

# **Supplemental file 2: Software Installation Instructions**

To use the microcontroller to control LEDs there are two functions that need to be installed. First, software for programming the microcontroller must be installed. Second the software to control the LEDs must be installed. Much of the software required for both processes are the same and can be done together on the same device. However, it is common to have one computer to program several microcontrollers to use with other PCs. Therefore we included instructions to install all of the necessary software together as well as for each function individually.

The LabView software can be obtained for little to no cost through student versions, free trials or by downloading the community version. Once the microcontroller is programmed there is no need for LabView 2020 unless you want to program more microcontroller boards for additional LED systems. If you just want to program the microcontroller, the free trial is sufficient (45 days). If using the LabView Community edition, several things are already included and don't need to be installed. These are Linx/Makerhub and the "VIPM". For LabView Community edition skip figures S46-S48 or S65-S67 (depending on options below).

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Installing the microcontroller driver.....	Figure S84

# Installing All in one device.

This option will install the software for programming microcontrollers as well as for controlling LEDs.

LabView 2020

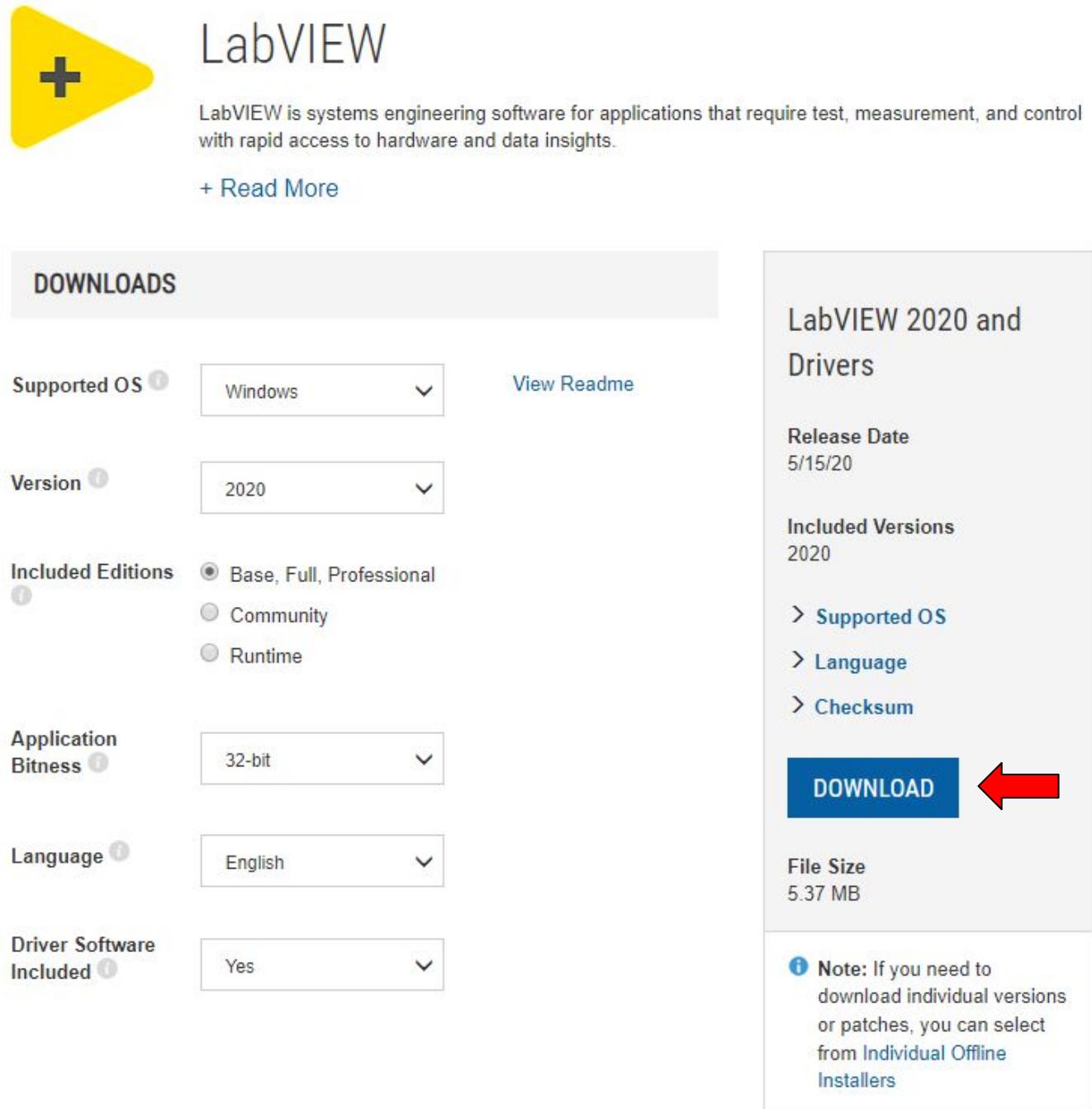
MakerHub/LINX

Using MakerHub to program a microcontroller

NI Runtime Engine 2012

User Interface

# Downloading LabView



The screenshot shows the LabVIEW download page. At the top, there's a yellow play button icon with a plus sign inside, followed by the word "LabVIEW". Below it is a brief description: "LabVIEW is systems engineering software for applications that require test, measurement, and control with rapid access to hardware and data insights." A "Read More" link is also present.

**DOWNLOADS**

**Supported OS**: Windows (dropdown menu)

**Version**: 2020 (dropdown menu)

**Included Editions**: Base, Full, Professional (radio buttons selected), Community, Runtime

**Application Bitness**: 32-bit (dropdown menu)

**Language**: English (dropdown menu)

**Driver Software Included**: Yes (dropdown menu)

**View Readme**

**LabVIEW 2020 and Drivers**

**Release Date**: 5/15/20

**Included Versions**: 2020

**Links:** > Supported OS, > Language, > Checksum

**DOWNLOAD** (button with a red arrow pointing to it)

**Note:** If you need to download individual versions or patches, you can select from Individual Offline Installers

File Size: 5.37 MB

**Figure S40: Downloading LabView 2020.** Search the internet for “NI LabView download” or go to <https://www.ni.com/en-us/support/downloads/software-products/download.labview.html#346254> to find the download page. Use the download settings shown and then press download.

## A Download the Latest Version of LabVIEW

Fill out this form to get started with your complimentary trial of LabVIEW software. During your evaluation you will have access to white papers, sample code and tutorials to help you maximize the use of your trial time.

If you are a member in the Standard Service Program (SSP), you are automatically entitled to free upgrades and software updates as they become available. The annual release cycle of LabVIEW ensures that you have access to all the latest features and improvements in LabVIEW when you are ready to upgrade.

To continue, create an account, or [log in >](#)

Create an NI User Account

Already have an account? [Log In >](#)

First Name  Last Name

Role

Company

Phone Number

Email Address

Password

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Complete Your Account

To continue, please provide the following information:



**PHILLIP KYRIAKAKIS**  
pkyriaka@ucsd.edu

**Primary Job Activity**

**CONTINUE**

**Figure S41: Enter personal information.** (A) Make a National Instruments account or sign in. (B) Enter Job Activity. A download will start once you click continue.

**A**MY ACCOUNT  
Philip | Log out

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## Downloading LabVIEW 2020 and Drivers

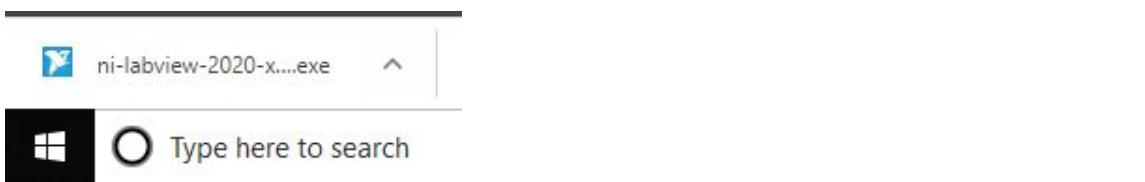


### Next Steps

Your downloaded software is delivered using NI Package Manager. NI Package Manager is your access hub to download, install, upgrade, and manage all NI software. Note that this utility is different from VI Package Manager.

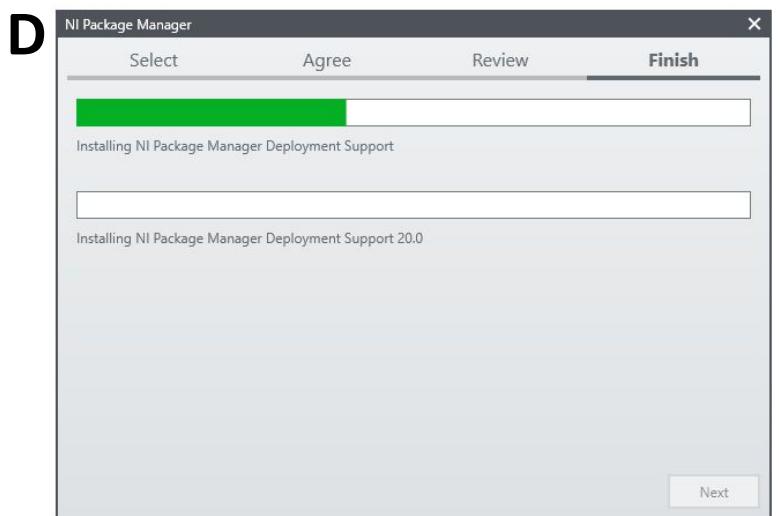
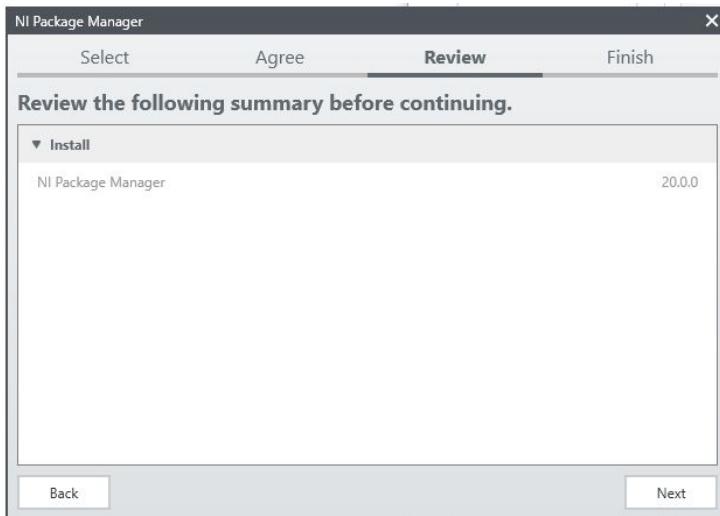
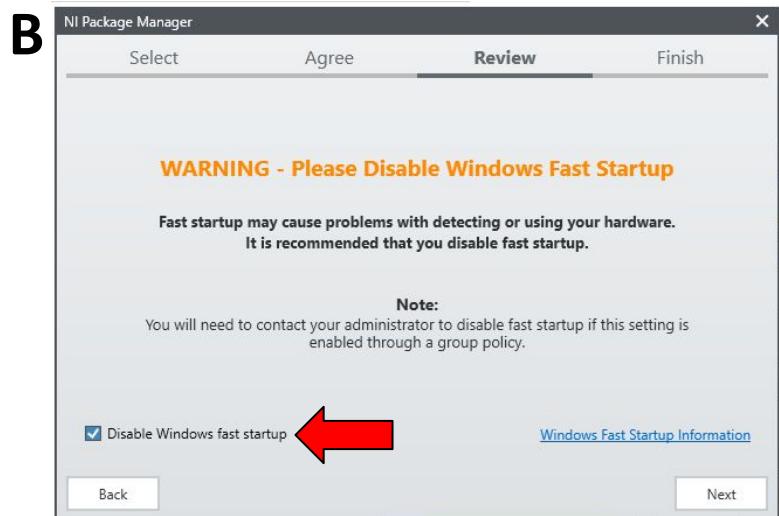
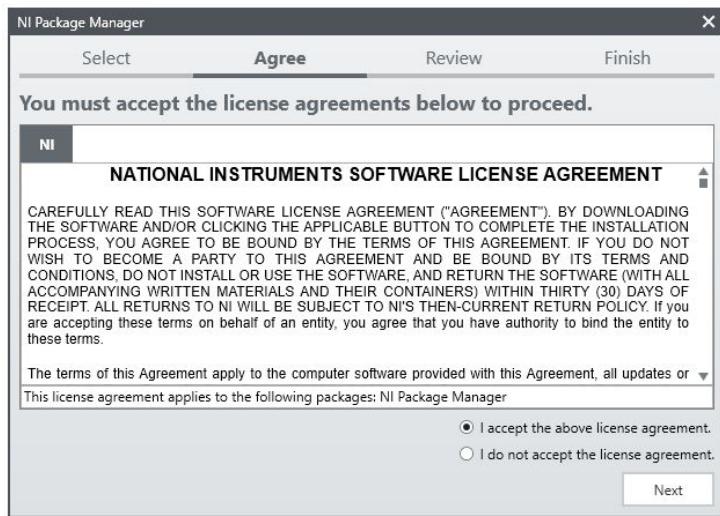
After the download is complete, NI Package Manager launches and you can install the software. If you have problems with this process, you can restart the download.

If the download doesn't start automatically, [restart the download now](#).

**B****C**

Name	Date modified	Type	Size
ni-labview-2020-x86_20.0_suite_online	5/28/2020 4:52 PM	Application	5,498 KB

**Figure S42: Downloading LabView 2020 installation files.** (A) A download screen will appear during the download. (B) If using Google Chrome the file should appear on the bottom of your browser. (C) This file will appear in your default download folder. Click on (B) or (C) to begin installing NI Package Manager.



**Figure S43: Installing NI Package Manager for managing the installation.** (A) Accept the licensing agreements and click Next. (B) Make sure to disable Windows fast startup as shown (red arrow). **This may not show up on all versions of Windows.** (C) Review and click next to install. (D) A screenshot of the installation running.

**A**

**B**

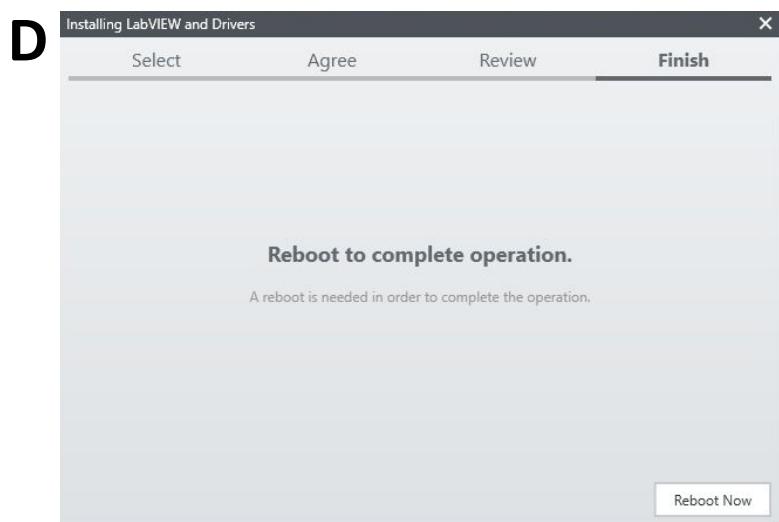
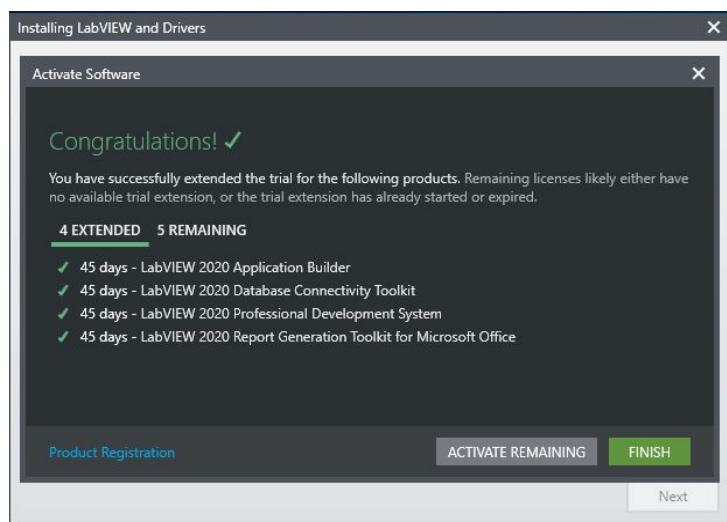
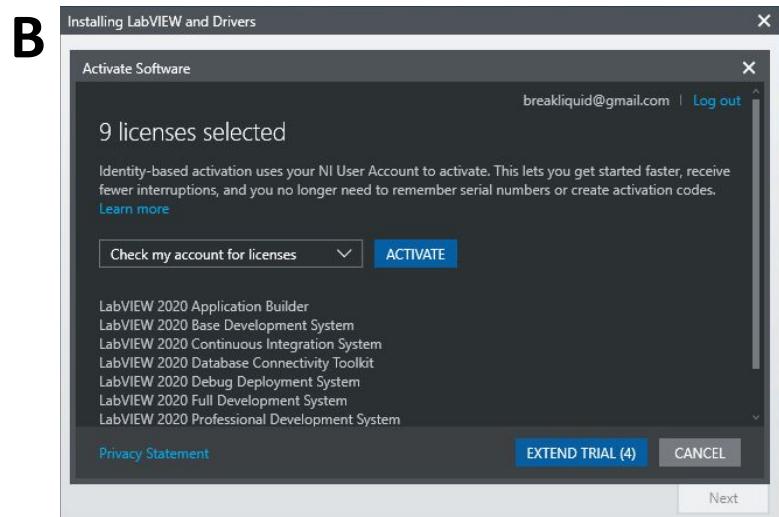
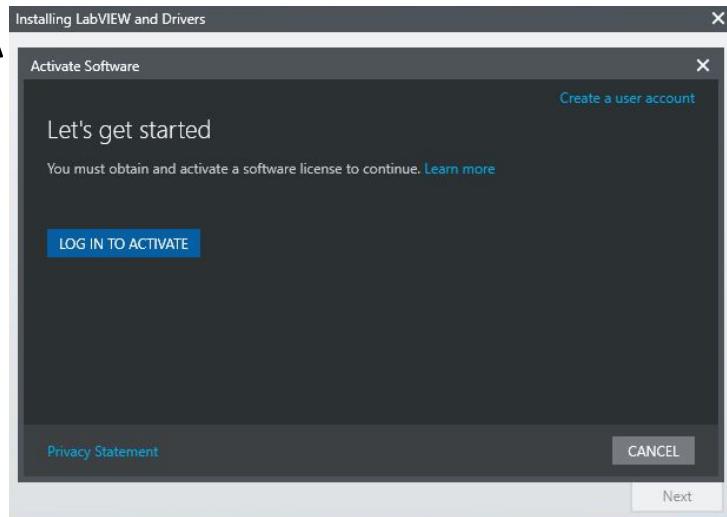
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**D**

