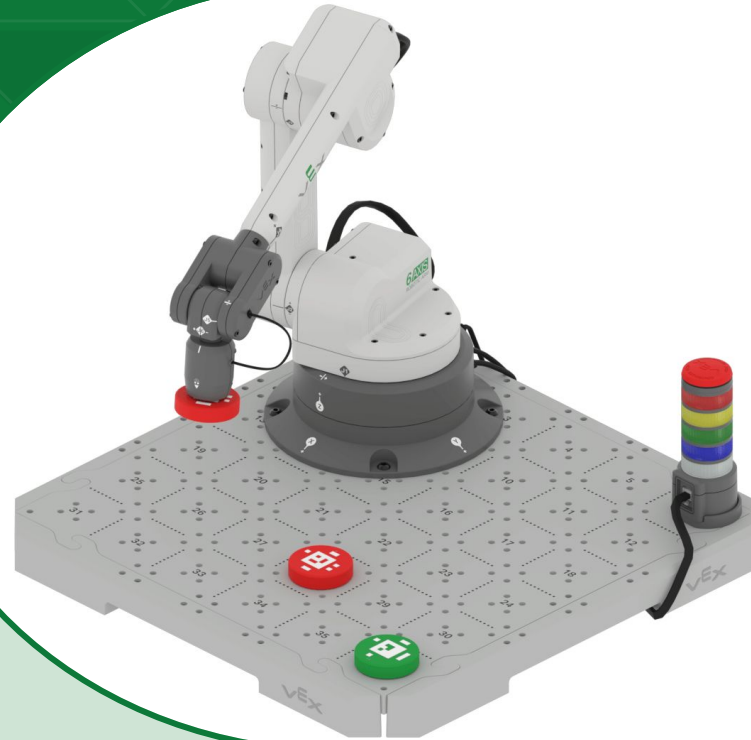


Robotics for Career and Technical Education

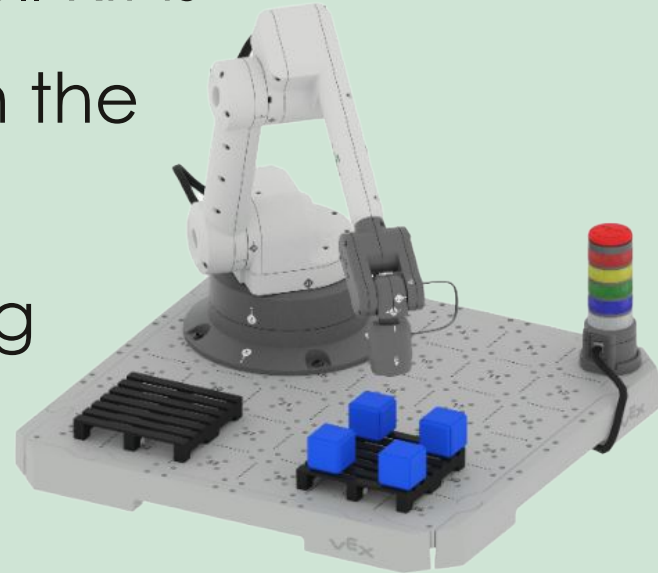
Audra Selkowitz

Senior Education Developer, VEX Robotics



Workshop Goals

- Identify what a 6-Axis Robotic Arm is
- Understand what the CTE Workcell Kit is
- Practice using the 6-Axis Arm with the Teach Pendant
- Identify how to get started coding the 6-Axis Arm in VEXcode EXP
- Move objects with the 6-Axis Arm



