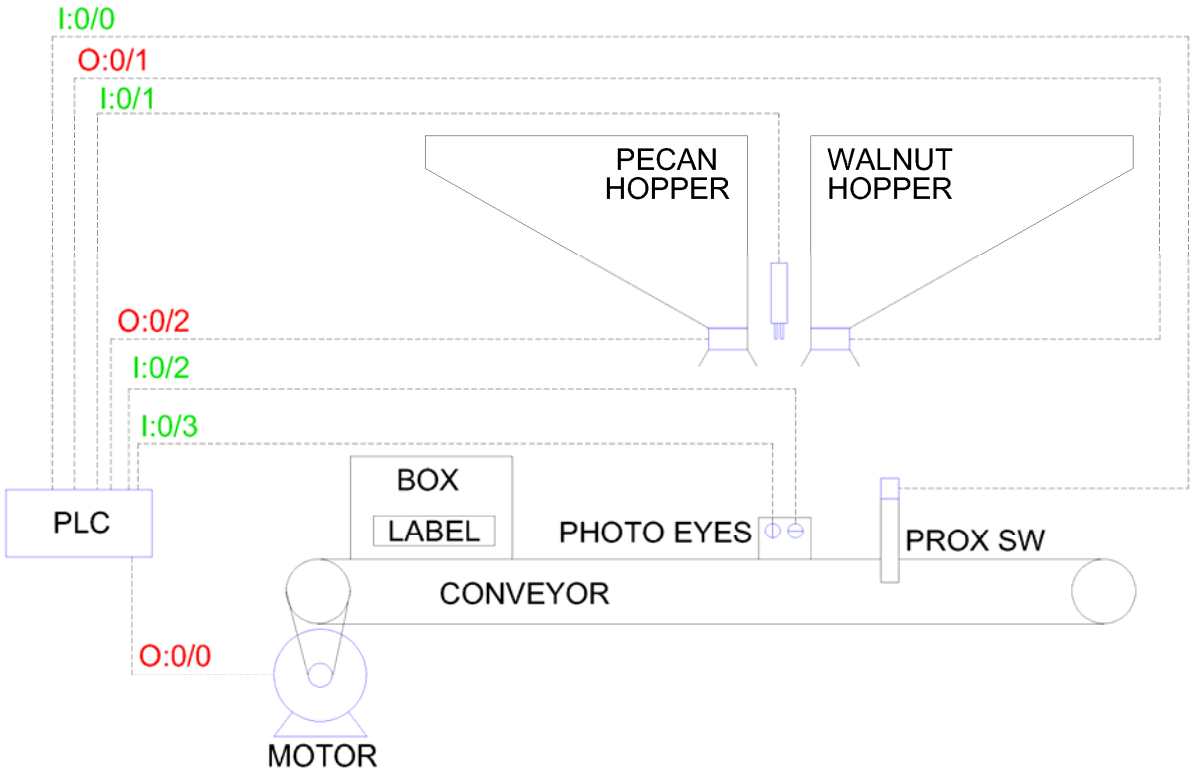
Project 2

PROCESS:



SUMMARY:

A conveyor belt carries boxes with colored labels to our filling station and beyond. The proximity switch closes when a box arrives, and either a red or blue photo eye tells us which label is on the box. Red labeled boxes get filled with pecans and blue labels are for walnuts. A level sensor tells us when the box is full and ready to send along.

IO / ASSIGNED MEMORY:

I:0/0 - Proximity switch (closes when a box is near)
I:0/1 - Level sensor (closes when the box is full)
I:0/2 - Red photo eye (closes when a red label is in front of it)
I:0/3 - Blue photo eye (closes when a blue label is in front of it)
O:0/0 - Conveyor motor (makes the conveyor move forward when closed)
O:0/1 - Walnut hopper (when closed, solenoid opens allowing contents to fall from the hopper)
O:0/2 - Pecan hopper (when closed, solenoid opens allowing contents to fall from the hopper)

TEST CRITERIA:

To start, run your program on Emulate. The conveyor motor should start immediately but both hoppers should be off.

Next, force only the proximity switch on (closed). The conveyor motor should shut off, and both hoppers should remain deenergized.

Third, leave the proximity switch switch closed and force the red photo eye on as well. The conveyor motor and the walnut hopper should remain off, but the pecan hopper should energize.

Fourth, leave the proximity switch closed and force the red photo eye off and the blue photo eye on. The conveyor motor should remain off, but the pecan hopper should deenergize and the walnut hopper should energize.

Next step, force the level sensor on. The hoppers should both deenergize and the conveyor should start back up to move the box forward.

Finally, force the proximity switch, the level sensor and both photo eyes off. Both hoppers should remain deenergized and the conveyor should keep running.

Bonus test: with the proximity switch and level sensor deenergized, force both photo eyes on. Neither hopper should energize. (We don't want to release product when there isn't a box to catch it in.)

NOTES:

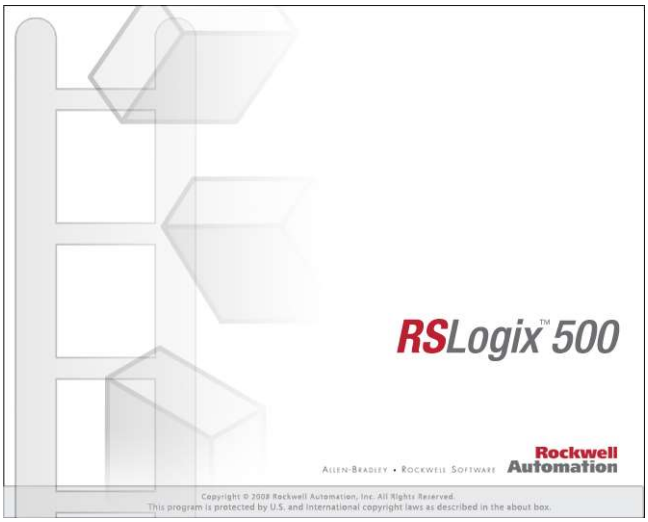
There is a lot of IO in this scenario, bit it's all digital, so this isn't QUITE as hard as it looks, but it's still a solid challenge. The trick is to envision this process as a cycle and manage it accordingly in your logic.

