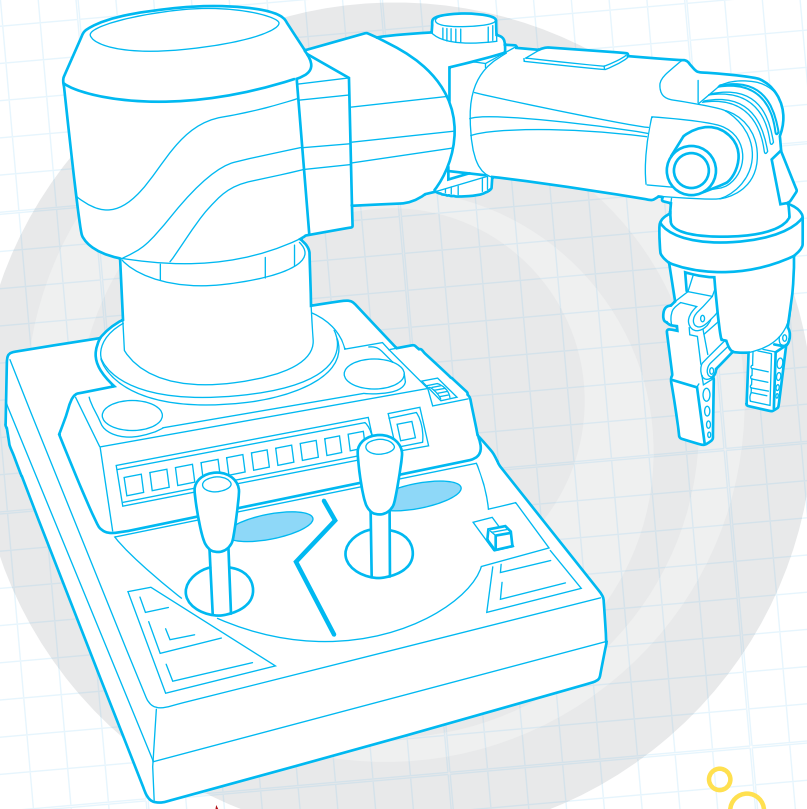
lab assistant guide

(this means for parents!)

how does this grab you?

robotic arm



spark™
ignite a world of discovery

5+
ages

50% KID
50% ADULT
interaction

science

in DOOR
experience

introduction

SPARK THE DISCOVERY

Spark™ is an exciting new synthesis of product and learning for kids ages 4 to 7. Spark believes in learning, but more importantly, it's about the joy of discovery. Beyond just teaching kids science, Spark products teach kids to discover for themselves. Give a kid an answer and you help them for a day—teach them to find their own answers and you help them for a lifetime.

Real scientists learn about the world around them by following the scientific method. Using the Spark Robotic Arm, your Young Scientist can learn the same way by making observations, asking questions, and conducting their own experiments. You can help by encouraging, inspiring, and guiding. This booklet, the Lab Assistant Guide, is for you. It gives you all the information and tools you need to help your Young Scientist.

Upon completion, your child will have experienced imagination, exploration, observation, trial and error, inspiration, and letting instinct be the guide—all part of being a scientist. That's sparking the discovery. As your child grows, the spark will grow, and like great scientists, thinkers and artists throughout time, your Young Scientist will always seek discovery.

How Spark Ignites Discoveries

Kids have wonderfully inquisitive minds, and they love nothing better than visual and tactile stimulus. That said, they often need direction and assistance. They also love some quality time with Mom or Dad. Acting as the Lab Assistant, you should help, but not dictate. It's not fun if you do it for them. Your Young Scientist is in charge of his or her own exploration. The philosophy of Spark is a 3-step process: Learn—Explore—Discover. It's new and it's great!

