automation engineering

BASTIAN ARSAW OPTIMIZATION

LOGICAL AND MECHANICAL ADJUSTMENTS

AUTOMATION ENGINEERING
AMAZON CORPORATE
[2023,09,11] [1.2] [ZHICKS]

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3.1.1 The Empty Tote Infeed Conveyor will be aligned and centered to the Destacker. The drive belts will be better protected from the totes traveling across them. 10

3.1.2 Totes will be centered inside the Destacker for the highest chance of a successful destack. 10

3.1.3 The Destacker will have 3 chances to separate the totes prior to generating a fault and requiring RME to engage. 10

3.1.4 The Lift Conveyor set screws will be secured with thread locker to increase the reliability of the taper lock bushing. 10

3.1.5 The Home setpoints for the Lift Conveyor will be coded into the PLC rendering the inaccurate toggle switches on the panel obsolete. 10

3.1.6 Debounce timers will be installed to eliminate erroneous signals interrupting the sequence. 10

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4.1.1 Rails are to be installed on the side of the Full Conveyor to prevent jams. 10

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4.1.3 All cables MUST be tied up away from photo eyes. 10

4.1.4 Overhaul of PM Procedure, Frequency, and Documentation is being conducted. 10

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Overview

1. Bastian ARSAW stations are experiencing in excessive of 100 faults per station/day. Each fault has an average recovery time of 15 minutes. The costs of these faults on average is equal to $383.33 per defect. Given a sample time of three months at one facility, there were a total of 7331 occurrences with a total cost of $2,810,155,58. The majority of these faults were due to mechanical install as well as misses in the logic.

2. The adjustments to the mechanical setup of these ARSAW station will provide an optimized alignment of totes entering and exiting the ARSAW and a higher reliability of the system.

3. The logic adjustments will allow the system to self-recover from NON-CRITICAL fault conditions and eliminate false tracking errors.

Precautionary Note

1. These modifications will require RME technician to adjust the mechanical guide rails behind the machine guards. PTP and Workorder Must been completed prior to implementing these changes.

2. This process will modify the PLC program while “Online”. A backup must be saved and stored on the NACF-AE drive prior to making any changes.

3. While adjusting the home positions of the tote lift, technicians will be exposed to a “Gravity” hazard if the machine is de-energized. Appropriate blocking will be required for the safety of the technician/s.

4. This procedure has been written for a competent Controls/MHE Technician associate to follow and assumes the associate possesses a reasonable level of knowledge of ladder logic and Rockwell Studio 5000 software (Controls) and the ability to use basic hand tools (MHE Technician).

Change Management Process MUST be utilized during the execution of this application guide

1 Mechanical Adjustments

1.1 Required Tools

1.1.1 Tape Measure – ASIN B07QG3ZXQC (example only) Link

1.1.2 Machinist Square – ASIN B084H232QS (example only) Link

1.1.3 Metric Allen Pack – ASIN B004VMR6ZK (example only) Link

1.1.4 Metric Wrenches or Socket Set – ASIN B0B8TR3WDL (example only) Link

1.1.5 Level (minimum length of 2 foot) – ASIN B07G2DLXKL (example only) Link

1.2 Empty Tote Infeed Conveyor

1.2.1 Lock out the ARSAW station.

1.2.2 Remove the guards from around the Empty Tote Infeed Conveyor.

1.2.3 Adjust the face of the guide rails on the drive belt side inward 2.5” from the conveyor frame. This distance will remain the same throughout the procedure. This will ensure that the drive belts are not exposed to the empty totes.

1.2.4 Adjust the opposing guide rail to a distance of 17” face to face at the entrance of the Empty Tote Infeed Conveyor.

