Dry Erase Marker Revitalizer

ENGR 480: Manufacturing

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Introduction

Our world today is in a constant need for automation and an elimination of product waste. There are several products in wide circulation that are very useful but have created a substantial amount of waste. Many of these products are inexpensive, but not reusable. The product that we are concerned with for this project is Quartet Dry Erase markers.

At Walla Walla University dry erase markers are in constant use and need to be replaced often. What appears to happen is that the markers run out of solvent easily, but still contain ink. The goal of this machine is to replace the solvent in the dry erase markers. This will allow for an extended life of the markers, creating less waste and saving the college money. There are several criteria that are to be used in this project besides the main goal. This project needs to minimalize human involvement and have adequate safety measures.

This project was completed using a programable logic controller (PLC) to control the Motoman Robot, the stepper motors, and the pneumatic grippers. The Motoman Robot is used in conjunction with pneumatic grippers to move the pen from station to station. There are five stations that involve the pen. There is the pen feeder, the pen cap holder, the decapitator, the centrifuge, and the rejuvenated pen holder. There are two pneumatic grippers used in this project. One is attached to the robot to grip the pen and the pen cap. The other is attached to the table and is to hold the pen while the cap is removed. There are two stepper motors used in this project. One is to pump the solvent into the pens, the other is to rotate the centrifuge. More about each of the stations, running the machine and clearing jams will be in the following sections of this manual.

Loading and Starting the Machine

Loading and starting the machine requires a few steps. First place the dry erase markers in the gravity feeder cap up.

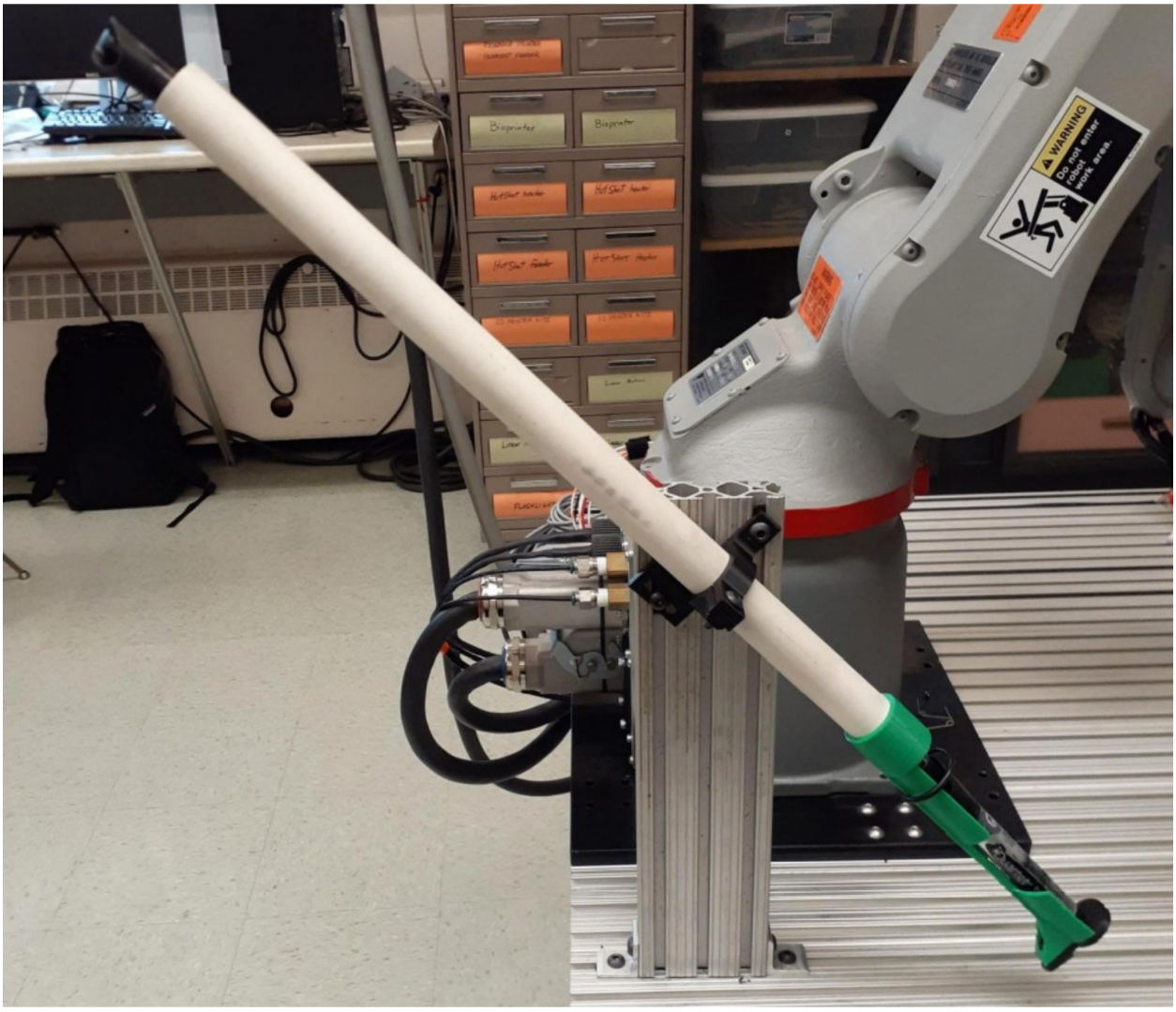


Figure 1:Gravity Pen Feeder

Starting the machine requires a few more steps. First turn on the power switch on the side of the table, this will allow power to the robot and the rest of the machine. Ensure that the Programable logic controller is in run. It can be located on the side of the table with all the electrical connections. Then push the start button located next to the E-stop on the side of the table below the centrifuge. This will start the machine.

Clearing the Jams

This machine has a few problems that need to be taken care of from time to time. If the machine is starting to cause problems, press the E-stop button. Once the machine is off turn off the table by turning the switch on the side of the table below the pen gravity feeder to off. If nothing is broken reset the machine to normal, by manually replacing the pens in the gravity feeder and removing all other clutter from the machine area. Then repeat the steps for loading and starting the machine.

Description of Station Operations

Station 1: Pen Feeder

Pen feeder:
The pen feeder station is a gravity feeder to allow the machine to be consistently supplied with pens. This dispenser works by using gravity to replace the dry erase marker with a new one when the old one is taken out. The robot will grab the ben shown below in the green slot and move it onto the next station, then gravity will supply the force needed to move the pen on top of the old one down into the green slot.

The maintenance of this pen feeder is mostly to replace the pens in the pen feeder when it is getting low. The pen feeder can hold up to five dry erase markers in it. The machine fills four pens at a time. This means that the pen dispenser will need to be refilled after every time the centrifuge runs.

There is always room for improvement and this station is no exception. The point of automating this process is to minimize the human involvement needed to refill the dry erase markers with ink. The main problem with the current dispenser involves such an issue. The problem is the dispenser needs to be refilled after every run of the machine. A solution would be to increase the capacity of the dispenser by increasing the length of the tube or designing a more voluminous dispenser.

Figure 2:Pen Dispenser

Station 2: Decapitation Station

The Decapitation Station allows us to remove the caps of the dry erase markers and then put them back on once the pen is refilled. First the robot will bring a dry erase marker and place in in the middle of the black grippers. They will then close to hold the pen tight while the robot removes the cap. Next the robot returns to the grippers and grabs the pen, and the grippers release their hold on the pen. Once the pen has been filled the pen is placed back in the grippers and the cap is replaced. Then the capped pen is taken out to go to its final resting place.

Maintenance may be needed for this section. If the grippers are not opening properly or closing when they should check to make sure the sensors are working. The Decapitation Station has two sensors. The sensor to tell if the grippers has closed is on the side of the metal section of the grippers. The proximity sensor for telling if the pen is there is screwed into the 3D printed section of the printer. In addition to the sensors the gripping part of the station may need some maintenance. There is a blue rubber glued to the inside of the grippers to allow more purchase on the dry erase marker. This rubber can get worn or start coming unglued at times. If this happens you can replace the rubber or reglue it. The decapitation station worked well. There is one thing that could be improved. The circular section gripping the pen was a little too large. The gripper could be redesigned to account for that.

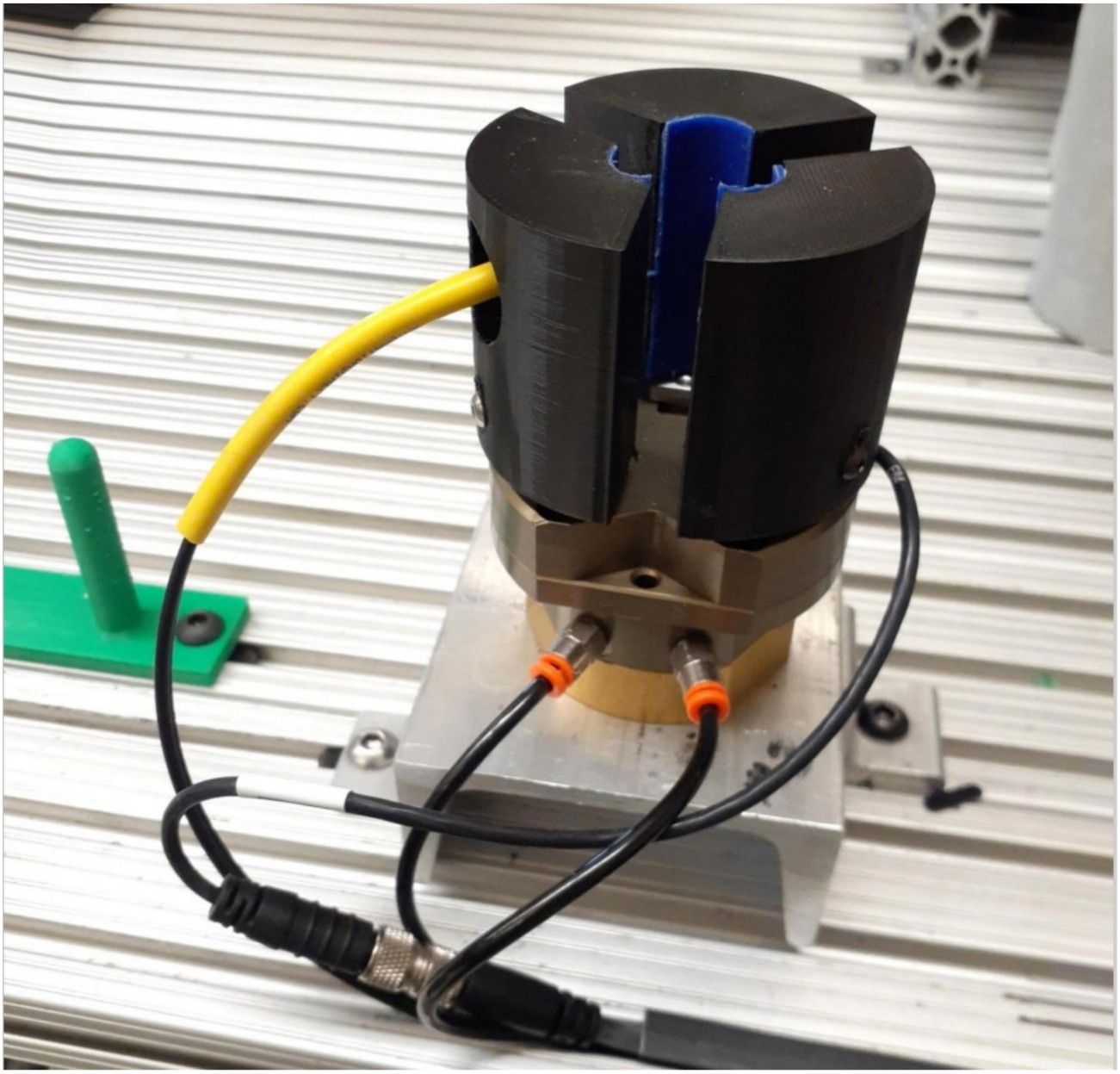


Figure 3: Decapitation Station

Station 3: Cap Holder

The cap holder is meant to hold the cap of the markers that are being loaded into the centrifuge. Each cap is loaded one by one from the decapitation station onto each of the pegs sticking up. Once the centrifuge is done spinning and the markers are ready to ger their caps back, the robot brings the cap over from each peg and puts it back on the marker at the decapitation station. Sometimes the pegs get slightly bumped by the robot while picking up the caps or dropping them off. The bottoms of the pegs are filleted so the wear should be minimal but cracks at the base of each peg should be checked for periodically. The tightness of the screws holding down the cap holder should also be checked periodically so the station won't

move, and the robot won’t miss. The only improvement is the location of the station. One of the pegs is somewhat hard for the robot to reach but has done fine so far. There is no performance data for this station.

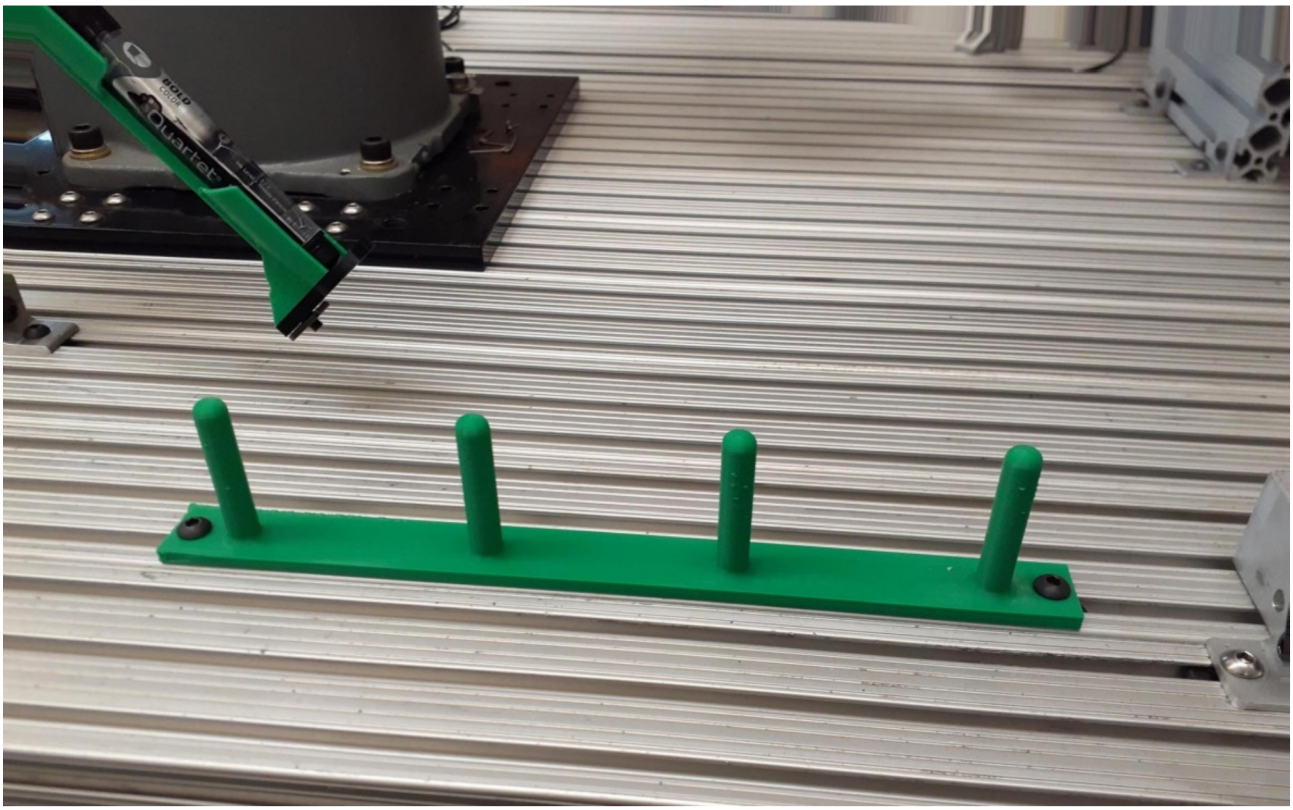


Figure 4:Cap Holder

Station 4: Solvent Dispenser

The fluid dispenser is a pump to pump the solvent into the centrifuge to replace the solvent in the pens. The pump is controlled by the PLC and its speed is set by that. The solvent will need to be replaced after about 32 runs of the machine. The pump will also need primed before the first run of the machine.

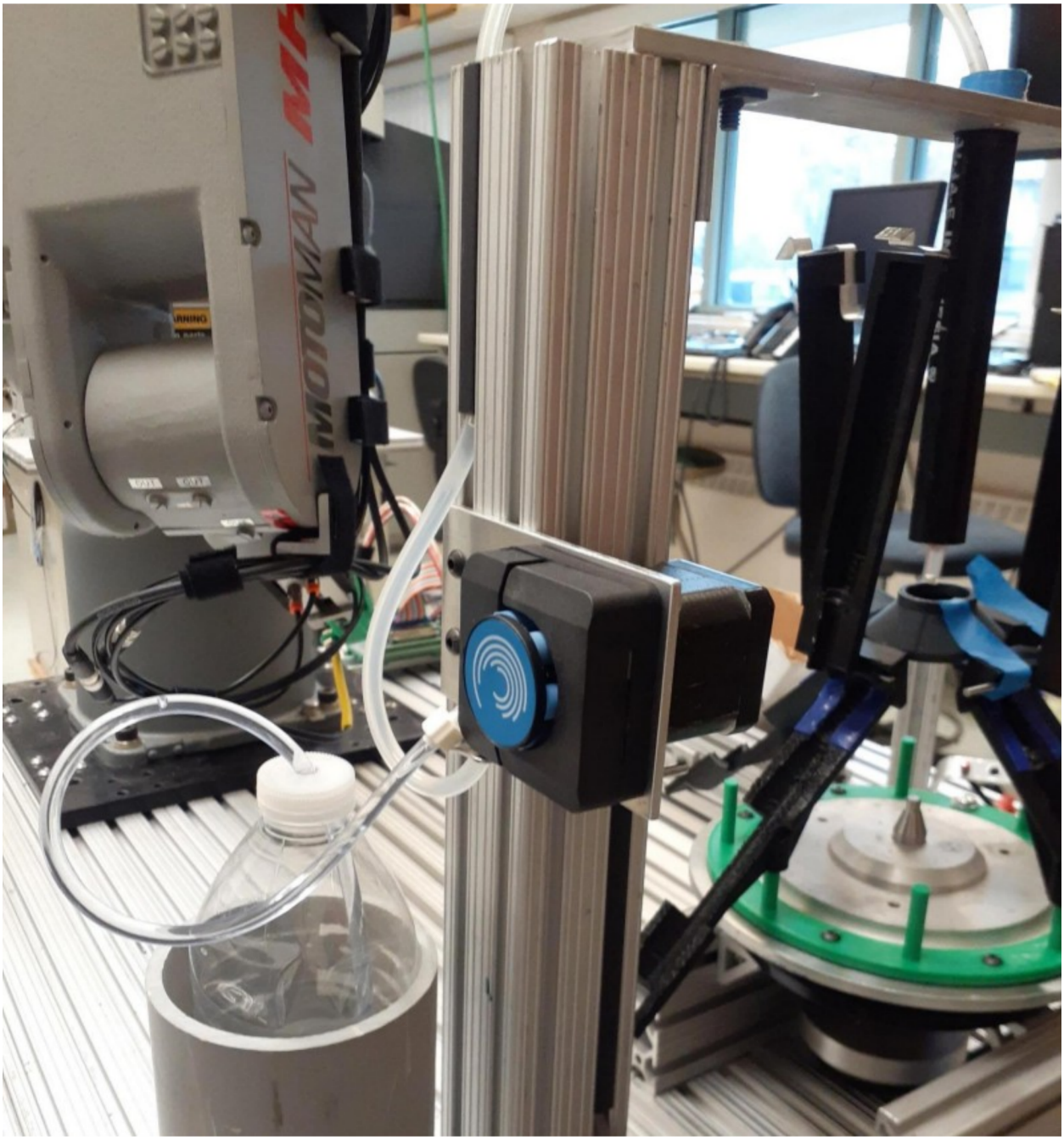


Figure 5: Fluid pump and Solvent Dispenser

Station 5: Centrifuge

The centrifuge is meant to hold each marker as it is filled with the alcohol. The robot places each marker into each case with the tip up and closes the case over the marker one by one. This is achieved through a sliding metal clip at the end of each case cap. The metal clip slides into slots at the bottom of the base cases which keeps the torsional springs at the top from lifting the top case up. Each case has a hole that the small tank connects to. This is where the alcohol is fed from the pump. Once each marker is loaded and the cases closed, the centrifuge will start to spin. The alcohol flows into the tank and as the centrifuge spins, alcohol is pulled into the tip of each marker. The robot then opens each case and by sliding the metal clip back which allows the torsion springs to lift the cases. The markers can now be grabbed out of the cases using the robot's grippers.

The connection between the tank and cases is very unstable. It is mostly held together with glue. If the centrifuge is run too many times, the spinning will cause separation between the tank and some of the cases. Tape or glue with need to keep being applied in order to keep the centrifuge together. The way the pump is set up to bring alcohol into the tank, there is very little clearance for the cases. The only way for them to make it by as the centrifuge spins is to have the cases all the way open or closed. If the case is half open it will clip the pump stand and break the case.

Future improvements would be to add support underneath the tank for stability. It is likely that the scenario where the robot broke the connection between the cases and the tank could have been avoided if the tank had better support. The biggest improvement would be getting better torsion springs to lift the case up. The current springs were either too weak to lift the case up all the way or would not open it as high as it needed to go. This problem made it so that the robot needed to assist the springs in opening the cases which ultimately led to the centrifuge breaking.

There is no performance data for the centrifuge since no measurements were taken. The final speed that the stepper motor powering the centrifuge ran at was 8000 pulses/second.