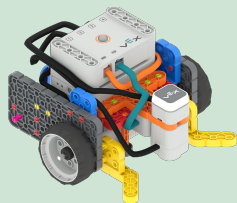
The VEX Continuum



VEX 123

Coding Starts Early

Ages 4+



VEX GO

STEM Starts Early

Ages 8+



VEX AIM

Real World Coding

Ages 8+



VEX IQ

Applied STEM Learning

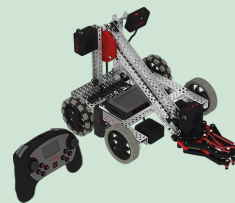
Ages 11+



VEX EXP

Real World STEM for Classrooms

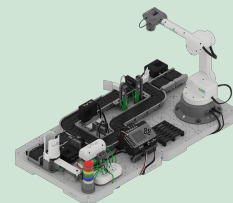
Ages 14+



VEX VS

Real World STEM for Competition

Ages 14+



VEX CTE

Workforce Readiness

Ages 14+



VEX AIR

STEM Skills Take Flight

Ages 14+

VEX CODE VR

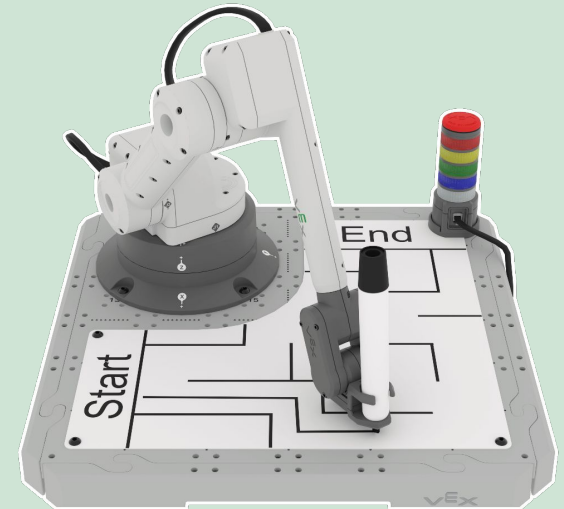
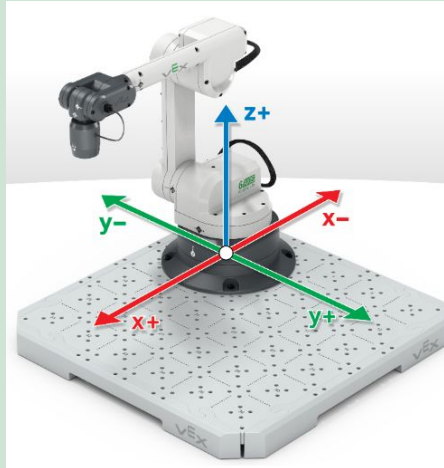
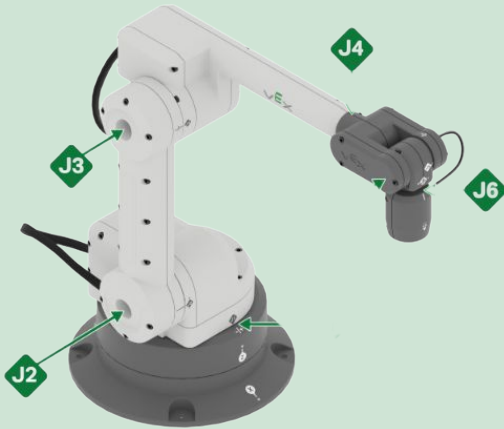
Virtual Robot Coding

Ages 8+

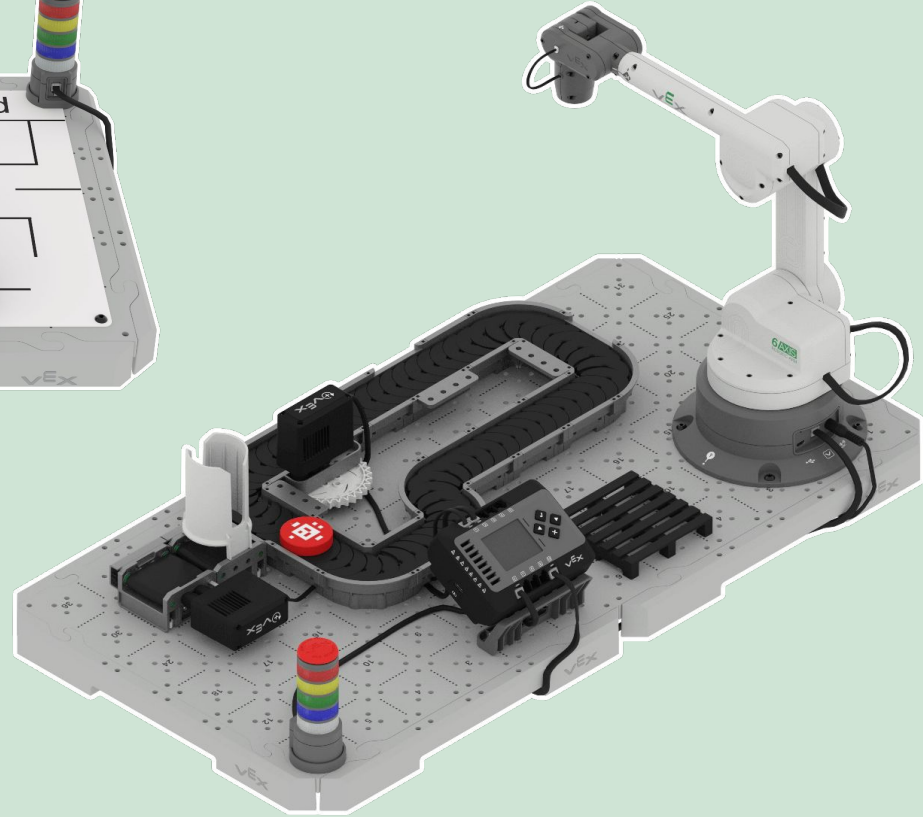
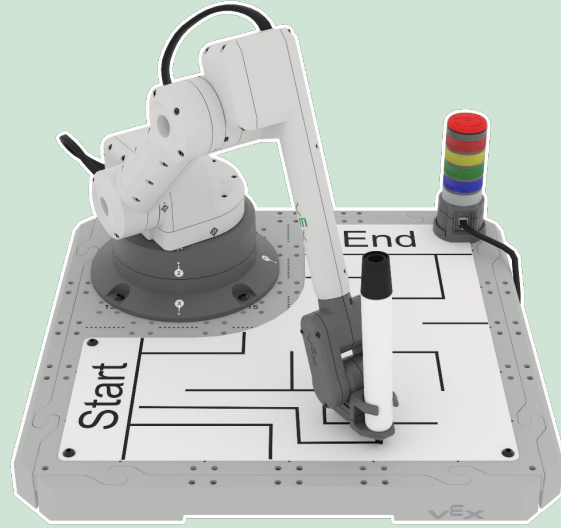
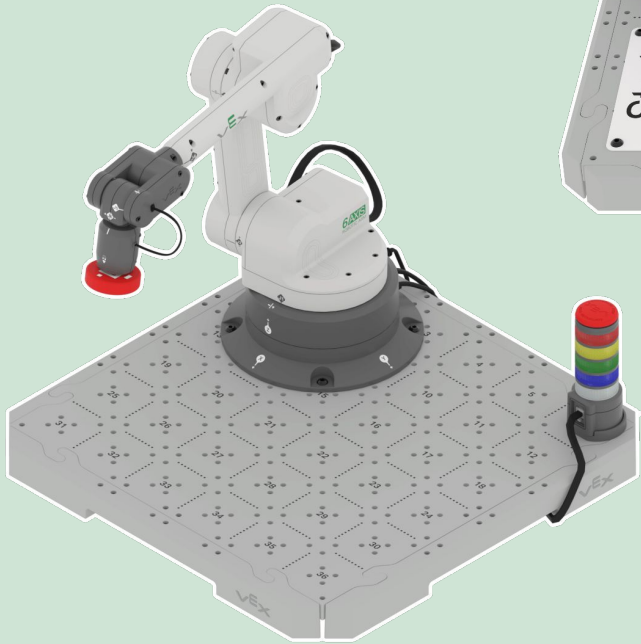


