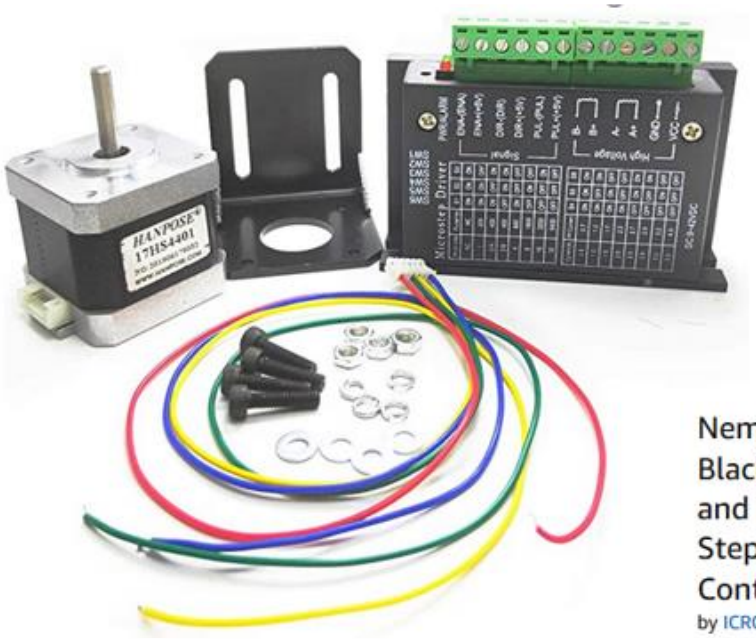
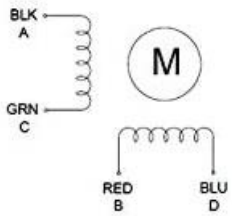
Chapter 19 Stepper using 3D Printer Stepper Motor

This lab is an upgrade or less-expensive version of the lab in Chapter 18. The lab in that chapter used parts as they existed in the year 2012. We were in a tremendous change at that time in the electronics/programming maker revolution that introduced components like the parts shown below. These components were made for the Arduino and 3D Printer. Distributors such as the Robot Shop or Amazon have many components such as these. The only difficulty is that the voltages may not match and the user manual for this stepper give the formula for describing the components needed.



Nema 17 Stepper Motor with Black L Stepper Motor Bracket and TB6600 4A 9-42V Stepper Motor Driver CNC Controller for 3D Printer

