Introduction to LabVIEW for FRC

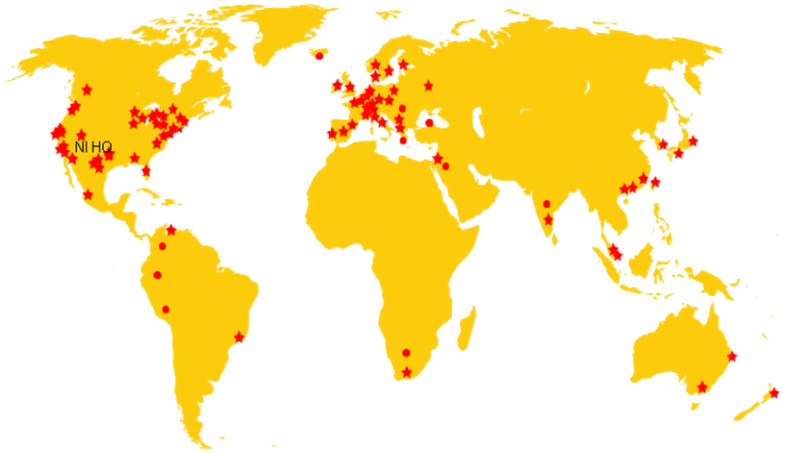
Part 1 - What you don't know you don't know