Introducing the 6-Axis Robotic Arm

- 6-Axis corresponds to 6 Degrees of Freedom
- Moves in the Cartesian Coordinate System
- 2 End Effectors — Magnet Pickup Tool and Pen Holder Tool
- Direct Connection or EXP Brain



Building up with the VEX CTE Workcell



Magnet Pickup Tool

Pneumatics

6-Axis
Robotic
Arm

Pallet
& Cubes

EXP
Brain

Signal
Tower

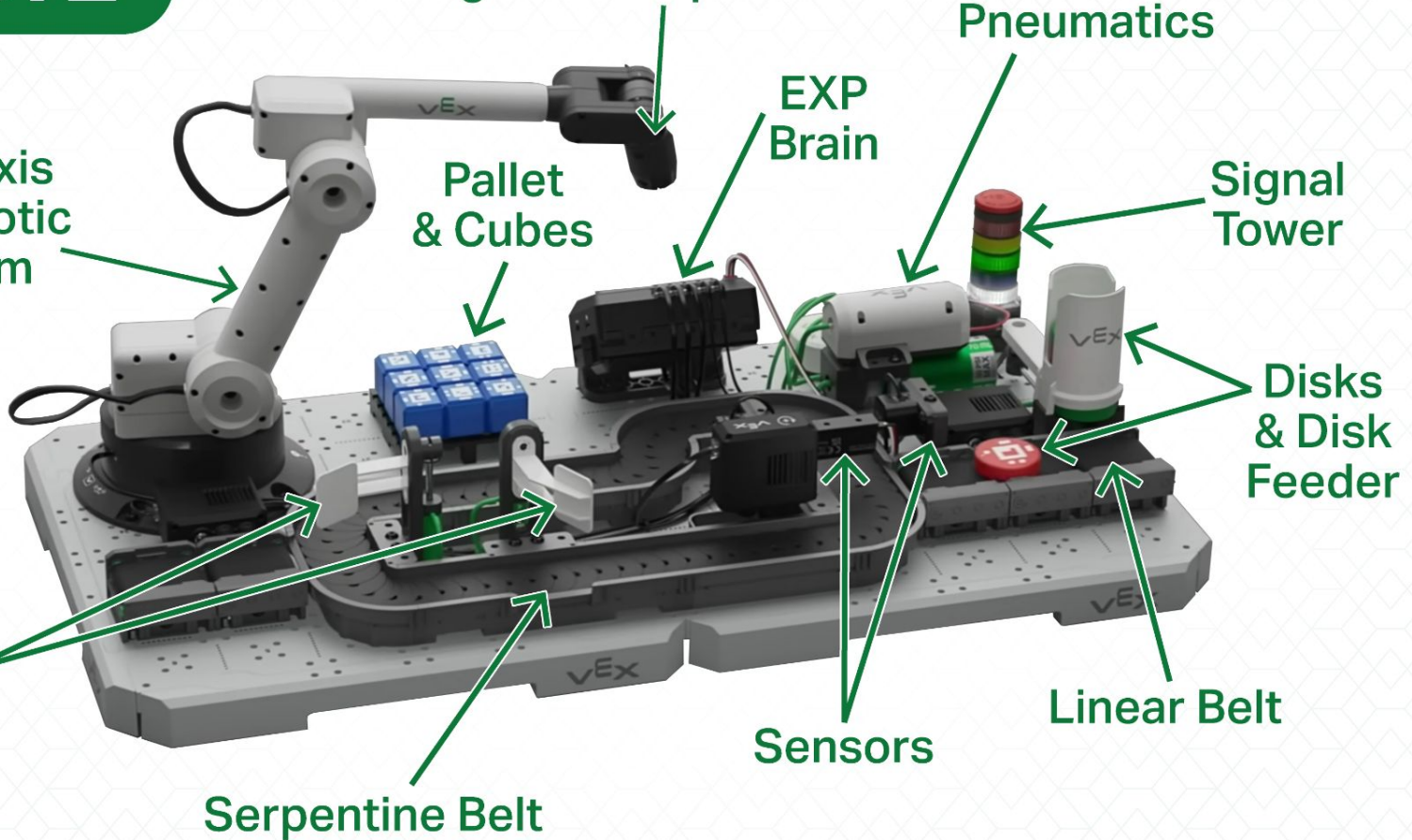
Diverters

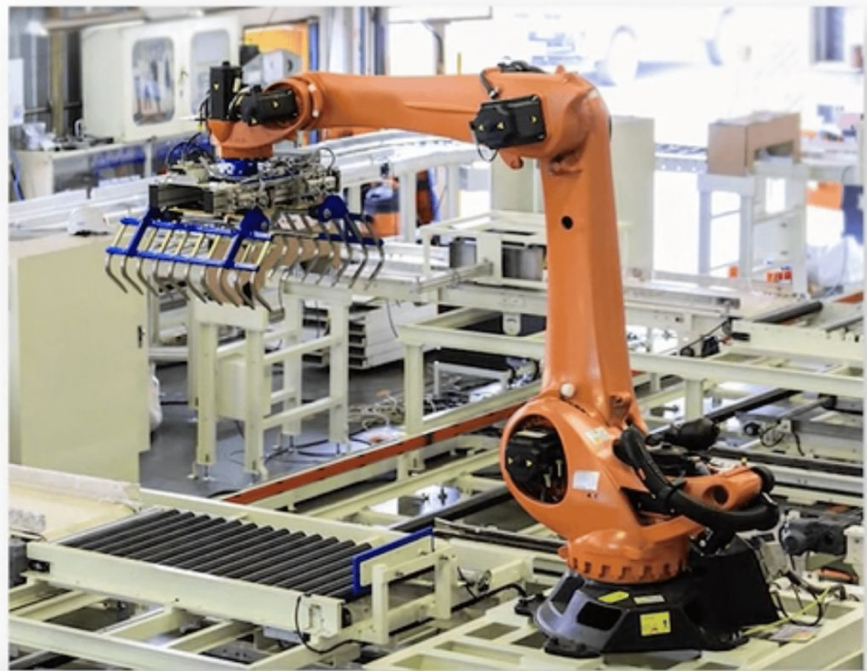
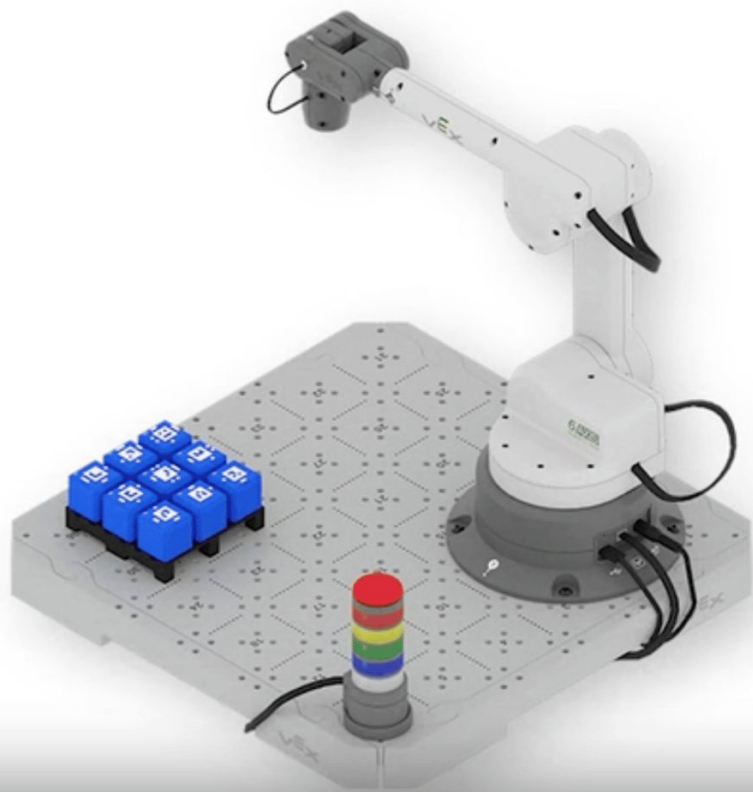
Serpentine Belt

Sensors

Linear Belt

Disks
& Disk
Feeder





21st-Century Skills

Foundational Literacies

How students apply core skills to everyday tasks



1. Literacy



2. Numeracy



3. Scientific literacy



4. ICT literacy



5. Financial literacy



6. Cultural and civic literacy

Competencies

How students approach complex challenges



7. Critical thinking/
problem-solving