by ICROATO

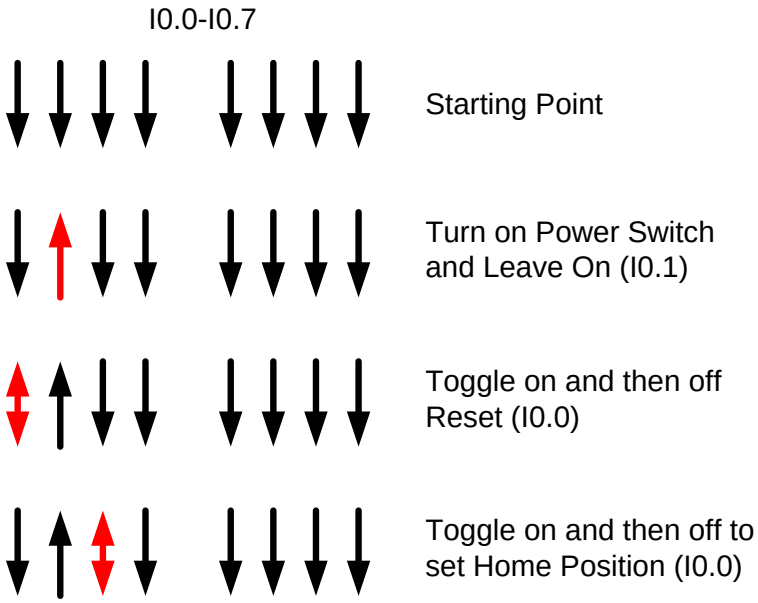


CCW	STEP	A	B	C	D	CW
	1	+	+			
	2		+	+		
	3			+	+	
	4	+			+	

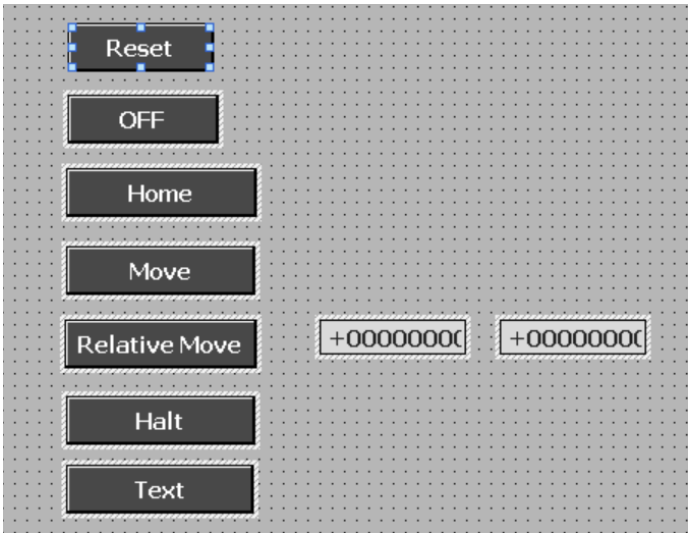
The program from Chapter 18 is the same for starting the motor. There may be a need to upgrade or change the processor and a help screen will show the steps necessary.

From Chapter 18:

The program given allows the user to toggle the various switches and rotate the motor. Some of the commands will be modified in the actual program. Notice that there is a command table that may be chosen. It is not usable if the pause and resume are to work properly. Try the toggle switches with the command table and then halt the motion. Then resume the motion. Notice that the motion is reset and starts again from the top. The problem associated with the reset action requires the additional programming. Follow the commands below in this order to begin the Siemens stepper application.



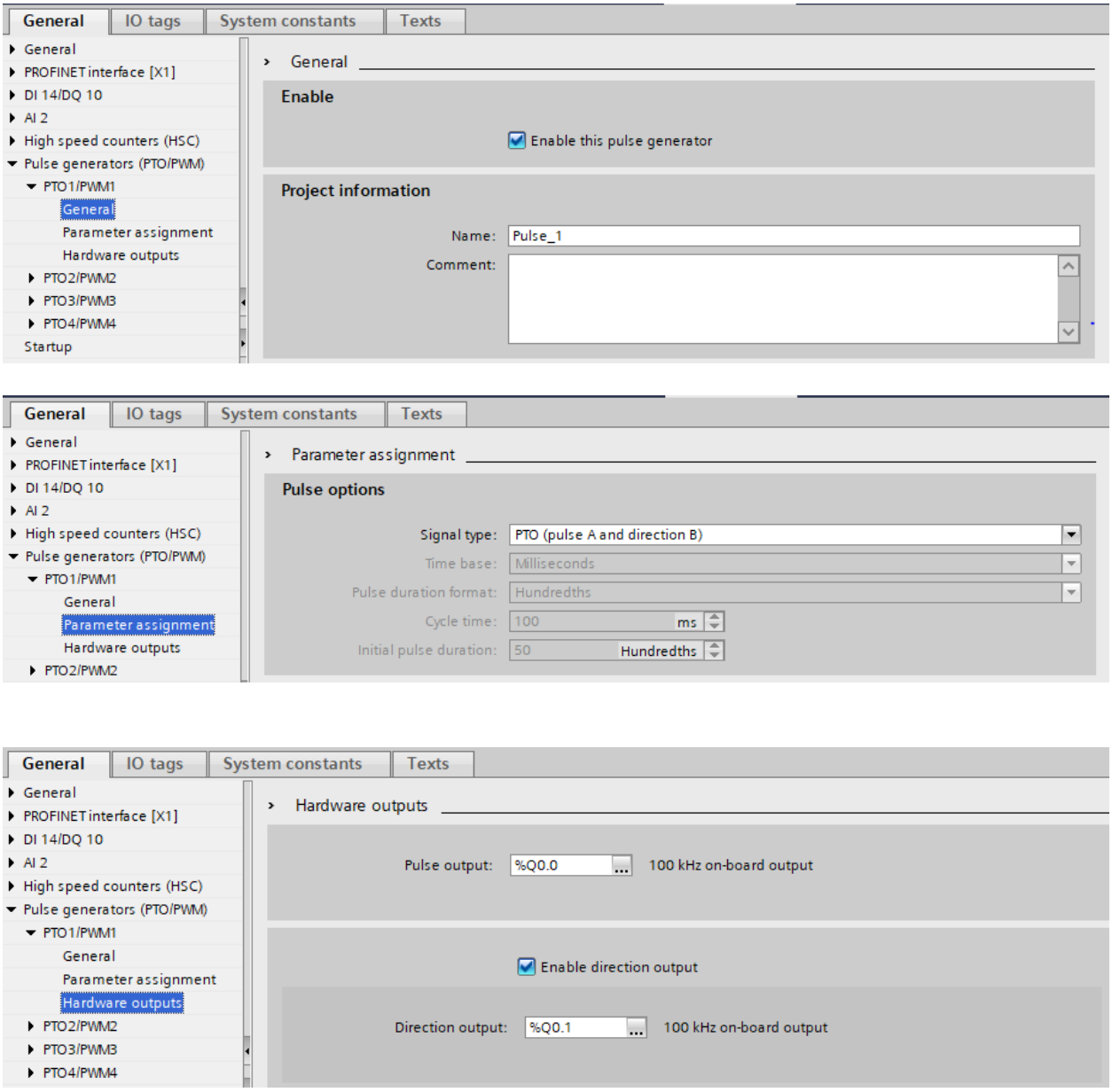
Toggle Switch Settings for Siemens Stepper



