The FIRST® Robotics Competition
2022 VIRTUAL KIT CATALOG

Brought to you by XILINX®

At Xilinx, we think it’s important to celebrate the technical heroes of tomorrow and salute you as you embark on this year’s journey! Learn more about our robotic journey at xilinx.com/krs
This Voucher Catalog is a reference for your team. Inside, you’ll find additional items and value available to your team via the Kit of Parts system. Each page represents a specific voucher and its particular instructions and details. Don’t miss out on any of these opportunities.

Questions about the Kit of Parts can be sent to: frcparts@firstinspires.org

We are extremely grateful for the generosity and support that our FIRST® Suppliers provide!

More information about the Kit of Parts can be found at our website:
https://www.firstinspires.org/robotics/frc/kit-of-parts
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VOUCHER CHECKLIST
Altium is excited to support FIRST®, committed to providing every designer and engineer with tools to enable you to turn your ideas into products in the easiest and most productive way.

- Altium Designer consists of all the tools required to produce a PCB from concept to manufacturing.
- A PCB development platform supplying both the electrical and mechanical view.
- Integrated access to over a hundred suppliers makes it easy to select the best parts for your design.

To access one-year student license, fill out the form www.altium.com/frc

Special Instructions: One to five student licenses to be shared per high school team
USE ALTIVM DESIGNER FOR FREE NOW!

www.altium.com/frc
1. Go to www.armabot.com
2. Select 1 or more RS7 encoders (first unit free with this voucher)
3. Enter your valid code from the FIRST® Team Registration System
4. Enter shipping and billing information
5. Place order and wait for arrival (3-5 days in continental USA)
6. Installation instructions at www.armabot.com
7. Technology tutorial for encoder implementation at www.armabot.com

Valid for purchase of one RS7 encoder individually or a multiple product order that includes one RS7 encoder. Limit one per FIRST® Robotics Competition Team. Must be registered for the 2022 robotics season. Voucher not transferable to other people or teams.
**Technology Tutorial**

CAN bus PID tuning via Talon SRX controller.

**Quick Integration**

**Worm-Drive Clamp**
Secure and simple attachment.

**Cool Running**
Vented Design
Doesn’t interfere with motor air flow.

**Strain Relief**
Secure Wiring
Integrated feature for cable tie.

**Custom Designed Mount**

**775pro Motor Encoder**
Successful use at 2016 & 2017 Championships.
www.autodesk.com/first Your destination for robotics CAD datasets, robotics simulation, robotics design tutorials, and access to Autodesk software.

**Autodesk Fusion 360** – This 3D CAD/CAM tool for PC and Mac enables robot designs, assemblies, photorealistic renderings, fabrication, and team collaboration.

**Autodesk Inventor** – With this professional software, teams can produce 3D models that help with the design and visualization of the robot.

**Synthesis:** An Autodesk Technology – Test your CAD designs for driver practice, robot code emulation, strategy, and more with this robotics simulator.

**Autodesk EAGLE** – Bring your next spark of an idea to life with powerful PCB design software made for every engineer.

**Autodesk Tinkercad** – Use Tinkercad Circuits environment to program and simulate an Arduino board for use on your robot.

**Autodesk 3ds Max** – With modeling, rendering, and animation capabilities, 3ds Max is an ideal solution for the VRC Game Design Animation Challenge.
Create winning designs

Autodesk is excited to provide open access to our design software, digital fields, and robot part models.

Put your designs to work with our competition simulation software – created specifically for FIRST® teams – and get the robot you want on the field faster.

Get started at www.autodesk.com/first
Use your $50 voucher toward any items available at www.AutomationDirect.com

IMPORTANT INSTRUCTIONS - We cannot apply the discount AFTER you place an order!

1. Obtain your voucher code at the Mentor Dashboard at www.firstinspires.org
2. Login, OR create a New Account here: www.automationdirect.com/new-user
3. Then visit www.automationdirect.com/Voucher to enter the voucher code. This will enable a one-time $50 credit for your account.

