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1. Preparing and Upgrading

- Read the Master MCM completely – reach out if you have any questions
  - https://mcm.amazon.com/cms/MCM-54257100#overview

- Submit a child MCM specific to your site

- Wait for MCM approval

- Check the Master MCM for updates – adjust as needed

- Read this document in its entirety – reach out if you have questions
  - **Make sure you understand g_Par's** – reach out for help if you have questions

- Review plan and expectations with Operations
  - Make sure all parties, Op's, RME, Associates, etc., are informed of the activities
  - There will be a rate reduction for days to weeks as associates adjust to a new rhythm
    - There will be associate frustration when their rates drop
  - There will be maintenance issues needing addressed causing delays in returning machines and potentially extending the planned time

- Plan you upgrades to occur first thing in the morning Monday through Thursday
  - There are limited engineering resources to address issues
  - The limited resources become even more limited on nights and weekends

- Download the PLC code and HMI from the repository noted in the MCM
  - **DO NOT use copies from any other source**

- First Machine - one (1) machine only
  - This must be a machine that can and will run production after the upgrade
  - Backup the PLC
  - Backup the HMI
  - Record all HMI settings
  - Record all g_Par settings
  - Update the PLC and HMI (both are needed)
  - Set all configurations to the values obtained during the backup process
  - Resolve any issues
  - Put machine in production
  - After at least 4 hours of running review performance with the Area Manager
    - Stop and request assistance if there is not alignment on moving forward
    - Allow to run for one complete day (day shift + night shift)
  - After the one day run review performance with the Area Manager and Leadership
    - Stop and request assistance if there is not alignment on moving forward

- AFTER successful first machine - Remaining machines
  - Must be machines that can and will run production after the upgrade
    - DO NOT upgrade down machines unless you are prepared to support issues when they do startup
  - Backup the PLC
  - Backup the HMI
  - Record all HMI settings
  - Record all g_Par settings
  - Update the PLC and HMI (both are needed)
    - Use a copy of the code from the first machine upgraded. Because this version was configured it will likely have the correct configuration for all other machines
  - Resolve any issues
  - Put machine in production
  - After at least 1 hours of running review performance with the Area Manager
    - Stop all upgrades and request assistance if any machine does not meet Op's expectations
    - Only resume updating with agreement from Op's

2. Important Links & Contacts

Master MCM

- https://mcm.amazon.com/cms/MCM-54257100

SmartPac 3 wiki

- https://w.amazon.com/index.php/FCShip/SmartPac

SmartPac 3 gPar setting

- https://w.amazon.com/bin/view/FCShip/SmartPac#g_Par_Definitions_.28Machine_Option_Settings.29

Smartpac 3 code

- https://w.amazon.com/index.php/FCShip/SmartPac#Software_Versions

SmartPac 5 wiki

- https://w.amazon.com/bin/view/FCShip/SmartPac/Version5_x/

SmartPac 5 gPar settings

- https://w.amazon.com/bin/view/FCShip/SmartPac/Version5_x/#Hg_ParDefinitions28MachineOptionSettings29

SmartPac 5 code

- https://w.amazon.com/bin/view/FCShip/SmartPac/Version5_x/#HSoftwareVersions

Contacts:

- Venki – venkitac@amazon.com
- Terin – thoterin@amazon.com
- Brian – bkeilly@amazon.com

3. Before you update

1. Summary of gripper interlock to light curtain change
   - Prevents gripper from closing if light curtain blocked
     - If the light curtain inhibits gripper close for 5 seconds or greater the machine faults

       SP3 Fault: ***1.17 - Gripper Open/Close Cycle Fault***

       SP5 Fault: ***1.24 -Gripper Open/Close Cycle Fault***

   - Prevents **start** of gripper upward movement if light curtain is blocked.
     - This means motion cannot be started. It is not obvious but there are two upward moves. The first from below the bag to under the jaw and the second from under the jaw to the bag grab. Both are independently interlocked to the light curtain

   - Will **stop** the gripper upward motion anytime the light curtain is blocked
     - Gripper motion will resume when the light curtain is unblocked
     - If the light curtain inhibits the griper motion for 10 seconds or greater the machine faults