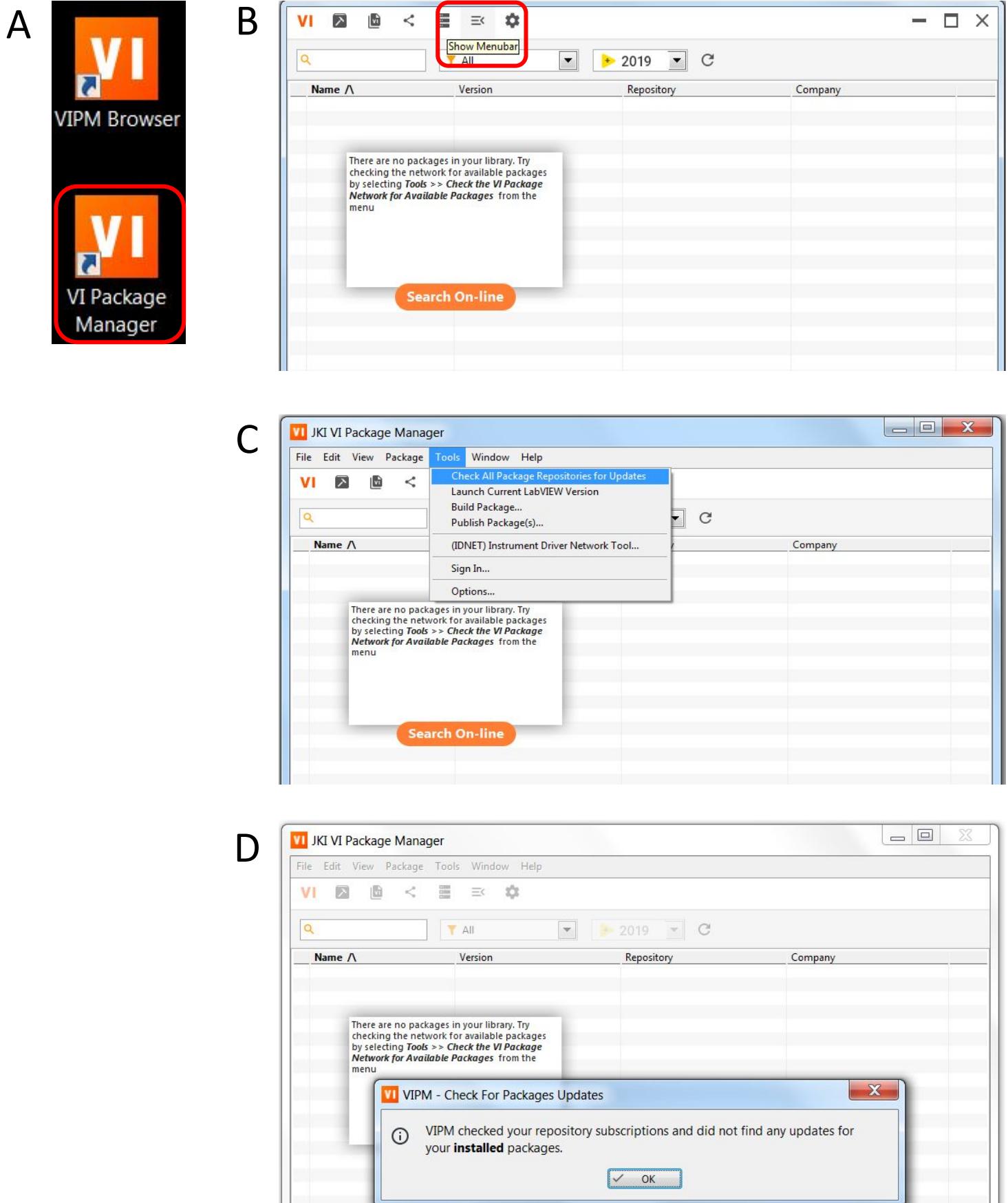
**E**

**F**

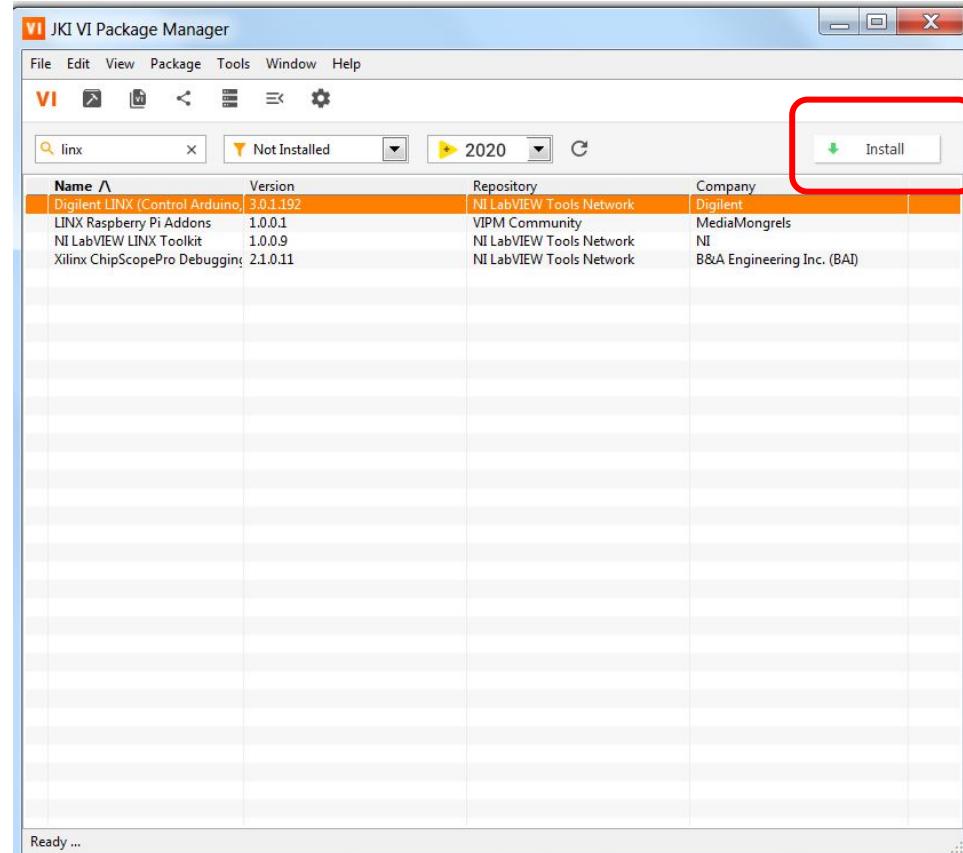
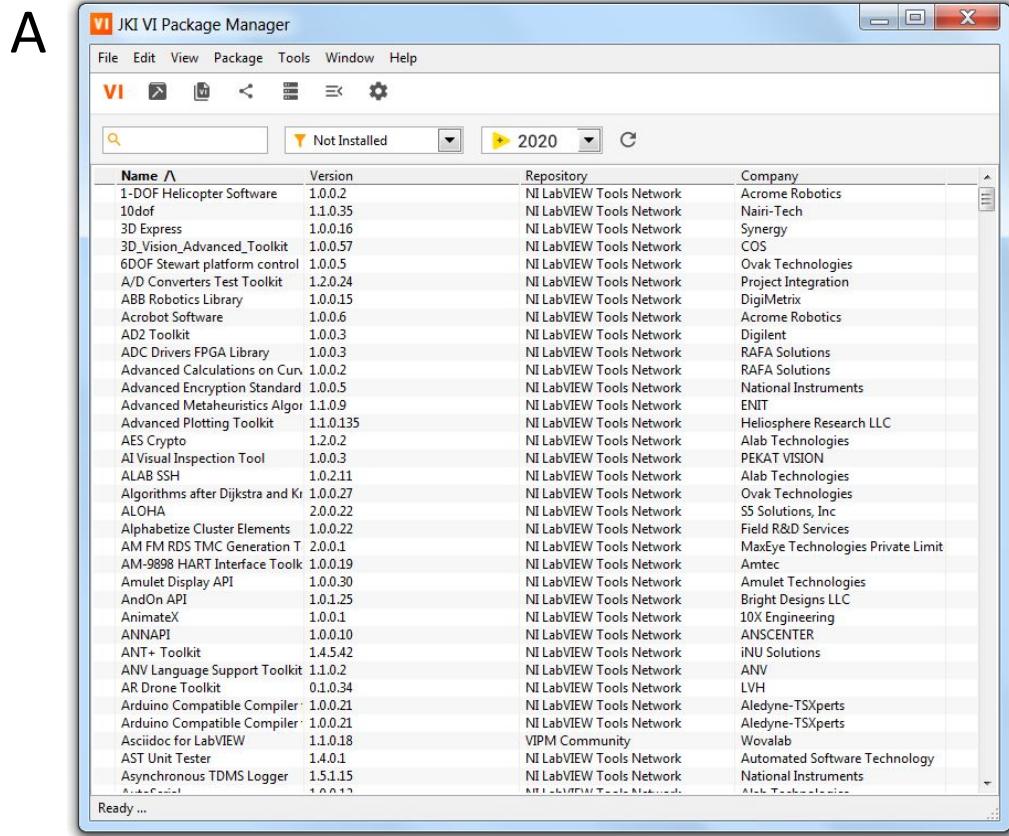
**Figure S44: Installing NI LabView 2020.** (A) After installing the NI Package manager, the LabView installation begins. There will be a list of many options to download. (B) Scroll down the list to find JKI VI Package Manager (VIPM-red arrow). Add this to the installation and then click next. (C) You can review the packages and then click next. (D) Accept the licensing agreements. (E) Accept the licensing agreements. (F) Review and then click next to continue the installation. This may take 30 minutes or more.



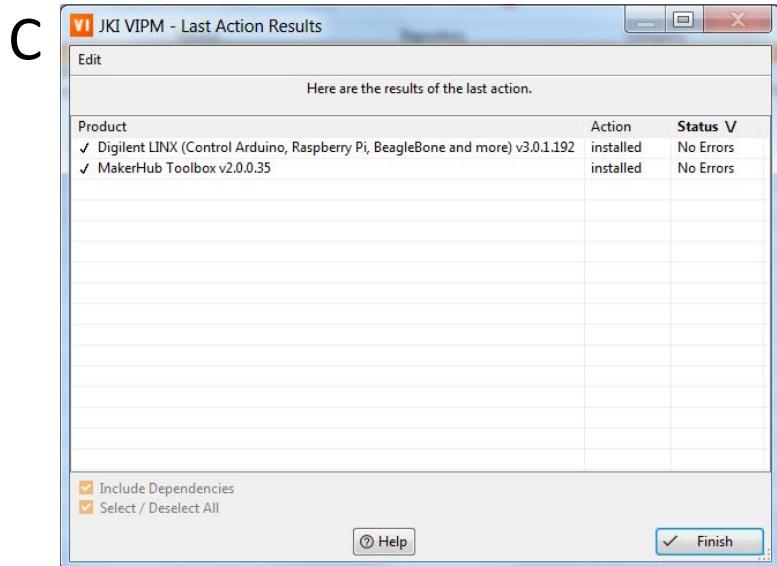
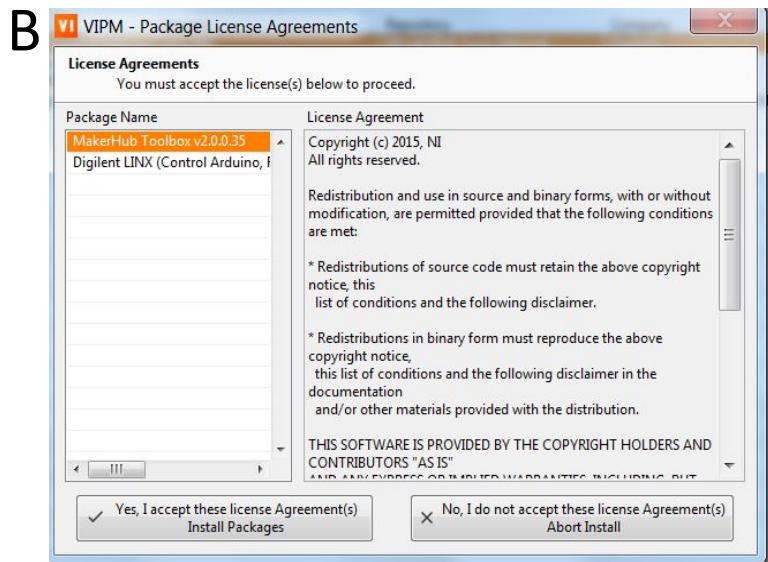
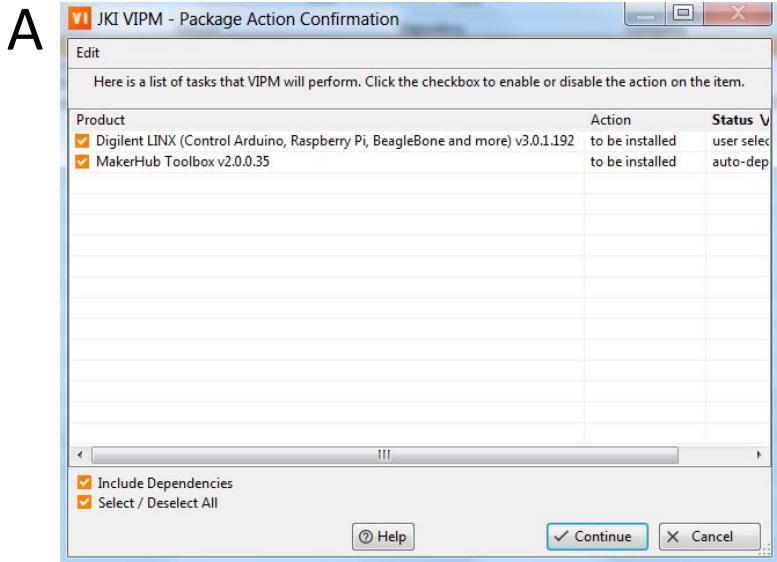
**Figure S45: Installing NI LabView 2020.** (A) You will be asked to login to the app before installation. (B) Activate all the default settings for the free trial. (C) Click “Finish” to install LabView. (D) Once installation is complete you will be prompted to reboot.



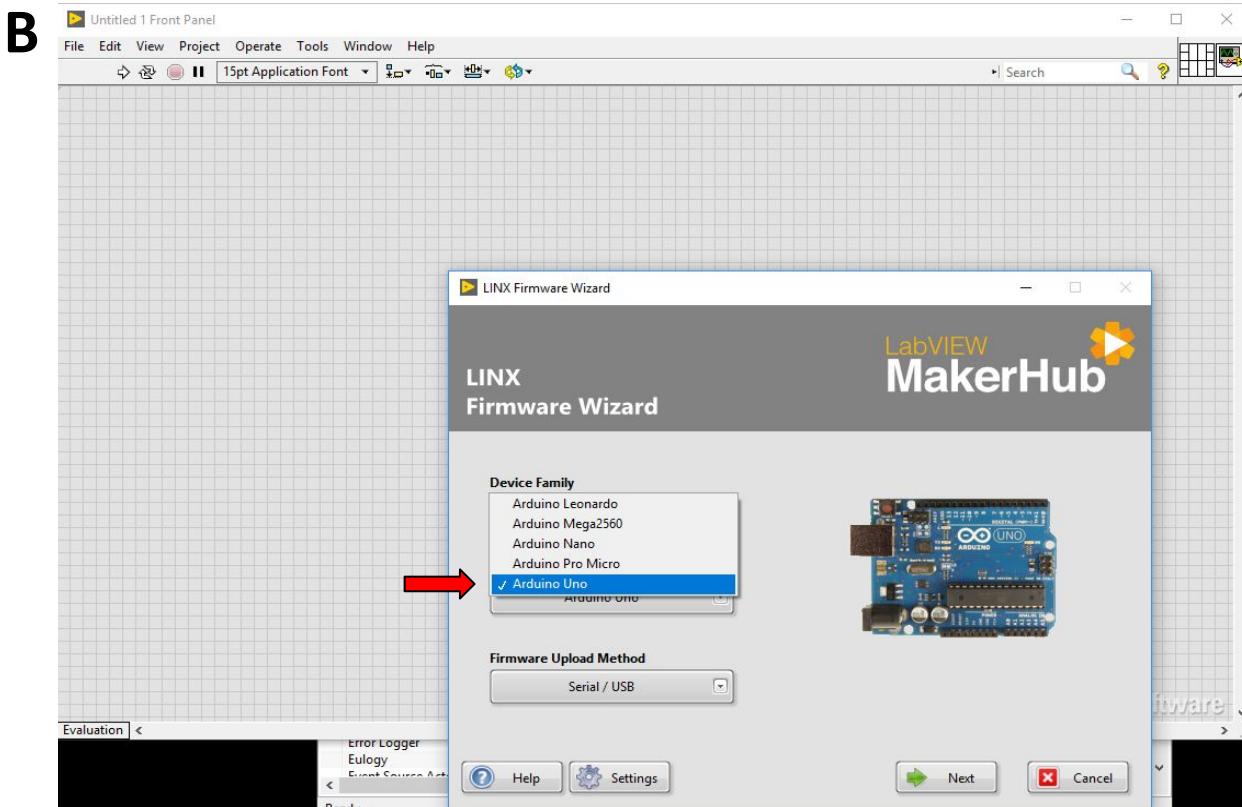
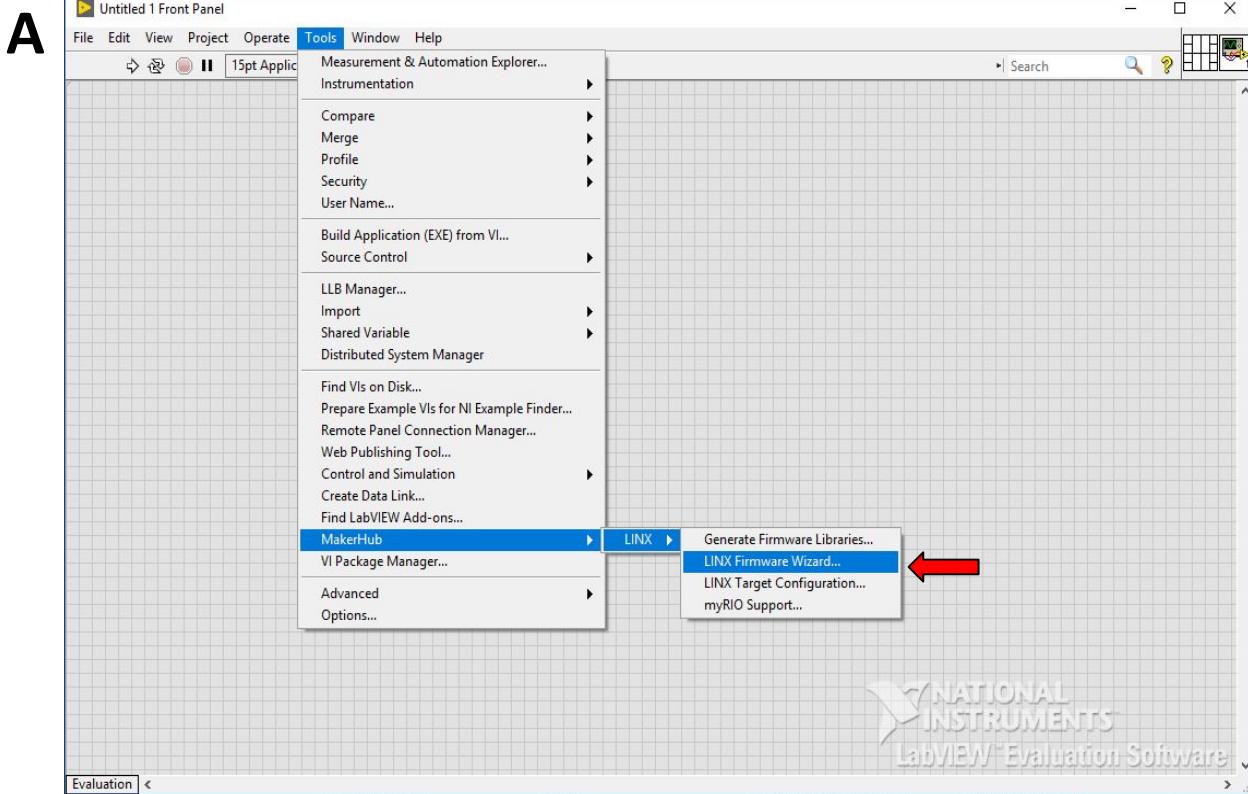
**Figure S46: Updating VIPM add ons.** After rebooting there will be an icon on your desktop for VI Package Manager (red box) and VI Browser. (A) Open VI Package Manager. (B) If the menu bar is not present press the menu bar icon (red box). (C) Click on Tools->Check All Package Repositories for Updates. (D) Click okay.