Robotics Academy

West Vancouver School District, West Vancouver

LabVIEW Usage in Universities

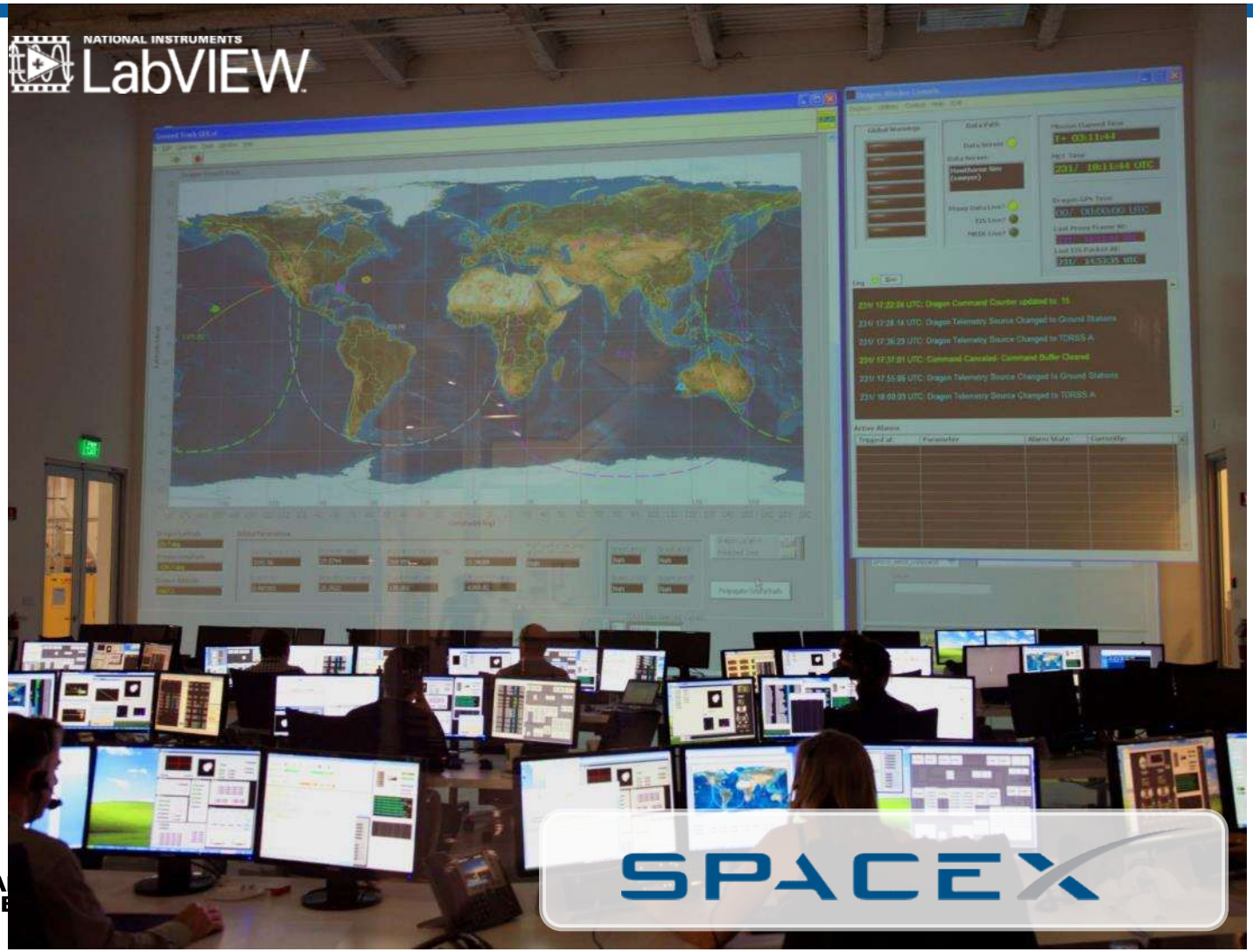
110
Countries
7000+
Universities



NATIONAL INSTRUMENTS

Companies that use LabVIEW

More than 35,000 companies use NI Tools


NATIONAL INSTRUMENTS
LabVIEW
SPACEX

The 4 Stages of Learning

1. Unconscious Incompetent
2. Conscious Incompetent
3. Conscious Competent
4. Unconscious Competent

NATIONAL INSTRUMENTS

Software Considerations: VEX Vs. FRC

VEX – entire 1010 team has	FRC – entire team has
many (23+) robots	1 robot
many (23+) programmers	multiple programmers
many (23) GitHub repositories	1 Github repository

How would you write code?

What changes would you need to make in how you work?

Think about it……..

NATIONAL INSTRUMENTS

Programming in a Group

1. Split up portions of code such that everyone can program efficiently.

2. Select the ***Team Integrator***.

   TI: combines all code written by the team into the final program.

   TI: communicates with programmers to ensure all code can work together effectively.

3. Ensure each workload is realistic.

   Certain portions of the project require more work than others.

   For eg: ***TI*** typically has a larger workload.

Readme.md

What to put in Readme.md?

- Team Members: Names/functions/assignments
- Descriptions of files/folders in the GitHub Repository
- Links to Tutorials / Resources
- Learn **Markdown** ! ! (that's why its *.md file)
- For example, Huskie Robotics, FRC-Team2655