Before You Begin

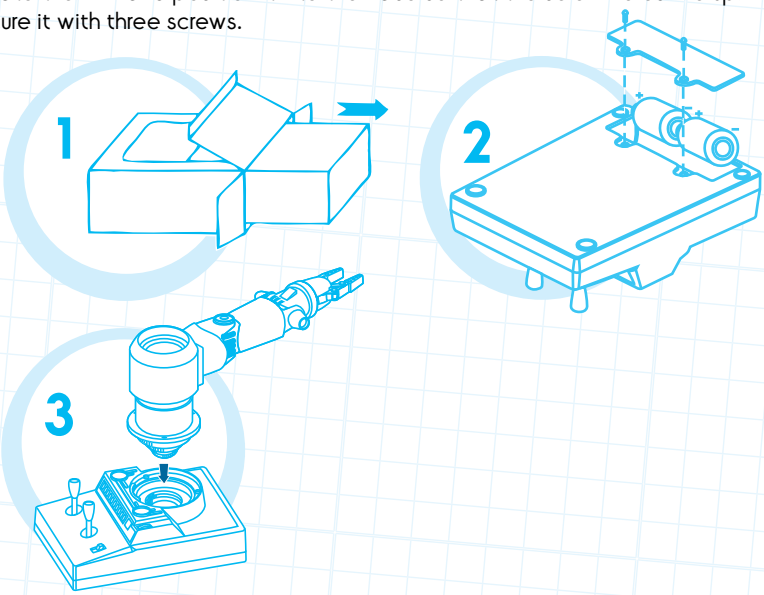
This guide was specifically designed to help you assist your Young Scientist. As the Lab Assistant, you should read the Lab Assistant's Guide all the way through before your Young Scientist begins. Lab Assistants should be aware of how the Spark Robotic Arm functions, the scope of the experiments, how to help young scientists explore and discover for themselves, and any safety considerations.

Included is a set of cards meant for your Young Scientist to use as a visual instruction manual, field guide, and for additional activities. They're called **Spark Cards**. As your child is interacting with the cards, you can follow along with this Lab Assistant Guide.

technical stuff

Getting Started

1. Take all the Robotic Arm parts out of the box and place on a clean, flat surface.
2. Install the batteries. The battery compartment is located on the under-side of the Base. Use a Phillips head screwdriver to loosen the two screws and remove the battery cover. Insert two 1.5V "D" batteries. Make sure they are positioned correctly as indicated in the illustration then secure the battery cover by tightening the two screws.
   - Do not use rechargeable batteries.
   - Non-rechargeable batteries are not to be recharged.
   - Do not mix old and new batteries.
   - Do not mix different types of batteries: alkaline, standard (carbon zinc) or rechargeable (nickel-cadmium) batteries.
   - Only batteries of the same or equivalent type are to be used.
   - Batteries must be inserted with the correct polarity.
   - Remove exhausted batteries from the unit.
   - The supply terminals are not to be short-circuited.
   - Dispose of batteries safely, following guidelines for your area.
3. Locate the Arm and position it into the Base so that the screw holes line up. Secure it with three screws.



Cleaning Instructions

Clean product with a damp or dry cloth. Do not immerse or spray any liquid or water on product.

spark step 1

learn!

In the first step, you will help your child learn about the Spark Robotic Arm. As you look over the Spark Cards, read the labels aloud: "Robotics," "Communication Station," "Motion Control." Don't explain what everything means right away. Give your Young Scientist time to examine and learn about this exciting scientific machine. Let your Young Scientist discover the Spark Robotic Arm independently.

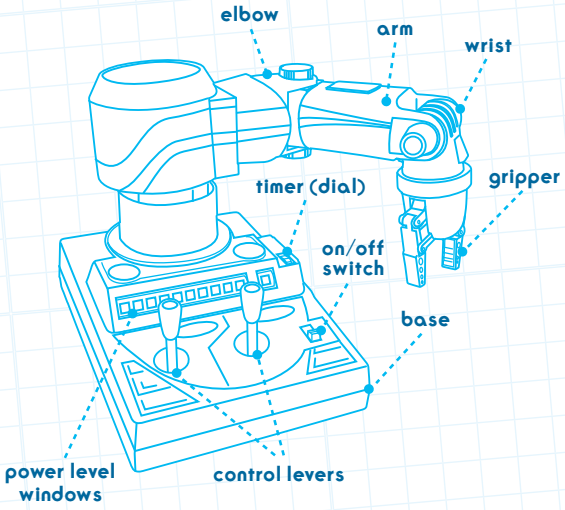
What is a Robot?