Ask yourself "When does the pecan hopper open?" "When does it need to close?" "When can I start the conveyor?" "What makes it stop?" What you don't want to happen is for the box to run away and you pour a bunch of pecans all over the floor. You also don't want to overfill the box or fill it and make it just sit there forever. Your program needs to keep everything working continuously – nothing wasted, and no delays.

There's one place where I expect everybody to get stuck on this. You'll fill your box and ask, "Now how do I start the conveyor again?" When you get into the testing, you'll see what I mean. ☺

Okay, make it work. The people want their NUTS!

RSLogix Micro Project Report



Processor Information

Processor Type: Bul.1763 MicroLogix 1100 Series B

Processor Name: SOL2

Total Memory Used: 195 Instruction Words Used - 43 Data Table Words Used

Total Memory Left: 6461 Instruction Words Left

Program Files: 6

Data Files: 9

Program ID: ba5f

I/O Configuration

0	Bul.1763	MicroLogix 1100 Series B
1		
2		
3		
4		

Channel Configuration

CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex
   CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex Edit Resource/Owner Timeout: 60
   CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex Passthru Link ID: 1
   CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex Write Protected: No
   CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex Comms Servicing Selection: Yes
   CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex Message Servicing Selection: Yes
   CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex 1st AWA Append Character: \d
   CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex 2nd AWA Append Character: \a

   Source ID: 1 (decimal)
   Baud: 19200
   Parity: NONE
   Control Line : No Handshaking
   Error Detection: CRC
   Embedded Responses: Auto Detect
   Duplicate Packet Detect: Yes
   ACK Timeout(x20 ms): 50
   NAK Retries: 3
   ENQ Retries: 3

CHANNEL 1 (SYSTEM) - Driver: Ethernet
   CHANNEL 1 (SYSTEM) - Driver: Ethernet Edit Resource/Owner Timeout: 60
   CHANNEL 1 (SYSTEM) - Driver: Ethernet Passthru Link ID: 1
   CHANNEL 1 (SYSTEM) - Driver: Ethernet Write Protected: No
   CHANNEL 1 (SYSTEM) - Driver: Ethernet Comms Servicing Selection: Yes
   CHANNEL 1 (SYSTEM) - Driver: Ethernet Message Servicing Selection: Yes

   Hardware Address: 00:00:00:00:00:00
   IP Address: 0.0.0.0
   Subnet Mask: 0.0.0.0
   Gateway Address: 0.0.0.0
   Msg Connection Timeout (x 1mS): 15000
   Msg Reply Timeout (x mS): 3000
   Inactivity Timeout (x Min): 30
   Bootp Enable: Yes
   Dhcp Enable No
   SNMP Enable: No
   HTTP Enable: Yes
   Auto Negotiate Enable: Yes
   Port Speed Enable: 10/100 Mbps Full Duplex/Half Duplex
   Contact:
   Location:

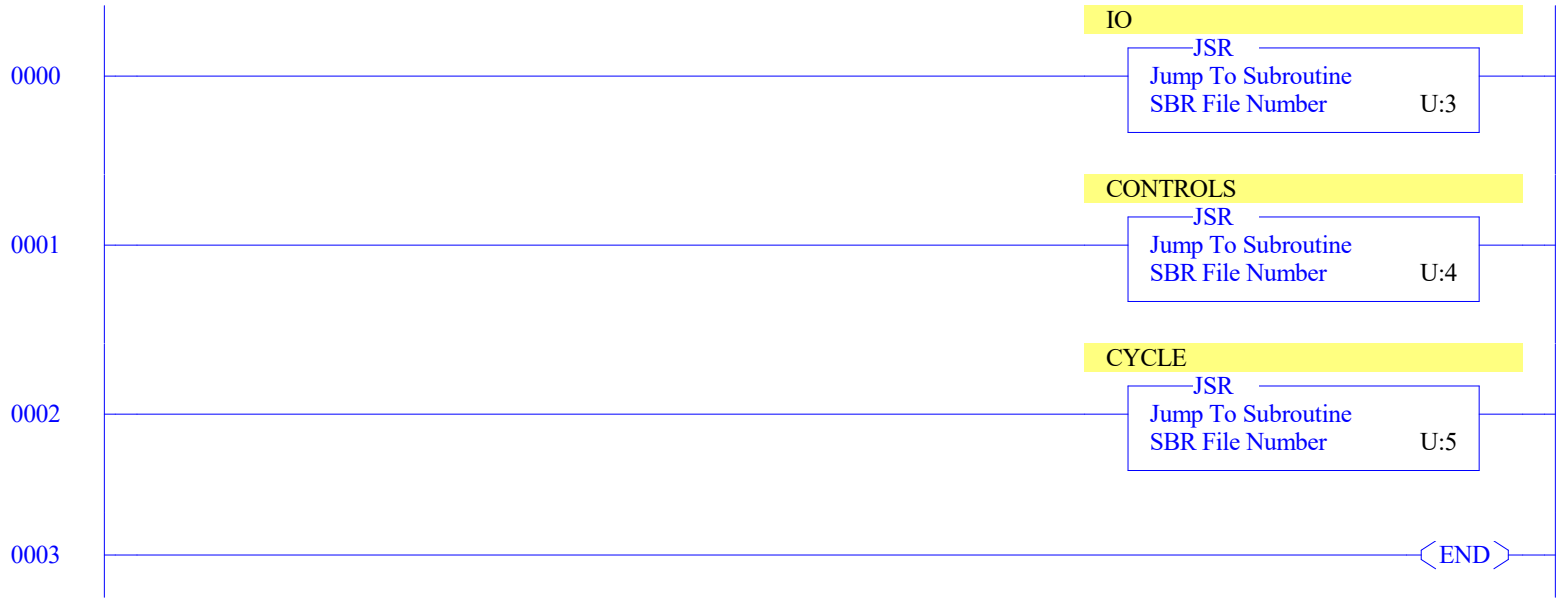
Program File List

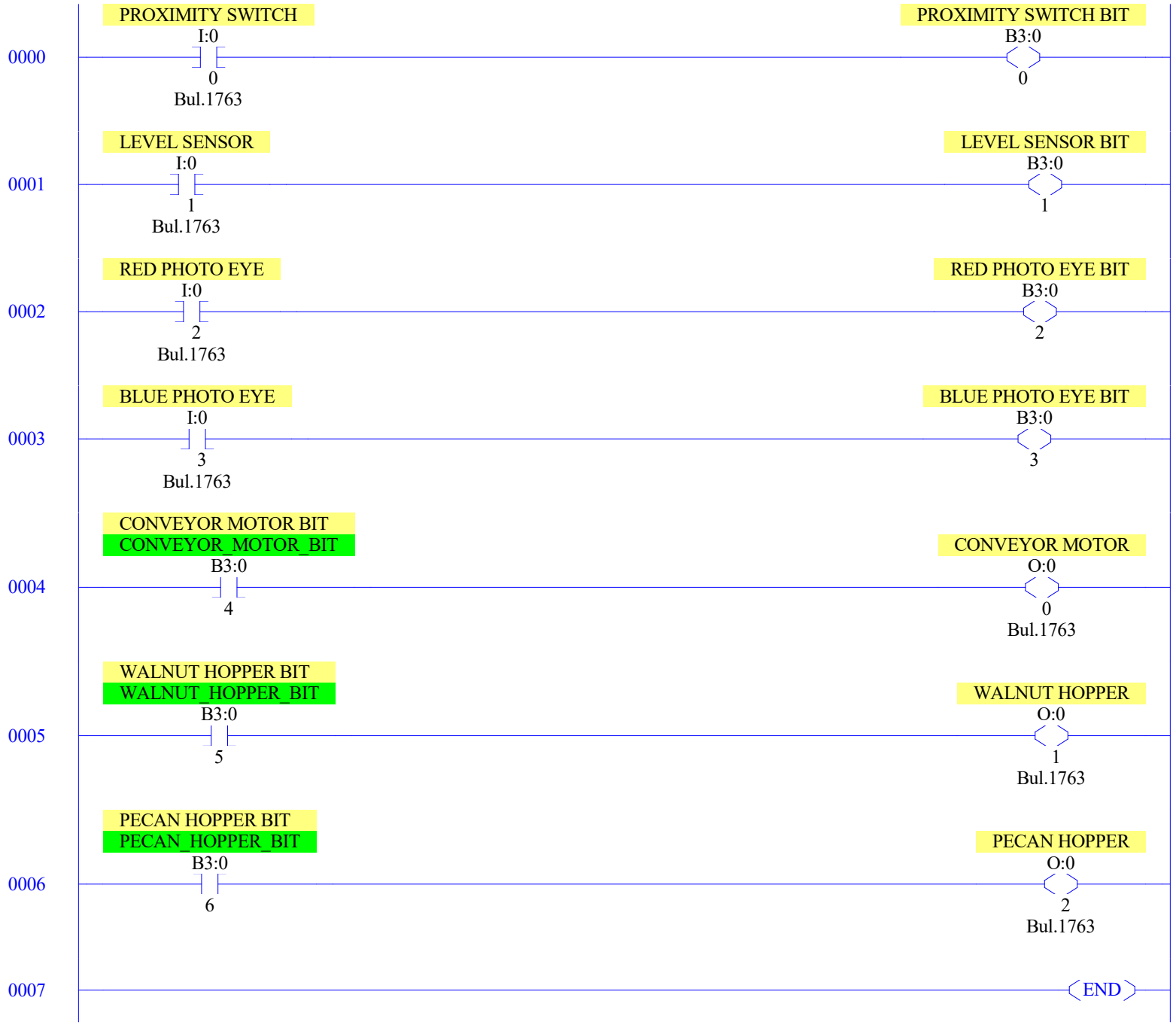
Name	Number	Type	Rungs	Debug	Bytes
[SYSTEM]	0	SYS	0	No	0
	1	SYS	0	No	0
MAIN	2	LADDER	4	No	30
IO	3	LADDER	8	No	115
CONTROLS	4	LADDER	6	No	214
CYCLE	5	LADDER	5	No	235

