ARNOLD AUTOMATION

Fabricated Extrusion Company

Extrusion Handling System

User’s Manual

Contents

INTRODUCTION

Overview

This system is an automated material handling system. It is designed to receive an extrusion, hole punch it, and count the correct number for a human operator to package. This system holds about 30 minutes of organized, punched extrusions before operator intervention is needed to package product.

The system is made up of three subassemblies: the transfer system (Figure 1), the hole punch (Figure 2), and the hopper and conveyor assembly (Figure 3). The transfer system receives the extrusion from an upstream cutter, orients it properly, and inserts it into the punch. If the extrusion is not easily fed into the punch, due to bow or other deformity, the transfer system will reject it for an operator to manually punch. The hole punch system completes the insertion of the extrusion into the hole punch and actuates the punch. It then drives the extrusion out of the hole punch and into the hopper. The hopper and conveyor system collects 30 extrusions and indexes such that an operator can package boxes of extrusions while the system continues to run.

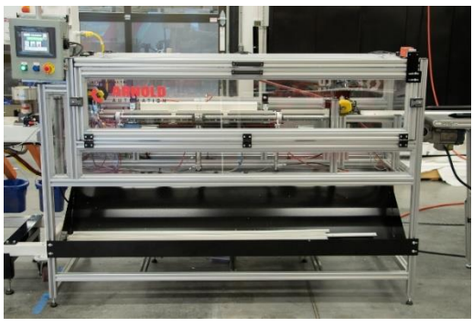


Figure 1: Transfer System

Figure 1: Hole Punch Assembly

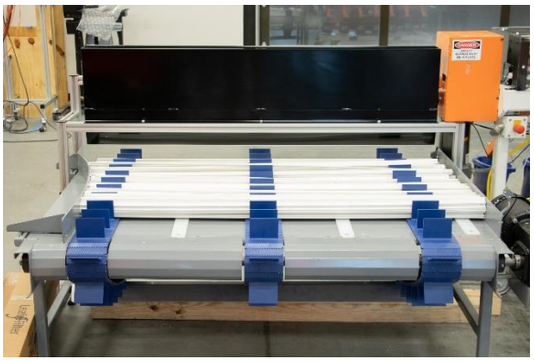


Figure 3: Hopper and Conveyor Assembly

Safety

There are 4 emergency stop (e-stop) buttons located on the system: one on the punch, one on the punch control box, one on the HMI box (Figure 4), and one on the main control box (Figure 5). Any of these e-stops will stop the entire system. The transfer system has one safety door lock located between the main side door and top maintenance door.

Figure 2: Emergency Stop Locations – Front

Figure 3: Emergency Stop Location - Back

MATERIAL HANDLING SYSTEM

Machine Start-Up

To start up machine, turn on power switch on main control box. Once HMI is active, it will prompt operator to push buttons in the correct sequence. The sequence is as follows:

- Release emergency stop on HMI box
- Press blue “E-Stop Reset” button
- Press green “Power On” button
- Turn on power switch on punch control box
- Press red “Reset” button on punch control box
    - Ensure the button is glowing red. If it is not, press again
- Press the “Home” button on HMI screen
    - “System Homing” banner will flash
- Machine is ready to run when “System Ready” banner is displayed on HMI
- Press “Start” button on HMI screen to start machine

Manual System Operation

To use the machine to manually punch pre-cut extrusions, first ensure that the machine is not running and is homed. To do this, press the red “Stop” button on the HMI screen. If the flashing banner displays the warning “Machine Not Homed,” press the “Home System” button on the HMI. Once the flashing banner displays the message “System Ready,” you are ready to begin setting up for manual mode.

To set the machine into manual mode, navigate to the “Manual Insert” screen on the HMI. Tap the “Manual Insert Mode” toggle switch to the “On” position. Tap the “Interlocks” toggle switch to the “Unlock” position. You will now be able to open the door. Open the door all the way so the yellow buttons (Figure 6) are accessible. Place extrusion in the guide channel, the extrusion should fit snuggly in the channel such that it can only move in the direction of the channel. If this is not the case, the extrusion may be placed incorrectly or may be too warped to be inserted into the punch. Once the extrusion is placed correctly, hold both yellow buttons simultaneously until the extrusion is fully inserted into the punch. Please note, the system will not run if both buttons are not fully pressed. Once the extrusion has been punched and driven out of the hole punch, you are free to run the next extrusion through.

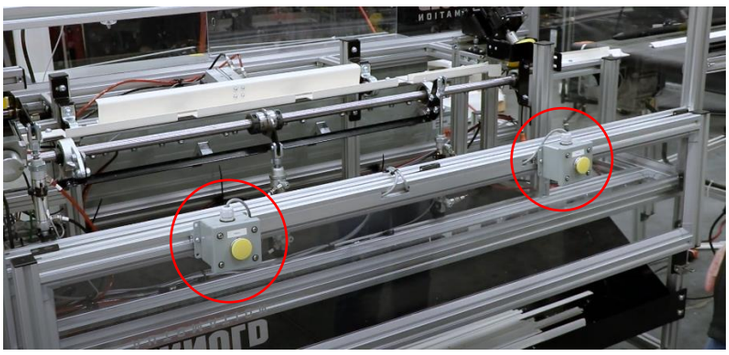


Figure 4: Manual Mode Buttons

To exit manual mode, first ensure there are no extrusions left in the hole punch or guide channel. Close the door and ensure the safety lock is pushed in completely. Tap the “Manual Insert Mode” toggle switch to the “Off” position. Tap the “Interlocks” toggle switch to the “Lock” position. Navigate back to main HMI screen. Press the “Home” button on HMI screen, “System Homing” banner will flash. Machine is ready to run when “System Ready” banner is displayed on HMI. Press “Start” to start machine.

Machine Fault Reset

To recover the machine from a fault, you may first need to remove any jammed extrusions. To do this, navigate to the “Manual Insert” screen on the HMI. Tap the “Interlocks” toggle button to the “Unlock” position. You will now be able to open the door to access the machine. Remove any jammed extrusions. Close the door and ensure the safety lock is pushed in completely. Switch the toggle button back to “Lock” position. Navigate back to main HMI screen.

Press “Fault Reset” button in upper righthand corner of HMI screen. Press the “Home” button on HMI screen, “System Homing” banner will flash. Machine is ready to run when “System Ready” banner is displayed on HMI. Press “Start” to start machine.

Emergency Stop Reset

To reset machine after an emergency stop button has been pressed, twist to disengage emergency stop button. On HMI box, press blue “E-Stop Reset” button followed by green “Power On” button. Press the “Home” button on HMI screen, “System Homing” banner will flash. Machine is ready to run when “System Ready” banner is displayed on HMI. Press “Start” to start machine.

Adjusting Third Drive

The third drive, locate on the hole punch assembly, may need to be adjusted if the extrusions are not being inducted fully into the hole punch or if the extrusions are not being correctly pushed out of the hole punch. This will need to be adjusted for one of two reasons, too much pressure or not enough pressure. In both cases, you will first need to remove the bottom polycarbonate cover to access the pneumatic actuator controlling the motor and wheel positioning. To do this, remove the bolts holding the cover to the black metal frame, there are two visible and two on the underside. Once the actuator is

accessible, unlatch the clevis pin to detach the rod end from the bracket. Be cautious as once the pin is removed, the actuator will swing downward and the motor bracket will move slightly out.

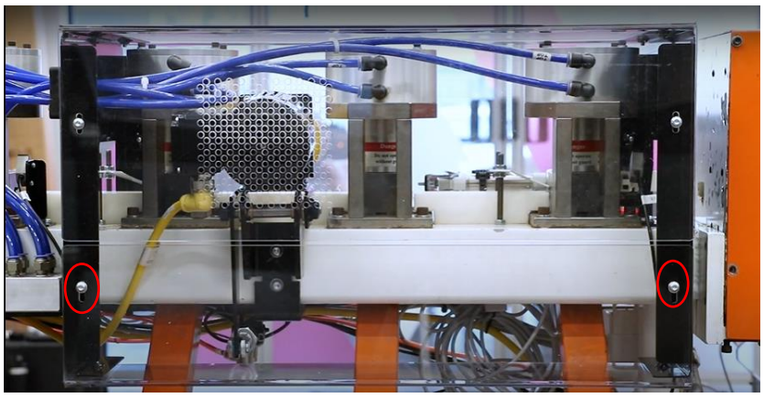


Figure 5: Drive 3 Actuator Enclosure

To increase wheel pressure on the extrusion, rotate the clevis counter-clockwise on the piston rod threads, such that the clevis is moving away from the body of the cylinder. Note that the clevis should never be adjusted to have fewer than 3 full threads engaged with the piston rod. To decrease wheel pressure, rotate the clevis in the opposite direction. Please note the piston rod can rotate, ensure you are turning the clevis on the threads, and not just turning the piston. Replace and lock the pin to finish.

Adjusting Pull-In Drive

The pull-in drive may need to be adjusted if the extrusions are not being inducted into the machine correctly. An example of this is if the extrusions are moving slowly into the machine as this indicates the wheel is not applying adequate pressure. To add more pressure, you will need to lower the motor. To do so, loosen the 2 nuts on the underside of the pull-in motor leveling plate (Figure 7). Ensure these nuts are being adjusted evenly. Now that the plate has lowered slightly, tighten the nuts on top of the plate. Test the pull-in motor to see if the adjustment was enough. Be cautious to make only small adjustments, never allowing the wheel to make contact with the plastic block below. Damage to both the wheel and the block are likely if they come in contact while the motor is running.

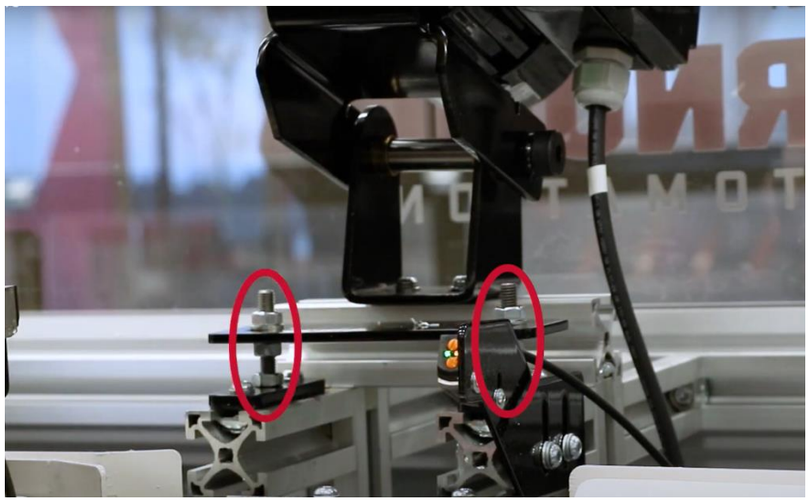


Figure 6: Pull-in Motor Leveling Plate

If the motor is adjusted such that the wheel is in contact with the plastic block below it or the extrusion is unable to fit between the wheel and the block, you will need to raise the motor. To raise the motor, loosen the 2 nuts on top of the pull-in motor leveling plate. Ensure these nuts are being adjusted evenly. Hold the plate up to these nuts and tighten the nuts on the underside of the plate. Test the pull-in motor to see if the adjustment was enough. Be cautious to make only small adjustments as an overcorrection can cause the wheel to apply too little pressure or miss contact with the extrusion entirely.

Disconnecting Hopper and Punch

The system can be broken down into three subsystems to be moved or stored, the hopper and conveyor assembly, the punch assembly, and the transfer system. First, the hopper and conveyor assembly must be disconnected from the punch. To do so, disconnect the power sources from the conveyor motor and two photo eyes and remove the cable mount from the frame. Disconnect the airlines from the actuator

that controls the hopper trap door as well as the actuator position sensor. Untwist the cable anchor to free the airlines and sensor cable from the frame (Figure 9).

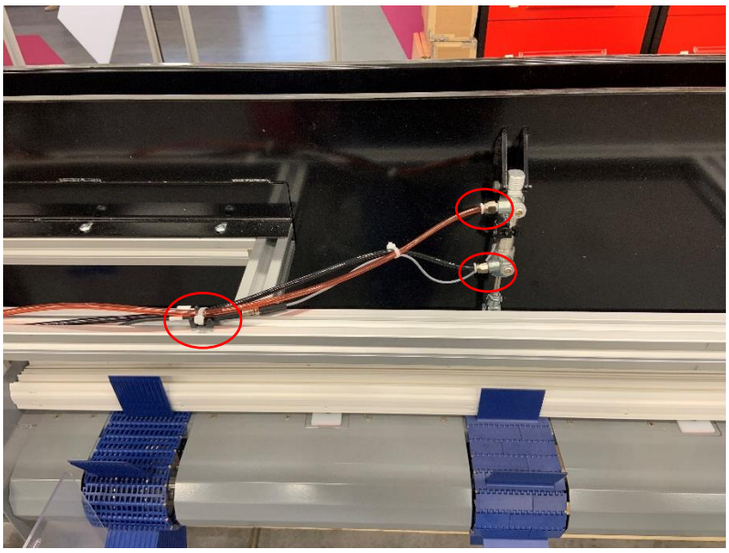


Figure 7: Hopper Trap Door Actuator

Using the two 70-inch long 4x4s placed under the support bars of the conveyor (Figure 10), use a forklift or two pallet jacks to slide the hopper and conveyor assembly away from the punch. Before lifting, ensure beams are extending past the conveyor legs on both sides to avoid tipping. To avoid interference, slide the assembly away from the punch in the same orientation until all components are clear.

