2018 Kansas BEST Breakout Sessions

Robot Programming – Linda Manfull
September 8, 2018
ROBOT PROGRAMMING AGENDA

- OOTB Operations
  - Review of Cortex
  - BEST Default Program
- Simulink
  - Installation notes
  - Tour of the Workbench
  - Programming
- EasyC
- Robot C
- Comparison of Environments
**Robot Programming**

**Vex Controller**

- 8 Analog inputs
- 12 Digital inputs or outputs
- Speaker Output
- System Status Indicators
- WiFi 802.11 Proprietary Comm.
- Standard Serial Interfaces (UART, I2C)
- 10 Motor/Servo Ports (Built-In ESC on 2 ports)
# BEST Default Program

<table>
<thead>
<tr>
<th>Motor/Servo Port</th>
<th>Function</th>
<th>Joystick Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Port 1 Not Allowed</td>
<td>&gt;&gt;&gt;&gt;&gt; Please Note!!!</td>
</tr>
<tr>
<td>2</td>
<td>Right Motor</td>
<td>Channel 1 (Lt, Rt)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Channel 2 (Fwd/Rev)</td>
</tr>
<tr>
<td>3</td>
<td>Empty</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Empty</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Servo</td>
<td>Channel 3 Inversed</td>
</tr>
<tr>
<td>6</td>
<td>Motor</td>
<td>Channel 4</td>
</tr>
<tr>
<td>7</td>
<td>Empty</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Empty</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Left Motor</td>
<td>Channel 1 (Lt, Rt)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Channel 2 (Fwd/Rev)</td>
</tr>
<tr>
<td>10</td>
<td>Port 10 Not Allowed</td>
<td>&gt;&gt;&gt;&gt;&gt; Please Note!!!</td>
</tr>
</tbody>
</table>
BRI File Manager | Welcome - Linda Manfull

Create a Folder  📂 Upload a File  🌐 Add a Link

_up One Folder_

Current Folder - MAIN / Public Resources & Training

- bESTology
- CAD Models
- Coach Survival Guide
- Kits
- Software

Team Resources
Technical Training

Current Folder - MAIN / Public Resources & Training / Software

<table>
<thead>
<tr>
<th>Filename</th>
</tr>
</thead>
<tbody>
<tr>
<td>bESTology 2018</td>
</tr>
<tr>
<td>Mobile ScoreBoard for iPhone or Android.pdf</td>
</tr>
<tr>
<td>Safety &amp; First Aid Info &amp; Training.docx</td>
</tr>
<tr>
<td>2015_BEST_Default_Program_Description.pdf</td>
</tr>
<tr>
<td>BEST_Default_Code_robotc.c</td>
</tr>
<tr>
<td>BEST_Default_Code_robotc.rbg</td>
</tr>
<tr>
<td>BEST_default_easyc.zip</td>
</tr>
<tr>
<td>BEST_default_easyc_2015_C_text.zip</td>
</tr>
<tr>
<td>BEST_default_simulink.xlsx</td>
</tr>
<tr>
<td>Programming Reference.pdf</td>
</tr>
<tr>
<td>Simulink Kickoff Intro Video</td>
</tr>
</tbody>
</table>
Robot Programming

Notebook Requirements

- The Project Engineering Notebook has a section of the scoring devoted to the development of your control program.

Software Development Process

Evidence that a software development process was effectively used

- What is a ‘Software Development Process’?
  - Define functions to be automated
  - Identify how those functions will be initiated or controlled by the driver
  - Testing/Simulation
  - Version Control
ROBOT PROGRAMMING Options…..

Instructions can be found on the BESTINC.org website in the File Manager. You will receive a password today that will let you access this year’s game files folder. Look in the ‘Software’ folder.
ROBOT PROGRAMMING Options…..

- MathWorks Simulink
- Easy C
- Robot C
- Dassault SolidWorks
- SolidWize
- HSMWorks CAM
- AUTODESK
- Siemens
- WOLFRAM One
Questions on the Default Program or Notebook Requirements?
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Simulink
ROBOT PROGRAMMING
Simulink Online Training

Academia

Interactive Online Training Courses
Learn by doing! Our 2-hour online courses provide a hands-on learning environment where you will interact with a web-based version of MATLAB and receive instant and contextual feedback.

Launch MATLAB Onramp
Launch Deep Learning Onramp

Mobile Robotics Training Videos
Learn to design and test autonomous robot algorithms using MATLAB and Simulink with these free training materials.

Request access to training videos

Additional Resources

Videos
- Creating a Simple Robot Model (14:52)
- Building and Downloading a Simulink Model to VEX Microcontroller (9:20)
- Using Gamepad/Controller for Simulation Input (5:00)
- Controlling Servomotor Angle with Gamepad Buttons (8:48)
- BEST Robotics Kickoff: Simulink Support for VEX Cortex Microcontroller (0:52)
- Tune Parameters Using Simulink External Mode for VEX Cortex (13:29)

Courseware
- Getting Started with MATLAB and Simulink for VEX Robotics

Software
- VEX Cortex Microcontroller Support for Simulink

Documentation
- Tutorials and Examples
SIMULINK TRAINING VIDEOS

- Build and Download video:
BEST SIMULINK DESIGN AWARD

Awarded to one team in each of the 5 BEST regions that best applies the ‘Simulink Support Package for VEX’ based on the specified judging criteria and their robot’s performance in the competition.