NATIONAL INSTRUMENTS

A direct relationship exists between LabVIEW development style and

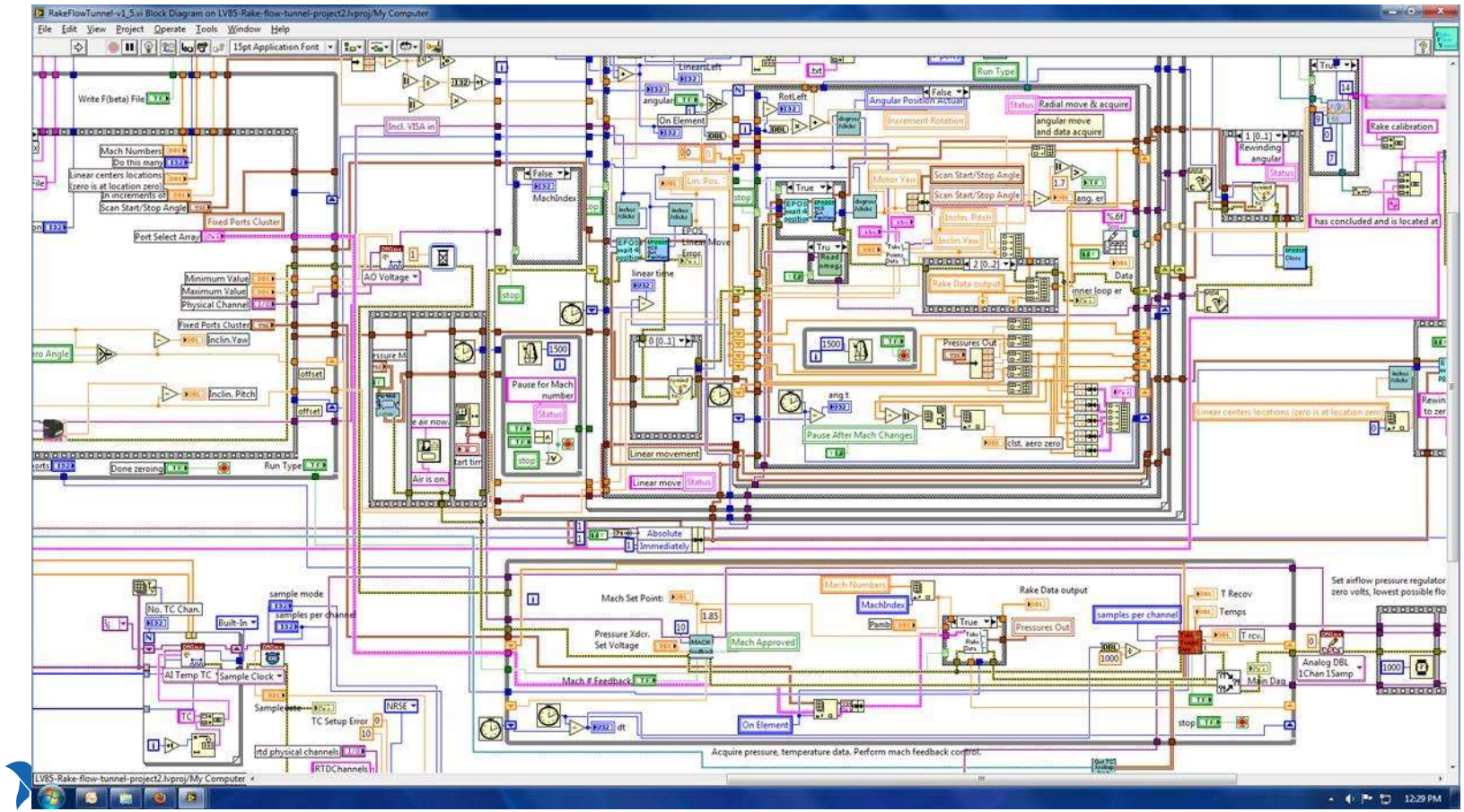
- Ease of use
- Readability
- Maintainability
- Efficiency
- Reliability
- Simplicity
- Performance
- Development time
- Standards
- Certifications
- Productivity

