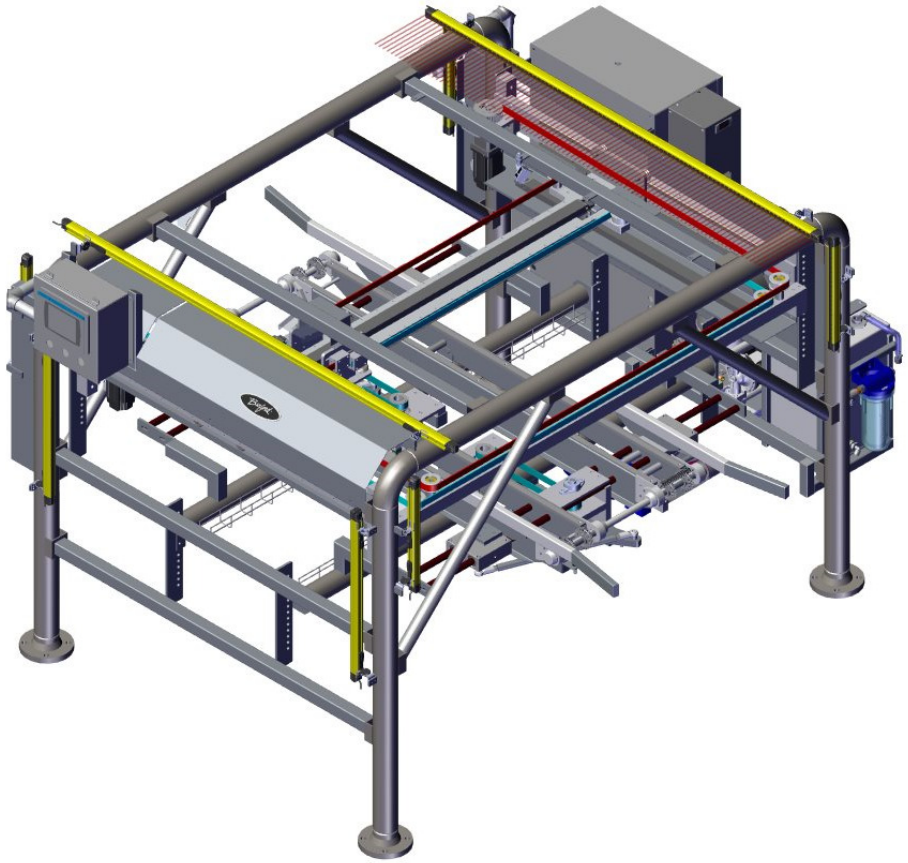
HX1000

High Speed Splitter



First Edition, Date: March/2015
Manual Part No. _____
Serial # _____

SAFETY PRECAUTIONS

As Burford® Corp. strives to promote safety in the maintenance and operation of Burford® equipment, we request that the following safety procedures be followed, along with any additional safety procedures set by the customer's in-plant safety officers or local codes.

1. Read the manual completely before attempting installation or operation of this unit.
2. This machine may contain programs that are password protected. Contact your supervisor or Burford® Corp. for password.
3. Incoming electrical power must be properly shielded, routed, and grounded. All safety codes should be followed. Study wiring diagrams before attempting installation.
4. Disconnect power to equipment before removing any guards or covers. Replace guards or covers before resuming operation of the unit.
5. Loose clothing, jewelry, and long hair should be considered a safety hazard around mechanical equipment. Ensure that they will not be entangled in the equipment.
6. Keep clear of moving machine parts. Bodily harm and/or serious injury may result from contact with moving gears, sprockets, chains or pneumatically controlled machine components.
7. Do not bypass safety switches.
8. Do not attempt repairs while equipment is running.
9. Use only original equipment parts designed to safely operate in the equipment.
10. Only authorized personnel should be allowed to operate or perform maintenance on the unit.
11. This unit is not wash-down ready. Do not wash the unit or any of its electrical or mechanical components, with any form of high pressure or running liquids.

CAUTION SYMBOL INDICATES BODILY HARM MAY INCUR IF INSTRUCTIONS ARE NOT FOLLOWED.

STOP SYMBOL INDICATES IMPORTANT INSTRUCTIONS TO PREVENT UNIT DAMAGE OR ADVERSE EFFECTS.

INFO SYMBOL INDICATES USEFUL INFORMATION TO ASSIST IN INSTALLATION AND OPERATION OF THE UNIT.

DISCLAIMER

The descriptions and specifications contained in this Service Manual were in effect when this manual was approved for printing. Our policy is one of continuous improvements, and we do hereby reserve the right to discontinue models at any time, or to change specifications, prices, or design without notice and without incurring obligations.

Burford® Corp. expressly disclaims any liability for damages and/or injuries caused as a result of negligence or misuse of its product. Such negligence or misuse includes, but is not limited to, software/program alteration, removal of guards, faulty wiring due to improper installation, subjecting the unit to wash-down environments or any physical or mechanical changes made to a Burford® unit, by anyone other than a qualified Burford® Technician.