8. Creativity



9. Communication



10. Collaboration

Character Qualities

How students approach their changing environment



11. Curiosity



12. Initiative



13. Persistence/
grit



14. Adaptability



15. Leadership



16. Social and cultural awareness

Lifelong Learning

Let's Get Our 6-Axis Arms Moving!

Using the VEXnet Server

VEX VEXnet Server

Everything you need to teach with VEX can be accessed directly from this local server. The VEXnet Server is ideal for classrooms, workshops, and events where internet access is limited.

Select a platform tile below to access VEXcode, curriculum, build instructions, and resources from the VEX Library and API Reference.



← Return to Home



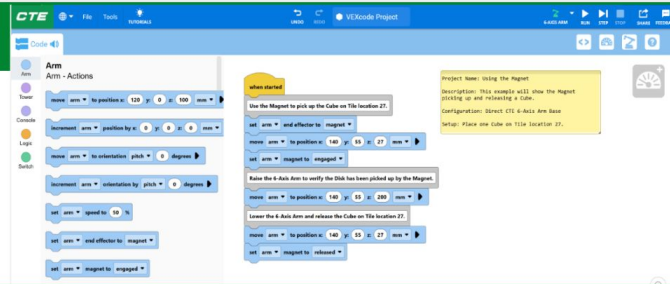
Everything you need to get started coding, teaching, building, and learning with VEX CTE is provided below.

VEXcode

Code your robot with VEXcode.

