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Motion Control

Do-more H2 Series PLC to *Sure*Step Stepping System with *C-more* Touch Panel (HMI)

Rotary Index Table Station
Part 3 of 5
Do-more Ladder Logic Programming

VID: L-PC-DM-STP-CM-001-3

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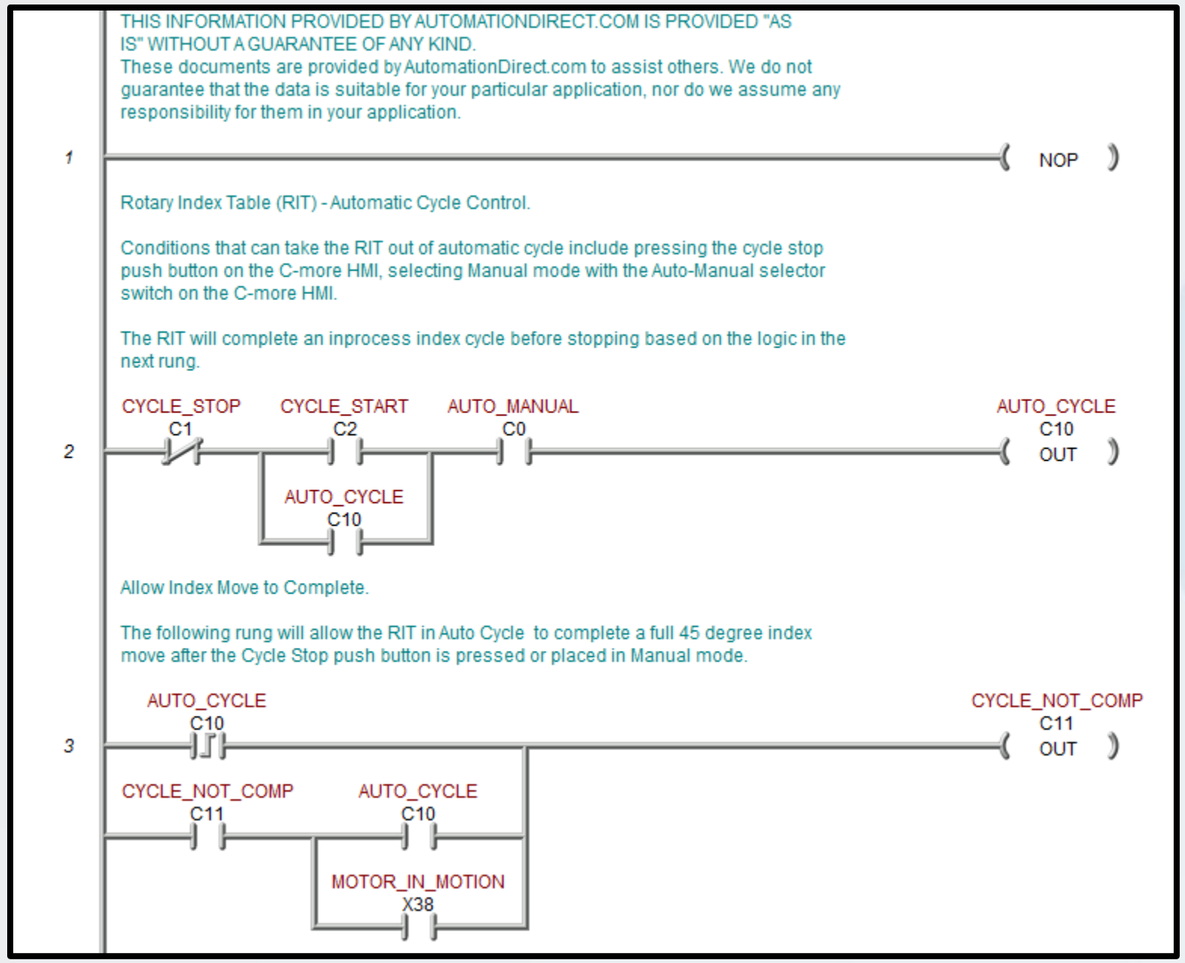
Do-more Designer Ladder Logic Programming – 1 of 13



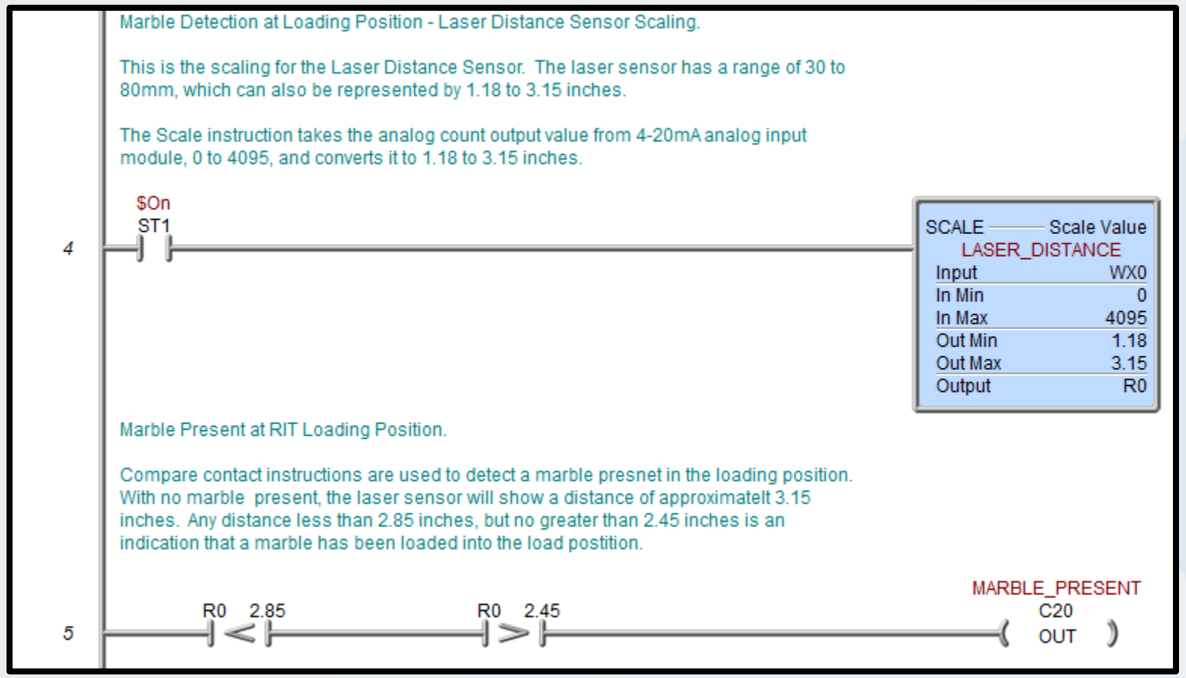
These first couple of rungs set up our logic for control of an auto cycle. A Cycle Start and Stop push button, along with an Auto/Manual selector switch are programmed on the ***C-more*** Touch Panel.