The winning teams will be awarded all of the following:
- A cash prize for the winning team.
- Plaque/trophy titled BEST Simulink Design Award
  - by MathWorks
- a MathWorks cap for each team member
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EasyC Installation Notes

- Version easyCv6
- System Requirements: Windows 7/8/10
- 1024MB RAM, 512MB HDD, 1024x768 Display
- VEXnet 2.0 Support Requires Radio Version 1.46
- Download File Size: 214MB
- Administrator Access on the PC
- 1 USB port available for Cortex programming

Go to
http://www.intelitekdownloads.com/easyCV6/
**Robot Programming**

*easyC Installation Notes*

- Must use the administrator account (or administrator mode)
- Right-click on the easyCv5 icon and select “Run as Administrator”
- Follow the on screen instructions
- Sample projects are copied into a “Intelitek” subfolder in the Documents folder
- Sample projects must be copied to each user's folder if the software will be shared by multiple users on the same machine.
- On the first startup of the software, there will be a prompt for registration code
- Enter the registration code provided on the BRI dashboard
- Be sure to select your CORTEX controller before starting a project or loading the default!!
easyC for Cortex • Choosing a Controller

easyC supports two different controllers: VEX Cortex and VEX IQ. The currently selected controller is indicated at the top of the easyC window.

You must select which controller you are working with before starting to build your program. Each time you launch easyC, it will open configured for the controller you used the last time.

To change the controller that you are working with:

1. Check which controller is currently selected. The current controller is indicated at the top of the easyC window.

2. In the main menu, navigate to **Tools > Choose Controller**.

3. Select the desired controller from the drop-down menu in the Choose Controller window.

4. Click **OK**.

5. You will be asked for confirmation. Click **Yes**. easyC will restart, configured for the controller you selected.
ROBOT PROGRAMMING

easyC TOUR OF THE WORKBENCH
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RobotC TOUR OF THE WORKBENCH
Robot Programming

RobotC Installation Notes

Step 2: Platform Type and Communication Port

- Specify that you are using the Cortex and how it is connected to your computer in ROBOTC. Go to the Robot → Platform Type → VEX Robotics menu option and select "VEX 2.0 Cortex".

Note:
You should choose "VEX 2.0 Cortex" if you plan on programming using the standard ROBOTC language. Click the "Natural Language" option if you want to take advantage of the Natural Language commands in ROBOTC.
ROBOT PROGRAMMING

RobotC INSTALLATION NOTES

Opening the Motors and Sensors Setup

1) Before you can make changes in Motors and Sensors setup window, you must first make sure that:
   - The correct Platform Type is selected under the Robot menu
   - A new or existing program is loaded in ROBOTC

2) To open the Motors and Sensors Setup window, navigate to the 'Robot -> Motors and Sensors Setup' menu option.

Alternatively, you can simply click on the 'Motors and Sensors Setup' icon on the toolbar.

There are three main sections to the Motors and Sensors Setup window:
   - The Standard Models tab
   - The Motors tab
   - The Sensors tab
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## Robot Programming Developer Workbench Comparison

<table>
<thead>
<tr>
<th>Feature</th>
<th>easyC</th>
<th>RobotC</th>
<th>Simulink</th>
</tr>
</thead>
<tbody>
<tr>
<td>C Programming text editor</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Graphical Programming Interface</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Online Debugger</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Boot Download to Cortex</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Tutorials</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Sample Programs</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Hardware Simulation</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Hardware Test</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Support for Mac OS</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
Cortex Debugging

On the BRI File Manager, navigate the following folder tree

MAIN -> Public Resources & Training -> Technical Training

- Cortex_Debugging_Guidelines.pdf
- CORTEX_Quick_Start_Guide_050710.pdf
- 2012_Control_System_Team_Training v2.ppt

Shows hardware hookups, syncing VEX keys, how to connect hardware to PC for programming and testing software.
**Robot Programming Notebook Content**

- Software development processes follow the Engineering design processes
- Notebooks should have a section dedicated to how the software was developed
- Scoresheet:

<table>
<thead>
<tr>
<th>Software Development Process</th>
<th>Evidence that a software development process was effectively used</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-25</td>
<td>Process is explicitly identified; steps are obvious and explanation is thorough. Design methods utilized are identified and explained.</td>
</tr>
<tr>
<td>16-20</td>
<td>Process is identified; steps are discernible and there is some explanation. Some design methods are discussed.</td>
</tr>
<tr>
<td>11-15</td>
<td>There is some discussion of a development process or design methods.</td>
</tr>
<tr>
<td>1-5</td>
<td>You can tell there were some software design methods used.</td>
</tr>
<tr>
<td></td>
<td>6-10 Process is mentioned but minimal detail.</td>
</tr>
<tr>
<td></td>
<td>0 No discernible software development process.</td>
</tr>
</tbody>
</table>

**Comments:**

Safety - Evidence that safety training occurred and safe practices were followed to prevent students’ misuse of tools and other devices/equipment.
NEXT STEPS

- Assign some one as your programming focal point.
- Begin process to get your Simulink registration key TODAY!
- Download EasyC or Robot C.
- Download the default program.
- Practice loading the program from your selected tool.
- Start your design process – document it and add it to the notebook.
- When you get your Simulink key, finish installing it.
- BE CREATIVE
- TEST – PRACTICE – IMPROVE – REPEAT
- Apply for the Simulink Design Award.
**Robot Programming Assistance**

- Linda Manfull
- Email: linda.manfull@bestinc.org
- Phone/Text: 316.821.8781
- www.bestinc.org
- Simulink links
- Q&A Forum

![BEST Robotics Logo](image1)

![BEST Robotics Website Screenshot](image2)