

Design Validation Plan					
360 Designs					
Encoder Automation Table					
Requirement	Test	Completed	Performance	Result	Notes/ Recommendations
Repeatability	Can the PLC read the Programmable encoder?	1/28/2020	The PLC can read the encoder	P	
	Can the PLC read the Linear encoder?	1/28/2020	The PLC can read the encoder	P	
	Can the PLC run the stepper motor?	1/28/2020	The PLC can run the stepper.	P	
	Can the PLC rotate the stepper motor a given number of rotations?	2/19/2020	it can run a given number of rotations	P	
	Can the PLC output a specific frequency?	2/19/2020	Yes	P	
	Can the HMI adjust the outputed frequency from the PLC?	2/19/2020	Yes	P	
	Can the PLC run the servo motor?	2/23/2020	the PLC runs the stepper	P	
	Can the PLC rotate the servo motor a given number of rotations?	2/23/2020	it can run a given number of rotations	P	
	Servo motor drive forwards and backwards?	3/6/2020	Yes, but only at a range of speeds and only at 15-85% duty cycle (getting too close to 0% or 100% is problematic, 100% is more likely due to line capacitance issues).	P*	See notes below about duty cycle.
	Can the PLC adjust the actuator speed?	3/10/2020	Can adjust the output frequency of the PLC which adjusts the actuator speed.	P	Possibly use adjustability to ramp up and down as opposed to 0-100-0 could do 0-20-40-60-80-100-80-60-40-20-0
Challenging to get, repeatably tested for each iteration of wiring.	Does the Relay switch allow the Programmable encoder to be programmed from the PC when the button is pressed?	3/20/2020	Yes, but button connection points to wires can be improved with a wiring harness plug	P*	Works 100% of the time, but connection will sometimes jump/flash due to a loose button to wire connection. This might be easily fixed with the appropriate button harness connection ordered off amazon.
	Does the servo motor step input see approximatly 50% duty cycle?	4/20/2020	Yes, but only at lower frequencies. At high frequencies if a lower duty cycle is driven (say 10%) then it is possible to still see 50% at the servo signal input at the higher frequency. Needs more testing.	P*	Try to remove duty cycle increasing at high frequencies with a better cable. Alternatively, code lower duty cycle outputs at higher frequencies to compensate for the capacitance effect.
Very challenging to achive success, repeatably tested for each iteration of wiring.	Does the TR2 signal by default output through the relay swiitch to the PLC signal line successuflly without noise or crosstalk?	4/24/2020	Yes	P	
Very challenging to achive success, repeatably tested for each iteration of wiring.	Does the Programmable encoder by default ouput through the relay switch to Servo signal line successfullly wihout noise or crosstalk?	4/24/2020	Yes	P	
	When a signal from the PLC is sent via relay connection, does the TR2 signal output through the relay swith to the Servo signal line wihtout noise or crosstalk?	4/24/2020	Yes	P	
	When a signal from the PLC is sent via relay connection, does the programmable encoder signal output through the relay swith to the PLC signal line wihtout noise or crosstalk?	4/24/2020	Yes	P	
	Does the servo motor drive without undue noise?	4/24/2020	Yes, but only at specific speeds/ duty cycles. Needs more testing.	P*	The motor makes very loud noises at many frequency inputs. More testing is required here.
	Does the TR2 run on 5V? (to Servo)	4/24/2020	Yes	P	
	Does the 58TP (programmable encoder) run on 5V? (to servo)	4/24/2020	Yes.	P	
	Does the 58TP (programmable encoder) run on 24V? (to PLC)	4/24/2020	Yes.	P	
	Can the PLC+HMI Display different operating mode pages (Citizen, Engineer)	4/29/2020	Yes	P	
	Can the PLC measure actuator speed?	NA	Not programmed	F	Can use the Freq Calc at 1ms measurement intervals from the TR2 data to calculate linear motion pf the actuator

	Can the origin limit switch send a signal to the PLC that it is depressed?	NA	No limit switch added	F	Instead of using a physical limit switch, could just use the TR2 to know location and keep the encoder from going too far. But
	Can the overtravel/end limit switch send a signal to the PLC that it is depressed?	NA	No limit switch added	F	Could use TR2 instead or physical electrical contact.
	Can the "slop" switch send a signal to the PLC that it is depressed?	NA	Not added	F	Could use TR2.
	Does the PLC output how accurate the distance was or was not met?	NA	Not added due to not using TR2	F	
	Does the TR2 run on 24V? (to PLC)	NA	No, not as wired.	F	
Requirement	Test	Completed	Performance	Result	Notes/ Recommendations
Success Routine	Does the candy dispenser motor run when it receives a signal?	4/2/2020	Motor rotates using Arduino Code	P	needs to be hooked up to PLC
	Does the candy dispenser motor stop after a given time or rotation distance?	4/2/2020	motor rotates 1/4 rotation	P	needs to be attached to dispenser
	Can the candy dispenser dispense 3-10 M&Ms per cycle?	4/2/2020	dispenser dispenses candy into bowl	P	
	Can degree of difficulty be specified?	4/24/2020		P	
	Can the PLC change the ranges when a difficulty is chosen via the HMI?	4/24/2020		P	
	Does each degree of difficulty have its own required range of accuracy for success?	NA		F	
	Is the success recognized by the PLC?	NA		F	
	Does the success routine show success on the HMI?	NA		F	
	Can the PLC send a signal to the LEDs?	NA		F	
	Is a random candy dispenser chosen?	NA		F	
	Does the PLC send a signal to the LEDs once the success routine has been randomly chosen within the given range?	NA		F	
	Does the PLC send a signal to the motor that drives the candy dispenser when within the desired range?	NA		F	