As long as the Auto Cycle is selected, and we have pressed the Cycle Start PB, internal Auto_Cycle control relay C10 will be locked in.

The Cycle_Not_Comp control relay circuit is used to allow an index cycle to complete by monitoring if the stepper motor is moving. If taken out of Auto_Cycle, C11 will stay locked in until Motor_in_Motion X38 signal opens.

Rung 1-3

Do-more Designer Ladder Logic Programming – 2 of 13

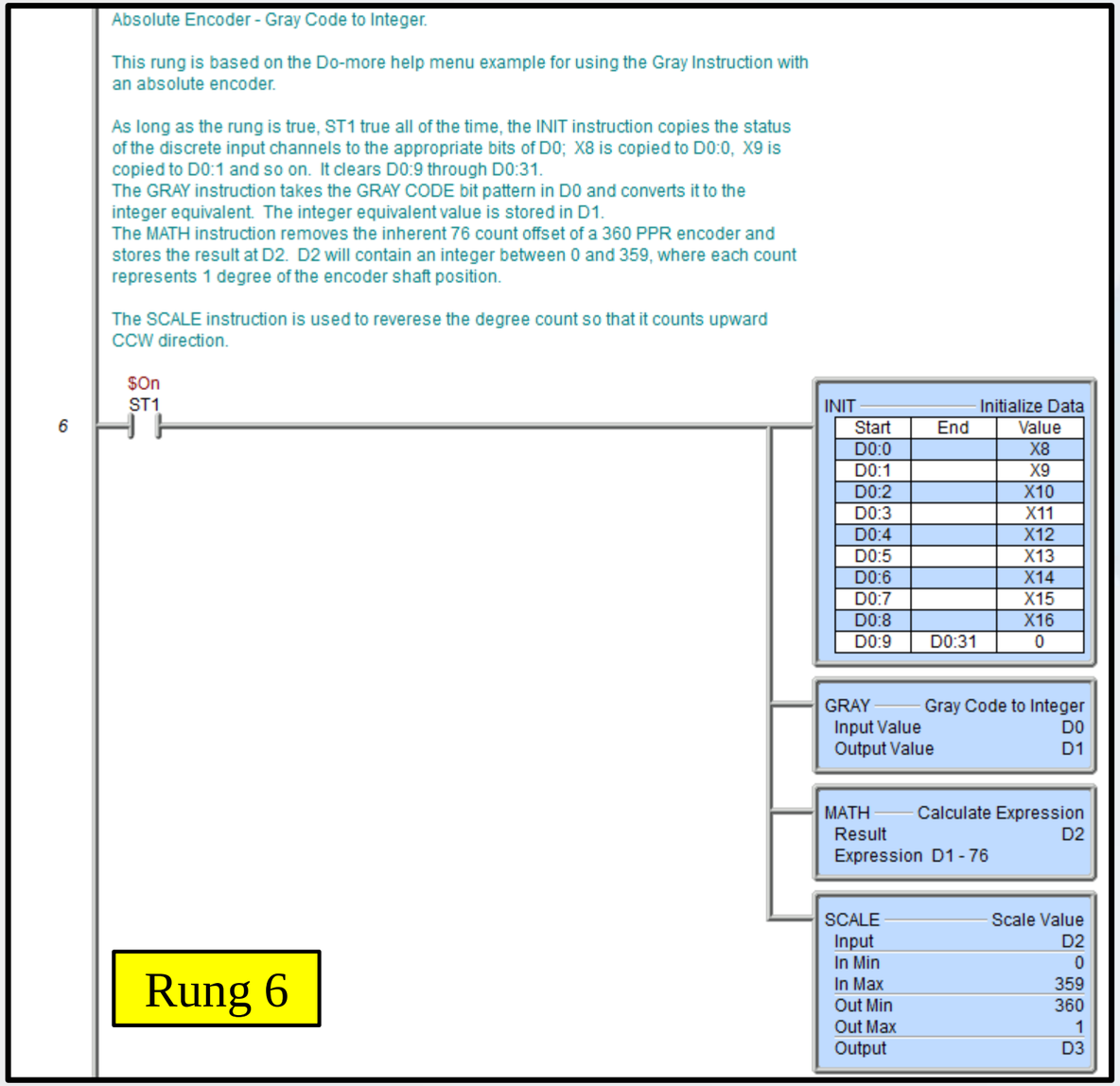


Rung 4-5

The 4-20mA output from the Laser Distance Sensor is scaled to represent a measured distance of 1.18 inches to 3.15 inches. The Scale instruction takes the 0 to 4095 value from the analog input module and converts it to show the actual distance in inches.

With no part in loaded in the rotary disk position 1, the Laser Distance sensor will indicate 1 distance of approximately 3.15 inches. The part will be seen as a distance of greater than 2.85 inches, but not more than 2.45 inches.

Do-more Designer Ladder Logic Programming – 3 of 13



The instructions shown here take the 9-bit output from the 360 degree absolute encoder and converts it to read as 1 to 360 degrees of rotation.

