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# What to Consider When Designing a Collaborative Robot



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## General Needs

**Table 1.**

| | AC / DC | DC / DC | Point−of−Load | Motor Drive | Communications | Power Management |
|---|---|---|---|---|---|---|
| **Collaborative Robots** | Mains to equipment, battery charging. | Legacy actuator needs at 24 V, 12 V. | Sensors, peripherals, communications. | Gripping, lifting, traction, actuation, etc. | Multiple Protocols | Whole System |

### As the industry moves into the collaborative robotics market, what design considerations do I have to consider?

That could be a long list, of course, but to start out, we suggest you consider four areas that play major roles in any robotics system. Those areas are motion control, communications, sensing, and power management (see more aspects in the General Needs table below). The key is to make sure all these areas interconnect smoothly and accurately in some way, whether that is directly or through a central robotic control of some sort. Having said that, you'll want to understand your application needs early on.

### In that case, can you suggest some application parameters to consider?

Yes. With respect to a collaborative robot, you'll want to know what load it will carry, and in what orientations; what operation it will perform; how fast it must move; what range limitations it has; and what safety features it needs. This will provide you with a baseline to start with. Collaborative robots are often designed to handle multiple applications and be moved from station to station where they can be reprogrammed for a different operation, so think flexibility as well.

### Should I start with motion control once I have my application planned out?

All areas mentioned need to be considered together, so we suggest you focus on what part of the electronics your engineers are most familiar with. For motion control, you'll want to remember that collaborative robots often have their motor control boards integrated into the robot arm, which means you'll have a variety of environmental conditions to pay attention to, including thermal management. This means that not only do you need to select components that are small, they must also use switches with low switching losses. There are a variety of metal−oxide (Mosfet) technology−based components available. High efficiency, lowpower

devices are also ideal for such applications. You'll want to work with a company that offers a wide range of motor drivers in the event that you use a mixture of motor types, such as stepper, brushed or brushless.

### What might I consider next in this scenario?

Whether you are designing an industrial robot or a collaborative robot, sensing will play a critical role in your design. Collaborative robots have the added need for sensors that detect human location and prevent collision, which make sophisticated sensor technologies important. Not only do they have to cover a wide range of space (up to several meters), they must also provide resolutions in the millimeter range – and multiple sensors are needed to cover wider ranges. Advanced sensing solutions, such as millimeter–wave radar, can detect objects at a range of up to 84 meters with a tight resolution. These RF sensors work in a variety of environmental conditions as well, including dust, smoke, fog, rain, and darkness. And this is only for safety precautions. What other sensor types does your application need? Video, audio, pressure, temperature. Be sure that the manufacturer of your sensor devices can handle all your needs so that you are not trying to integrate components from several companies that may not operate with the same efficiencies.

### When considering the power distribution of all these components, are there things I should be aware of?

Again, taking your application into consideration, be sure that your power management system provides a full range of supply voltages, as well as key energy–saving capabilities (such as power management for very low quiescent currents in standby modes), a microprocessor wake–up signal, self–contained converters (if needed), and short circuit protection and tested operating ranges within standard temperature ranges from –25°C to 85°C.

### When creating a communications interface, are there certain things to consider?

Most likely you'll have to consider that you'll be working with multiple communications protocols – again, dependent on your application needs. Make sure your selection includes flexible peripherals, connectivity, and a unified software support system. Such devices often use several cores to assure that the balance of integration, connectivity, and performance matches your needs.

### I want to move pretty quickly so I don't miss the window of opportunity. What do you suggest?

Make sure you work with a company that provides a wide range of components that will be necessary from start to finish, such as the sensors you'll need to use on grippers and end–effectors to analog and digital timing components to discrete electronics, and computer chips, Finally, motor control electronics and power and power management

devices to regulate all the operations you're looking to implement. Another thing to consider is to work with a company that offers a wide range of development boards for you to explore a variety of solutions for your application.



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