGRATE | **OPERATE**

STÄUBLI
TX2-40

These robots are stand-alone, meaning they don't have optional end-effectors. The robot is built around the principle of having an industrial robot collaborate with workers.

OUR **OPINION**

Since the programming of these robots is not so intuitive, the real advantage of using them is if you are already used to STÄUBLI robots and would like to introduce a fenceless lightweight application within your production line.

APPLICATIONS

machine tending

pick & place

These robots have unique features that make them adaptable to all industries, including sensitive environments. Optional SIL3-PLe safety functionalities allow high productivity while ensuring Man-Machine collaboration.

https://www.staubli.com/en/robotics/product-range/6-axis-scara-picker-industrial-robots/6-axis-robots/tx2-40/

DESIGN **INTEGRATE** **OPERATE**

SPECIFICATIONS

Weight	29 kg
Temperature (C°)	40
Payload	2.3 kg
Reach	515 mm
Joints	6
Price	N/A
Repeatability	0.02 mm
Maximum speed	8.6 m/s
Typical Power Consumption	N/A
Robot Mounting	Floor, wall, ceiling (upside down)
Communication	Ethernet, Profinet, Profibus, EtherCat, Cercos, PowerLink
IP rating	IP 65
Certifications	N/A

STÄUBLI
TX2-60 - 60L

The robots are stand-alone, meaning they don't have optional end-effectors. The two robots are basically the same, except the TX2-60L has a bigger reach and a slightly smaller payload.

OUR **OPINION**

Since the programming of these robots is not so intuitive, the real advantage of using them is if you are already used to STÄUBLI robots and would like to introduce a fenceless lightweight application within your production line.

APPLICATIONS

machine tending

pick & place

These robots have unique features that make them adaptable to all industries, including sensitive environments. Optional SIL3-PLe safety functionalities allow high productivity while ensuring Man-Machine collaboration.

https://www.staubli.com/en/robotics/product-range/6-axis-scara-picker-industrial-robots/6-axis-robots/tx2-40/

DESIGN | INTEGRATE | **OPERATE**

JOINT SENSING

SPECIFICATIONS

	60	60L
Weight	52.2 kg	52.5 kg
Temperature (C°)	40	
Payload	4.5 kg	3.7 kg
Reach	670 mm	920 mm
Joints	6	
Price	N/A	
Repeatability	0.02 mm	0.03 mm
Maximum speed	8.4 m/s	11.1 m/s
Typical Power Consumption	N/A	
Robot Mounting	Floor, wall, ceiling (upside down)	
Communication	Ethernet, Profinet, Profibus, EtherCat, Cercos, PowerLink	
IP rating	IP 65	
Certifications	N/A	

STÄUBLI
TX2-90 - 90L - 90XL

These robots are stand-alone, meaning they don't have optional end-effectors. The robot is built around the principle of having an industrial robot collaborate with workers.

OUR **OPINION**

Since the programming of these robots is not so intuitive, the real advantage of using them is if you are already used to STÄUBLI robots and would like to introduce a fenceless lightweight application within your production line.

APPLICATIONS

machine tending

These robots have unique features that make them adaptable to all industries, including sensitive environments. Optional SIL3-PLe safety functionalities allow high productivity while ensuring Man-Machine collaboration.

https://www.staubli.com/en/robotics/product-range/6-axis-scara-picker-industrial-robots/6-axis-robots/tx2-40/

DESIGN | INTEGRATE | **OPERATE**

SPECIFICATIONS

	90	90L	90XL
Weight (kg)	114	117	119
Temperature (C°)	40		
Payload (kg)	14	12	7
Reach (mm)	1000	1200	1450
Joints	6		
Price	N/A		
Repeatability (mm)	0.03	0.035	0.04
Maximum speed (m/s)	10.9	11.1	11.6
Typical Power Consumption	N/A		
Robot Mounting	Floor, wall, ceiling (upside down)		
Communication	Ethernet, Profinet, Profibus, EtherCat, Cercos, PowerLink		
IP rating	IP 65		
Certifications	N/A		

STÄUBLI
TX2touch-60 - 60L

TX2touch is the only cobot with the SIL3/PLe safety level. It is highly productive due to the performance, smart connectivity, and reliability inherited from TX2 robots and its CS9 controller.

OUR **OPINION**

Since the programming of these robots is not so intuitive, the real advantage of using them is if you are already used to STÄUBLI robots and would like to introduce a fenceless lightweight application within your production line.