Start by asking some questions, and be sure to add your own!

1. **What do you think a robot is?**
2. **Have you ever seen one? Where?**
3. **How can we use these Spark Cards?**
4. **What kind of scientists use robots?**
5. **What do you think this robot can do?**

We bet you get some pretty creative answers (shoot baskets?). Let the answers come; let your Young Scientist think about it. Let your Young Scientist be amazed when he or she takes the controls and sees a real robot in action!

Your Young Scientist can refer to **Spark Card 1** to learn about the Spark Robot Arm and the world of robotics, or the science of making and using robots. Explain to your Young Scientist that a robot is a machine that can perform tasks like a human. Together, identify the different parts of your Robot Arm.



Help your Young Scientist pronounce the word Physicist (fiz-uh-sist). It's a tough one, but your Young Scientist will feel like an expert once it's mastered. Explain that a Robot Physicist is a type of scientist who builds and tests out robots. Some of these robots are designed to conduct science experiments and gather information. Laboratory robots often perform tasks that are too dangerous, too small or too boring for scientists to do themselves! Use **Spark Card 1** to learn about the different types of robots and how they can help scientists in the laboratory and beyond.

Here are some questions you might hear (or choose to ask). Remember to encourage your Young Scientist to come up with their own answers first!

- **What is a Stationary Robot? (This type of robot stays in one place and moves objects around using arms.)**
- **Where can I find Stationary Robots? (Science laboratories use stationary robots to help conduct experiments. Stationary robots can also be found on assembly lines building cars, toys, computers – anything with parts that need to be assembled over and over again exactly the same way.)**
- **What is a Mobile Robot? (This type of robot can really move – either on wheels or robotic legs.)**
- **Where can I find Mobile Robots? (There's no holding back a mobile robot – there's even one on Mars! The Mars Rover is "walking" on the surface of Mars helping scientists gather information about our neighboring planet. Mobile Robots are good for going places humans can't go.)**
- **What makes a robot smart? (A Smart Robot can sense and learn. These robots have sensors that allow them to get "smarter" the more they explore – kind of like a real human!)**
- **What are Smart Robots used for? (Many things! One type of smart robot can even vacuum and sweep your house – it learns where the rugs, walls and furniture are so it gets faster the more it cleans!)**
- **What type of robot is your Robot Arm?**

spark step 2 explore!

Now that your Young Scientist has figured out what robots are, it's time to EXPLORE!

Your Young Scientist can refer to **Spark Cards 2 & 3** as scientific guides to operating the Robot Arm. These cards will help your Young Scientist take control of the robot step-by-step. Discuss that robotics is the study of machines that perform human tasks and that today your Young Scientist is going to be a real Robot Physicist!

Operating a real robot may take some trial and error. That's okay. That's science. It makes sense to help your child understand that real scientists always make a lot of mistakes– and that these mistakes are all part of science. Congratulate them! Tell your child, "By trying again and again you are just like a real scientist!"

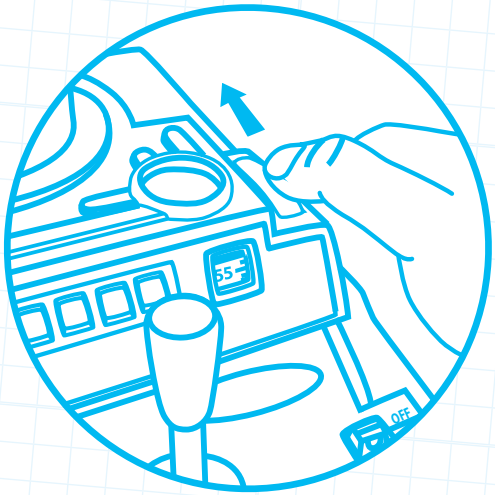
As your Young Scientist explores the movements, or motion control, of the Robot Arm, you may want to point out that the Robot Arm articulates, or moves, at joints. Joints are spots where two or more bones or robot parts connect. The Spark Robot Arm has elbow and wrist joints just like your Young Scientist!