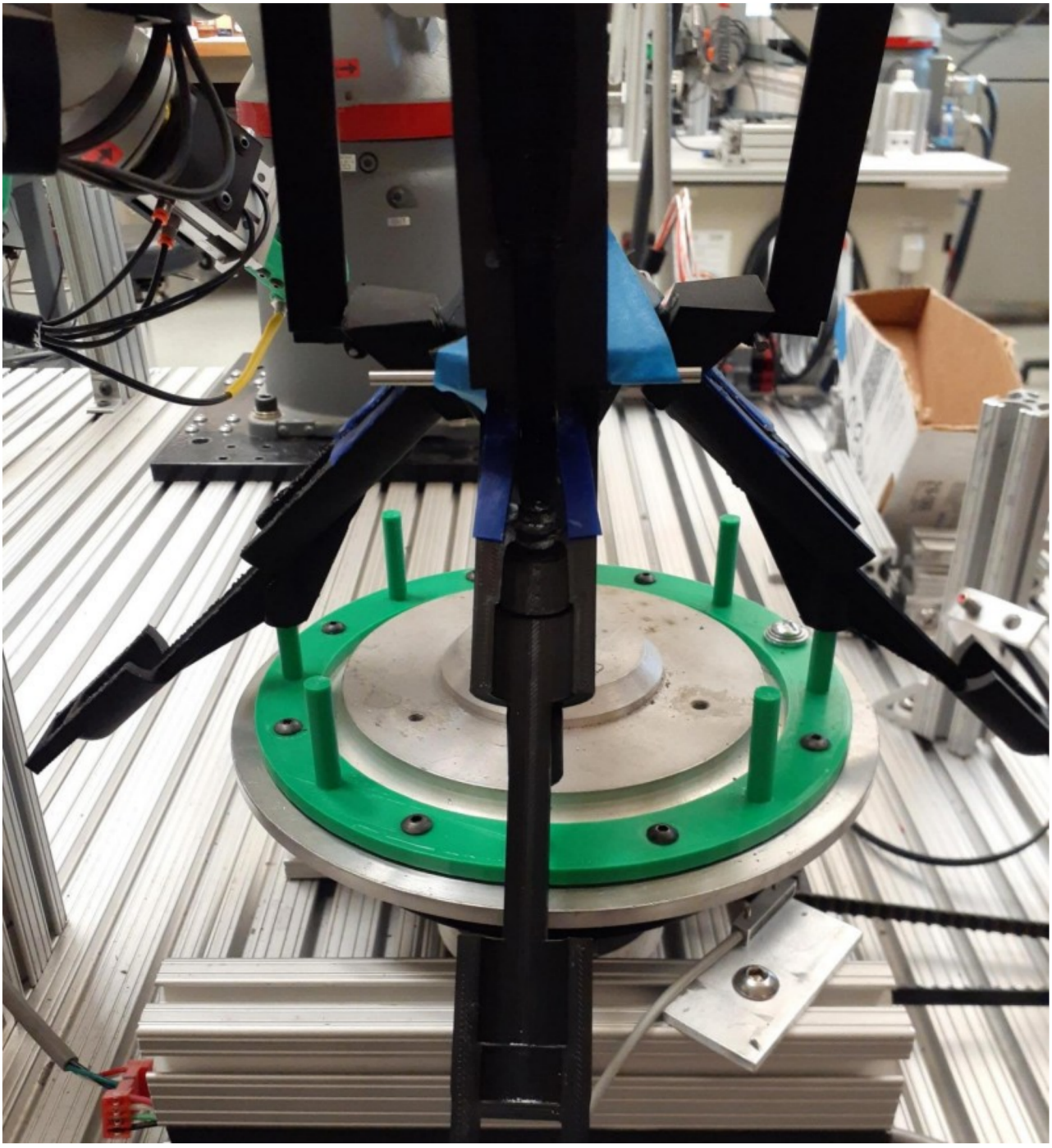
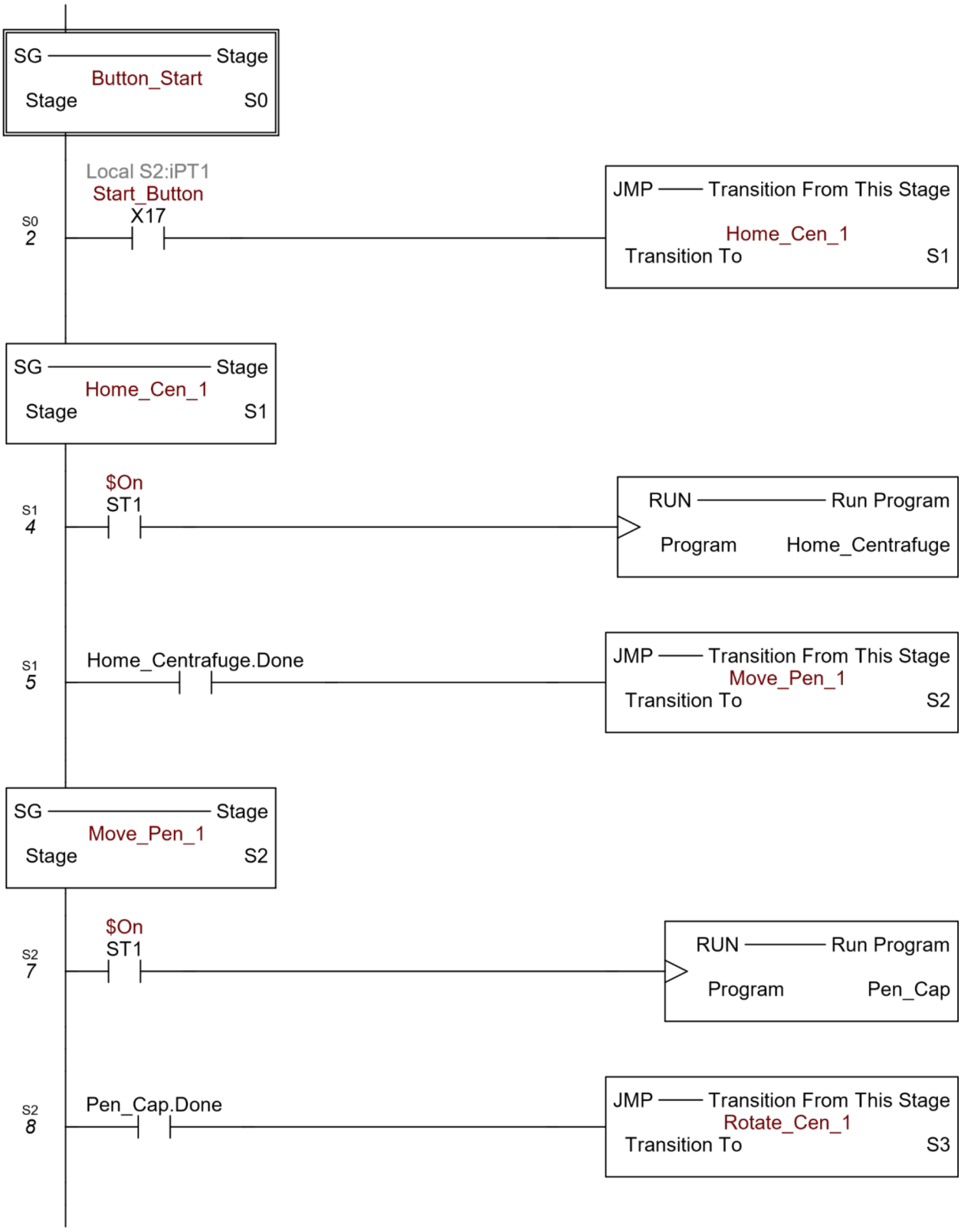
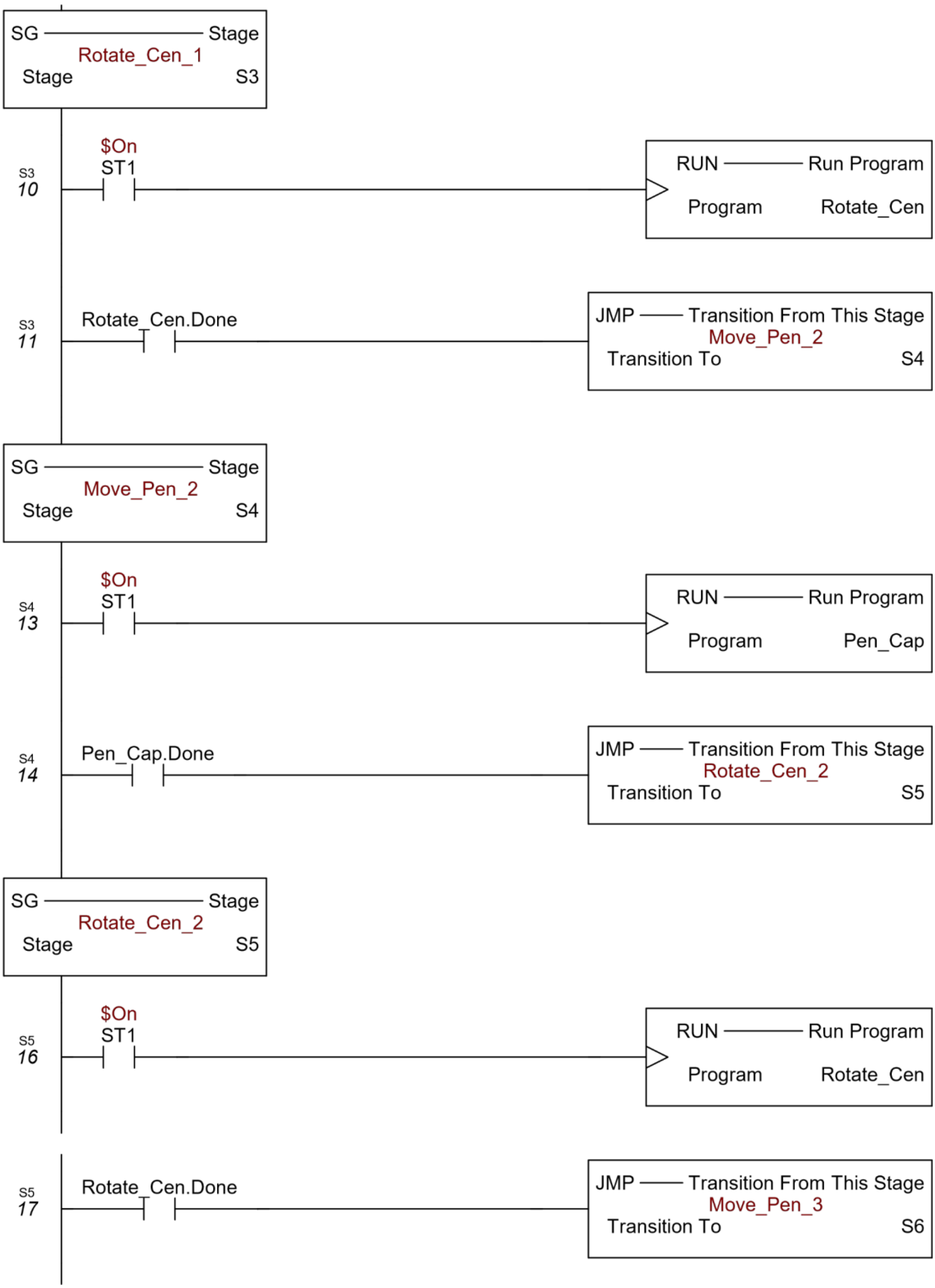


Figure 6: Open Centrifuge

Diagrams

PLC Logic Ladder

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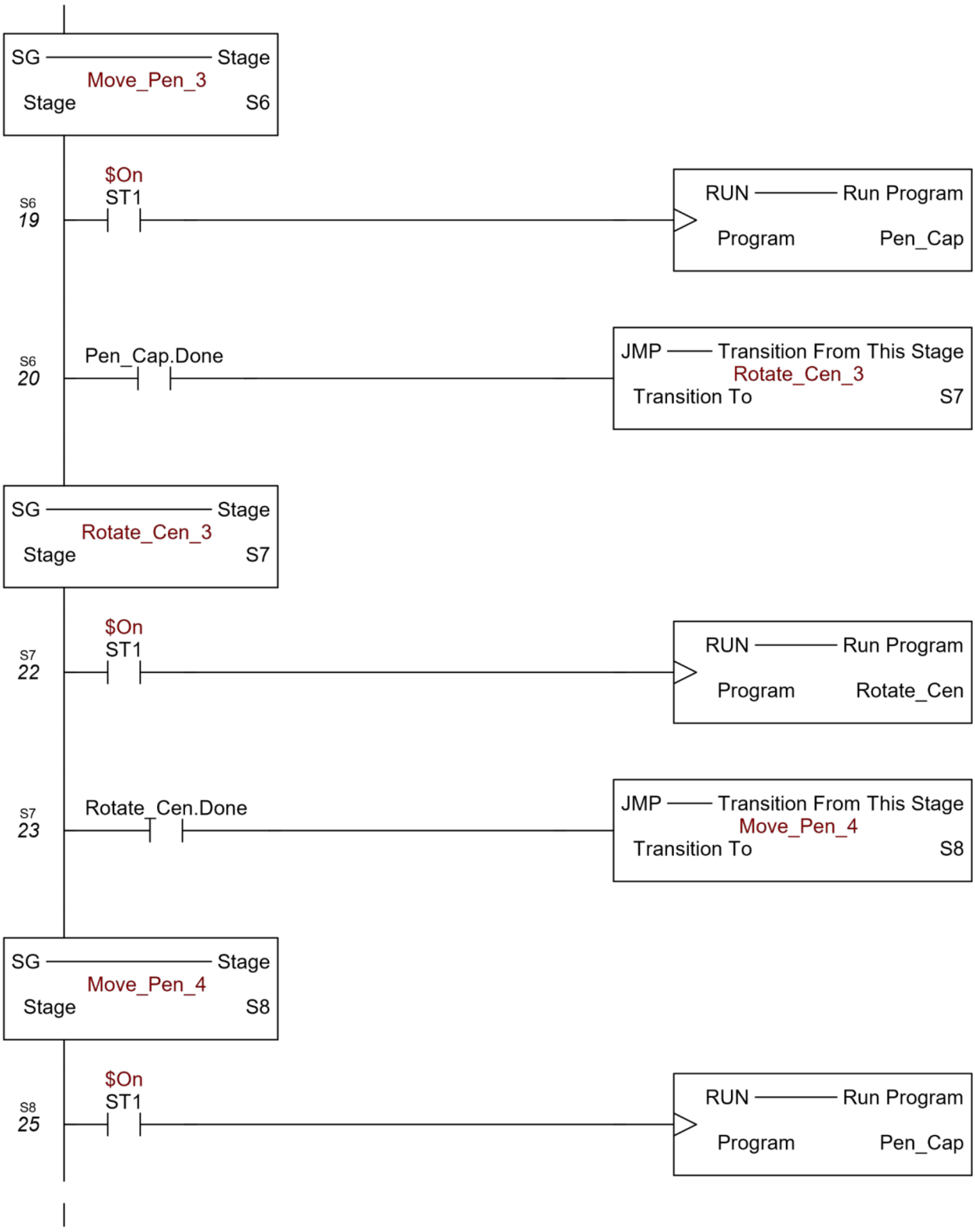
Stage
Rotate_Cen_1
Stage
S3
$On
ST1
S3
10
RUN
Run Program
Program
Rotate_Cen
S3
11
Rotate_Cen.Done
JMP
Transition From This Stage
Move_Pen_2
Transition To
S4
SG
Stage
Move_Pen_2
Stage
S4
$On
ST1
S4
13
RUN
Run Program
Program
Pen_Cap
S4
14
Pen_Cap.Done
JMP
Transition From This Stage
Rotate_Cen_2
Transition To
S5
SG
Stage
Rotate_Cen_2
Stage
S5
$On
ST1
S5
16
RUN
Run Program
Program
Rotate_Cen
S5
17
Rotate_Cen.Done
JMP
Transition From This Stage
Move_Pen_3
Transition To
S6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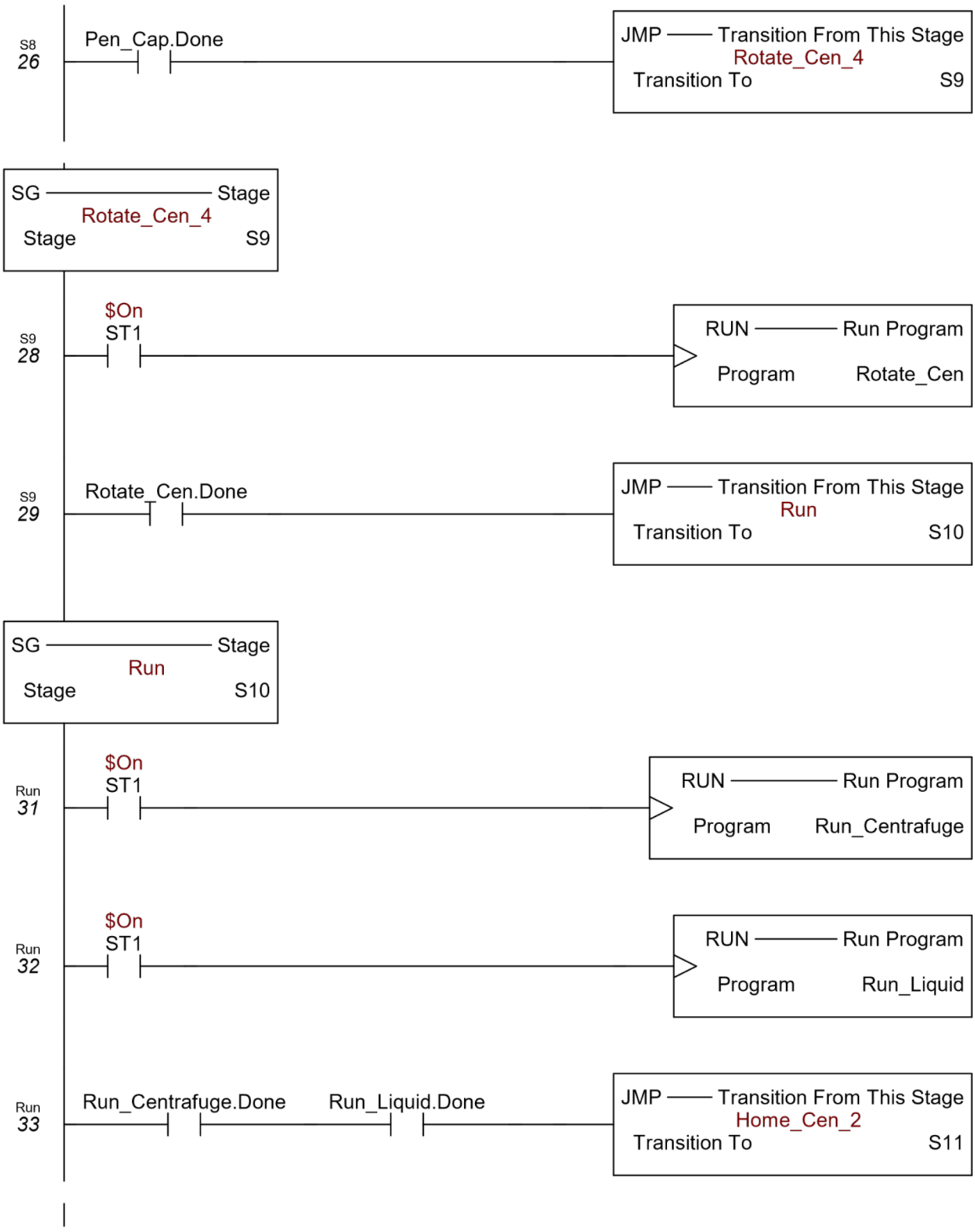
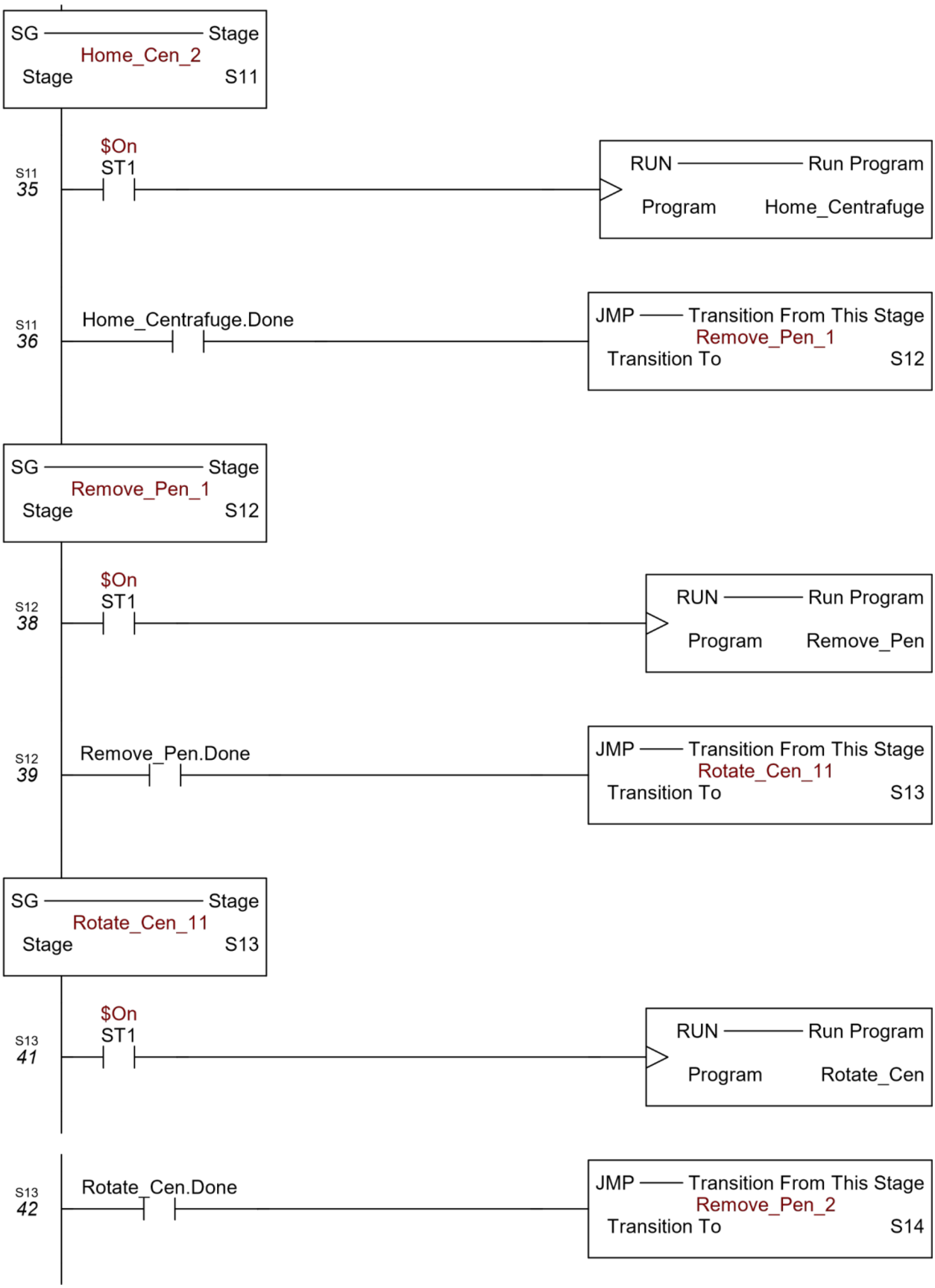
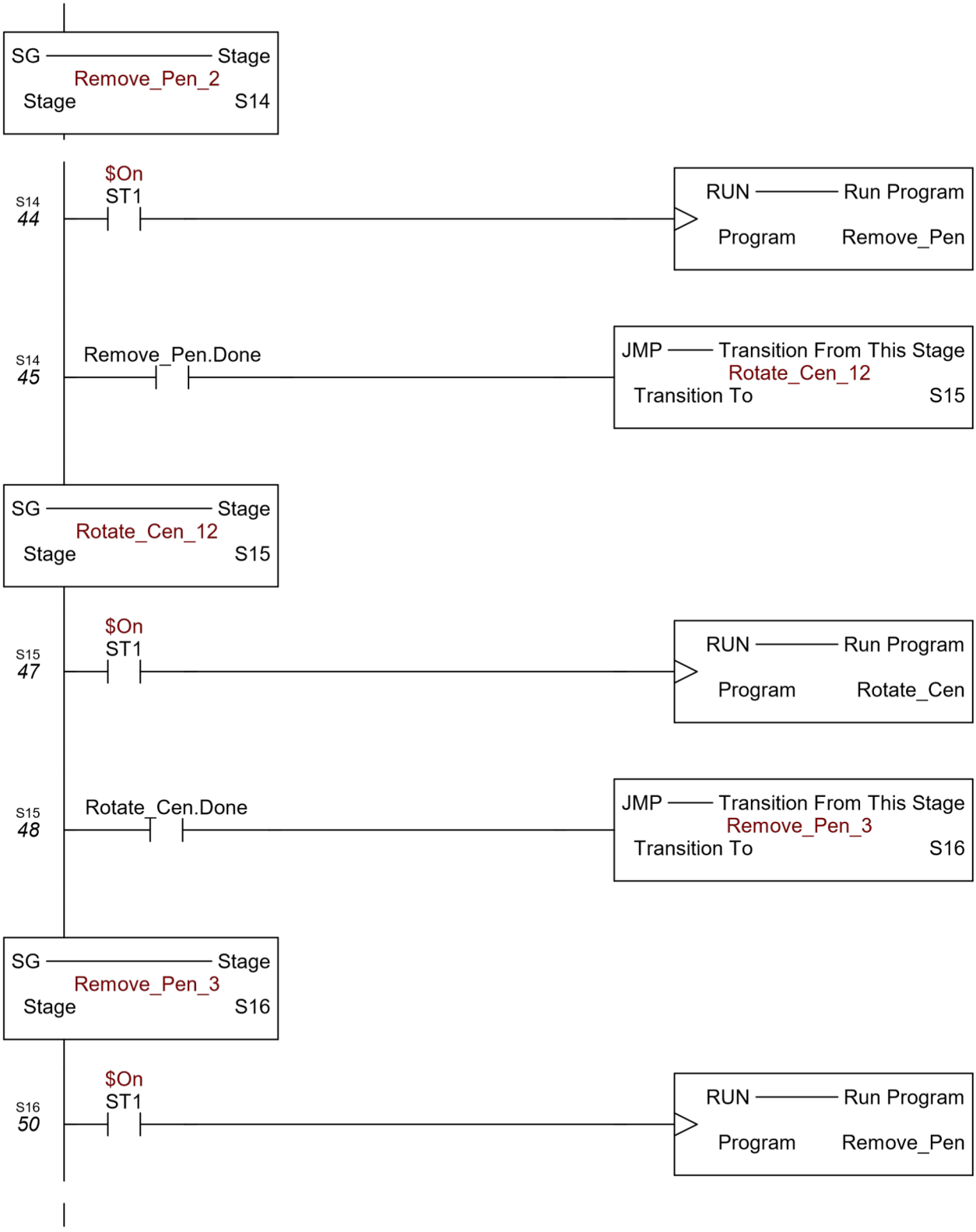
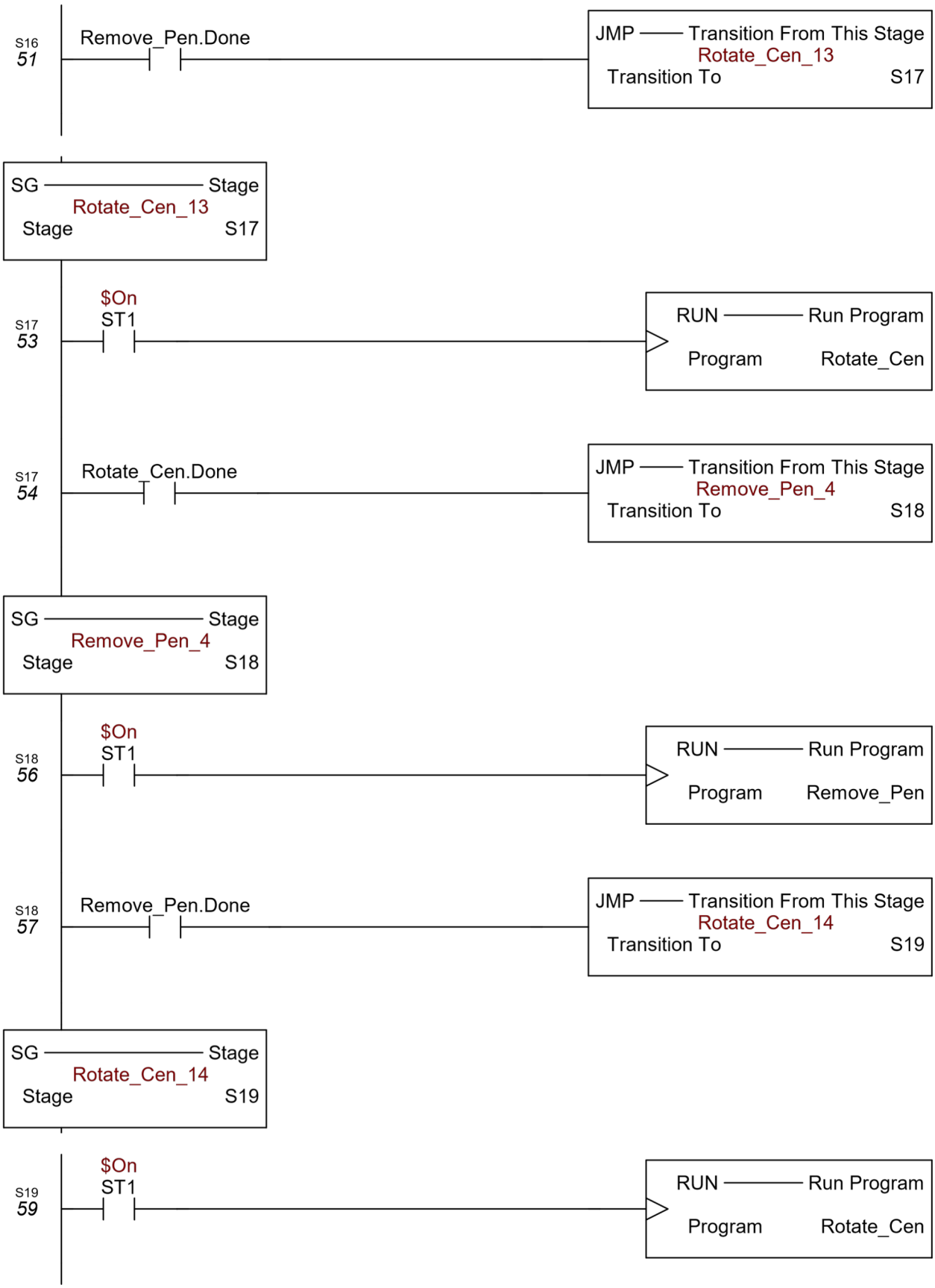
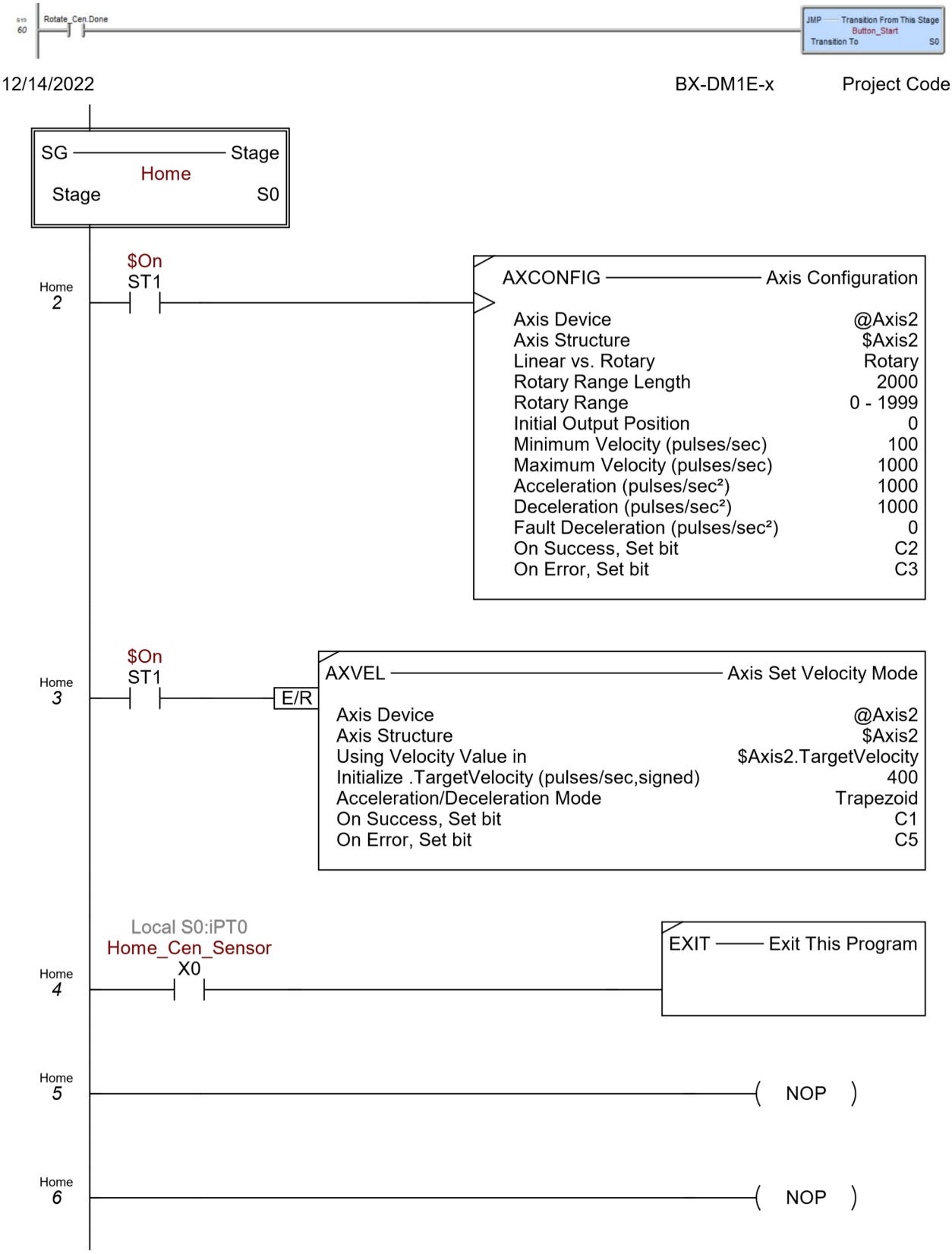
Stage
Move_Pen_3
Stage
S6
S6
19
$On
ST1
RUN
Run Program
Program
Pen_Cap
S6
20
Pen_Cap.Done
JMP
Transition From This Stage
Rotate_Cen_3
Transition To
S7
SG
Stage
Rotate_Cen_3
Stage
S7
S7
22
$On
ST1
RUN
Run Program
Program
Rotate_Cen
S7
23
Rotate_Cen.Done
JMP
Transition From This Stage
Move_Pen_4
Transition To
S8
SG
Stage
Move_Pen_4
Stage
S8
S8
25
$On
ST1
RUN
Run Program
Program
Pen_Cap