Figure 8: Conveyor Lift

To reassemble, follow the steps in reverse order. When replacing the hopper and conveyor assembly, use the corner bracket to locate the assembly correctly to the punch. The assembly is correctly located when the exit opening on the orange box is lined up with the entry opening on the hopper.

Disconnecting Transfer System and Punch

After removing the hopper and conveyor assembly, it is possible to disconnect the transfer system and punch. Locate the pneumatic manifold on the back of the machine. Remove airlines labeled 3, 6, and 7. These are push to connect fittings, push the orange ring in and pull the air tube out. Remove the three power sources: the yellow cable from the punch control box (Figure 11), the black cable on the front of the punch (Figure 12), and the yellow cable on the drive 3 motor (Figure 13). Detach the punch from the transfer system by undoing the two latches located between them.

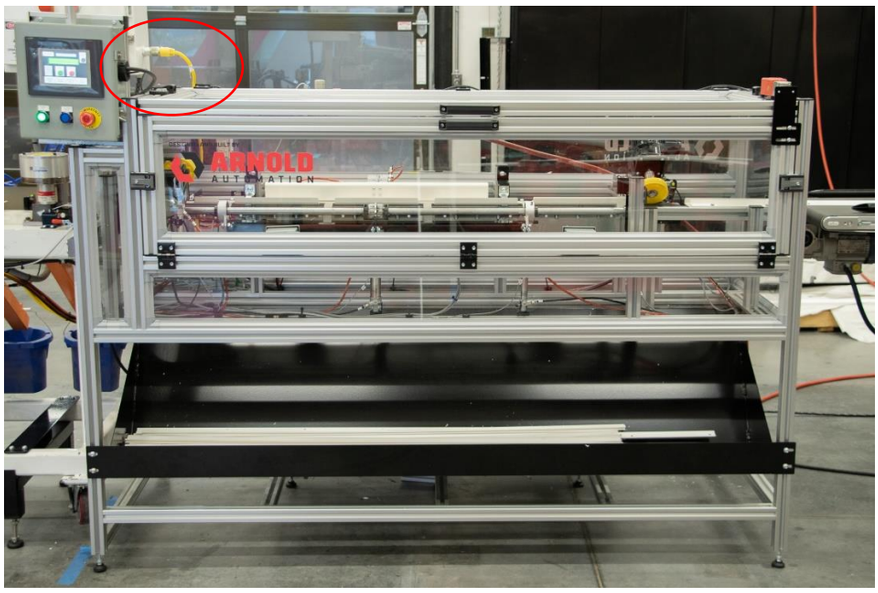


Figure 9: Control Box Power Cable

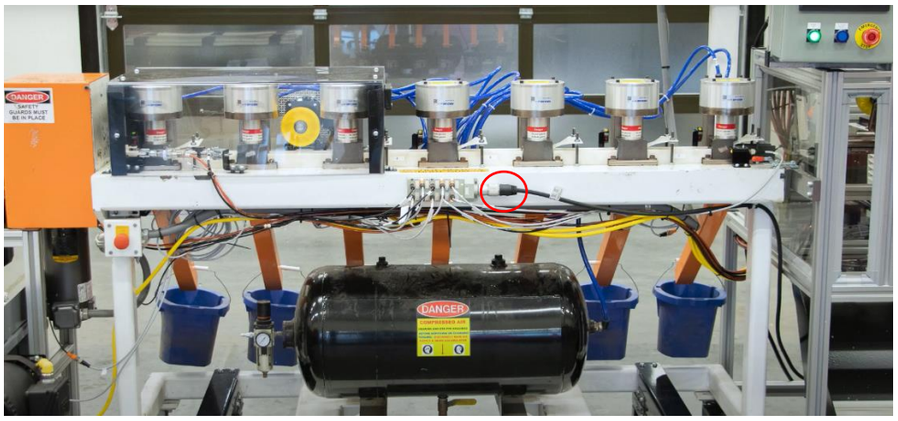


Figure 10: Punch Power Cable

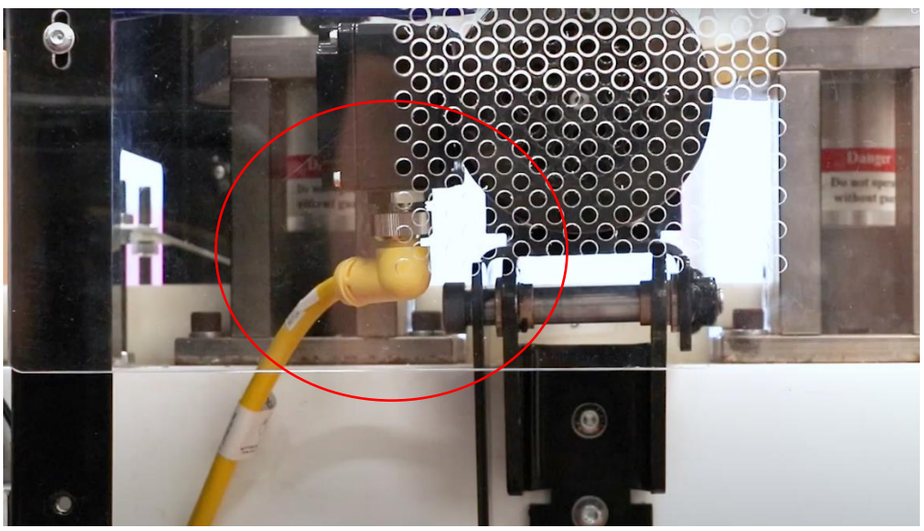


Figure 11: Drive 3 Motor Cable

Using a pallet jack or forklift, slightly lift the punch. Once the punch is elevated, remove the yellow pin from the legs (Figure 12) and fold the legs up into the punch frame. Replace the yellow pin such that it rests on the punch frame and keeps the legs folded. Pull the punch away in a straight line for the first few inches to avoid any interference.

Figure 12: Punch Legs

To reassemble, follow the steps in reverse order. When reconnecting the punch and transfer system, ensure the locating pins on the punch are properly aligned with the locating holes on the transfer system – including the height. Fully engage the latches, then release the punch legs and use the leveling feet to take the weight of the punch off of the forklift or pallet jack.

Example of Normal Sequence

The function of this system begins at the end of the existing extruder and cutting mechanism. The normal sequence is as follows:

- The exit conveyor located after the cutting mechanism feeds and extrusion of length 60in into the entry funnel and guide
- Pull-in wheel makes contact with the extrusion and drives it into the receiving rail
- Once the full extrusion is resting in the receiving rail, the receiving rail rotates down so the extrusion is sitting on top of the four transfer fingers
- Slide table extends to push extrusion down transfer fingers
- Transfer fingers rotate down and slide table retracts, extrusion falls into place in guide channel
- Punch drive wheel lowers to contact extrusion in channel
- Extrusion is driven into punch
    - If extrusion gets jammed during insertion, it is pulled back out and guide channel drops to reject it. System resets to receive next extrusion
- Third drive lowers to make contact with extrusion to fully insert it into punch. Third drive lifts once extrusion is in contact with hard stop
- Hole punch is triggered
- Hard stop is retracted
- Third drive lowers and drives extrusion until it makes contact with existing punch exit wheel
- Punch exit wheel pushes extrusion into hopper
- Hopper drops extrusions into conveyor, conveyor indexes after 30 extrusions

Regular Maintenance

Component	Description	Frequency
Wipe down/blow out	Clear plastic build-up inside machine enclosure, around punch blocks, inside drive 3 enclosure	Daily
Wheels	Check wear and pressure	Weekly
Belt Tension	Check for correct tension. Belt should flex somewhat easily under pressure to ±3/8”, and then become noticeably more difficult to deflect. See Figure 13.	Monthly
Drain filter bowl	Visual Inspection, drain	Monthly
Grease bearings	Grease two bearings on rotating shaft in transfer system	Quarterly
Check for pneumatic leaks	Manually actuate each cylinder to check for leaks	Quarterly
Sensor bolts	Ensure all bolts on sensors and sensor mounting brackets are tight	Quarterly
Conveyor bearings	Check and grease bearings on conveyor shaft	Quarterly
Locking switch functionality	Ensure switch is locking properly	Semi-Annual
Drive motor pivot bushings	Check for play in drive motor pivot bushings – all three drive motors	Semi-Annual

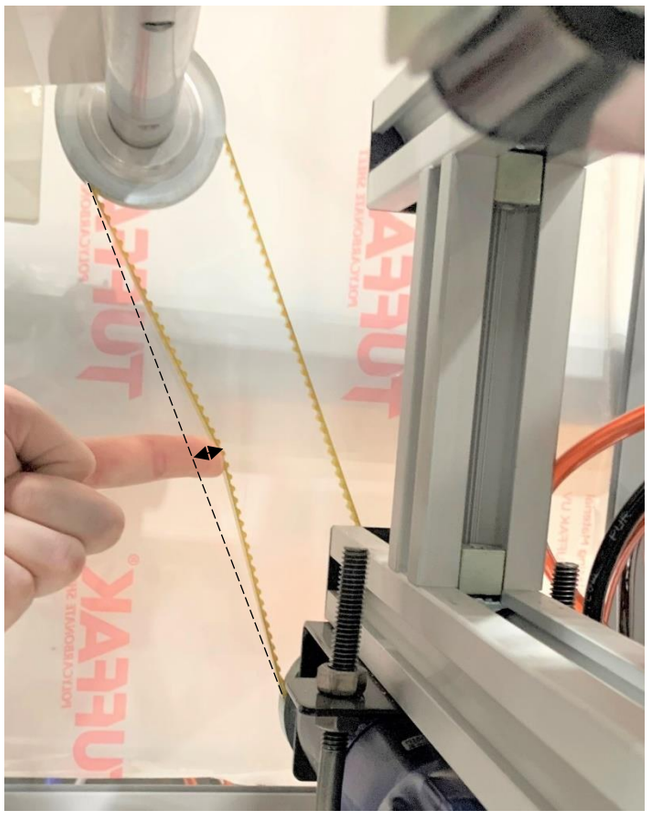


Figure 13: Belt Tension Metric

HUMAN MACHINE INTERFACE (HMI)

The C-More operator interface is the main method for the operator to interact with the machine controls. The device allows the operator to start and stop all machine functions. The display will also show WARNING and FAULT conditions. The interface will display running conditions of the machine. Overall machine status is available for the operator's information. Important machine software file identifications are also available to the operator.

This device is suitable for the industrial environment, however, it is meant only to be touched with fingers – **DO NOT USE POINTED OR HARD DEVICES TO OPERATE THE TOUCH SCREEN.**

The following figures and descriptions will describe all of the screens that may be presented to the operator.

Certain screens will be displayed automatically depending on machine status. Others will be available on operator request. Some screens are not accessible during certain portions of machine operation. These display conditions will be explained in the following screen descriptions.

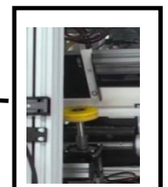
The following typical icons are used throughout all of the screens developed for the C-MORE HMI. The word "icon" will appear throughout this manual. Icon refers to any visual object that is displayed on the HMI (human machine interface) screen. Icons used to move to different screens (screen navigation icons are located at the BOTTOM of every screen.

Before beginning discussions of HMI (Human Machine Interface – C-More Operator Interface), review the equipment locations on the following page. Understanding where things are will improve the understanding of the HMI operation.

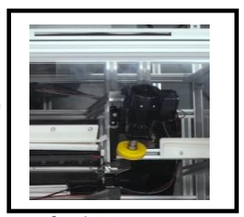
Hopper

Punch

Transfer Unit

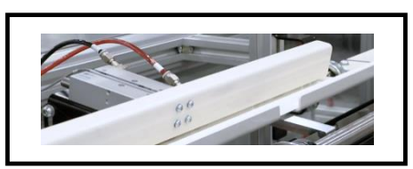


Middle Motor Assembly



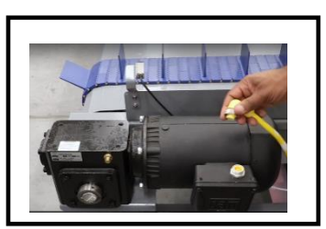
Infeed Drive Assembly

Locking limit Switch

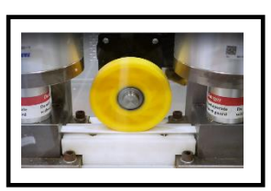


Transfer table Assembly

Guide Finger Actuator

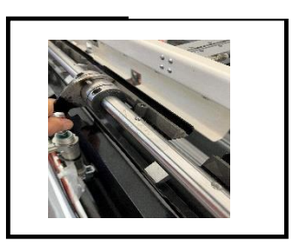


14 Transfer Conveyor Drive



OutfeedDrive Assembly

HMI - Stacklight



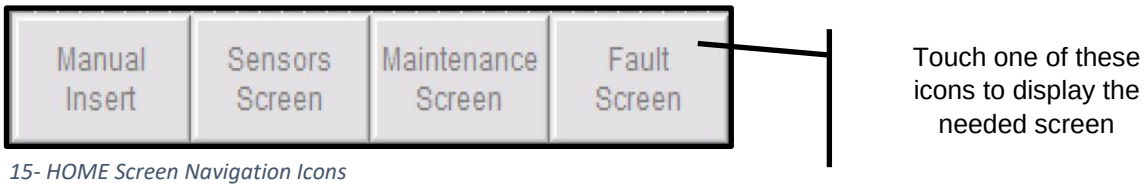
Receiving Rail Actuator

Equipment Locations

Typical Icon Sequence

Screen Navigation Icons

Screen navigation Icons are used to move to different screens are as shown in the example below:



15- HOME Screen Navigation Icons

These are the screen navigation icons available on the HOME Screen. They appear at the bottom of the screen. By touching one of the icons, the operator is able to access the needed screen (see the screen map following for details on avalable screens

16- MAINTENANCE Screen navigation icons

Once the operator moves to the MAINTENANCE Screen, the navigaion icons will appear as above. These also appear at the bottom of the screen. The GREEN background indicates the current screen being viewed.