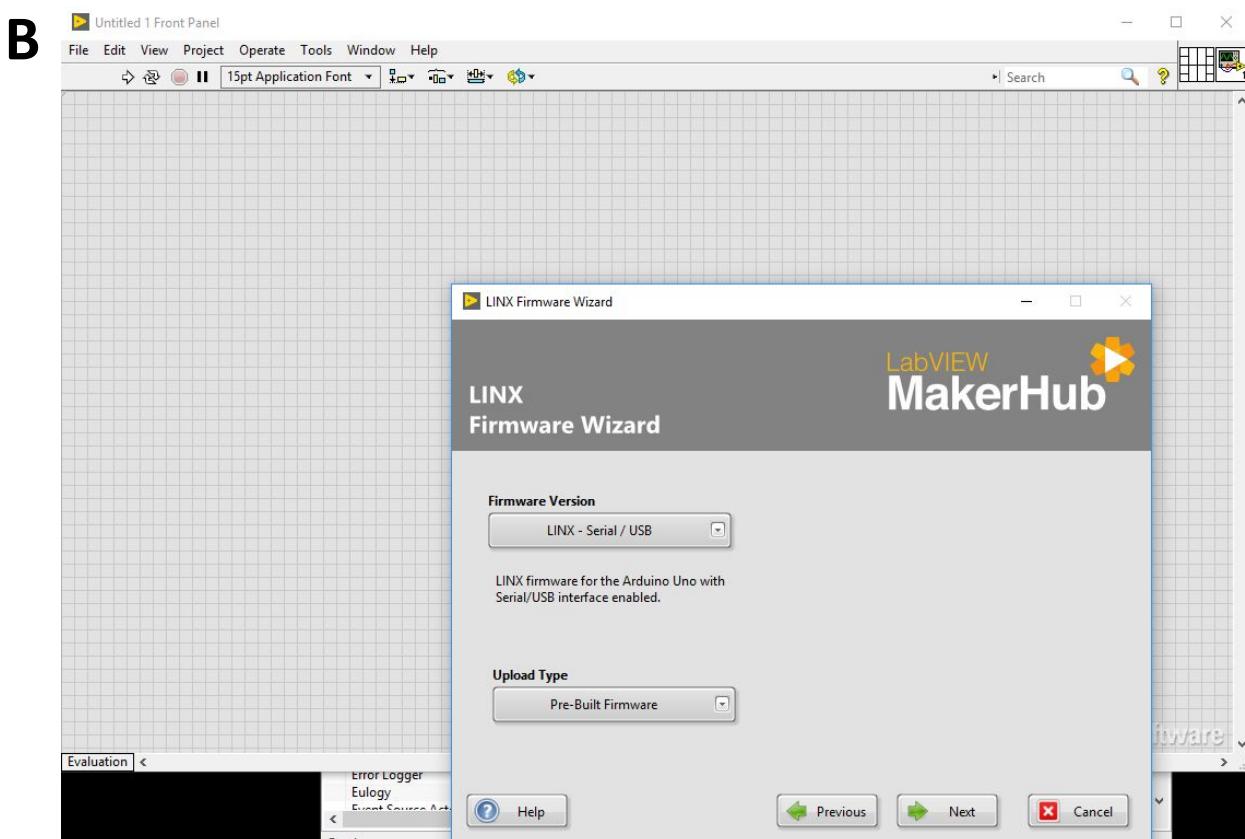
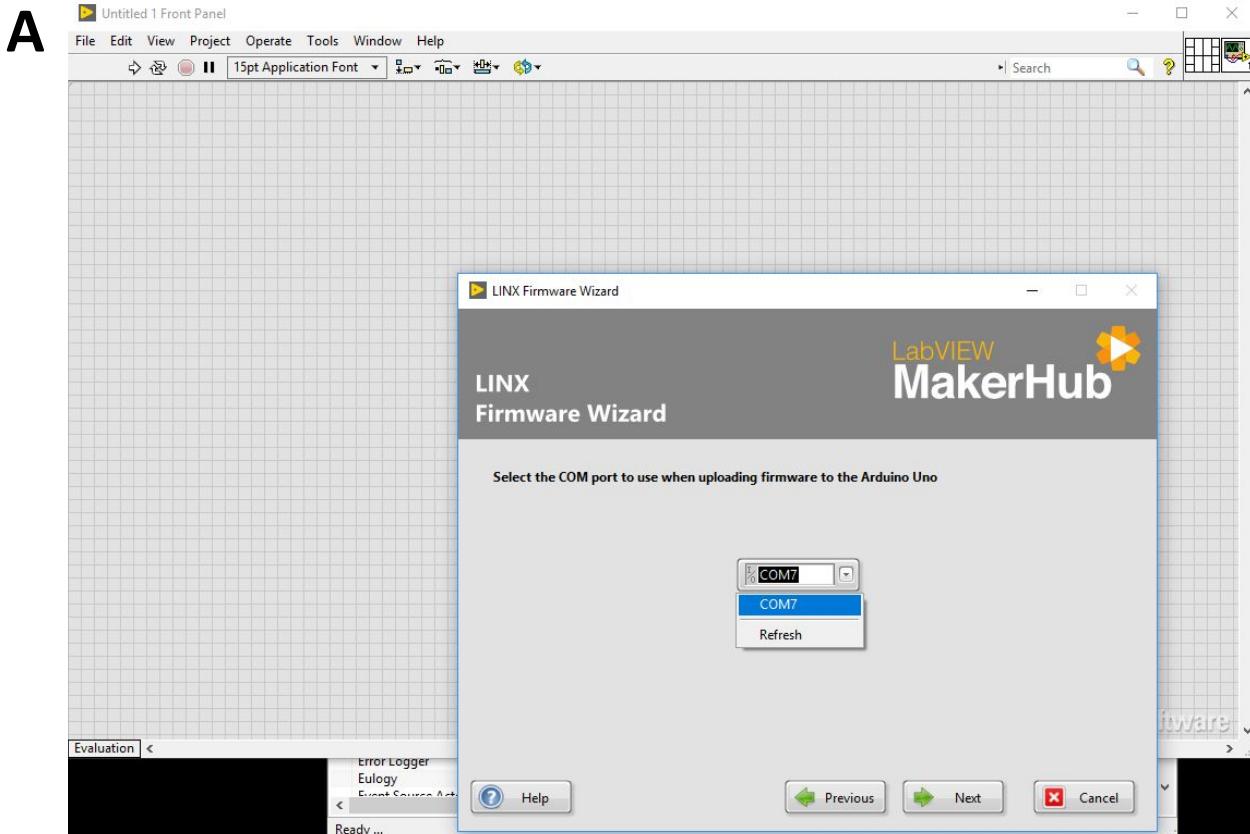
**Figure S47: Installing LINX and MakerHub.** (A) After the window says VIPM did not find updates for installed programs, many new uninstalled programs appear. (B) Search for “LINX” in the search box, select the version shown and click install (red box).



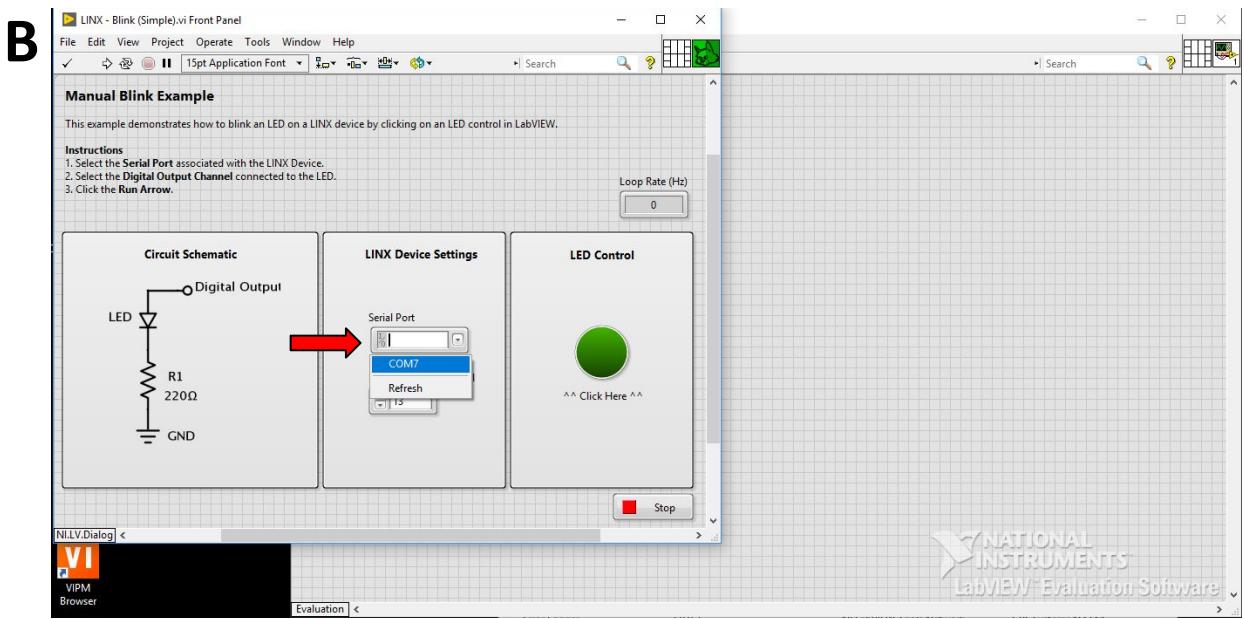
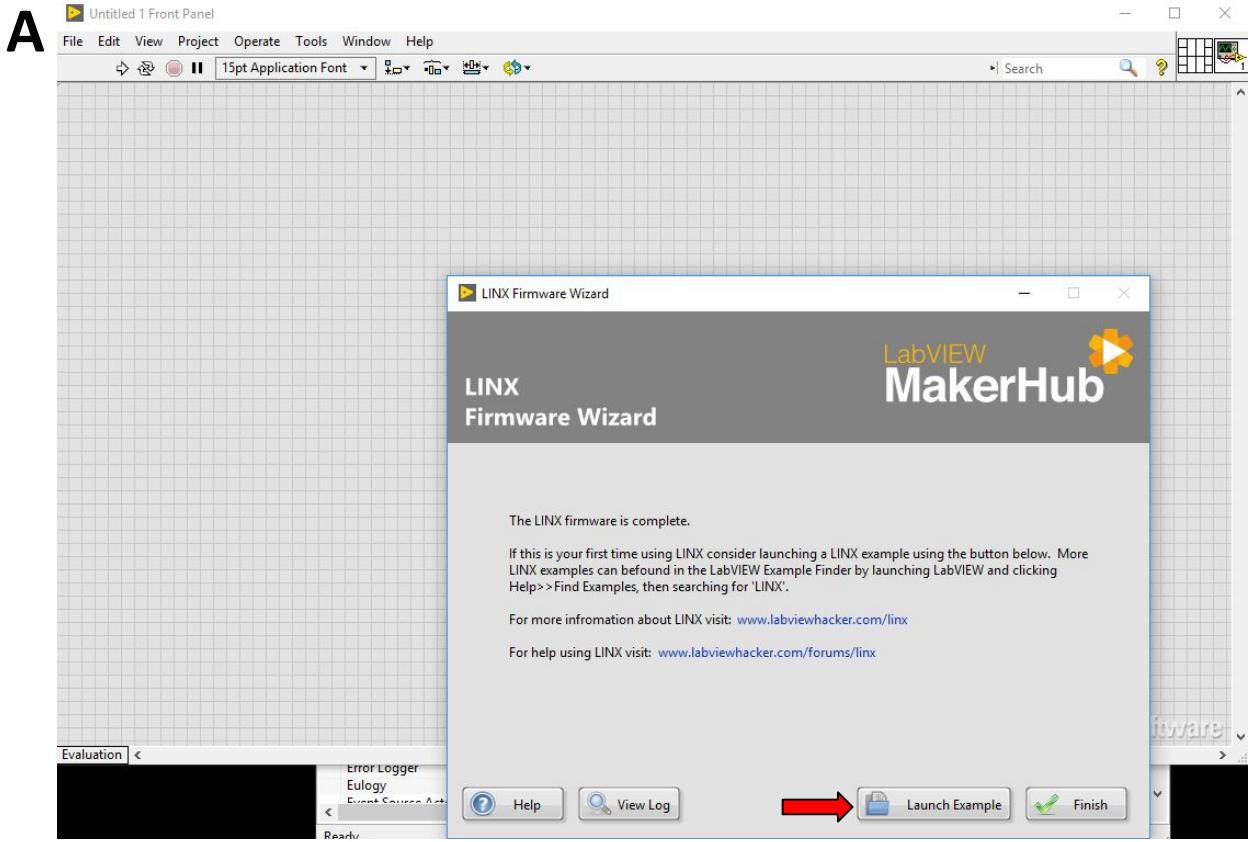
**Figure S48: Installing LINX and MakerHub** (A) You will be asked to confirm the installation. Makerhub will be auto installed with LINX. (B) Accept license agreements. (C) Installation is complete.



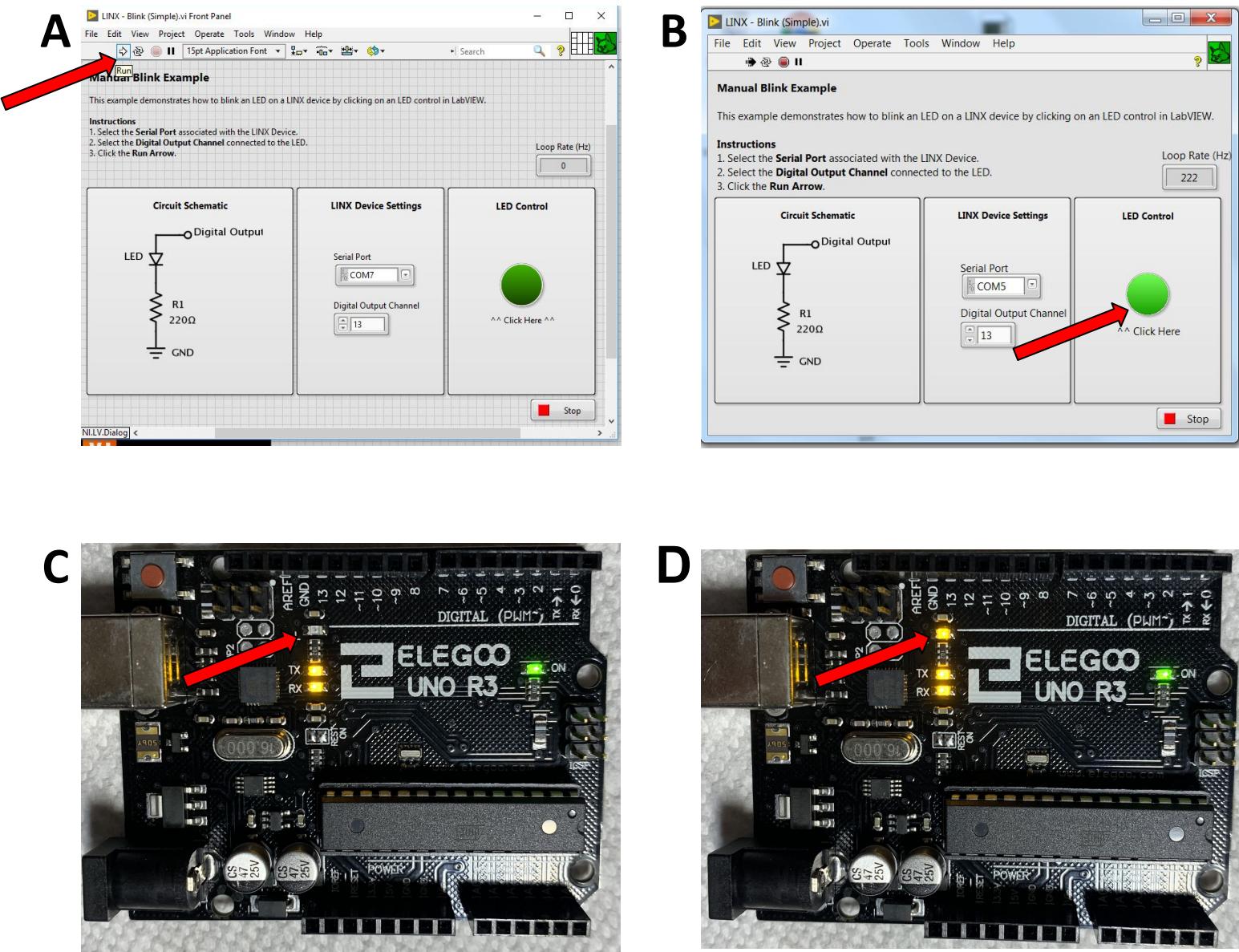
**Figure S49: Programming a microcontroller.** With Makerhub and LINUX installed you can now use LabVIEW to program microcontrollers to communicate with labview software. (A) Open LabVIEW 2020. On the menu bar click Tools>>MakerHub>>LINUX>>LINUX Firmware Wizard... (B) Select the microcontroller.



**Figure S50: Programming the microcontroller.** (A) Select a COM port. If your microcontroller is new it will be the highest number COM port in the list. A new COM port will be made for every microcontroller that is plugged into your Windows system. Click next to proceed. (If you do not see a COM port here check Figure S84 for installing the microcontroller driver.) (B) Click next again to install the Pre-built Firmware.



**Figure S51: Checking the microcontroller programming.** (A) Once the microcontroller is programmed a window will appear that gives the option to “Launch Example”. Click on this to test (red arrow) (B) Select the COM port again.



**Figure S52: Checking the microcontroller programming.** (A) Click “Run” to start the test program. (B) Click the green circle to blink the LED on the microcontroller board. (C) The microcontroller before clicking the green circle (LED off). (D) The microcontroller after clicking the green circle (LED on). If the LED blinks when you keep clicking the green circle the microcontroller is programmed.

ni.com/en-us/support/downloads/software-products/download.labview-runtime.html#306234

**NATIONAL INSTRUMENTS™**

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Home > Support > Software and Driver Downloads > NI Software Product Downloads > Download Detail Page

**LabVIEW Runtime**

LabVIEW is systems engineering software for applications that require test, measurement, and control with rapid access to hardware and data insights.

+ Read More

**DOWNLOADS**

Supported OS: Windows

Version: 2012 SP1

Included Editions: Runtime

Application Bitness: 32-bit

Language: English, French, German, Japanese, Korean, Simplified Chinese

**LabVIEW 2012 SP1 Runtime**

Release Date: 3/4/13

> Supported OS  
> Language  
> Checksum

**DOWNLOAD**

File Size: 264.23 MB

**Figure S53: Installing LabView Runtime Engine 2012.** Search the internet for “NI labview runtime engine 2012” or go to the following web address and choose 2012 SP1. Be sure you are downloading the runtime engine:  
<https://www.ni.com/en-us/support/downloads/software-products/download.labview-runtime.html#346222>

A [ni.com/en-us/support/downloads/software-products/download/unpackaged.labview-runtime.306234.html](https://ni.com/en-us/support/downloads/software-products/download/unpackaged.labview-runtime.306234.html)

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## Downloading LabVIEW 2012 SP1 Runtime



### Next Steps

After the download is complete, you can launch an installer that will take you through the process of selecting features and installing the software. If you have problems with this process, you can restart the download.

If the download doesn't start automatically, [restart the download now](#).