S8
26
Pen_Cap.Done
JMP
Transition From This Stage
Rotate_Cen_4
Transition To
S9
SG
Stage
Rotate_Cen_4
Stage
S9
S9
28
$On
ST1
RUN
Run Program
Program
Rotate_Cen
S9
29
Rotate_Cen.Done
JMP
Transition From This Stage
Run
Transition To
S10
SG
Stage
Run
Stage
S10
Run
31
$On
ST1
RUN
Run Program
Program
Run_Centrafuge
Run
32
$On
ST1
RUN
Run Program
Program
Run_Liquid
Run
33
Run_Centrafuge.Done
Run_Liquid.Done
JMP
Transition From This Stage
Home_Cen_2
Transition To
S11


SG
Stage
Home_Cen_2
Stage
S11
$On
ST1
S11
35
RUN
Run Program
Program
Home_Centrafuge
S11
36
Home_Centrafuge.Done
JMP
Transition From This Stage
Remove_Pen_1
Transition To
S12
SG
Stage
Remove_Pen_1
Stage
S12
$On
ST1
S12
38
RUN
Run Program
Program
Remove_Pen
S12
39
Remove_Pen.Done
JMP
Transition From This Stage
Rotate_Cen_11
Transition To
S13
SG
Stage
Rotate_Cen_11
Stage
S13
$On
ST1
S13
41
RUN
Run Program
Program
Rotate_Cen
S13
42
Rotate_Cen.Done
JMP
Transition From This Stage
Remove_Pen_2
Transition To
S14


SG
Stage
Remove_Pen_2
Stage
S14
S14
44
$On
ST1
RUN
Run Program
Program
Remove_Pen
S14
45
Remove_Pen.Done
JMP
Transition From This Stage
Rotate_Cen_12
Transition To
S15
SG
Stage
Rotate_Cen_12
Stage
S15
S15
47
$On
ST1
RUN
Run Program
Program
Rotate_Cen
S15
48
Rotate_Cen.Done
JMP
Transition From This Stage
Remove_Pen_3
Transition To
S16
SG
Stage
Remove_Pen_3
Stage
S16
S16
50
$On
ST1
RUN
Run Program
Program
Remove_Pen


S16
51
Remove_Pen.Done
JMP
Transition From This Stage
Rotate_Cen_13
Transition To
S17
SG
Stage
Rotate_Cen_13
Stage
S17
S17
53
$On
ST1
RUN
Run Program
Program
Rotate_Cen
S17
54
Rotate_Cen.Done
JMP
Transition From This Stage
Remove_Pen_4
Transition To
S18
SG
Stage
Remove_Pen_4
Stage
S18
S18
56
$On
ST1
RUN
Run Program
Program
Remove_Pen
S18
57
Remove_Pen.Done
JMP
Transition From This Stage
Rotate_Cen_14
Transition To
S19
SG
Stage
Rotate_Cen_14
Stage
S19
S19
59
$On
ST1
RUN
Run Program
Program
Rotate_Cen



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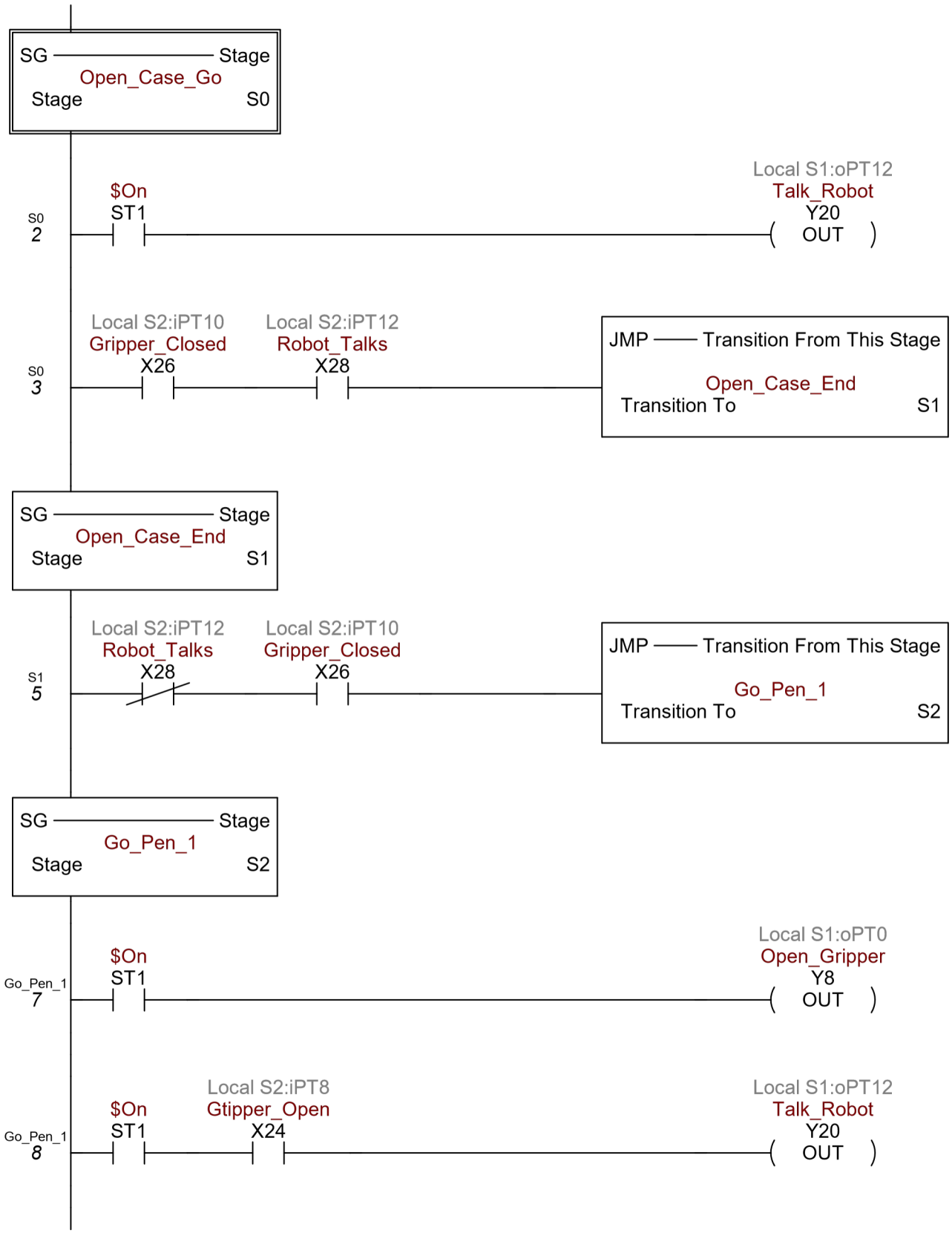
Do-more Technology Version: 2.9
Description: Plc with extras
Version:
Company:
Department:
Programmer: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Stage
S0
S0
2
$On
ST1
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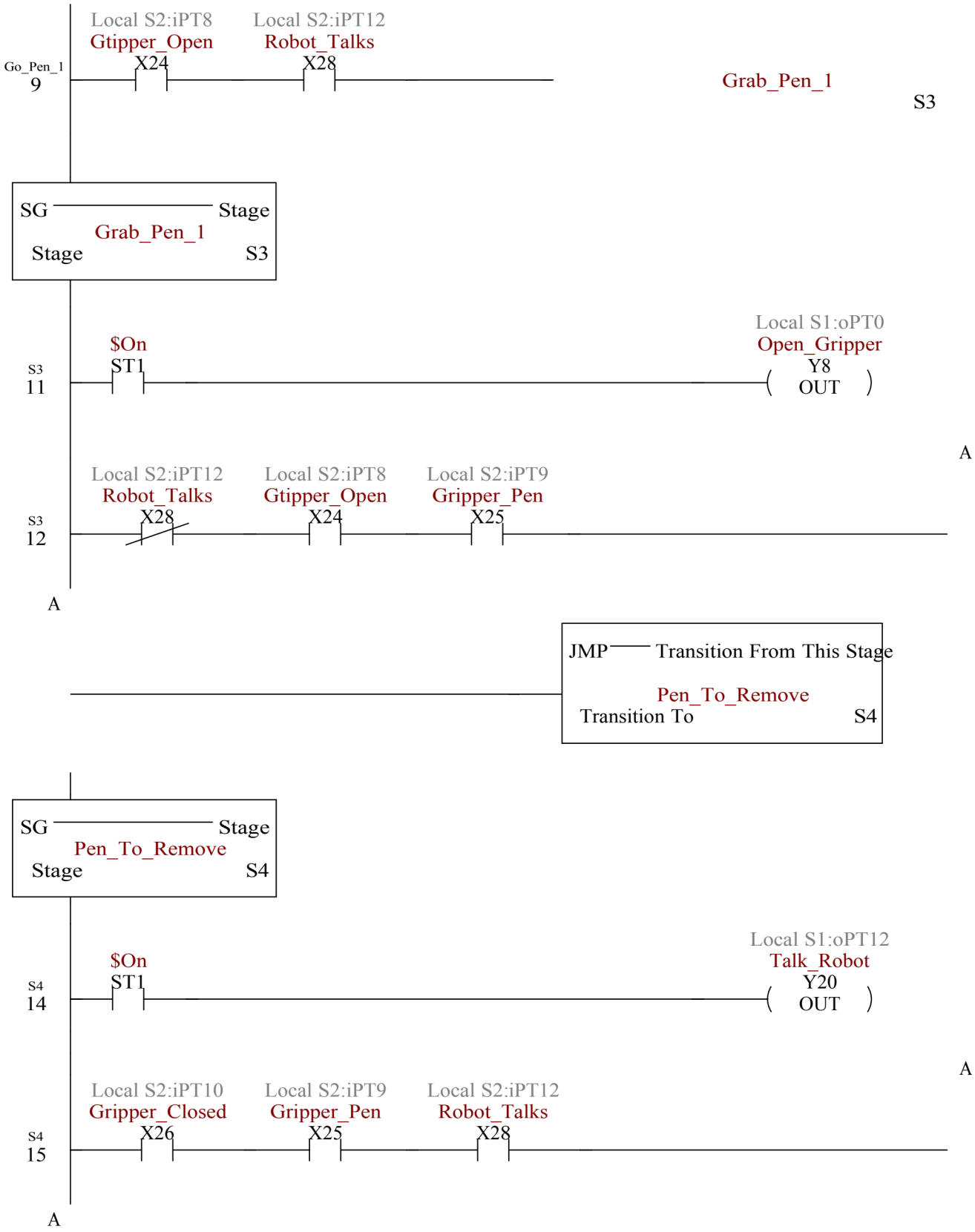
Talk_Robot
Y20
OUT
S0
3
Local S2:iPT10
Gripper_Closed
X26
Local S2:iPT12
Robot_Talks
X28
JMP
Transition From This Stage
Open_Case_End
Transition To
S1
SG
Stage
Open_Case_End
Stage
S1
S1
5
Local S2:iPT12
Robot_Talks
X28
Local S2:iPT10
Gripper_Closed
X26
JMP
Transition From This Stage
Go_Pen_1
Transition To
S2
SG
Stage
Go_Pen_1
Stage
S2
Go_Pen_1
7
$On
ST1
Local S1:oPT0
Open_Gripper
Y8
OUT
Go_Pen_1
8
$On
ST1
Local S2:iPT8
Gtipper_Open
X24
Local S1:oPT12
Talk_Robot
Y20
OUT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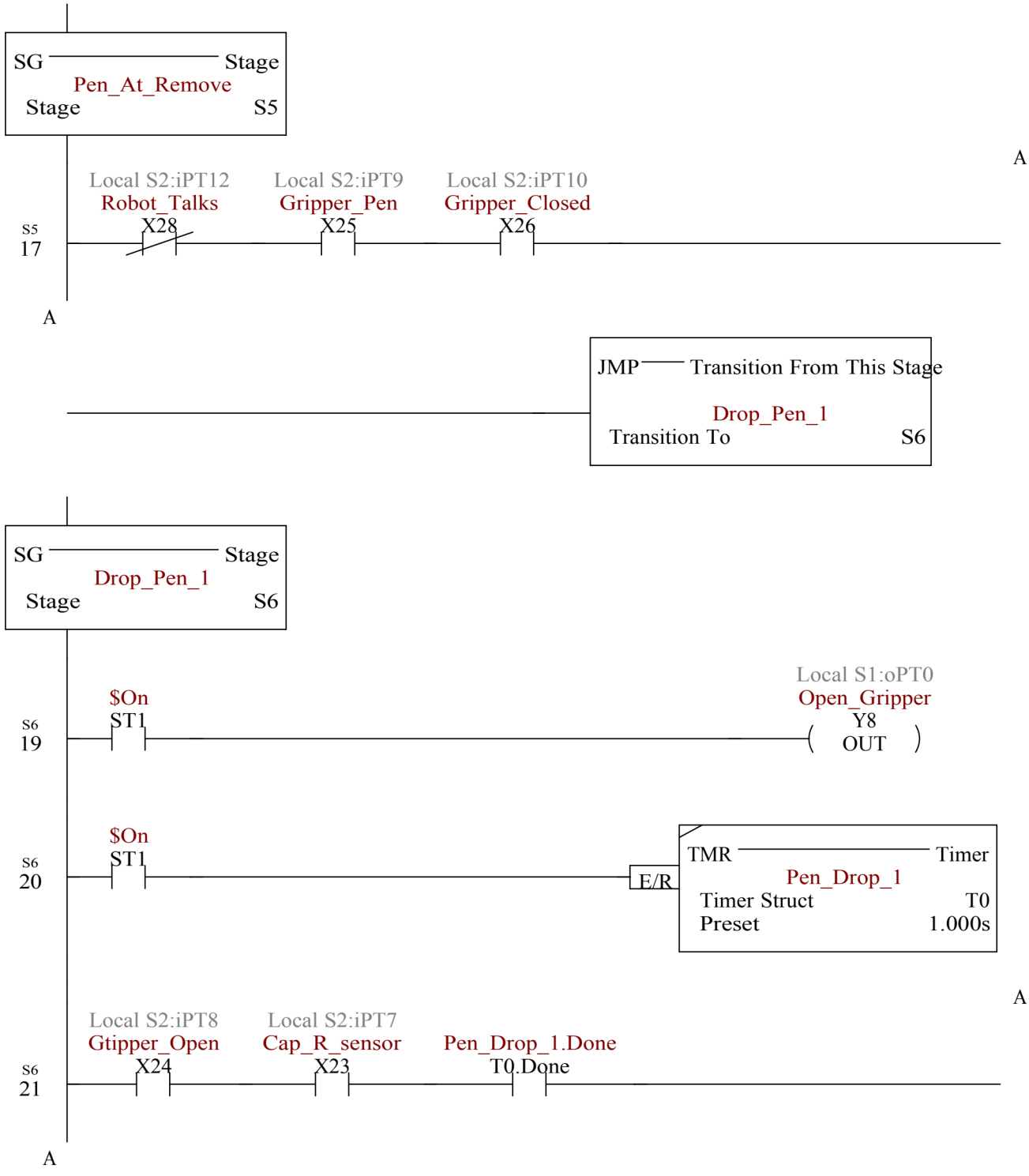
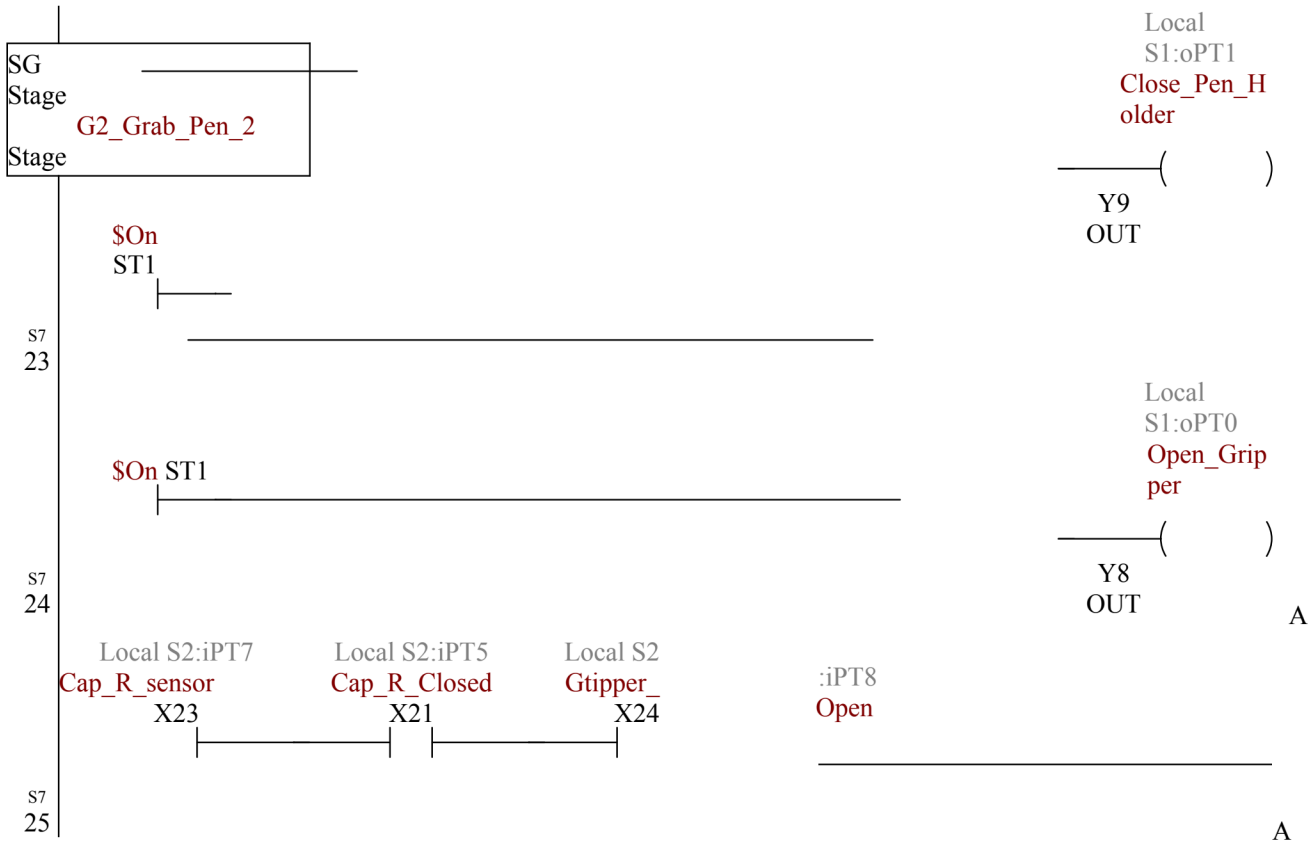
Gtipper_Open
X24
Local S2:iPT12
Robot_Talks
X28
Go_Pen_1
9
Grab_Pen_1
S3
SG
Stage
Grab_Pen_1
Stage
S3
Local S1:oPT0
Open_Gripper
Y8
OUT
$On
ST1
S3
11
A
Local S2:iPT12
Robot_Talks
X28
Local S2:iPT8
Gtipper_Open
X24
Local S2:iPT9
Gripper_Pen
X25
S3
12
A
JMP
Transition From This Stage
Pen_To_Remove
Transition To
S4
SG
Stage
Pen_To_Remove
Stage
S4
Local S1:oPT12
Talk_Robot
Y20
OUT
$On
ST1
S4
14
A
Local S2:iPT10
Gripper_Closed
X26
Local S2:iPT9
Gripper_Pen
X25
Local S2:iPT12
Robot_Talks
X28
S4
15
A