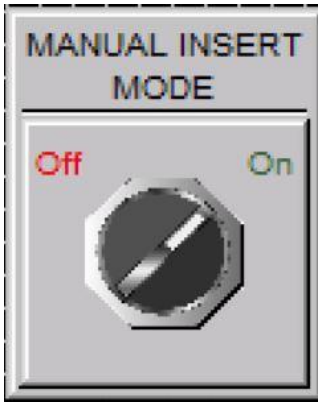
Pushbutton Icons

18-Pushbutton in Normal state

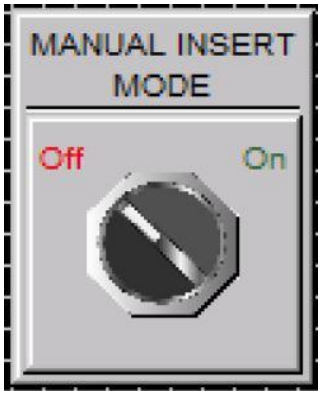
17-Pushbutton in Pressed state

Pushbutton icons appear as pushbutton operators with labels designating the function of the icon. Normally, the icon will have two states: the 'normal state' and the 'pressed state' which will allow the operator to verify operation of the icon.

Selector Switch Icons



20-Selector Switch ON



19-Selector switch OFF

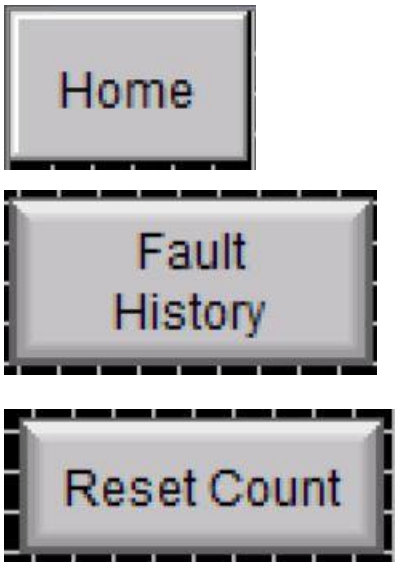
Selector Switch icons appear as selector switch operators with labels designating their function. The selector switch icon will have one of two functions as shown at the right.

Slide Switch

21-Slide Switch

The Slide switch operates by touching the central region of the icon and sliding the finger either left or right to move to the state indicated.

Miscellaneous Pushbutton icons



Several screens contain pushbutton icons that `appear as shown at the left. These are used to provide non-essential machine controls (screen changes, etc.)

22- Miscellaneous pushbutton icons

Message Display icons

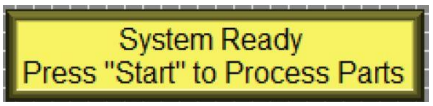
Message Display icons require no operator action. They are meant to provided pertinent information on the machine process, and guidance to operator activity. Shown below is the Home Screen Message Display Icon. Notice the ELEVEN different states that will be indicated automatically by machine logic through this same icon.

When the EMERGENCY STOP pushbutton on the main control panel has been pressed, this message will appear in the message display.

Once the E-STOP button has been reset, this message will advise the operator of the next step to be taken.

Depending on the system condition, it may be necessary to HOME the equipment before proceeding in start-up. This display screen advises the operator.

This message display lets the operator know the machine is responding to the request.



The message display indicates the machine is ready and advises how to proceed.

This message display will appear when the system has been successfully started

Should the operator be operating the machine manually, the message display will indicate the next step to return to AUTOMATIC operation.

This will be displayed on the message display when the operator is manually inserting an extrusion for punching

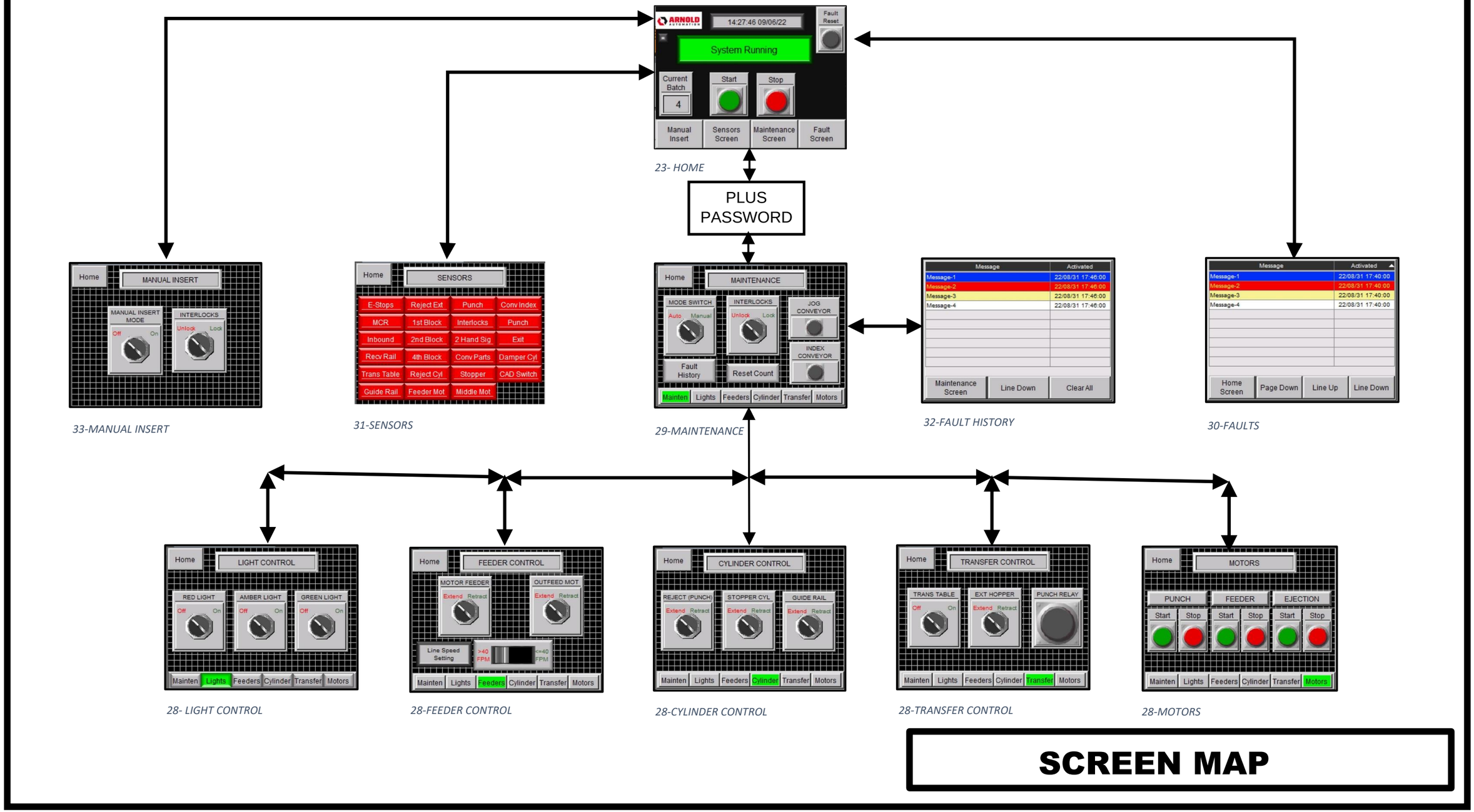
This message display alerts the operator to an unlocked access door.

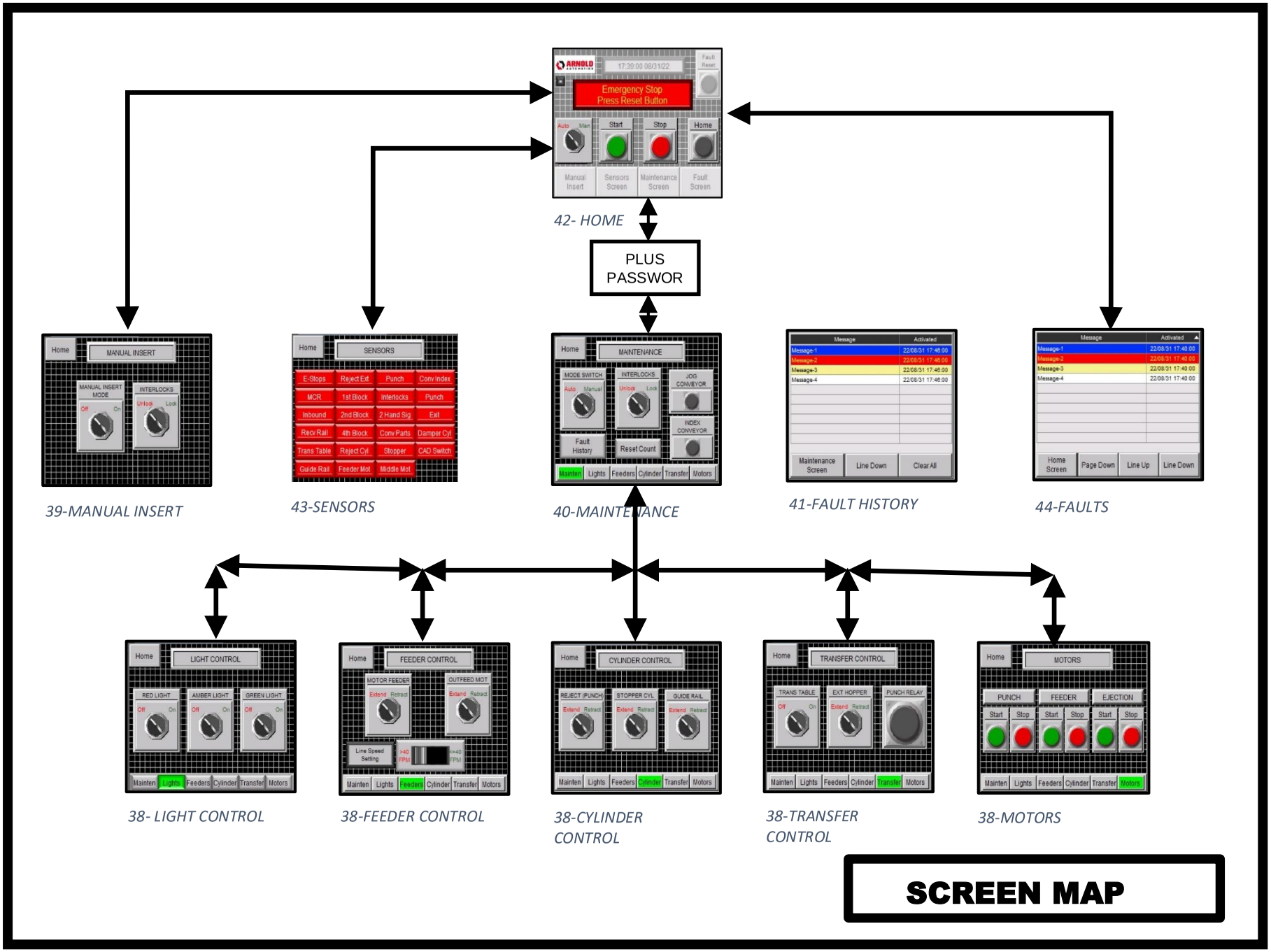
When a machine fault is active, this message display will be shown

When the punch Emergency Stop button has been depressed, this message will display to notify the operator

Screen Map

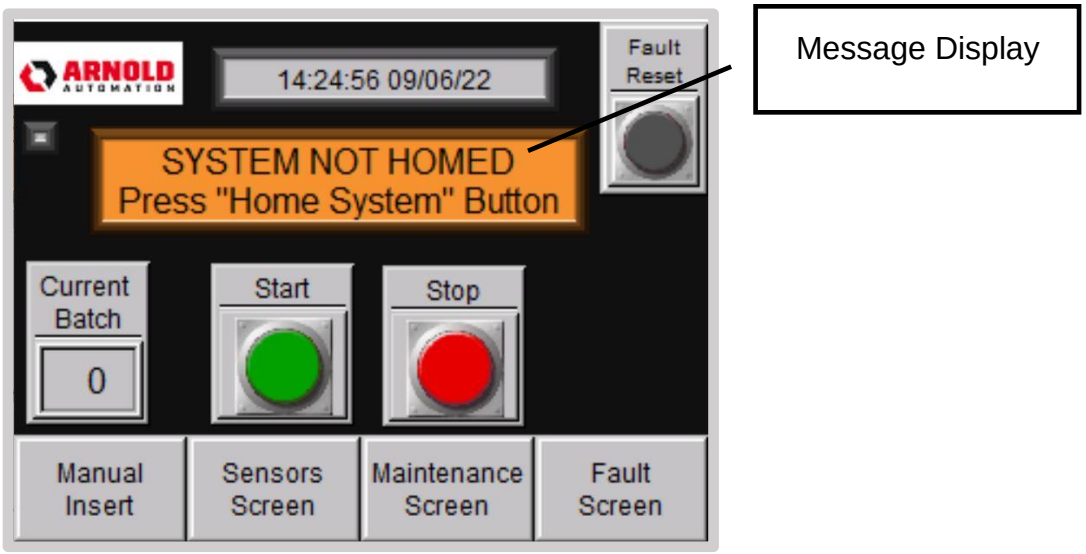
The following page will provide the Screen Map for this project. It provides the operator with directions for moving between the various screens, including those 'paths' which will require security to enter.