       SP3 Fault: ***0.8 - Gripper Fault Cycle too long or Servo Not***

       SP5 Fault: ***1.29 -Gripper Servo Fault Movement Overtime***

2. What to expect
   a. SmartPac 3
      - (safety) The tamp is interlocked to the light curtain

        the printer tamp head will stop motion if the light curtain is broken during its motion. Under normal circumstances the tamp will resume operation after the light curtain is unblocked. If the light curtain remains blocked for too long a fault will occur

      - (safety) Jaw interference faults (light curtain blocked during jaw closure or jaw close fault)

        Because these are safety faults a manual reset is required.

      - (safety) Gripper upward and grip finger close interlocked to light curtain

        To prevent hitting an associate during induct the gripper upward motion is stopped and/or the gripper fingers are prevented from closing when the light curtain is interrupted. Under normal circumstances the gripper will resume operation after the light curtain is unblocked. If the light curtain remains blocked for too long a fault will occur

      - Material Types

        The machine now supports multiple material types with specialized configurations for each type

- Gripper advance/retract issues

  Some previous versions of code had the gripper advanced sensors (move right) removed from the code. This is not ideal because the sensor is used to prevent the gripper hitting the jaw. The ideal solution is to repair the sensor. If repairing will substantially delay implementation then g_par.24 may be used to enable an operational mode that does not use the sensor

- Gripper servo issues

  Implementation of 3 bag has surfaced issues with the gripper servo control. To mitigate these issues and standardize operation, and therefore repair, the servo control is more sensitive than it was before. Soft limits are controlled to prevent hitting of hard stops and lower position deviations outside of acceptable limits are detected. More details in the servo section. Be advised that maintenance and/or repair of the gripper drive system may be required to eliminate servo errors.

b. SmartPac 5
- (safety) Gripper upward and grip finger close interlocked to light curtain

    To prevent hitting an associate during induct the gripper upward motion is stopped and/or the gripper fingers are prevented from closing when the light curtain is interrupted. Under normal circumstances the gripper will resume operation after the light curtain is unblocked. If the light curtain remains blocked for too long a fault will occur

- Material Types

    The machine now supports multiple material types with specialized configurations for each type

3. SmartPac 3
   a. **STOP** if your machines had not been upgraded to 3 Bag Monet
4. SmartPac 5
   a. Identify the version of code you are running
      - SmartPac5_v32_SS1b3B11_xxxx_xx_xx
        1. Requires "SmartPac5_v32_GrpFix10" code
      - SmartPac5_v32_AC73bB11_xxxx_xx_xx
        1. Requires "SmartPac5_v32_AC73bB11" code
      - Any other versions
        1. Reach out to Venki, Terin or Brian for direction
5. Run machine for 15 minutes with production associate
   a. Note rate and performance
   b. Correct any maintenance issues found
   c. **STOP** if machine has operational or maintenance issues that cannot be resolved before upgrade
6. Backup current PLC and HMI code
7. Record all current g_par values
   a. Compare current values to the wiki:
      - SmartPac 3
        https://w.amazon.com/bin/view/FCShip/SmartPac#g_Par_Definitions_.28Machine_Option_Settings.29

      - SmartPac 5
        https://w.amazon.com/bin/view/FCShip/SmartPac/Version5_x/#Hg_ParDefinitions28MachineOptionSettings29

   b. Determine your setup
      - SmartPac 3
        1. **note**: g_par.2 downstream interlock - is no longer user controlled and is inverted from previous
        2. **note**: g_par.4 landscape printer - is no longer used

3. **note**: g_par.5 OEE starved - is no longer user controlled and is inverted from previous
4. **note**: g_par.7 allows Slide Tote sensor mode selection
    a. *see section 3. Tote Supply conveyor and Tote Slide sensor setup*
5. **note**: g_par.8 allows Conveyor Tote sensor mode selection
    a. *see section 3. Tote Supply conveyor and Tote Slide sensor setup*
6. **note**: g_par.13 – 17 & g_par.20 – 23 are material type selection (see below)
    a. *see section 4. Material Setup*
7. **note**: g_par.18 selects Ultrasonic version (see below)
    a. *see section 5. Ultrasonic Sensor Setup*
8. **note**: g_par.24 selects use or non-use of gripper advanced sensor (see below)
    a. *see section 6. 1.16 - Gripper Adv/Ret Cycle Fault*