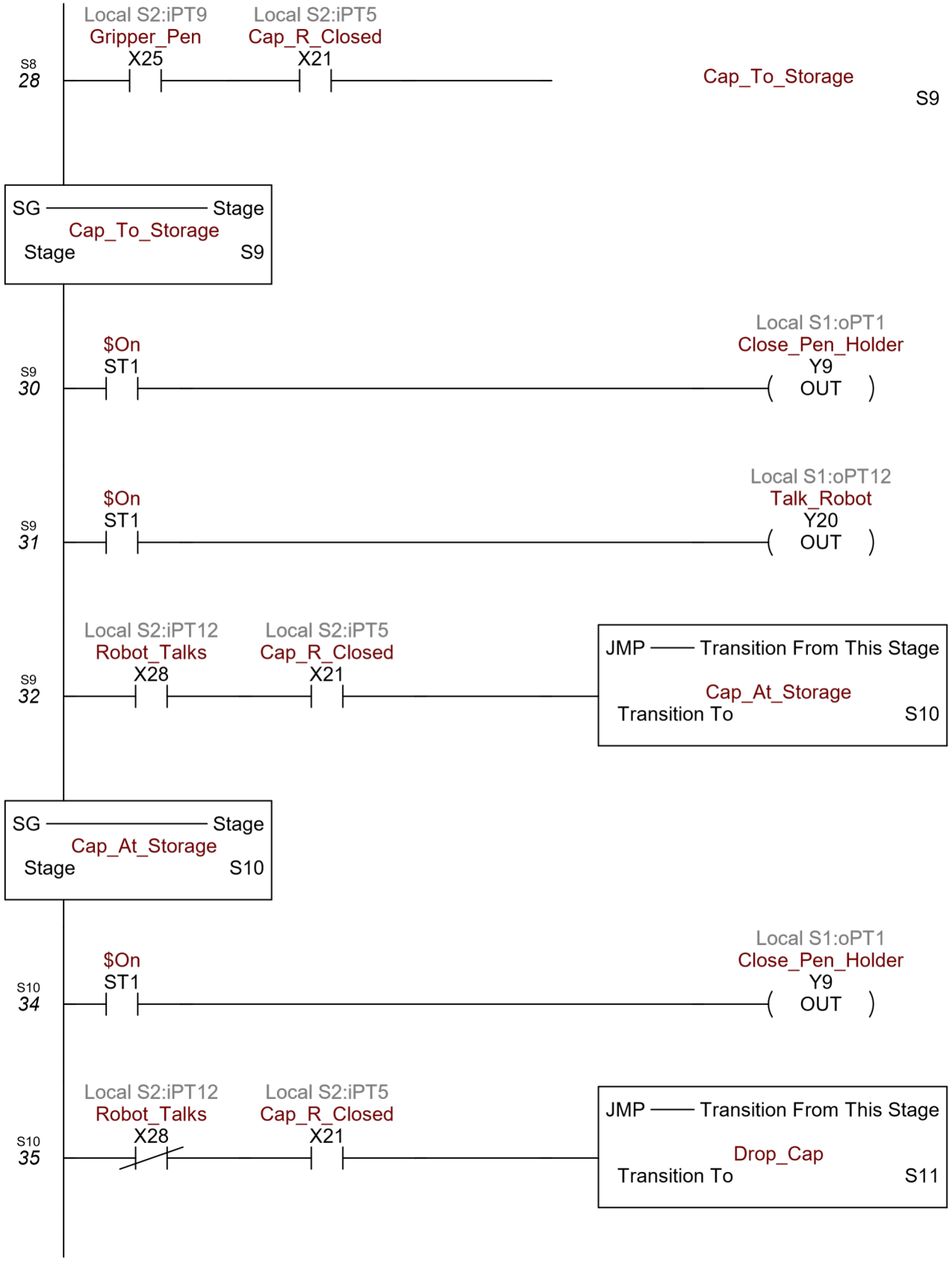
Pen_At_Remove S5

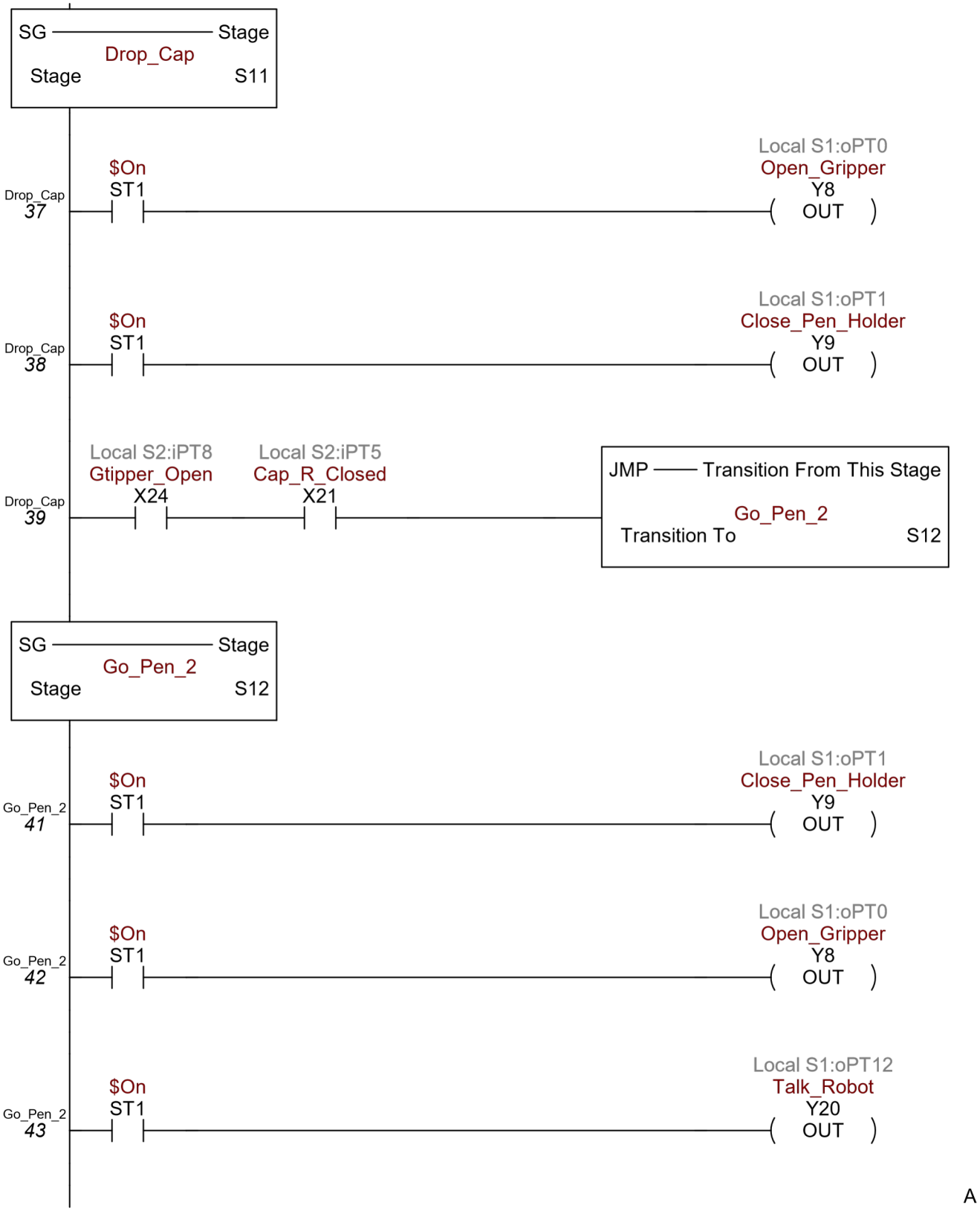


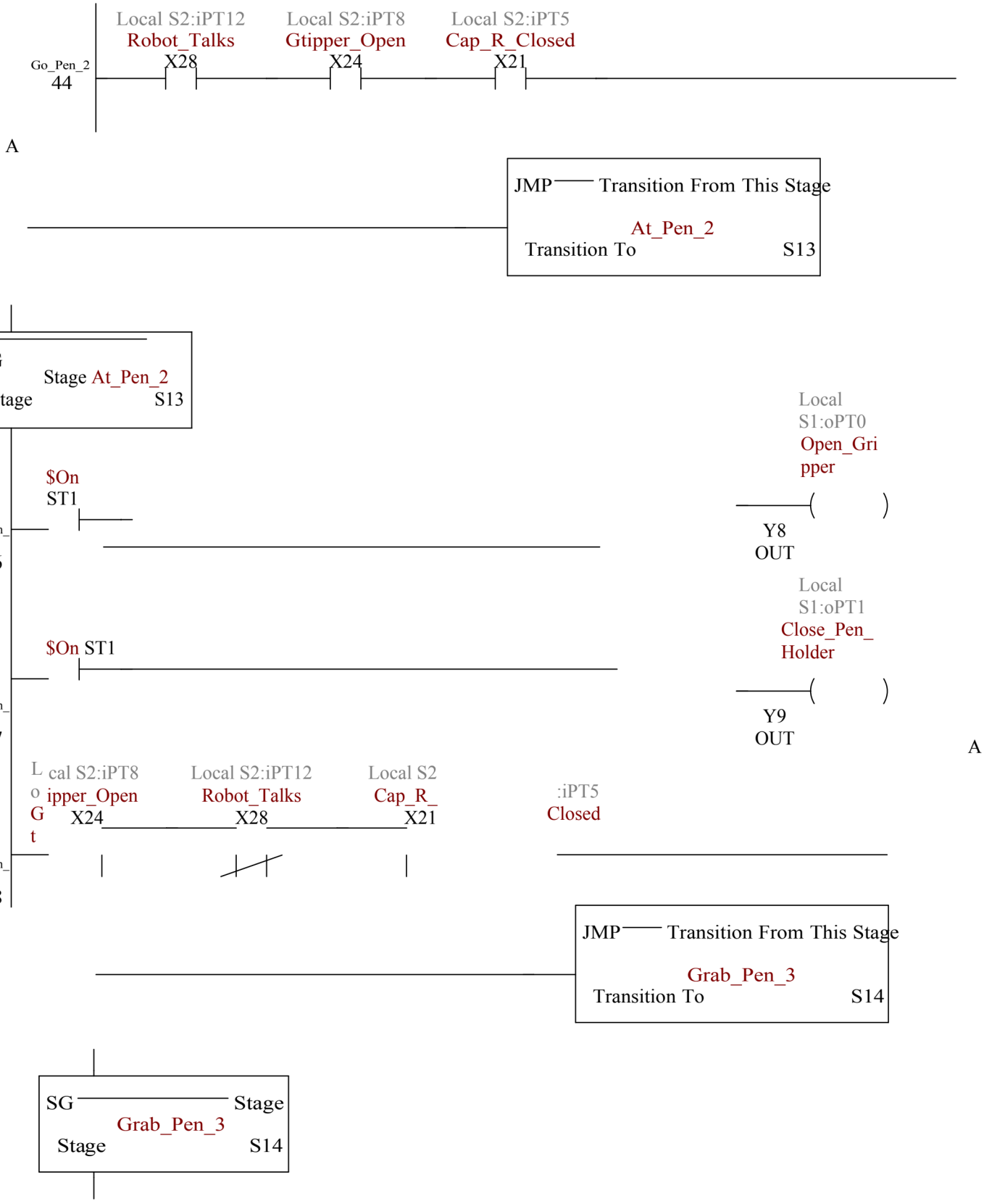
G2_Grab_Pen_2

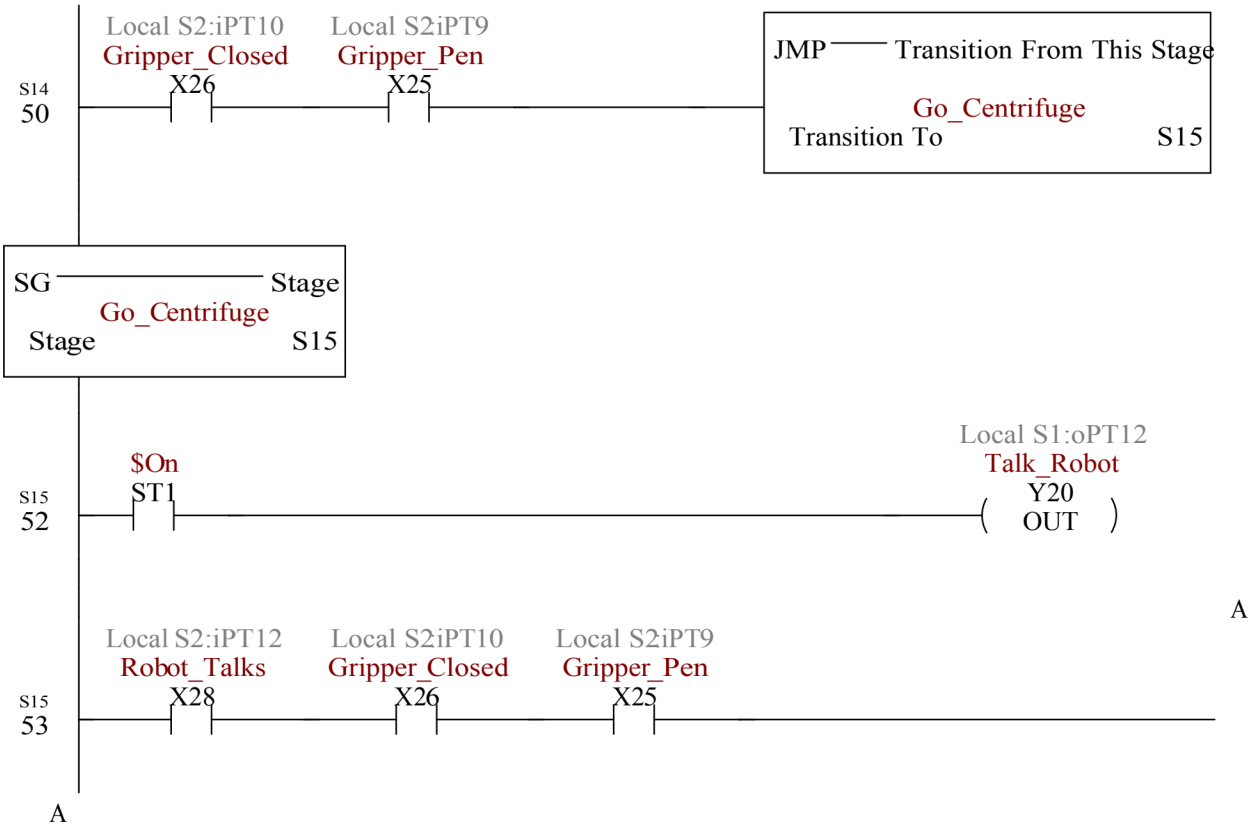
S7

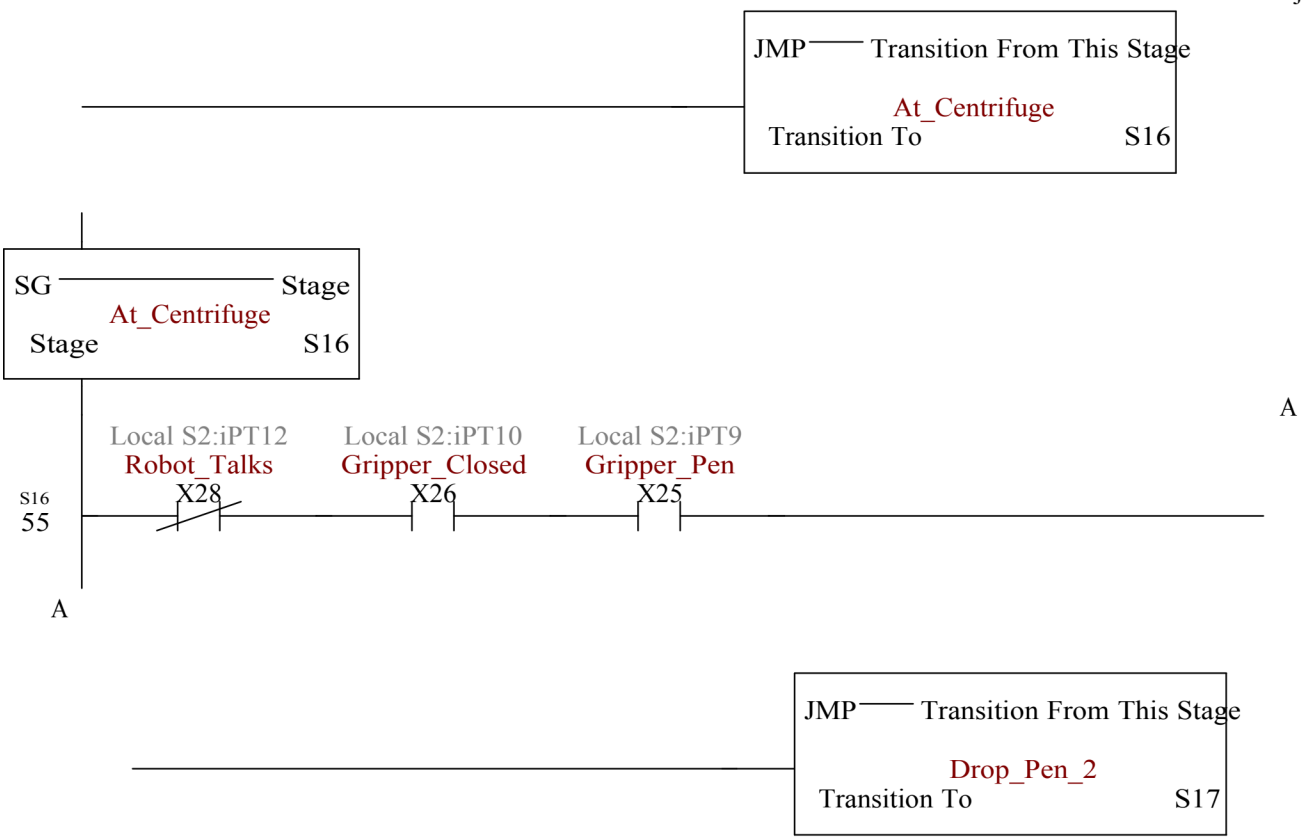



S8
28
Local S2:iPT9
Gripper_Pen
X25
Local S2:iPT5
Cap_R_Closed
X21
Cap_To_Storage
S9
SG
Stage
Cap_To_Storage
Stage
S9
S9
30
$On
ST1
Local S1:oPT1
Close_Pen_Holder
Y9
OUT
S9
31
$On
ST1
Local S1:oPT12
Talk_Robot
Y20
OUT
S9
32
Local S2:iPT12
Robot_Talks
X28
Local S2:iPT5
Cap_R_Closed
X21
JMP
Transition From This Stage
Cap_At_Storage
Transition To
S10
SG
Stage
Cap_At_Storage
Stage
S10
S10
34
$On
ST1
Local S1:oPT1
Close_Pen_Holder
Y9
OUT
S10
35
Local S2:iPT12
Robot_Talks
X28
Local S2:iPT5
Cap_R_Closed
X21
JMP
Transition From This Stage
Drop_Cap
Transition To
S11

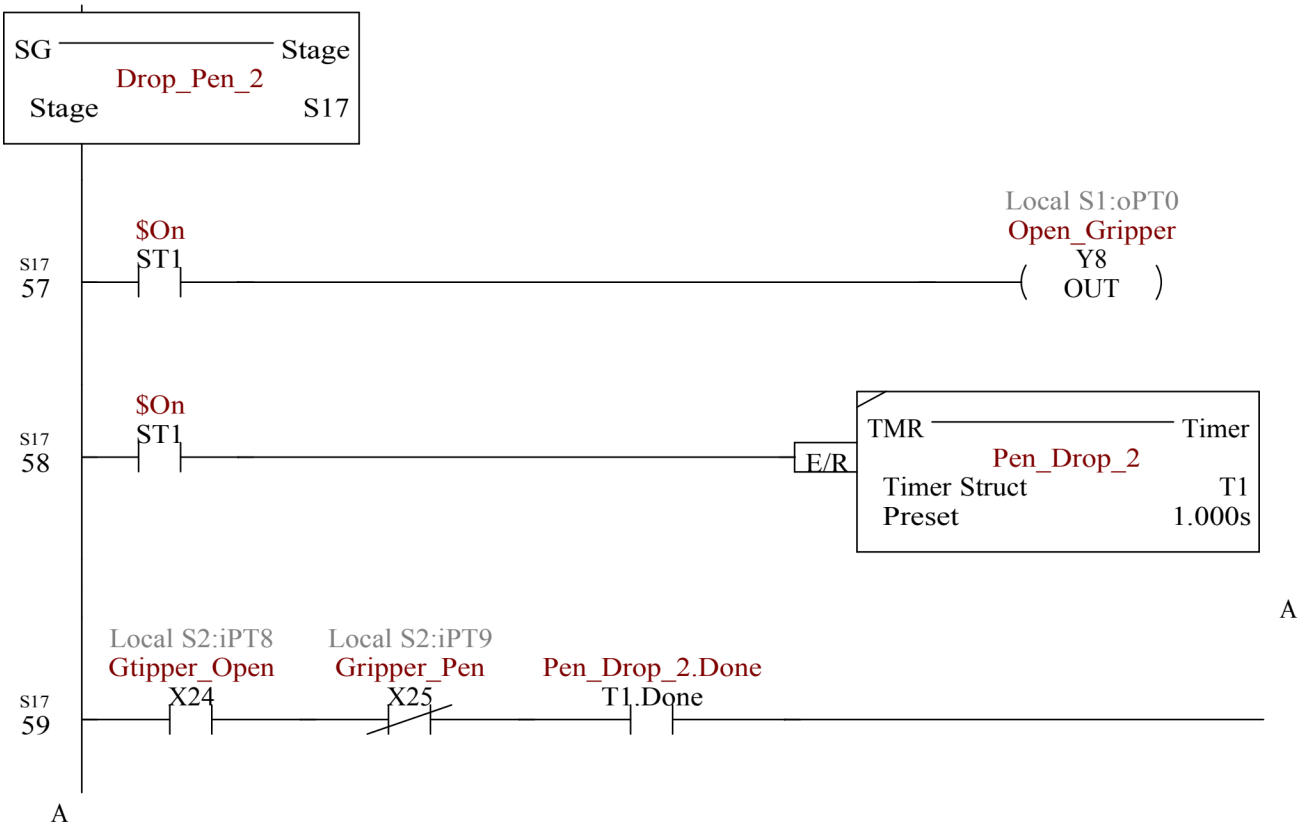

SG
Stage
Drop_Cap
Stage
S11
Drop_Cap
37
$On
ST1
Local S1:oPT0
Open_Gripper
Y8
OUT
Drop_Cap
38
$On
ST1
Local S1:oPT1
Close_Pen_Holder
Y9
OUT
Drop_Cap
39
Local S2:iPT8
Gtipper_Open
X24
Local S2:iPT5
Cap_R_Closed
X21
JMP
Transition From This Stage
Go_Pen_2
Transition To
S12
SG
Stage
Go_Pen_2
Stage
S12
Go_Pen_2
41
$On
ST1
Local S1:oPT1
Close_Pen_Holder
Y9
OUT
Go_Pen_2
42
$On
ST1
Local S1:oPT0
Open_Gripper
Y8
OUT
Go_Pen_2
43
$On
ST1
Local S1:oPT12
Talk_Robot
Y20
OUT
A