ARNOLD AUTOMATION
14:27:46 09/06/22
Fault Reset
System Running
Current Batch
4
Start
Stop
Manual Insert
Sensors Screen
Maintenance Screen
Fault Screen
23- HOME
PLUS PASSWORD
Home
MANUAL INSERT
MANUAL INSERT MODE
Off
On
INTERLOCKS
Unlock
Lock
33-MANUAL INSERT
Home
SENSORS
E-Stops
Reject Ext
Punch
Conv Index
MCR
1st Block
Interlocks
Punch
Inbound
2nd Block
2 Hand Sig
Exit
Recv Rail
4th Block
Conv Parts
Damper Cyl
Trans Table
Reject Cyl
Stopper
CAD Switch
Guide Rail
Feeder Mot
Middle Mot
31-SENSORS
Home
MAINTENANCE
MODE SWITCH
Auto
Manual
INTERLOCKS
Unlock
Lock
JOG CONVEYOR
INDEX CONVEYOR
Fault History
Reset Count
Mainten
Lights
Feeders
Cylinder
Transfer
Motors
29-MAINTENANCE
Message
Activated
Message-1
22/08/31 17:46:00
Message-2
22/08/31 17:46:00
Message-3
22/08/31 17:46:00
Message-4
22/08/31 17:46:00
Maintenance Screen
Line Down
Clear All
32-FAULT HISTORY
Message
Activated
Message-1
22/08/31 17:40:00
Message-2
22/08/31 17:40:00
Message-3
22/08/31 17:40:00
Message-4
22/08/31 17:40:00
Home Screen
Page Down
Line Up
Line Down
30-FAULTS
Home
LIGHT CONTROL
RED LIGHT
AMBER LIGHT
GREEN LIGHT
Off
On
Mainten
Lights
Feeders
Cylinder
Transfer
Motors
28- LIGHT CONTROL
Home
FEEDER CONTROL
MOTOR FEEDER
OUTFEED MOT
Extend
Retract
Line Speed Setting
>40 FPM
<=40 FPM
Mainten
Lights
Feeders
Cylinder
Transfer
Motors
28-FEEDER CONTROL
Home
CYLINDER CONTROL
REJECT (PUNCH)
STOPPER CYL
GUIDE RAIL
Extend
Retract
Mainten
Lights
Feeders
Cylinder
Transfer
Motors
28-CYLINDER CONTROL
Home
TRANSFER CONTROL
TRANS TABLE
EXT HOPPER
PUNCH RELAY
Off
On
Extend
Retract
Mainten
Lights
Feeders
Cylinder
Transfer
Motors
28-TRANSFER CONTROL
Home
MOTORS
PUNCH
FEEDER
EJECTION
Start
Stop
Mainten
Lights
Feeders
Cylinder
Transfer
Motors
28-MOTORS
SCREEN MAP


Emergency Stop
Press Reset Button
Start
Stop
Home
Manual Insert
Sensors Screen
Maintenance Screen
Fault Screen
42- HOME
PLUS
PASSWOR
MANUAL INSERT
39-MANUAL INSERT
SENSORS
43-SENSORS
MAINTENANCE
40-MAINTENANCE
41-FAULT HISTORY
44-FAULTS
LIGHT CONTROL
38- LIGHT CONTROL
FEEDER CONTROL
38-FEEDER CONTROL
CYLINDER CONTROL
38-CYLINDER CONTROL
TRANSFER CONTROL
38-TRANSFER CONTROL
MOTORS
38-MOTORS
SCREEN MAP

Initial Power Up – Screen Navigation

Upon initial power up, after both the PLC and the HMI have finished their self-test routines, the following screen will be displayed. It will be necessary to reset all Emergency Stop pushbuttons that may be pressed, and to initiate control power by pressing the "Control Power On" Pushbutton.



45- The Home Screen - Start up

This screen will provide the operator with all of the functions necessary to run the machine.

Machine Safety

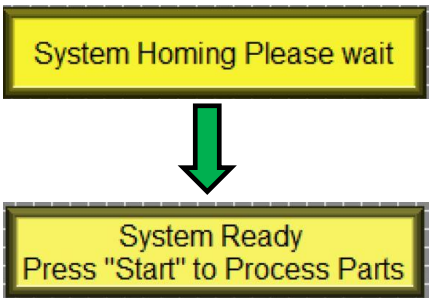
Before continuing, a brief description of the Machine Safety included on this machine is provided. Four (4) Emergency Stop stations are provided: one at the load end, one at the unload end, one at the punch, and one at the main control box.

One door locking limit switch is also provided to prevent operator ingress into potentially hazardous areas. Additionally, in manual mode, should ingress be necessary and operation with the guard open, two pushbuttons operated as a two-hand safety circuit have been provided.

These safety functions are each monitored by discrete safety relays.

Normal Operations

The first task the operator must perform (as indicated by the message display, above) is to the 'HOME' the machine. This places all of the various subsystems in the proper orientation to begin processing the extrusions. By pressing the HOME button icon on the HOME screen, the homing procedure will; commence. During this process, the operator will see the message display on the HOME Screen change to:

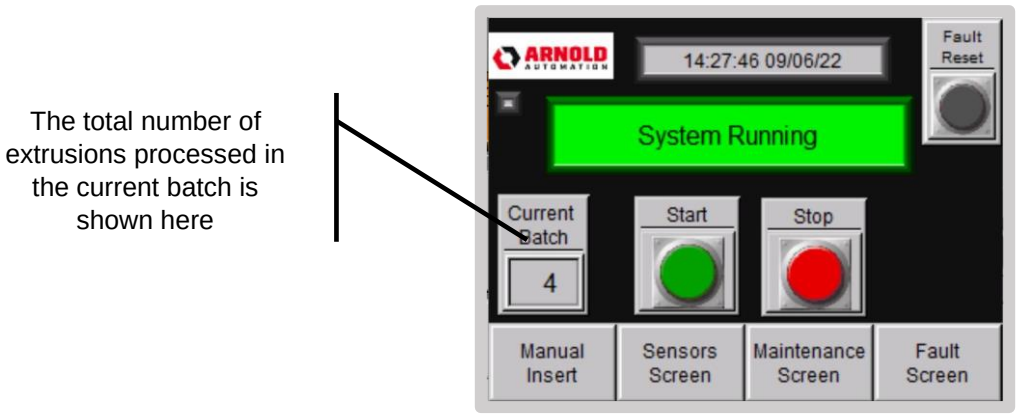


This will let the operator know what function the machine is performing. Once the homing is complete, the message display will change to “

Now, the machine is ready to process parts.

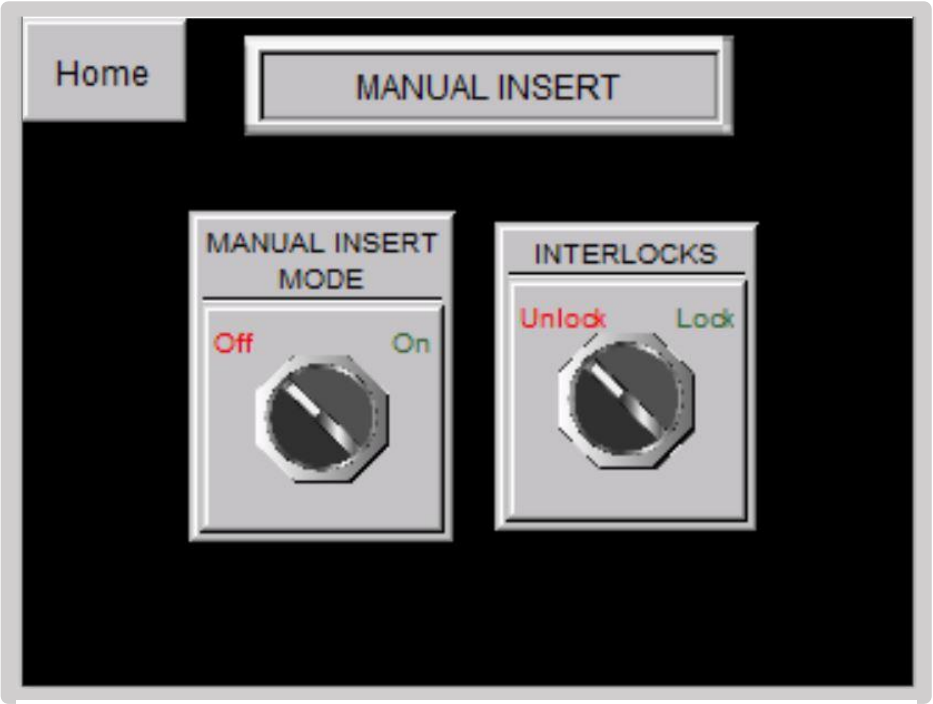
Once this message has been displayed, the operator should press the START button icon on the HOME Screen to begin processing extrusions.

Once processing is underway, the operator may see the number of extrusions that have been processed in the current batch by viewing the CURRENT BATCH indicator on the HOME Screen.



Manual Mode

At some time, it may be necessary for the operator to manually load extrusions into the punch. By pressing the MANUIAL INSERT Screen Navigation button at the bottom of the HOME Screen, the following screen will be opened.

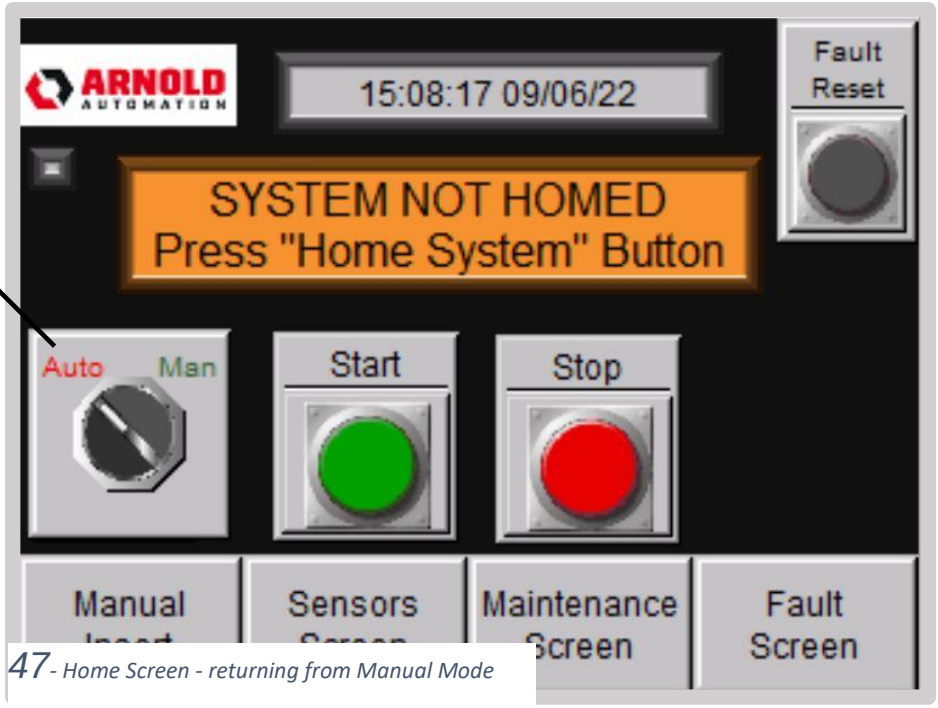


46- Manual Insert Screen

The operator should press the Manual Insert Mode switch icon to place the transfer system in manual. This will unlock the protective locking limit switch allowing the doors of the transfer system to be opened. After aligning the extrusion, the operator will depress and hold both of the yellow pushbutton operators simultaneously. This will feed the extrusion into the punch for processing. NOTE: the yellow buttons are configured as a two-hand safety circuit and must be pressed at the SAME time or the operation will not proceed.

When manual operations are complete, the operator should press the HOME screen navigation icon at the top left of the screen to return to the HOME Screen. The HOME Screen will now display as:

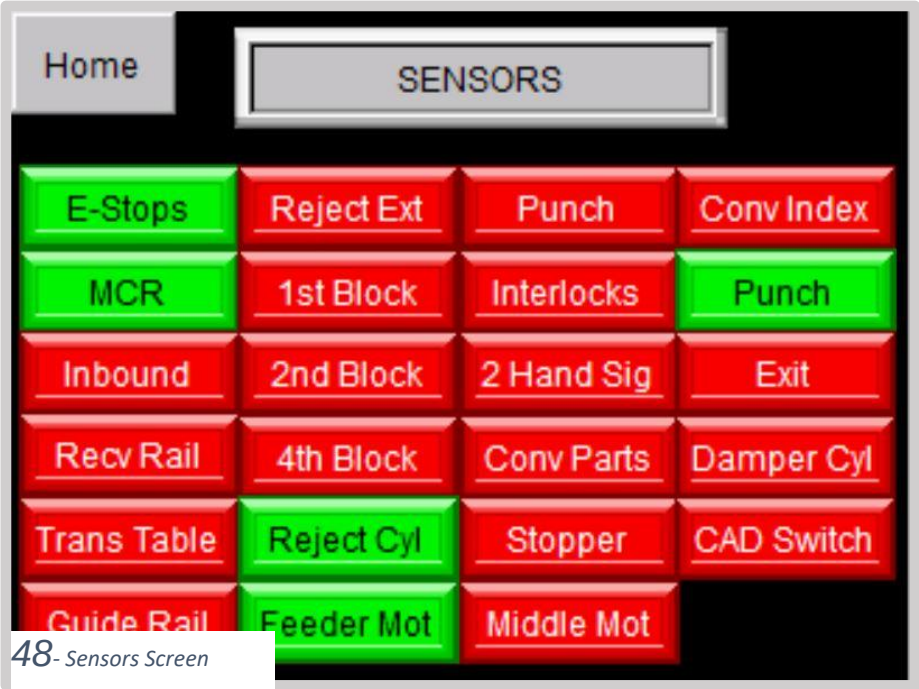
Press this selector switch icon so that it faces the AUTO mode as shown to return from MANUAL operation of the transfer system



47 - Home Screen - returning from Manual Mode

The operator will now need to press the AUTO-MAN selector switch icon to return to normal automatic operations. NOTE: it may be necessary to perform the homing operation if indicated by the message display.