Open VEXcode EXP (web-based)




Install VEXcode EXP to your device



Curriculum

Access STEM Labs, Activities, and Activity Series to teach with VEX.

Curriculum for VEX CTE

	<p>Unit 1</p> <h3>Introduction to Robotic Arms</h3> <p>Set up the 6-Axis Robotic Arm, explore the Cartesian coordinate system, and learn about how robotic arms are used in industry.</p>
	<p>Unit 2</p> <h3>Using the Teach Pendant</h3> <p>Use the Teach Pendant to control the movement of the 6-Axis Robotic Arm as you pick up and place Disks on the CTE Tile.</p>
	<p>Unit 3</p> <h3>Coding Movements</h3> <p>The block-based coding to code the 6-Axis Robotic Arm to move along the x- and z-axes, and rotate.</p>

What is a Teach Pendant?



A Teach Pendant is...

- A common device in industrial robotics – allows a user to control a robotic arm remotely and manually
- Used to execute a series of movements, and test and refine them from a distance



**A Teach Pendant
was built into
VEXcode to offer
a scaffolded step
to learn about
how the 6-Axis
Arm moves in
space.**

The screenshot displays the 'Teach Pendant' interface with the following elements:

- Top Bar:** 'Teach Pendant' title and navigation icons (back, home, search, help, forward).
- Buttons:** 'Move to Safe Position' and 'Enable Manual Mode'.
- Status:** A field showing 'Ready'.
- Position Table:**

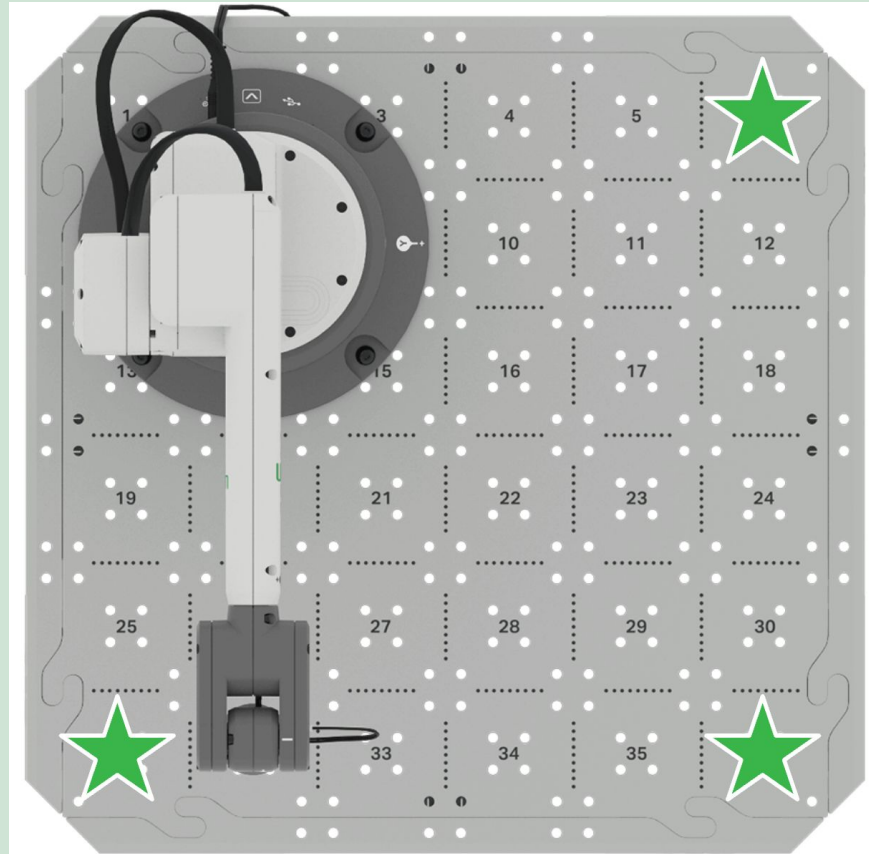
X	Y	Z
120 mm	2 mm	99 mm
- Arm Jogging:** A section with six directional buttons: '+X', '+Y', '+Z', '-X', '-Y', and '-Z'.
- Jogging Increment:** A row of buttons for movement increments: '1 mm', '5 mm', '10 mm' (selected), '25 mm', and '50 mm'.
- Move To:** A section with input fields for 'X: 200 mm', 'Y: 0 mm', and 'Z: 200 mm', followed by a 'Move to Position' button.

Moving in Manual Mode

The screenshot displays a control interface for a 6-axis arm robot. At the top, there is a navigation bar with icons for '6-AXIS ARM', 'RUN', 'STEP', 'STOP', 'SHARE', and 'FEEDBACK'. Below this is a 'Teach Pendant' section with icons for navigation, a fan, a microscope, a question mark, and a right arrow. The main control area features two buttons: 'Move to Safe Position' and 'Enable Manual Mode', with the latter highlighted by a black border. Below the buttons, the status is shown as 'Ready'. At the bottom, a table displays the current position in millimeters for the X, Y, and Z axes.

X	Y	Z
120 mm	0 mm	101 mm

Find These 3 Coordinates



Jogging the 6-Axis Arm

The image shows a screenshot of a 'Teach Pendant' interface. At the top, there are navigation icons: a left arrow, a fan icon, a magnifying glass icon, a question mark icon, and a right arrow. Below these are two buttons: 'Move to Safe Position' and 'Enable Manual Mode'. The status is displayed as 'Ready'. A table shows the current coordinates for the X, Y, and Z axes. Below the table is a button 'Add 'Move To' Block to Workspace'. The 'Arm Jogging' section contains six directional buttons: +X, +Y, +Z, -X, -Y, and -Z. The 'Jogging Increment' section has five buttons: 1 mm, 5 mm, 10 mm, 25 mm, and 50 mm.