Some Restrictions Apply:
1. Orders must be placed online. No ‘call-in’ orders. Stock items ordered by 6:00pm EST will ship via 2-day service.
2. Orders must ship to a US or Canadian address. Credit card billing address must also be US or Canadian.
3. The voucher cannot be used towards shipping fees. Orders under $49 are shipped via 2-day service to US addresses for a flat rate of $10 (a credit card will be required to pay for shipping). Orders to Canada will incur brokerage fees. Larger orders may qualify for FREE two-day shipping. See website for details: https://www.automationdirect.com/static/specs/adpolicy.pdf

This voucher cannot be used to pay sales tax. A credit card (or PayPal) will be required to pay any applicable taxes. If your team/organization is tax exempt, you can submit appropriate documentation online during checkout.
These items are popular with FIRST® teams:

- Miniature Pneumatic Devices: go2adc.com/fittings
- Pneumatic Cylinders: go2adc.com/cylinders
- Belts & Pulleys: go2adc.com/tbp
- Ferrules, Terminals, and Crimp Tools: go2adc.com/zfewire
- Ethernet Cables (and crossovers!): go2adc.com/cat5e
- Wire Ties: go2adc.com/sapiselco
- Sensors and Encoders: go2adc.com/sensenco
- Push connect fittings: go2adc.com/ptcfittings

New Colors!
Congratulations on the many successes you have achieved to earn your team a position in the 2022 FIRST® Robotics Competition!

As long-time supporters of the FIRST® organization, and the new generation of pneumatic enthusiasts, Clippard is happy to provide you with a complimentary AIR VOLUME TANK (#AVT-PP-35) found in your kit of parts.

In addition, we are proud to provide you with an additional $20.00 of FREE Clippard products for your design needs. Simply visit clippard.com to select your products, and use the promotional code above at check out.

PLEASE NOTE: YOU MUST CREATE AN ACCOUNT AND BE LOGGED IN FOR THE VOUCHER TO BE VALIDATED.

If you need technical assistance, don’t hesitate to contact us at 1-877-245-6247.
Air Cylinders • Pressure Controls • Directional Control Valves
Electronic Valves • Control Valves • Isolation Valves • Pinch Valves
Manual Valves • Fittings • Air Preparation Equipment
Tubing • Custom Valves & Assemblies

PRECISION FLOW CONTROL PRODUCTS & SOLUTIONS
www.clippard.com
Digi-Key is proud to provide you with $50 of components.

- Visit www.digikey.com/first to redeem your team’s voucher.
- The $50 voucher will not display on the total of your order, but will be subtracted from your order during processing.
- This Product Donation Voucher valued at $50 is good for the purchase of components only at www.digikey.com

Taxes not included. This voucher is good for a one time use. Any amount not utilized in your initial transaction will be forfeited.
Digi-Key has the product portfolio, service, tools, resources, and know-how to support students, coaches, and mentors on FIRST® teams.

REDEEM YOUR VOUCHER IN 3 EASY STEPS!
• Visit digikey.com/first
• Enter your team info
• Shop at digikey.com

VISIT US ONLINE TO ACCESS OVER 2.2 MILLION PRODUCTS IN STOCK, RESOURCES, AND MORE AT:

Digi-Key has the product portfolio, service, tools, resources, and know-how to support students, coaches, and mentors on FIRST® teams.

VISIT US ONLINE TO ACCESS OVER 2.2 MILLION PRODUCTS IN STOCK, RESOURCES, AND MORE AT:

DIGIKEY.COM

*Free Shipping offer does not apply to Marketplace products.
**FIRST® teams can request a license of DriveWorks Solo Design Automation Software for a period of one (1) year.**

DriveWorks Solo allows engineers and students to quickly and easily create and configure variations of your SOLIDWORKS models directly inside of SOLIDWORKS. DriveWorks Solo is a powerful SOLIDWORKS Automation Tool. It allows teams to automate their SOLIDWORKS parts, assemblies and detailed drawings.

- Control Dimensions, features, custom properties, advanced feature parameters, instances and file formats.
- Dynamically replace components.
- Create a library of components using intelligent file reuse.

**Key benefits of DriveWorks Solo**

- Capture and re-use your design knowledge
- Incorporate design rules to reduce errors and rework, and improve product quality
- Automate repetitive tasks to reduce design time
- Liberate students and mentors to focus on quality variations of robot design.

**How does our FIRST® Robotics Competition Team request a license of DriveWorks Solo?**

Please visit https://www.driveworks.co.uk/education/first/ to submit your request for a license of DriveWorks Solo. Once on the website, you will be asked to complete and submit a “Request a License” form. Upon completion of this form, we will review for completion, process and once approved you will receive detailed instructions on how to download and install the software.

Valid for one (1) license of DriveWorks Solo requested by the Team Leader. License includes access to FREE online learning resources which include DriveWorks Solo Online Training webinars, How to Videos, Help Files and other learning resources. Product support and assistance provided to Team Leader by DriveWorks Ltd. via email to first@driveworks.co.uk. Must be registered for the 2022 Robotics Season. License is non-transferable to another team.

**Questions?**

Contact us at first@driveworks.co.uk
Powerful Design Automation for SOLIDWORKS®

FIRST® Robotics Competition Teams can get a free 12 month license of DriveWorks Solo

Automate repetitive SOLIDWORKS tasks & free up students & mentors to focus on quality robot design.