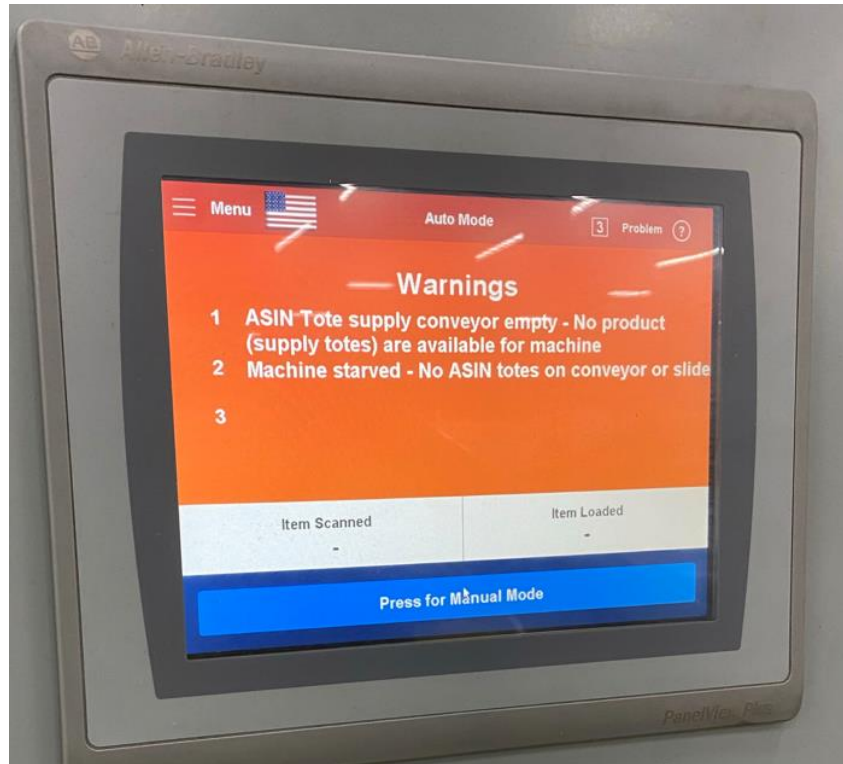- SmartPac 5
    1. **note**: g_par.3 allows Conveyor Tote sensor mode selection
        a. *see section 3. Tote Supply conveyor and Tote Slide sensor setup*
    2. **note**: g_par.4 allows Slide Tote sensor mode selection
        a. *see section 3. Tote Supply conveyor and Tote Slide sensor setup*
    3. **note**: g_par.5 OEE starved - is no longer user controlled
    4. **note**: g_par.7 downstream interlock - is no longer user controlled
    5. **note**: g_par.13 – 17 & g_par.20 – 23 are material type selection (see below)
        a. *see section 4. Material Setup*
    6. **note**: g_par.18 selects Ultrasonic version (see below)
        a. *see section 5. Ultrasonic Sensor Setup*
    7. **note**: g_par.19 Nip roller rotate forward or reverse
        a. ON machines built prior to 2021
        b. OFF machines built in or after 2021

8. Upload the new version of PLC and HMI code
9. Setup the machine specific g_par's
10. Setup the machine specific HMI settings

4. Tote Supply conveyor and Tote Slide sensor setup

4.1. ASIN Tote Supply conveyor empty and/or Machine Starved warnings on HMI

This is likely due to sensors being light activated vs dark activated.