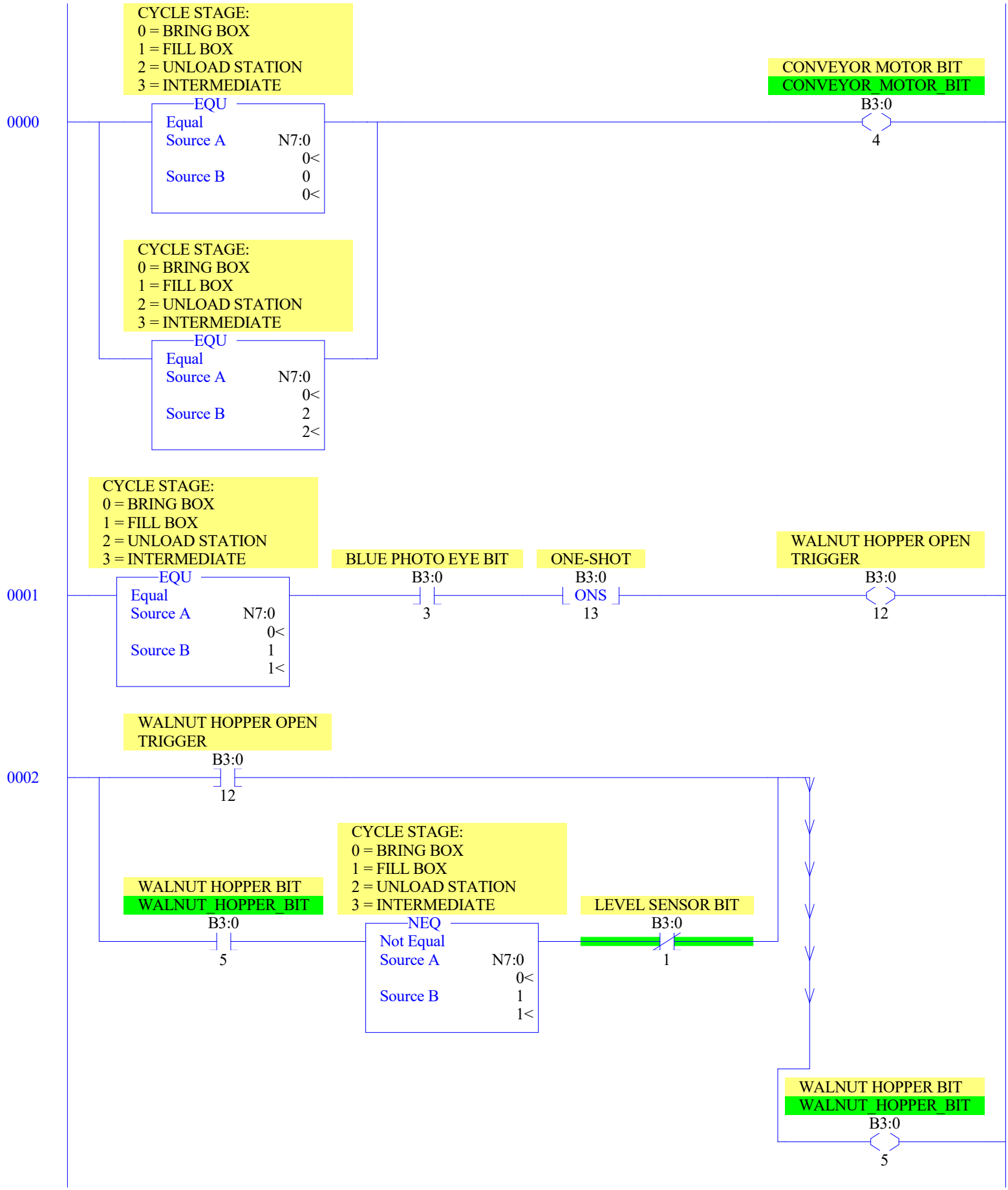
Data File List

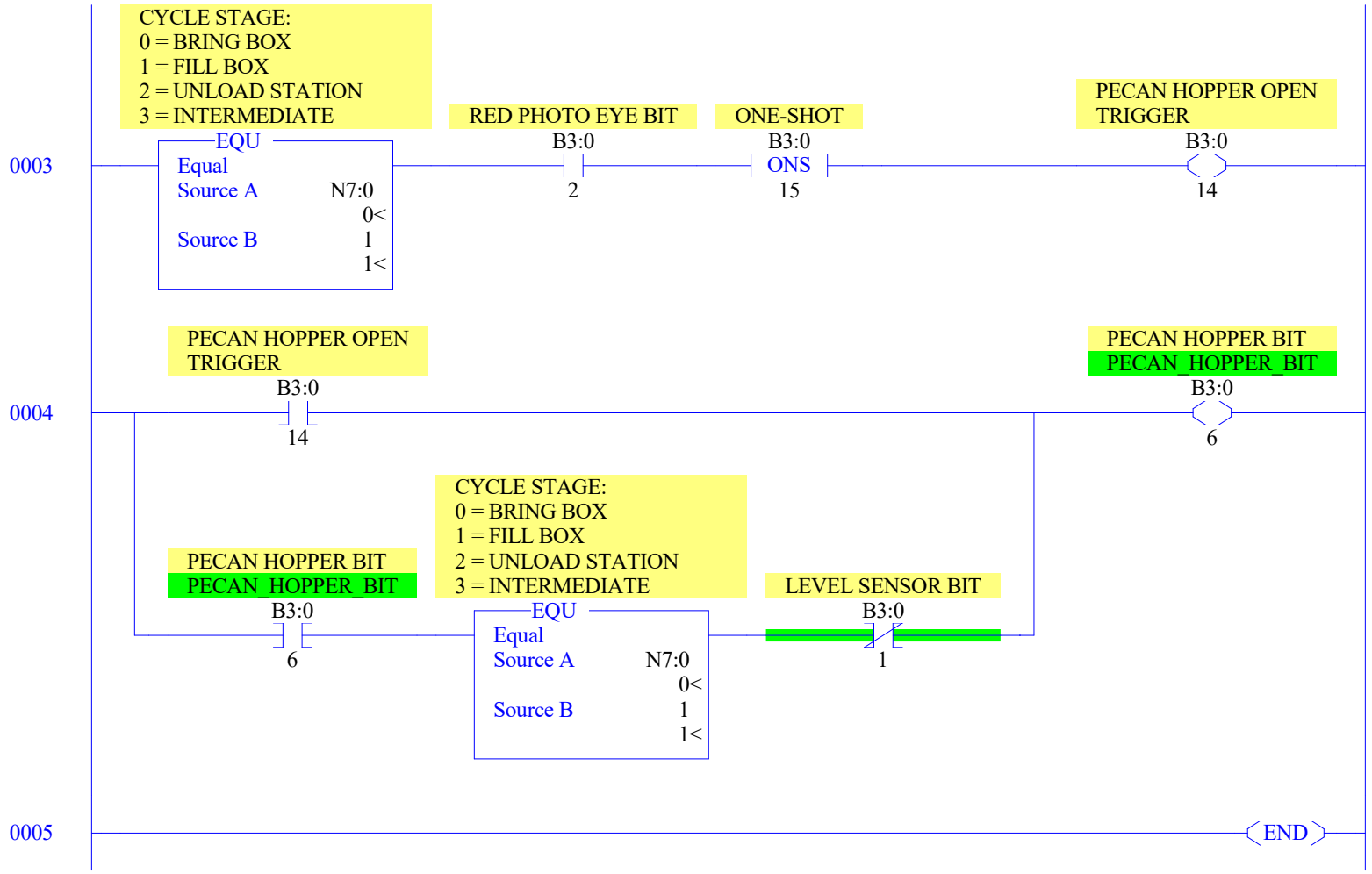
Name	Number	Type	Scope	Debug	Words	Elements	Last
OUTPUT	0	O	Global	No	12	4	O:3
INPUT	1	I	Global	No	18	6	I:5
STATUS	2	S	Global	No	0	66	S:65
BINARY	3	B	Global	No	1	1	B3:0
TIMER	4	T	Global	No	3	1	T4:0
COUNTER	5	C	Global	No	3	1	C5:0
CONTROL	6	R	Global	No	3	1	R6:0
INTEGER	7	N	Global	No	1	1	N7:0
FLOAT	8	F	Global	No	2	1	F8:0

