

## Rubiks Cube Club – Introduction

Welcome and let's get started. First, each student is being given a PLC, an Ethernet cable and software. The software is from Siemens and is labelled:

Simatic Step 7 Basic V19

This software is licensed and is good for as long as the computer supports Windows 10 or 11. The license is not time limited. You will only need the first DVD from the box. It is labelled:

Siemens V19 Simatic Step 7 Basic/Professional, Step 7 Safety...

### Download Siemens Software:

If you choose to download the software from Siemens directly over the web, see instructions at:

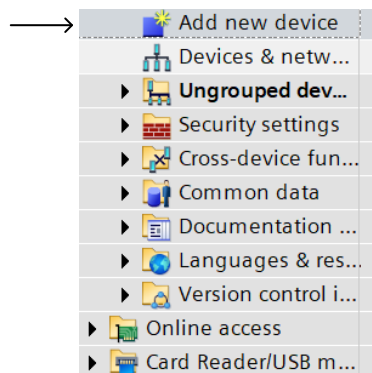
<https://hybridplc.org/wp-content/uploads/TIA-Portal-Instructions.pdf>

If you download the software from the website, it will refer to a 21 day trial. This can be ignored if you have a key. There is a one download key in the box. It is the black memory stick located in the box.

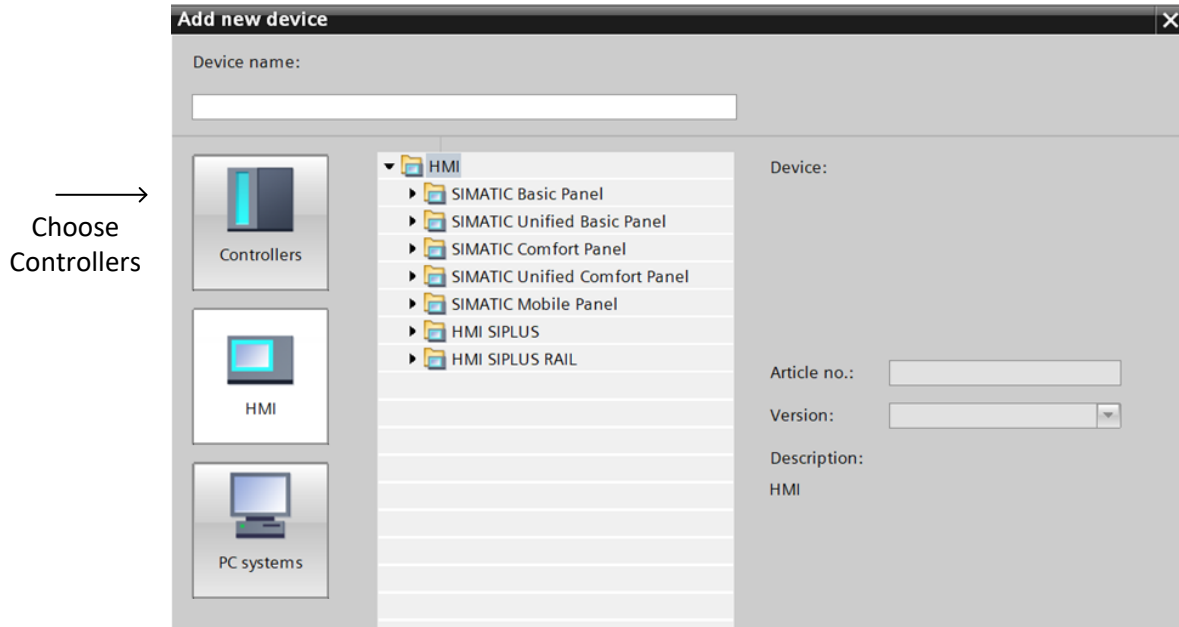
### Key:

Use it to set up the license on the C drive of your computer. This is a single download key. Use the instructions above for this. **DO NOT DRAG/DROP THE LICENSE KEY.** Follow the instructions under the Automation License Manager.