GETTING STARTED

B

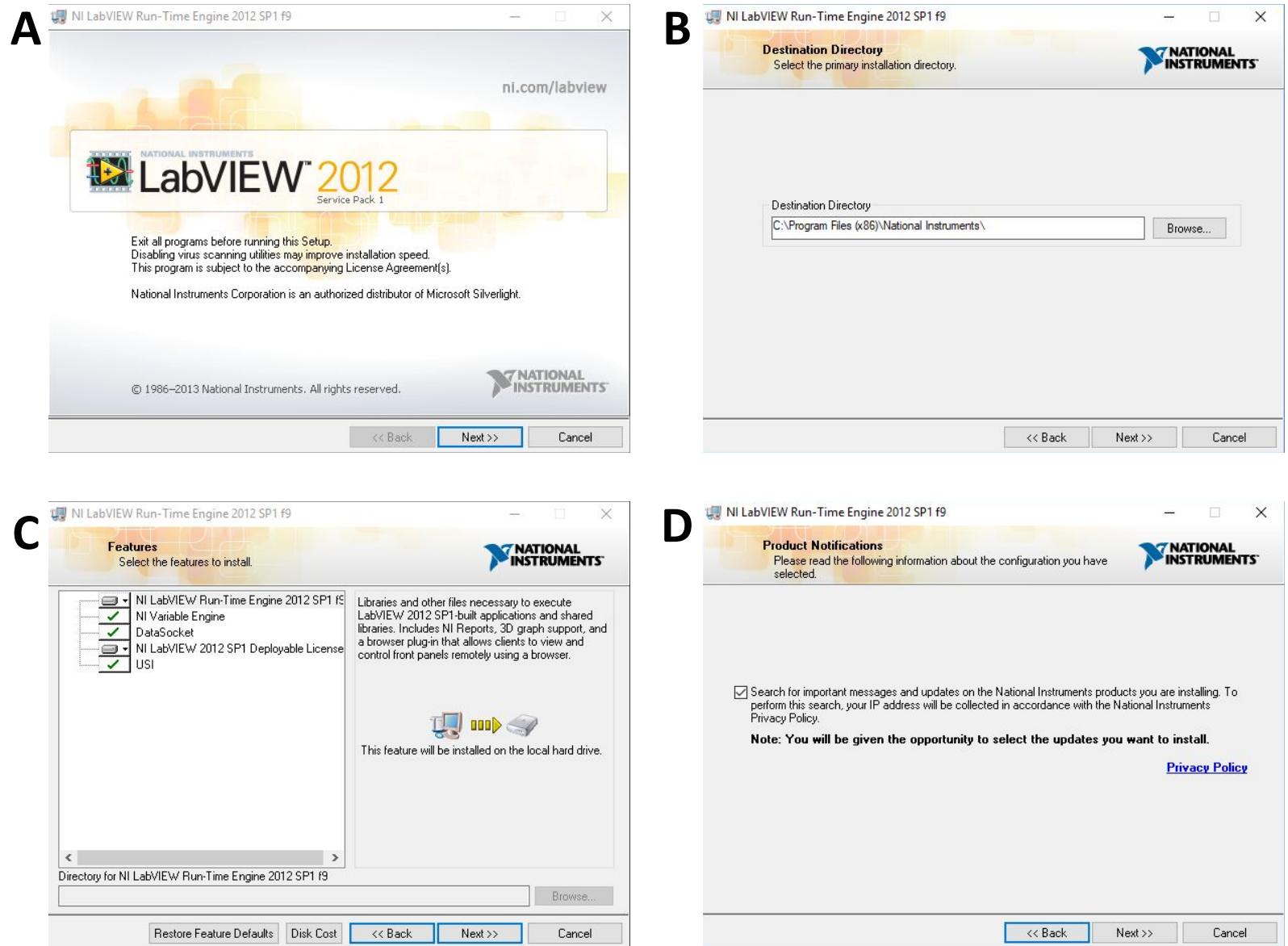


LVRTE2012SP1\_f9P....zip

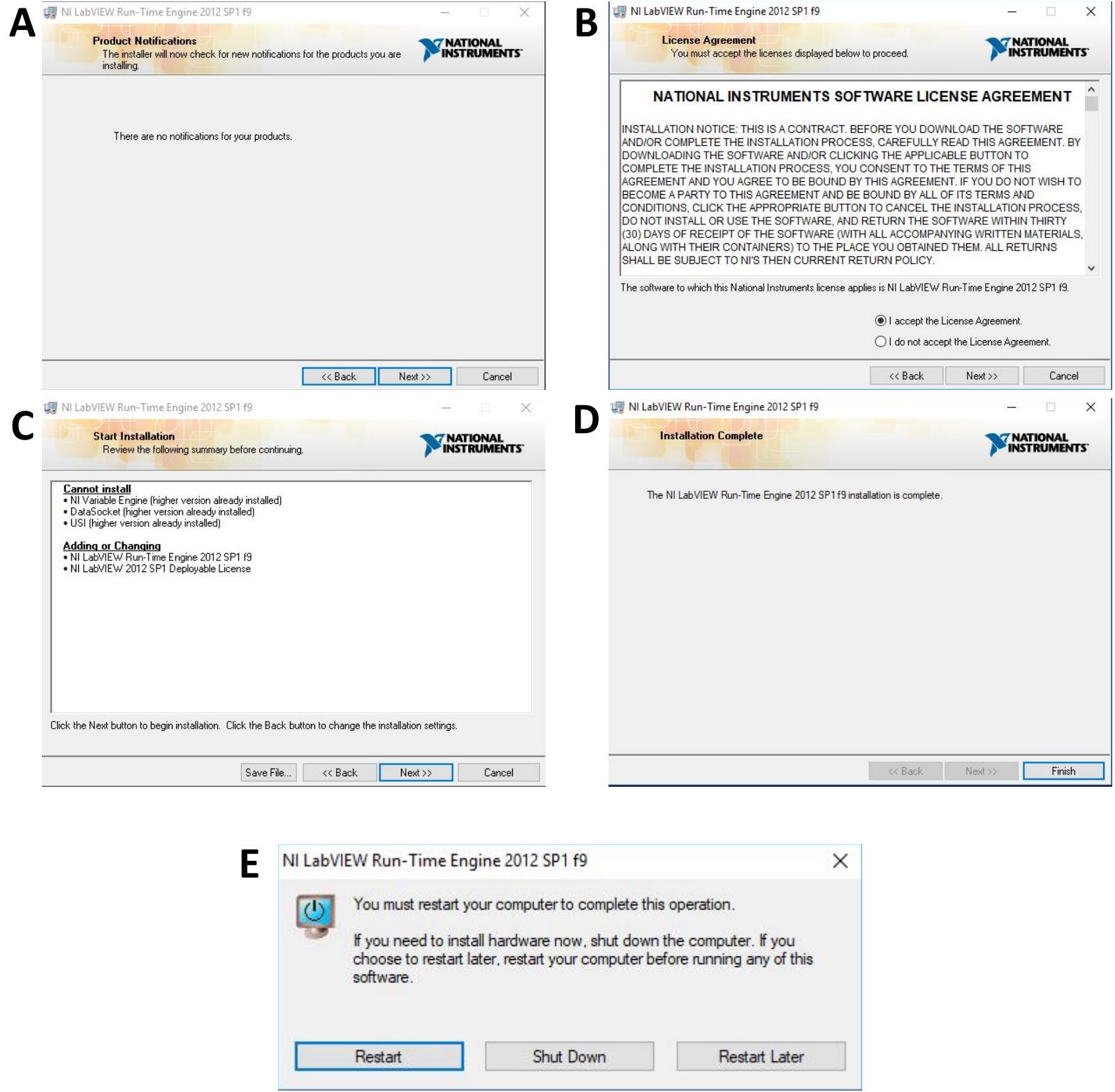
C

Name	Size	Packed	Type
..			File folder
Bin			File folder
Licenses			File folder
Products			File folder
nidist.id	333	239	ID File
patents.txt	21,950	6,107	Text Document
<b>setup.exe</b>	1,436,000	1,390,985	Application
setup.ini	25,479	5,737	Configuration setti...

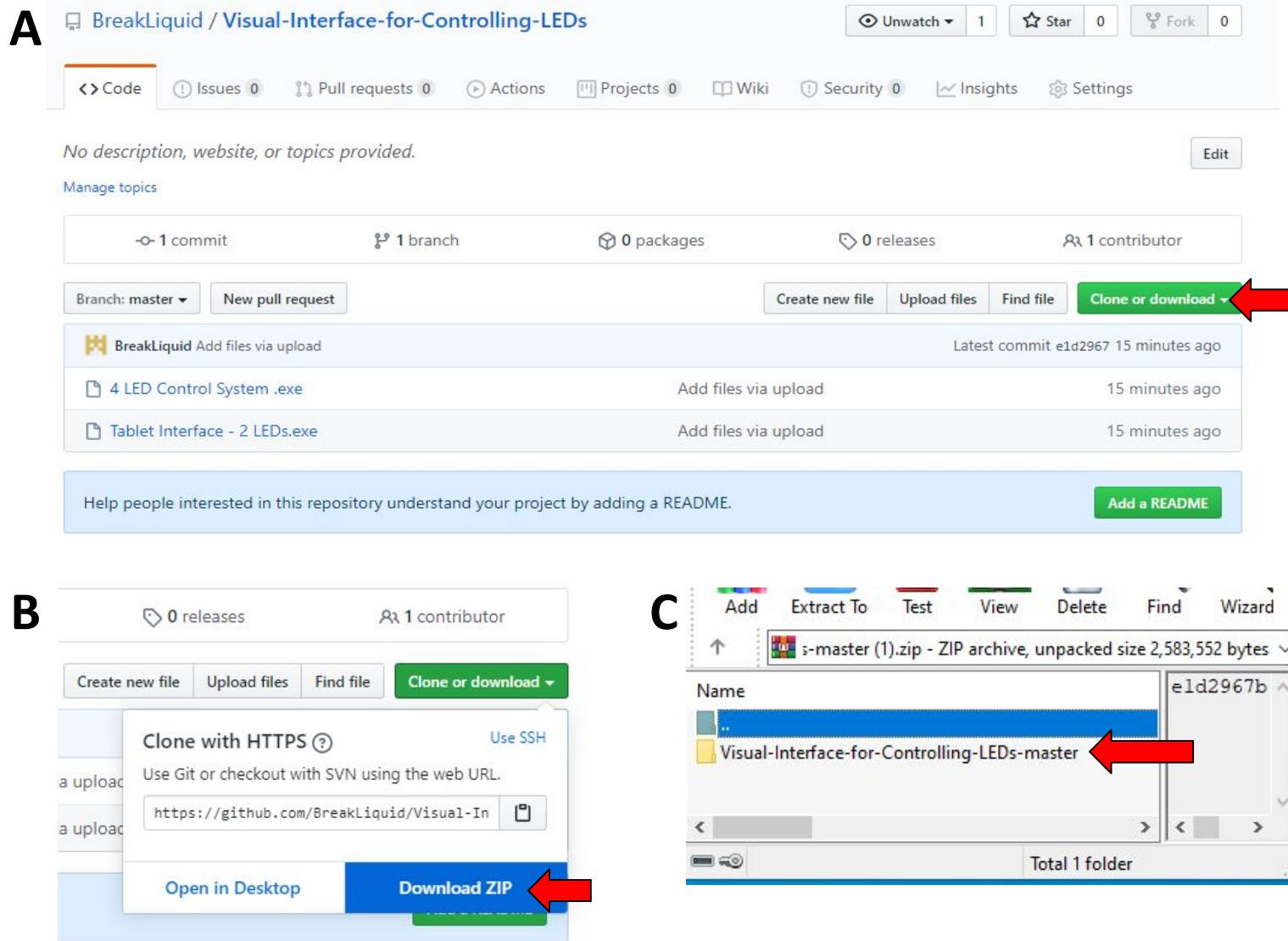
**Figure S54: Installing LabView Runtime Engine 2012.** (A) After clicking “Download”, a download screen appears and the download begins automatically. (B) The zipfile will appear on your browser and be in your downloads folder. (C) Open the Zip file and run the “setup.exe” file (red box).



**Figure S55: Installing LabView Runtime Engine 2012.** (A) Click next to continue installation. (B) Choose the default installation folder. (C) Keep the default installation settings. (D) Click next to proceed with installation.



**Figure S56: Installing LabView Runtime Engine 2012.** (A) Click next to continue. (B) Accept the license agreements. (C) Review installation and click next. (B) The zipfile will appear on your browser and be in your downloads folder. (D) Click “Finish” to acknowledge the installation is complete. (E) Restart your system when prompted.



**Figure S57: Downloading and running the user interface for Controlling LEDs.** (A) Go to Github: <https://github.com/BreakLiquid/LED-Control-User-Interfaces> and click “Clone or Download”. (B) Click “Download Zip”. (C) Open the Zip file and the folder containing the two user interfaces. (D) Choose which a user interface and drag it onto your desktop. This file can be run directly by clicking on the icon.

A

**Arduino Connection**

**Serial Port**

<b>Connection</b>	<b>Loop Rate (Hz)</b>
<b>Not Connected</b>	<input type="text" value="0"/>

B

<b>Pin #</b>	<b>Time On</b>	<b>Frequency</b>
<input type="button" value="A"/> 13 <input type="button" value="V"/>	<input type="button" value="A"/> 0 min <input type="button" value="V"/>	<input type="text" value="0 mHz"/>
<b>Run Time</b>	<b>Time Off</b>	<b>Cycle Time</b>
<input type="text" value="00:00"/>	<input type="button" value="A"/> 0 min <input type="button" value="V"/>	<input type="text" value="00:00"/>
<b>On/Off</b>		<b>Sample ID/Notes</b>
<input type="button" value="LED Status"/>		<input type="text" value="OFF"/>

C

**Main Timing Control**

<b>Start Delay</b>	<b>Time Until Start</b>
<input type="button" value="A"/> 00:00 <input type="button" value="V"/>	<input type="text" value="00:00:00"/>
<b>Total Run Time</b>	<b>Total Elapsed Time</b>
<input type="button" value="A"/> 00:00 <input type="button" value="V"/>	<input type="text" value="00:00:00"/>
<b>Program Status</b>	<b>Start</b>
<input type="text" value="OFF"/>	<input type="button" value="Start"/>
<b>Run Complete</b>	<input type="text" value="Not Yet"/>

**Figure S58: Operating the LED control system.** (A) Click on the “Serial Port” tab and select the COM port that corresponds to the microcontroller, then click connect. (B) Choose illumination settings for each LED. For continuous light select any number of minutes for “Time On” and zero for “Time Off”. To pulse the LEDs choose the frequency by changing the “Time On” and “Time Off” settings. Fractions of minutes can be used. To select a run time for an individual LED select a run time in this box. (C) To run after a specific time, program a Start Delay here. Total Run Time for all the LEDs can be controlled below the start delay. The run time will start after the start delay.

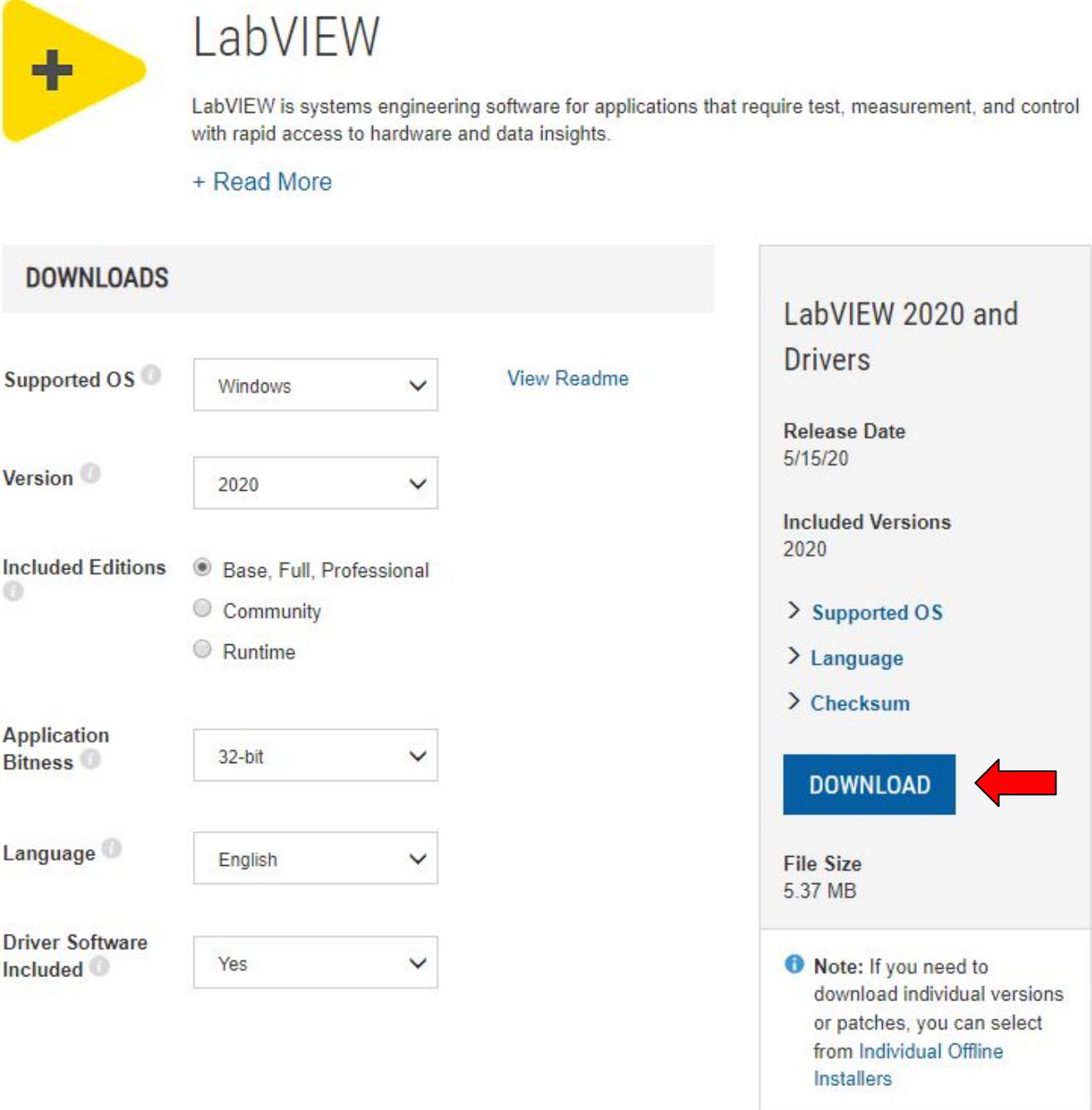
# Installing software only for programming an microcontroller

LabView 2020

MakerHub/LINX

Programming the microcontroller

# Downloading LabView



The screenshot shows the LabVIEW download page. At the top left is a yellow play button icon with a plus sign. To its right is the word "LabVIEW". Below that is a brief description: "LabVIEW is systems engineering software for applications that require test, measurement, and control with rapid access to hardware and data insights." A "Read More" link is below the description.

**DOWNLOADS**

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**View Readme**

**LabVIEW 2020 and Drivers**

**Release Date**: 5/15/20

**Included Versions**: 2020

**Links**: > Supported OS, > Language, > Checksum

**DOWNLOAD** (button with a red arrow pointing to it)

**Note**: If you need to download individual versions or patches, you can select from Individual Offline Installers

**File Size**: 5.37 MB

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To continue, create an account, or [log in >](#)

Create an NI User Account

Already have an account? [Log In >](#)

First Name  Last Name

Role

Company

Phone Number

Email Address

Password

## B Download the Latest Version of LabVIEW

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Complete Your Account

To continue, please provide the following information:



**PHILLIP KYRIAKAKIS**  
pkyriaka@ucsd.edu

Primary Job Activity

**CONTINUE**

**Figure S60: Enter personal information.** (A) Make a National Instruments account or sign in. (B) Enter Job Activity. A download will start once you click continue.