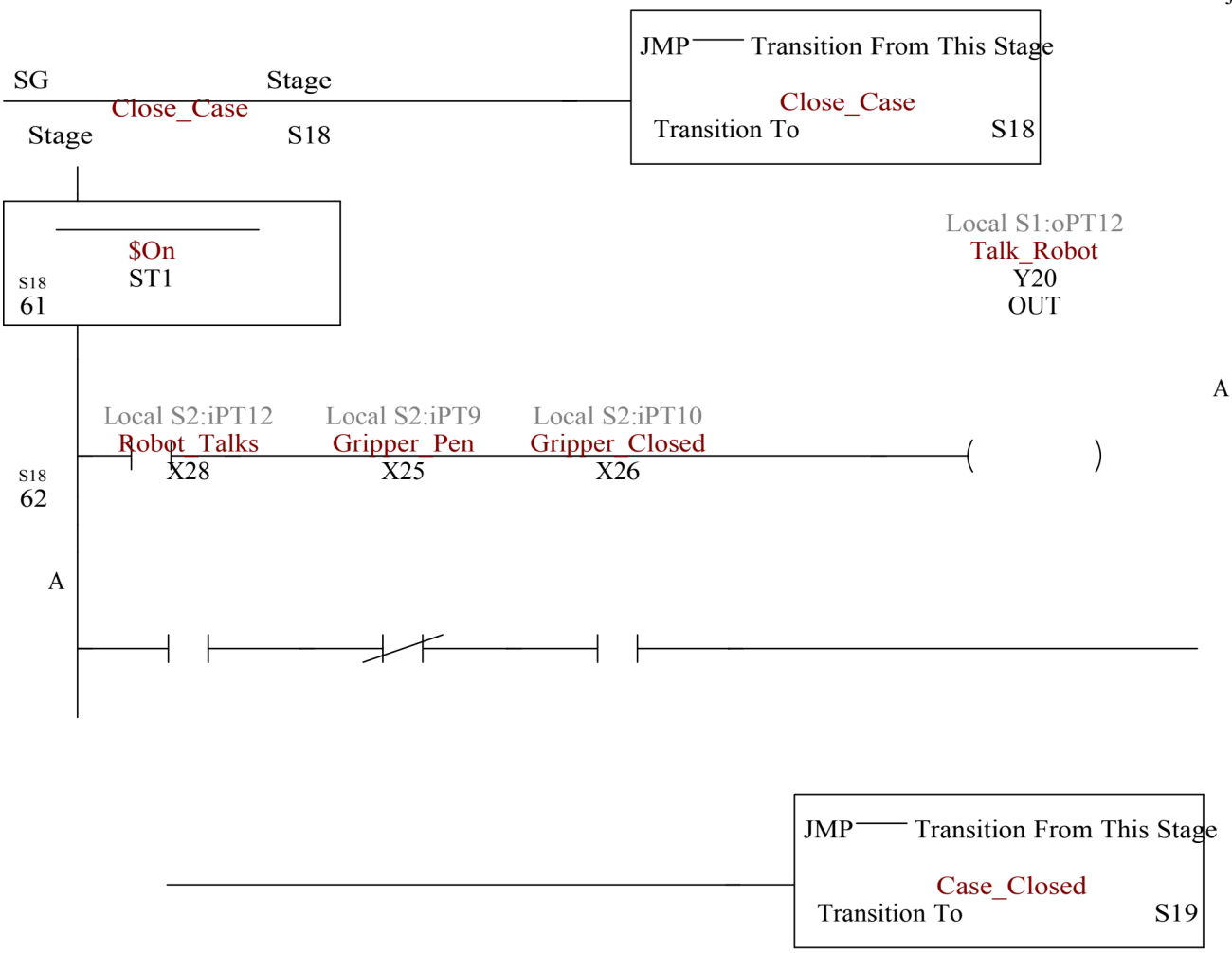

Local S2:iPT12
Robot_Talks
X28
Local S2:iPT8
Gtipper_Open
X24
Local S2:iPT5
Cap_R_Closed
X21
Go_Pen_2
44
A
JMP
Transition From This Stage
At_Pen_2
Transition To
S13
SG
Stage
Stage At_Pen_2
Stage
S13
$On
ST1
At_Pen_2
46
Local
S1:oPT0
Open_Gripper
Y8
OUT
$On ST1
At_Pen_2
47
Local
S1:oPT1
Close_Pen_Holder
Y9
OUT
A
Local S2:iPT8
Gripper_Open
X24
Local S2:iPT12
Robot_Talks
X28
Local S2
Cap_R_
X21
:iPT5
Closed
At_Pen_2
48
JMP
Transition From This Stage
Grab_Pen_3
Transition To
S14
SG
Stage
Grab_Pen_3
Stage
S14

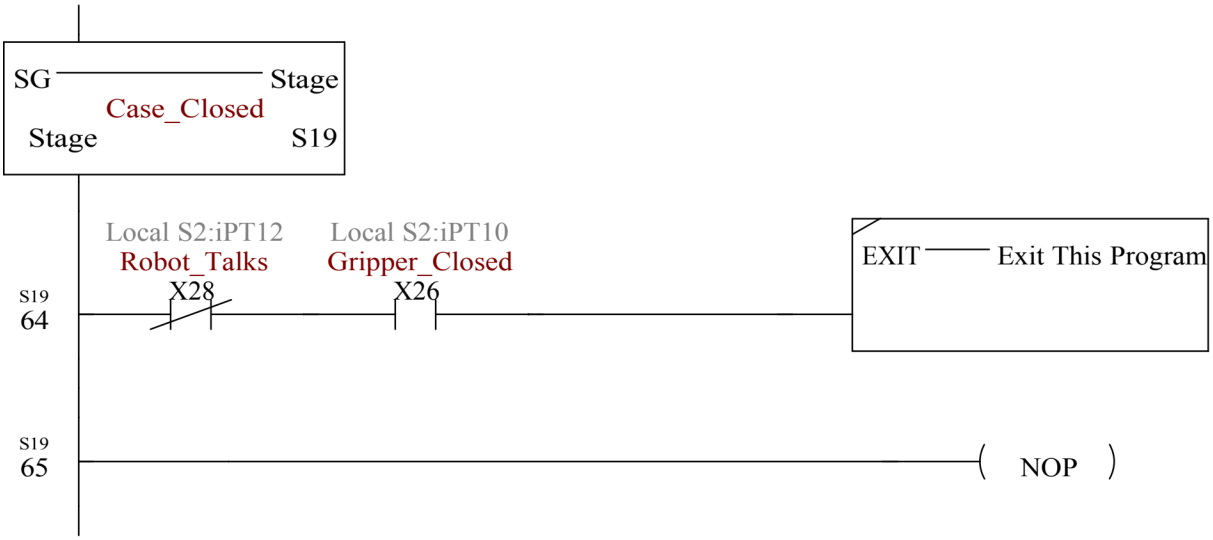

Local S2:iPT10
Gripper_Closed
X26
Local S2iPT9
Gripper_Pen
X25
S14
50
JMP
Transition From This Stage
Go_Centrifuge
Transition To
S15
SG
Stage
Go_Centrifuge
Stage
S15
Local S1:oPT12
Talk_Robot
Y20
OUT
$On
ST1
S15
52
A
Local S2:iPT12
Robot_Talks
X28
Local S2iPT10
Gripper_Closed
X26
Local S2iPT9
Gripper_Pen
X25
S15
53
A


JMP
Transition From This Stage
At_Centrifuge
Transition To
S16
SG
Stage
At_Centrifuge
Stage
S16
A
Local S2:iPT12
Robot_Talks
X28
Local S2:iPT10
Gripper_Closed
X26
Local S2:iPT9
Gripper_Pen
X25
S16
55
A

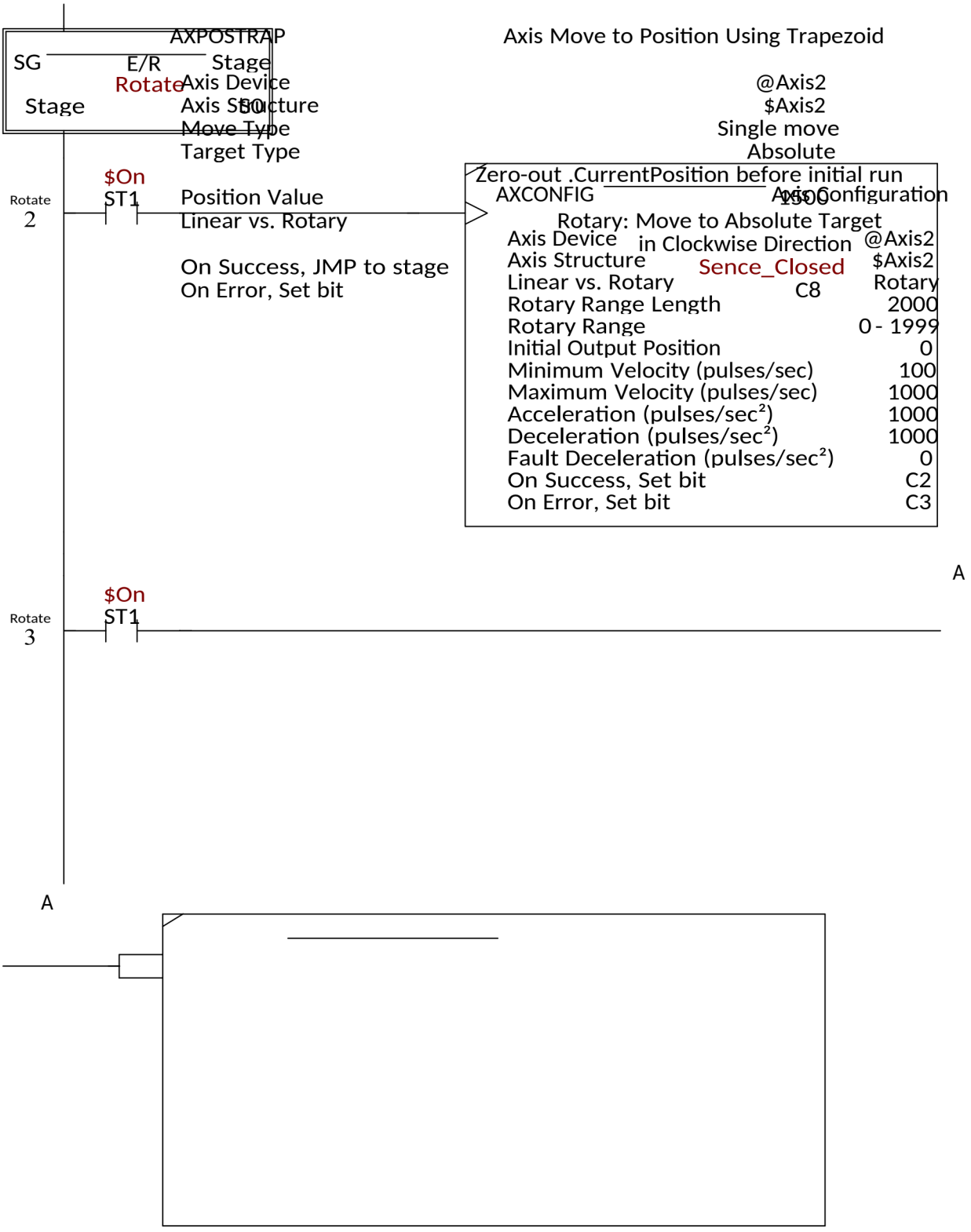
JMP
Transition From This Stage
Drop_Pen_2
Transition To
S17

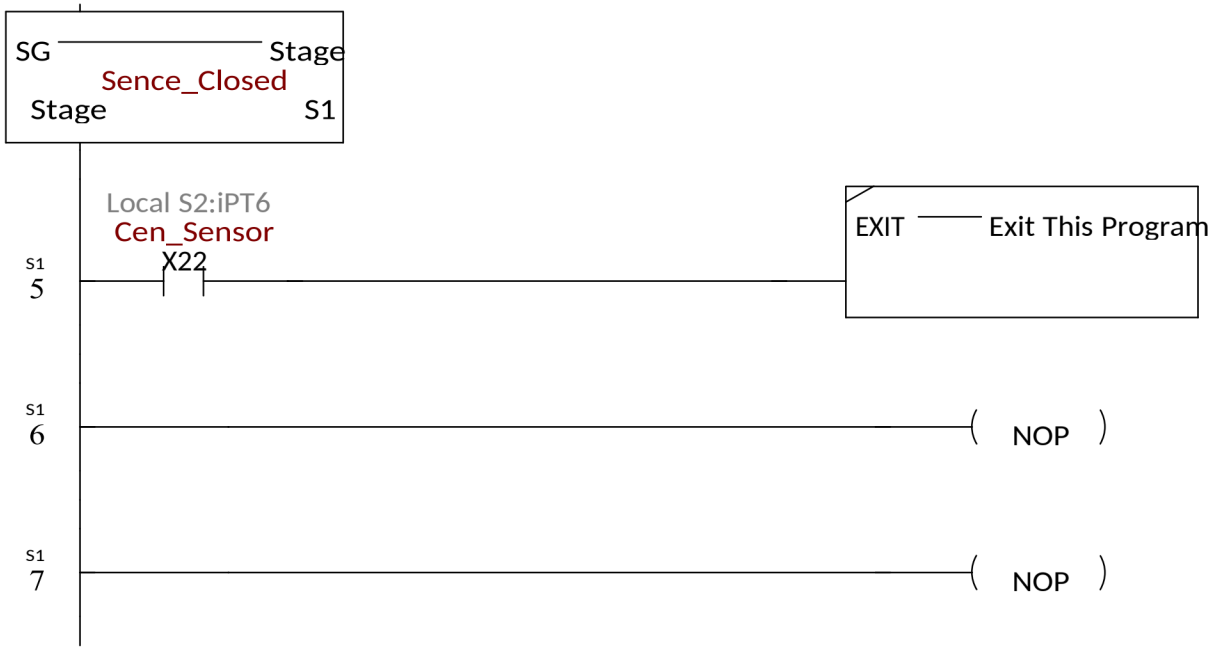

SG
Stage
Drop_Pen_2
Stage
S17
S17
57
$On
ST1
Local S1:oPT0
Open_Gripper
Y8
OUT
S17
58
$On
ST1
E/R
TMR
Timer
Pen_Drop_2
Timer Struct
T1
Preset
1.000s
A
S17
59
Local S2:iPT8
Gtipper_Open
X24
Local S2:iPT9
Gripper_Pen
X25
Pen_Drop_2.Done
T1.Done
A

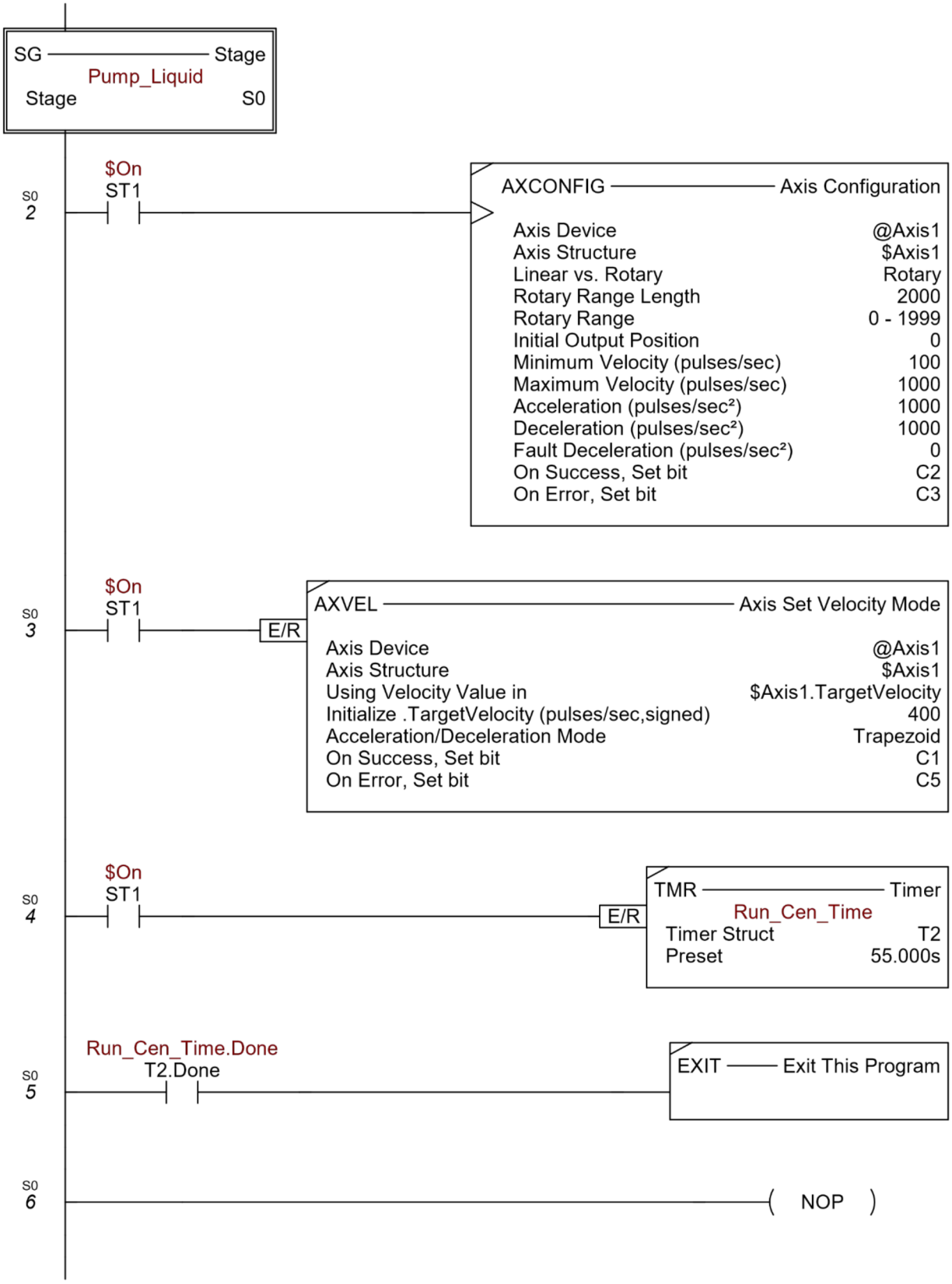

JMP
Transition From This Stage
Close_Case
Transition To S18
SG
Stage
Close_Case
Stage S18
$On
ST1
S18
61
Local S1:oPT12
Talk_Robot
Y20
OUT
A
Local S2:iPT12
Robot_Talks
X28
Local S2:iPT9
Gripper_Pen
X25
Local S2:iPT10
Gripper_Closed
X26
S18
62
A
JMP
Transition From This Stage
Case_Closed
Transition To S19



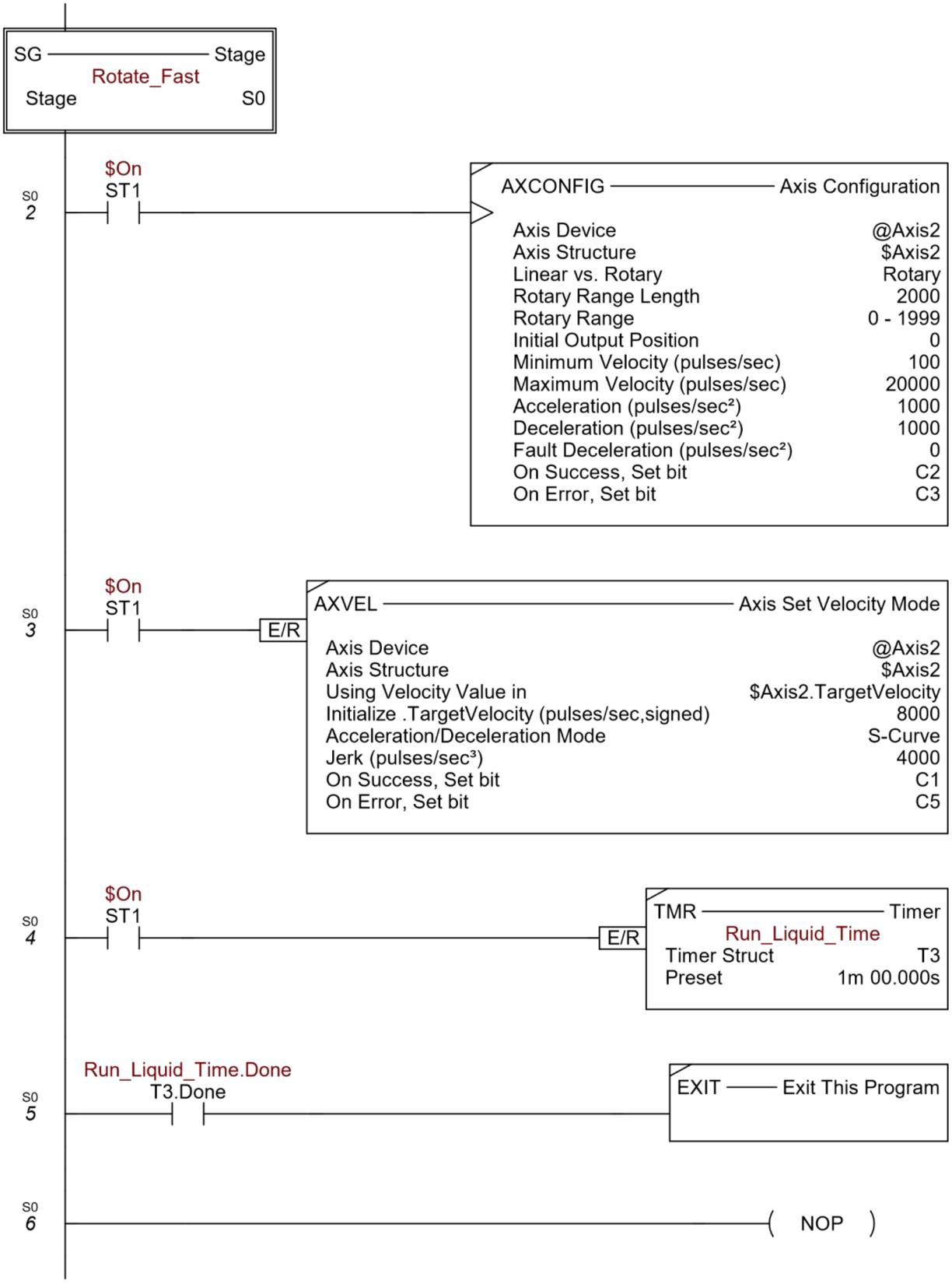
Rotate Centrafuge


AXPOSTRAP
Axis Move to Position Using Trapezoid
SG
E/R
Stage
Rotate
Stage
Axis Device
Axis Structure
Move Type
Target Type
@Axis2
$Axis2
Single move
Absolute
$On
ST1
Rotate
2
Position Value
Linear vs. Rotary
On Success, JMP to stage
On Error, Set bit
Zero-out .CurrentPosition before initial run
AXCONFIG
Axis Configuration
Rotary: Move to Absolute Target
in Clockwise Direction
Axis Device @Axis2
Axis Structure $Axis2
Linear vs. Rotary Rotary
Rotary Range Length 2000
Rotary Range 0 - 1999
Initial Output Position 0
Minimum Velocity (pulses/sec) 100
Maximum Velocity (pulses/sec) 1000
Acceleration (pulses/sec²) 1000
Deceleration (pulses/sec²) 1000
Fault Deceleration (pulses/sec²) 0
On Success, Set bit C2
On Error, Set bit C3
Sence_Closed
C8
A
$On
ST1
Rotate
3
A

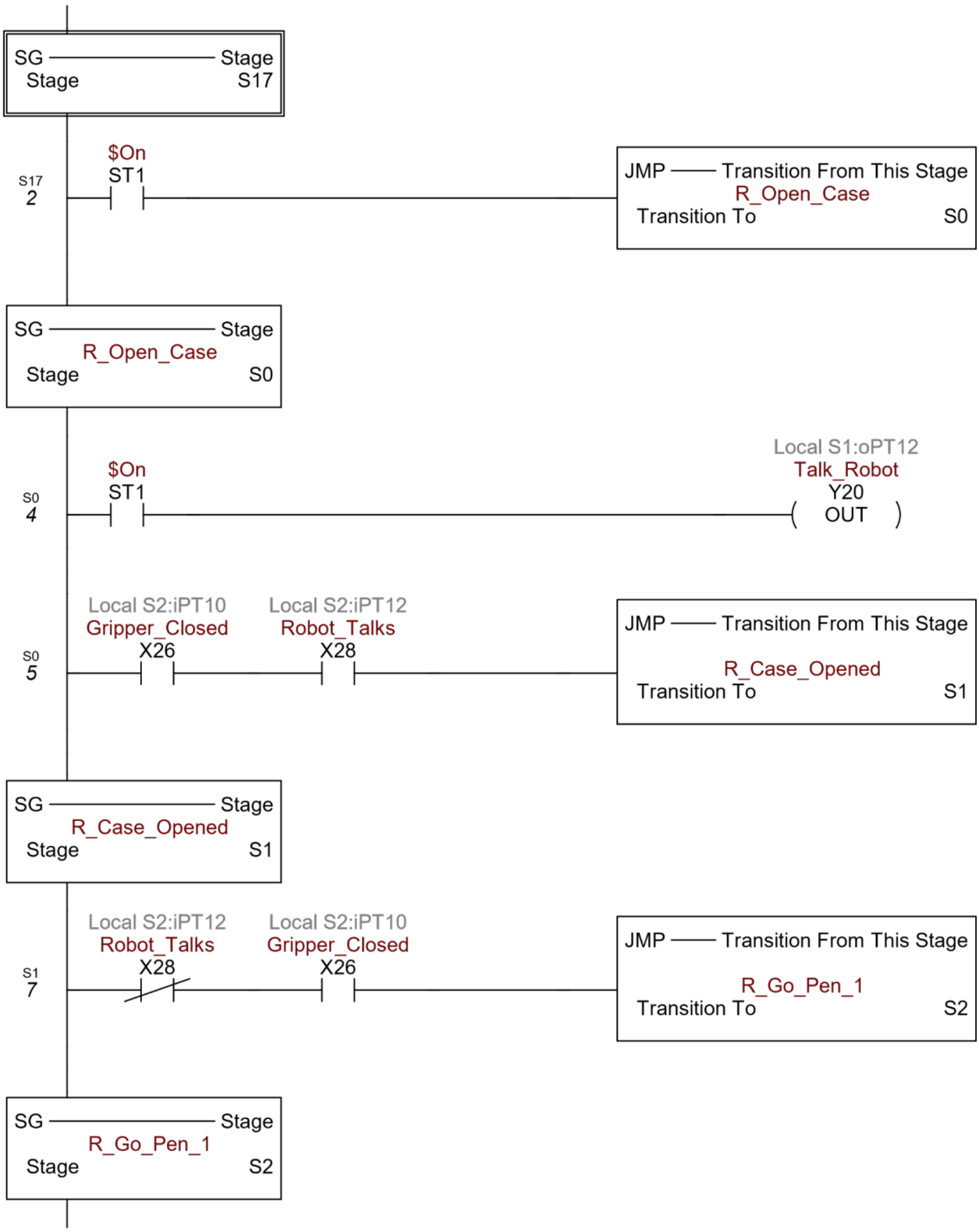

SG
Stage
Sence_Closed
Stage
S1
Local S2:iPT6
Cen_Sensor
X22
S1
5
EXIT
Exit This Program
S1
6
NOP
S1
7
NOP