1.2.5 At the midway point, adjust the opposing guide rail to a distance of 16” face to face.

1.2.6 At the end of the Empty Tote Infeed Conveyor, set the distance to 15” face to face. (Displayed in figure 1.2.5)

1.3 Destacker

1.3.1 Adjust the tote guides on the drive belt side to 3” from the conveyor rail.

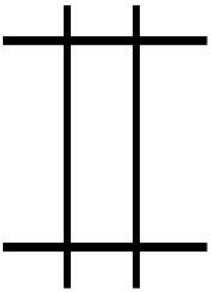
1.3.2 Adjust the tote guides to 14” face to face.

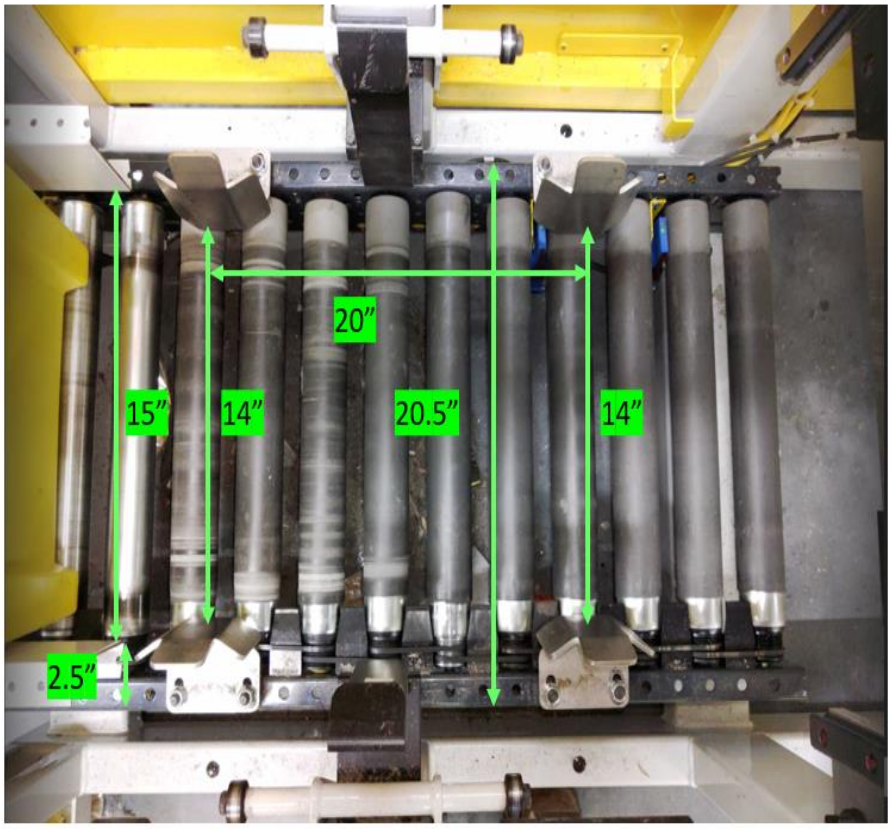
1.3.3 These must be square with the conveyance and tightened securely.

1.3.4 Adjust the extend and retract setpoints on the lift cylinder to 8.

1.3.5 Verify that the fingers on the lift are disengaging at the same height while releasing the tote stack.

Unistrut:
2 x 22”
2 x 20”





1.4 Tote Lift

1.4.1 Remove on bolt from the taper lock bushing on the Drive pulley.

1.4.2 Apply Medium Strength (Blue) thread locker to the bolt and reinstall.

1.4.3 Repeat the process for the remaining bolt/bolts.

2 Logical Modifications

2.1 Destacker Logic

2.1.1 Open Studio 5000.

2.1.2 Connect to ARSAW PLC.

2.1.3 Navigate to EM01_StackConveyor – S10_DestackerSequence

2.1.4 Select rung 11, then delete the rung.

2.1.5 Replace the rung with the following script.

EQU(destackerAutoSequence.currentStep,50)[[OTE(destackerAutoSequence.step[50].enabled),OTE(gOEEStackTotalCount)],TON(destackerAutoSequence.step[50].delayTimer,?,?),XIC(shotgunComplete)MOV(60,destackerAutoSequence.currentStep),XIC(destackerAutoSequence.step[50].delayTimer.DN)[XIC(Local:1:I.Pt11.Data)XIC(Local:1:I.Pt10.Data)XIC(Local:1:I.Pt05.Data)[MOV(0,destackerAutoSequence.currentStep),OTE(Destack_Multiple_Attempt[0])],[XIO(Local:1:I.Pt11.Data),XIO(Local:1:I.Pt10.Data),XIO(Local:1:I.Pt05.Data)]MOV(55,destackerAutoSequence.currentStep)]];