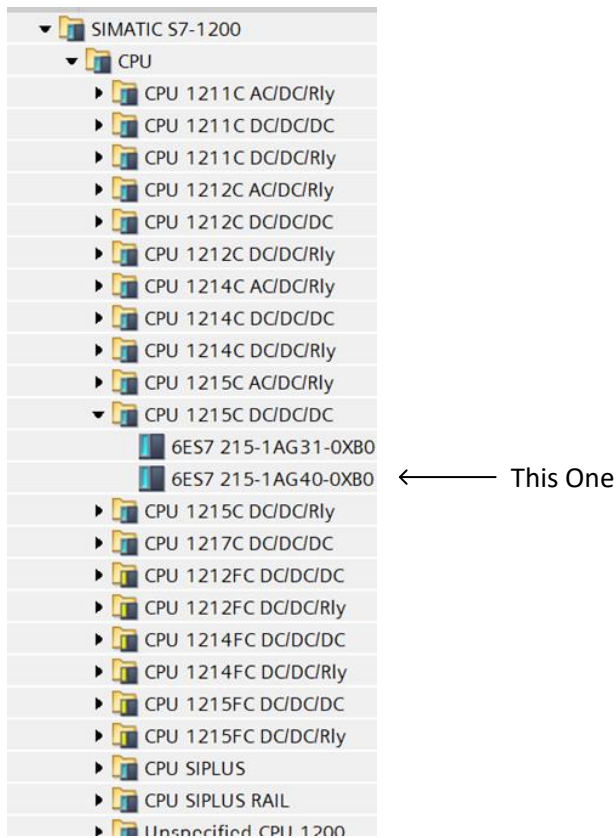
When setting up the software, test it by creating a new project, pick in the lower left corner Project View and then Add new device:



You should see the following screen:



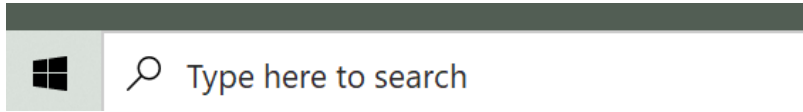
This allows you to pick the Controller from the list, the S7-1215C DCDCDC:



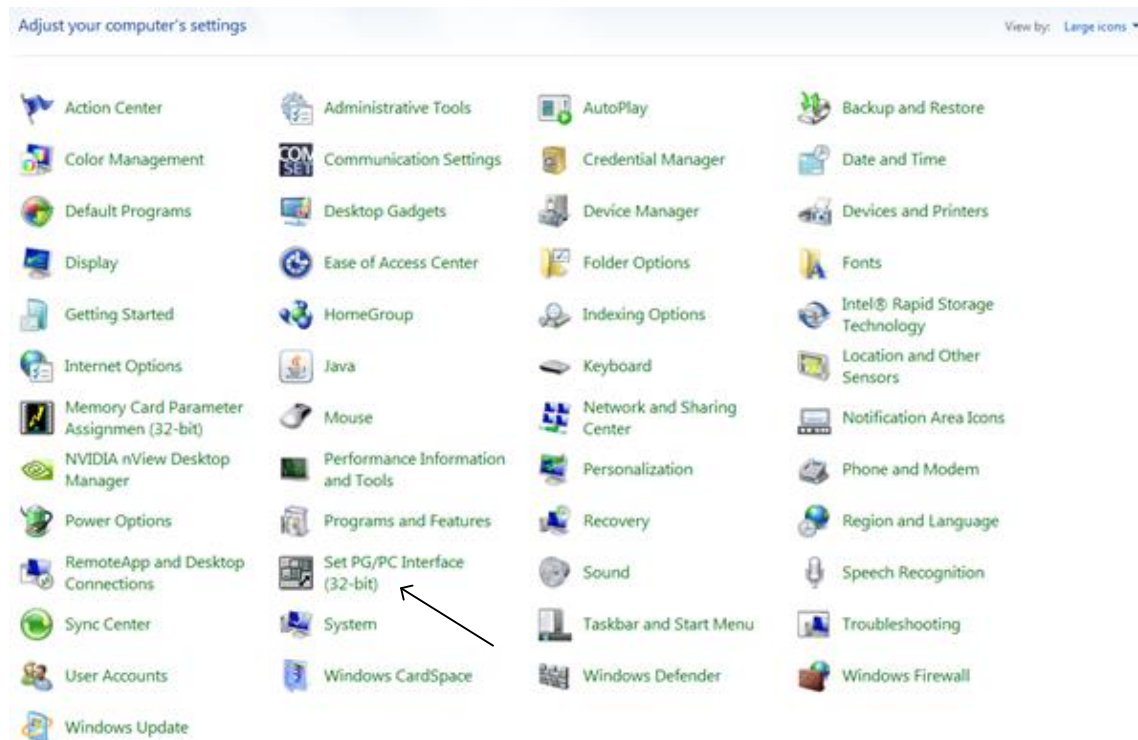
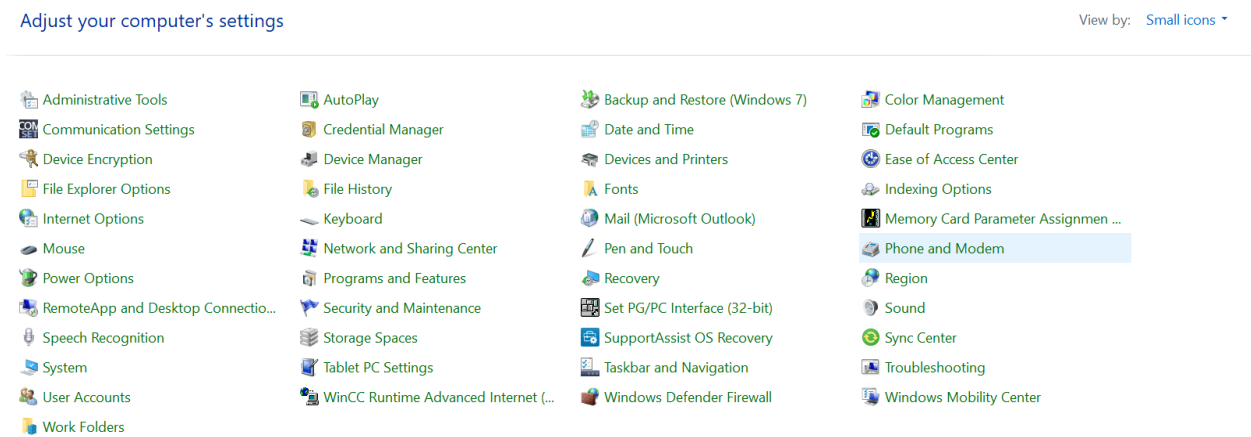
**You may call the University or my cell 419-343-3681 at any time in this process. Siemens also has a Hot Line that is available 8-5 M-F at 800-333-7421.**

The following must be set up to get the Siemens program to run properly with the HMI simulate mode. This should only be required only once at initial set-up of the program.