APPLICATIONS

machine tending

pick & place

Based on the proven TX2 industrial robot, it offers safe operation thanks to its advanced skin technology, quick reaction time and embedded modular safety functions.

https://www.staubli.com/en/robotics/product-range/cobots/power-cobot/

DESIGN | INTEGRATE | OPERATE

JOINT SENSING

SPECIFICATIONS

	60	60L
Weight	51 kg	52 kg
Temperature (C°)	N/A	
Payload	4.5 kg	3.7 kg
Reach	670mm	920 mm
Joints	6	
Price	N/A	
Repeatability	0.02 mm	0.03 mm
Maximum speed	N/A	
Typical Power Consumption	N/A	
Robot Mounting	Floor	
Communication	Ethernet, Profinet, Profibus, EtherCat, Cercos, PowerLink	
IP rating	IP 67	
Certifications	N/A	

STÄUBLI

STÄUBLI
TX2touch-90 - 90L - 90XL

TX2touch is the only cobot with the SIL3/PLe safety level. It is highly productive due to the performance, smart connectivity, and reliability inherited from TX2 robots and its CS9 controller.

JOINT SENSING

OUR **OPINION**

Since the programming of these robots is not so intuitive, the real advantage of using them is if you are already used to STÄUBLI robots and would like to introduce a fenceless lightweight application within your production line.

APPLICATIONS

machine tending

pick & place

Based on the proven TX2 industrial robot, it offers safe operation thanks to its advanced skin technology, quick reaction time and embedded modular safety functions.

https://www.staubli.com/en/robotics/product-range/cobots/power-cobot/

DESIGN INTEGRATE OPERATE

SPECIFICATIONS

	90	90L	90XL
Weight (kg)	111	114	116
Temperature (C°)	N/A		
Payload (kg)	14	12	7
Reach (mm)	1000	1200	1450
Joints	6		
Price	N/A		
Repeatability (mm)	0.03	0.035	0.04
Maximum speed	N/A		
Typical Power Consumption	N/A		
Robot Mounting	Floor		
Communication	Ethernet, Profinet, Profibus, EtherCat, Cercos, PowerLink		
IP rating	IP 67		
Certifications	N/A		

TECHMAN
TM5-700 - TM5-900

Indeed, Techman's first collaborative robots, the **TM5-700** and **TM5-900,** have an embedded camera at their wrists, a compatible two finger parallel gripper, an intuitive programming method, are inherently safe, and can be programmed directly from your smartphone.

OUR **OPINION**

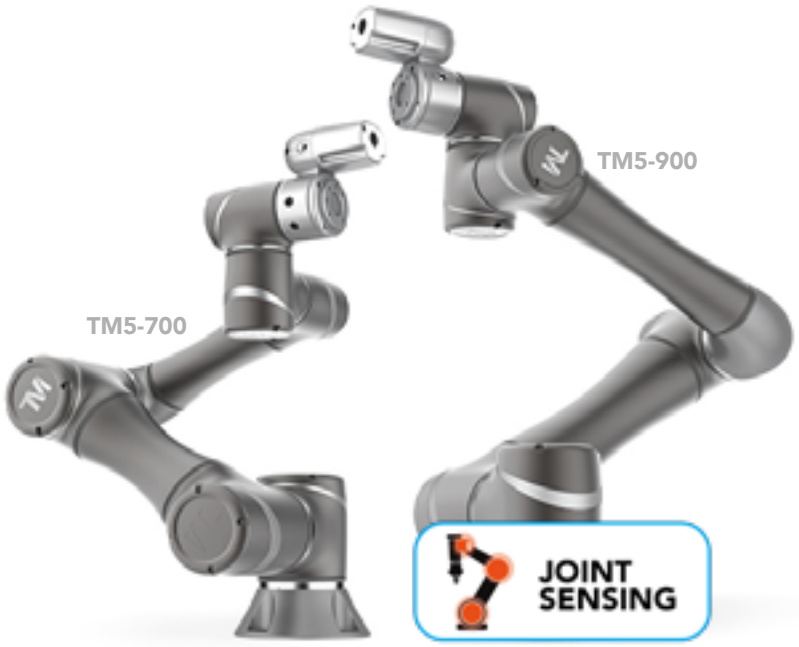
Techman is an innovative robot maker with a multidisciplinary team, including machinery, electronics, control, software, and vision. It's an all-inclusive solution and we like it!