At some point, the operator may wish to view the status of any/all of the sensors in the system. By touching the Sensors Screen screen navigation button icon at the bottom of the Home page, the following screen will be displayed.



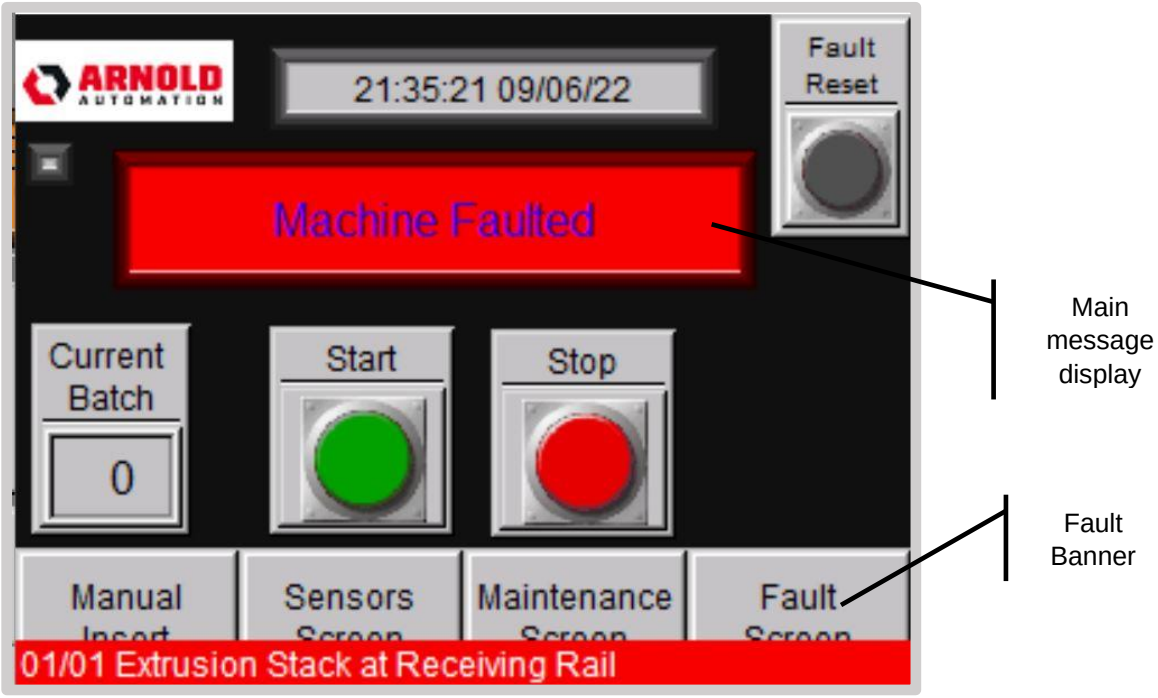
48- Sensors Screen

From this screen, the status of all of the sensors is displayed: GREEN indicates that the sensor is in a normal (ready to run) state; RED indicates that the sensor is in an abnormal (not ready to run) state.

Many times, a simple view of this screen may allow the operator top take corrective actions to avoid extended downtime.

FAULTS

The punch system is responsive to a number of fault conditions that will stop/prevent operation of the equipment. Any time a fault condition occurs, the operator will see the following:



49- Faulted Machine display

The main message display will be indicating “Machine Faulted’; the fault banner will also appear at the bottom of the screen to advise of the latest fault condition.

The following table lists all of the conditions that will generate a fault.

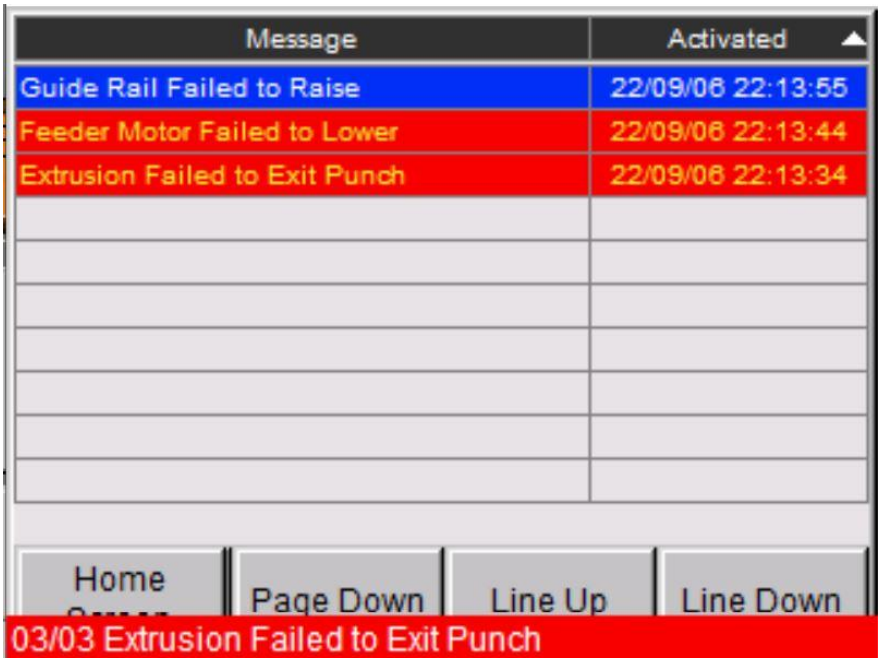
1	Extrusion Stack at Receiving Rail
2	Receiving Rail Rotation Failed
3	Slide Table Failed to Transfer Extrusion
4	Slide Table Failed to Retract
5	Guide Rail Failed to Lower
6	Feeder Motor Failed to Lower
7	Feeder Motor Failed to Run
8	Extrusion Insertion Failed

9	Extrusion Did Not Reach Punch Block
10	Guide Rail Failed to Raise
11	Middle Motor Failed to Lower
12	Feeder Motor Failed to Raise
13	Middle Motor Failed to Raise
14	Stopper Failed to Extend
15	Stopper Failed to Retract
16	Middle Motor Failed to Lower for Ejection
17	Extrusion Failed to Eject
18	Middle Motor Failed to Raise After Ejection
19	Extrusion Failed to Exit Punch
20	Low Compressed Air Pressure
21	Extrusion Failed to Insert. Remove Extrusion Manually
22	Incoming rail failed to reject extrusion.
23	Inbound Sensor did not detect incoming extrusion. Check SEN 404
24	Receiving rail(s) not in position.

50- Table of Fault Conditions

Refer to the Troubleshooting Section for details on clearing each of these faults. When corrective action has been taken, press the FAULT RESET pushbutton icon at the top left of the screen to continue.

Additionally, the operator can access the FAULT SCREEN display by pressing the FAULT SCREEN screen navigation button at the bottom of the HOME Screen. The following will be displayed:



The Fault Screen displays all of the active faults; it shows time and date that the fault occurred. The BLUE highlight shows the condition being viewed with the LINE UP/LINE DOWN buttons. Once a fault condition has been successfully reset, it will automatically be removed from the screen.

SCREEN SECURITY

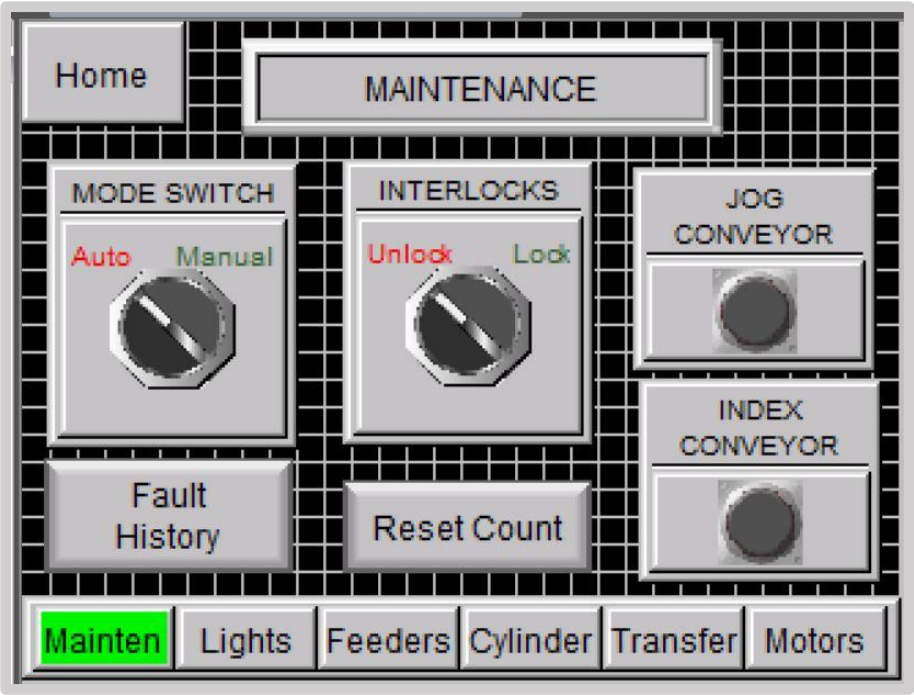
The MAINTENANCE Screen (and all of its sub screens) is only available to the operator with the necessary security credentials. This limits access to screens containing WARNING and FAULT data that are of limited operational data, but contain important historical data. This screen also contains functions necessary only to Maintenance operations. The FAULT SCREEN is typically available to operators. The FAULT HISTORY is only available to operators within the MAINT group.

When attempting to access these screens, the operator will be presented with the following security keypad:

52- Security Keypad

The operator should use the numeric portion to enter the proper 4-digit security code for the appropriate level of clearance. The code for the MAINT group is 1900 Once the correct code has been entered, the MAINTENANCE screen will be displayed:

Maintenance Screen



53- Maintenance Screen

From the Maintenance Screen, a number of other screens (available only through security) are available from the screen navigation button icons located at the bottom of the screen. These will be discussed in the following sections.

From the Maintenance Screen, the maintenance operator my perform the following functions:

1) Mode Switch ->Place the machine into manual operation. This will enable a number of controls on the following screens.

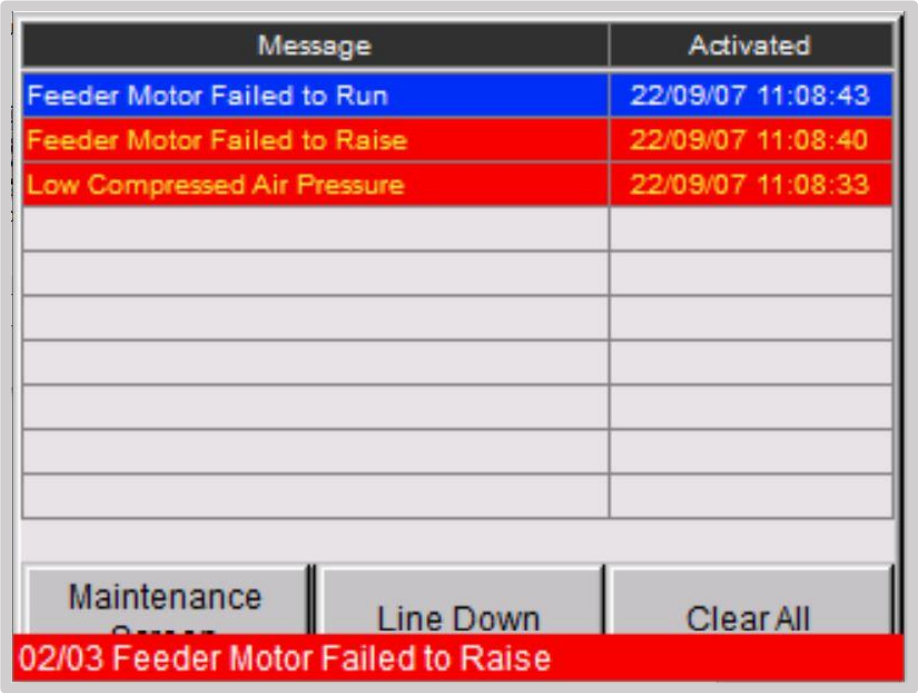
2) Interlocks->Unlock the locking limit switch on the transfer unit. It is NOT necessary for the machine to be placed into manual mode (see 1 above) for this function to operate.

3) Reset Count ->Resets the current batch count shown on the HOME Screen.

4) Jog Conveyor-> When in manual mode, this icon allows the maintenance operator to jog the hopper unit conveyor.