## Downloading LabVIEW 2020 and Drivers

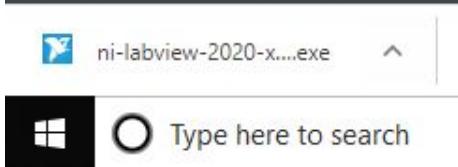


### Next Steps

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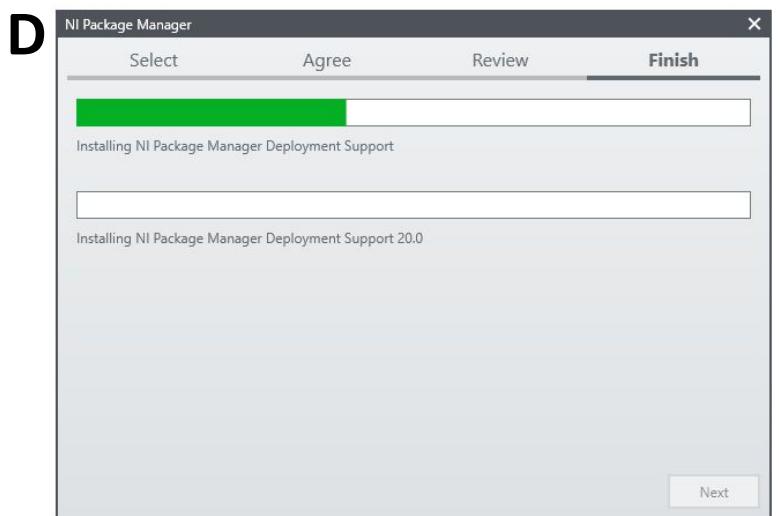
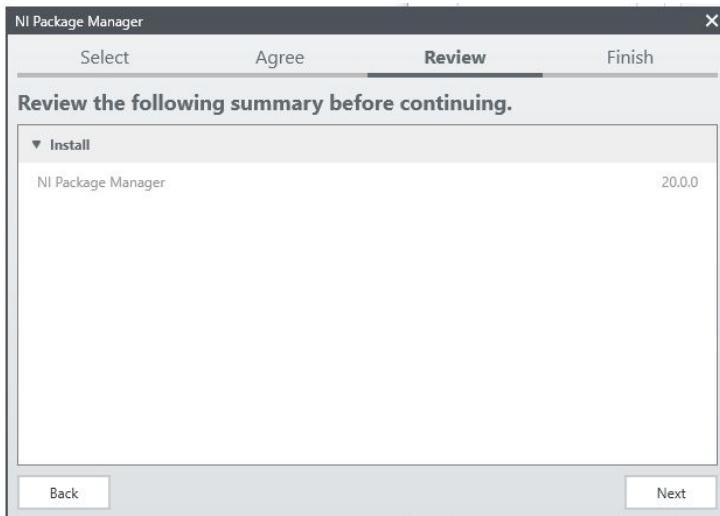
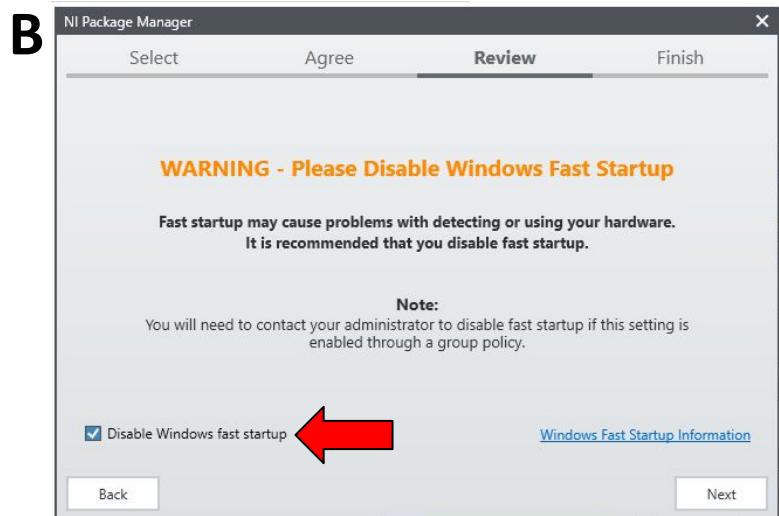
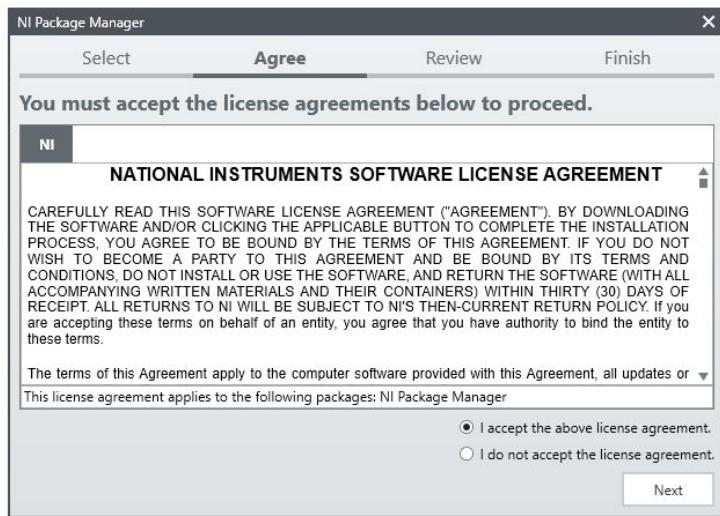
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**B****C**

Name	Date modified	Type	Size
ni-labview-2020-x86_20.0_suite_online	5/28/2020 4:52 PM	Application	5,498 KB

**Figure S61: Downloading LabView 2020 installation files.** (A) A download screen will appear during the download. (B) If using Google Chrome the file should appear on the bottom of your browser. (C) This file will appear in your default download folder. Click on (B) or (C) to begin installing NI Package Manager.



**Figure S62: Installing NI Package Manager for managing the installation.** (A) Accept the licensing agreements and click Next. (B) Make sure to disable Windows fast startup as shown (red arrow). **This may not show up on all versions of Windows.** (C) Review and click next to install. (D) A screenshot of the installation running.

**A**

**B**

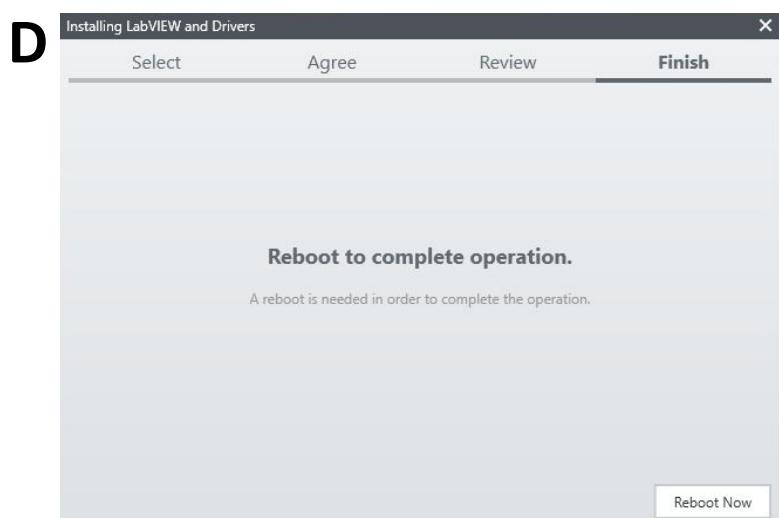
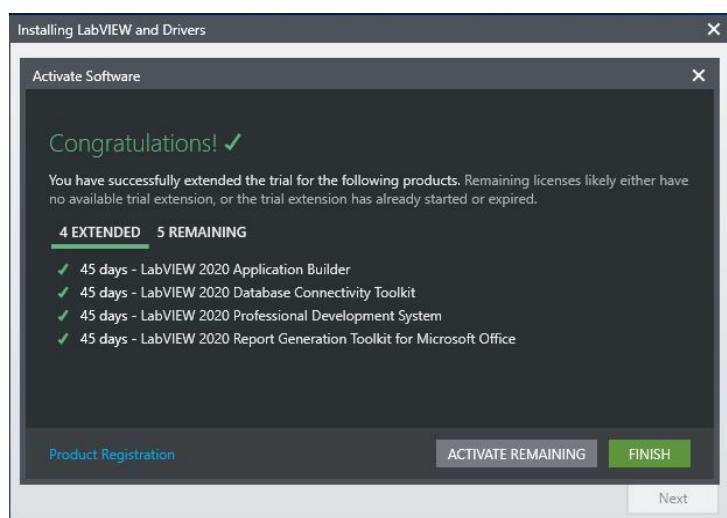
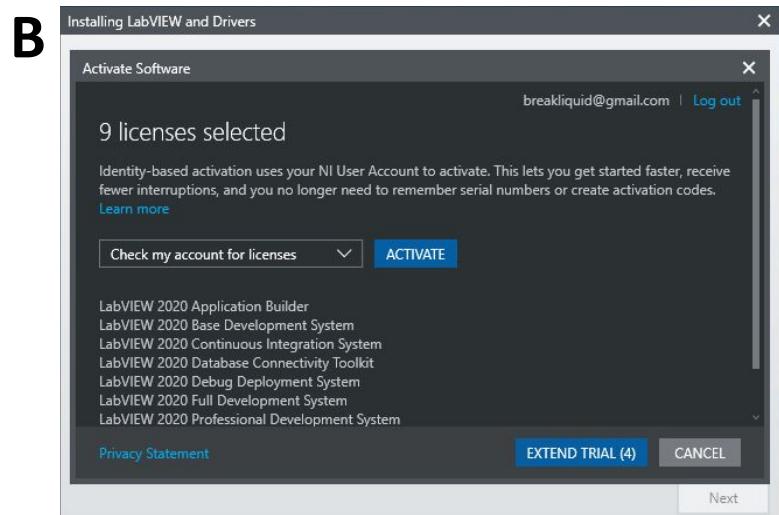
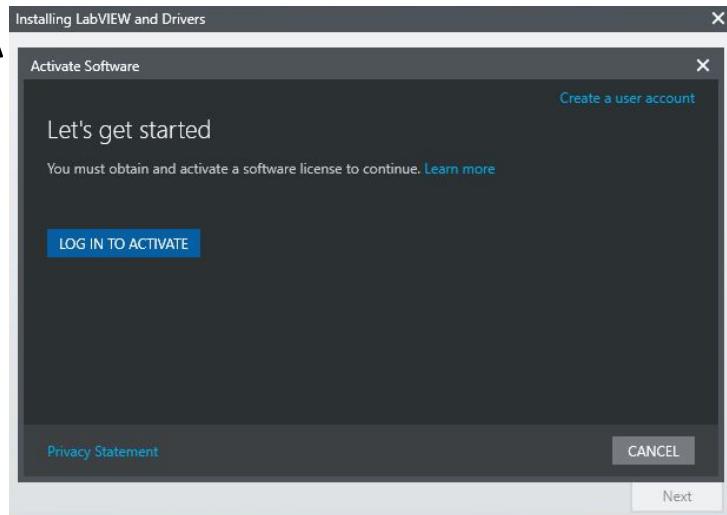
**C**

**D**

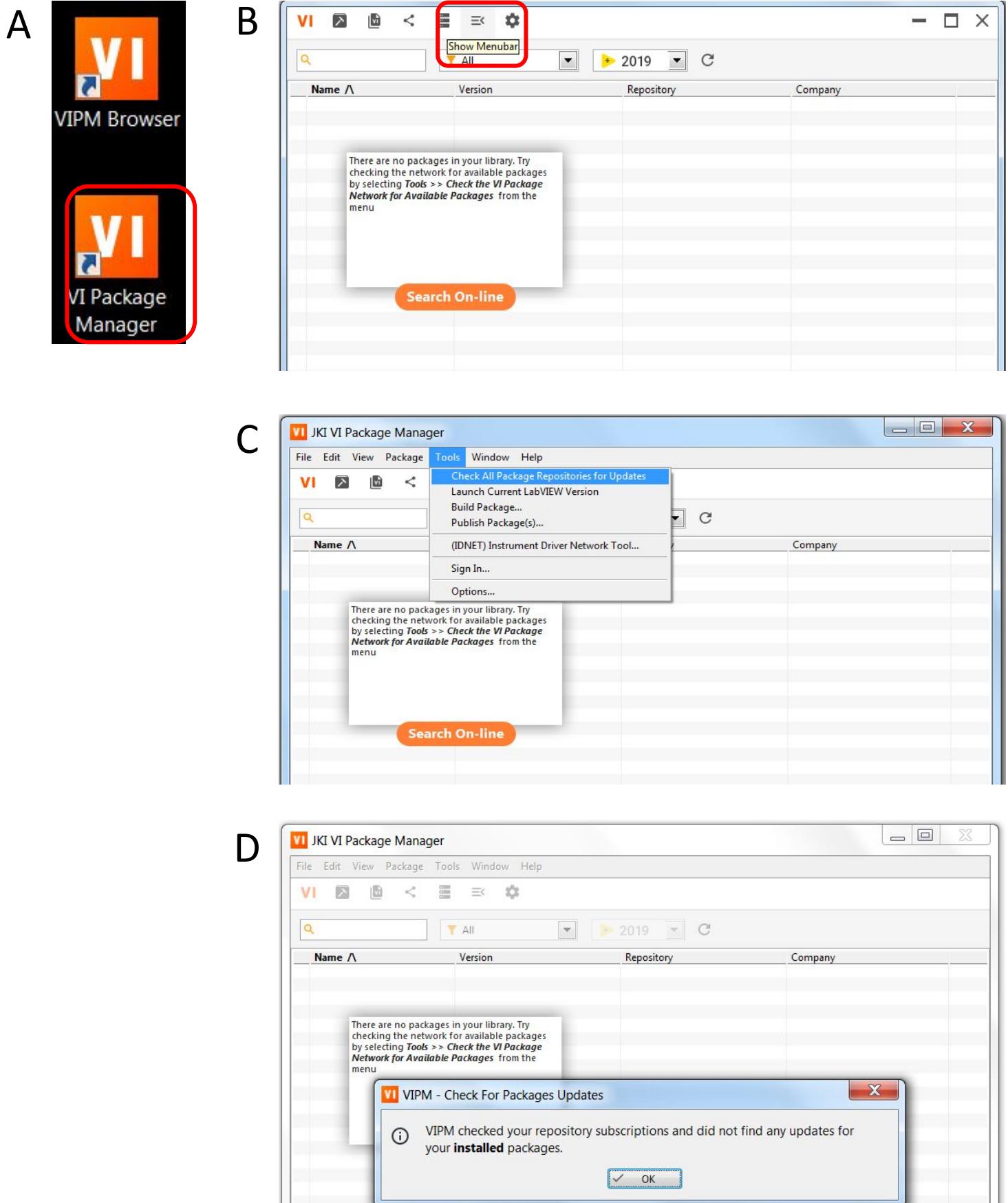
**E**

**F**

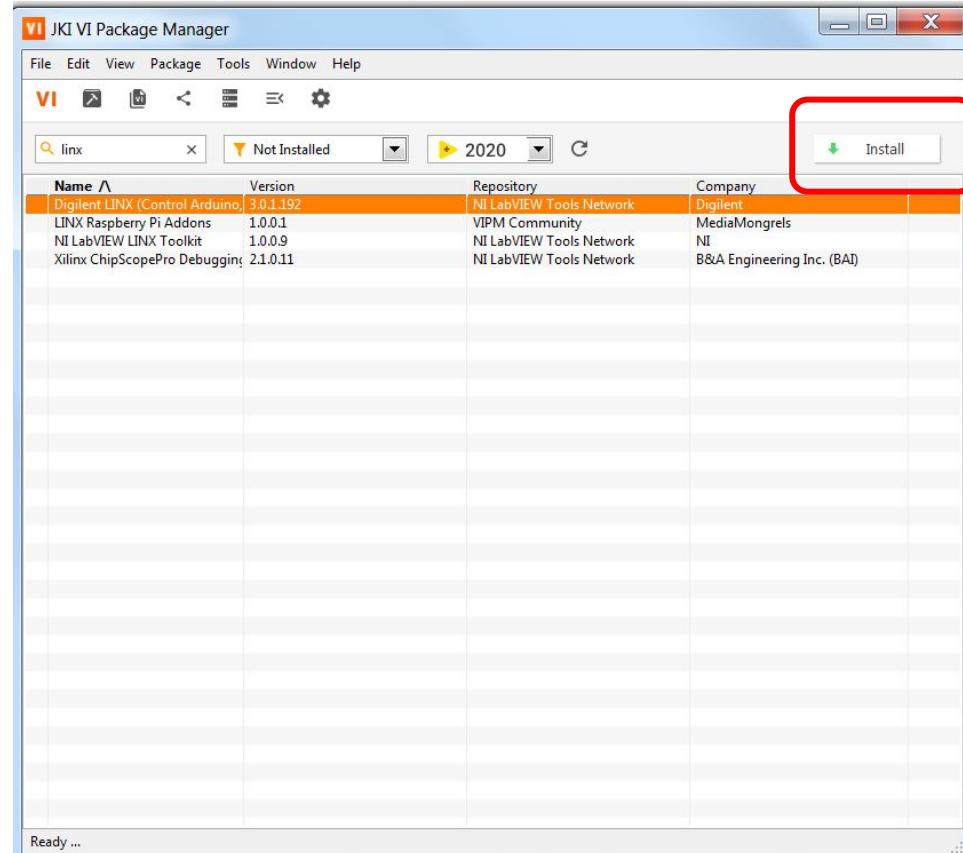
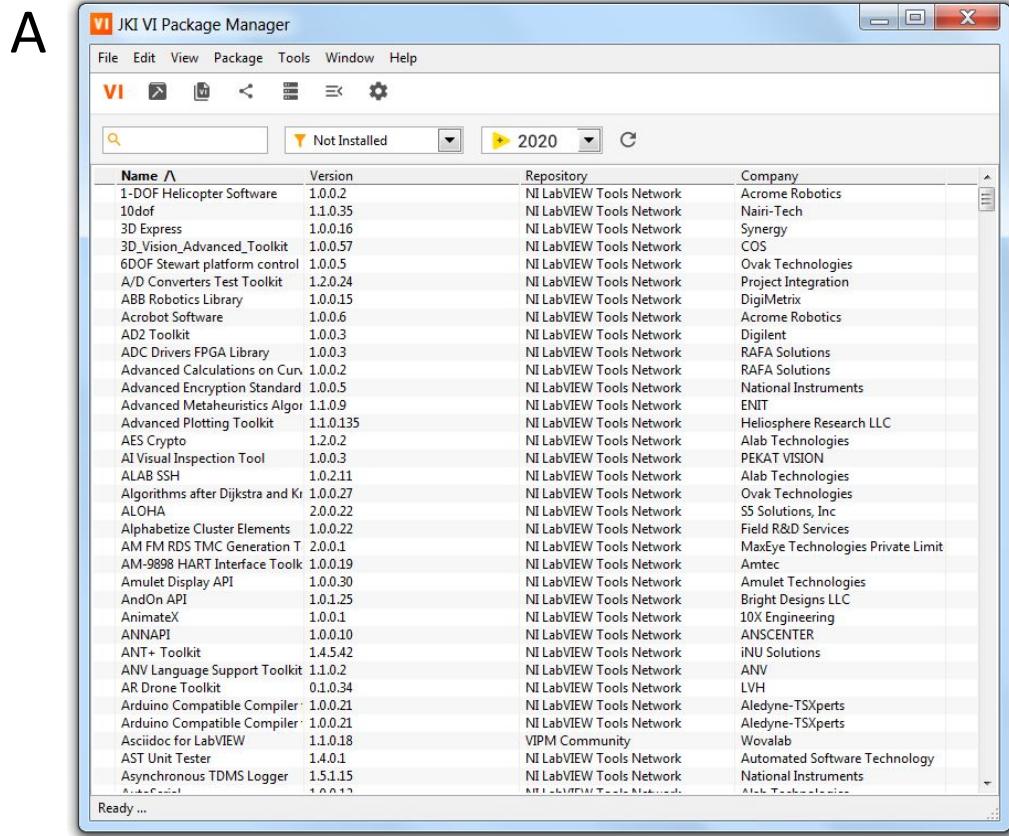
**Figure S63: Installing NI LabView 2020.** (A) After installing the NI Package manager, the LabView installation begins. There will be a list of many options to download. (B) Scroll down the list to find JKI VI Package Manager (VIPM-red arrow). Add this to the installation and then click next. (C) You can review the packages and then click next. (D) Accept the licensing agreements. (E) Accept the licensing agreements. (F) Review and then click next to continue the installation. This may take 30 minutes or more.