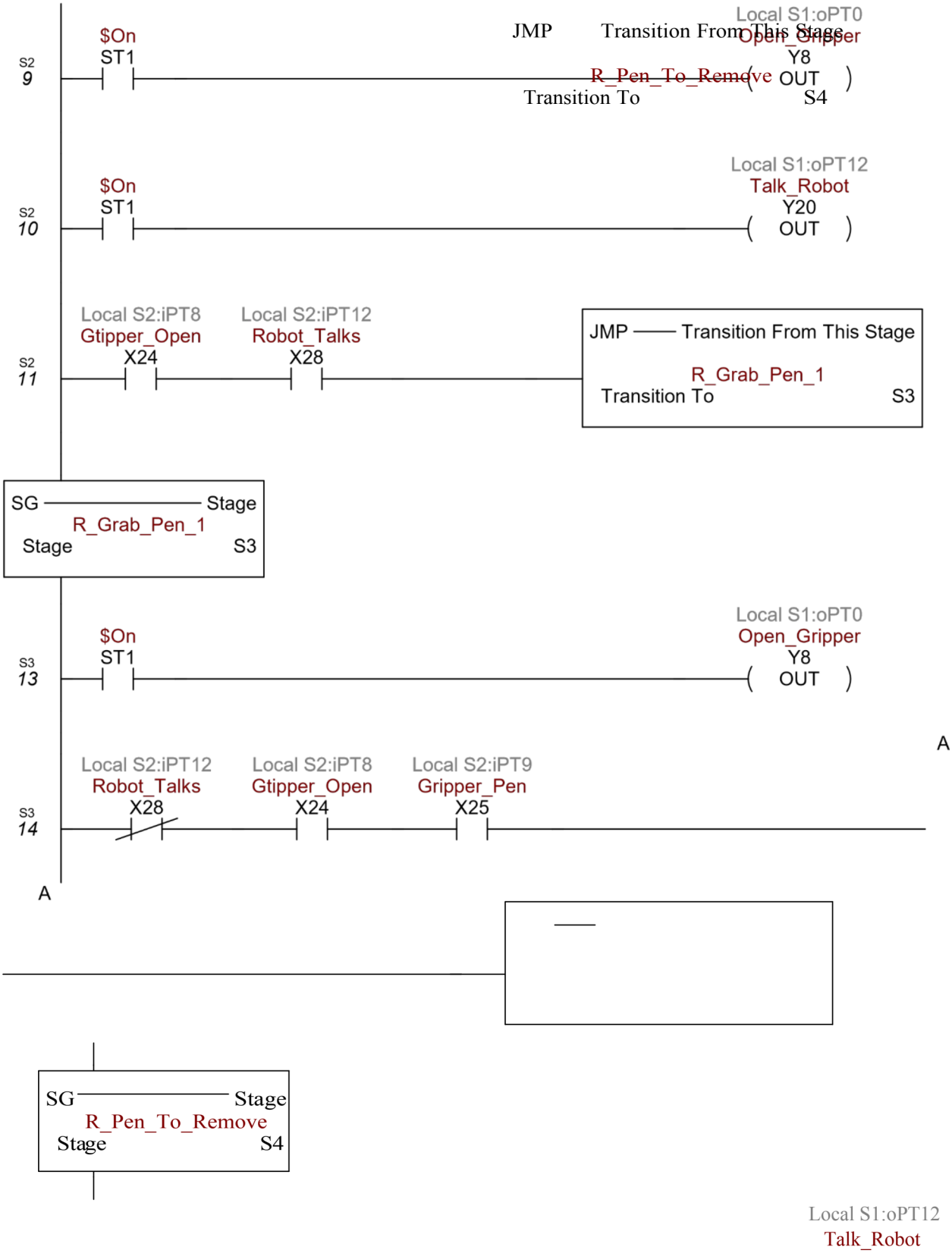

SG
Stage
Pump_Liquid
Stage
S0
S0
2
$On
ST1
AXCONFIG
Axis Configuration
Axis Device @Axis1
Axis Structure $Axis1
Linear vs. Rotary Rotary
Rotary Range Length 2000
Rotary Range 0 - 1999
Initial Output Position 0
Minimum Velocity (pulses/sec) 100
Maximum Velocity (pulses/sec) 1000
Acceleration (pulses/sec²) 1000
Deceleration (pulses/sec²) 1000
Fault Deceleration (pulses/sec²) 0
On Success, Set bit C2
On Error, Set bit C3
S0
3
$On
ST1
E/R
AXVEL
Axis Set Velocity Mode
Axis Device @Axis1
Axis Structure $Axis1
Using Velocity Value in $Axis1.TargetVelocity
Initialize .TargetVelocity (pulses/sec,signed) 400
Acceleration/Deceleration Mode Trapezoid
On Success, Set bit C1
On Error, Set bit C5
S0
4
$On
ST1
E/R
TMR
Timer
Run_Cen_Time
Timer Struct T2
Preset 55.000s
S0
5
Run_Cen_Time.Done
T2.Done
EXIT
Exit This Program
S0
6
NOP

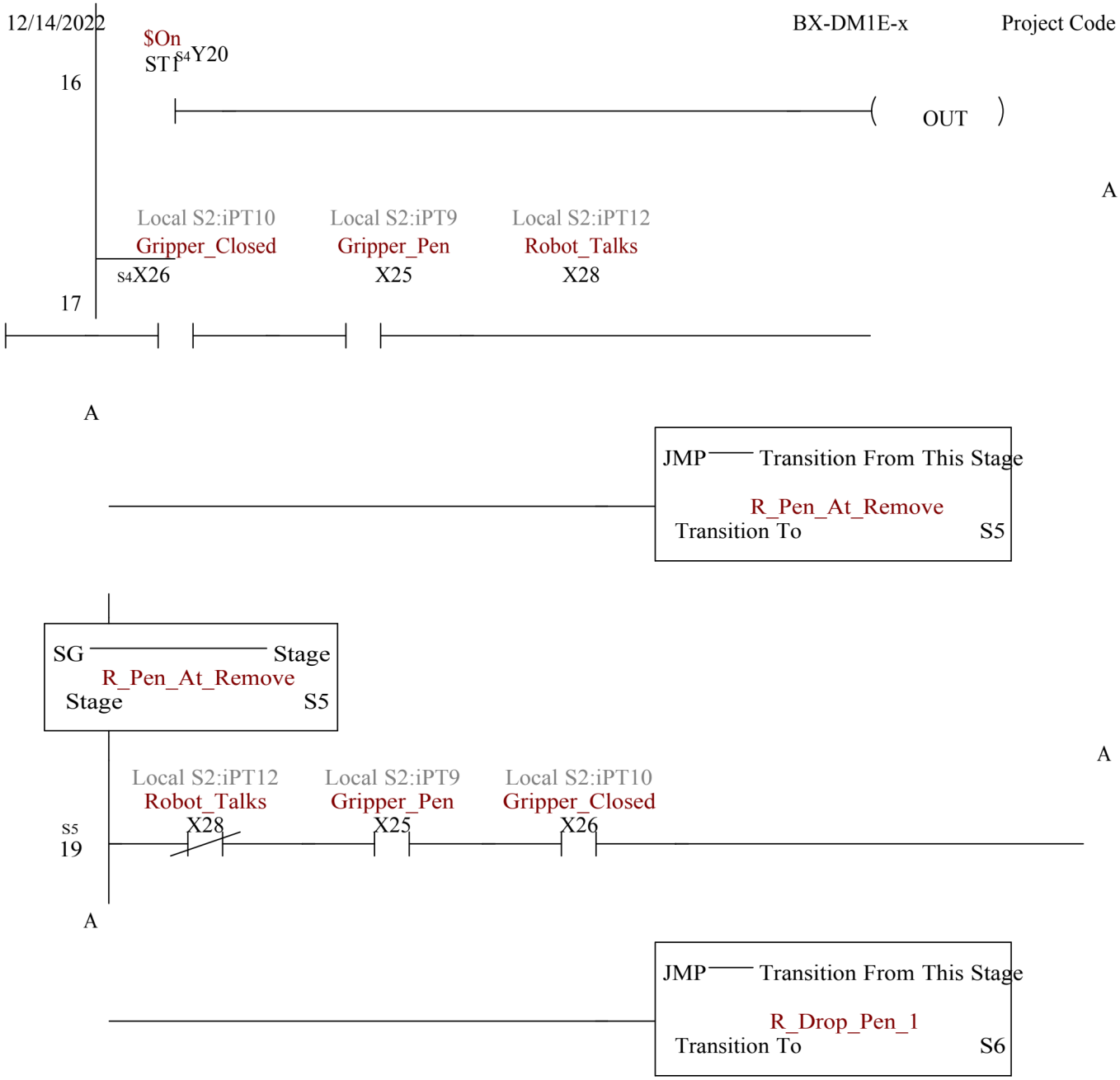
Run Centrafuge

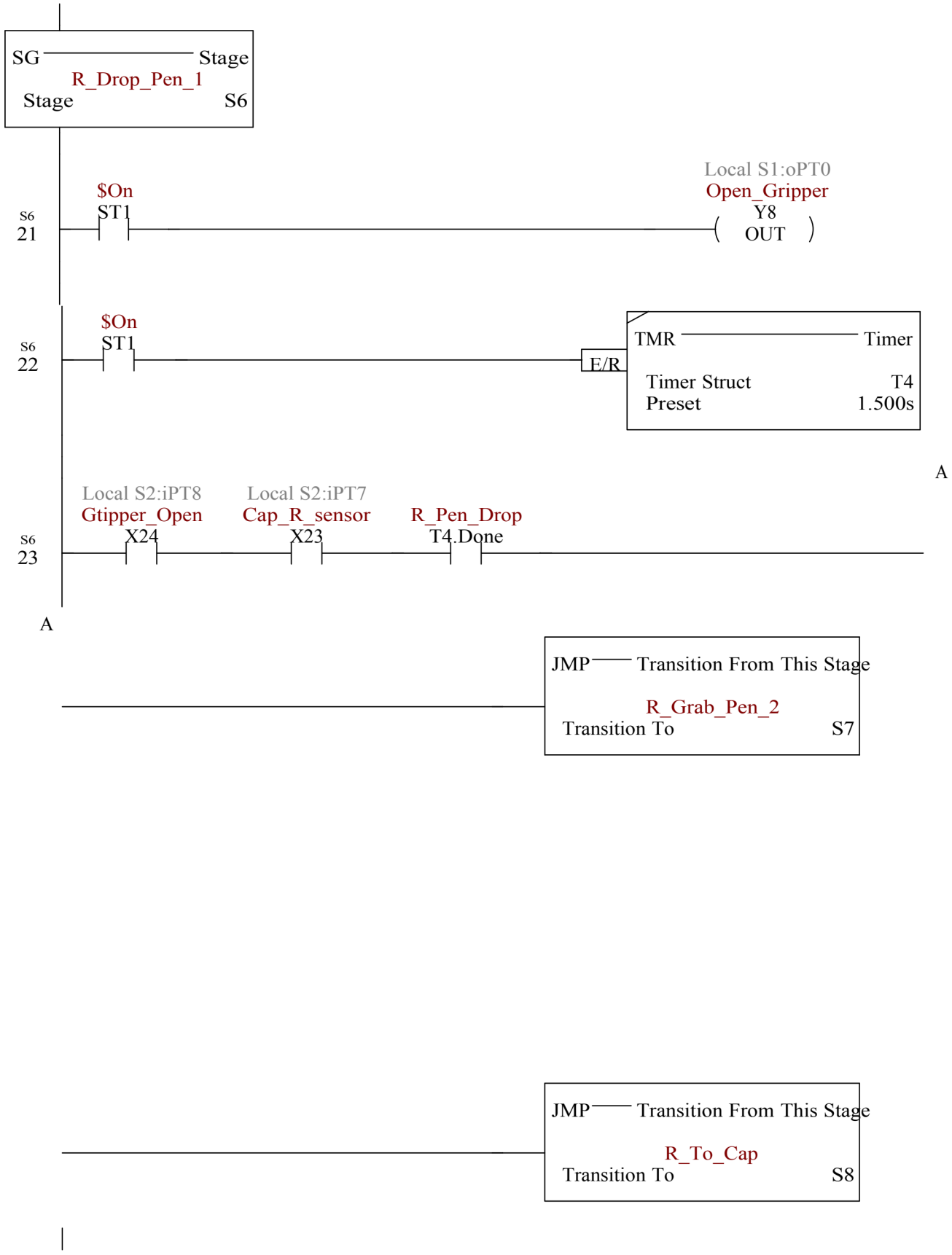

SG
Stage
Rotate_Fast
Stage
S0
S0
2
$On
ST1
AXCONFIG
Axis Configuration
Axis Device @Axis2
Axis Structure $Axis2
Linear vs. Rotary Rotary
Rotary Range Length 2000
Rotary Range 0 - 1999
Initial Output Position 0
Minimum Velocity (pulses/sec) 100
Maximum Velocity (pulses/sec) 20000
Acceleration (pulses/sec²) 1000
Deceleration (pulses/sec²) 1000
Fault Deceleration (pulses/sec²) 0
On Success, Set bit C2
On Error, Set bit C3
S0
3
$On
ST1
E/R
AXVEL
Axis Set Velocity Mode
Axis Device @Axis2
Axis Structure $Axis2
Using Velocity Value in $Axis2.TargetVelocity
Initialize .TargetVelocity (pulses/sec,signed) 8000
Acceleration/Deceleration Mode S-Curve
Jerk (pulses/sec³) 4000
On Success, Set bit C1
On Error, Set bit C5
S0
4
$On
ST1
E/R
TMR
Timer
Run_Liquid_Time
Timer Struct T3
Preset 1m 00.000s
Run_Liquid_Time.Done
T3.Done
S0
5
EXIT
Exit This Program
S0
6
NOP

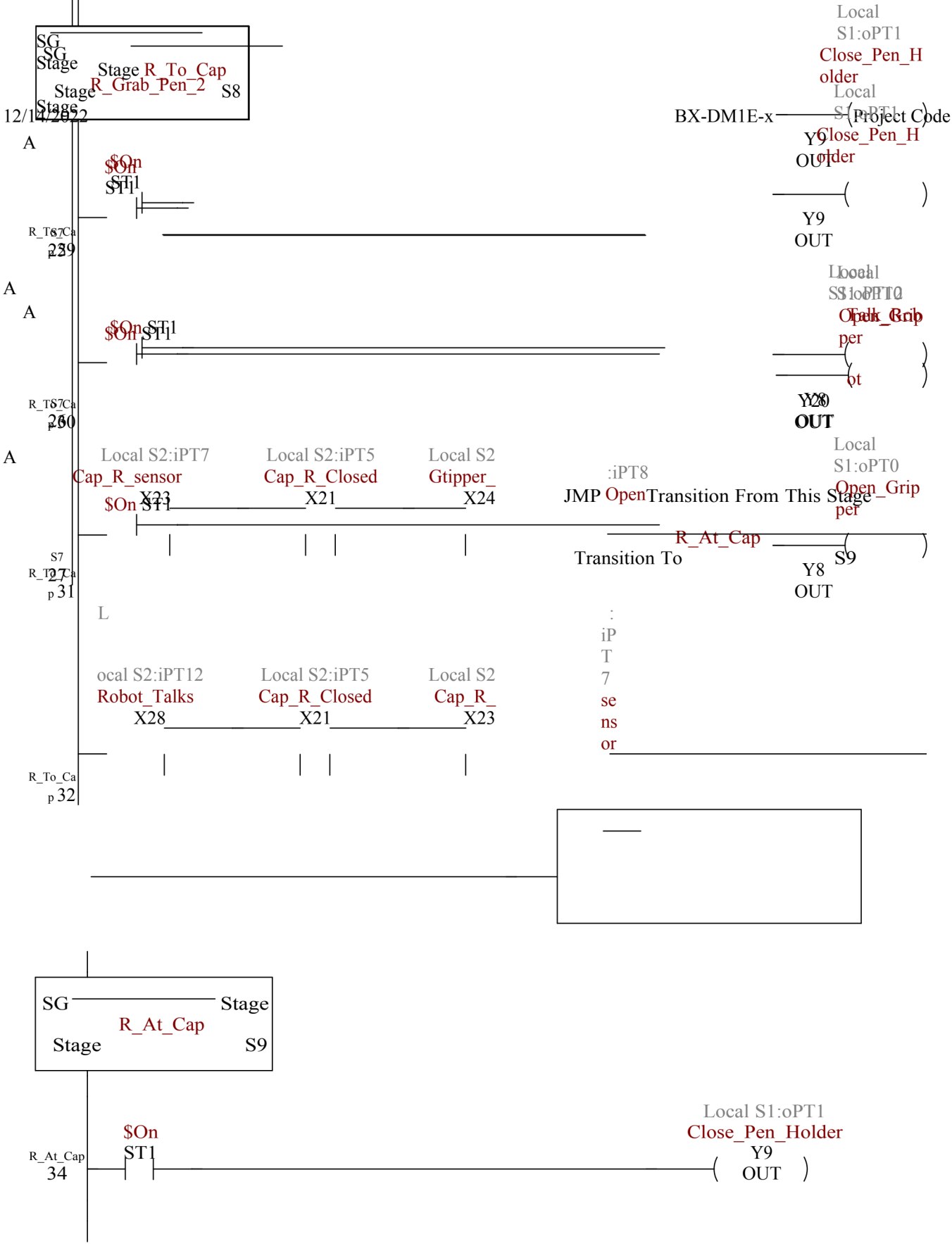
Remove Pen

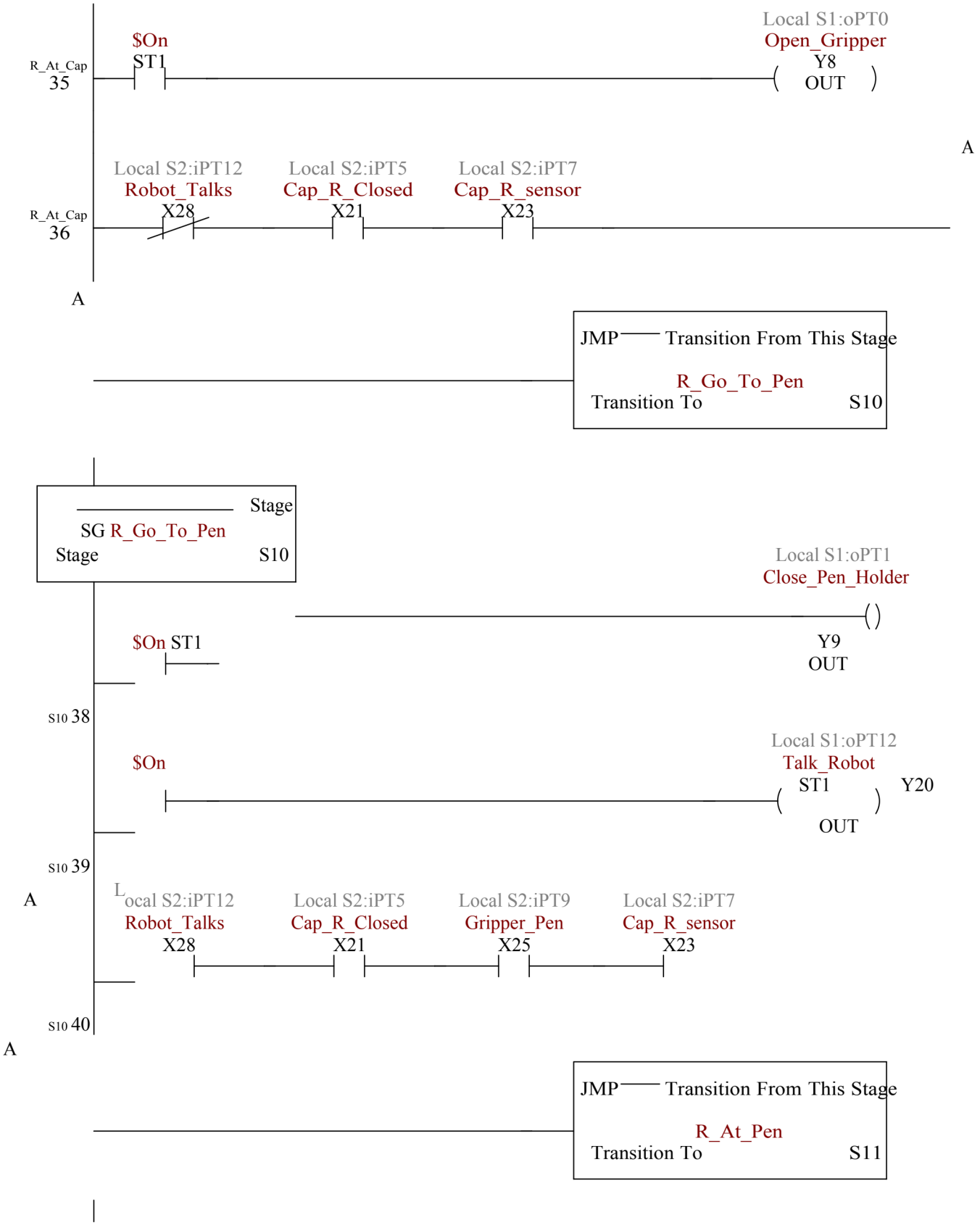

SG
Stage
Stage
S17
S17
2
$On
ST1
JMP
Transition From This Stage
R_Open_Case
Transition To
S0
SG
Stage
R_Open_Case
Stage
S0
S0
4
$On
ST1
Local S1:oPT12
Talk_Robot
Y20
OUT
S0
5
Local S2:iPT10
Gripper_Closed
X26
Local S2:iPT12
Robot_Talks
X28
JMP
Transition From This Stage
R_Case_Opened
Transition To
S1
SG
Stage
R_Case_Opened
Stage
S1
S1
7
Local S2:iPT12
Robot_Talks
X28
Local S2:iPT10
Gripper_Closed
X26
JMP
Transition From This Stage
R_Go_Pen_1
Transition To
S2
SG
Stage
R_Go_Pen_1
Stage
S2