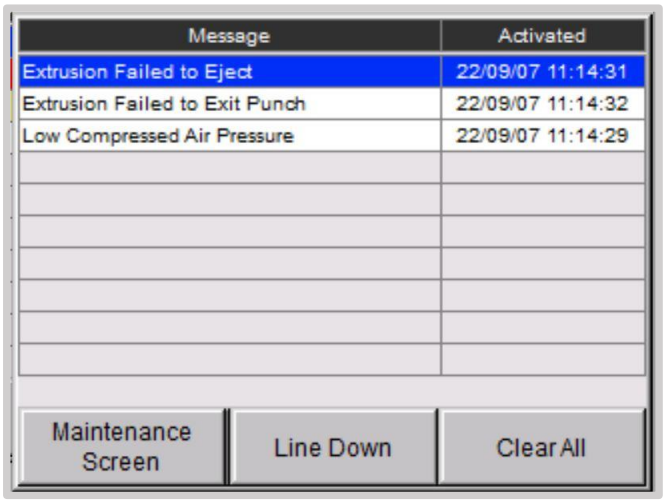
5) Index Conveyor -> When in manual mode, this icon will advance the hopper unit conveyor to the next normal stop position,

6) Fault History -> This screen navigation pushbutton icon will display the Fault History Screen for the maintenance operator.



54- Fault History Screen

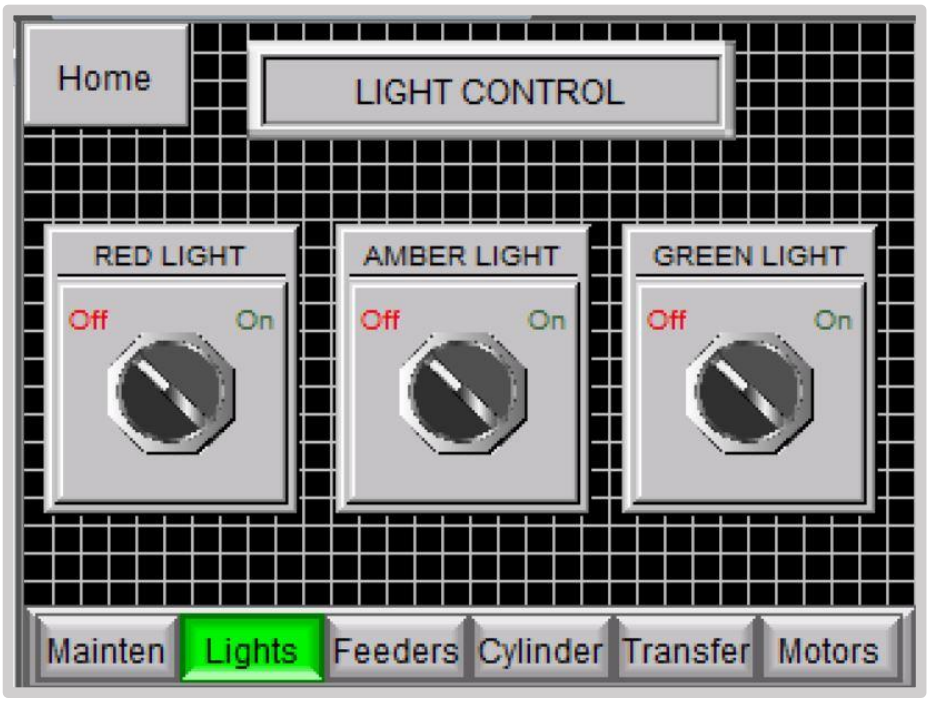
The Fault History Screen provides the same information that is available to the operator, however, the entries do not clear when a fault is reset. Instead, the entries which are no longer currently affecting machine operation are shown with a WHITE field background.



55- Fault History - Inactive faults

These inactive fault entries will remain until they are cleared by the maintenance operator by pressing the Clear All pushbutton icon located at the bottom right of the screen. NOTE: the Clear All will only remove the inactive fault entries – any active fault will still remain on the list.

Lights Screen



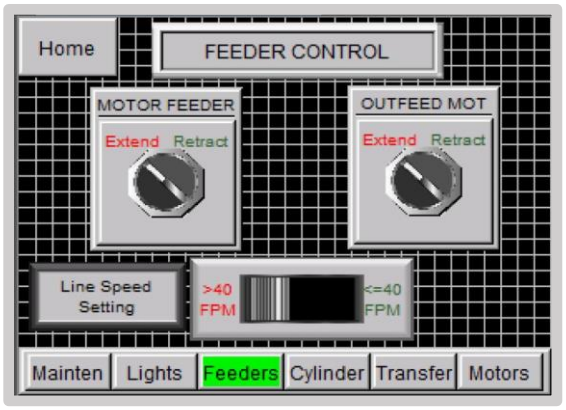
56- Lights Screen

The Lights Screen provides the maintenance operator with a means to test all three positions of the Stack Light which is located just above the HMI station

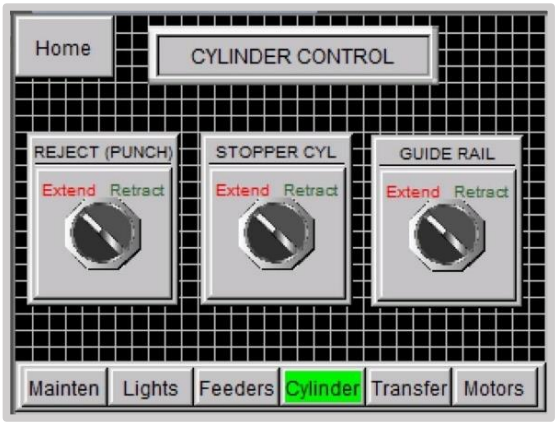
The Stack Light can be seen here – just above the HMI Display

57- Stack Light location

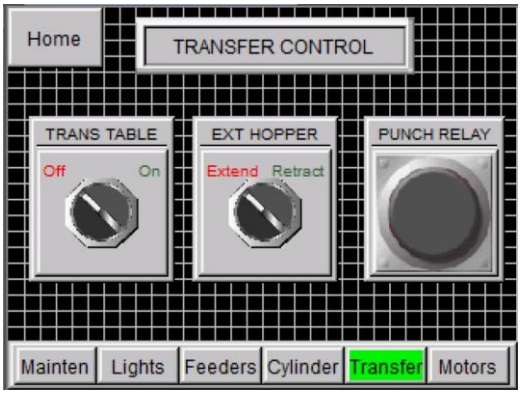
Feeders Screen – Cylinder Screen – Transfer Screen



58- Feeders Screen



59- Cylinders Screen



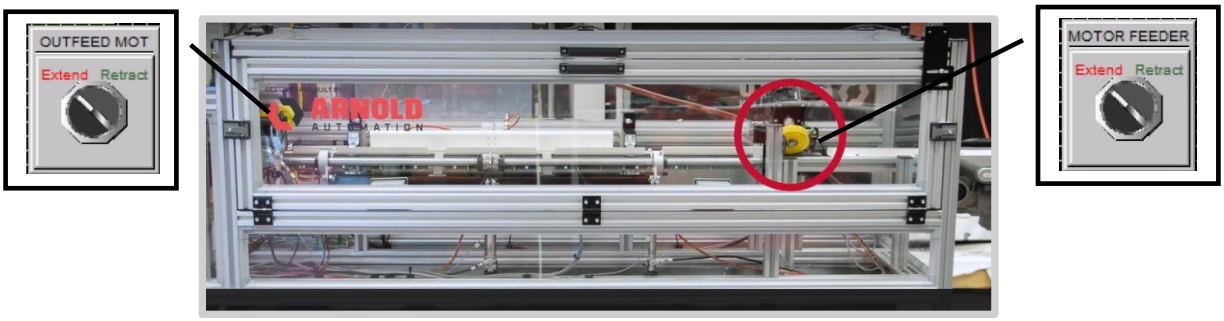
60- Transfer Screen

These three screens offer manual control of all of the pneumatic actuators (cylinders) on this system.

<u>On the Feeder Screen</u>

The <u>Motor Feeder Selector</u> switch icon is used to Lower or Raise the pull in motor at the right-hand side of the transfer unit.

The <u>Outfeed Mot Selector</u> switch icon is used to Lower or Raise the punch drive motor at the left-hand side of the transfer unit.

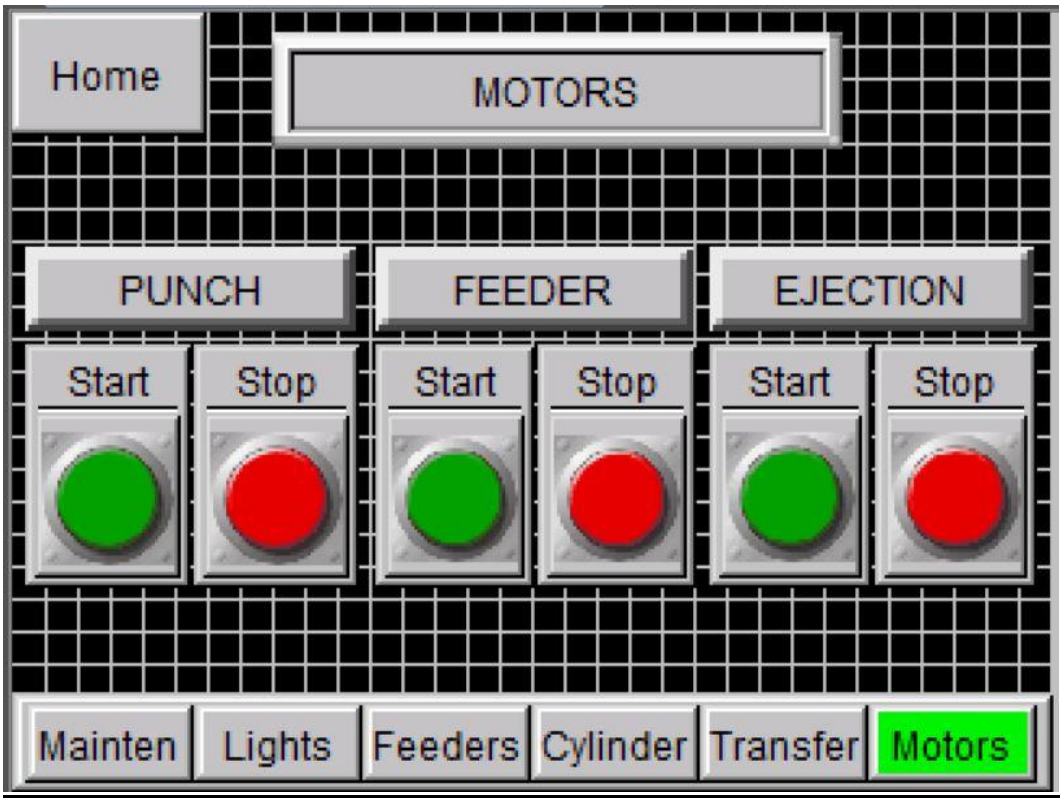


62- Transfer Unit Drives

Note – These controls only affect the position of the drive assemblies; to operate the actual motor rotation, move to the MOTORS Screen.

On the Cylinder Screen

On the Motor Screen



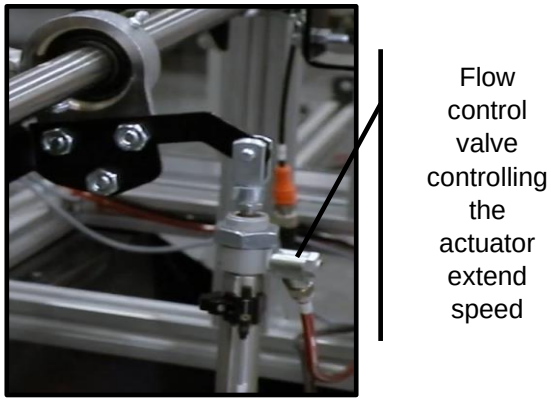
TROUBLE SHOOTING

Following the Fault List provided earlier, troubleshooting tips for each fault will be provided. NOTE: the terms 'ACTUATOR' and 'CYLINDER' are used interchangeably in the following discussions.

Typically, all pneumatic actuators are equipped with one or two magnetically coupled position sensing switches. These switches are equipped with an LED indicator. Checking these switches can be done by: 1) watching the LED as the actuator is cycled Extended and Retracted – LED illumination should be noted; alternately, the switch retaining bracket may be loosened, and the switch slide along the length of the actuator – the LED should illuminate at some point. If no LED illumination can be noted, the switch should be replaced.

Fault #1 - Extrusion Stack at Receiving Rail. This fault is generated when too much time has occurred in transferring an extrusion into the punch. Check tension on Middle Motor Drive motor drive wheel, and on the Outfeed Drive motor wheel and adjust as necessary to obtain proper transfer time. (Ref: https://arnoldacademy.com/fabex - Adjusting the pull in drive, and Adjusting the third drive for details on making adjustments).

Fault #2 - Receiving Rail Rotation Failed. This fault is generated when the receiving rail has been commanded to rotate to receive the extrusion entering the transfer unit. The receiving rail position is controlled by a stepper motor. The limits of travel are set and monitored by the stepper motor controller. Please refer to the stepper motor controller user manual for further details on troubleshooting this fault.