Burford® equipment should only be used for the purpose for which it was sold, and should not be modified in any way without notifying the General Manager of Burford® Corp. in writing of the modification.

The original language for this document is English. Translations to other languages may not be accurate.

CONTENTS

CONTENTS

CONTENTS

CONTENTS

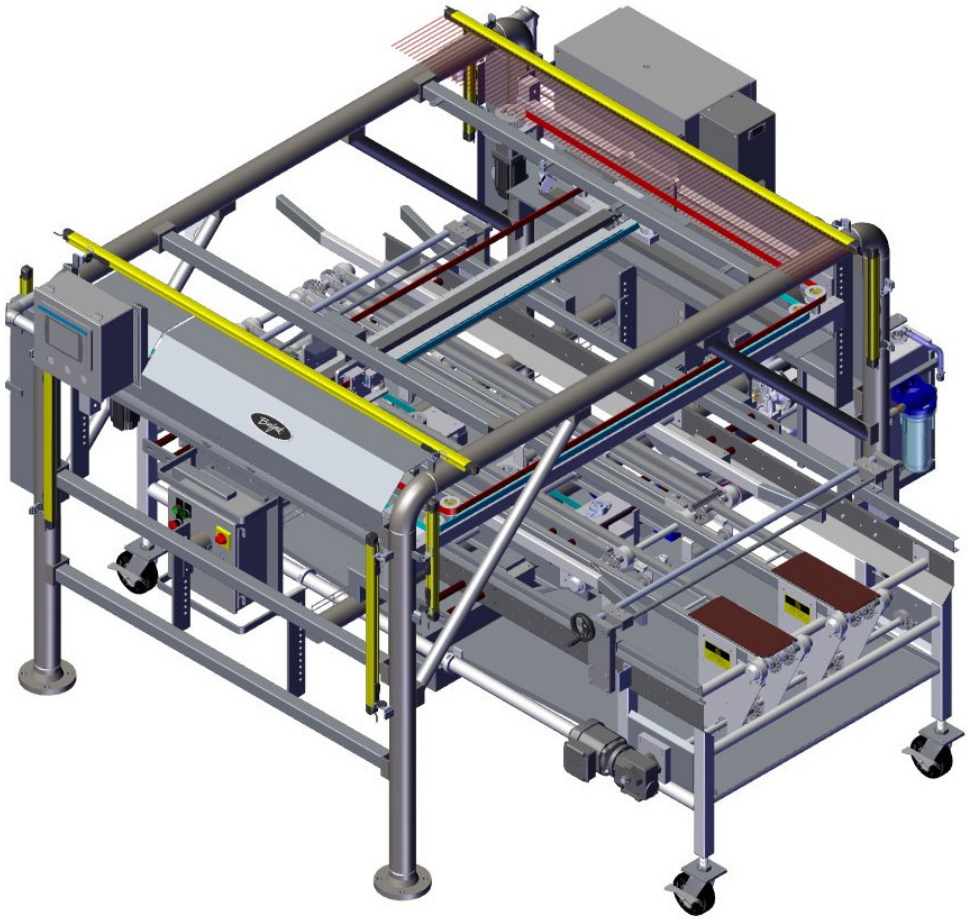
CONTENTS

Chapter 1

Introduction

CHAPTER 1: INTRODUCTION

The Burford® HX 1000 Splitter has been designed to provide a knife-like split, of a particular pattern on top of proofed dough. This system provides precise split location in relation to the pan shape and program stored in the motion controller. The Burford® HX 1000Splitter brings together precise application, convenience of operation and ease of maintenance in one system.