- **Can you rotate, or turn, the robot wrist? (Try twisting the right joystick.)**
- **What part of the robot arm can you use to pick things up? (The grippers are like robot fingers—they're great for picking things up!)**
- **What joint do you need to use to make very big movements? (The joint at the base of the arm lets the robot arm rotate in big circles.)**
- **How many different ways can your robot arm move? (Explore!)**

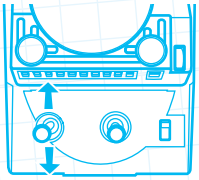
If your Young Scientist needs some help from their Lab Assistant, here are some guidelines for exploring the Spark Robot Arm.

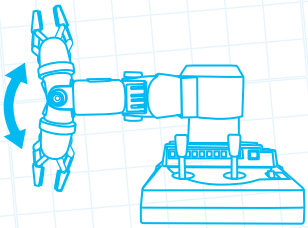
Power Up

1. Turn the on/off switch to the on position.
2. The Spark ROBOT ARM has 10 windows which show the level of power available. To begin exploring, roll the dial forward until the timer reads "55" and all the power windows are orange. The Robot Arm now has full power.
4. As the timer clicks down, the Robot Arm "loses" power. You lose one level of power each time the timer completes one full revolution.
5. When the Robot Arm is completely out of power (all the windows are dark green) it will automatically shut off.

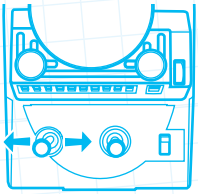


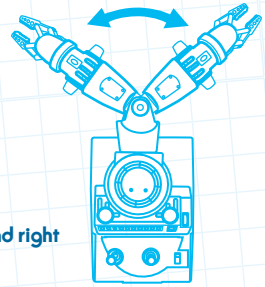
Motion Control - Left Joystick



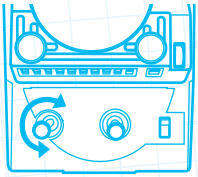


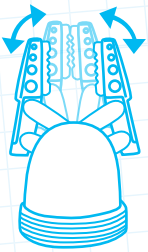
Up and Down = wrist moves up and down





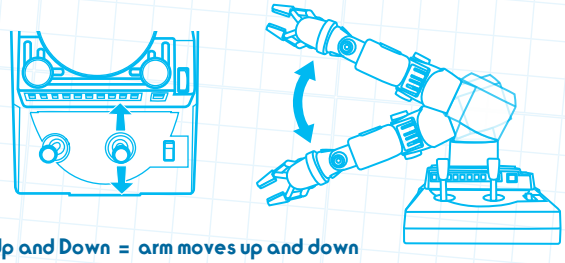
Left and Right = elbow pivots left and right



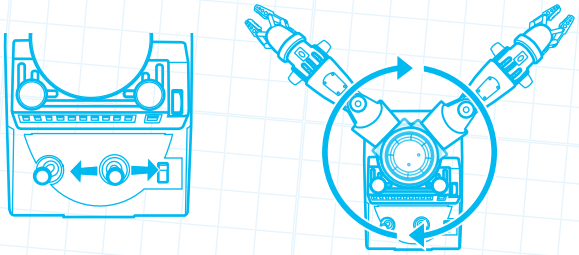


Twist = fingers open and close

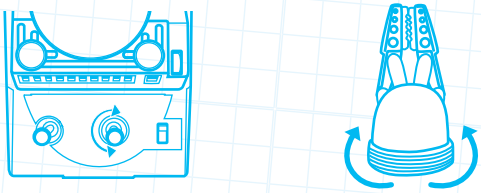
Motion Control - Right Joystick



Up and Down = arm moves up and down



Left and Right = arm rotates clockwise/counter-clockwise



Twist = wrist rotates clockwise/counter-clockwise

Experiment!