Teach Pendant

Move to Safe Position Enable Manual Mode

Status: Ready

X	Y	Z
120 mm	1 mm	98 mm

Add 'Move To' Block to Workspace

Arm Jogging

+X +Y +Z

-X -Y -Z

Jogging Increment

1 mm 5 mm 10 mm 25 mm 50 mm

Generate a block with coordinates

Teach Pendant

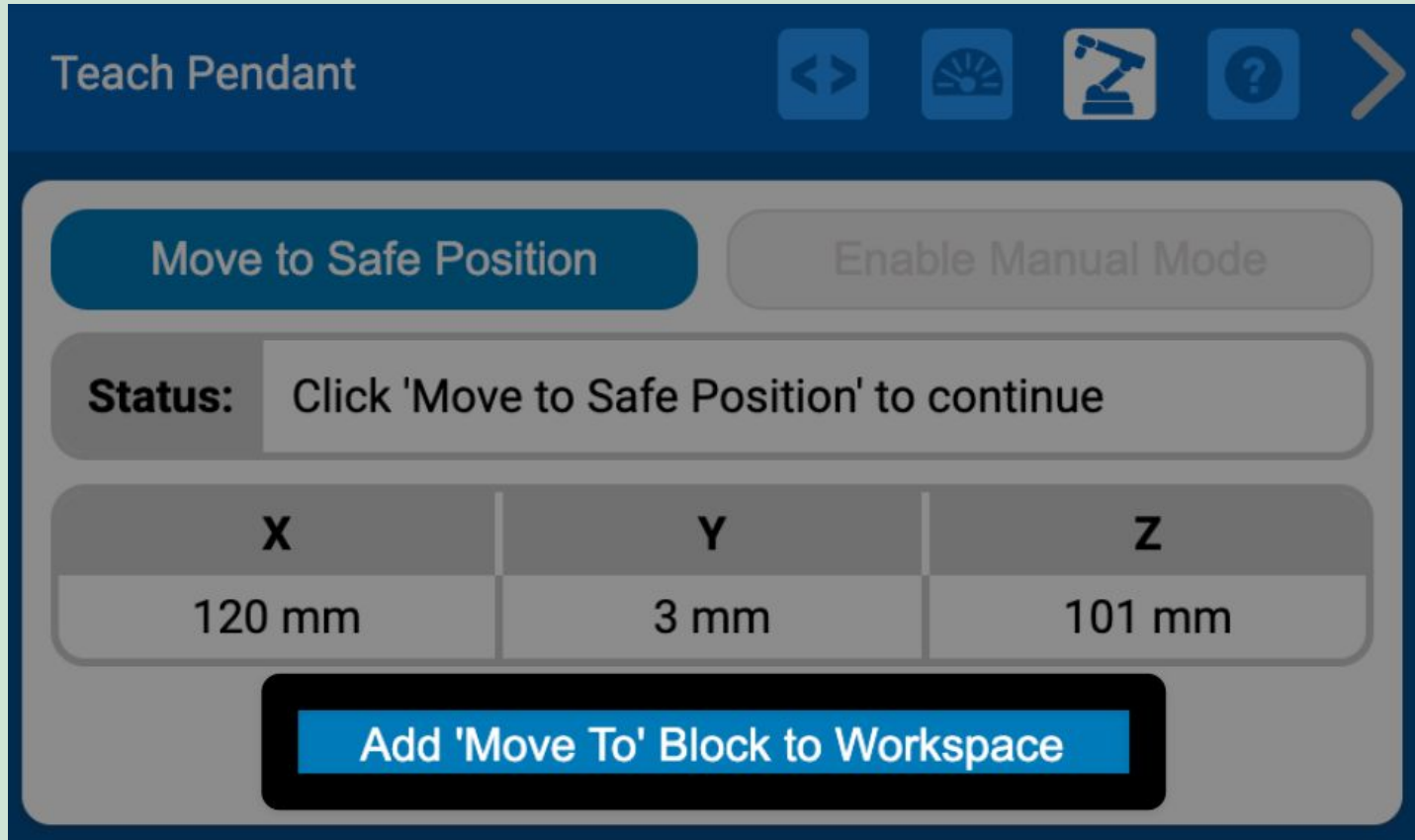
Move to Safe Position

Enable Manual Mode

Status: Click 'Move to Safe Position' to continue

X	Y	Z
120 mm	3 mm	101 mm

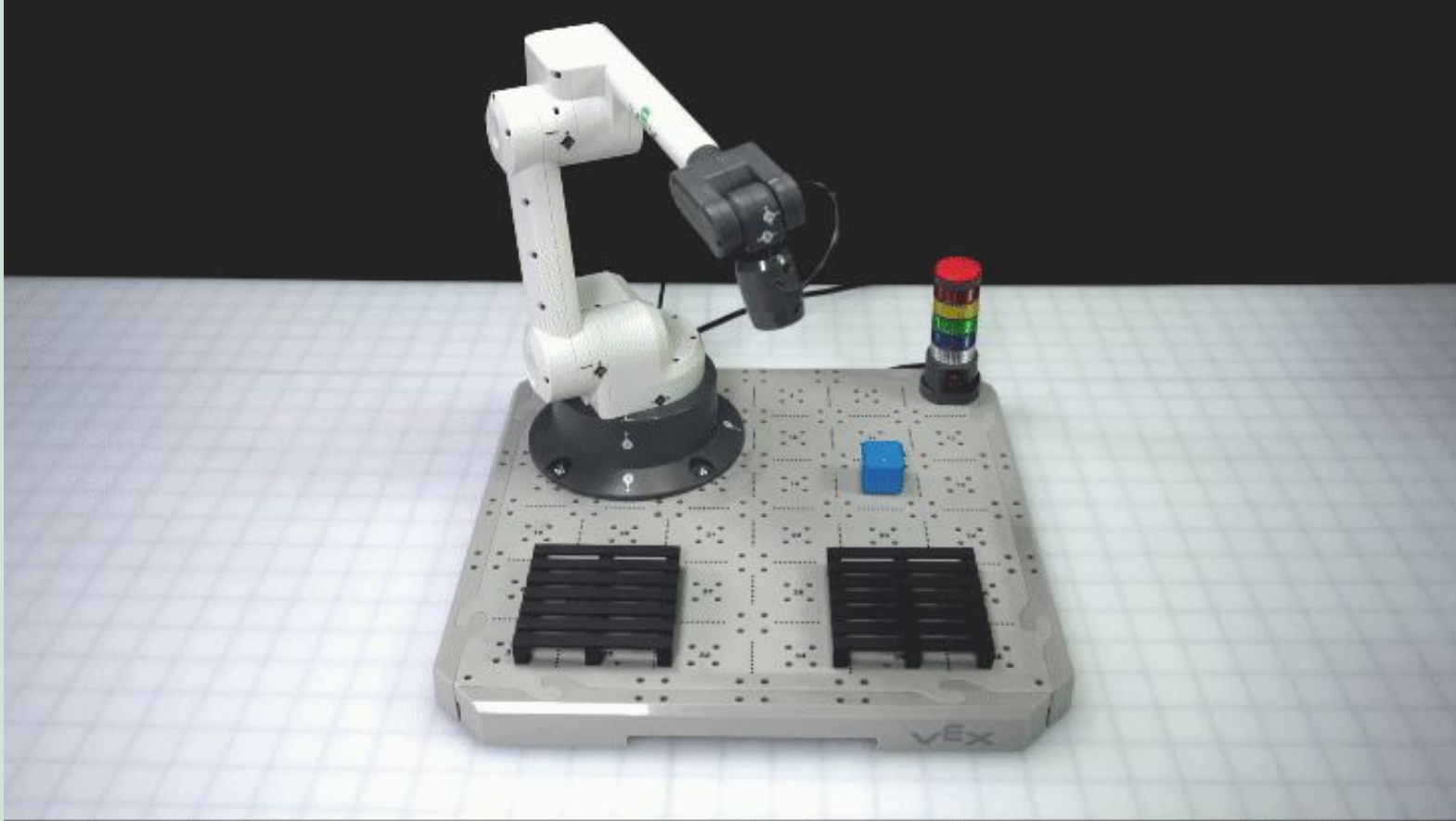
Add 'Move To' Block to Workspace

The image shows a screenshot of a 'Teach Pendant' interface. At the top, there is a dark blue header with the text 'Teach Pendant' and four icons: a double-headed arrow, a sun, a microscope, and a question mark, followed by a right-pointing chevron. Below the header is a light gray panel. On the left, there is a blue button labeled 'Move to Safe Position'. To its right is a gray button labeled 'Enable Manual Mode'. Below these buttons is a status bar with the text 'Status: Click 'Move to Safe Position' to continue'. Underneath the status bar is a table with three columns labeled 'X', 'Y', and 'Z'. The 'X' column contains '120 mm', the 'Y' column contains '3 mm', and the 'Z' column contains '101 mm'. At the bottom of the panel is a blue button with a black border labeled 'Add 'Move To' Block to Workspace'.

What do you notice about how the 6-Axis Arm moves?

- Built-in kinematics allow the 6-Axis Arm to move smoothly without complex coding
- Multiple joints enable precise positioning
- This lowers the classroom entry barrier and safely introduces students to concepts like kinematics without needing large, expensive equipment or the space to house it