LabVIEW Style Checklist

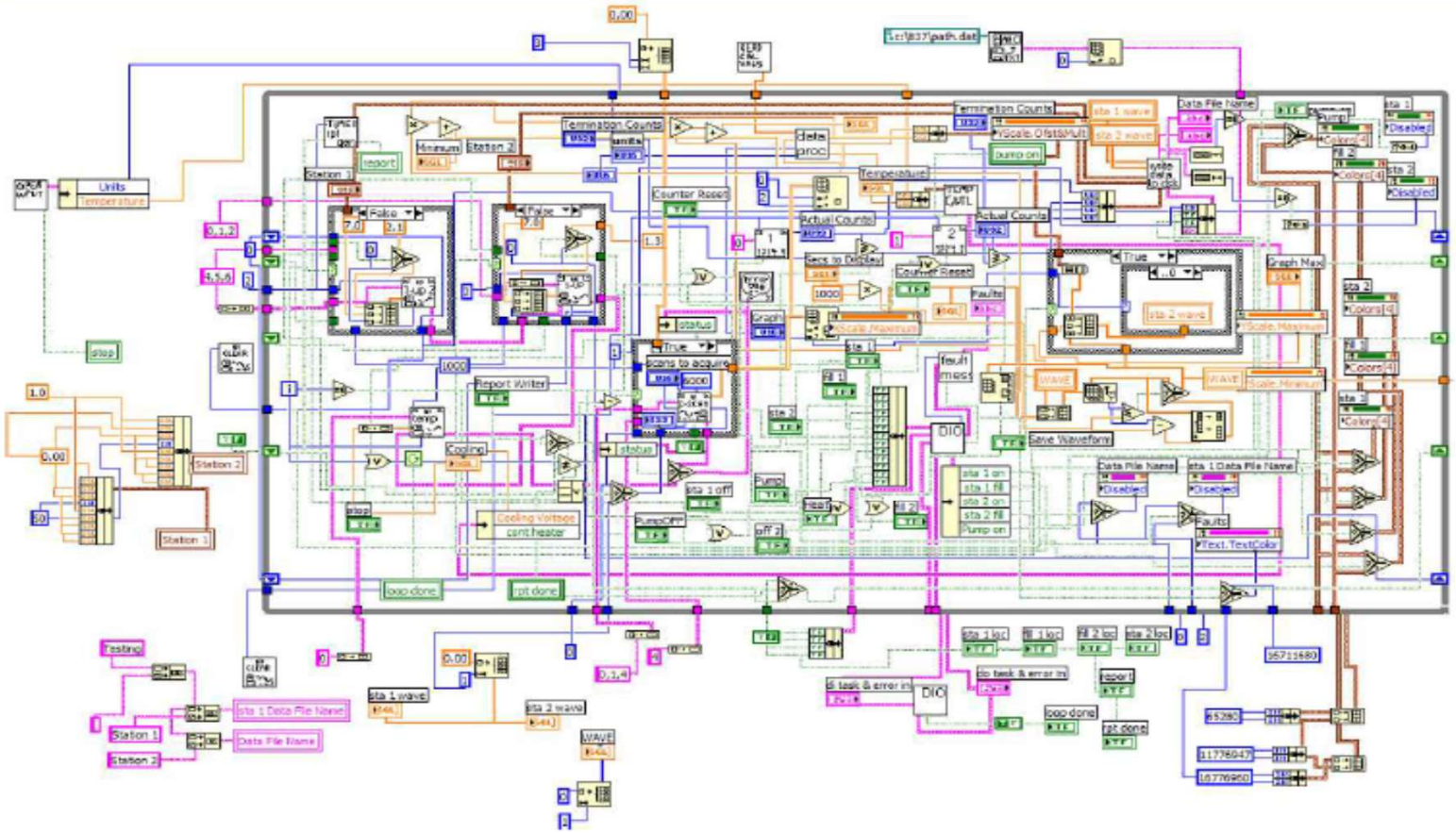
- Use *spaces between words* in a label (variable). Keep it consistent!
- Label *shift registers* and *long wires*
  Eg: long wires that span the entire block diagram.
- Verify that *data flows from left to right*, and that wires enter from the left and exit to the right.
- Use the *Bundle by Name* and *Unbundle by Name* functions when you access clusters. Avoid using the unnamed Bundle and Unbundle functions.