Have your Young Scientist try moving, stacking, knocking down and picking up different household objects. What can or can't the gripper pick up? As always, be sure to ask your Young Scientist plenty of questions. There is no wrong way to experiment—the key is to explore!

self-made robot physicist

As you can see, there has been a natural progression. In the first Spark, your Young Scientist learned all about robots. In the second Spark, EXPLORE!, your Young Scientist explored the articulation and motion control of the Robotic Arm. In the next Spark, your Young Scientist will make discoveries by using elements of the Scientific Method. You might want to remind your Young Scientist that this is exactly how all great discoveries have been made by real scientists throughout history!

Now, it's time for your Young Scientist to put his or her robotics skills to the test — it's time to build the Communication Station. The following activity takes what your child has learned a step further and helps him or her become a Self-Made Robot Physicist!

Observe & Record Data

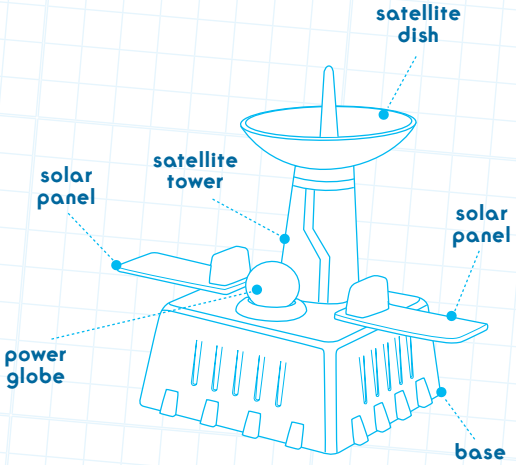
A good scientist doesn't leave anything to chance—at least not when it comes to observing and recording findings. You are about to teach your child how to observe and record data like a real scientist.

Observe - Take a look!

One of the basic skills and great joys for a questioning mind is to learn to observe, which means to notice everything you can. As your Young Scientist uses the Spark Robotic Arm to build the Communication Station, encourage your Young Scientist to really notice which strategies work best. Start by asking your child some questions to prompt observation.

- **Which part of the Communication Station do you think will be the hardest to build? Why?**
- **Which part will you start with?**
- **How long do you think it will take?**

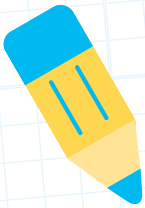
Use **Spark Card 4** to observe and identify the parts of the Communication Station. Once your Young Scientist is familiar with the Communication Station assembly and comfortable using the Robot Arm, it's time to start building!



1. **Scatter the six parts of the Communication Station no more than eight inches away from the Robotic Arm all around it.**
2. **Roll the dial forward to "55" and start the timer.**
3. **Start building! The goal is to assemble all of the parts onto the Base Unit to complete the Communication Station before time runs out and all the power windows are shaded.**
4. **Each time your Young Scientist completes a time trial, be sure to record the data.**

Record Data – Write it down!

Scientists love to look—and look closely—but that's not the end of the discovery. It is just as important to record, or write down, what they observe. Why? Well, scientists throughout time have struggled to have their discoveries accepted or even believed! That is one reason why it is very important to record data, or findings. The other reason is that it helps scientists to keep track of all those discoveries—after all, there are quite a few robots out there!



Your Young Scientist can use the "Robot Time Trials" on **Spark Card 4** to record each time trial. Your Young Scientist might need your assistance to add up totals for each time trial and compare results.