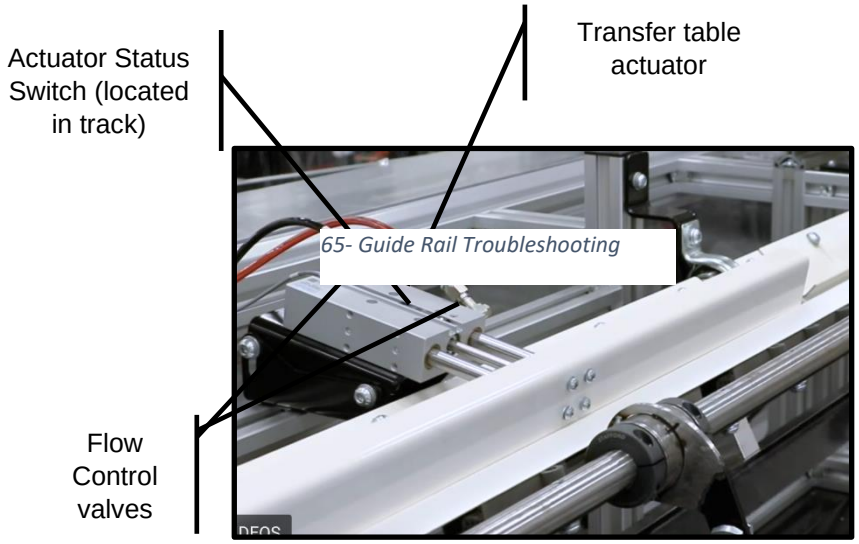


63- Checking Guide Rail Fault

Fault #3 and Fault #4 - Slide Table Failed to Transfer Extrusion, and Slide Table Failed to Retract

Both of these faults are generated when the transfer table has been commanded to extend or retract to move the extrusion to the guide rail or to return to the home position. It uses a magnetic sensor on the actuator to disable timer logics in the PLC. If the timer logics are allowed to go to completion, it means that the actuator did not operate correctly (fully extended or retracted), or the switch on the actuator did not apply the signal to the PLC.

First, check the incoming air pressure. Next, from the Maintenance Screen, place the machine in MANUAL MODE. Move to the TRANSFER screen and operate the trans table selector switch, first to the ON position – now verify that the actuator has fully extended - now to the OFF position – and again verify that the actuator has fully retracted. If either of these seem to fail, try opening the flow control valves and perform the tests again. If the actuator is able to EXTEND and RETRACT properly, the next item to check is the actuator status switch. If either condition fails the actuator should be replaced and the following status switch adjustment will need to be done as well.



64- Transfer Table Troubleshooting

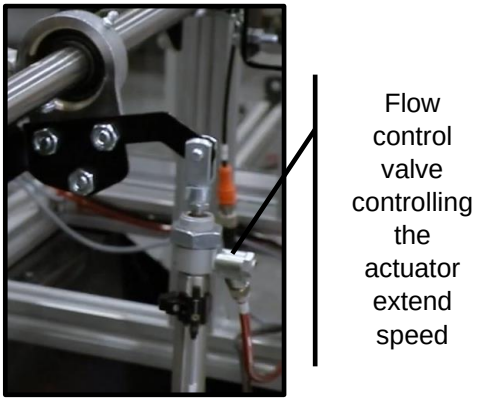
Finally, readjust any flow control valves to make the actuator extend and retract smoothly, without banging in either direction.

Fault #5 and Fault #10 - Guide Rail Failed to Lower – Guide Rail Failed to Raise

These faults are generated when the guide rail has been commanded to rotate to receive or reject the extrusion. It uses a magnetic sensor on the actuator to disable a timer logic in the PLC. If the timer logic is allowed to go to completion, it means that the actuator did not operate, or the switch on the actuator did not apply the signal to the PLC.

First, check the incoming air pressure. Next, from the Maintenance Screen, place the machine in MANUAL MODE.

Move to the CYLINDER screen and operate the GUIDE RAIL selector switch, first to the EXTEND position – now verify that the actuator has fully extended - now to the RETRACT position – and again verify that the actuator has fully retracted. If either of these seem to fail, try opening the flow control valves and perform the tests again. If the actuator is able to EXTEND and RETRACT properly, the next item to check is the



actuator status switch. If either condition fails the actuator should be replaced and the status switch adjustment will need to be done as well.

Finally, readjust any flow control valves to make the actuator extend and retract smoothly, without banging in either direction.

Fault #6 and Fault #12- Feeder Motor Failed to Lower - Feeder Motor Failed To Raise

These faults are generated when the feeder motor assembly has been commanded to rotate to position the drive wheel in contact with the extrusion or to lift the assembly. It uses a magnetic sensor on the actuator to disable a timer logic in the PLC. If the timer logic is allowed to go to completion, it means that the actuator did not operate, or the switch on the actuator did not apply the signal to the PLC.

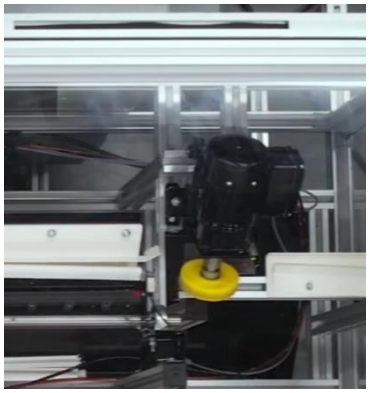


Figure 66-Feeder motor troubleshooting

First, check the incoming air pressure. Next, from the Maintenance Screen, place the machine in MANUAL MODE. Move to the CYLINDER screen and operate the OUTFEED MOT selector switch, first to the EXTEND position – now verify that the actuator has fully extended - now to the RETRACT position – and again verify that the actuator has fully retracted. If either of these seem to fail, try opening the flow control valves and perform the tests again. If the actuator is able to EXTEND and RETRACT properly, the next item to check is the actuator status switch. If either condition fails the actuator should be replaced and the status switch adjustment will need to be done as well.

Finally, readjust any flow control valves to make the actuator extend and retract smoothly, without banging in either direction.

Fault #7 – Feeder Motor failed to run

This fault is generated when an extrusion is set to be transferred but the transfer motor (Middle Motor) has not started to run. First, reset the fault and attempt to run the motor manually by setting the machine to manual insert. If the motor failed to run under this setting, open the main control panel and look at MC540A drive and check if the status light is red. If the red light is on, power cycle the machine and wait for the drive to boot up. If this step failed to fix the problem, contact the service department for additional troubleshooting steps.

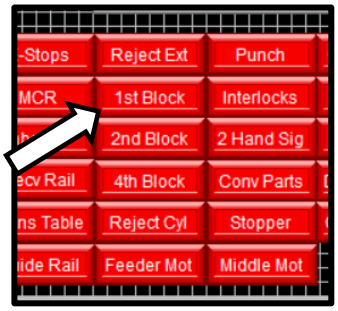
Fault #8 – Extrusion Insertion Failed

This fault indicates that an extrusion failed to fully insert into the punch and was not ejected. You will need to remove the extrusion manually.

Fault #9 – Extrusion did not reach punch block

This fault will be triggered whenever an extrusion is being transferred into the punch block unit and the extrusion is not sensed by photosensor 410 at punch block #4 within a preset time limit. Check tensions on both the Middle Motor drive wheel and the Outfeed Dirv wheel.
If these appear correct, verify that photosensor 410 is operational. First, verify that the LED indicator at the PHOTOSENSOR changes states as the sensor is blocked/unblocked. If it does not change, replace the photo sensor.

Next, (assuming the change in LED state at the sensor was correct) from the HOME Screen, press the SENSOR SCREEN navigation button icon at the bottom of the screen. This will display the SENSORS SCREEN. From this screen, watch the indicator for the 4th Block as the photo sensor is blocked and unblocked. The indicator should remain RED when the sensor is unblocked -..



and should 

turn GREEN when the photosensor is blocked.
If this fails, check the wiring from the sensor to the terminal blocks in the control panel.

Fault #11 and Fault #13 – <u>Middle Motor Failed to Lower and Middle Motor Failed to Raise</u>

The middle motor drive assembly is controlled by a pneumatic actuator. Both of these faults are generated when the middle motor drive assembly has been commanded to extend or retract to move the drive wheel towards or away from the extrusion. It uses a magnetic sensor on the actuator to disable timer logics in the PLC. If the timer logics are allowed to go to completion, it means that the actuator did not operate correctly (fully extended or retracted), or the switch on the actuator did not apply the signal to the PLC.

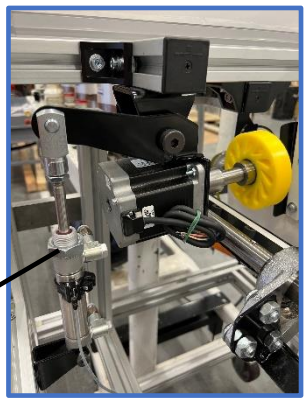


Figure 67-Middle Wheel Drive Assembly

First, check the incoming air pressure. Next, from the Maintenance Screen, place the machine in MANUAL MODE. Move to the CYLINDER screen and operate the MOTOR FEEDER selector switch, first to the EXTEND position – now verify that the actuator has fully extended - now to the RETRACT position – and again verify that the actuator has fully retracted. If either of these seem to fail, try opening the flow control valves and perform the tests again. If the actuator is able to EXTEND and RETRACT properly, the next item to check is the actuator status switch. If either condition fails the actuator should be replaced and the status switch adjustment will need to be done as well.

Finally, readjust any flow control valves to make the actuator extend and retract smoothly, without banging in either direction.

Fault #14 and Fault #`15 – Stopper Failed to Extend; Stopper Failed to Retract

The Stopper mechanism is located just after the final punch station. It is used to stop the extrusion at the precise location to allow accurate punches to be made. The Stopper arm is controlled by a pneumatic actuator. Both of these faults are generated when the stopper arm has been commanded to extend or retract. The stopper actuator uses a magnetic sensor on the actuator to disable timer logics in the PLC. If the timer logics are allowed to go to completion, it means that the actuator did not operate correctly (fully extended or retracted), or the switch on the actuator did not apply the signal to the PLC.

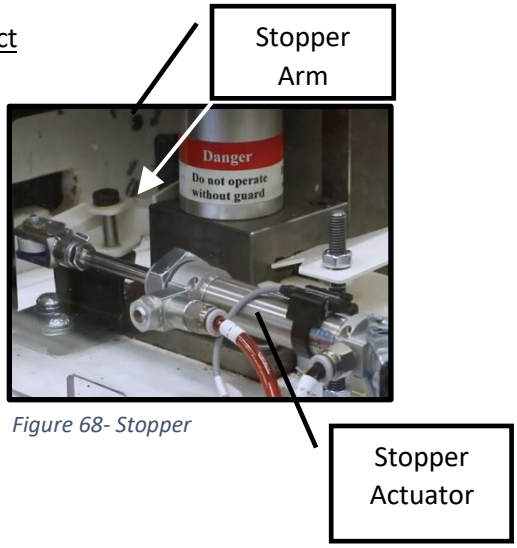


Figure 68- Stopper

First, check the incoming air pressure. Next, from the Maintenance Screen, place the machine in MANUAL MODE. Move to the CYLINDER screen and operate the STOPPER CYL selector switch, first to the EXTEND position – now verify that the actuator has fully extended - now to the RETRACT position – and again verify that the actuator has fully retracted. If either of these seem to fail, try opening the flow control valves and perform the tests again. If the actuator is able to EXTEND and RETRACT properly, the next item to check is the actuator status switch. If either condition fails the actuator should be replaced and the status switch adjustment will need to be done as well.

Fault #16 & Fault #18 – Middle Motor failed to Lower for Ejection; Middle Motor Failed to Raise after Ejection

Refer to Fault #11 and Fault #13 discussion above. The same actuator is involved in this fault trigger.

Fault #17 – Extrusion failed to Eject

When an extrusion is to be ejected, when the Middle Motor Drive assembly has been lowered to contact the extrusion, if the Extrusion Exit Sensor does not detect the edge of the extrusion within preset time, then this fault will be triggered.
Check the Middle Wheel Drive assembly contact tension and adjust as necessary to obtain proper transfer time. (Ref : https://arnoldacademy.com/fabex - Adjusting the pull in drive, and Adjusting the third drive for details on making adjustments).

Check the Extrusion Exit Sensor for proper operation – adjust/replace as necessary.

Fault # 19 – Extrusion Failed to Exit punch

Similar to Fault #17, above, this fault is triggered when the trailing edge of the extrusion is not detected within the preset time. Check the Extrusion Exit Sensor for proper operation – adjust/replace as necessary.

Fault #20 – Low Compressed Air Pressure

Compressed Air Pressure coming in to this machine is monitored by an air pressure switch. Any time the incoming pressure falls below the setting of this switch, a fault is triggered. Correct the air supply as necessary.

Fault #21 – Extrusion Failed to Insert. Remove Extrusion Manually

This fault is triggered when one (or more) of the photosensors at each punch station has failed to detect the extrusion.

Fault #22 – Incoming rail failed to reject extrusion

This fault is triggered when the system fails to reject an extrusion.