From the area in the lower left corner of the screen, type: control panel

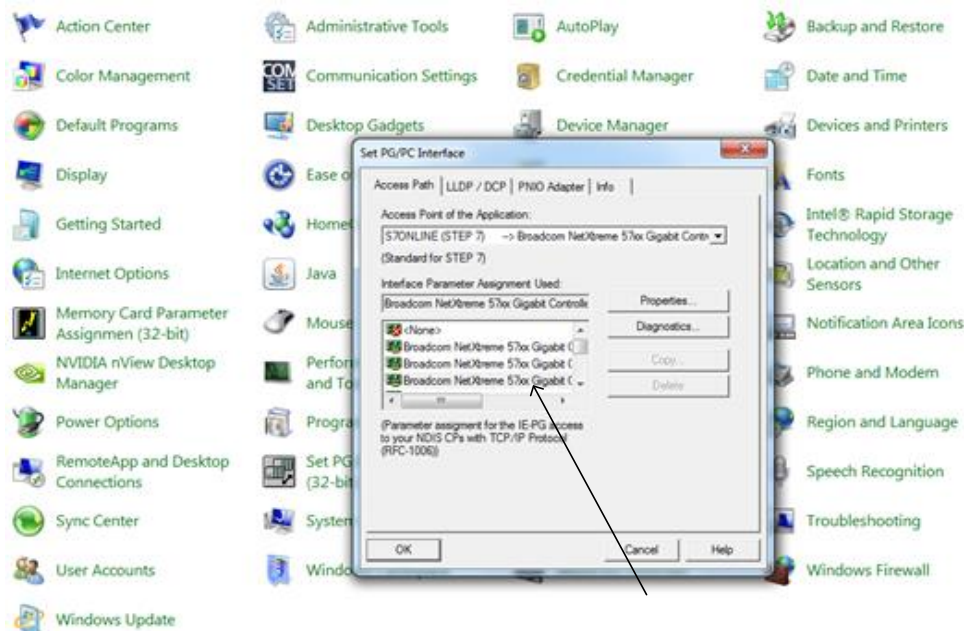


With the Control Panel displayed, look in the upper right and toggle to 'large icons':



Click on the SetPG/PC Interface box above:

Choose the third of the Broadcom choices. Click OK.



This allows the Siemens program to run the HMI (Human Machine Interface) program in simulate mode. Then download the program to the PLC. Do not download the HMI program since we do not have the HMI to download to.

### Setup of IP Address:

A note about the Ethernet IP addresses:

Please set up the computer port that communicates to the PLC to 192.168.0.2. We will get students to set the PLC to 192.168.0.3. If you choose another address, you are responsible for student instruction on how to set up the PLC.

Also it was found out tha we need to enable the .net framework for 3.5.

## What to Expect:

We will post exercises starting week of Jan 13, hopefully Monday, January 13 to start the first lab. There may actually be some postings before this time but the official start date is Jan. 13. While exercises are expected to be completed by the students, there is no grade associated with the labs. However, we would like students to verify their attendance with a screen shot of the lab hopefully running with the final program statements shown. This will be explained as the class progresses.

An introduction with a 'syllabus' is given at the following:

<https://hybridplc.org/high-school-plc-club/>

under the tab Instructions to Get Started – Rubiks Club.

Instruction Videos will be found under

<https://hybridplc.org/videos/>

then youtube channel, then playlists, then Rubiks\_Club.

## Getting Started Programming:

The first thing we need to do is to check if you can load a program with the computer and PLC you have.

The sequence of programs written will be as follows:

Download a blank program Week 1

Write and execute the Hot Dog Program Week 1

Write and execute the Traffic Light Program Week 2

Write and Execute the Cash Register Program Week 3

At this time, if you have completed at least the Traffic Light program, you will be given a wiring kit. We will then redo the Hot Dog Program with Input wiring Week 4

Redo the Traffic Light Program with Input and Output wiring Week 5

Write, wire and execute the Simon Says Program Week 6, 7

Write, wire and execute the Stepper Motor Program Week 8

About this time, the schools will be given at least one Rubiks 6 Axis Automated System. These will be used by the students to prove their programs in solving the Rubiks Cube automatically using the programs being written by themselves.

Write, wire and execute the Function Block Program

Week 9

Combine a Stepper Motor with a Function Block

Week 10, 11

At end of Week 11, a completed version of this program will be given out if students are not able to complete this portion. We will then begin programming the algorithm to solve the first phase of the Rubiks Cube – the White Cross. If the school can achieve with at least one team the White Cross in a demonstrable form, then they will be provided a table at the at the College Expo at the University of Toledo during the last week of April to demonstrate their success.

Begin programming the First Level of the Rubiks Block

Week 12, 13

Regroup – See Where We Have Been

Week 14

**For any questions, please contact:**

Wm Ted Evans

Professor, U of Toledo

Email: [william.evans@utoledo.edu](mailto:william.evans@utoledo.edu)

Cell 419-343-3681