NATIONAL INSTRUMENTS

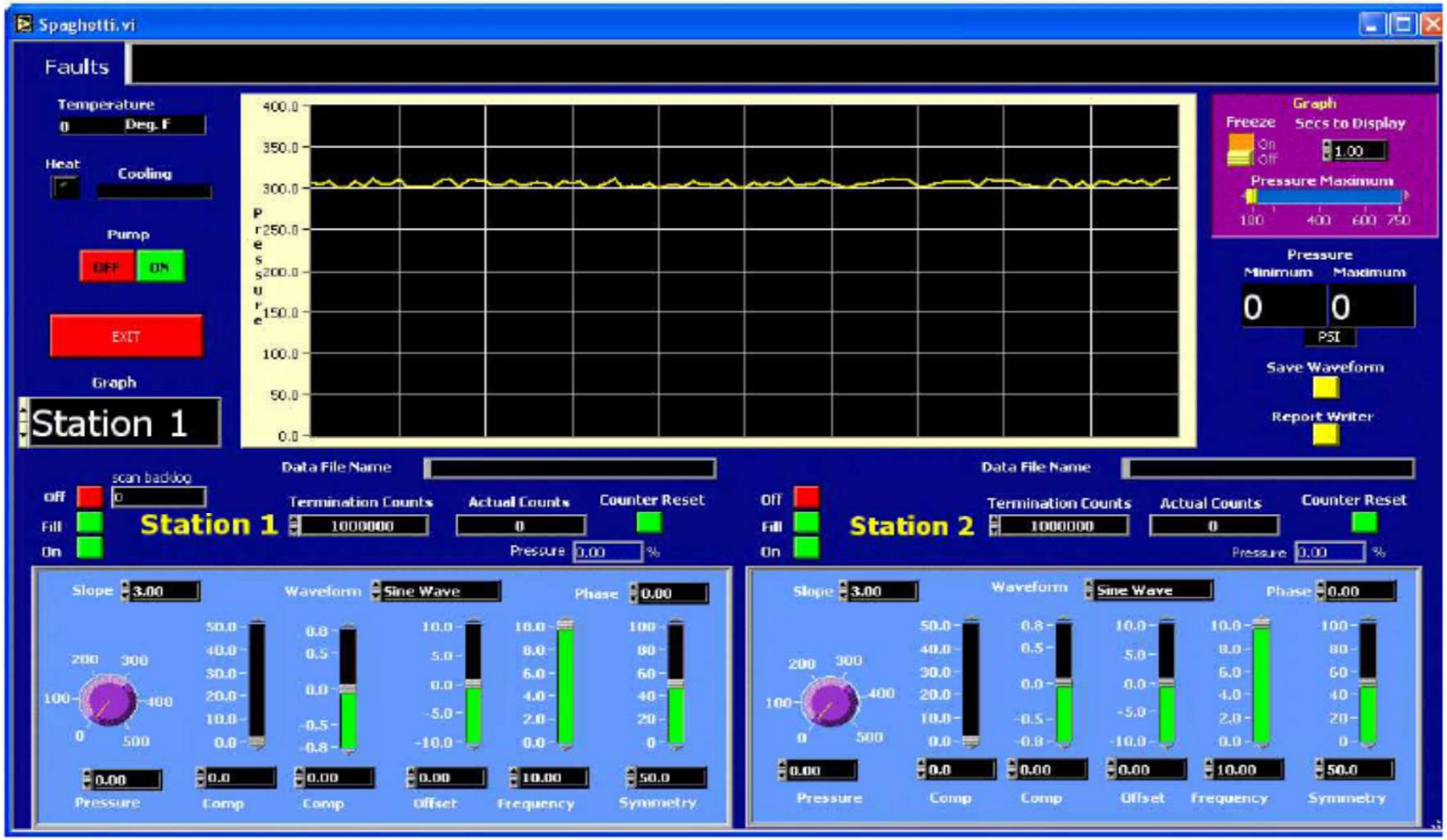
LabVIEW Spaghetti Code – Messy Block Diagram



Spaghetti VI - Diagram



Spaghetti VI - Panel



And now…..

……on to LabVIEW

- Bring up LabVIEW
- Open up a new Blank VI

NATIONAL INSTRUMENTS

Test your LabVIEW Skills…..