APPLICATIONS

finishing | packaging | machine tending | assembly

TM Robot is equipped with a built-in vision system, which integrates into both the hard-ware and software perfectly.

https://tm-robot.com/tm-robot/



SPECIFICATIONS

	700	900
Weight	22.1 kg	22.6 kg
Temperature (C°)	50	
Payload	6 kg	4 kg
Reach	700 mm	900 mm
Joints	6	
Price	$$	
Repeatability	0.05 mm	
Maximum speed	N/A	
Typical Power Consumption	0.22 kW	
Robot Mounting	Floor	
Communication	Ethernet, Modbus TCP/RTU	
IP rating	IP 54	
Certifications	N/A	

DESIGN | **INTEGRATE** | **OPERATE**

TECHMAN
TM12 - TM14

Indeed, Techman's first collaborative robots, the **TM12** and **TM14,** have an embedded camera at their wrists, a compatible two finger parallel gripper, an intuitive programming method, are inherently safe, and can be programmed directly from your smartphone.

OUR **OPINION**

Techman is an innovative robot maker with a multidisciplinary team, including machinery, electronics, control, software, and vision. It's an all-inclusive solution and we like it!

APPLICATIONS

finishing | packaging | machine tending | assembly

"TM Robot is equipped with a built-in vision system, which integrates into both the hard-ware and software perfectly.

https://tm-robot.com/tm-robot/

JOINT SENSING

SPECIFICATIONS

	TM12	TM14
Weight	33.3 kg	32.6 kg
Temperature (C°)	50	
Payload	12 kg	14 kg
Reach	1300 mm	1100 mm
Joints	6	
Price	$$	
Repeatability	0.1 mm	
Maximum speed	1.3 m/s	1.1 m/s
Typical Power Consumption	300 W	
Robot Mounting	Floor	
Communication	Ethernet, Modbus TCP/RTU	
IP rating	IP 54	
Certifications	N/A	

DESIGN | **INTEGRATE** | **OPERATE**

UNIVERSAL ROBOTS

UNIVERSAL ROBOTS
UR3 - UR5 - UR10

The UR CB Series has a wide variety of tools and applications available. With three different payloads and ranges, it can be integrated in many different applications. Plus, the UR+ platform makes third-party product integration much easier.

OUR **OPINION**

Universal Robots is probably the collaborative robot manufacturer with the most industrial experience. This robot has proven itself time and time again, and is suitable for many different applications.

APPLICATIONS

finishing | packaging | machine tending | assembly | dispensing

Universal Robots arms are advanced tools that can be used by all levels of production staff to help increase productivity, reduce injury, and boost morale.

https://www.universal-robots.com/about-universal-robots/

DESIGN | INTEGRATE | OPERATE

SPECIFICATIONS

	UR3	UR5	UR10
Weight (kg)	11	18.4	28.9
Temperature (C°)	50		
Payload (kg)	3	5	10
Reach (mm)	500	850	1300
Joints	6		
Price	$		
Repeatability (mm)	0.1		
Maximum speed (m/s)	1		
Typical Power Consumption (kW)	0,125	0.15	0.25
Robot Mounting	Floor, wall, ceiling (upside down)		
Communication	Modbus TCP, Profinet, Ethernet IP		
IP rating	IP 64	IP 54	IP 54
Certifications	ISO 10218-1 ISO 13849-1 & -2		

UNIVERSAL ROBOTS

UNIVERSAL ROBOTS
e-Series UR3 - UR5 - UR10

The e-Series for UR is the updated version of the CB-Series. With an integrated force-torque sensor and better control, it is perfect for applications requiring force control.

OUR **OPINION**

Universal Robots is probably the collaborative robot manufacturer with the most industrial experience. This robot has proven itself time and time again, and is suitable for many different applications.

APPLICATIONS

finishing | packaging | machine tending | assembly | dispensing

Our family of collaborative robots offers four different payload options—3, 5, 10 and 16 kg—enabling a wide variety of applications. And with six degrees of freedom, incredible flexibility, and easy integration into existing production environments, our collaborative robots are built to do more.

https://www.staubli.com/en/robotics/product-range/cobots/power-cobot/

DESIGN | **INTEGRATE** | **OPERATE**

SPECIFICATIONS

	UR3	UR5	UR10
Weight (kg)	11.2	20.6	33.5
Temperature (°C)	50		
Payload (kg)	3	5	10
Reach (mm)	500	850	1300
Joints	6		
Price	$$		
Repeatability (mm)	0.03	0.03	0.05
Maximum speed (m/s)	1		
Typical Power Consumption (kW)	0,1	0.2	0.35
Robot Mounting	Floor, wall, ceiling (upside down)		
Communication	Modbus TCP, Profinet, Ethernet IP		
IP rating	IP 54		
Certifications	ISO 10218-1 ISO 13849-1 & -2		

UNIVERSAL ROBOTS

UNIVERSAL ROBOTS
e-Series UR16

The e-Series for UR is the updated version of the CB-Series. With an integrated force-torque sensor and better control, it is perfect for applications requiring force control.