LAD 2 - MAIN --- Total Rungs in File = 4

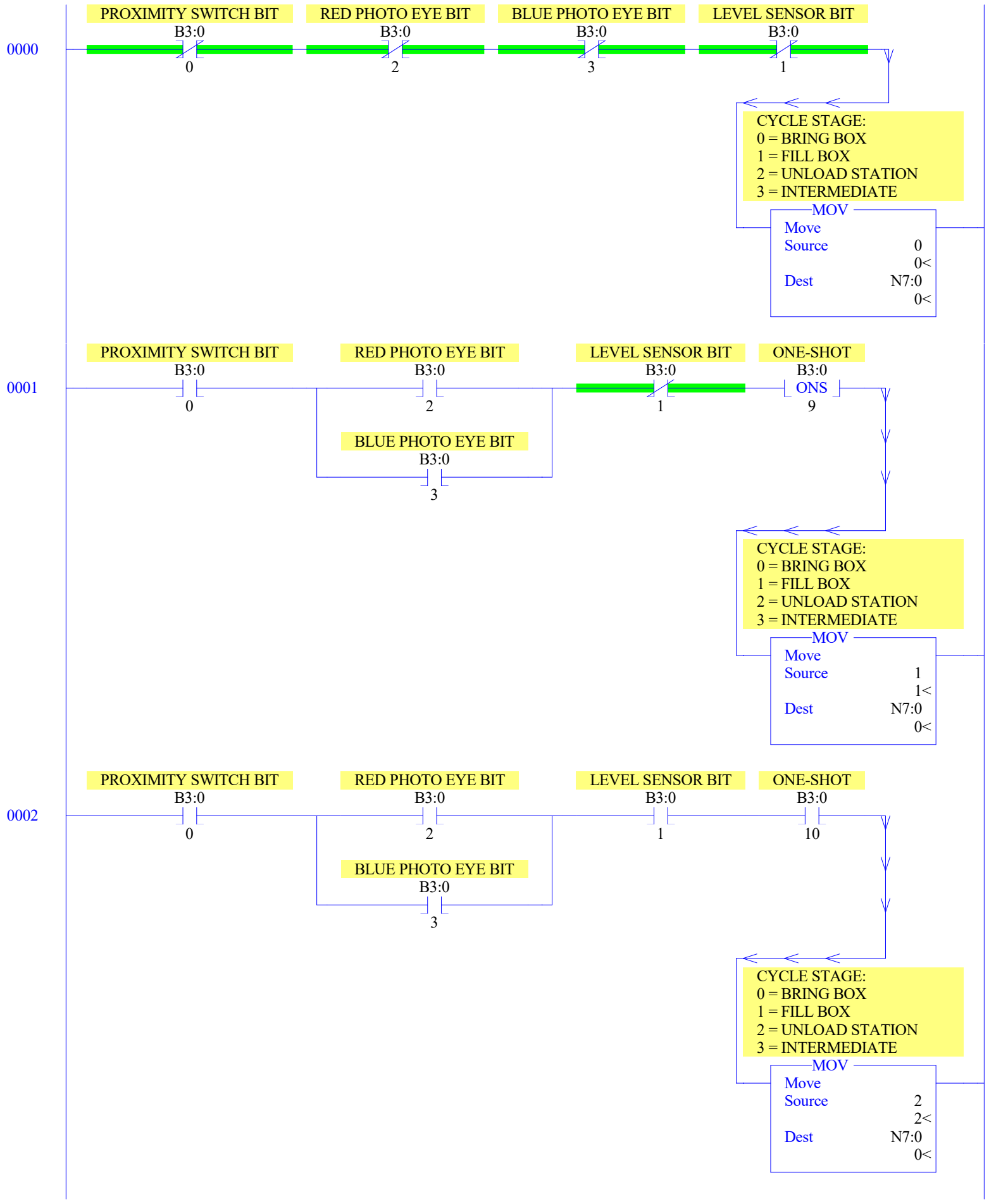


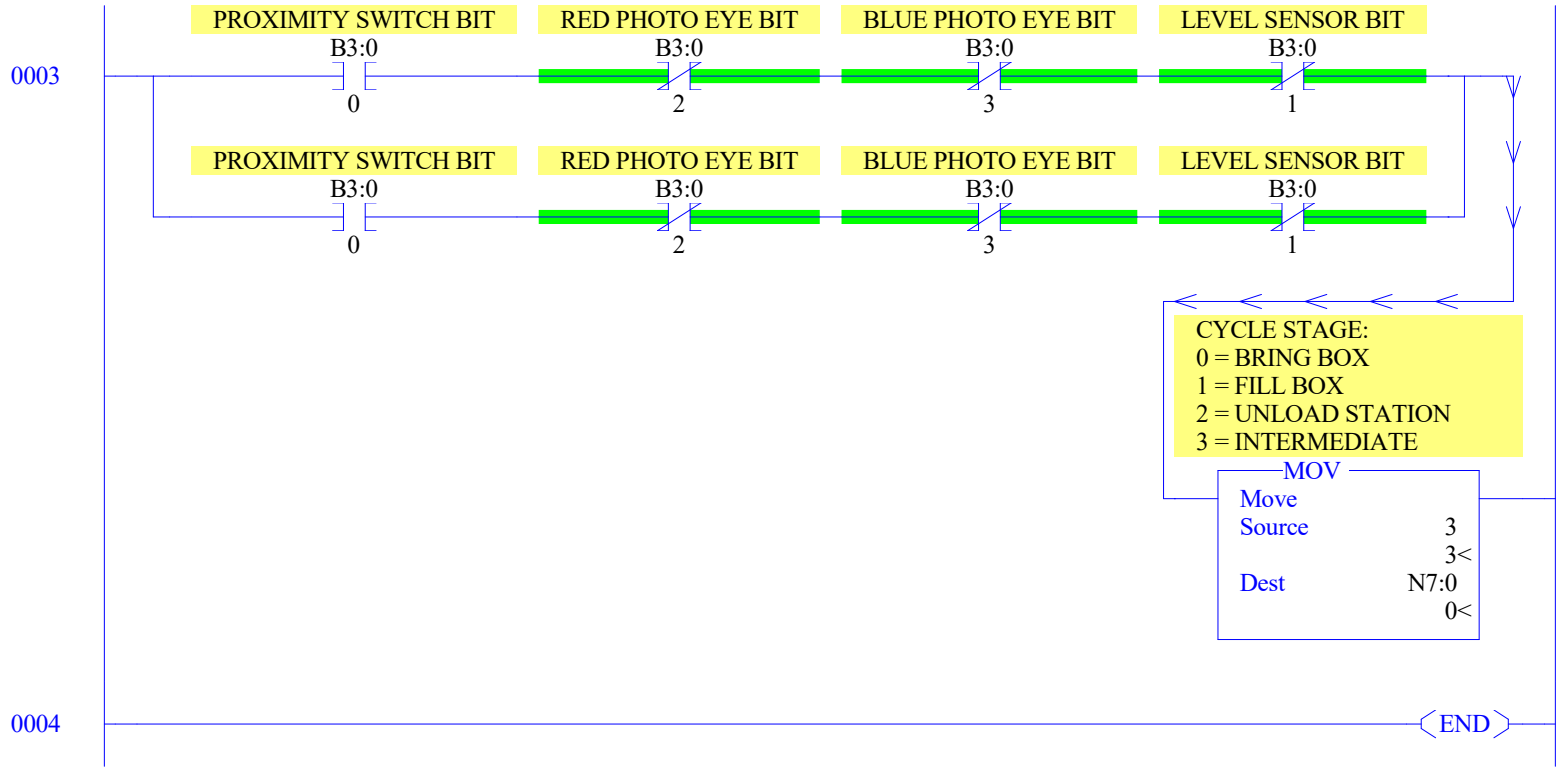

PROXIMITY SWITCH
I:0
0
Bul.1763
PROXIMITY SWITCH BIT
B3:0
0
0000
LEVEL SENSOR
I:0
1
Bul.1763
LEVEL SENSOR BIT
B3:0
1
0001
RED PHOTO EYE
I:0
2
Bul.1763
RED PHOTO EYE BIT
B3:0
2
0002
BLUE PHOTO EYE
I:0
3
Bul.1763
BLUE PHOTO EYE BIT
B3:0
3
0003
CONVEYOR MOTOR BIT
CONVEYOR_MOTOR_BIT
B3:0
4
CONVEYOR MOTOR
O:0
0
Bul.1763
0004
WALNUT HOPPER BIT
WALNUT_HOPPER_BIT
B3:0
5
WALNUT HOPPER
O:0
1
Bul.1763
0005
PECAN HOPPER BIT
PECAN_HOPPER_BIT
B3:0
6
PECAN HOPPER
O:0
2
Bul.1763
0006
END
0007


CYCLE STAGE:
0 = BRING BOX
1 = FILL BOX
2 = UNLOAD STATION
3 = INTERMEDIATE
CONVEYOR MOTOR BIT
CONVEYOR_MOTOR_BIT
B3:0
4
0000
EQU
Equal
Source A N7:0 0<
Source B 0 0<
CYCLE STAGE:
0 = BRING BOX
1 = FILL BOX
2 = UNLOAD STATION
3 = INTERMEDIATE
EQU
Equal
Source A N7:0 0<
Source B 2 2<
CYCLE STAGE:
0 = BRING BOX
1 = FILL BOX
2 = UNLOAD STATION
3 = INTERMEDIATE
BLUE PHOTO EYE BIT
B3:0
3
ONE-SHOT
B3:0
ONS
13
WALNUT HOPPER OPEN
TRIGGER
B3:0
12
0001
EQU
Equal
Source A N7:0 0<
Source B 1 1<
WALNUT HOPPER OPEN