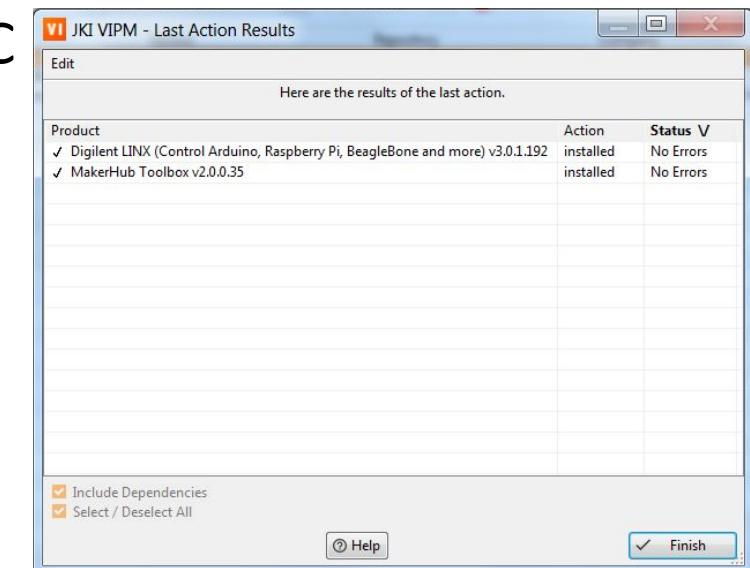
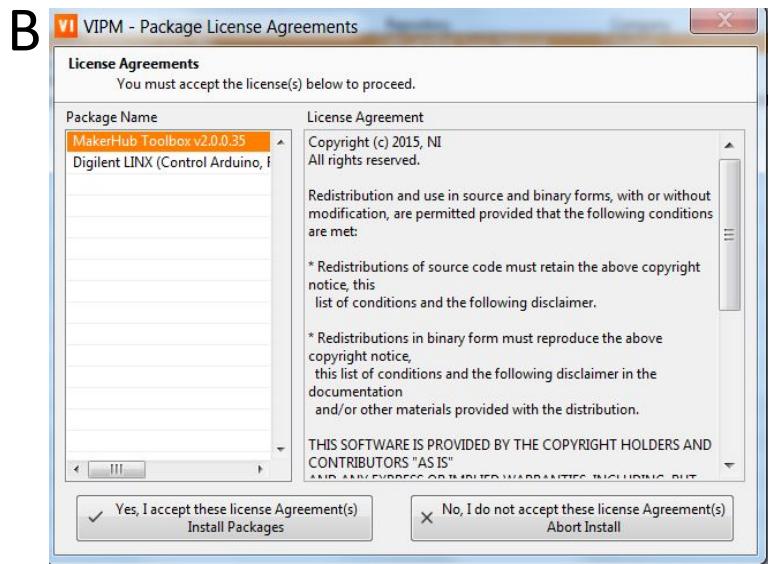
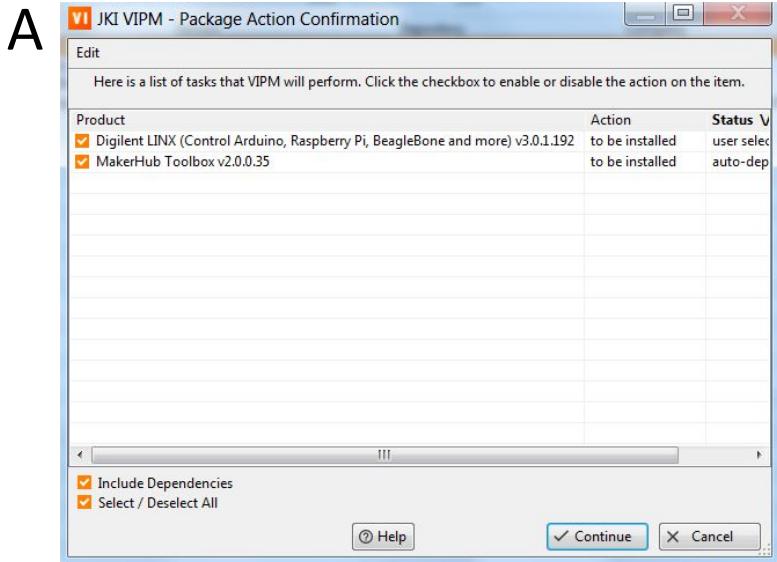
**Figure S64: Installing NI LabView 2020.** (A) You will be asked to login to the app before installation. (B) Activate all the default settings for the free trial. (C) Click “Finish” to install LabView. (D) Once installation is complete you will be prompted to reboot.



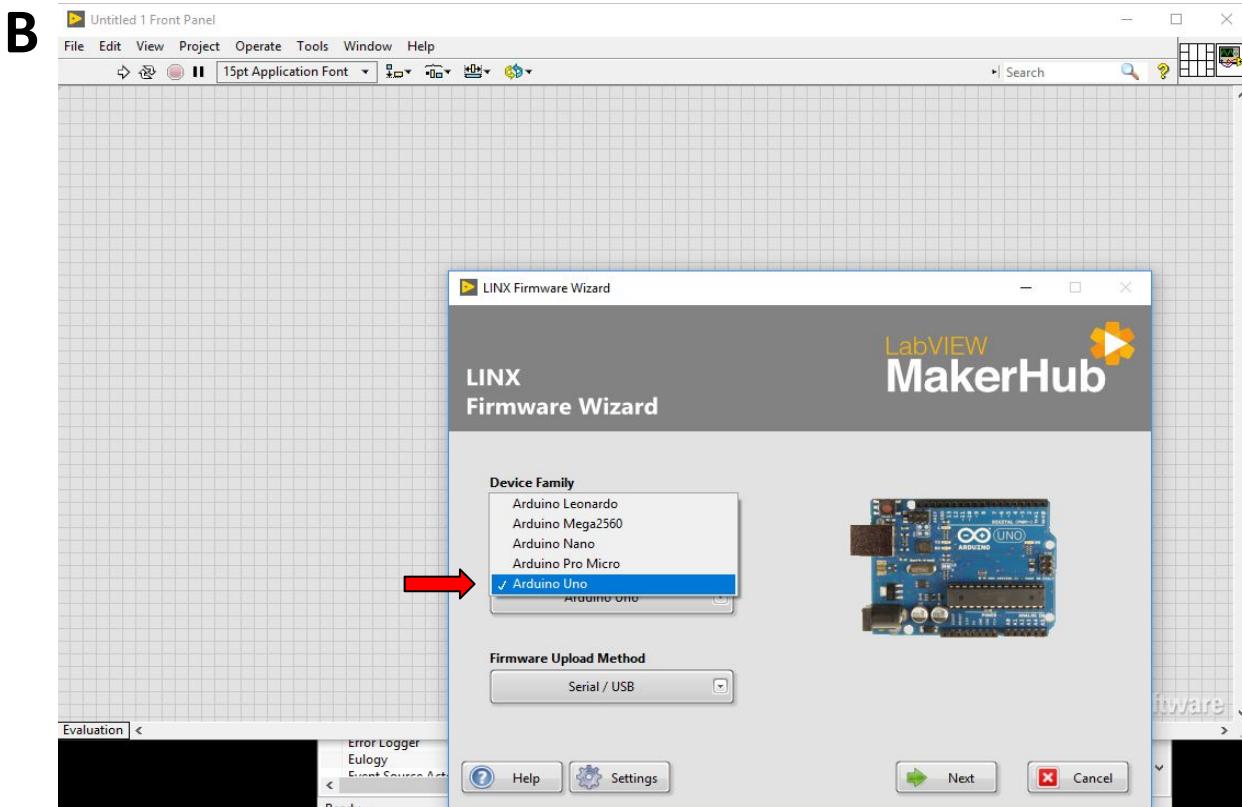
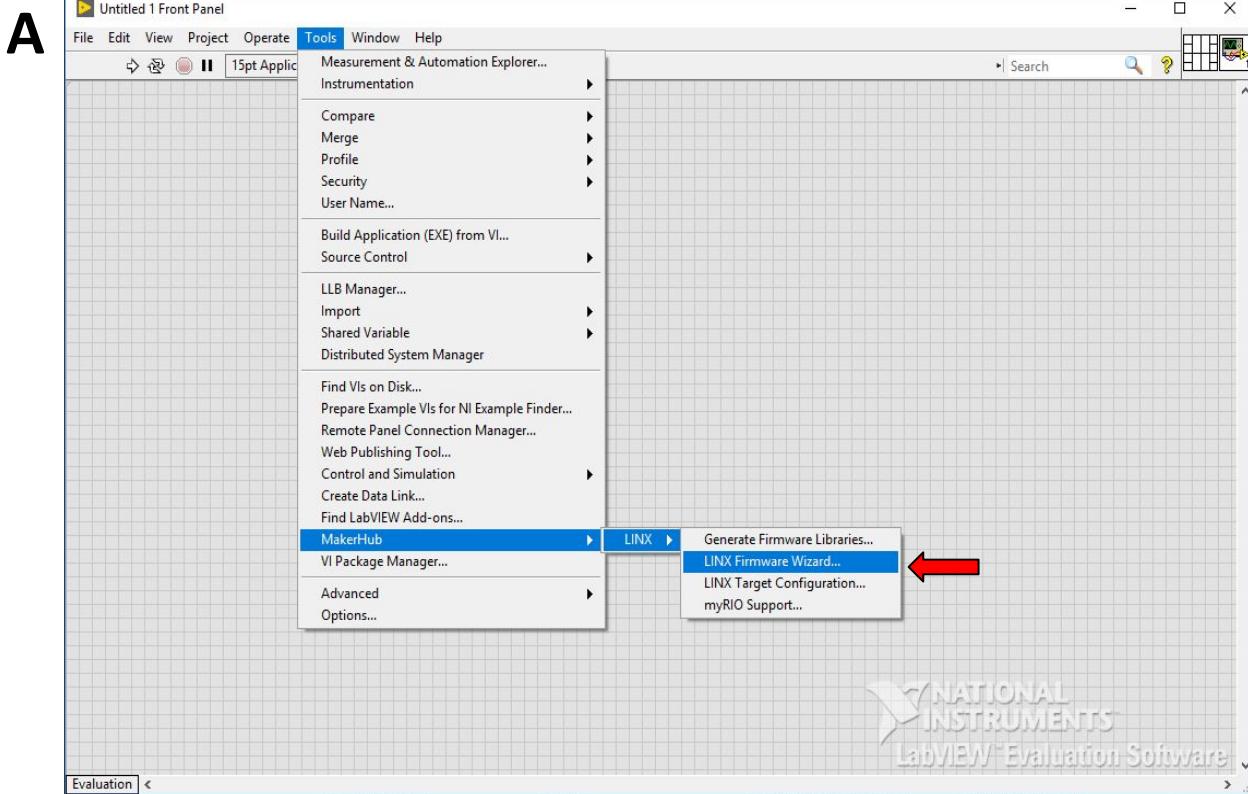
**Figure S65: Updating VIPM add ons.** After rebooting there will be an icon on your desktop for VI Package Manager (red box) and VI Browser. (A) Open VI Package Manager. (B) If the menu bar is not present press the menu bar icon (red box). (C) Click on Tools->Check All Package Repositories for Updates. (D) Click okay.



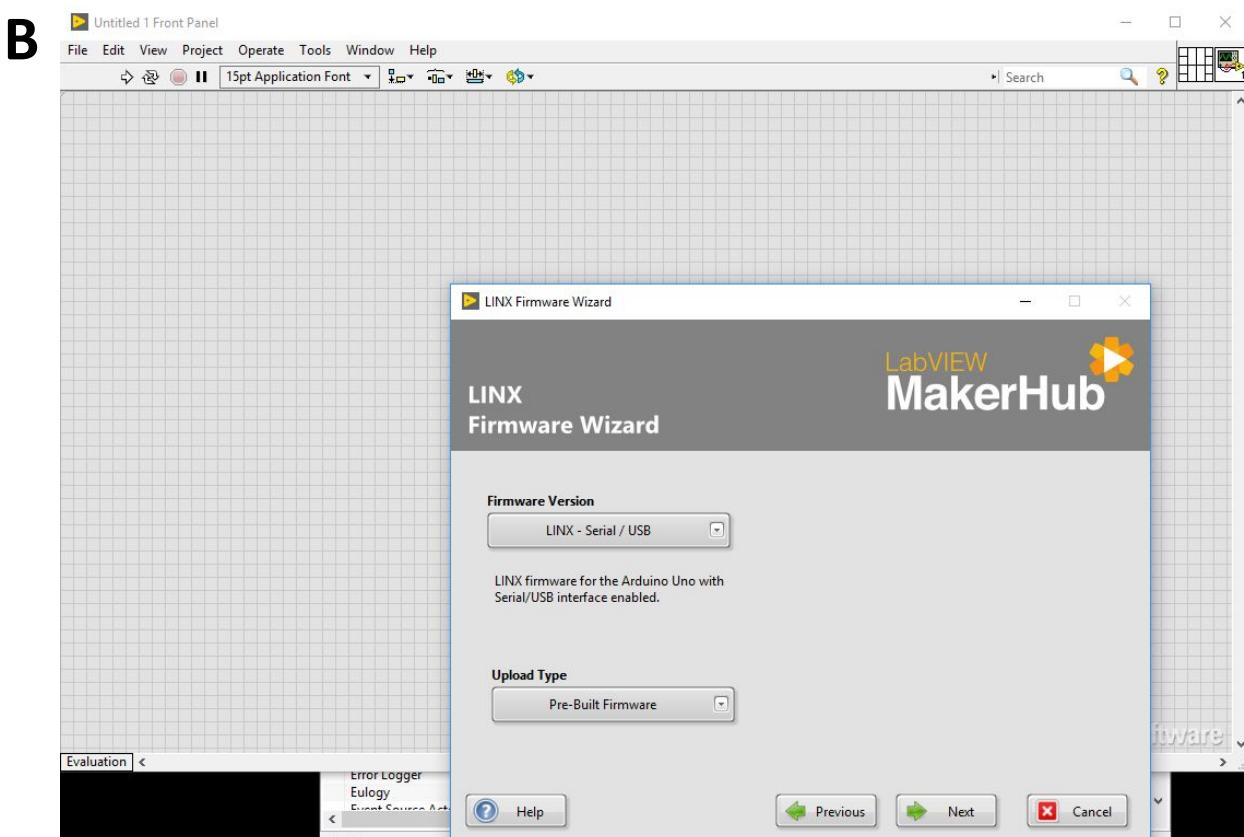
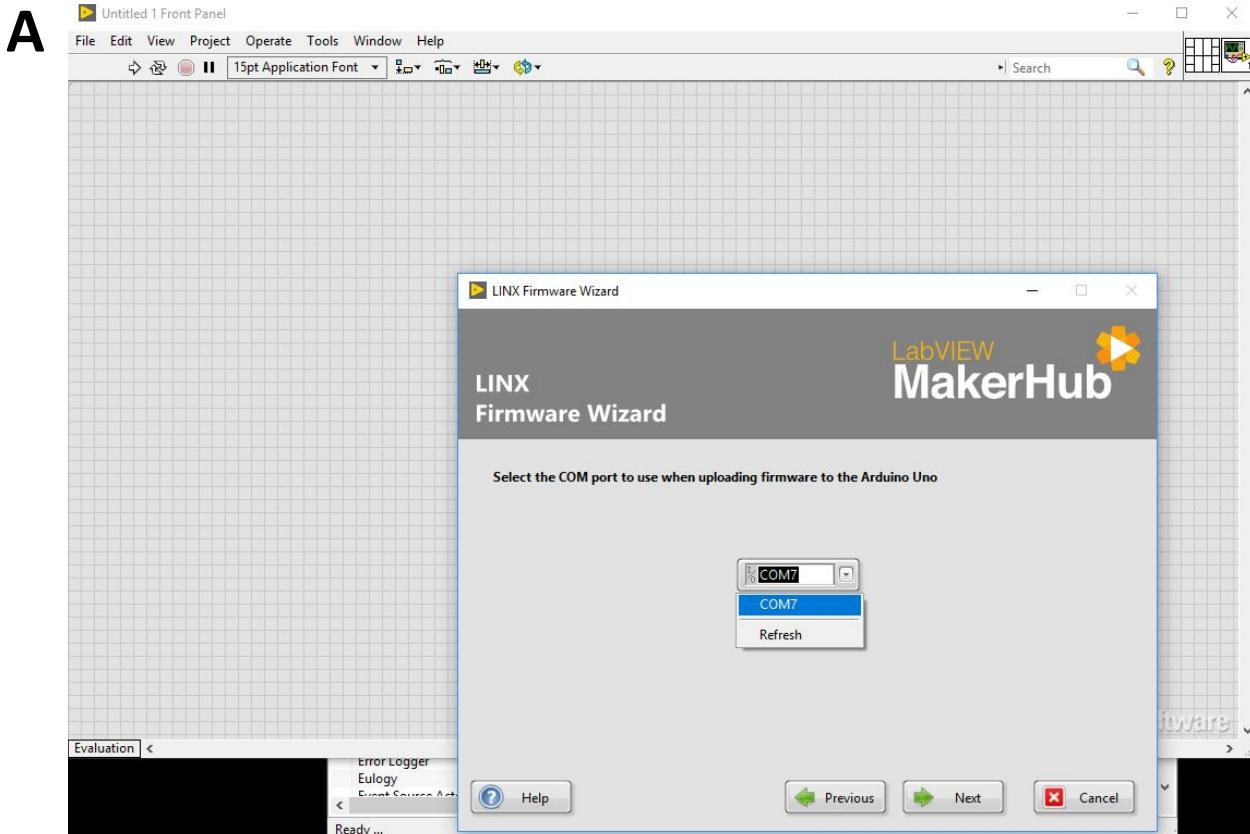
**Figure S66: Installing LINX and MakerHub.** (A) After the window says VIPM did not find updates for installed programs, many new uninstalled programs appear. (B) Search for “LINX” in the search box, select the version shown and click install (red box).



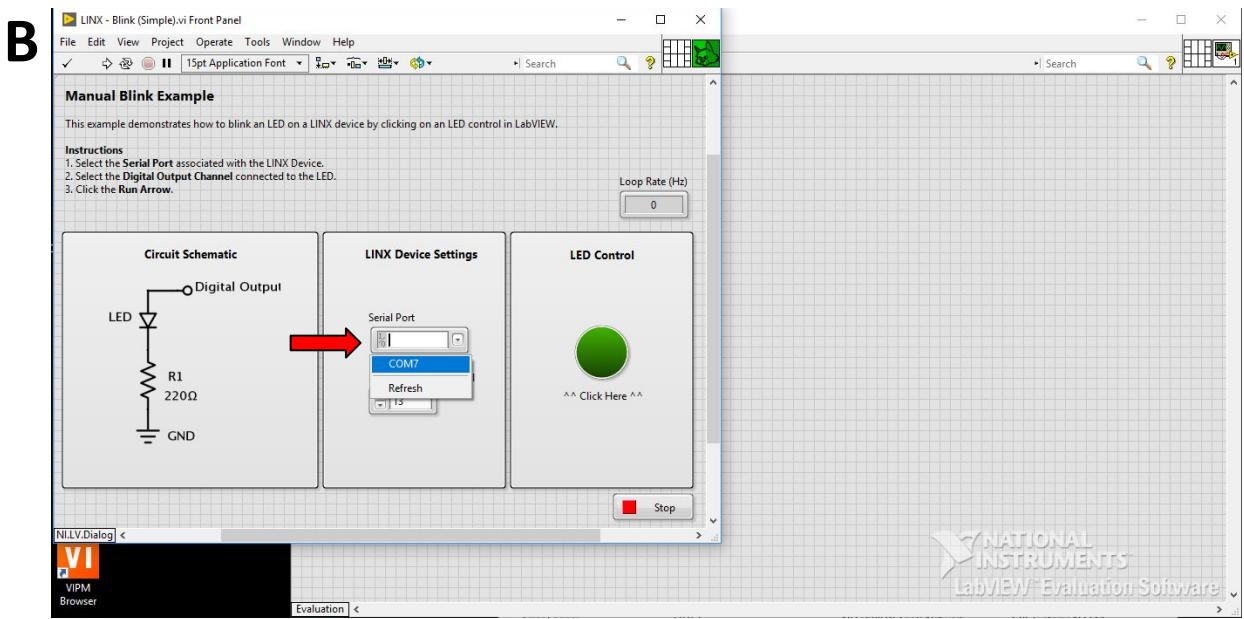
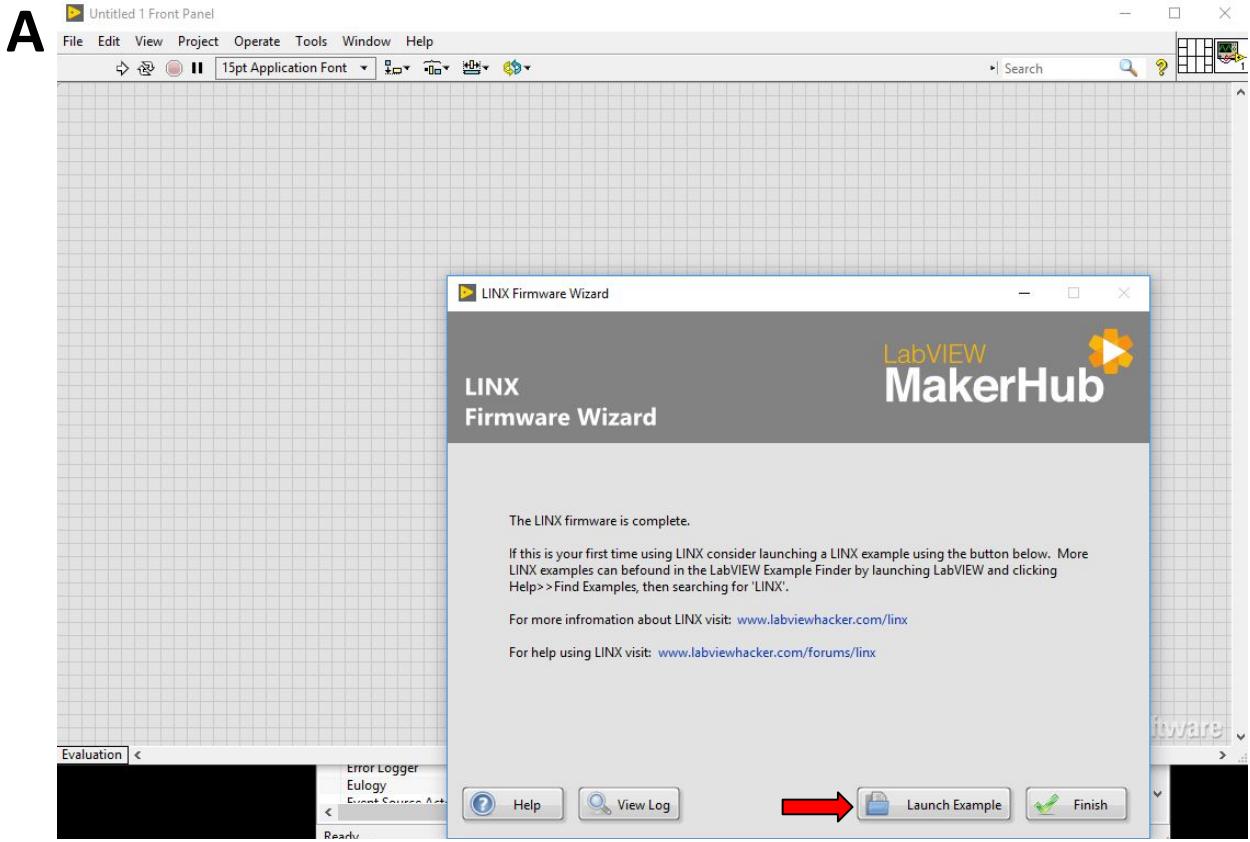
**Figure S67: Installing LINX and MakerHub** (A) You will be asked to confirm the installation. Makerhub will be auto installed with LINX. (B) Accept license agreements. (C) Installation is complete.