Moving a Cube with a VEXcode Project

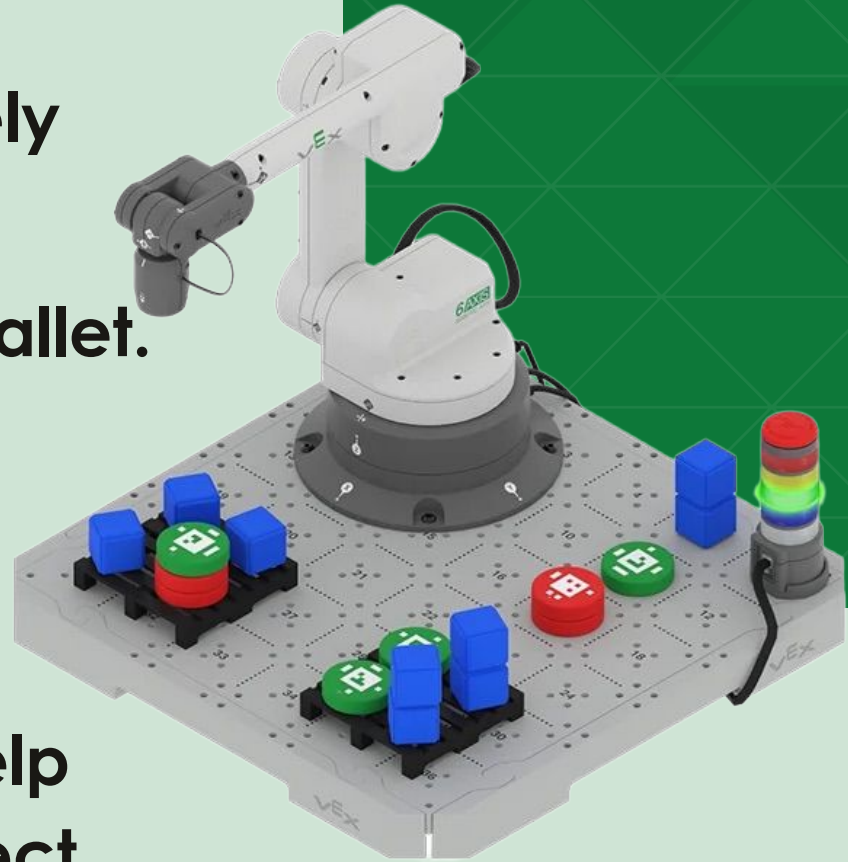


Pack n' Ship Challenge!



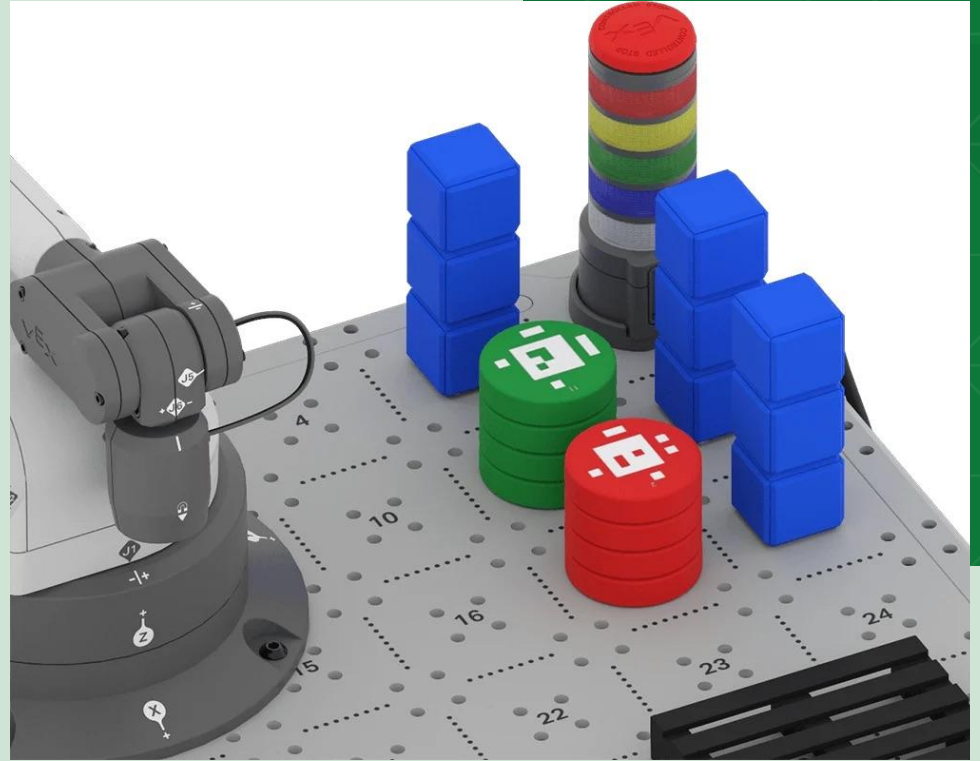
The Challenge:

- Fulfill your invoices accurately and safely.
- One invoice goes to each pallet.
- Some items will need to be stacked in order to fit on the pallet.
- Use the Teach Pendant to help you build and test your project.



Setup:

- Cubes are placed in stacks of 3 on Tile locations 5, 12, and 18.
- 4 Red Disks are placed in a stack on Tile location 17.
- 4 Green Disks are placed in a stack on Tile location 11.





Pack n' Ship Co.
123 MAIN STREET
ROBOTICS, VR 12345

Invoice

Invoice #0611

ORDERED BY
Armand Jogg
1001010 AXIS HWY
ESTOP, XY 15212

Item	Qty	Points per Item	Total Points
Cubes	6	70	420
Red Disks	1	35	35
Green Disks	1	35	35
			490



Pack n' Ship Co.
123 MAIN STREET
ROBOTICS, VR 12345

Invoice

Invoice #0333

ORDERED BY
Lenora Loop
25 OFFSET DRIVE
CONDITION, AL 27854

Item	Qty	Points per Item	Total Points
Cubes	3	70	210
Red Disks	3	35	105
Green Disks	3	35	105
			420

Wrap Up

- **How did you solve the challenge?**
 - All of the Activities and concepts we've covered today are directly from the Introduction to the 6-Axis Robotic Course.
 - Students work up to a full-scale Workcell with sensors, conveyors, pneumatics, Brain, Disk Feeder, etc. *Come on up for a demo!*

Stay Connected

Join me in the **VEX PD+ Community**

@Audra_Selkowitz

Want to Learn More? Join PD+ as an All-Access Member!

Schedule a **1-on-1 Session** in VEX PD+!