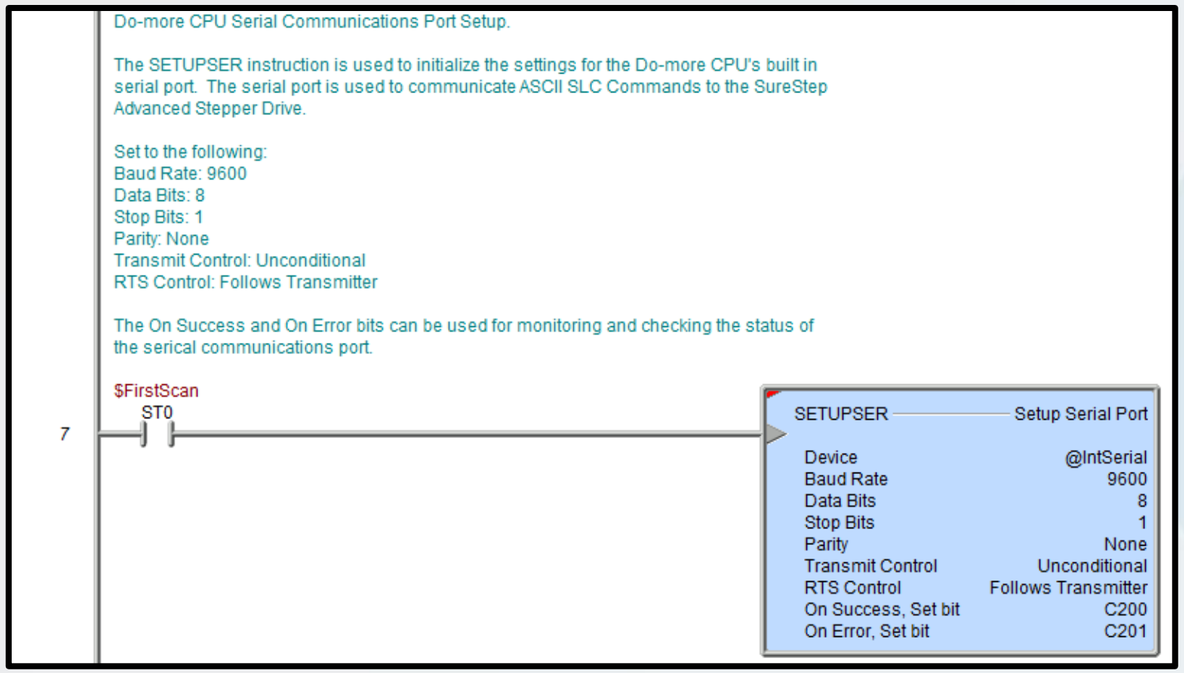
The first step is to set up the 9 inputs, X8 thru X16, into a one word value. This is accomplished with the INIT instruction.

The output from the absolute encoder is Gray Code, and is converted to an integer value using the GRAY instruction.

There is a fixed offset value of 76 that is associated with the 360 degree encoder, so a MATH instruction is used to remove the offset value.

Our application calls for the degrees to read 1 to 360 as the rotary disk moves in a counter clockwise direction, so a SCALE instruction is used to reverse and change the reading.

Do-more Designer Ladder Logic Programming – 4 of 13



The SETUPSER instruction is used to initialize the **Do-more's** CPU serial port.

To communicate to the ***Sure*Step** advanced drive, the serial port is set as follows:

Baud Rate: 9600

Data Bits: 8

Step Bits: 1

Parity: None

Transmit Control: Unconditional

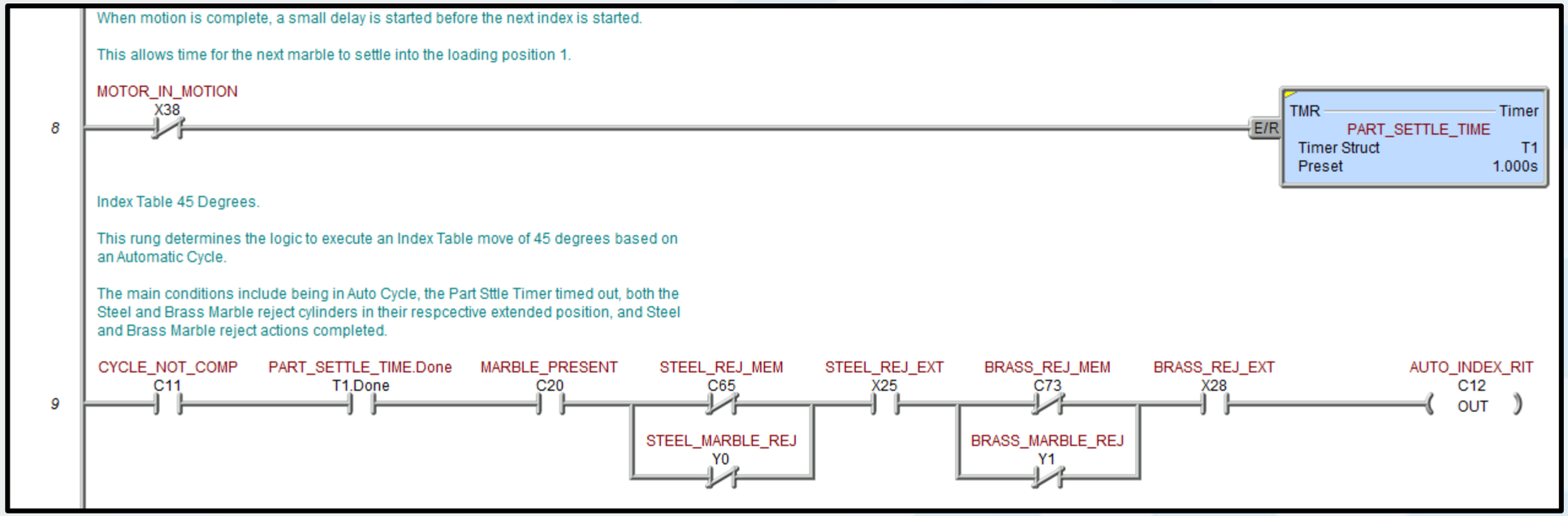
RTS Control: Follows Transmitter

Rung 7

Do-more Designer Ladder Logic Programming – 5 of 13

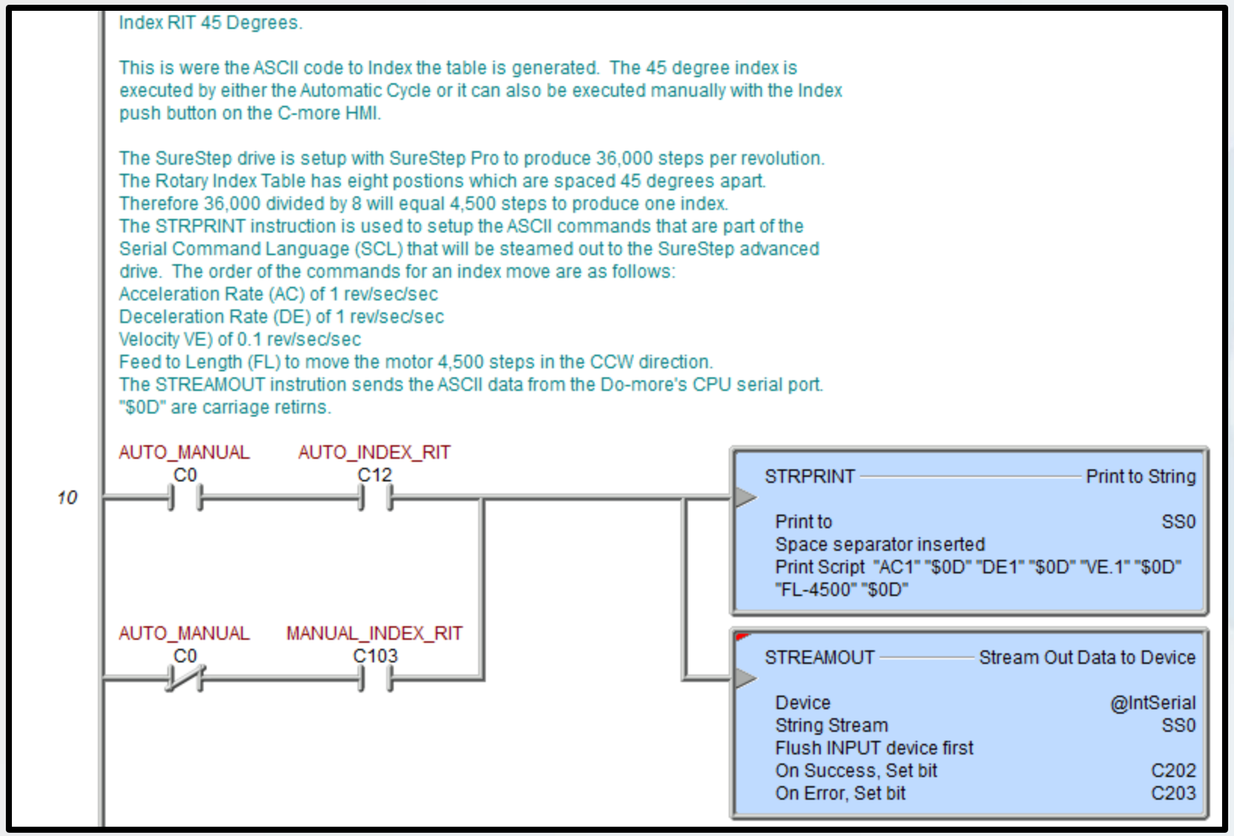
The following two rungs control the Rotary Index Table's indexing function. The TMR timer shown is used to slightly delay the next index to allow the part that is loading to settle into position.

The Auto_Index_RIT internal relay C12 logic becomes true when all of the conditions are met. The requirements are the cycle is not complete, settle timer timed out, part is loaded, and the steel/brass marble reject cycles are not in process.



Rung 8-9

Do-more Designer Ladder Logic Programming – 6 of 13



Rung 10

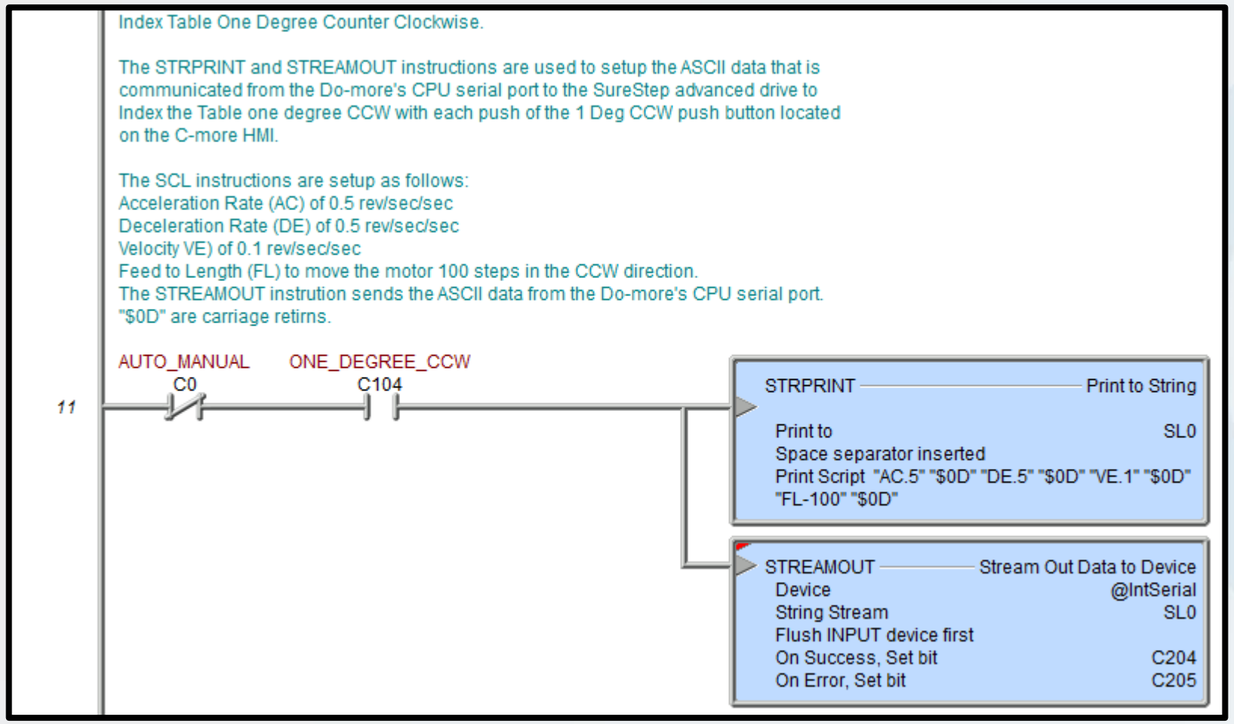
Here is the logic that sends the ASCII commands of the Serial Command Language from the **Do-more's** CPU serial port to the ***Sure*Step** advanced driver's serial port.

This is our index move. The rotary disk has eight positions with a pocket to accept a part at each position. The positions are separated by 45 degrees. The stepper drive is set up to produce 36,000 steps per revolution, therefore it will take 4,500 steps to move 45 degrees.