TRIGGER
B3:0
12
0002
CYCLE STAGE:
0 = BRING BOX
1 = FILL BOX
2 = UNLOAD STATION
3 = INTERMEDIATE
WALNUT HOPPER BIT
WALNUT_HOPPER_BIT
B3:0
5
NEQ
Not Equal
Source A N7:0 0<
Source B 1 1<
LEVEL SENSOR BIT
B3:0
1
WALNUT HOPPER BIT
WALNUT_HOPPER_BIT
B3:0
5


CYCLE STAGE:
0 = BRING BOX
1 = FILL BOX
2 = UNLOAD STATION
3 = INTERMEDIATE
RED PHOTO EYE BIT
ONE-SHOT
PECAN HOPPER OPEN TRIGGER
0003
EQU
Equal
Source A
N7:0
0<
Source B
1
1<
B3:0
2
B3:0
ONS
15
B3:0
14
PECAN HOPPER OPEN TRIGGER
PECAN HOPPER BIT
PECAN_HOPPER_BIT
0004
B3:0
14
B3:0
6
CYCLE STAGE:
0 = BRING BOX
1 = FILL BOX
2 = UNLOAD STATION
3 = INTERMEDIATE
PECAN HOPPER BIT
PECAN_HOPPER_BIT
LEVEL SENSOR BIT
B3:0
6
EQU
Equal
Source A
N7:0
0<
Source B
1
1<
B3:0
1
0005
END

LAD 5 - CYCLE --- Total Rungs in File = 5




0003
PROXIMITY SWITCH BIT
B3:0
0
RED PHOTO EYE BIT
B3:0
2
BLUE PHOTO EYE BIT
B3:0
3
LEVEL SENSOR BIT
B3:0
1
PROXIMITY SWITCH BIT
B3:0
0
RED PHOTO EYE BIT
B3:0
2
BLUE PHOTO EYE BIT
B3:0
3
LEVEL SENSOR BIT
B3:0
1
CYCLE STAGE:
0 = BRING BOX
1 = FILL BOX
2 = UNLOAD STATION
3 = INTERMEDIATE
MOV
Move
Source 3
3<
Dest N7:0
0<
0004
END