Follow the video from Chapter 17 and build an HMI panel with soft switches similar to the hard-wired switches above. The soft switches provide the same function and should be accessed in the same order listed above to initialize the drive to move.

The figure at left shows the buttons from this HMI screen. The two numeric entry boxes are for distance and speed of a relative move.

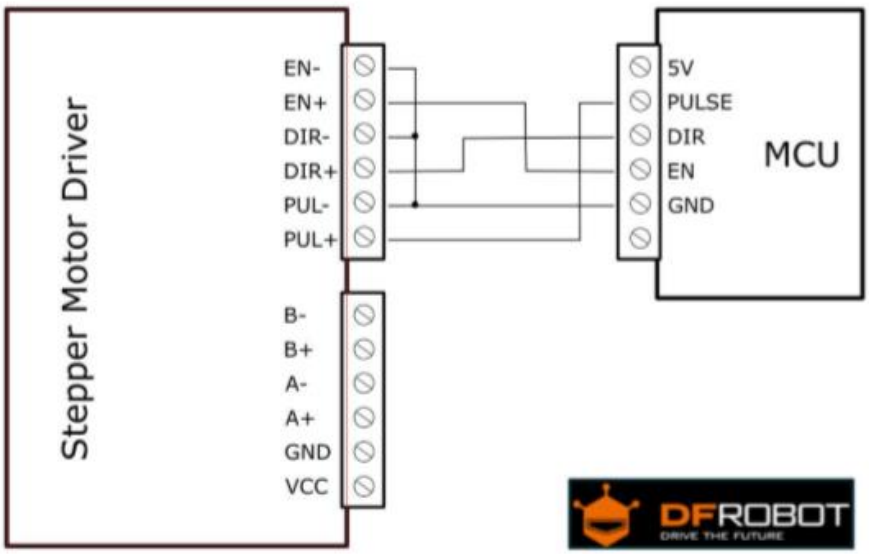
The figure below show the program's configuration of the pulse output for the stepper.