- gPar.7 and gPar.8 allow inverting the sensor if needed.
  https://w.amazon.com/index.php/FCShip/SmartPac#g_Par_Definitions_.28Machine_Option_Settings.29

- Setup Information

  https://w.amazon.com/index.php/FCShip/SmartPac#OEE_Starved_Condition_Definition

5. Material Setup

Check the configuration on the HMI

- only one (1) box should be green
- options are read-only – changes must be made through the PLC as noted further down

5.1. SmartPac 3 HMI – view material settings (read only)

5.2. SmartPac 5 HMI – view material settings (read only)

5.3. PLC g_par's to adjust material type setting

Only the config for the material you are running should be active (ON). Typically, this is g_par_FilmWidth30in as shown in the screen shot below or Poly Film g_par_FilmPoly (g_par.16).

```
16 ─────────────────────────────────────────────────────────────────────
                              spare
                         g_par_FilmSpare3
                           <g_par.21>        ┌─────────────────────────┐
                              ─┤ ├─          │ MOV                     │
                                             │ Source               6  │
                                             │                         │
                                             │ Dest  filmMaterialSelected│
                                             │                      4 ◄ │
                                             └─────────────────────────┘

                              Film XXX
                              spare
                         g_par_FilmSpare4
                           <g_par.22>        ┌─────────────────────────┐
                              ─┤ ├─          │ MOV                     │
                                             │ Source               7  │
                                             │                         │
                                             │ Dest  filmMaterialSelected│
                                             │                      4 ◄ │
                                             └─────────────────────────┘

                              Film XXX
                              spare
                         g_par_FilmSpare5
                           <g_par.23>        ┌─────────────────────────┐
                              ─┤ ├─          │ MOV                     │
                                             │ Source               8  │
                                             │                         │
                                             │ Dest  filmMaterialSelected│
                                             │                      4 ◄ │
                                             └─────────────────────────┘
```
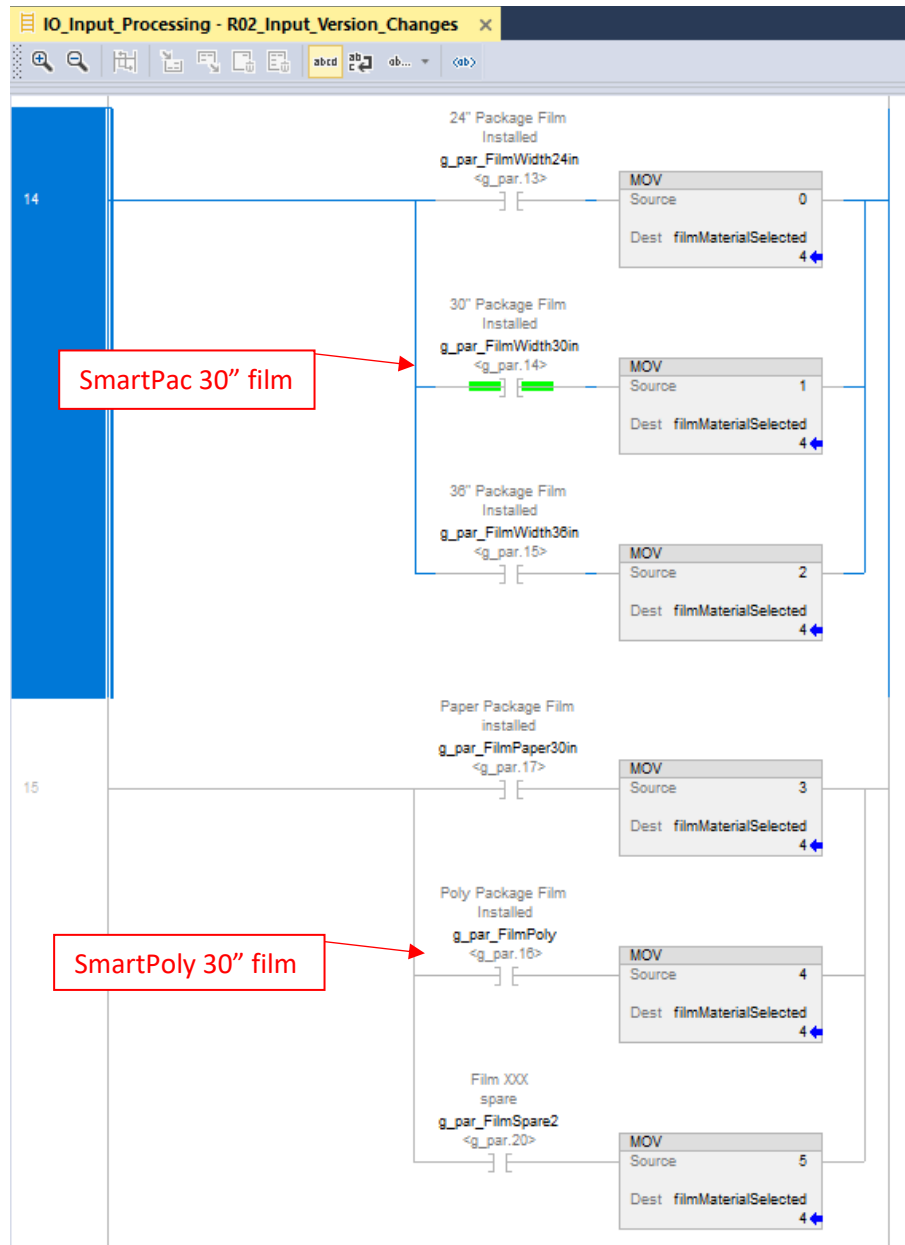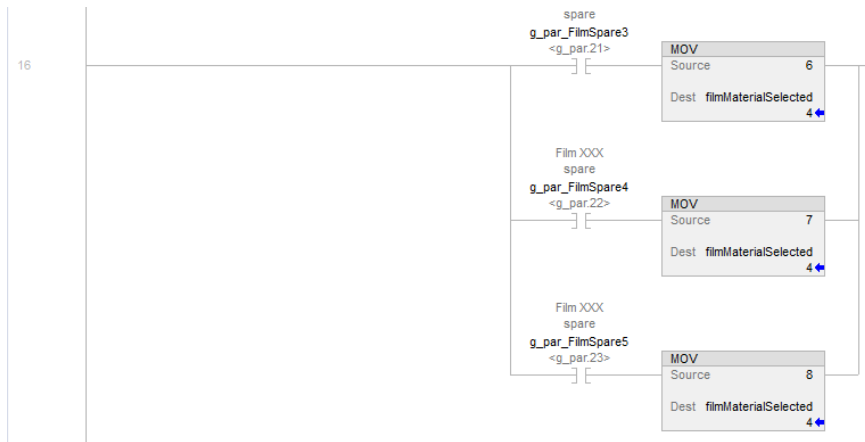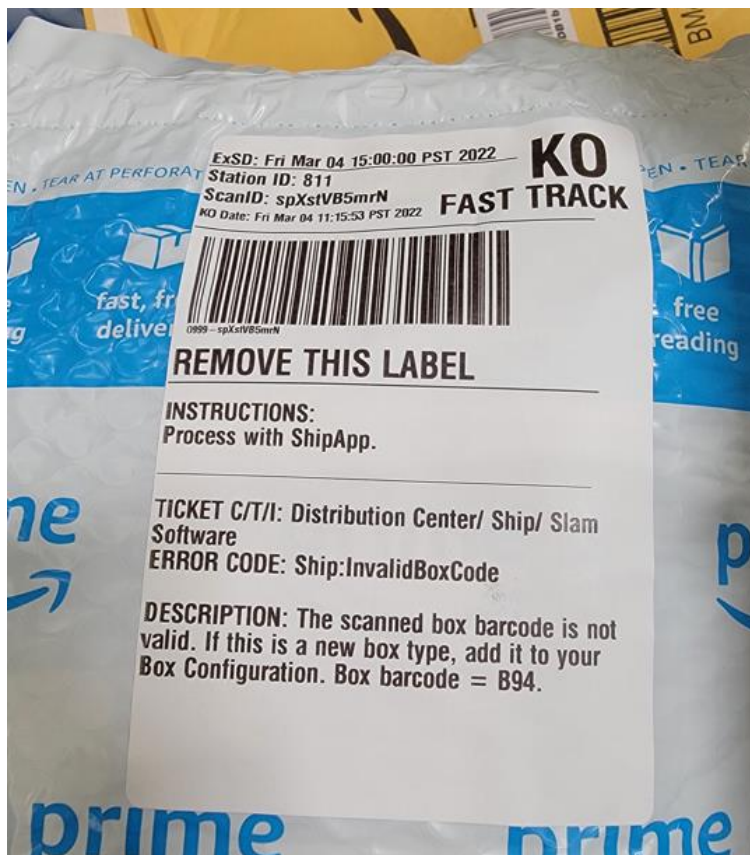
5.4. Kickout "The scanned box barcode is not valid"