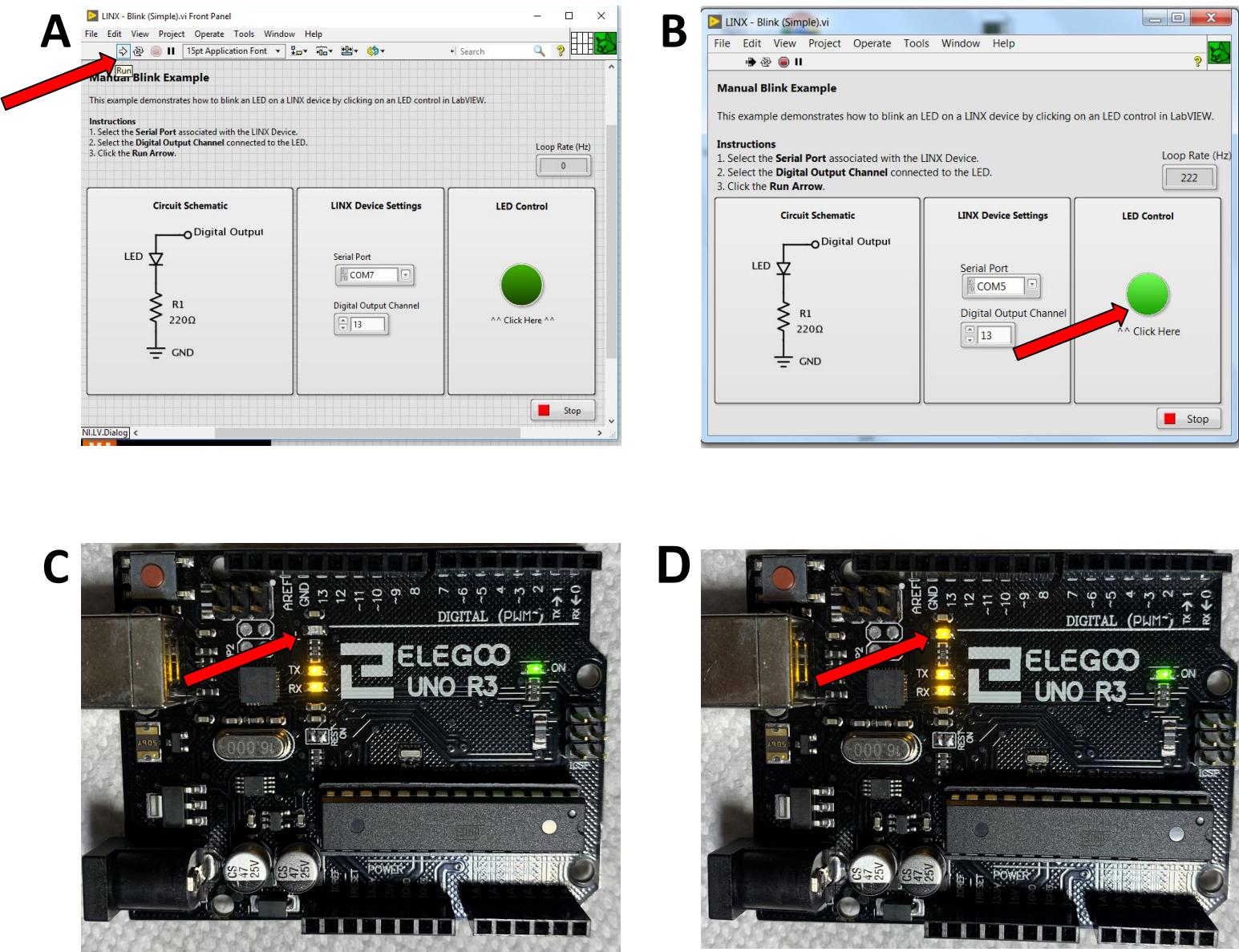
**Figure S68: Programming an microcontroller.** With Makerhub and LINUX installed you can now use LabVIEW to program microcontrollers to communicate with labview software. (A) Open LabVIEW 2020. On the menu bar click Tools>>MakerHub>>LINUX>>LINUX Firmware Wizard... (B) Select the microcontroller.



**Figure S69: Programming the microcontroller.** (A) Select a COM port. If your microcontroller is new it will be the highest number COM port in the list. A new COM port will be made for every microcontroller that is plugged into your Windows system. Click next to proceed. (If you do not see a COM port here check Figure S84 for installing the microcontroller driver.) (B) Click next again to install the Pre-built Firmware.



**Figure S70: Checking the microcontroller programming.** (A) Once the microcontroller is programmed a window will appear that gives the option to “Launch Example”. Click on this to test (red arrow) (B) Select the COM port again.



**Figure S71: Checking the microcontroller programming.** (A) Click “Run” to start the test program. (B) Click the green circle to blink the LED on the microcontroller board. (C) The microcontroller before clicking the green circle (LED off). (D) The microcontroller after clicking the green circle (LED on). If the LED blinks when you keep clicking the green circle the microcontroller is programmed.

# Installing software for a PC to control the LEDs

NI-VISA

NI Runtime Engine 2012

User Interface

ni.com/en-us/support/downloads/software-products/download.labview-runtime.html#306234

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**LabVIEW Runtime**

LabVIEW is systems engineering software for applications that require test, measurement, and control with rapid access to hardware and data insights.

+ Read More

**DOWNLOADS**

Supported OS: Windows

Version: 2012 SP1

Included Editions: Runtime

Application Bitness: 32-bit

Language: English, French, German, Japanese, Korean, Simplified Chinese

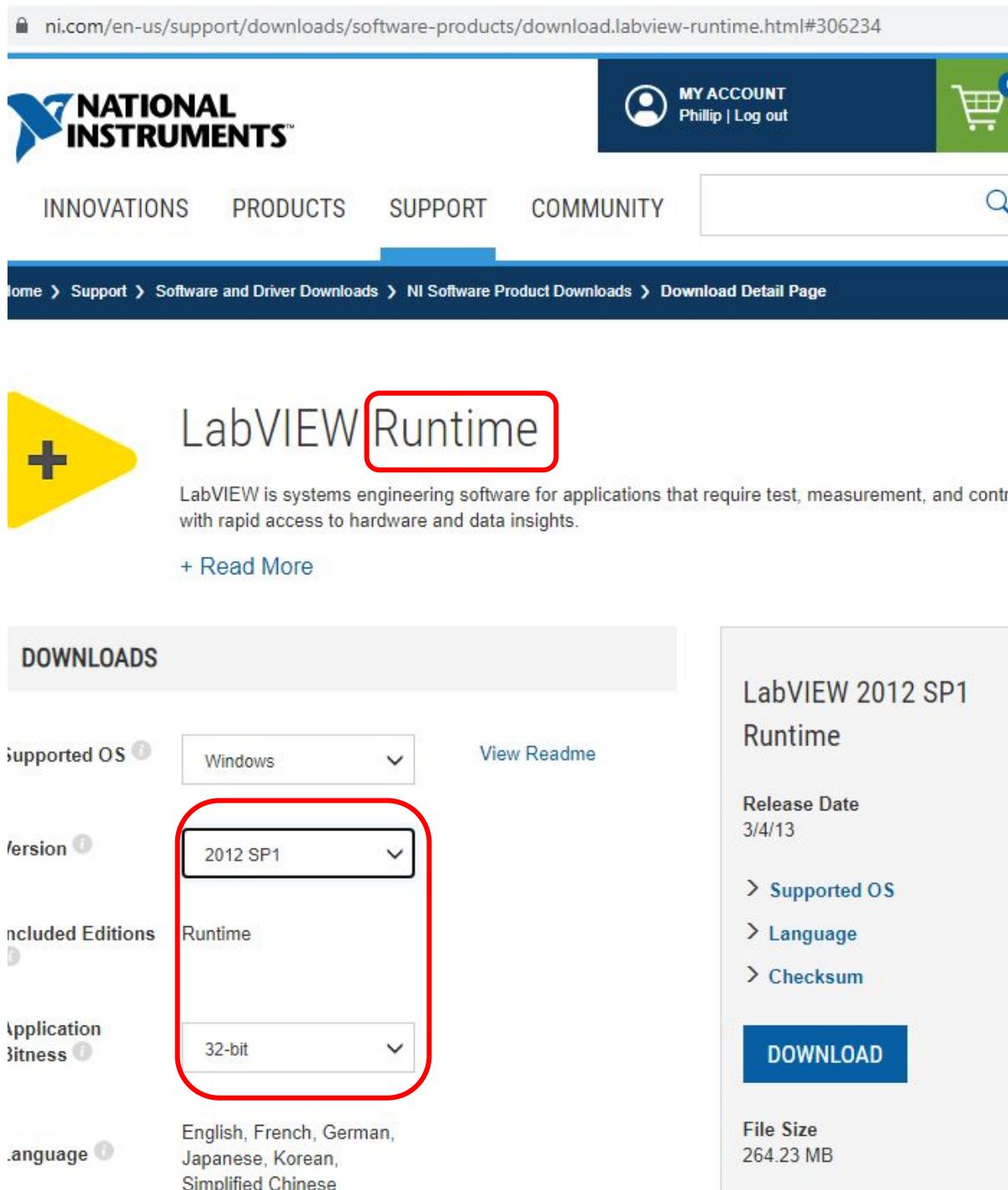
**LabVIEW 2012 SP1 Runtime**

Release Date: 3/4/13

> Supported OS  
 > Language  
 > Checksum

**DOWNLOAD**

File Size: 264.23 MB



**Figure S72: Installing LabView Runtime Engine 2012.** Search the internet for “NI labview runtime engine 2012” or go to the following web address and choose 2012 SP1. Be sure you are downloading the runtime engine:  
<https://www.ni.com/en-us/support/downloads/software-products/download.labview-runtime.html#346222>

A [ni.com/en-us/support/downloads/software-products/download/unpackaged.labview-runtime.306234.html](https://ni.com/en-us/support/downloads/software-products/download/unpackaged.labview-runtime.306234.html)

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## Downloading LabVIEW 2012 SP1 Runtime



### Next Steps

After the download is complete, you can launch an installer that will take you through the process of selecting features and installing the software. If you have problems with this process, you can restart the download.

If the download doesn't start automatically, [restart the download now](#).

GETTING STARTED

B

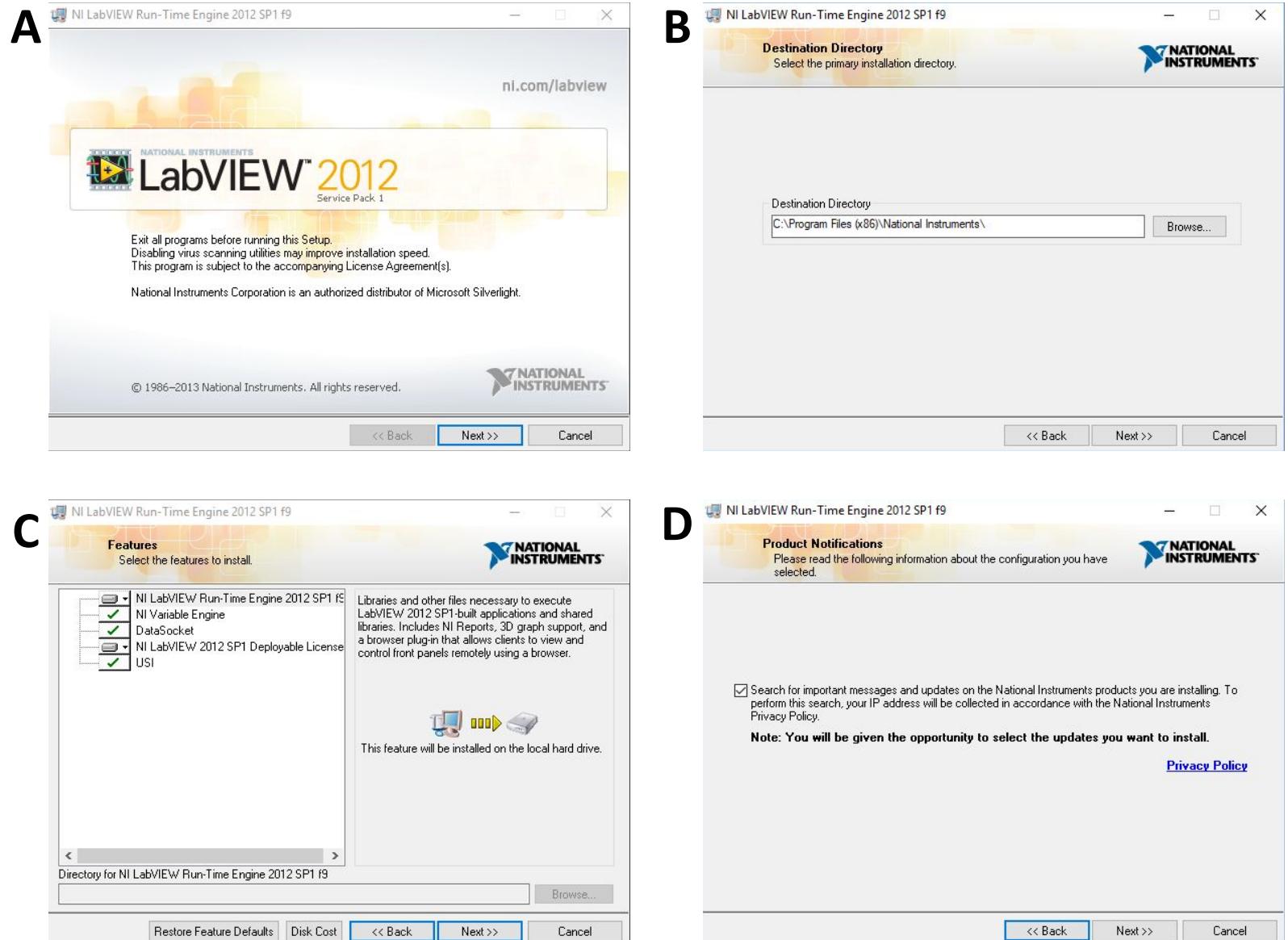


LVRTE2012SP1\_f9P....zip

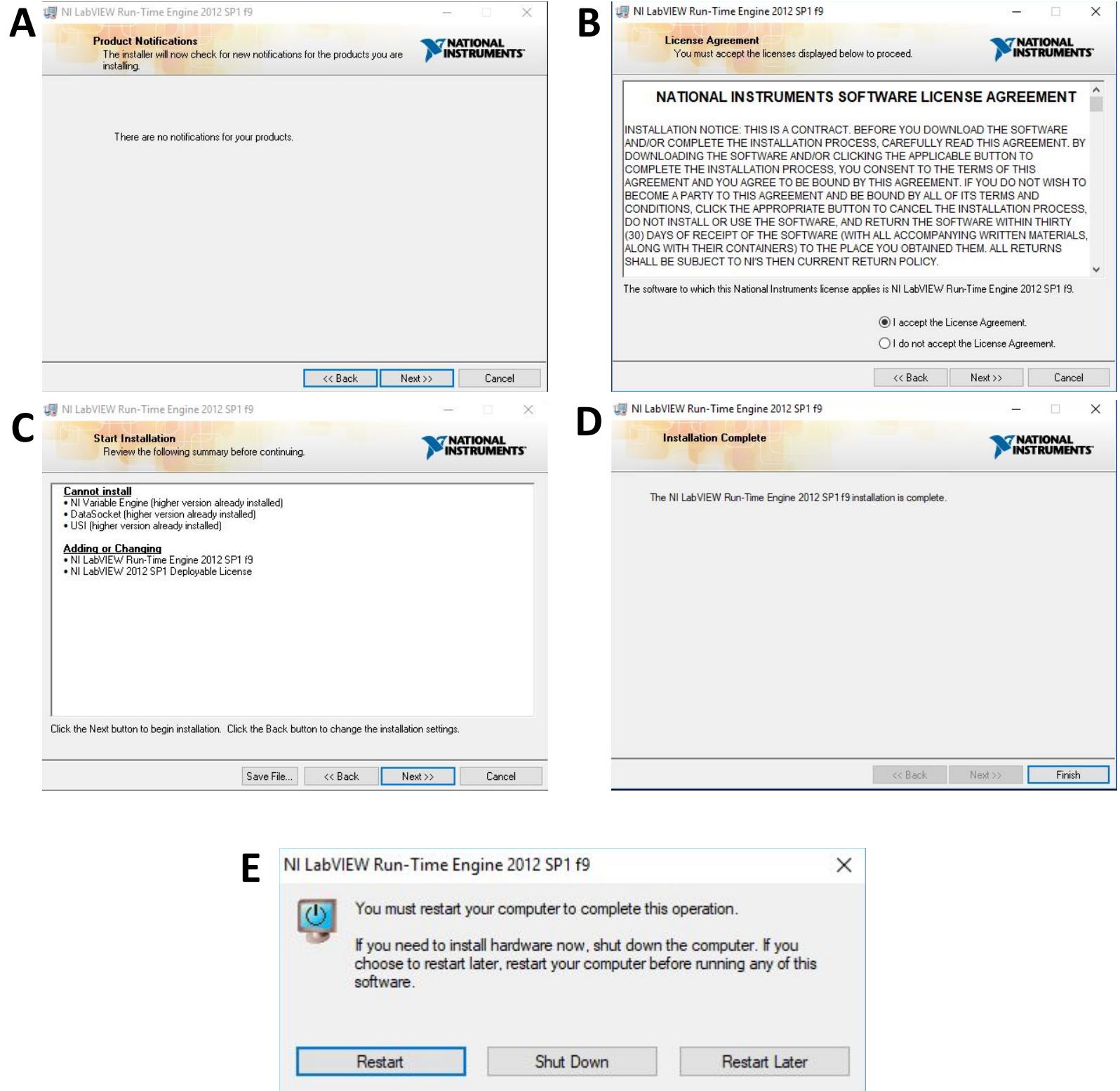
C

Name	Size	Packed	Type
..			File folder
Bin			File folder
Licenses			File folder
Products			File folder
nidist.id	333	239	ID File
patents.txt	21,950	6,107	Text Document
<b>setup.exe</b>	1,436,000	1,390,985	Application
setup.ini	25,479	5,737	Configuration setti...