Easy: Write a VI for a **stopwatch**.

START button starts the timer.

STOP button stops the timer.

RESET button resets the timer.

Medium: Write a VI For a **7-segment display**

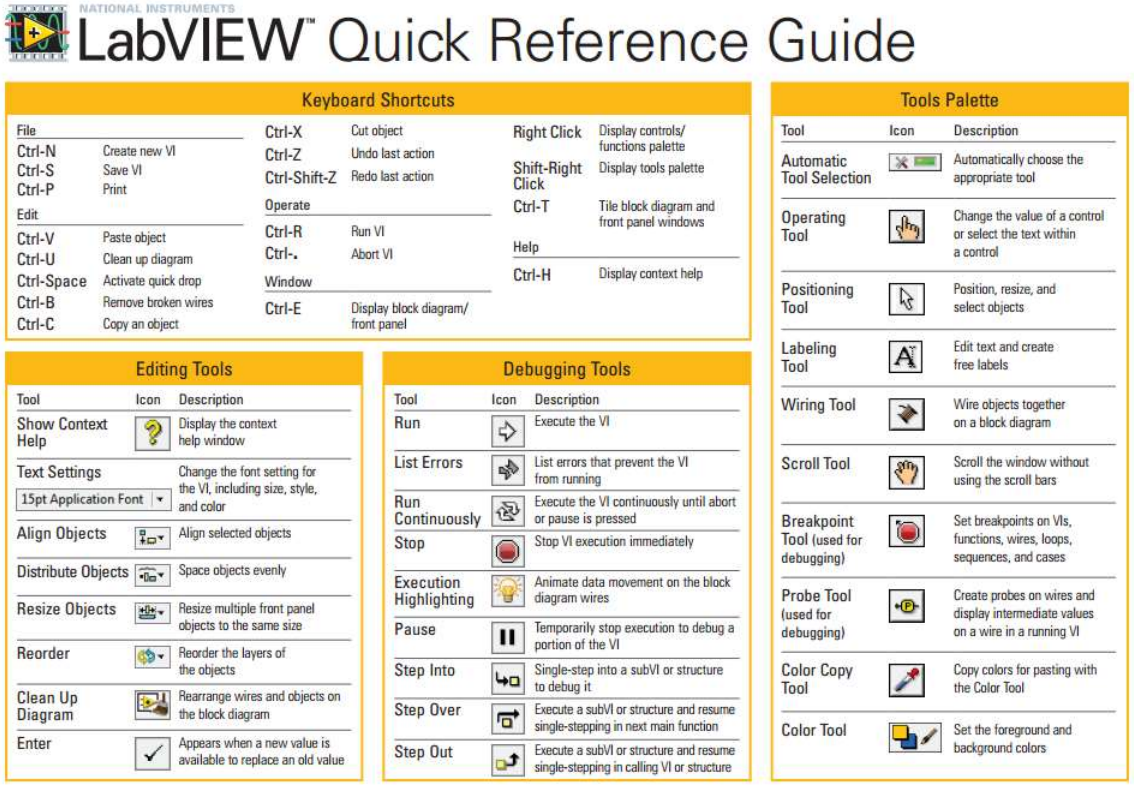
User can enter a number from 0 – 9,

and the corresponding LEDs light up

Bonus: Write a VI for a **Calculator** : + - X /

NATIONAL INSTRUMENTS

Learn Your Hotkeys



NATIONAL INSTRUMENTS

LabVIEW™ Quick Reference Guide

Keyboard Shortcuts

File

Ctrl-N	Create new VI
Ctrl-S	Save VI
Ctrl-P	Print

Edit

Ctrl-V	Paste object
Ctrl-U	Clean up diagram
Ctrl-Space	Activate quick drop
Ctrl-B	Remove broken wires
Ctrl-C	Copy an object
Ctrl-X	Cut object
Ctrl-Z	Undo last action
Ctrl-Shift-Z	Redo last action