Data File O0 (bin) -- OUTPUT

Offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		
O:0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1763	MicroLogix 1100 Series B
O:0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1763	MicroLogix 1100 Series B
O:0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1763	MicroLogix 1100 Series B
O:0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1763	MicroLogix 1100 Series B

Data File I1 (bin) -- INPUT

Offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		
I:0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1763	MicroLogix 1100 Series B
I:0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1763	MicroLogix 1100 Series B
I:0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1763	MicroLogix 1100 Series B
I:0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1763	MicroLogix 1100 Series B
I:0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1763	MicroLogix 1100 Series B-Analo
I:0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1763	MicroLogix 1100 Series B-Analo

Data File S2 (hex) -- STATUS

Main

Processor Mode S:1/0 - S:1/4 = Remote Program Mode
On Power up Go To Run (Mode Behavior) S:1/12 = 0
First Pass S:1/15 = No
Free Running Clock S:4 = 0000-0000-0000-0000

Proc

OS Catalog Number S:57 = 1100
OS Series S:58 = A
OS FRS S:59 =
Processor Catalog Number S:60 =
Processor Series S:61 = A
Processor FRN S:62 =
User Program Type S:63 = 8001h
Compiler Revision Number S:64 =

Scan Times

Maximum (x10 ms) S:22 = 0
Watchdog (x10 ms) S:3 (high byte) = 10
Last 100 uSec Scan Time S:35 = 0
Scan Toggle Bit S:33/9 = 0

Math

Math Overflow Selected S:2/14 = 0
Overflow Trap S:5/0 = 0
Carry S:0/0 = 0
Overflow S:0/1 = 0
Zero Bit S:0/2 = 0
Sign Bit S:0/3 = 0
Math Register (lo word) S:13 = 0
Math Register (high word) S:14-S:13 = 0
Math Register (32 Bit) S:14-S:13 = 0

Chan 0

Processor Mode S:1/0- S:1/4 = Remote Program Mode
Node Address S:15 (low byte) = 0
Baud Rate S:15 (high byte) = ?
Channel Mode S:33/3 = 0
Comms Active S:33/4 = 0
Incoming Cmd Pending S:33/0 = 0
Msg Reply Pending S:33/1 = 0
Outgoing Msg Cmd Pending S:33/2 = 0

Debug

Suspend Code S:7 = 0
Suspend File S:8 = 0

Errors

Fault Override At Power Up S:1/8 = 0
Startup Protection Fault S:1/9 = 0
Major Error Halt S:1/13 = 0
Overflow Trap S:5/0 = 0
Control Register Error S:5/2 = 0
Major Error Executing User Fault Rtn. S:5/3 = 0
Battery Low S:5/11 = 0
Input Filter Selection Modified S:5/13 = 0
ASCII String Manipulation error S:5/15 = 0
Fault Routine S:29 = 0
Major Error S:6 = 0h
Error Description:

Protection

Deny Future Access S:1/14 = No
Data File Overwrite Protection Lost S:36/10 = False

Mem Module

Memory Module Loaded On Boot S:5/8 = 0
Password Mismatch S:5/9 = 0
Load Memory Module On Memory Error S:1/10 = 0
Load Memory Module Always S:1/11 = 0
On Power up Go To Run (Mode Behavior) S:1/12 = 0
Program Compare S:2/9 = 0
Data File Overwrite Protection Lost S:36/10 = 0

Forces

Forces Enabled S:1/5 = Yes
Forces Installed S:1/6 = No

Data File B3 (bin) -- BINARY

Offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	(Symbol)	Description
B3:0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		

Data File T4 -- TIMER

Offset	EN	TT	DN	BASE	PRE	ACC	(Symbol)	Description
T4:0	0	0	0	.01 sec	0	0		

Data File C5 -- COUNTER

Offset	CU	CD	DN	OV	UN	UA	PRE	ACC	(Symbol)	Description
C5:0	0	0	0	0	0	0	0	0		

Data File R6 -- CONTROL

Offset	EN	EU	DN	EM	ER	UL	IN	FD	LEN	POS	(Symbol)	Description
R6:0	0	0	0	0	0	0	0	0	0	0		