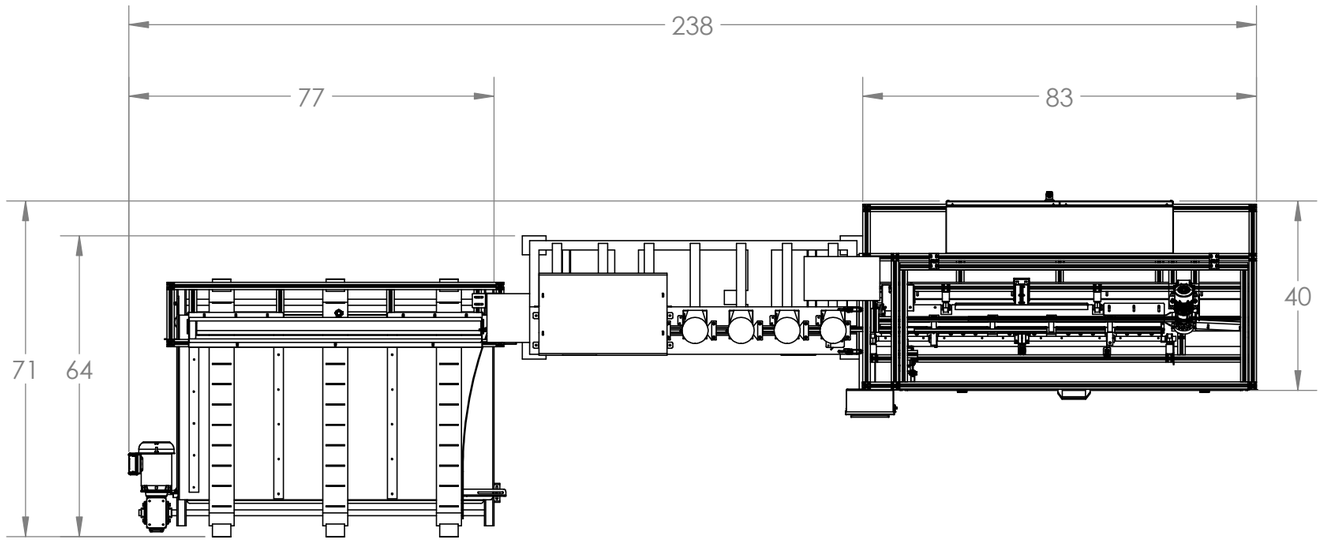
Fault #23 - Inbound Sensor did not detect incoming extrusion – Check SEN 404

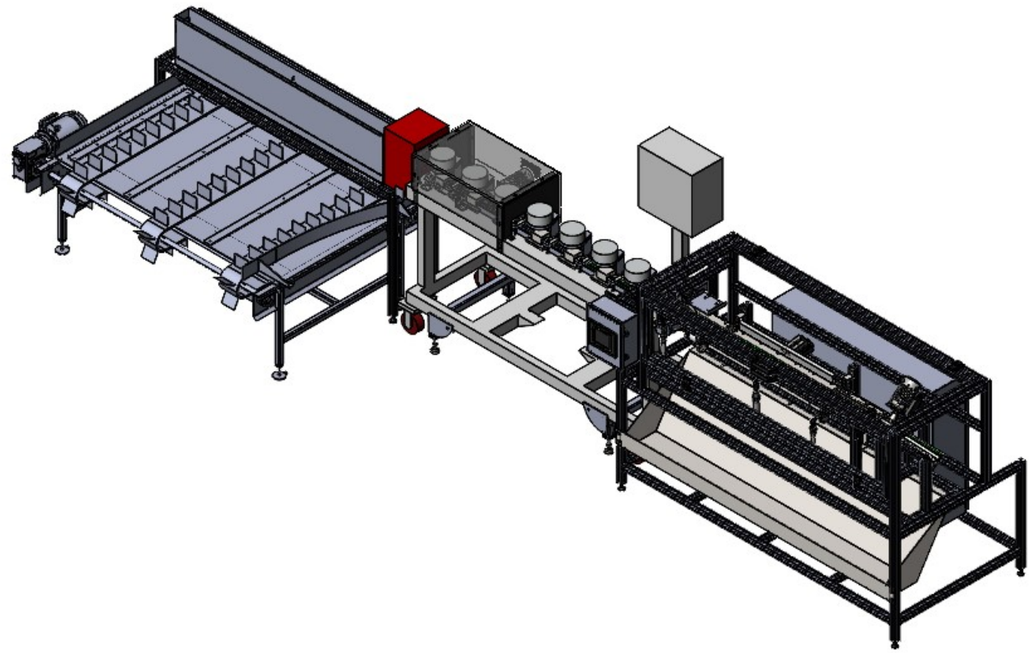
This fault is triggered when the receiving rail sensor is triggered but the inbound sensor did not detect a new extrusion entering the transfer system. This fault is meant to prevent jams in the transfer system in case an extrusion is left in the rail inadvertently.

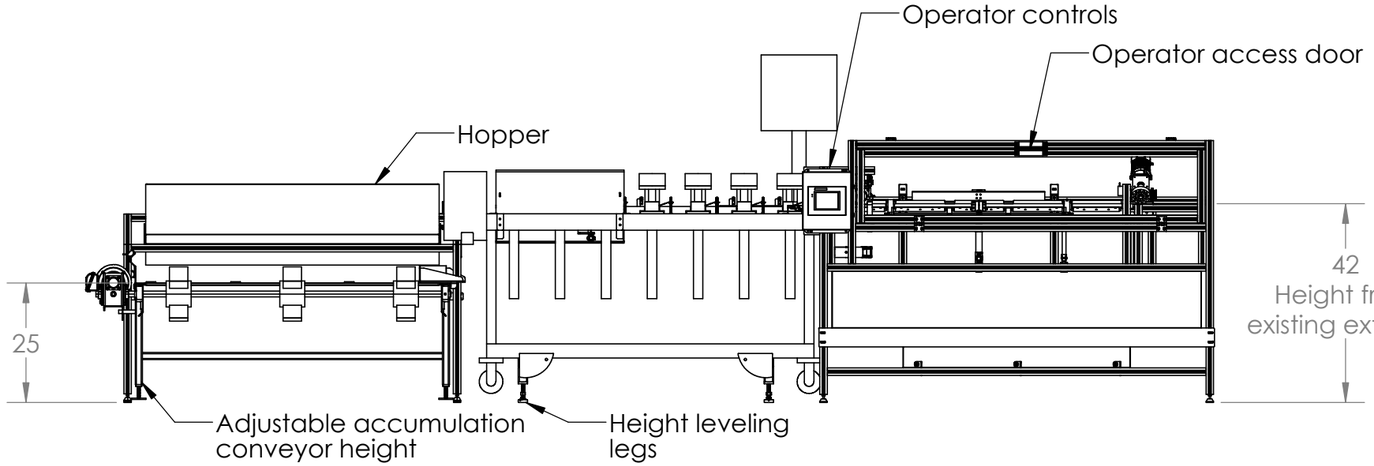
Fault #24 – Receiving rail(s) not in position

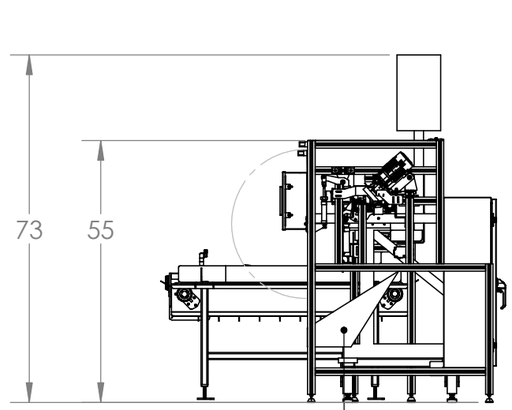
This fault is triggers when the receiving rail fails to rotate and transfer the extrusion to the insertion guiderail.

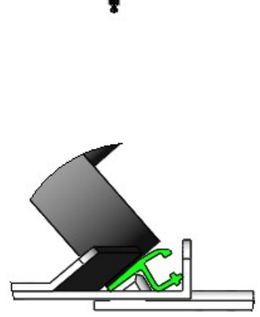
MECHANICAL DRAWINGS











DETAIL A
SCALE 1 : 2
Incoming extrusion
orientation: Die 3076

NOTES:
1. Required Utilities:
   - 460 VAC/3 Ø/20 A
   - Compressed air, 5 SCFM @ 80-100 PSI

ARNOLD AUTOMATION

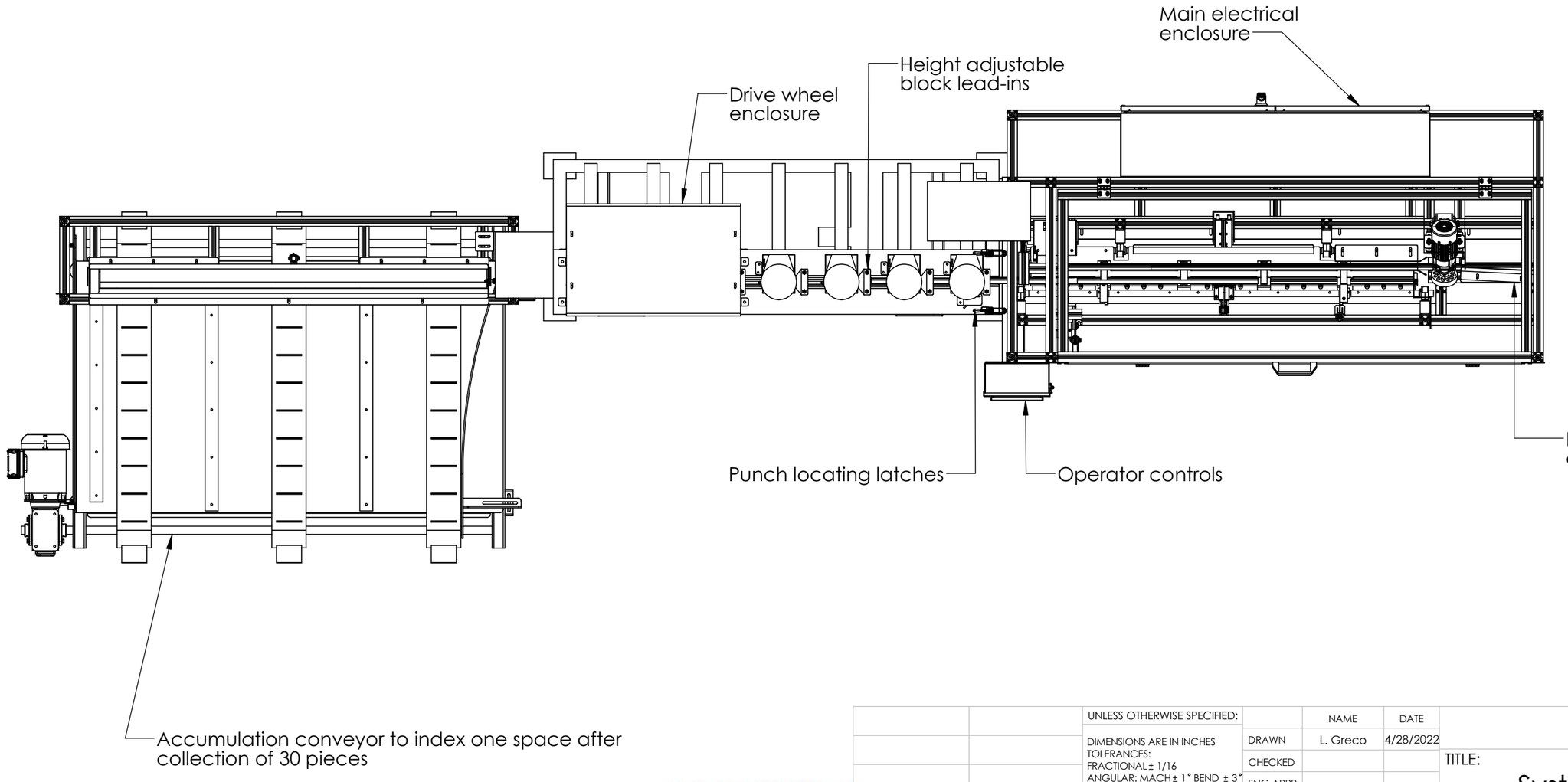
		UNLESS OTHERWISE SPECIFIED:		NAME	DATE
		DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ± 1/16 ANGULAR: MACH ± 1° BEND ± 3° TWO PLACE DECIMAL ±0.030 THREE PLACE DECIMAL ±0.005	DRAWN	L. Greco	4/28/2022
			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
		MATERIAL N/A	COMMENTS:		
NEXT ASSY	USED ON	FINISH N/A			
APPLICATION		DO NOT SCALE DRAWING			

TITLE:

System, Leaf Automation - Die 3076

SIZE	DWG. NO.	REV
B	AA1027	-.01

SCALE: 1:32 | WEIGHT: - | SHEET 1 OF 5



ARNOLD AUTOMATION

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ± 1/16
ANGULAR: MACH ± 1° BEND ± 3°
TWO PLACE DECIMAL ±0.030
THREE PLACE DECIMAL ±0.005

INTERPRET GEOMETRIC TOLERANCING PER:

MATERIAL: N/A

FINISH: N/A

DO NOT SCALE DRAWING

	NAME	DATE
DRAWN	L. Greco	4/28/2022
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		

COMMENTS:

TITLE:

System, Leaf Automation - Die 3076

SIZE	DWG. NO.	REV
B	AA1027	-.01

SCALE: 1:18 | WEIGHT: - | SHEET 2 OF 5

Recommended Spare Parts List

Vendor	Part No.	Description	Qty.
Meridian Laboratory	NCW-370-70*	Drive 2 + 3 wheel	2
Rexel	SM34-850	Stepper motor – punch drive	1
Arnold	AA1001178	Pull-in block	1
	AA1001214	Punch lead-in – 3076	1
	AA1001213	Guide channel block	4
FESTO	19208 DSNU-20-25-P-A	Hopper door actuator	1
	19237 DSNU-20-50-PPV-A	Hard stop actuator	1
	19218 DSNU-25-10-P-A	Drive 3 actuator	1
	19221 DSNU-25-50-P-A	Punch drive actuator	1
	196023 DSNU-32-80-PPV-A	Guide channel actuator	1

	19239 DSNU-20-100-PPV-A	Transfer finger actuator	1
	170838 DFM-16-80-P-A	Slide table	1
	6144 SG-M10x1.25	M10 clevis end	3
	3111 SG-M8	M8 clevis end	3
Moxley	GP56-N2-11-SR	Inline reducer for PD4 motor	1
	PD4-EB59CD-E-65-3	Receiving rail motor	1
	T5-10-138*	Timing belt	1
Bodine	0451*	Gearmotor – pull-in drive &drive 3	2
	0984*	Terminal box kit for 0451	2
	49401054*	Capacitor for 0451	2
McMaster-Carr	2475K73-60A*	Blue drive wheel – pull-in motor	2

* NOTE: Items on this list marked with an asterisk * are regarded as higher priority.