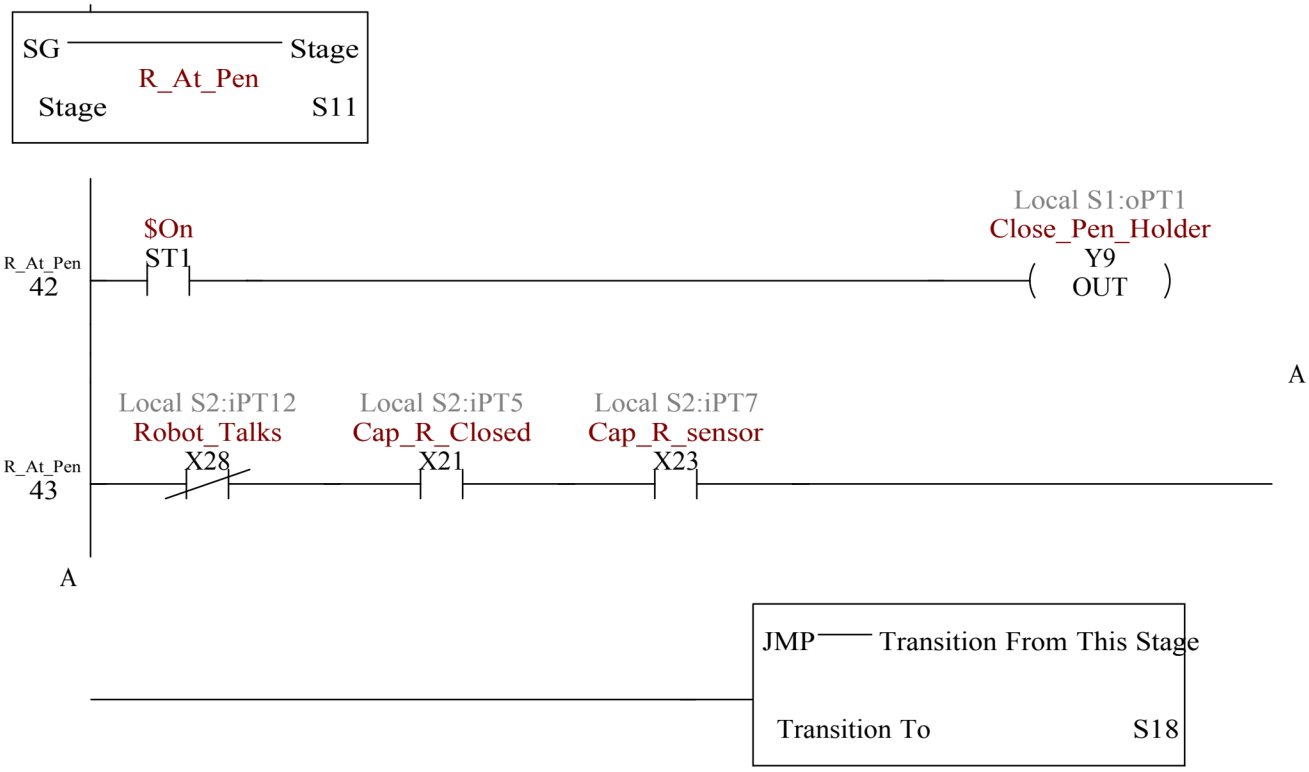

S2
9
$On
ST1
JMP
Transition From This Stage
R_Pen_To_Remove
Transition To
Local S1:oPT0
Open_Gripper
Y8
OUT
S4
S2
10
$On
ST1
Local S1:oPT12
Talk_Robot
Y20
OUT
S2
11
Local S2:iPT8
Gtipper_Open
X24
Local S2:iPT12
Robot_Talks
X28
JMP
Transition From This Stage
R_Grab_Pen_1
Transition To
S3
SG
Stage
R_Grab_Pen_1
Stage
S3
S3
13
$On
ST1
Local S1:oPT0
Open_Gripper
Y8
OUT
A
S3
14
Local S2:iPT12
Robot_Talks
X28
Local S2:iPT8
Gtipper_Open
X24
Local S2:iPT9
Gripper_Pen
X25
A
SG
Stage
R_Pen_To_Remove
Stage
S4
Local S1:oPT12
Talk_Robot

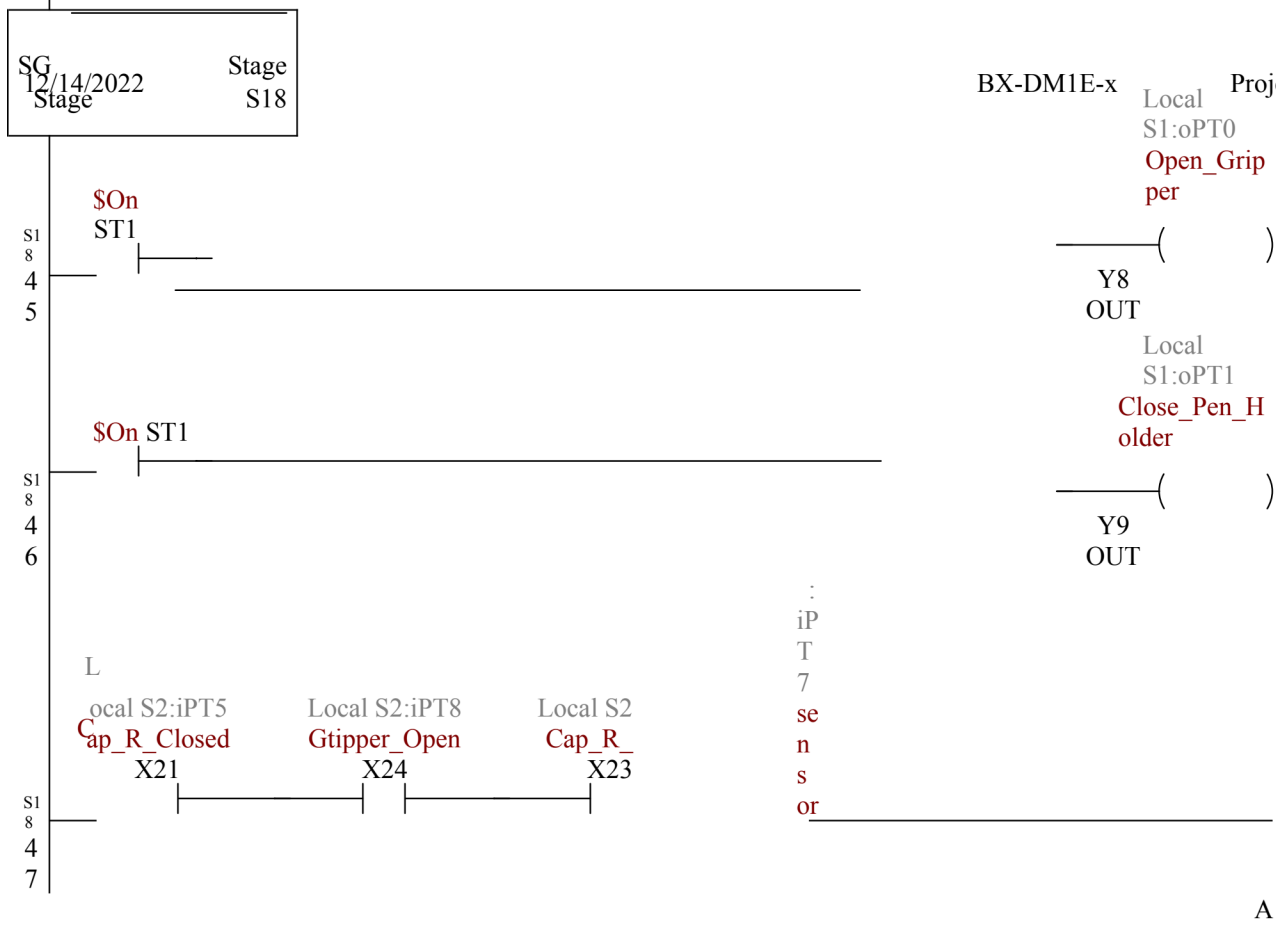

$On
STF S4Y20
16
OUT
A
Local S2:iPT10
Gripper_Closed
S4X26
Local S2:iPT9
Gripper_Pen
X25
Local S2:iPT12
Robot_Talks
X28
17
A
JMP Transition From This Stage
R_Pen_At_Remove
Transition To S5
SG Stage
R_Pen_At_Remove
Stage S5
A
Local S2:iPT12
Robot_Talks
X28
Local S2:iPT9
Gripper_Pen
X25
Local S2:iPT10
Gripper_Closed
X26
S5
19
A
JMP Transition From This Stage
R_Drop_Pen_1
Transition To S6


SG
Stage
R_Drop_Pen_1
Stage
S6
S6
21
$On
ST1
Local S1:oPT0
Open_Gripper
Y8
OUT
S6
22
$On
ST1
E/R
TMR
Timer
Timer Struct
T4
Preset
1.500s
A
S6
23
Local S2:iPT8
Gtipper_Open
X24
Local S2:iPT7
Cap_R_sensor
X23
R_Pen_Drop
T4.Done
A
JMP
Transition From This Stage
R_Grab_Pen_2
Transition To
S7
JMP
Transition From This Stage
R_To_Cap
Transition To
S8


SG
Stage
Stage R_To_Cap
R_Grab_Pen_2
Stage
S8
Local S1:oPT1
Close_Pen_H
older
Y9
OUT
$On
ST1
R_To_Cap
29
A
$On
ST1
Local S1:oPT0
Open_Grip
per
Y8
OUT
R_To_Cap
30
A
Local S2:iPT7
Cap_R_sensor
X23
Local S2:iPT5
Cap_R_Closed
X21
Local S2
Gtipper_
X24
:iPT8
JMP OpenTransition From This Stage
R_At_Cap
Transition To
S9
R_To_Cap
31
L
ocal S2:iPT12
Robot_Talks
X28
Local S2:iPT5
Cap_R_Closed
X21
Local S2
Cap_R_
X23
R_To_Cap
32
SG
Stage
R_At_Cap
Stage
S9
$On
ST1
R_At_Cap
34
Local S1:oPT1
Close_Pen_Holder
Y9
OUT

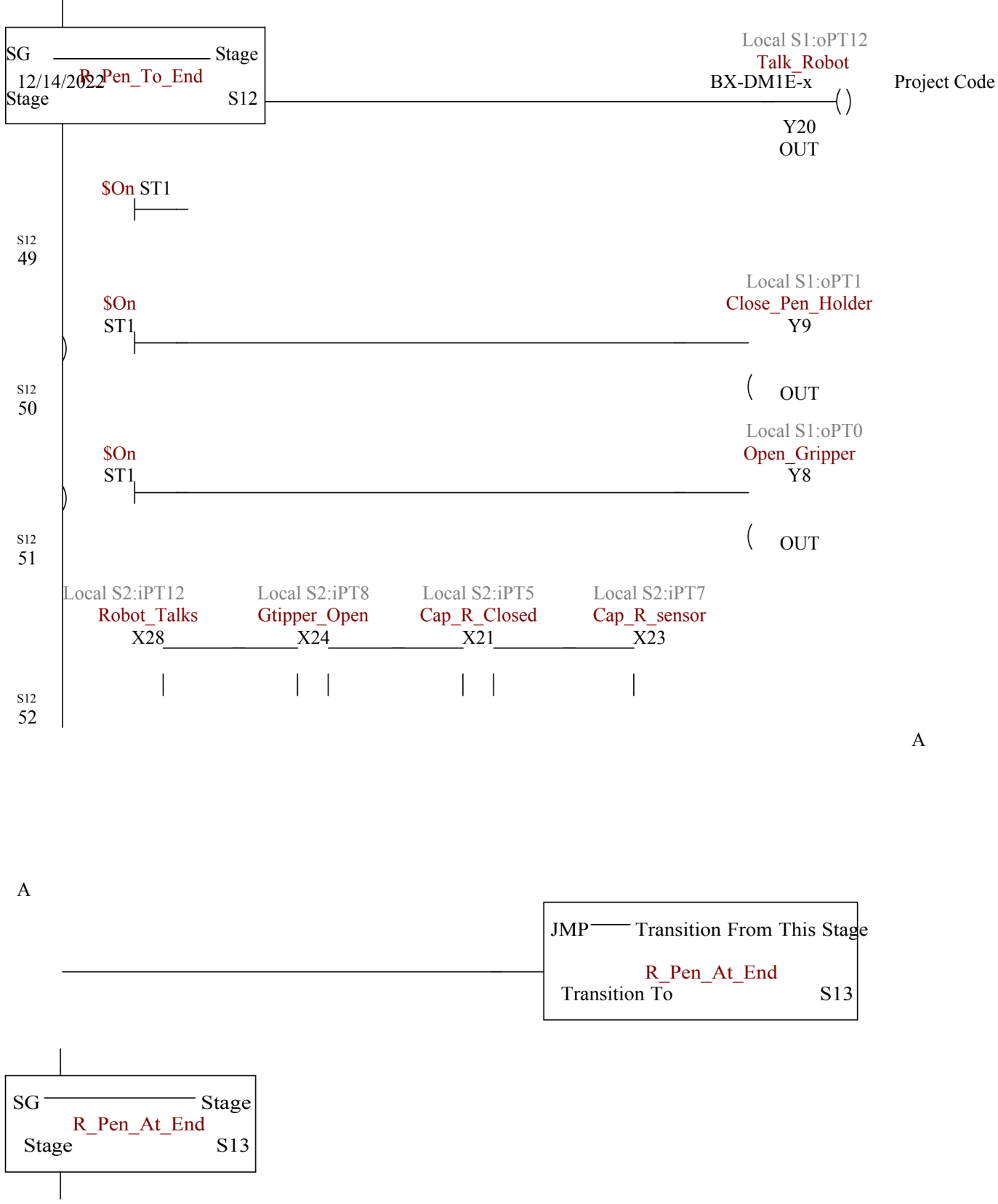

R_At_Cap
35
$On
ST1
Local S1:oPT0
Open_Gripper
Y8
OUT
A
Local S2:iPT12
Robot_Talks
X28
Local S2:iPT5
Cap_R_Closed
X21
Local S2:iPT7
Cap_R_sensor
X23
R_At_Cap
36
A
JMP
Transition From This Stage
R_Go_To_Pen
Transition To
S10
Stage
SG R_Go_To_Pen
Stage
S10
Local S1:oPT1
Close_Pen_Holder
Y9
OUT
$On ST1
S10 38
Local S1:oPT12
Talk_Robot
$On
ST1
Y20
OUT
S10 39
A
Local S2:iPT12
Robot_Talks
X28
Local S2:iPT5
Cap_R_Closed
X21
Local S2:iPT9
Gripper_Pen
X25
Local S2:iPT7
Cap_R_sensor
X23
S10 40
A
JMP
Transition From This Stage
R_At_Pen
Transition To
S11

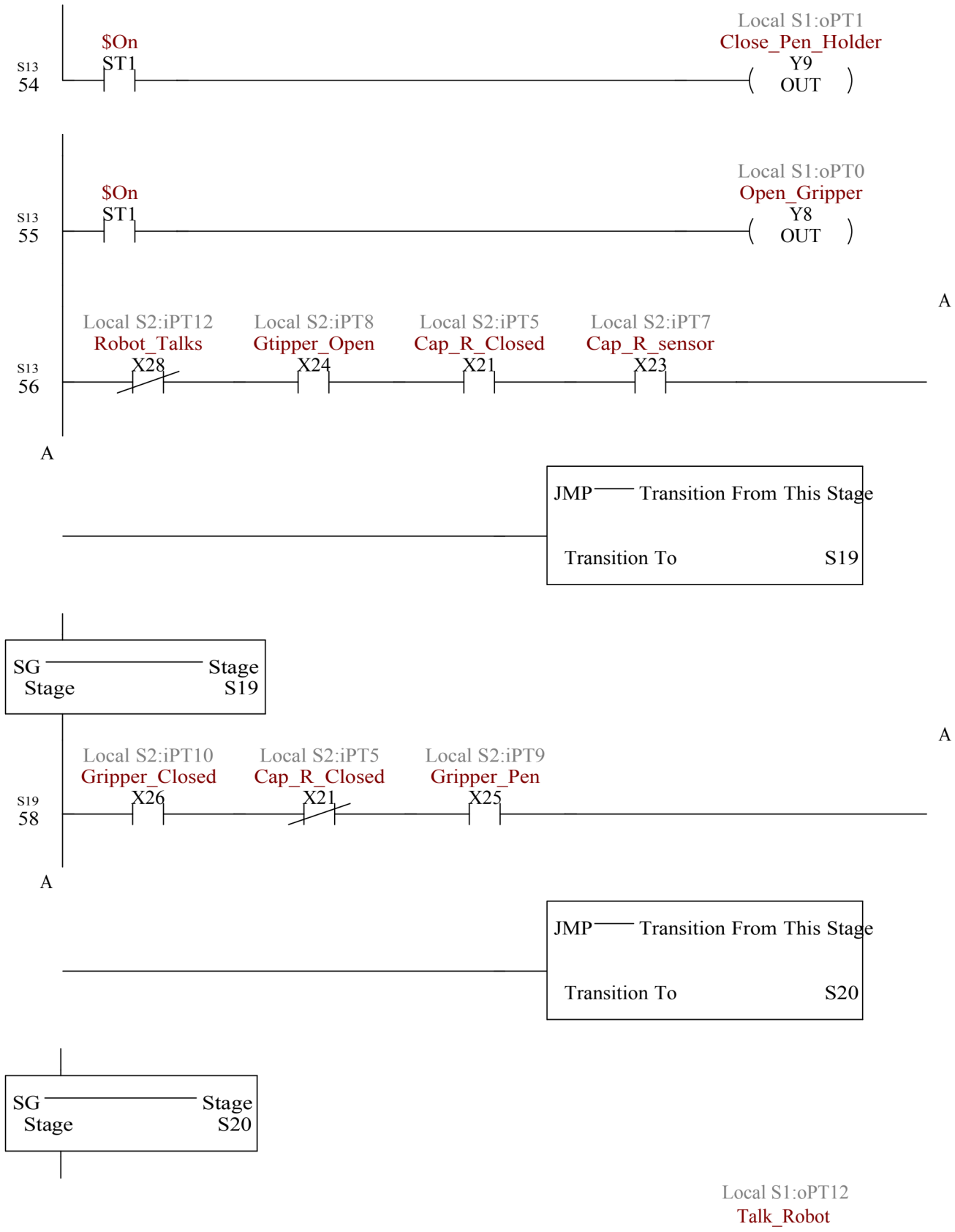

SG
Stage
R_At_Pen
Stage
S11
R_At_Pen
42
$On
ST1
Local S1:oPT1
Close_Pen_Holder
Y9
OUT
A
R_At_Pen
43
Local S2:iPT12
Robot_Talks
X28
Local S2:iPT5
Cap_R_Closed
X21
Local S2:iPT7
Cap_R_sensor
X23
A
JMP
Transition From This Stage
Transition To
S18

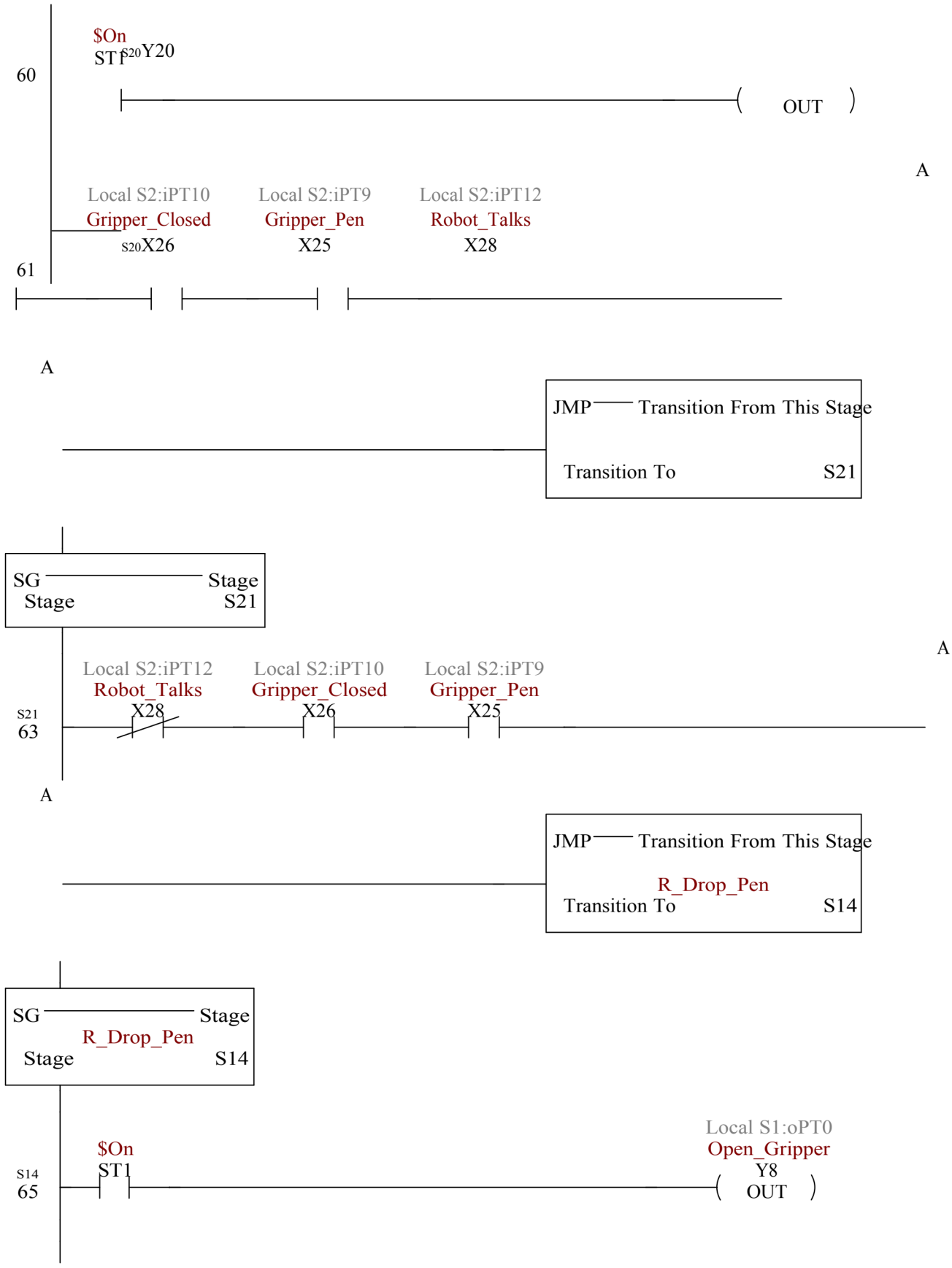

$On
ST1
S18 45
Local S1:oPT0
Open_Gripper
Y8
OUT
$On ST1
S18 46
Local S1:oPT1
Close_Pen_Holder
Y9
OUT
Local S2:iPT5
Cap_R_Closed
X21
Local S2:iPT8
Gtipper_Open
X24
Local S2
Cap_R_
X23
S18 47
A

A


JMP
Transition From This Stage
R_Pen_To_End
Transition To
S12


SG
Stage
R_Pen_To_End
12/14/2022
Stage
S12
Local S1:oPT12
Talk_Robot
BX-DM1E-x
Project Code
Y20
OUT
$On ST1
S12
49
Local S1:oPT1
$On
Close_Pen_Holder
ST1
Y9
S12
50
OUT
Local S1:oPT0
$On
Open_Gripper
ST1
Y8
S12
51
OUT
Local S2:iPT12
Robot_Talks
X28
Local S2:iPT8
Gtipper_Open
X24
Local S2:iPT5
Cap_R_Closed
X21
Local S2:iPT7
Cap_R_sensor
X23
S12
52
A
A
JMP
Transition From This Stage
R_Pen_At_End
Transition To
S13
SG
Stage
R_Pen_At_End
Stage
S13


S13
54
$On
ST1
Local S1:oPT1
Close_Pen_Holder
Y9
OUT
S13
55
$On
ST1
Local S1:oPT0
Open_Gripper
Y8
OUT
A
S13
56
Local S2:iPT12
Robot_Talks
X28
Local S2:iPT8
Gtipper_Open
X24
Local S2:iPT5
Cap_R_Closed
X21
Local S2:iPT7
Cap_R_sensor
X23
A
JMP
Transition From This Stage
Transition To
S19
SG
Stage
Stage
S19
A
S19
58
Local S2:iPT10
Gripper_Closed
X26
Local S2:iPT5
Cap_R_Closed
X21
Local S2:iPT9
Gripper_Pen
X25
A
JMP
Transition From This Stage
Transition To
S20
SG
Stage
Stage
S20
Local S1:oPT12
Talk_Robot


$On
STS20Y20
60
OUT
A
Local S2:iPT10
Gripper_Closed
S20X26
Local S2:iPT9
Gripper_Pen
X25
Local S2:iPT12
Robot_Talks
X28
61
A
JMP Transition From This Stage
Transition To S21
SG Stage
Stage S21
A
Local S2:iPT12
Robot_Talks
X28
Local S2:iPT10
Gripper_Closed
X26
Local S2:iPT9
Gripper_Pen
X25
S21
63
A
JMP Transition From This Stage
R_Drop_Pen
Transition To S14
SG Stage
R_Drop_Pen
Stage S14
$On
ST1
Local S1:oPT0
Open_Gripper
Y8
OUT
S14
65