*******This MUST be done while have selected "In Neutral Text"******

2.1.6 Add another rung (rung 12). Add the following script:

[XIC(Destack_Multiple_Attempt[0])[CTU(Destack_Attempt_Current,?,?),CTU(Destack_Attempt_Total,?,?),EQU(Destack_Attempt_Current.ACC,3)MOV(55,destackerAutoSequence.currentStep)],EQU(destackerAutoSequence.currentStep,60)RES(Destack_Attempt_Current),GRT(Destack_Attempt_Total.ACC,32000)RES(Destack_Attempt_Total)];

*******This MUST be done while have selected "In Neutral Text"******

2.1.7 Add the following tags to the program.

2.1.7.1 Destack_Attempt_Total – Counter

2.1.7.2 Destack_Attempt_Current – Counter

2.1.7.3 Destack_Multiple_Attempt – Boolean Array [10]

2.1.8 Accept Pending Routine Edits.

2.1.9 Verify there are no faults present.

2.1.10 Test Accepted Edits.

2.1.11 Compile Test Edits.

2.2 Photo Eye Debounce Timers

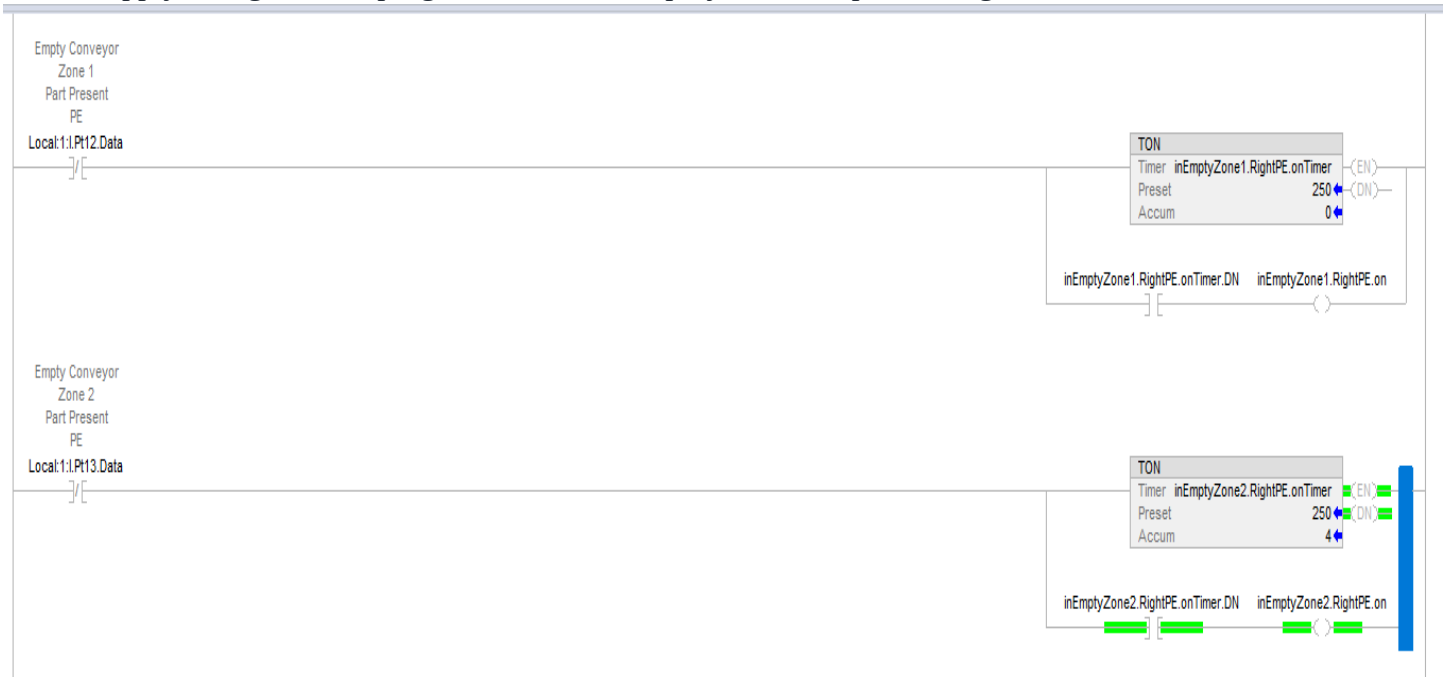
2.2.1 Navigate to the “EM01_EmptyConveyor – E02_InputMap”