The drives acceleration, deceleration, and velocity rates are part of the ASCII string that is sent.

The move command is a Feed to Length type of move.

Do-more Designer Ladder Logic Programming – 7 of 13



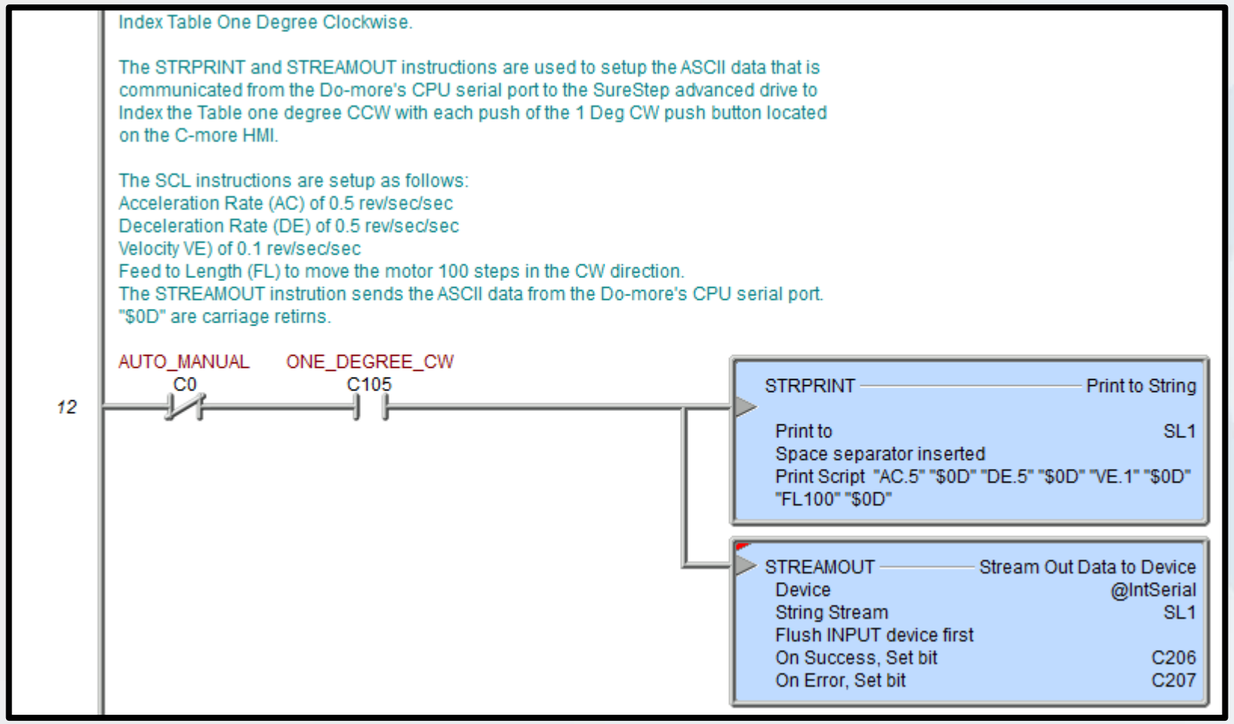
Rung 11

Shown here is the simple logic that is used to allow the rotary disk to be jogged one degree at a time in the counter clockwise direction.

The system needs to be selected in Manual Mode by the Auto_Manual selector switch on the ***C-more*** Touch Panel. Press the 1 Deg CCW push button on ***C-more*** to execute.

The SCL commands are basically the same sequence that are used for the index move as described on the previous rung. One degree of movement requires 100 steps.