Follow us on Instagram @driveworksconfigurator

www.driveworks.co.uk/education/first
Mastercam Educational Suite: one free license of the current version of the Mastercam Educational Suite. The Mastercam Educational Suite includes Mill, Lathe, Wire, Router, Design, Art, and Mastercam For SOLIDWORKS.

Please go to www.mastercam.com/community/competitions/first-robotics/
Please fill out the required information on the registration page. Once we receive your request, an email will be sent with your activation code and instructions on downloading Mastercam.
MATLAB and Simulink allow students/participants to simulate robots, develop control and navigation algorithms, and optimize their mechanical designs. Please visit our website to request access to MathWorks software as well as find other resources available to FIRST® teams:

- Software license to over 50 products, including:
- Links to free, 2-hour online courses to get started with MATLAB and Simulink
- Tutorials, videos, and examples for students participating in robotics competitions

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<thead>
<tr>
<th>Organization Name</th>
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<tr>
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<td>MathWorks Resources for FIRST® Teams</td>
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<tr>
<td>Website</td>
<td>mathworks.com/first-robotics</td>
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function Lout = membrane(k,m,n,np)
%MEMBRANE Generate MathWorks's logos.
%
% L = MEMBRANE(k), for k <= 12, is the k-th eigenfunction of
% the L-shaped membrane.  The first three eigenfunctions have
% been shown on the covers of various MathWorks publications.
%
% MEMBRANE(k), with no output parameters, plots the k-th eigenfunction.
%
% MEMBRANE, with no input or output parameters, plots MEMBRANE(1).
%
% L = MEMBRANE(k,m,n,np) also sets some mesh and accuracy parameters:
%   k = index of eigenfunction, default k = 1.
%   m = number of points on 1/3 of boundary.  The size of
%       the output is 2*m+1-by-2*m+1.  The default m = 15.
%   n = number of terms in sum, default n = min(m,9).
%   np = number of terms in partial sum, default np = min(n,2).
%   With np = n, the eigenfunction is nearly zero on the boundary.
%   With np < n, like np = 2, the boundary is not tied down.
%
% Out-of-date reference:
% Cleve Moler 4-21-85, 7-21-87, 6-30-91, 6-17-92;
% Copyright (c) 1984-94 by The MathWorks, Inc.

if nargin < 1, k = 1; end
if nargin < 2, m = 15; end
if nargin < 2 & isstudent, m = 10; end
if nargin < 3, n = min(m,9); end
if nargin < 4, np = min(n,2); end
if k > 12
    error(ÔOnly the first 12 membrane eigenfunctions are available.Õ)
end
lambda = [9.6397238445, 15.19725192, 2*pi^2, 29.5214811, 31.9126360, ...
          41.4745099, 44.948488, 5*pi^2, 5*pi^2, 56.709610, 65.376535, 71.057755];
lambda = lambda(k);
sym = [1 2 3 2 1 1 2 3 3 1 2 1];
sym = sym(k);

% Part of the boundary in polar coordinates
theta = (1:3*m)Õ/m * pi/4;
r = [ones(m,1)./cos(theta(1:m)); ones(2*m,1)./sin(theta(m+1:3*m))];

% if sym = 1, alfa = [1 5 7 11 13 17 19 ... ] * 2/3, (odd, not divisible by 3)
% if sym = 2, alfa = [2 4 8 10 14 16 20 ... ] * 2/3, (even, not divisible by
% 3)
% if sym = 3, alfa = [3 6 9 12 15 18 21 ... ] * 2/3, (multiples of 3)
alfa = sym;
del = sym + 3*(sym == 1);
for j = 2:n,
    alfa(j) = alfa(j-1) + del;
    del = 6-del;
end;
alfa = alfa * 2/3;

% The desired coefficients are the null vector.
% (lambda was chosen so that the matrix is rank deficient).
[Q,R,E] = qr(A);

% Now evaluate the eigenfunction on a rectangular mesh in the interior.
mm = 2*m+1;
x = ones(m+1,1)*(-m:m)/m;
y = (m:-1:0)Õ/m*ones(1,mm);
r = sqrt(x.*x + y.*y);
theta = atan2(y,x);
theta(m+1,m+1) = 0;
S = zeros(m+1,mm);
r = sqrt(lambda)*r;
for j = 1:np
    S = S + c(j) * besselj(alfa(j),r) .* sin(alfa(j)*theta);
end
L = zeros(mm,mm);
L(1:m+1,:) = triu(S);
if sym == 3, L = L + LÕ - diag(diag(L)); end
if sym == 2, L = L - LÕ; end
if sym == 3, L = L + LÕ - diag(diag(L)); end
L = rot90(L/max(max(abs(L))),-1);

if nargout == 0
    x = -1:1/m:1;
surf(x,xÕ,L)
colormap(cool)
else
    Lout = L;
end