2.2.2 Create timers for all associated photo eyes.

2.2.3 Set the Preset value to 100. ***Updated Value***

2.2.4 Repeat for ALL InputMap routines.

2.2.5 Apply changes to the program and Save the project before proceeding.



2.3 Tote Lift Logic

2.3.1 Navigate to EM01_ToteLift – T11_LiftHomeSequence

2.3.2 At the bottom of the routine, create a new rung.

2.3.3 Add the following script.

MOV(Home_Stack,servoLift.posStackPerm)MOV(Home_Empty,servoLift.posEmptyPerm)MOV(Home_Full,servoLift.posFullPerm)MOV(Home_Output,servoLift.posOutfeedPerm);

Add the tags to the PLC program with data type REAL

*******This MUST be done while have selected “In Neutral Text”******

2.4 Setting the Lift Conveyor Positions

*******This step requires both MHE and Controls personnel*******

2.4.1 Homing Sequence Setpoints
2.4.2 Use the cabinet key to put the ARSAW into manual mode.
2.4.3 Begin the "Homing" sequence.
2.4.4 When the Lift Conveyor is in the first position, request access and open the door.
2.4.5 Place a level across the top of the rollers on the Lift Conveyor and the Shotgun Conveyor (from the Destacker). The level needs to be half way on each platform to ensure the most accurate reading.
2.4.6 Adjust the homing setpoints as needed until the two platforms are completely level.
2.4.7 Go "Online" with the PLC program.
2.4.8 Monitor Tag "servoToteLift.ActualPosition".
2.4.9 Enter the REAL numerical value into the MOV instruction tag "Home_Stack".
2.4.10 Repeat this process for the remaining 3 positions.
2.4.11 After all values have been added to the logic, return the ARSAW station into "Automatic" mode and monitor.

3 Conclusion

3.1.1 The Empty Tote Infeed Conveyor will be aligned and centered to the Destacker. The drive belts will be better protected from the totes traveling across them.
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3.1.3 The Destacker will have 3 chances to separate the totes prior to generating a fault and requiring RME to engage.
3.1.4 The Lift Conveyor set screws will be secured with thread locker to increase the reliability of the taper lock bushing.
3.1.5 The Home setpoints for the Lift Conveyor will be coded into the PLC rendering the inaccurate toggle switches on the panel obsolete.
3.1.6 Debounce timers will be installed to eliminate erroneous signals interrupting the sequence.
3.1.7 Improvement from Logic changes = 37.02% reduction in faults ($1,039,757.56 cost avoided). Improvement from Logic and Mechanical changes = 50% reduction in faults ($1,405,077.79 potential cost avoided).

4 Future Development

4.1.1 Rails are to be installed on the side of the Full Conveyor to prevent jams.
4.1.2 Rail design will be distributed to the associated facilities once the design has been finalized.
4.1.3 All cables MUST be tied up away from photo eyes.
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