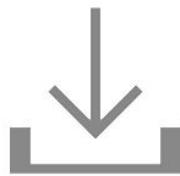
**Figure S73: Installing LabView Runtime Engine 2012.** (A) After clicking “Download”, a download screen appears and the download begins automatically. (B) The zipfile will appear on your browser and be in your downloads folder. (C) Open the Zip file and run the “setup.exe” file (red box).



**Figure S74: Installing LabView Runtime Engine 2012.** (A) Click next to continue installation. (B) Choose the default installation folder. (C) Keep the default installation settings. (D) Click next to proceed with installation.



**Figure S75: Installing LabView Runtime Engine 2012.** (A) Click next to continue. (B) Accept the license agreements. (C) Review installation and click next. (B) The zipfile will appear on your browser and be in your downloads folder. (D) Click finish to acknowledge the installation is complete. (E) restart your system when prompted.

**A**

## NI-VISA

NI-VISA provides support for customers using Ethernet, GPIB, serial, USB, and other types of instruments.

[+ Read More](#)

Note: Install programming environments such as NI LabVIEW or Microsoft Visual Studio® before installing this product.

### DOWNLOADS

Supported OS

Windows

[View Readme](#)

Version

20.0

Included Editions

Full

Application Bitness

32-bit & 64-bit

Language

English, French, German, Japanese, Korean,  
Simplified Chinese

### NI-VISA 20.0

Release Date

5/15/20

Included Versions  
20.0.0

[> Supported OS](#)

[> Language](#)

[> Checksum](#)

[DOWNLOAD](#)

File Size

5.37 MB

Note: If you need to download individual versions or patches, you can select from [Individual Offline Installers](#)

**B**

ni-visa\_20.0\_online.exe



**Figure S76: Downloading NI-VISA 2020.** (A) Search the internet for “labview NI VISA download” or go to <https://www.ni.com/en-us/support/downloads/drivers/download.ni-visa.html#346210> to find the download page. Download with the settings shown. (B) Click on the download file to begin installation.

**A**

**B**

**C**

**D**

**E**

**Figure S77: Installing NI-VISA 2020.** (A, B) After opening the setup file click next to install all the default programs. (C) Agree to terms and click next to install LabView. (D) Review the install and then click “Next” to install. (E) When the installation is complete click “Reboot Now”.

ni.com/en-us/support/downloads/software-products/download.labview-runtime.html#306234

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**LabVIEW Runtime**

LabVIEW is systems engineering software for applications that require test, measurement, and control with rapid access to hardware and data insights.

+ Read More

**DOWNLOADS**

Supported OS: Windows

Version: 2012 SP1

Included Editions: Runtime

Application Bitness: 32-bit

Language: English, French, German, Japanese, Korean, Simplified Chinese

**LabVIEW 2012 SP1 Runtime**

Release Date: 3/4/13

> Supported OS  
 > Language  
 > Checksum

**DOWNLOAD**

File Size: 264.23 MB

**Figure S78: Installing LabView Runtime Engine 2012.** Search the internet for “NI labview runtime engine 2012” or go to the following web address and choose 2012 SP1. Be sure you are downloading the runtime engine:  
<https://www.ni.com/en-us/support/downloads/software-products/download.labview-runtime.html#346222>

A [ni.com/en-us/support/downloads/software-products/download/unpackaged.labview-runtime.306234.html](https://ni.com/en-us/support/downloads/software-products/download/unpackaged.labview-runtime.306234.html)

INNOVATIONS PRODUCTS SUPPORT COMMUNITY

## Downloading LabVIEW 2012 SP1 Runtime



### Next Steps

After the download is complete, you can launch an installer that will take you through the process of selecting features and installing the software. If you have problems with this process, you can restart the download.

If the download doesn't start automatically, [restart the download now](#).

GETTING STARTED

B

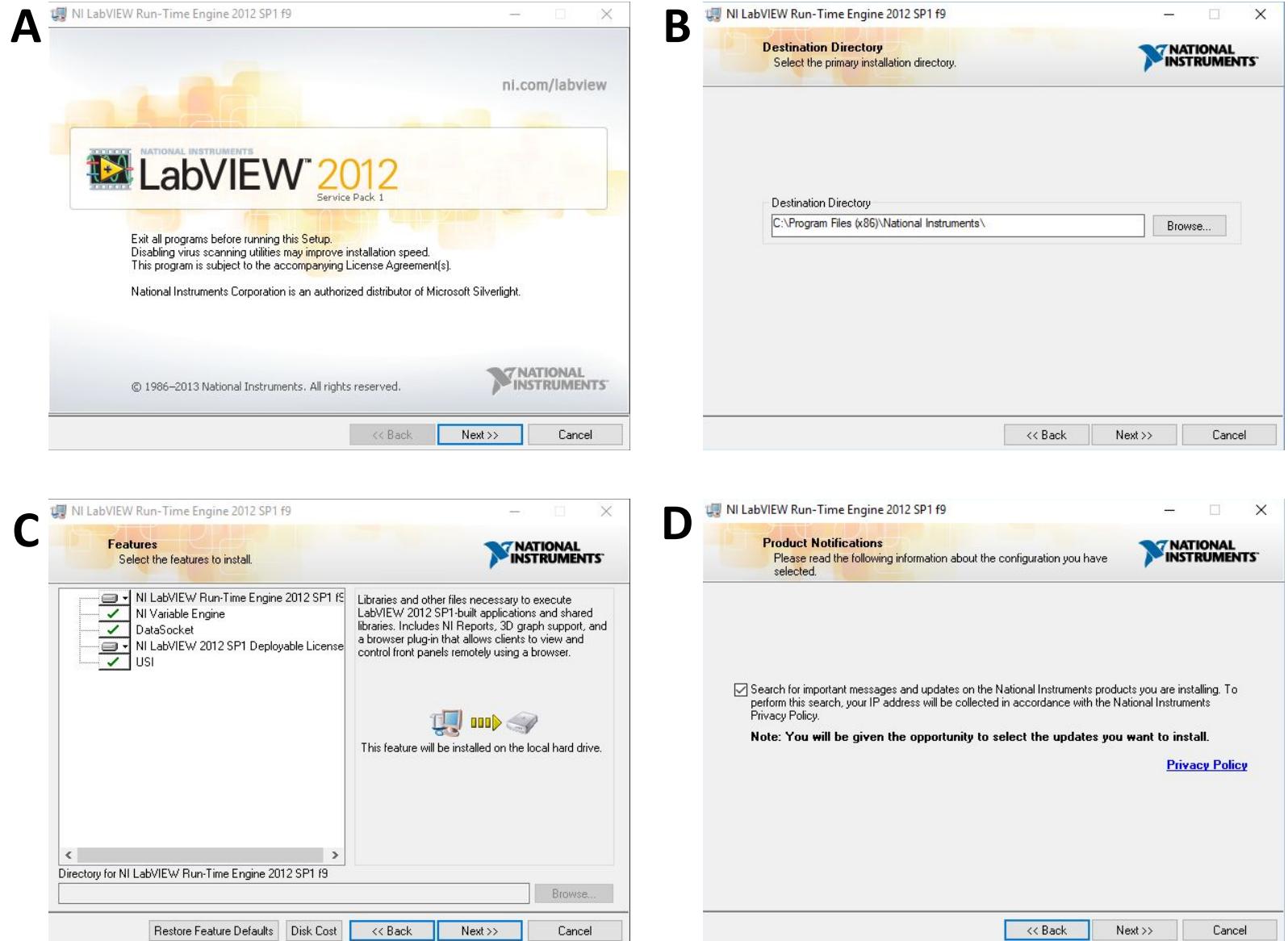


LVRTE2012SP1\_f9P....zip

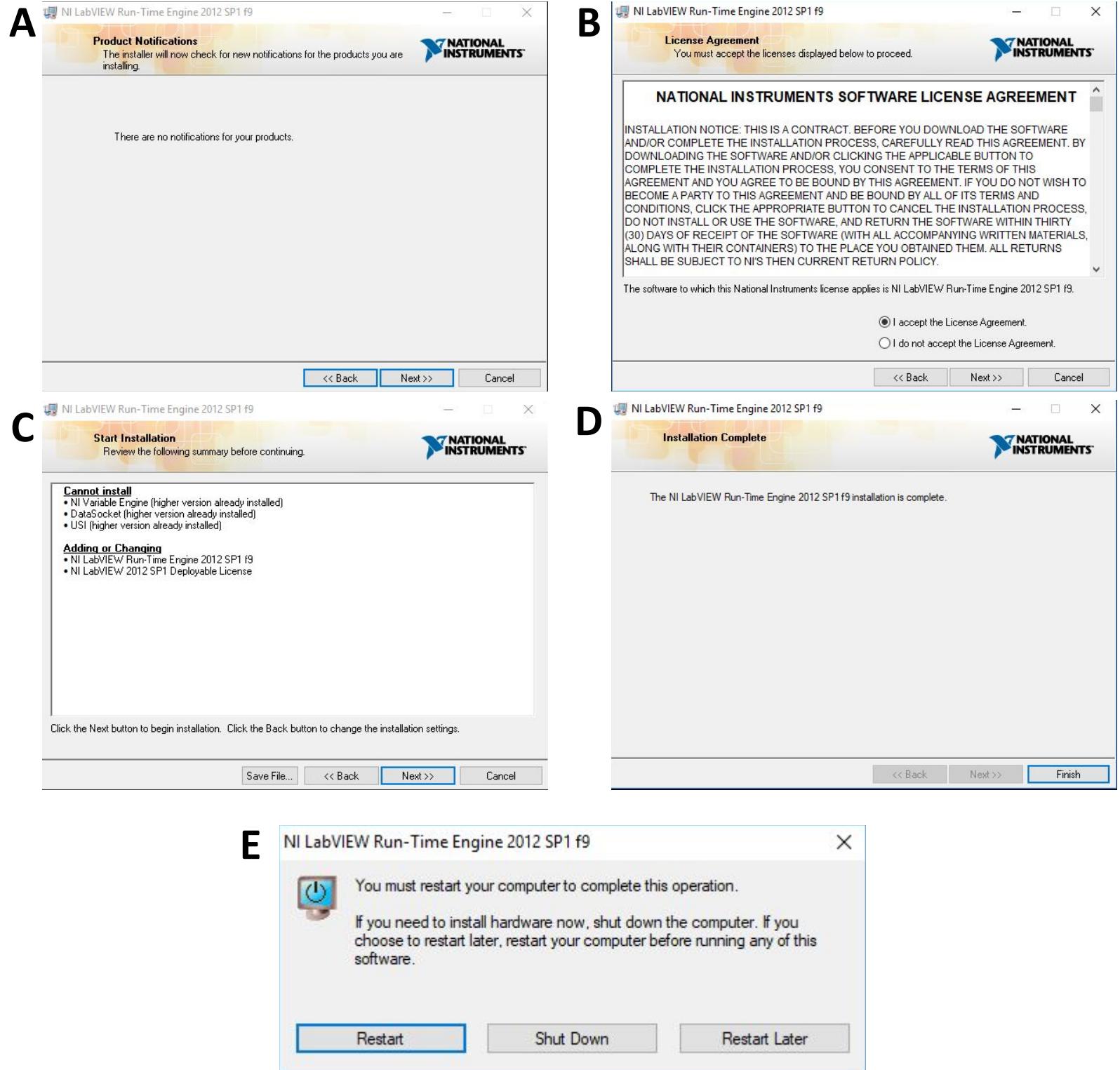
C

Name	Size	Packed	Type
..			File folder
Bin			File folder
Licenses			File folder
Products			File folder
nidist.id	333	239	ID File
patents.txt	21,950	6,107	Text Document
<b>setup.exe</b>	1,436,000	1,390,985	Application
setup.ini	25,479	5,737	Configuration setti...

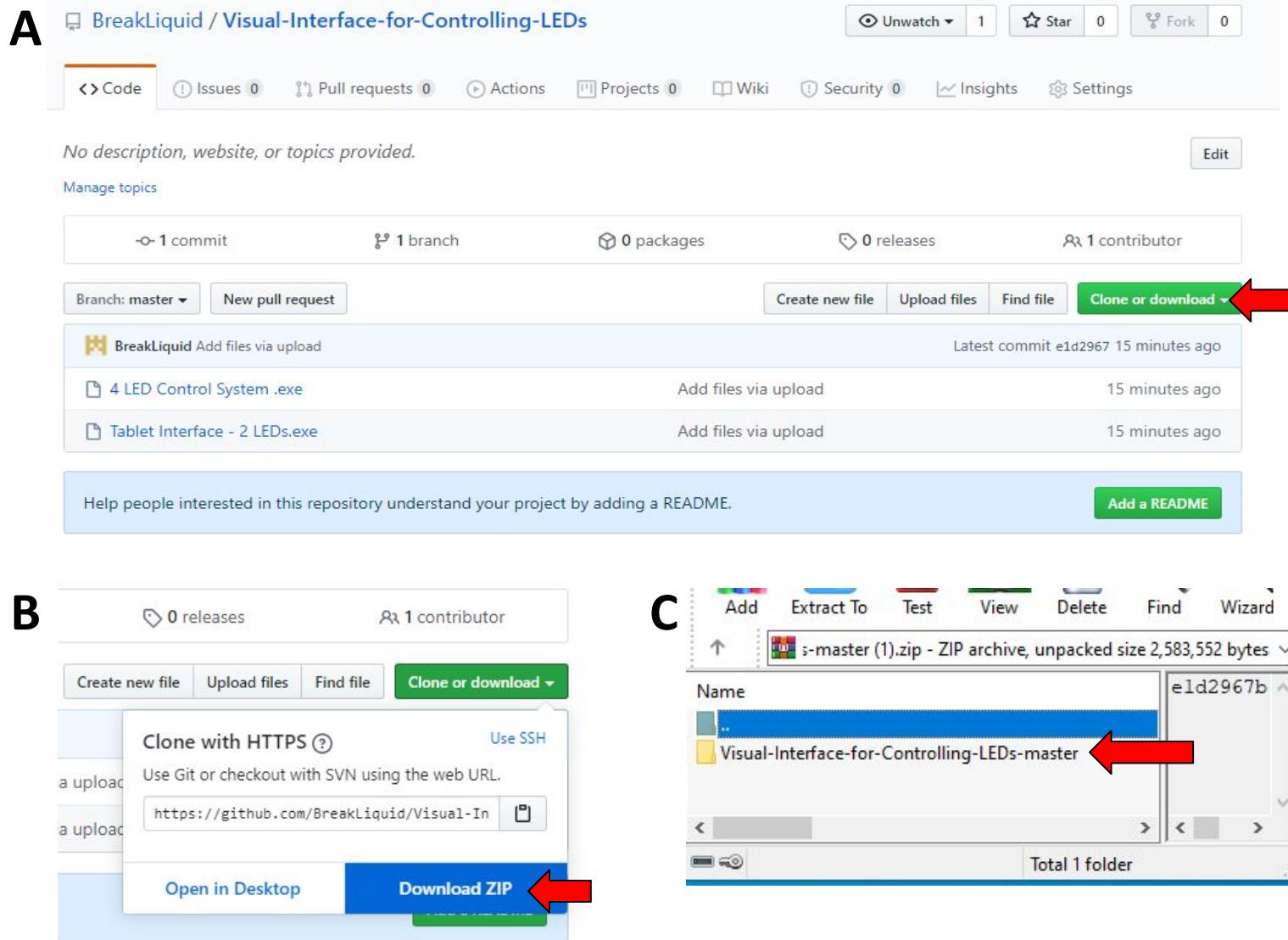
**Figure S79: Installing LabView Runtime Engine 2012.** (A) After clicking “Download”, a download screen appears and the download begins automatically. (B) The zipfile will appear on your browser and be in your downloads folder. (C) Open the Zip file and run the “setup.exe” file (red box).



**Figure S80: Installing LabView Runtime Engine 2012.** (A) Click next to continue installation. (B) Choose the default installation folder. (C) Keep the default installation settings. (D) Click next to proceed with installation.



**Figure S81: Installing LabView Runtime Engine 2012.** (A) Click next to continue. (B) Accept the license agreements. (C) Review installation and click next. (B) The zipfile will appear on your browser and be in your downloads folder. (D) Click “Finish” to acknowledge the installation is complete. (E) Restart your system when prompted.



**Figure S82: Downloading and running the user interface for Controlling LEDs.** (A) Go to Github: <https://github.com/BreakLiquid/LED-Control-User-Interfaces> and click “Clone or Download”. (B) Click “Download Zip”. (C) Open the Zip file and the folder containing the two user interfaces. (D) Choose which a user interface and drag it onto your desktop. This file can be run directly by clicking on the icon.

**A**

### Arduino Connection

Serial Port

Connect

Connection  
Not Connected

Loop Rate (Hz)  
0

**B**

Pin #	Time On	Frequency
13	0 min	0 mHz
Run Time	Time Off	Cycle Time
00:00	0 min	00:00
On/Off		Sample ID/Notes
<input type="button" value="LED Status"/>		OFF

**C**

### Main Timing Control

Start Delay  
00:00

Time Until Start  
00:00:00

Total Run Time  
00:00:00

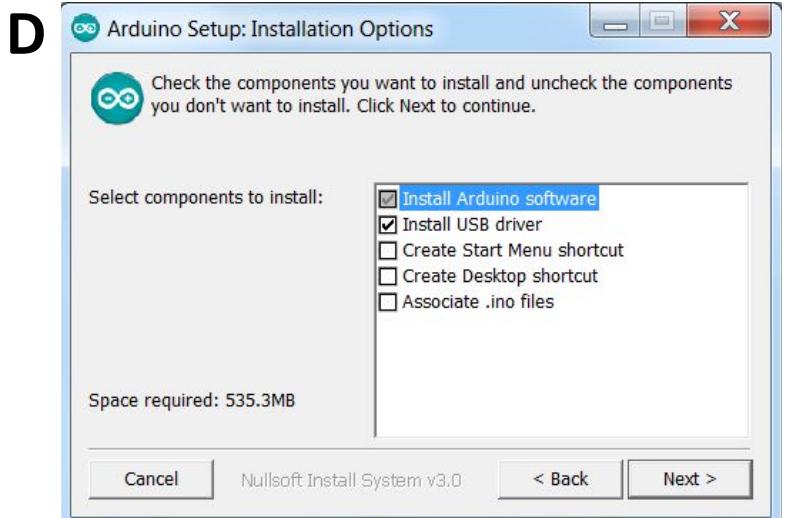
Total Elapsed Time  
00:00:00

Program Status  
OFF

Start

Run Complete  
Not Yet

**Figure S83: Operating the LED control system.** (A) Click on the “Serial Port” tab and select the COM port that corresponds to the microcontroller, then click connect. (B) Choose illumination settings for each LED. For continuous light select any number of minutes for “Time On” and zero for “Time Off”. To pulse the LEDs choose the frequency by changing the “Time On” and “Time Off” settings. Fractions of minutes can be used. To select a run time for an individual LED select a run time in this box. (C) To run after a specific time, program a Start Delay here. Total Run Time for all the LEDs can be controlled below the start delay. The run time will start after the start delay.



**Figure S84: Error due to microcontroller driver missing.** (A) In some computers the microcontroller driver does not automatically install when plugging it into the USB port. You will see this when you try and program the microcontroller using MakerHub. If when trying to select a COM port none appear and your microcontroller is plugged in the driver is likely missing. (B) Go to <https://www.arduino.cc/en/main/software> to download it. (C) Agree to the license. (D) Install only the options selected here. Once the installation is complete the driver is installed and MakerHub can program the microcontroller. (Go back to Figures S50A or S69A)