Operate

Ctrl-R	Run VI
Ctrl-.	Abort VI

Window

Ctrl-E	Display block diagram/ front panel
Right Click	Display controls/ functions palette
Shift-Right Click	Display tools palette
Ctrl-T	Tile block diagram and front panel windows

Help

Ctrl-H	Display context help

Editing Tools

Tool	Icon	Description
Show Context Help		Display the context help window
Text Settings		Change the font setting for the VI, including size, style, and color
15pt Application Font		
Align Objects		Align selected objects
Distribute Objects		Space objects evenly
Resize Objects		Resize multiple front panel objects to the same size
Reorder		Reorder the layers of the objects
Clean Up Diagram		Rearrange wires and objects on the block diagram
Enter		Appears when a new value is available to replace an old value

Debugging Tools

Tool	Icon	Description
Run		Execute the VI
List Errors		List errors that prevent the VI from running
Run Continuously		Execute the VI continuously until abort or pause is pressed
Stop		Stop VI execution immediately
Execution Highlighting		Animate data movement on the block diagram wires
Pause		Temporarily stop execution to debug a portion of the VI
Step Into		Single-step into a subVI or structure to debug it
Step Over		Execute a subVI or structure and resume single-stepping in next main function
Step Out		Execute a subVI or structure and resume single-stepping in calling VI or structure

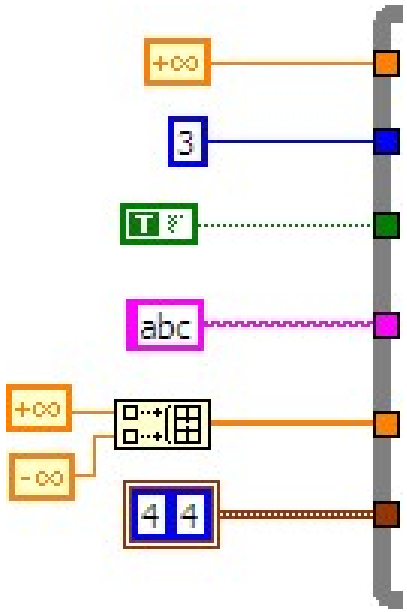
Tools Palette

Tool	Icon	Description
Automatic Tool Selection		Automatically choose the appropriate tool
Operating Tool		Change the value of a control or select the text within a control
Positioning Tool		Position, resize, and select objects
Labeling Tool		Edit text and create free labels
Wiring Tool		Wire objects together on a block diagram
Scroll Tool		Scroll the window without using the scroll bars
Breakpoint Tool (used for debugging)		Set breakpoints on VIs, functions, wires, loops, sequences, and cases
Probe Tool (used for debugging)		Create probes on wires and display intermediate values on a wire in a running VI
Color Copy Tool		Copy colors for pasting with the Color Tool
Color Tool		Set the foreground and background colors

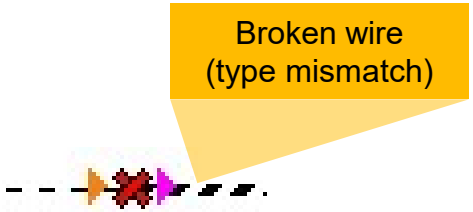
NATIONAL INSTRUMENTS

Wires (Data Types)

- Other examples of wires in LabVIEW



- Floating point
- Integer
- Boolean
- String
- Array—note the wire thickness
- Cluster (group of other data types)



To Do List …. (recommendations)

- Documentation in ***Readme.md*** file in FIRST repository on GitHub

- Write ***test programs*** to test different robot subsystems
- Test longer programs in simulator

- ***Backwards Plan*** (a) from now till Jan 5
  (b) from Jan 6 onwards

- RoboRIO ***wiring diagram***

- LabVIEW ***Programming Style*** Checklist

NATIONAL INSTRUMENTS