Do-more Designer Ladder Logic Programming – 8 of 13

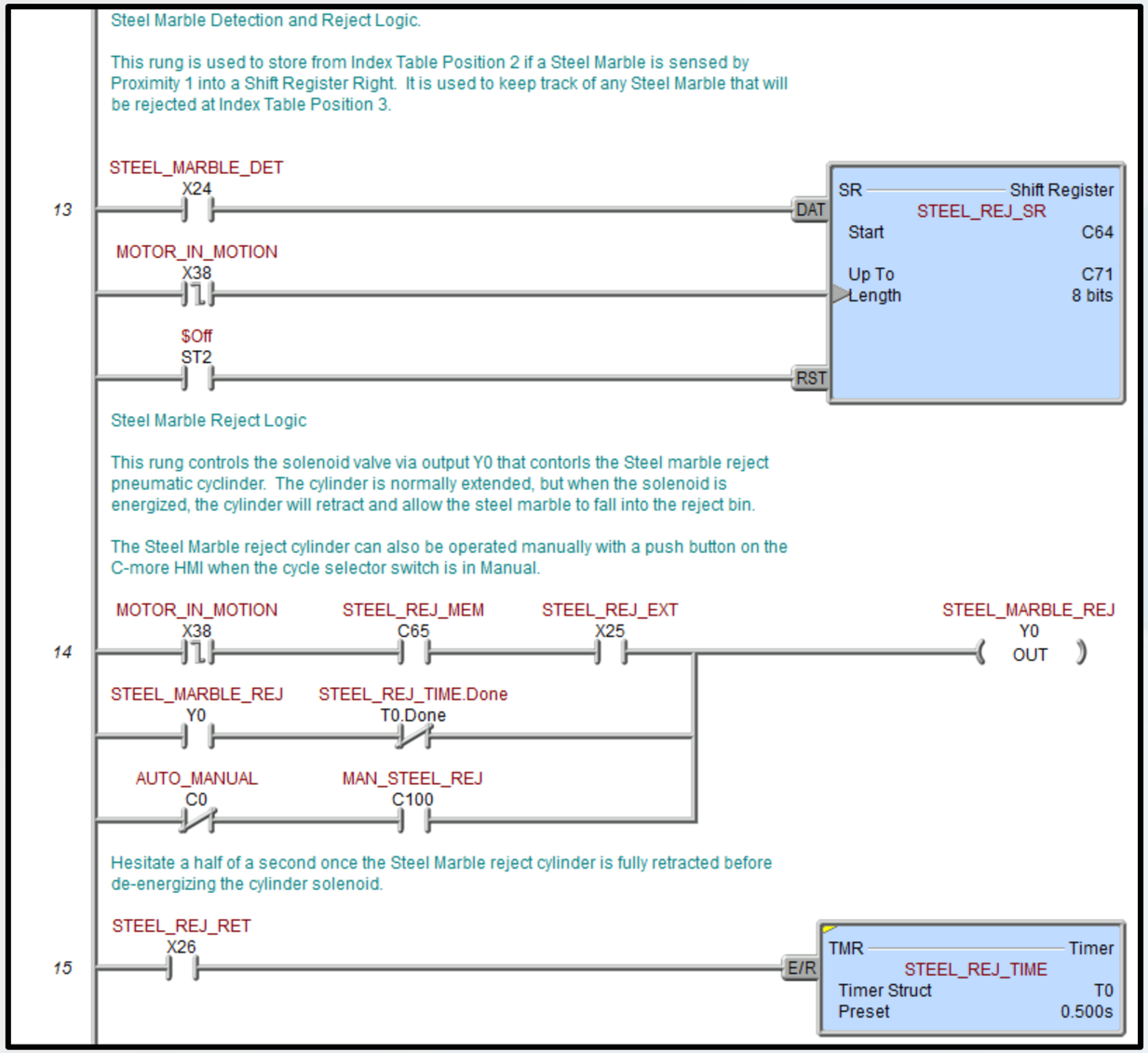


Rung 12

The previous rung explained the logic to jog the rotary disk one degree counter clockwise in manual mode.

This is the logic to jog the rotary disk one degree clockwise in manual mode.

Do-more Designer Ladder Logic Programming – 9 of 13



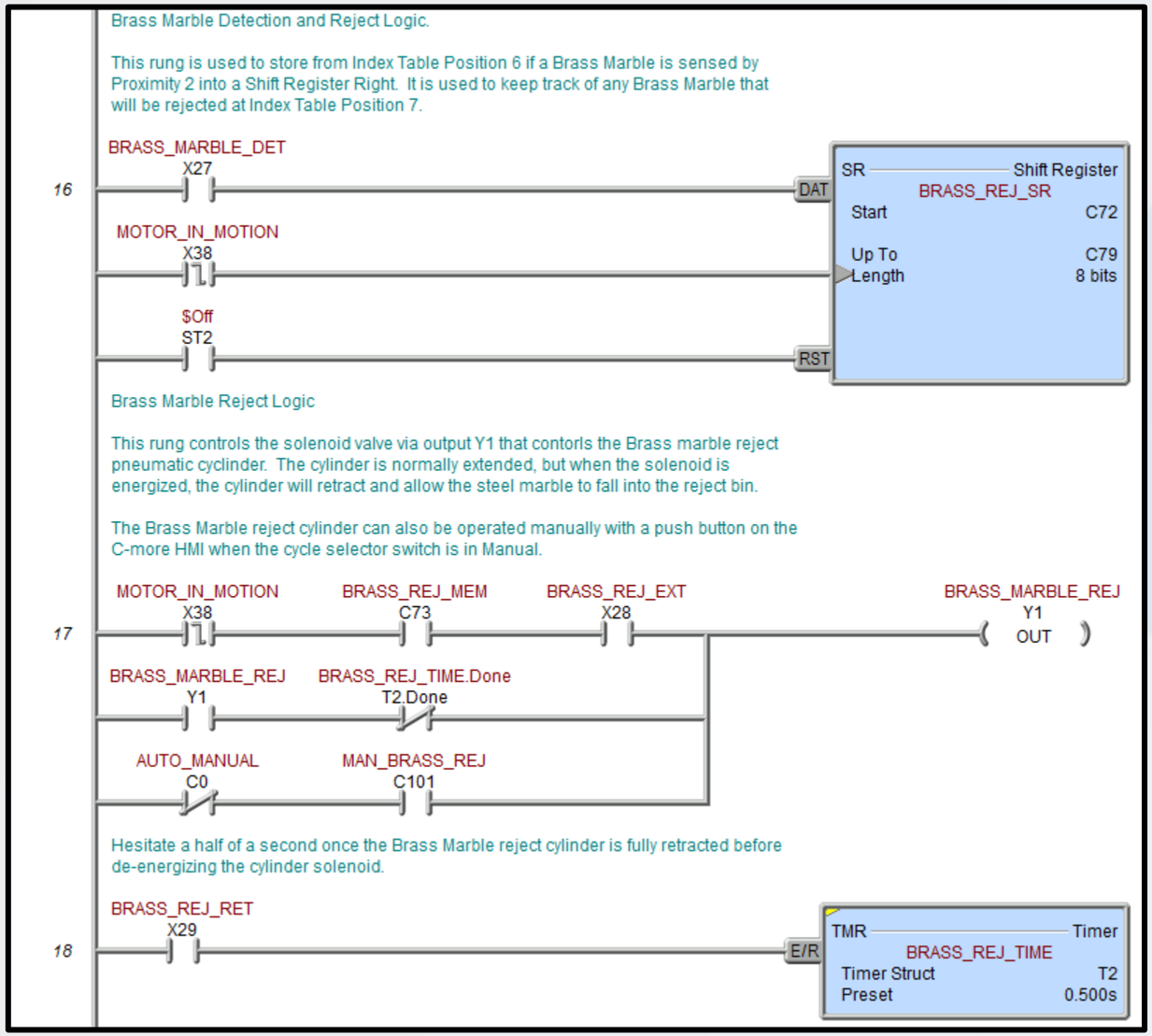
This is the logic for the detection and rejection of any steel marbles that come through the Rotary Index Table. The steel marbles are detected at position 2 of the rotary disk by an inductive proximity.

A shift register, SR instruction, is used to keep track of any steel marble reject. In our situation, the steel marble is rejected at position 3. The reject is handled by a pneumatic slide cylinder that retracts a gate, allowing the steel marble to fall through a tube into a bin.

If a reject is indicated by the Shift Register bit C65, then the solenoid valve, Y0 output, is energized to open the reject gate. Magnetic sensors on the slide cylinder are used to sequence the operation.