The following kick out can occur if the material type is not properly setup

6. Ultrasonic Sensor Setup

6.1.   I/O Link version

6.1.1. Item Too Large Warning

6.1.2. Frequent Flush for tall packages

- Visually verify ultrasonic sensor version – sensors are under cover above induct pocket
- Set g_par.18 to match the sensor version
    - IO Link 1.0
        - If sensor model numbers are Pico+25/WK/F, Pico+35/WK/F
        - g_par.18 ON (1)
    - IO Link 1.1
        - If sensor model numbers are Pico+25/WK/F/A or Pico+25/F/A; Pico+35/WK/F/A or Pico+35/F/A
        - g_par.18 OFF (0)

See section 5.2 for SmartPac 3.x machines and section 5.3 for SmartPac 5.3 machines

6.2. Ultrasonic sensor version (for 3.x machines)

Toggle the g_par bit to indicate the IO Link version of ultrasonic sensor installed on the machine (g_par.18)

IO Link version 1.0 – Pico+25/WK/F, Pico+35/WK/F
IO Link version 1.1 – Pico+25/WK/F/A, Pico+35/WK/F/A

Front sensor model number (close to operator) : Pico+25/WK/F   Rear sensor model number (away from operator): Pico+35/WK/F   -   IO Link version 1.0 **(g_par.18 ON)**

Front sensor model number (close to operator): Pico+25/WK/F/A   Rear sensor model number (away from operator): Pico+35/WK/F/A – IO Link version 1.1 **(g_par.18 OFF)**

Note sensors have to be either both IO Link version 1.0 or both IO Link version 1.1.

## 6.3. Ultrasonic sensor version (for 5.3 machines)

5.3 machines should be running IO Link version 1.1 sensors.

- IO Link version 1.1 **(g_par.18 OFF)**
- Front sensor model number (close to operator): Pico+25/WK/F/A or Pico+25/F/A
- Rear sensor model number (away from operator): Pico+35/WK/F/A or Pico+35/F/A

7. 1.16 - Gripper Adv/Ret Cycle Fault

- Indicates the gripper advance (move to right) cylinder advance reed switch is not working
- It is suggested that this sensor be repaired
- If you choose not to repair the sensor, enable g_par.24