From the manual for the stepper drive, we find the following wiring diagram which shows the wiring between the PLC and the stepper drive:

Common-Cathode Connection:

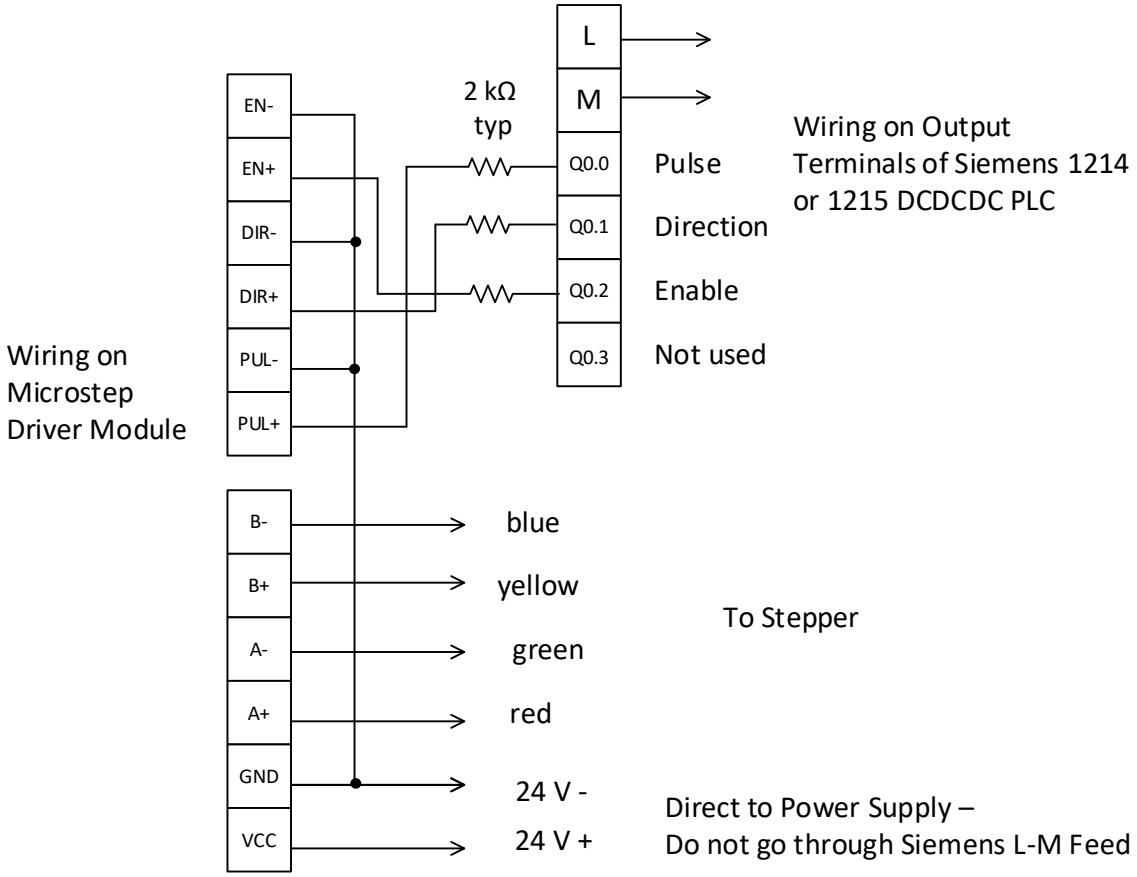
Connect PUL -, DIR - and EN - to the ground terminal of the control system. Pulse signal connects to PUL-; direction signal connects to Dir- ; Enable signal connects to EN-. As shown below:



Wiring from the PLC to the Stepper Controller using the diagram above:

Pulse wiring from MCU:	Q0/0	from Siemens PLC
Dir wiring from MCU	Q0.1	from Siemens PLC
EN wiring from MCU	Q0.2	from Siemens PLC
GND wiring from MCU	M Terminal	from Siemens PLC (0 V)
VCC on drive	L Terminal	from Siemens PLC (24 V)

Resistor value between PLC output and stepper drive input:



Warning:

The stepper motors consume a great deal of power even when not in use but with the power left on. Please turn off the power or at least lift the power wire to the driver module when not actively running the program.