OUR **OPINION**

Universal Robots is probably the collaborative robot manufacturer with the most industrial experience. This robot has proven itself time and time again, and is suitable for many different applications.

APPLICATIONS

finishing
packaging
machine tending
assembly
dispensing

Our family of collaborative robots offers four different payload options - 3, 5, 10 and 16 kg. – enabling a wide variety of applications. And with six degrees of freedom, incredible flexibility, and easy integration into existing production environments, our collaborative robots are built to do more. https://www.staubli.com/en/robotics/product-range/cobots/power-cobot/

DESIGN **INTEGRATE** **OPERATE**

SPECIFICATIONS

Weight	33.1 kg
Temperature (°C)	50
Payload	16 kg
Reach	900 mm
Joints	6
Price	$$
Repeatability	0.02 mm
Maximum speed	1 m/s
Typical Power Consumption	N/A
Robot Mounting	Floor, wall, ceiling (upside down)
Communication	Ethernet, Profinet, Profibus, EtherCat, Cercos, PowerLink
IP rating	IP 65
Certifications	N/A

What's coming next?

ABB - Roberta

Gomtec, the maker of Roberta, was purchased by automation giant ABB in 2015. Since the Roberta concept was super promising, we thought the robot would be released a couple of months after the acquisition. But it seems like we'll have to wait a little longer. While there hasn't been much news about Roberta recently, we remember that ABB took a long time to release the highly regarded, dual-arm YuMi. Check out our blog for updates on Roberta and other cobot news.

TAL - BRABO

The first "built in India" series of cobots launched in 2016 as a range of low-cost alternatives to the most well-known cobot brands, without sacrificing too much in terms of functionality. The company is reportedly working on additional sensor technology to help its cobots compete with the more advanced capabilities of leading models, but no fixed date has been set for their release.

Festo - BionicRobot

The large industrial manufacturer FESTO has developed a pneumatic cobot with a unique principle. In fact, unlike all other cobots with electric motors, FESTO uses a pneumatic circular actuator. They based their design on the agonist and antagonist motion of human arms: they realized that they could make their circular actuator act similarly depending on the pressure in the actuator. It's a promising concept in terms of safety and biomechanics. The robot is not yet commercially available, but will probably be present at all the trade shows for the next couple of years.

Diligent Robotics - Moxi

Austin, Texas-based Diligent Robotics has developed a mobile cobot for hospital assistant tasks, such as delivering supplies and transporting lab samples. Reported to have performed beyond expectations during 2018-2019 trials, Moxi is an exciting addition to the worldwide cobot family. To learn more, visit their website.

Three Key Trends

Bigger payloads and heavy-duty applications

Cobots are typically associated with small payloads and lightweight applications, but collaborative robots are getting stronger every year. In fact, some are already capable of handling the heavy-duty payloads and applications that are traditionally thought of as being beyond cobot capabilities.

The UR16e, for example, which launched in September 2019, has a 16kg payload and is well-suited to heavy-duty material handling, part handling, palletizing, and machine tending applications. Expect to see the capabilities of cobots grow over the coming years while they retain the safety, low cost, ease of use, and flexibility that make cobots so appealing.

Medical/lab cobots

Moxi isn't the only cobot making waves in medical and lab environments. ABB is working on a mobile version of its YuMi cobot for laboratory facilities, as part of the Hospital of the Future project, the National Science Foundation (U.S.A.) is developing a mobile cobot for use as a nursing assistant and UniteLabs unveiled a new lab assistant cobot in late 2019. Meanwhile, KUKA's LBR Med cobot is a key part of AOT's CARLOS bone surgery robot system. It's exciting to see collaborative robots assisting humans in such important domains, and we expect more medical applications to emerge in the years to come.

More and more cobots!

Leading analyst firm ABI Research predicts that cobot hardware's share of the global industrial robots market will grow from 5 percent in 2019 to 29 percent by 2030. This increase is driven by ease-of-use, re-programmability, lower total cost compared to industrial systems, and re-deployability, according to ABI. Expect to see more and more cobots being deployed across a growing list of applications in the coming years.