Rung 13-15

Do-more Designer Ladder Logic Programming – 10 of 13



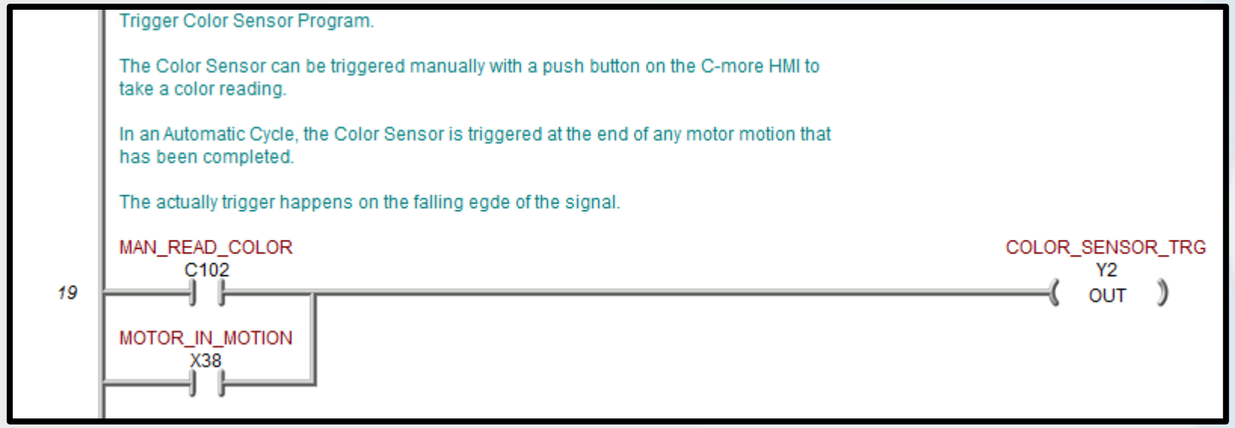
This is the logic for the detection and rejection of any brass marbles that come through the Rotary Index Table. The brass marbles are detected at position 6 of the rotary disk by an inductive proximity.

A shift register, SR instruction, is used to keep track of any brass marble reject. In our situation, the brass marble is rejected at position 7. The reject is handled by a pneumatic slide cylinder that retracts a gate, allowing the brass marble to fall through a tube into a bin.

If a reject is indicated by the Shift Register bit C73, then the solenoid valve, Y1 output, is energized to open the reject gate. Magnetic sensors on the slide cylinder are used to sequence the operation.

Rung 16-18

Do-more Designer Ladder Logic Programming – 11 of 13



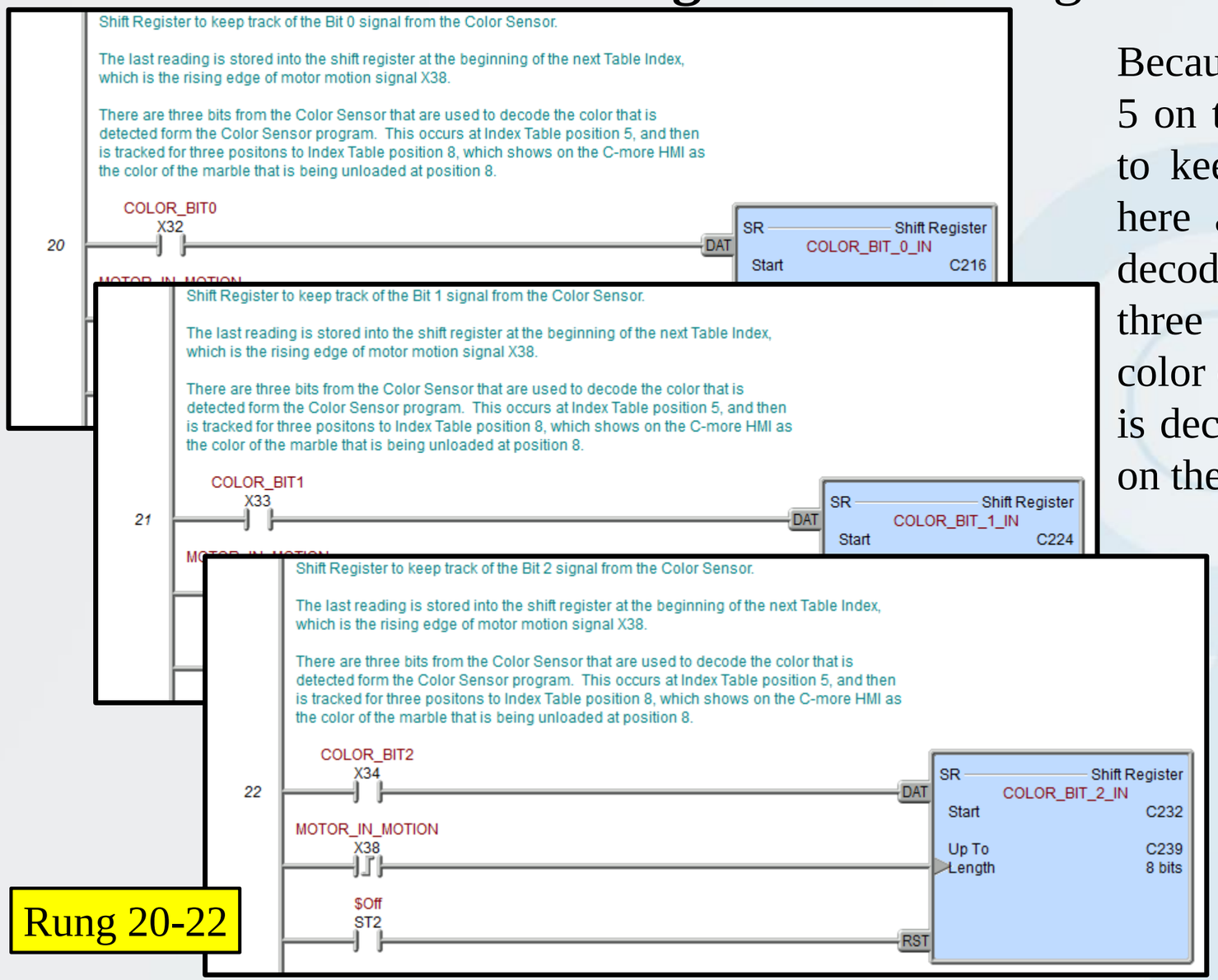
Rung 19

The logic to trigger the color sensor to take a reading is very simple. DC output Y2 is used to actuate a solid state relay that is used as a signal isolator between the 24 VDC PLC output and the 5 VDC TTL level input to the color sensor.

The actual reading takes place on the falling edge of the trigger signal.

In an Auto Cycle, the color sensor reading occurs when the stepper motor has stopped its motion. A manual reading can be called for from a push button on the ***C-more*** Touch Panel.