4. DIP Switch

Micro Step Setting

The follow tablet shows the driver Micro step. You can set the motor micro step via the first three DIP switch.

Step Angle = Motor Step Angle / Micro Step

E.g. An stepper motor with 1.8° step angle , the finial step angle under "Micro step 4" will be 1.8°/4=0.45°

Micro Step	Pulse/Rev	S1	S2	S3
NC	NC	ON	ON	ON
1	200	ON	ON	OFF
2/A	400	ON	OFF	ON
2/B	400	OFF	ON	ON
4	800	ON	OFF	OFF
8	1600	OFF	ON	OFF
16	3200	OFF	OFF	ON
32	6400	OFF	OFF	OFF

Current Control Setting

Current (A)	S4	S5	S6
0.5	ON	ON	ON
1.0	ON	OFF	ON
1.5	ON	ON	OFF
2.0	ON	OFF	OFF
2.5	OFF	ON	ON
2.8	OFF	OFF	ON
3.0	OFF	ON	OFF
3.5	OFF	OFF	OFF

From the dip-switch table above, be sure to turn off at least one of the first three (S1-3). To start, turn the switches to S1 – on, S2 - on, S3 - off, S4 – on, S5 – off, S6 – off.

Part Number : 17HS4401

Function : 2 Phase Hybrid Stepper Motor

Motor Length : 40 mm, Motor Weight : 220 g

Manufacturers : MotionKing (China) Motor Industry.

Description

Stepper motor is a motor that moves in discrete steps, one step at a time. It is generally used in a variety of applications where precise position control is desirable such as 3D printer, laser cutter and pick & place machine.

1. Frame Size: 42 x 42mm (1.7 inch x 1.7 inch)
2. Body Length: 40mm
3. Shaft Diameter: 5mm
4. Number of Wire Leads: 4
5. Wire Length: 400mm
6. Step angle accuracy : ± 5%(full step,not load)
7. Resistance accuracy : ± 10%
8. Inductance accuracy : ± 20%
9. Temperature rise : 80deg Max (rated current,2 phase on)
10. Ambient temperature : -20deg ~ +50deg
11. Insulation resistance :100MΩ Min, 500VDC
12. Insultion Strength : 500VAC for one minute

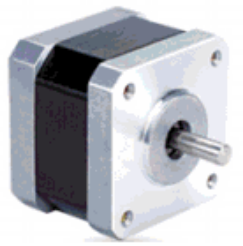
Arduino Wiring:

1. Red : A+
2. Green : A-
3. Yellow :B+
4. Blue : B-

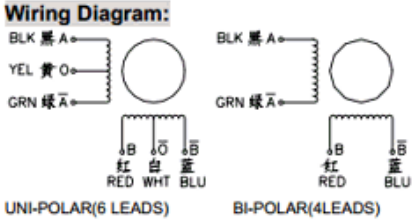
MotionKing (China) Motor Industry Co., Ltd.

17HS4401

2 Phase Hybrid Stepper Motor
17HS series-Size 42mm(1.8 degree)



Wiring Diagram:

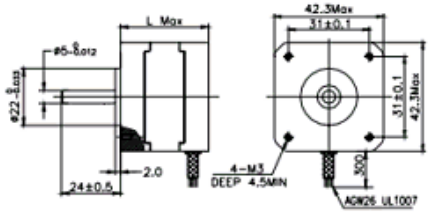


Electrical Specifications:

Series Model	Step Angle (deg)	Motor Length (mm)	Rated Current (A)	Phase Resistance (ohm)	Phase Inductance (mH)	Holding Torque (N.cm Min)	Detent Torque (N.cm Max)	Rotor Inertia (g.cm²)	Lead Wire (No.)	Motor Weight (g)
17HS2408	1.8	28	0.6	8	10	12	1.6	34	4	150
17HS3401	1.8	34	1.3	2.4	2.8	28	1.6	34	4	220
17HS3410	1.8	34	1.7	1.2	1.8	28	1.6	34	4	220
17HS3430	1.8	34	0.4	30	35	28	1.6	34	4	220
17HS3630	1.8	34	0.4	30	18	21	1.6	34	6	220
17HS3616	1.8	34	0.16	75	40	14	1.6	34	6	220
17HS4401	1.8	40	1.7	1.5	2.8	40	2.2	54	4	280
17HS4402	1.8	40	1.3	2.5	5.0	40	2.2	54	4	280
17HS4602	1.8	40	1.2	3.2	2.8	28	2.2	54	6	280
17HS4630	1.8	40	0.4	30	28	28	2.2	54	6	280
17HS8401	1.8	48	1.7	1.8	3.2	52	2.6	68	4	350
17HS8402	1.8	48	1.3	3.2	5.5	52	2.6	68	4	350
17HS8403	1.8	48	2.3	1.2	1.6	46	2.6	68	4	350
17HS8630	1.8	48	0.4	30	38	34	2.6	68	6	350

*Note: We can manufacture products according to customer's requirements.

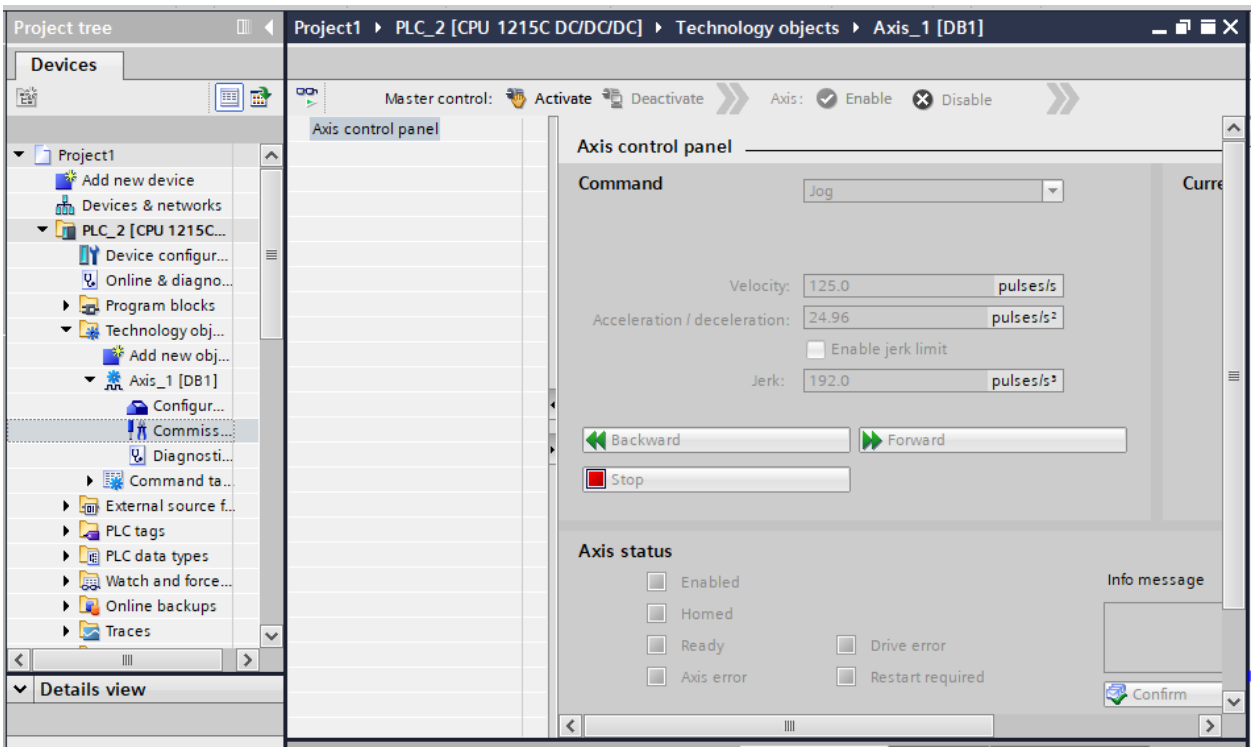
Dimensions: unit=mm



Motor Length:

