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# LEGO® MINDSTORMS® NXT-G

## Programming Guide

*MASTER THE NXT-G LANGUAGE  
FOR PROGRAMMING LEGO  
MINDSTORMS ROBOTS.*



**James Floyd Kelly**

**SECOND EDITION**



# LEGO MINDSTORMS NXT-G Programming Guide

*Second Edition*



James Floyd Kelly

Apress®

## **LEGO MINDSTORMS NXT-G Programming Guide, Second Edition**

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For the LEGO MINDSTORMS team, past and present...

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# About the Author



■ **James Floyd Kelly** is a freelance writer living in Atlanta, Georgia, with degrees in English and Industrial Engineering. He has written books on a variety of subjects including netbooks, free software, building your own computer, and LEGO robotics. He is editor-in-chief of the world's most popular LEGO NXT robotics blog, [thenxtstep.com](http://thenxtstep.com), which continues to draw an estimated 50,000+ readers monthly, and is a regular contributor to the LEGO MINDSTORMS development team. He is also the author of *Build Your Own CNC Machine*, the first book to include step-by-step instructions for building your very own computer controlled cutting and milling machine. When not writing, he and his wife enjoy time with their two sons.

# About the Technical Reviewer



■ **Fay Rhodes** is a member of the LEGO MINDSTORMS Community Partners and has authored two books of NXT animals—*LEGO MINDSTORMS NXT Zoo!* and *Robots Alive! Endangered Species*. She also contributed to the LEGO MINDSTORMS NXT idea Book. Fay comes to the NXT from the perspective of the artist, and has a particular interest in helping teachers use the NXT creatively with their students.

# Acknowledgments

Writing books is fun. I really mean that. And part of the enjoyment of my job comes from my “co-workers.” While I work from home (or a coffee shop), I still get to interact with a great group of people over at Apress. I say over, but that’s not completely true as they’re all spread across the globe in different cities and countries. You can read the names of all the people involved in getting this book polished and out the door a few pages back, but I’d like to make sure that Jonathan Gennick and Laurin Becker know just how much I appreciate their feedback and hard work on this book. I really hope to get to work with them again in the future.

I also want to thank Fay Rhodes for her help as the Technical Editor of the book. She found my errors and made sure I got them fixed. And many thanks to the readers of The NXT Step blog who pointed out errors in the first edition and made suggestions for this second edition.

Finally, thanks go to my wife, Ashley, as always... for her support.

# Introduction

Welcome to the second edition of LEGO MINDSTORMS NXT-G Programming Guide. Since the release of the first edition in 2007, the LEGO MINDSTORMS robotics kit has exploded in popularity and continues to find its way into the hands of newcomers. The first NXT robotics kit was released in late 2006 to rave reviews, and NXT-G, the graphical software used to program robots, was a huge hit.

By following along with some built-in tutorials, users of the new robotics kit were given the basics of the software and set free to design and create some of the strangest, silliest, useful, and/or most unique robots you'd ever imagine. But programming with the NXT-G software wasn't easy for everyone to understand – some took to it immediately and others struggled to understand basic concepts.

I wrote the first edition using simple language, a familiar tone, and short chapters to try and not overwhelm those new to programming with NXT-G. I avoided technical jargon where I could and introduced readers to my version of pseudo code that I felt would help new NXT-G programmers better understand how to formulate an idea and turn it into a real NXT-G program. The feedback I received from the book was overwhelming, especially from teachers and parents who found themselves also needing to learn NXT-G to work and enjoy robot building and programming with their students or children.

In late 2009 a new version of the NXT robotics kit was release – NXT 2.0. And with the new kit came an update to the NXT-G software. Luckily, the majority of the software looked and worked just like the 1.0 version released back in 2006. There were new features and tools, yes, but the basics of how NXT-G works and looks stayed the same. Students, teachers, and parents, familiar with NXT-G 1.0, would have very little difficulty figuring out NXT-G 2.0. But what about those completely new to the NXT robotics kit?

It's my hope that LEGO MINDSTORMS NXT-G Programming Guide Second Edition will help not only those new to the NXT robotics kit but also help update those familiar with the 1.0 kit (and software) with the changes and updates found in NXT-G 2.0. Errors in the first edition have been fixed, new material has been added, and over 25 new exercises have been provided (along with solutions) for readers to take what they've learned and put their skills to the test. I've also added the building instructions for a robot that can be used throughout the book when testing programs. (A big thanks to Chris Smith for providing the images used in Appendix B.)

I hope you find the book easy and enjoyable to read... and then I hope you'll go and build and program some amazing robots that will astound your friends, family, schoolmates, co-workers, and anyone else that has the fortune to view your creations.