Conclusion

Cobots will help boost your output, increase your productivity, prevent injuries, and reduce human error. And with most cobots promising an ROI within 6-12 months, they're a worthwhile investment regardless of conditions in the labor market.

The process of successfully deploying your first cobot doesn't have to take long, especially if you base your decision-making on Lean Robotics principles. . But pay careful attention to each step in the process, from shopping for your robot to finding the right application, the right person to oversee implementation and the right way to introduce it in your enterprise.

And it all starts with choosing the cobot that suits your needs. Having a robot with the right reach, degrees of freedom, and payload is crucial. It's also important to be application-centric, which means choosing the cobot that best fits the application(s) you have in mind.

After selecting your cobot, the next step will be to choose the tools to fit on your cobot. Some of the robots in this eBook come with a bunch of tools and accessories as standard, so part selection is quite easy. If your cobot that does not include tooling, however, or you don't have much (or any) robotics experience, you should select tools that are relatively easy to integrate. Look out for "plug-and-play" tooling where available.

To help choose your robotic tooling, or for more information on how to integrate your robot into your facility, visit our Resource Center.

Browse Other eBooks

Getting Started with Collaboratives Robots

Collaborative Robots in Global Companies

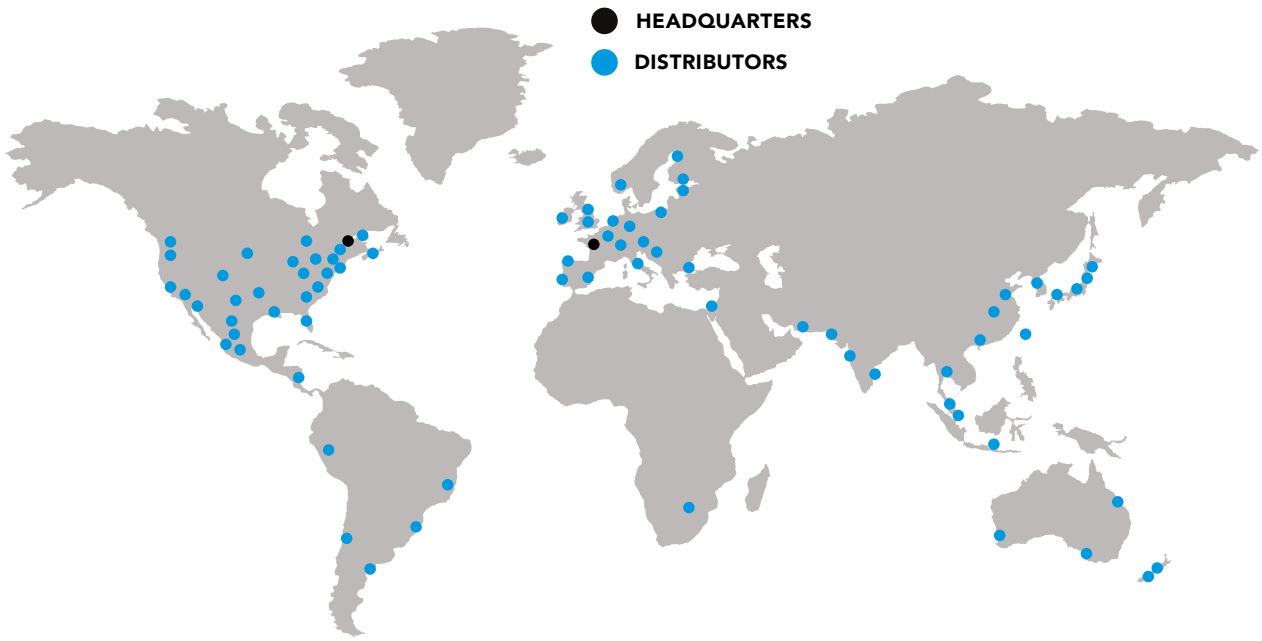
Grippers for Cobots

About Robotiq

At Robotiq, we free human hands from repetitive tasks.

We help manufacturers overcome their workforce challenges by enabling them to install robots on their own. They succeed with our robotic plug + play tools and the support of our automation experts community.

Robotiq is the humans behind the robots: an employee-owned business with a passionate team and an international partner network.



Let's Keep in Touch

For any questions concerning robotic and automated handling or if you want to learn more about the advantages of using flexible electric handling tools, contact us.

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