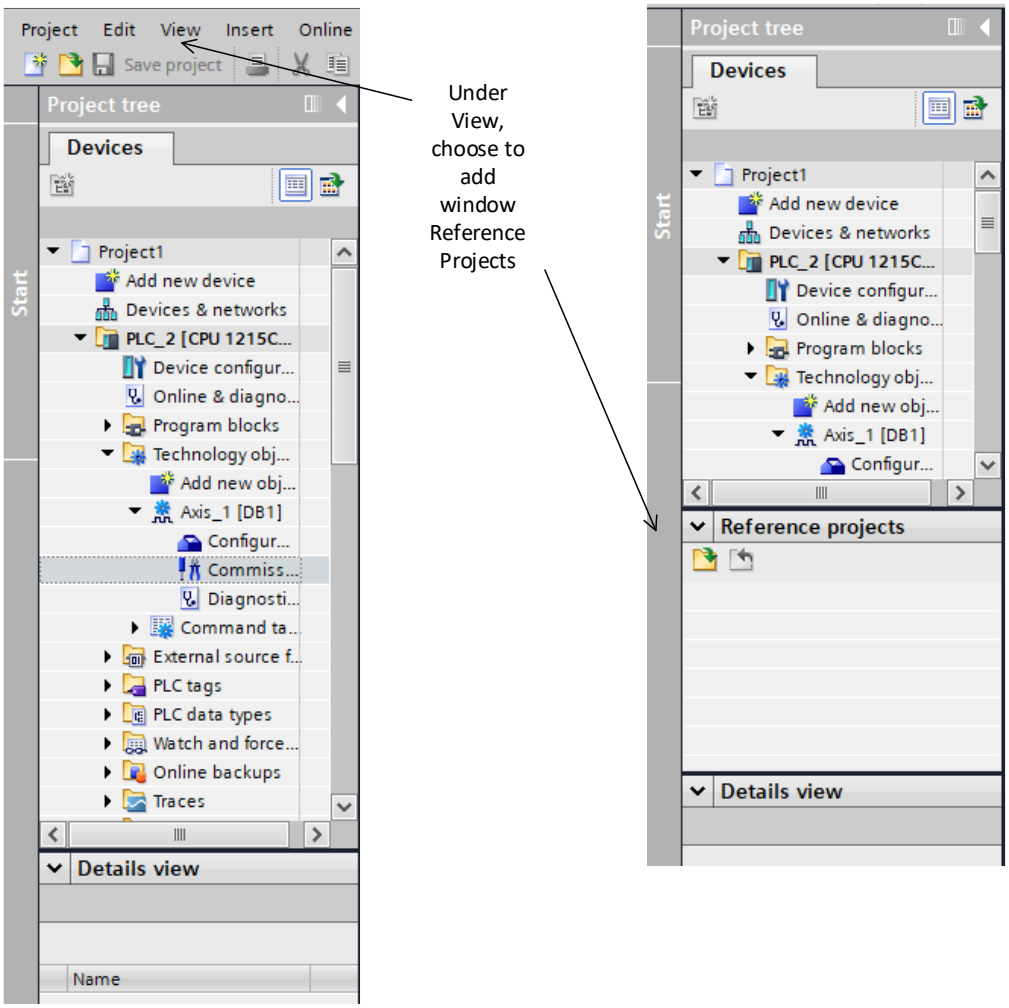
Model	Length
17HS2XXX	28 mm
17HS3XXX	34 mm
16HS4XXX	40 mm
16HS8XXX	48 mm

Try the stepper motor before using the input switches by using the Commissioning window:



Try Activate, then Enable, and then jog Forward or Reverse. Verify pulses coming from the outputs on the PLC.

If the processor needed is different from the program downloaded, then use the following. It gives an outline for converting or upgrading a program from one processor to another:



The reference project allows the processor type or version to be changed without change to the program. Otherwise, a number of copy-paste operations are needed to move the contents of one program to another and this process may not change all the variables.