Data File N7 (dec) -- INTEGER

Offset	0	1	2	3	4	5	6	7	8	9
N7:0	0									

Data File F8 -- FLOAT

Offset	0	1	2	3	4
F8:0	0				

Address/Symbol Database

Address	Symbol	Scope	Description	Sym Gro
B3:0/0			PROXIMITY SWITCH BIT	
B3:0/1			LEVEL SENSOR BIT	
B3:0/2			RED PHOTO EYE BIT	
B3:0/3			BLUE PHOTO EYE BIT	
B3:0/4	CONVEYOR_MOTOR_BIT	Global	CONVEYOR MOTOR BIT	
B3:0/5	WALNUT_HOPPER_BIT	Global	WALNUT HOPPER BIT	
B3:0/6	PECAN_HOPPER_BIT	Global	PECAN HOPPER BIT	
B3:0/7			CONVERYOR MOTOR START BIT	
B3:0/8			CONVEYOR MOTOR INTERRUPT	
B3:0/9			ONE-SHOT	
B3:0/10			ONE-SHOT	
B3:0/11			ONE-SHOT	
B3:0/12			WALNUT HOPPER OPEN TRIGGER	
B3:0/13			ONE-SHOT	
B3:0/14			PECAN HOPPER OPEN TRIGGER	
B3:0/15			ONE-SHOT	
I:0/0			PROXIMITY SWITCH	
I:0/1			LEVEL SENSOR	
I:0/2			RED PHOTO EYE	
I:0/3			BLUE PHOTO EYE	
N7:0			CYCLE STAGE: 0 = BRING BOX 1 = FILL BOX 2 = UNLOAD STATION 3 = INTERMEDIATE	
O:0/0			CONVEYOR MOTOR	
O:0/1			WALNUT HOPPER	
O:0/2			PECAN HOPPER	
S:0			Arithmetic Flags	
S:0/0			Processor Arithmetic Carry Flag	
S:0/1			Processor Arithmetic Underflow/ Overflow Flag	
S:0/2			Processor Arithmetic Zero Flag	
S:0/3			Processor Arithmetic Sign Flag	
S:1			Processor Mode Status/ Control	
S:1/0			Processor Mode Bit 0	
S:1/1			Processor Mode Bit 1	
S:1/2			Processor Mode Bit 2	
S:1/3			Processor Mode Bit 3	
S:1/4			Processor Mode Bit 4	
S:1/5			Forces Enabled	
S:1/6			Forces Present	
S:1/7			Comms Active	
S:1/8			Fault Override at Powerup	
S:1/9			Startup Protection Fault	
S:1/10			Load Memory Module on Memory Error	
S:1/11			Load Memory Module Always	
S:1/12			Load Memory Module and RUN	
S:1/13			Major Error Halted	
S:1/14			Access Denied	
S:1/15			First Pass	
S:2/0			STI Pending	
S:2/1			STI Enabled	
S:2/2			STI Executing	
S:2/3			Index Addressing File Range	
S:2/4			Saved with Debug Single Step	
S:2/5			DH-485 Incoming Command Pending	
S:2/6			DH-485 Message Reply Pending	
S:2/7			DH-485 Outgoing Message Command Pending	
S:2/15			Comms Servicing Selection	
S:3			Current Scan Time/ Watchdog Scan Time	
S:4			Time Base	
S:5/0			Overflow Trap	
S:5/2			Control Register Error	
S:5/3			Major Err Detected Executing UserFault Routine	
S:5/4			M0-M1 Referenced on Disabled Slot	
S:5/8			Memory Module Boot	
S:5/9			Memory Module Password Mismatch	
S:5/10			STI Overflow	
S:5/11			Battery Low	
S:6			Major Error Fault Code	
S:7			Suspend Code	
S:8			Suspend File	
S:9			Active Nodes	
S:10			Active Nodes	
S:11			I/O Slot Enables	
S:12			I/O Slot Enables	
S:13			Math Register	
S:14			Math Register	
S:15			Node Address/ Baud Rate	
S:16			Debug Single Step Rung	
S:17			Debug Single Step File	
S:18			Debug Single Step Breakpoint Rung	
S:19			Debug Single Step Breakpoint File	
S:20			Debug Fault/ Powerdown Rung	
S:21			Debug Fault/ Powerdown File	
S:22			Maximum Observed Scan Time	
S:23			Average Scan Time	
S:24			Index Register	
S:25			I/O Interrupt Pending	
S:26			I/O Interrupt Pending	
S:27			I/O Interrupt Enabled	
S:28			I/O Interrupt Enabled	
S:29			User Fault Routine File Number	
S:30			STI Setpoint	

Address/Symbol Database

Address	Symbol	Scope	Description	Sym Gro
S:31			STI File Number	
S:32			I/O Interrupt Executing	
S:33			Extended Proc Status Control Word	
S:33/0			Incoming Command Pending	
S:33/1			Message Reply Pending	
S:33/2			Outgoing Message Command Pending	
S:33/3			Selection Status User/DF1	
S:33/4			Communicat Active	
S:33/5			Communicat Servicing Selection	
S:33/6			Message Servicing Selection Channel 0	
S:33/7			Message Servicing Selection Channel 1	
S:33/8			Interrupt Latency Control Flag	
S:33/9			Scan Toggle Flag	
S:33/10			Discrete Input Interrupt Reconfigur Flag	
S:33/11			Online Edit Status	
S:33/12			Online Edit Status	
S:33/13			Scan Time Timebase Selection	
S:33/14			DTR Control Bit	
S:33/15			DTR Force Bit	
S:34			Pass-thru Disabled	
S:34/0			Pass-Thru Disabled Flag	
S:34/1			DH+ Active Node Table Enable Flag	
S:34/2			Floating Point Math Flag Disable,Fl	
S:35			Last 1 ms Scan Time	
S:36			Extended Minor Error Bits	
S:36/8			DII Lost	
S:36/9			STI Lost	
S:36/10			Memory Module Data File Overwrite Protection	
S:37			Clock Calendar Year	
S:38			Clock Calendar Month	
S:39			Clock Calendar Day	
S:40			Clock Calendar Hours	
S:41			Clock Calendar Minutes	
S:42			Clock Calendar Seconds	
S:43			STI Interrupt Time	
S:44			I/O Event Interrupt Time	
S:45			DII Interrupt Time	
S:46			Discrete Input Interrupt- File Number	
S:47			Discrete Input Interrupt- Slot Number	
S:48			Discrete Input Interrupt- Bit Mask	
S:49			Discrete Input Interrupt- Compare Value	
S:50			Processor Catalog Number	
S:51			Discrete Input Interrupt- Return Number	
S:52			Discrete Input Interrupt- Accumulat	
S:53			Reserved/ Clock Calendar Day of the Week	
S:55			Last DII Scan Time	
S:56			Maximum Observed DII Scan Time	
S:57			Operating System Catalog Number	
S:58			Operating System Series	
S:59			Operating System FRN	
S:61			Processor Series	
S:62			Processor Revision	
S:63			User Program Type	
S:64			User Program Functional Index	
S:65			User RAM Size	
S:66			Flash EEPROM Size	
S:67			Channel 0 Active Nodes	
S:68			Channel 0 Active Nodes	
S:69			Channel 0 Active Nodes	
S:70			Channel 0 Active Nodes	
S:71			Channel 0 Active Nodes	
S:72			Channel 0 Active Nodes	
S:73			Channel 0 Active Nodes	
S:74			Channel 0 Active Nodes	
S:75			Channel 0 Active Nodes	
S:76			Channel 0 Active Nodes	
S:77			Channel 0 Active Nodes	
S:78			Channel 0 Active Nodes	
S:79			Channel 0 Active Nodes	
S:80			Channel 0 Active Nodes	
S:81			Channel 0 Active Nodes	
S:82			Channel 0 Active Nodes	
S:83			DH+ Active Nodes	
S:84			DH+ Active Nodes	
S:85			DH+ Active Nodes	
S:86			DH+ Active Nodes	
U:3			IO	
U:4			CONTROLS	
U:5			CYCLE	

Instruction Comment Database

Address	Instruction	Description

Symbol Group Database

Group_Name Description