MathWorks is a proud supporter of student competitions that inspire learning and advance education in engineering, science, and math

Learn more at mathworks.com/academia/student-competitions
Attention FIRST® Robotics Competition Teams:

1. Be sure to email sales@nextgenrobots.com with your Lead Mentor Name, FIRST Robotics Competition Team Number, and PDV Code found on the FIRST Robotics Competition Team Registration System so that we can make sure that your code is active!

2. Once confirmed, enter the team’s assigned code from step 1 into “Coupon code” on your order and the discount will appear during checkout. Do not “Checkout as guest”.

3. This coupon can be redeemed for one CIM Cooler 180 (an $8.00 value) or one 775 Cooler 360 (an $8.00 value) but products can be purchased in any combination and multiple amounts of the CIM Cooler or the 775 Cooler. After applying the coupon code during checkout, the total will be less $8.00. Before submitting the order make sure the discount has been applied to the total. If the discount is not showing, try clicking “view cart” and reapply the code.

Organization Name | Next Gen Robots
Voucher Detail | 1 CIM Cooler 180 or 775 Cooler 360
Expiration Date | 05/31/2022
Shipping | Team Responsibility
Access Code(s) | Visit Team Registration Account (Lead Mentor 1 or 2)
Website | www.nextgenrobots.com
This license also provides access to more than a dozen LabVIEW add-ons, NI Multisim for SPICE simulations, and NI Ultiboard for PCB design.

1. Access Your Team’s Serial Number
Have your Lead Mentor 1 or 2 log in to your team’s account at www.firstinspires.org to access your serial number by clicking on “Passwords/Voucher Codes.”

2. Download Software
Get NI LabVIEW for FIRST Robotics Competition via the FIRST Robotics Competition Resource Hub at www.ni.com/frc

3. Learn and Earn
Learn LabVIEW with free online training and earn skills badges at www.ni.com/frc
National Instruments is now NI.

At NI, we believe in the power and potential of making connections—between people, ideas, and technology—to create a path forward.

It’s time. Let’s Engineer Ambitiously.
OneIPM is pleased to provide complimentary use of our cloud-based Project/Task Management and Product Structure Explorer solution for all FIRST® teams.

OneIPM is an Onshape add-in that provides innovative visuals of your Onshape documents and assemblies, helping teams better understand design intent, while also managing all your project related tasks with complete associativity to your CAD documents.

To access OneIPM:
- Create an account in Onshape at onshape.com
- Subscribe to the free trial of OneIPM in the Onshape app store at appstore.onshape.com
- Extend your free trial of OneIPM for the entire season at oneipm.com/first/

For detailed information and step-by-step instruction, please visit: oneipm.com/first/ Best wishes for a great season!
Manage all your projects and tasks *within* Onshape

*Link* tasks directly to documents, parts, assemblies, drawings...

Visualize product structure with OneIPM’s innovative *tree and node views*

Gain insight into design intent using part *version history* viewer
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</table>

Free access to the Onshape Education Plan and full access to the Learning Center.

Visit the FIRST Onshape webpage for information and resources: https://www.onshape.com/edu/frc

Email comments or questions: FIRST@ptc.com
Access to the following PTC Software:

- **Vuforia Chalk** – Application to facilitate AR remote assistance between team members
- **Onshape** – Cloud-based 3D CAD software
- **Creo** – 3D CAD software
- **Mathcad** – Software for engineering calculations

Visit the FIRST PTC webpage for more information: [https://www.ptc.com/en/academic-program/student/first](https://www.ptc.com/en/academic-program/student/first)

Send comments or questions to FIRST@ptc.com
Receive $50 towards any product on www.revrobotics.com

Enter the code you receive as a “gift certificate” at checkout.

More instructions will be posted to http://www.revrobotics.com/frc-voucher/

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<tr>
<th>Organization Name</th>
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<td>Voucher Value</td>
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<tr>
<td>Website</td>
<td><a href="http://www.revrobotics.com">www.revrobotics.com</a></td>
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Proud supporters of FIRST® Robotics Competition

Custom robot parts-designed for FIRST® students, by FIRST® mentors.