- **When your Young Scientist completes a trial, go down the "Time Trial 1" column and write in a "1" for each part that was assembled before time ran out. Everyone starts with 1 point for the base.**
- **Beat the clock and score bonus points! If your Young Scientist completed the Communication Station before time ran out, you can also record the number of orange windows remaining. Each power window is worth 1 point.**
- **Add up all the numbers in the column and write the total at the bottom.**
- **Review the data together. Are there parts that were more difficult to assemble? Were any parts were missing? Does your Young Scientist have ideas to improve robot performance?**
- **Try again! Keep testing the limits of your robot motion control and agility!**

Check the Totals after each trial. What level can your Young Scientist (and Robot Arm) reach?

- 1-2 = Tired Technician
- 3-5 = Agile Assistant
- 5-6 = Excellent Engineer
- 7 = Master Controller
- 7+ = Scientific Genius!

TIP: For a real challenge, begin without full power. Roll the dial back to obtain the desired level.

Even if your Young Scientist becomes a "Scientific Genius" at building the Communication Station, there's no reason to stop experimenting. Try setting up different time trials with household objects. See how many objects your Young

Scientist can pick up and drop into a bowl before time is up. Use **Spark Card 5** to record each trial.

Here are some suggested objects to test – or come up with your own!

– Grapes

– Cotton balls

– Crayons

– Tissues

– Blocks

– Toys

Believe it or not, you've been teaching the real scientific process to your child. Your child has discovered, observed and recorded findings—and used those findings to improve robot performance!

Fantastic! Now's the time for BIG congratulations! Explain to your Young Scientist that he or she has just conducted robot experiments like a real robot physicist. Look at all that was learned. To reinforce how much knowledge was gained in the process, make sure to discuss your child's findings.

– What did you build?

– What was the robot best at moving?

– What tasks were hard for your robot?

– What was your highest score? How did you get it?

– What was the hardest part to figure out?

Now do a quick recap: Your Young Scientist Learned about robots. Your Young Scientist also Explored how to operate a robot arm and Discovered new knowledge by conducting timed experiments. Your child really is a Self-Made Robot Physicist!

Spark™ knows that someday your Young Scientist might use a robot to explore the outer universe – and there are no easy answers out there either!

extra spark

Spark Card 6

Your Young Scientist can try using the Spark Robotic Arm for all kinds of everyday tasks. How good is your robot at combing hair? Eating cereal? How about writing? Use **Spark Card 6** to inspire new robotics experiments. For safety reasons, these projects need the help of you, the Lab Assistant.

Here are a few ideas for everyday tasks to try with your Robot Arm:

– Brush hair

– Eat cereal

– Write your name

– Turn on T.V.

– Turn the page of a book

As always, be sure to ask your Young Scientist questions as they experiment!

– Which tasks do you think robots are good at?

– Which tasks are better for humans to do?

– What kind of robot would you like to invent?

– Do you think you can design your own?

For an extra challenge, ask your Young Scientist to try completing the robotic connect-the-dots on Spark Card 6 – talk about motion control and agility!

You might need to help hold the card or tape it to the table while the arm is drawing.

Encourage Further Exploration and Discoveries

Although you and your child have completed all the experiments in this guide, there is always more to learn and discover. For example, to keep the Spark alive, you could ask you child to keep thinking about what would be exciting to try doing with the Robotic Arm. Ask every so often—every day even. Make sure to give a time-frame. "Next Sunday, we'll try a whole bunch of new stuff, okay?"

Make it something you do together. The goal should be this: your Young Scientist comes running to you at the kitchen table with a checker board.

He or she says: "my robot can play checkers!" Now you've started something that your child will never lose. That is the joy of Spark.

Keep the Spark Alive

Spark™ is a great opportunity to teach – not just science – but the scientific method. It's an opportunity to inspire your child to learn a process that's empowering.

It's an opportunity to truly spark your child's discovery. Someday your child may invent a new robotic technology in their own laboratory!

lab assistant guide

(this means for parents!)

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spark™
ignite a world of discovery