Robot Code

```
/JOB
//NAME MASTER1
//POS
///NPOS 0,0,0,0,0,0
//INST
///DATE 2022/12/11 22:20
///ATTR SC,RW
///GROUP1 RB1
NOP
*REPEAT
CALL JOB:PROGRAM1
CALL JOB:PROGRAM12
CALL JOB:PROGRAM13
CALL JOB:PROGRAM14
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
CALL JOB:2NDSTAGE
CALL JOB:2NDSTAGE12
CALL JOB:2NDSTAGE13
CALL JOB:2NDSTAGE14
JUMP *REPEAT
END


/JOB
//NAME PROGRAM1
//POS
///NPOS 26,0,0,0,0,0
///TOOL 0
///POSTYPE PULSE
///PULSE
C00000=-7599,36438,-74957,-128688,-37954,-21812
C00001=-62369,45159,-67132,39493,-47787,-65885
C00002=-72748,60949,-70934,54555,-40065,-74001
C00003=-77881,48924,-75913,55861,-30924,-72618
C00004=-76416,49032,-75063,54238,-31167,-72065
C00005=-74499,51228,-73654,53428,-30977,-72338
```

```
C00006=-62368,45159,-67135,39492,-47786,-65886
C00007=-46022,58130,-54193,141259,-79266,-66550
C00008=-46196,80563,-48866,141503,-85536,-66785
C00009=-46196,63966,-53441,141503,-79429,-65042
C00010=-47421,64541,-62701,125627,-88282,-67573
C00011=-42042,89622,-50398,110498,-70059,-72104
C00012=-39914,105804,-43732,107615,-83535,-74639
C00013=-39914,92229,-50350,107629,-81924,-72764
C00014=-60187,74732,-68328,147522,-98239,-71008
C00015=-27359,85267,-46193,114035,-87427,-69045
C00016=-32114,85248,-46490,117473,-87688,-69084
C00017=-37268,85806,-41219,120277,-85458,-67405
C00018=-37268,89770,-39657,120216,-86304,-67992
C00019=-37419,72905,-45572,120835,-82452,-63660
C00020=21346,54141,-82170,-170381,-71751,-66500
C00021=-5378,53422,-77445,-139033,-69269,-64960
C00022=591,60453,-67674,-142239,-66845,-65943
C00023=1193,44898,-81289,-147901,-65056,-64552
C00024=-7329,41667,-76736,-135401,-81598,-63721
C00025=-24323,41313,-78125,-125044,-82382,-63552
//INST
///DATE 2022/12/11 17:20
///ATTR SC,RW
///GROUP1 RB1
NOP
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00000 VJ=2.00
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00001 VJ=5.00
MOVJ C00002 VJ=0.78
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00003 VJ=1.00
MOVJ C00004 VJ=1.00
MOVJ C00005 VJ=1.00
MOVJ C00006 VJ=4.00
MOVJ C00007 VJ=4.00
MOVJ C00008 VJ=0.78
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00009 VJ=0.78
MOVJ C00010 VJ=4.00
MOVJ C00011 VJ=4.00
MOVJ C00012 VJ=2.00
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
```

```
MOVJ C00013 VJ=0.78
MOVJ C00014 VJ=4.00
MOVJ C00015 VJ=4.00
MOVJ C00016 VJ=4.00
MOVJ C00017 VJ=2.00
MOVJ C00018 VJ=0.78
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00019 VJ=0.78
MOVJ C00020 VJ=10.00
MOVJ C00021 VJ=4.00
MOVJ C00022 VJ=0.78
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00023 VJ=0.78
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00024 VJ=3.00
MOVJ C00025 VJ=3.00
'GO BACK TO GRAB NEXT MARKER
END


/JOB
//NAME PROGRAM12
//POS
///NPOS 26,0,0,0,0,0
///TOOL 0
///POSTYPE PULSE
///PULSE
C00000=-7599,36438,-74957,-128688,-37954,-21812
C00001=-62369,45159,-67132,39493,-47787,-65885
C00002=-72748,60949,-70934,54555,-40065,-74001
C00003=-77881,48924,-75913,55861,-30924,-72618
C00004=-76416,49032,-75063,54238,-31167,-72065
C00005=-74499,51228,-73654,53428,-30977,-72338
C00006=-62368,45159,-67135,39492,-47786,-65886
C00007=-46022,58130,-54193,141259,-79266,-66550
C00008=-46196,80563,-48866,141503,-85536,-66785
C00009=-46196,63966,-53441,141503,-79429,-65042
C00010=-49437,62699,-72402,113330,-81790,-71456
C00011=-49169,108468,-54548,112380,-90010,-79108
C00012=-49169,101239,-58346,112561,-89117,-78259
C00013=-39914,92229,-50350,107629,-81924,-72764
C00014=-60187,74732,-68328,147522,-98239,-71008
C00015=-27359,85267,-46193,114035,-87427,-69045
C00016=-32114,85248,-46490,117473,-87688,-69084
C00017=-37268,85806,-41219,120277,-85458,-67405
C00018=-37268,89770,-39657,120216,-86304,-67992
C00019=-37419,72905,-45572,120835,-82452,-63660
```

```
C00020=21346,54141,-82170,-170381,-71751,-66500
C00021=-5378,53422,-77445,-139033,-69269,-64960
C00022=-794,59928,-68402,-141436,-67010,-65850
C00023=1193,44898,-81289,-147901,-65056,-64552
C00024=-7329,41667,-76736,-135401,-81598,-63721
C00025=-24323,41313,-78125,-125044,-82382,-63552
//INST
///DATE 2022/12/11 17:51
///ATTR SC,RW
///GROUP1 RB1
NOP
MOVJ C00000 VJ=2.00
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00001 VJ=5.00
MOVJ C00002 VJ=0.78
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00003 VJ=1.00
MOVJ C00004 VJ=1.00
MOVJ C00005 VJ=1.00
MOVJ C00006 VJ=4.00
MOVJ C00007 VJ=4.00
MOVJ C00008 VJ=0.78
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00009 VJ=0.78
'CAP POSITION
MOVJ C00010 VJ=4.00
MOVJ C00011 VJ=1.00
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00012 VJ=1.00
MOVJ C00013 VJ=0.78
MOVJ C00014 VJ=4.00
MOVJ C00015 VJ=4.00
MOVJ C00016 VJ=4.00
MOVJ C00017 VJ=1.00
MOVJ C00018 VJ=0.78
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00019 VJ=0.78
MOVJ C00020 VJ=10.00
MOVJ C00021 VJ=4.00
MOVJ C00022 VJ=0.78
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
```

```
MOVJ C00023 VJ=0.78
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00024 VJ=3.00
MOVJ C00025 VJ=3.00
'GO BACK TO GRAB NEXT MARKER
END


/JOB
//NAME PROGRAM13
//POS
///NPOS 26,0,0,0,0,0
///TOOL 0
///POSTYPE PULSE
///PULSE
C00000=-7599,36438,-74957,-128688,-37954,-21812
C00001=-62369,45159,-67132,39493,-47787,-65885
C00002=-72748,60949,-70934,54555,-40065,-74001
C00003=-77881,48924,-75913,55861,-30924,-72618
C00004=-76416,49032,-75063,54238,-31167,-72065
C00005=-74499,51228,-73654,53428,-30977,-72338
C00006=-62368,45159,-67135,39492,-47786,-65886
C00007=-46022,58130,-54193,141259,-79266,-66550
C00008=-46196,80563,-48866,141503,-85536,-66785
C00009=-46196,63966,-53441,141503,-79429,-65042
C00010=-49437,62699,-72402,113330,-81790,-71456
C00011=-62990,115975,-62287,118564,-99620,-83038
C00012=-62990,94271,-73297,119732,-96259,-80504
C00013=-60187,74732,-68328,147522,-98239,-71008
C00014=-27359,85267,-46193,114035,-87427,-69045
C00015=-32114,85248,-46490,117473,-87688,-69084
C00016=-37268,85806,-41219,120277,-85458,-67405
C00017=-37268,89770,-39657,120216,-86304,-67992
C00018=-37419,72905,-45572,120835,-82452,-63660
C00019=21346,54141,-82170,-170381,-71751,-66500
C00020=-5378,53422,-77445,-139033,-69269,-64960
C00021=-16904,54624,-75054,-124983,-68836,-64636
C00022=-6805,62354,-64959,-130560,-67070,-65945
C00023=1193,44898,-81289,-147901,-65056,-64552
C00024=-7329,41667,-76736,-135401,-81598,-63721
C00025=-24323,41313,-78125,-125044,-82382,-63552
//INST
///DATE 2022/12/11 18:02
///ATTR SC,RW
///GROUP1 RB1
NOP
MOVJ C00000 VJ=2.00
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00001 VJ=5.00
```

```
MOVJ C00002 VJ=0.78
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00003 VJ=1.00
MOVJ C00004 VJ=1.00
MOVJ C00005 VJ=1.00
MOVJ C00006 VJ=4.00
MOVJ C00007 VJ=4.00
MOVJ C00008 VJ=0.78
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00009 VJ=0.78
'CAP POSITION
MOVJ C00010 VJ=4.00
MOVJ C00011 VJ=3.00
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00012 VJ=3.00
MOVJ C00013 VJ=4.00
MOVJ C00014 VJ=4.00
MOVJ C00015 VJ=4.00
MOVJ C00016 VJ=1.00
MOVJ C00017 VJ=0.78
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00018 VJ=0.78
MOVJ C00019 VJ=10.00
MOVJ C00020 VJ=4.00
MOVJ C00021 VJ=0.78
MOVJ C00022 VJ=0.78
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00023 VJ=0.78
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00024 VJ=3.00
MOVJ C00025 VJ=3.00
'GO BACK TO GRAB NEXT MARKER
END


/JOB
//NAME PROGRAM14
//POS
///NPOS 26,0,0,0,0,0
///TOOL 0
///POSTYPE PULSE
```

```
///PULSE
C00000=-7599,36438,-74957,-128688,-37954,-21812
C00001=-62369,45159,-67132,39493,-47787,-65885
C00002=-72748,60949,-70934,54555,-40065,-74001
C00003=-77881,48924,-75913,55861,-30924,-72618
C00004=-76416,49032,-75063,54238,-31167,-72065
C00005=-74499,51228,-73654,53428,-30977,-72338
C00006=-62368,45159,-67135,39492,-47786,-65886
C00007=-46022,58130,-54193,141259,-79266,-66550
C00008=-46196,80563,-48866,141503,-85536,-66785
C00009=-46196,63966,-53441,141503,-79429,-65042
C00010=-49437,62699,-72402,113330,-81790,-71456
C00011=-64065,91891,-62046,86145,-75949,-78728
C00012=-64065,106025,-55323,86588,-76261,-81029
C00013=-64065,85817,-64438,85902,-75797,-77511
C00014=-60187,74732,-68328,147522,-98239,-71008
C00015=-27359,85267,-46193,114035,-87427,-69045
C00016=-32114,85248,-46490,117473,-87688,-69084
C00017=-37268,85806,-41219,120277,-85458,-67405
C00018=-37268,89770,-39657,120216,-86304,-67992
C00019=-37419,72905,-45572,120835,-82452,-63660
C00020=21348,54141,-82170,-170380,-71748,-66499
C00021=-5380,53421,-77446,-139035,-69265,-64959
C00022=-18551,54044,-70730,-119934,-64968,-66051
C00023=-9835,61128,-62902,-124877,-64046,-66747
C00024=-7329,41667,-76736,-135401,-81598,-63721
C00025=-24323,41313,-78125,-125044,-82382,-63552
//INST
///DATE 2022/12/11 18:12
///ATTR SC,RW
///GROUP1 RB1
NOP
MOVJ C00000 VJ=2.00
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00001 VJ=5.00
MOVJ C00002 VJ=0.78
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00003 VJ=1.00
MOVJ C00004 VJ=1.00
MOVJ C00005 VJ=1.00
MOVJ C00006 VJ=4.00
MOVJ C00007 VJ=4.00
MOVJ C00008 VJ=0.78
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00009 VJ=0.78
'CAP POSITION
MOVJ C00010 VJ=4.00
```

```
MOVJ C00011 VJ=3.00
MOVJ C00012 VJ=3.00
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00013 VJ=3.00
MOVJ C00014 VJ=4.00
MOVJ C00015 VJ=4.00
MOVJ C00016 VJ=4.00
MOVJ C00017 VJ=1.00
MOVJ C00018 VJ=0.78
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00019 VJ=0.78
MOVJ C00020 VJ=10.00
MOVJ C00021 VJ=4.00
MOVJ C00022 VJ=0.78
MOVJ C00023 VJ=0.78
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00024 VJ=3.00
MOVJ C00025 VJ=3.00
'GO BACK TO GRAB NEXT MARKER
END


/JOB
//NAME 2NDSTAGE
//POS
///NPOS 31,0,0,0,0,0
///TOOL 0
///POSTYPE PULSE
///PULSE
C00000=-12257,23766,-81475,-123490,-35885,-23803
C00001=-2984,49632,-70061,-134632,-41306,-19138
C00002=-3319,48086,-68964,-133466,-39856,-19984
C00003=-31041,29023,-77866,-111053,-37880,-24728
C00004=-1221,44004,-63025,-125875,-35223,30862
C00005=2102,55440,-60845,-136050,-46220,33934
C00006=-4060,40870,-71025,-131383,-45249,33024
C00007=-34816,70067,-43144,112781,-77389,-61844
C00008=-34816,70067,-43144,112781,-77389,41384
C00009=-34816,78566,-40770,113003,-79299,39609
C00010=-34816,64242,-44422,112542,-75947,42740
C00011=-34816,53283,-46031,111843,-72954,45626
C00012=-43599,58074,-62293,118473,-80931,-65375
C00013=-28339,57063,-67885,109192,-82977,-67098
C00014=-33216,103355,-48294,105959,-76555,-76076
```

```
C00015=-40731,101055,-46258,110033,-76214,-74137
C00016=-40731,81390,-54592,109289,-73250,-70955
C00017=-32023,48682,-42470,96149,-62682,-53677
C00018=-32693,72152,-38123,102887,-78557,-60782
C00019=-32504,79580,-35814,102938,-79684,-62399
C00020=-26992,82771,-37057,99703,-81126,-63944
C00021=-19542,58281,-46654,93692,-79745,-59118
C00022=-44418,59765,-33612,107286,-72050,-55226
C00023=-44418,71230,-31736,108140,-74694,-58336
C00024=-44418,71642,-31644,108163,-74782,-58437
C00025=-44418,61141,-33461,107411,-72388,-55632
C00026=-27648,56278,-43090,98180,-77343,-57073
C00027=-24153,87150,-34921,96782,-81536,-64604
C00028=-31764,87736,-32367,101367,-80610,-63812
C00029=-31764,72110,-37328,101064,-78494,-60399
C00030=74634,15103,-72978,-167970,-3914,-91145
//INST
///DATE 2022/12/11 18:17
///ATTR SC,RW
///GROUP1 RB1
NOP
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00000 VJ=5.00
MOVJ C00001 VJ=1.00
MOVJ C00002 VJ=1.00
MOVJ C00003 VJ=0.50
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00004 VJ=1.50
MOVJ C00005 VJ=0.50
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00006 VJ=0.50
MOVJ C00007 VJ=10.00
MOVJ C00008 VJ=5.00
MOVJ C00009 VJ=0.50
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00010 VJ=0.50
MOVJ C00011 VJ=5.00
MOVJ C00012 VJ=3.00
MOVJ C00013 VJ=3.00
MOVJ C00014 VJ=1.00
MOVJ C00015 VJ=1.00
'CAP POSITION
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
```

```
MOVJ C00016 VJ=1.00
MOVJ C00017 VJ=1.00
MOVJ C00018 VJ=1.00
MOVJ C00019 VJ=1.00
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00020 VJ=1.00
MOVJ C00021 VJ=1.00
MOVJ C00022 VJ=1.00
MOVJ C00023 VJ=1.00
MOVJ C00024 VJ=1.00
MOVJ C00025 VJ=1.00
MOVJ C00026 VJ=1.00
MOVJ C00027 VJ=1.00
MOVJ C00028 VJ=1.00
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00029 VJ=1.00
MOVJ C00030 VJ=10.00
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
END


/JOB
//NAME 2NDSTAGE12
//POS
///NPOS 31,0,0,0,0,0
///TOOL 0
///POSTYPE PULSE
///PULSE
C00000=-12257,23766,-81475,-123490,-35885,-23803
C00001=-2984,49632,-70061,-134632,-41306,-19138
C00002=-3319,48086,-68964,-133466,-39856,-19984
C00003=-31041,29023,-77866,-111053,-37880,-24728
C00004=-1221,44004,-63025,-125875,-35223,30862
C00005=5892,49488,-59680,-140686,-32227,36629
C00006=892,25938,-71156,-132140,-27468,32468
C00007=-34816,70067,-43144,112781,-77389,-61844
C00008=-34816,70067,-43144,112781,-77389,41384
C00009=-34816,78566,-40770,113003,-79299,39609
C00010=-34816,64242,-44422,112542,-75947,42740
C00011=-34816,53283,-46031,111843,-72954,45626
C00012=-43599,58074,-62293,118473,-80931,-65375
C00013=-28339,57063,-67885,109192,-82977,-67098
C00014=-42251,108036,-58338,111471,-83330,-80942
C00015=-50051,103793,-57016,115822,-83007,-78401
C00016=-50051,86486,-64694,115751,-80049,-75965
C00017=-32023,48682,-42470,96149,-62682,-53677
C00018=-32693,72152,-38123,102887,-78557,-60782
```

```
C00019=-32504,79580,-35814,102938,-79684,-62399
C00020=-26992,82771,-37057,99703,-81126,-63944
C00021=-19542,58281,-46654,93692,-79745,-59118
C00022=-44418,59765,-33612,107286,-72050,-55226
C00023=-44418,71230,-31736,108140,-74694,-58336
C00024=-44418,71642,-31644,108163,-74782,-58437
C00025=-44418,61141,-33461,107411,-72388,-55632
C00026=-27648,56278,-43090,98180,-77343,-57073
C00027=-24153,87150,-34921,96782,-81536,-64604
C00028=-31764,87736,-32367,101367,-80610,-63812
C00029=-31764,72110,-37328,101064,-78494,-60399
C00030=74634,15103,-72978,-167970,-3914,-91145
//INST
///DATE 2022/12/11 19:06
///ATTR SC,RW
///GROUP1 RB1
NOP
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00000 VJ=5.00
MOVJ C00001 VJ=1.00
MOVJ C00002 VJ=1.00
MOVJ C00003 VJ=0.50
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00004 VJ=1.50
MOVJ C00005 VJ=0.78
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00006 VJ=0.78
MOVJ C00007 VJ=10.00
MOVJ C00008 VJ=5.00
MOVJ C00009 VJ=0.50
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00010 VJ=0.50
MOVJ C00011 VJ=5.00
MOVJ C00012 VJ=3.00
MOVJ C00013 VJ=3.00
MOVJ C00014 VJ=0.78
MOVJ C00015 VJ=0.78
'CAP POSITION
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00016 VJ=0.78
MOVJ C00017 VJ=1.00
MOVJ C00018 VJ=1.00
MOVJ C00019 VJ=1.00
```

```
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00020 VJ=1.00
MOVJ C00021 VJ=1.00
MOVJ C00022 VJ=1.00
MOVJ C00023 VJ=1.00
MOVJ C00024 VJ=1.00
MOVJ C00025 VJ=1.00
MOVJ C00026 VJ=1.00
MOVJ C00027 VJ=1.00
MOVJ C00028 VJ=1.00
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00029 VJ=1.00
MOVJ C00030 VJ=10.00
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
END


/JOB
//NAME 2NDSTAGE13
//POS
///NPOS 31,0,0,0,0,0
///TOOL 0
///POSTYPE PULSE
///PULSE
C00000=-12257,23766,-81475,-123490,-35885,-23803
C00001=-2984,49632,-70061,-134632,-41306,-19138
C00002=-3319,48086,-68964,-133466,-39856,-19984
C00003=-31041,29023,-77866,-111053,-37880,-24728
C00004=-1221,44004,-63025,-125875,-35223,30862
C00005=1381,55594,-61080,-137276,-44158,35777
C00006=-6377,35145,-73996,-130643,-41947,33994
C00007=-34816,70067,-43144,112781,-77389,-61844
C00008=-34816,70067,-43144,112781,-77389,41384
C00009=-34816,78566,-40770,113003,-79299,39609
C00010=-34816,64242,-44422,112542,-75947,42740
C00011=-34816,53283,-46031,111843,-72954,45626
C00012=-43599,58074,-62293,118473,-80931,-65375
C00013=-28339,57063,-67885,109192,-82977,-67098
C00014=-51267,115838,-65428,111203,-92235,-84223
C00015=-60906,112471,-62590,116993,-92700,-80819
C00016=-60906,90780,-72998,117692,-89206,-78079
C00017=-32023,48682,-42470,96149,-62682,-53677
C00018=-32693,72152,-38123,102887,-78557,-60782
C00019=-32504,79580,-35814,102938,-79684,-62399
C00020=-26992,82771,-37057,99703,-81126,-63944
C00021=-19542,58281,-46654,93692,-79745,-59118
C00022=-44418,59765,-33612,107286,-72050,-55226
```

```
C00023=-44418,71230,-31736,108140,-74694,-58336
C00024=-44418,71642,-31644,108163,-74782,-58437
C00025=-44418,61141,-33461,107411,-72388,-55632
C00026=-27648,56278,-43090,98180,-77343,-57073
C00027=-24153,87150,-34921,96782,-81536,-64604
C00028=-31764,87736,-32367,101367,-80610,-63812
C00029=-31764,72110,-37328,101064,-78494,-60399
C00030=74634,15103,-72978,-167970,-3914,-91145
//INST
///DATE 2022/12/11 21:58
///ATTR SC,RW
///GROUP1 RB1
NOP
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00000 VJ=5.00
MOVJ C00001 VJ=1.00
MOVJ C00002 VJ=1.00
MOVJ C00003 VJ=0.50
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00004 VJ=1.50
MOVJ C00005 VJ=0.78
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00006 VJ=0.78
MOVJ C00007 VJ=10.00
MOVJ C00008 VJ=5.00
MOVJ C00009 VJ=0.50
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00010 VJ=0.50
MOVJ C00011 VJ=5.00
MOVJ C00012 VJ=3.00
MOVJ C00013 VJ=3.00
MOVJ C00014 VJ=0.78
MOVJ C00015 VJ=0.78
'CAP POSITION
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00016 VJ=0.78
MOVJ C00017 VJ=1.00
MOVJ C00018 VJ=1.00
MOVJ C00019 VJ=1.00
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00020 VJ=1.00
```

```
MOVJ C00021 VJ=1.00
MOVJ C00022 VJ=1.00
MOVJ C00023 VJ=1.00
MOVJ C00024 VJ=1.00
MOVJ C00025 VJ=1.00
MOVJ C00026 VJ=1.00
MOVJ C00027 VJ=1.00
MOVJ C00028 VJ=1.00
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00029 VJ=1.00
MOVJ C00030 VJ=10.00
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
END


/JOB
//NAME 2NDSTAGE14
//POS
///NPOS 32,0,0,0,0,0
///TOOL 0
///POSTYPE PULSE
///PULSE
C00000=-17607,29844,-74802,-115027,-38095,-24866
C00001=-9289,48363,-65892,-124437,-37750,-16922
C00002=-9285,48332,-65869,-124365,-40773,-16968
C00003=-17607,29844,-74802,-115027,-38095,-24866
C00004=-31041,29023,-77866,-111053,-37880,-24728
C00005=-14414,32685,-71703,-116368,-40843,28431
C00006=-2931,56060,-58321,-127129,-43072,31901
C00007=-14414,32685,-71703,-116368,-40843,28431
C00008=-34816,70067,-43144,112781,-77389,-61844
C00009=-34816,70067,-43144,112781,-77389,41384
C00010=-34816,78566,-40770,113003,-79299,39609
C00011=-34816,64242,-44422,112542,-75947,42740
C00012=-34816,53283,-46031,111843,-72954,45626
C00013=-43599,58074,-62293,118473,-80931,-65375
C00014=-28339,57063,-67885,109192,-82977,-67098
C00015=-56375,107880,-53310,82182,-71856,-78358
C00016=-63590,106779,-54085,86193,-73599,-78246
C00017=-63590,84319,-64180,85106,-73152,-74287
C00018=-32023,48682,-42470,96149,-62682,-53677
C00019=-32693,72152,-38123,102887,-78557,-60782
C00020=-32504,79580,-35814,102938,-79684,-62399
C00021=-26992,82771,-37057,99703,-81126,-63944
C00022=-19542,58281,-46654,93692,-79745,-59118
C00023=-44418,59765,-33612,107286,-72050,-55226
C00024=-44418,71230,-31736,108140,-74694,-58336
C00025=-44418,71642,-31644,108163,-74782,-58437
C00026=-44418,61141,-33461,107411,-72388,-55632
```

```
C00027=-27648,56278,-43090,98180,-77343,-57073
C00028=-24153,87150,-34921,96782,-81536,-64604
C00029=-31764,87736,-32367,101367,-80610,-63812
C00030=-31764,72110,-37328,101064,-78494,-60399
C00031=74634,15103,-72978,-167970,-3914,-91145
//INST
///DATE 2022/12/12 14:28
///ATTR SC,RW
///GROUP1 RB1
NOP
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00000 VJ=0.78
MOVJ C00001 VJ=0.78
MOVJ C00002 VJ=0.78
MOVJ C00003 VJ=0.78
MOVJ C00004 VJ=0.50
MOVJ C00005 VJ=0.78
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00006 VJ=0.78
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00007 VJ=0.78
MOVJ C00008 VJ=10.00
MOVJ C00009 VJ=5.00
MOVJ C00010 VJ=0.50
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00011 VJ=0.50
MOVJ C00012 VJ=5.00
MOVJ C00013 VJ=3.00
MOVJ C00014 VJ=3.00
MOVJ C00015 VJ=0.78
MOVJ C00016 VJ=0.78
'CAP POSITION
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00017 VJ=0.78
MOVJ C00018 VJ=1.00
MOVJ C00019 VJ=1.00
MOVJ C00020 VJ=1.00
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00021 VJ=1.00
MOVJ C00022 VJ=1.00
MOVJ C00023 VJ=1.00
```

```
MOVJ C00024 VJ=1.00
MOVJ C00025 VJ=1.00
MOVJ C00026 VJ=1.00
MOVJ C00027 VJ=1.00
MOVJ C00028 VJ=1.00
MOVJ C00029 VJ=1.00
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
MOVJ C00030 VJ=1.00
MOVJ C00031 VJ=10.00
DOUT OT#(1) OFF
WAIT IN#(1)=ON
DOUT OT#(1) ON
END
```