Motors, Structure, Electronics, and more: www.revrobotics.com
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<tr>
<th>Organization Name</th>
<th>RoboPromo</th>
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<tr>
<td>Voucher Detail</td>
<td>FIRST® Iron-On Bumper Logos (set of 8)</td>
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<td>Expiration Date</td>
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<td>Access Code</td>
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<tr>
<td>Website</td>
<td><a href="http://www.robopromo.com">www.robopromo.com</a></td>
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</table>

**Instructions:**

- Go to www.robopromo.com and enter access code LOGO22 at checkout (include team number) to receive (1) pack of (8) iron-on logos: 3.75” x 5”
- Available to FIRST® Robotics Competition Teams only.
- Available 01/08/22 (one order per team)
To access your free license of Solid Edge 3D CAD, Solid Edge Simulation, and PADS Professional software visit [www.siemens.com/firstrobotics](http://www.siemens.com/firstrobotics), and download your software in minutes. You’ll also find a library of tutorials that will help you to accelerate your design phase, as well as an opportunity to take the Solid Edge certification exam free of charge. Siemens also invites all FIRST® teams who are using SIEMENS software to apply for funding. Criteria for funding is detailed on our FIRST resource page, and made available on a first-come, first served basis. [www.siemens.com/firstrobotics](http://www.siemens.com/firstrobotics)

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<th>Organization Name</th>
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<tr>
<td>Voucher Detail</td>
<td>Siemens software, training, tutorials, and certification exam for Solid Edge and NX applications</td>
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</table>
| Websites          | [www.siemens.com/FIRSTRobotics](http://www.siemens.com/FIRSTRobotics)  
                      [www.siemens.com/plm/solidedgecertification](http://www.siemens.com/plm/solidedgecertification) |
Looking for a competitive advantage this season? Try designing your robot in 3D CAD!

Download Siemens Solid Edge® Software for students today! Solid Edge is powerful, easy-to-learn, fun to use and free of charge.

Quickly learn how to design in Solid Edge with our self-paced online tutorials. And once you become proficient, be sure to take advantage of Solid Edge certification. Visit www.siemens.com/plm/solidedgecertification to register for certification.

Download your license of Solid Edge today: www.siemens.com/firstrobotics
With this voucher, your team will receive one free individual annual membership to SolidProfessor ($490 value).

This membership will give you access to online CAD and CAM courses that will help your team become more effective design engineers. Each course includes bite-sized video lessons, practice exercises, and short quizzes that will make learning CAD and CAM easier than ever! Plus, when students successfully complete a course, they can show off their new skills by earning a Technical Certificate.

To access your free membership:
1. Visit the SolidProfessor FIRST® Robotics web page and complete the short form.
2. Within a week, a SolidProfessor team member will set up your free membership and reach out to you at the email address provided with information about how to access your account.
1-Year SolidProfessor Membership

Voucher available for FIRST® teams in the 2022 Virtual Kit of Parts. Access online CAD training today!
Dassault Systèmes SolidWorks Corporation wants to help you develop the engineers and innovators of tomorrow. That is why we are pleased to sponsor your FIRST® team.

Student teams now have the choice of using our SOLIDWORKS desktop product, which includes over twelve powerful design, and engineering products. OR the 3D EXPERIENCE platform, a cloud-based portfolio of integrated tools and apps. Teams can apply for both sponsorships separately if they choose.

To request SOLIDWORKS Desktop visit: solidworks.com/studentchallenges
To request 3D EXPERIENCE Platform visit: edu.3ds.com/challenges
Complimentary access to Tableau Desktop data analysis and visualization, and Tableau Prep for data preparation. 

Visualize your data. Quickly answer questions. Play better defense, pick alliance partners, analyze robot performance, target your fundraising, and reduce inventory waste.

- Use the product code found in your Lead Mentors’ 1 and 2 FIRST® registration accounts for five activations per team.
- Don’t forget to check out Tableau’s free online resources (https://www.tableau.com/first-robotics) created specifically for FIRST® Robotics Competition students.

These access codes are for educational use only. Please do not share your key with anyone outside your team.
Tableau Desktop is free for FIRST® Robotics Competition students.
We are offering six constant force springs to each team participating in the competition. Mix and Match any springs from our constant force stock offering. The offer also includes free shipping within the USA and Canada! Orders are limited to 1 per team per year.
Sharing Spring Solutions with FIRST® Robotics Competition Since 2007

Phone: 215-721-1721 | 501 Schoolhouse Road, Telford, PA 18969
To claim your software, visit www.wolfram.com/firstrobotics

Students: Please use the screencast code “FRCSTU53SYSW1PR2022” and complete the team name and coach name fields in the form.

Coaches: Please use “FRCOACH54SYSW1PR2022” as the screencast code in the form.

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