Do-more Designer Ladder Logic Programming – 12 of 13

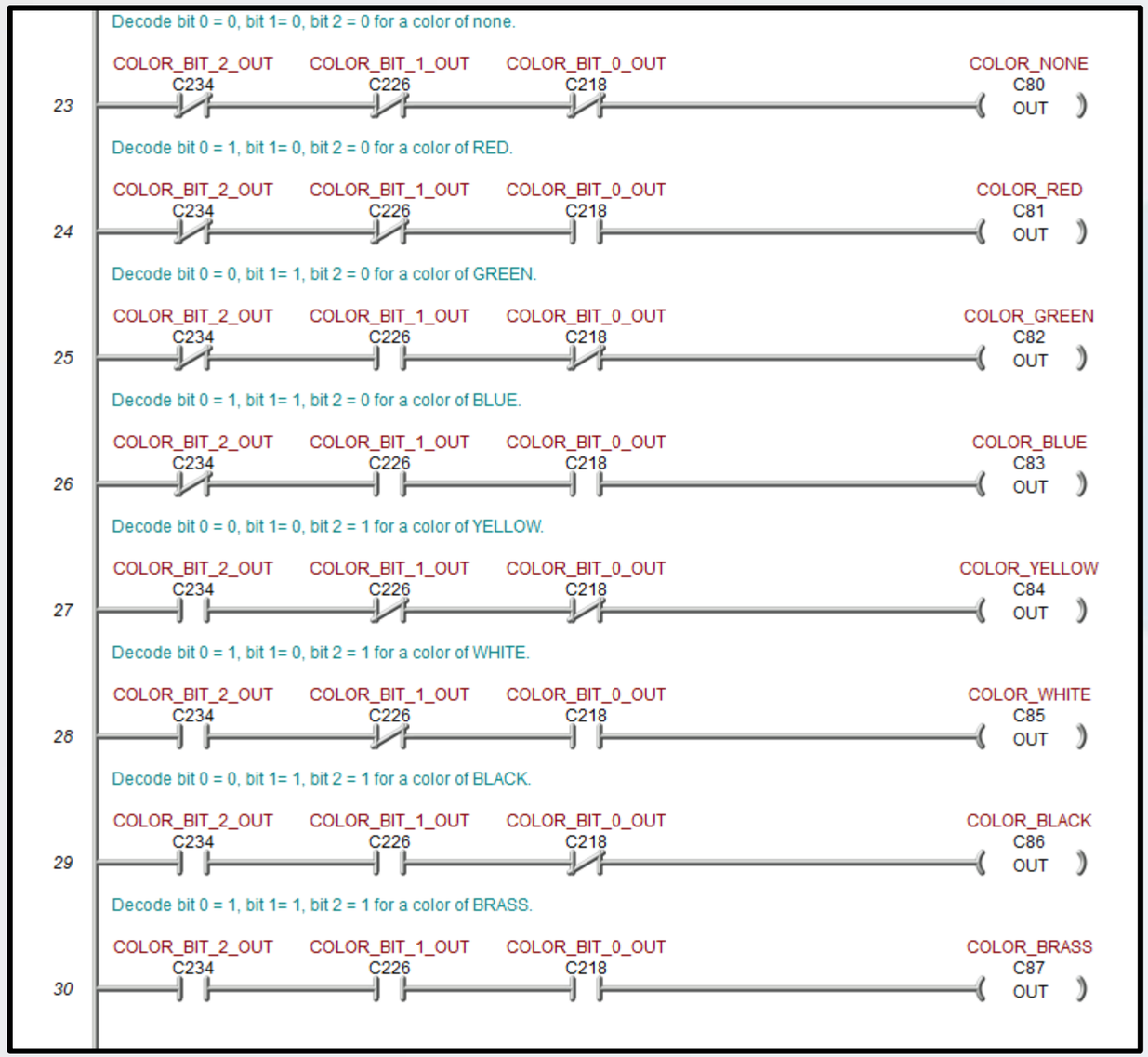


Rung 20-22

Because the color sensor takes a reading at Position 5 on the rotary disk, three Shift Registers are used to keep track of the color senor's reading shown here as rungs 20, 21, & 22. The readings are decoded and displayed on the C-more Touch Panel three positions later, so at Position 8 we see the color exiting. For example, bit 0 starts at C216, but is decoded at C218. The logic to decode is shown on the next slide.

Color	Bit 2	Bit 1	Bit 0
None	0	0	0
Red	0	0	1
Green	0	1	0
Blue	0	1	1
Yellow	1	0	0
White	1	0	1
Black	1	1	0
Brass	1	1	1

Do-more Designer Ladder Logic Programming – 13 of 13



This is the logic to decode the three bits from the color sensor that indicate the color reading from Position 5, but indicated at the exit from the Rotary Index Table from position 8.

The color exiting is indicated on the ***C-more*** Touch Panel.

Rung 23-30

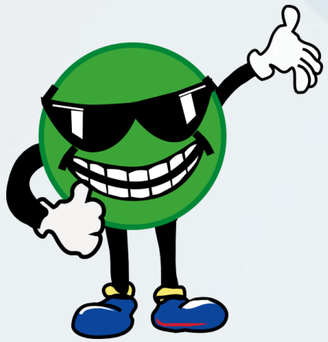
Do-more Designer Ladder Logic Programming – Information

There is additional information in regards to the **Do-more** PLC and **Do-more** Designer programming software at the AboutPLCs **Do-more** Website. A link to the site is shown below.

Link to Do-more PLC Website: http://bit.ly/28X07Hz

The **Do-more** Designer project that was created for this Motion Control demonstration is fully commented and can be downloaded for your review. See the Note below.

NOTE: **Do-more Designer** Version 1.4.3 Production software used on this demo.



NOTE: A complete commented **Do-more Designer** project for the Motion Control demo presented here is available for downloading from the **AutomationDirect** Video Tutorial website. Look for the note that says Related Documents.

Other available videos in this series on Motion Control.

Title	VID Number
Part 1 of 5 – Control System Overview.	L-PC-DM-STP-CM-001-1
Part 2 of 5 – Schematic Diagrams.	L-PC-DM-STP-CM-001-2
Part 4 of 5 – ***C-more*** Touch Panel Programming.	L-PC-DM-STP-CM-001-4
Part 5 of 5 – Operational Demonstration.	L-PC-DM-STP-CM-001-5

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