8. HMI not showing data after update
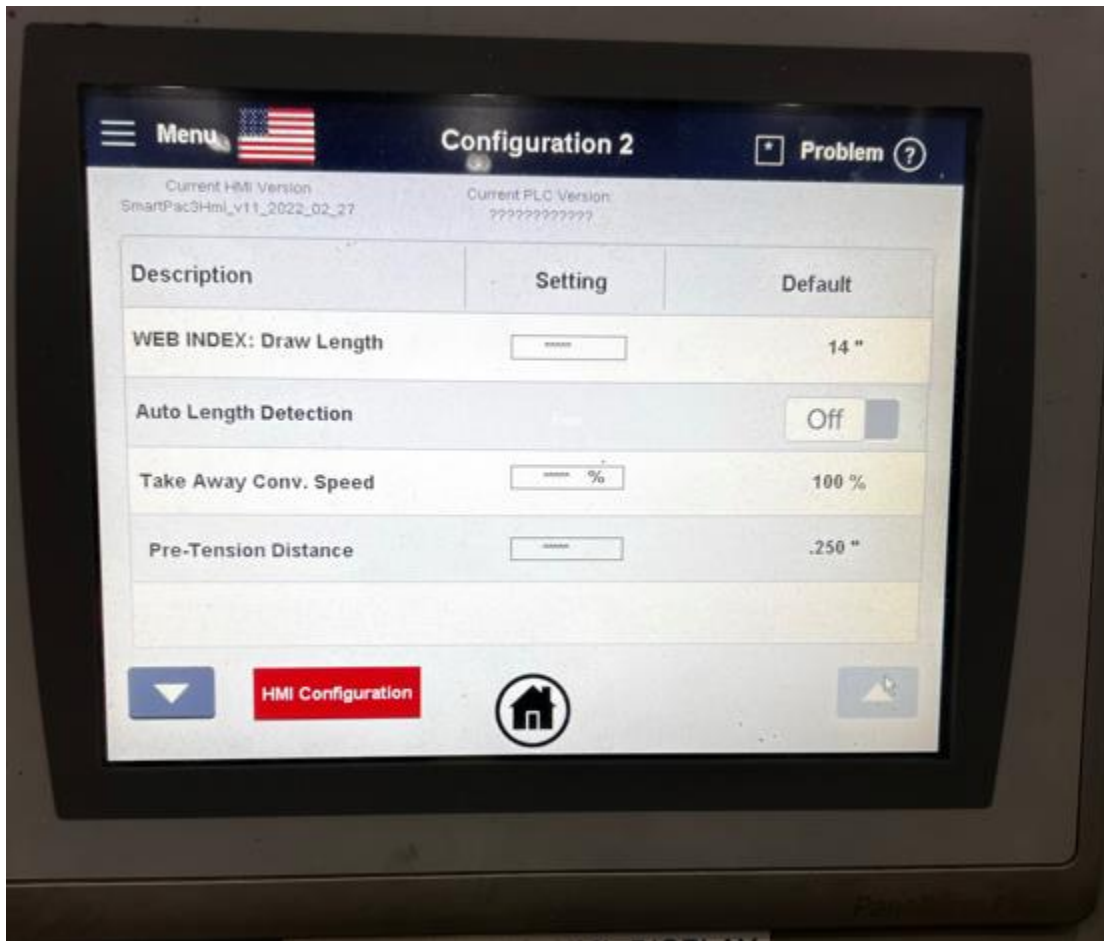
Update HMI firmware

https://drive.corp.amazon.com/folders/SmartPac/Code%20Repository/02_HMI%20Code/SmartPac%203.x/firmware

9. SmartPac 3 Gripper Servo errors

9.1. Overview

- The gripper maximum up position and down position are detected by resistance (this has always been the functionality). The gripper moves up until it hits the physical limit, as detected by current. The same process is used for the maximum lower position
- The soft limits are set 0.15" inside the maximum up and maximum down position
  - Because of this, lash or excess resistance in the gripper drive system can cause the servo to overshoot tripping a limit
- The gripper position is being more rigidly checked to ensure consist 3 bag sizes and to correct problems found in the field
  - Gripper not dropping low enough and tearing long bags
  - Gripper not dropping low enough and causing tall items to be crushed in the jaw
  - Gripper hitting the jaw
  - Gripper hitting hard stops

9.2. Troubleshooting - Do this first!

- Set pre-tension to zero (0) – this is a temporary change to identify if pre-tension is pulling the gripper mechanicals out of alignment with the servo position which indicates excessive lash in the mechanical system.
- If setting pre-tension to zero (0) resolves your issues it indicates too much lash in the gripper drive mechanism.

9.3. 0.8 - Gripper Fault Cycle too long or Servo Not Ready - Press Reset - Call Maintenance if Recurring

- For first occurrence press the e-stop under the HMI and then retry
- If the problem is repetitive it is typically occurs because the gripper failed to find the home sensor

9.4. 1.4 - Gripper Servo Axis Fault - Press Reset - Call Maintenance if Recurring ECode 16

- Typically this is due to mechanical issues in the gripper drive.
  - Ensure all gripper components are tightly affixed
  - Ensure gripper belt tension is correct
  - Ensure gripper motion is smooth with low resistance from top to bottom
  - Ensure gripper home and overtravel sensors are firm and triggering properly

9.5. 1.5 - Gripper Servo Down Position Limit Incorrect - Rehome Gripper - Call Maintenance if Recurring

- Typically caused by something obstructing detection of the lower limit
    - Check for packages and/or package material prevent the gripper from going all the way down to the mechanical limit
    - Check for mechanical issue preventing the gripper from going all the way down to the mechanical limit
    - Check for mechanical resistance near the mechanical limit