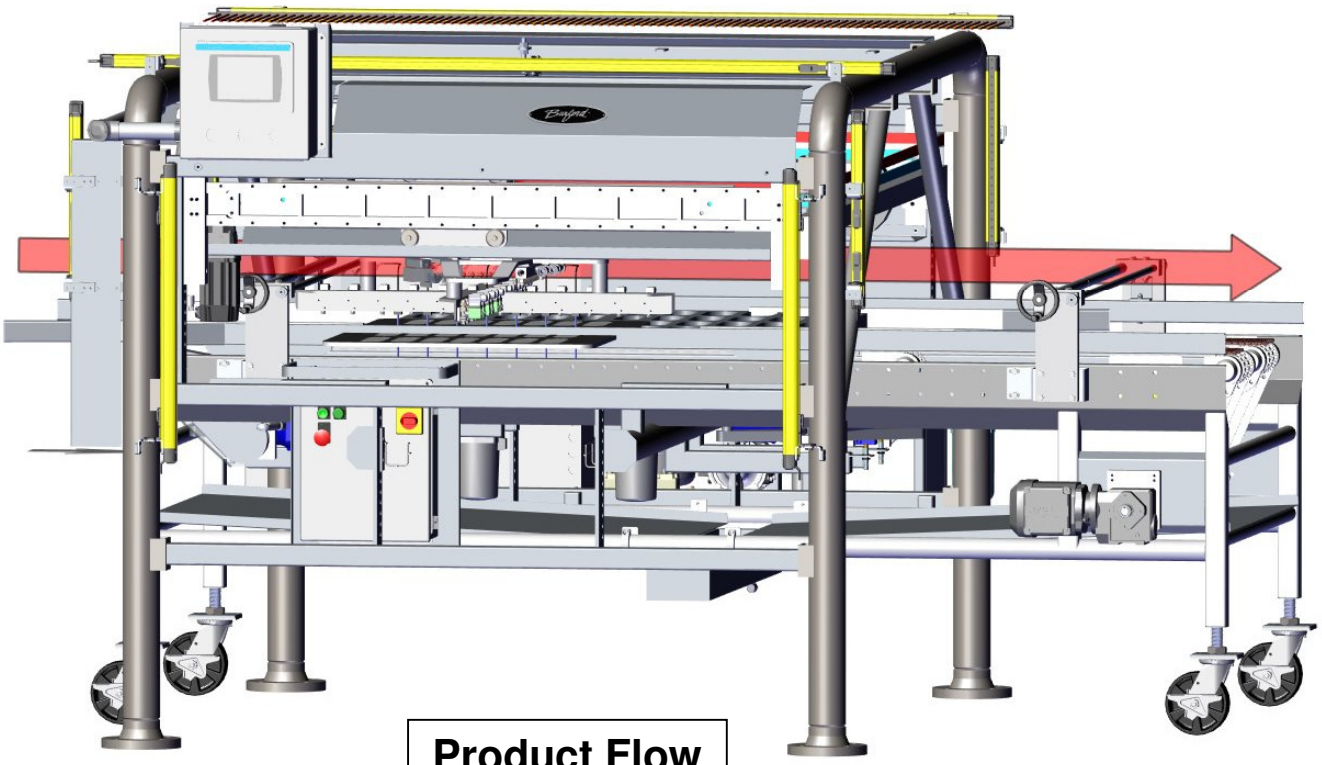


■ Specifications

SPECIFICATIONS	
Electrical:	
	480 V_{AC}, 50/60 H_Z, 3 Φ, 25 A
Air:	
	60 psi
Water:	
	40 Psi

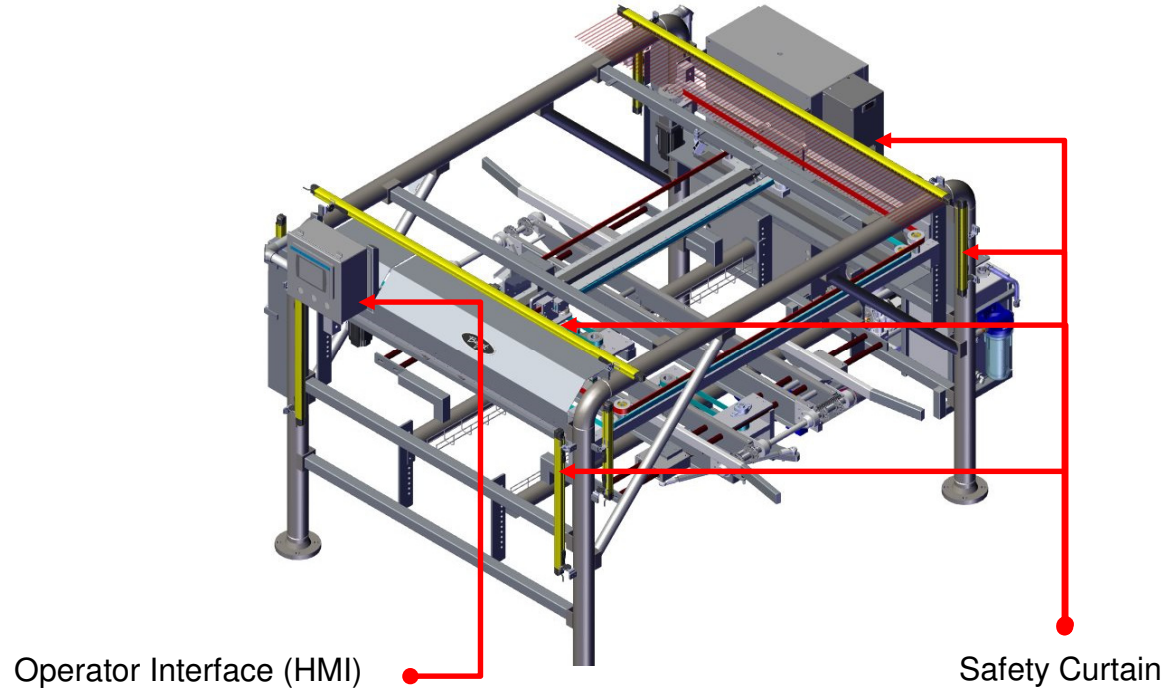
■ Models

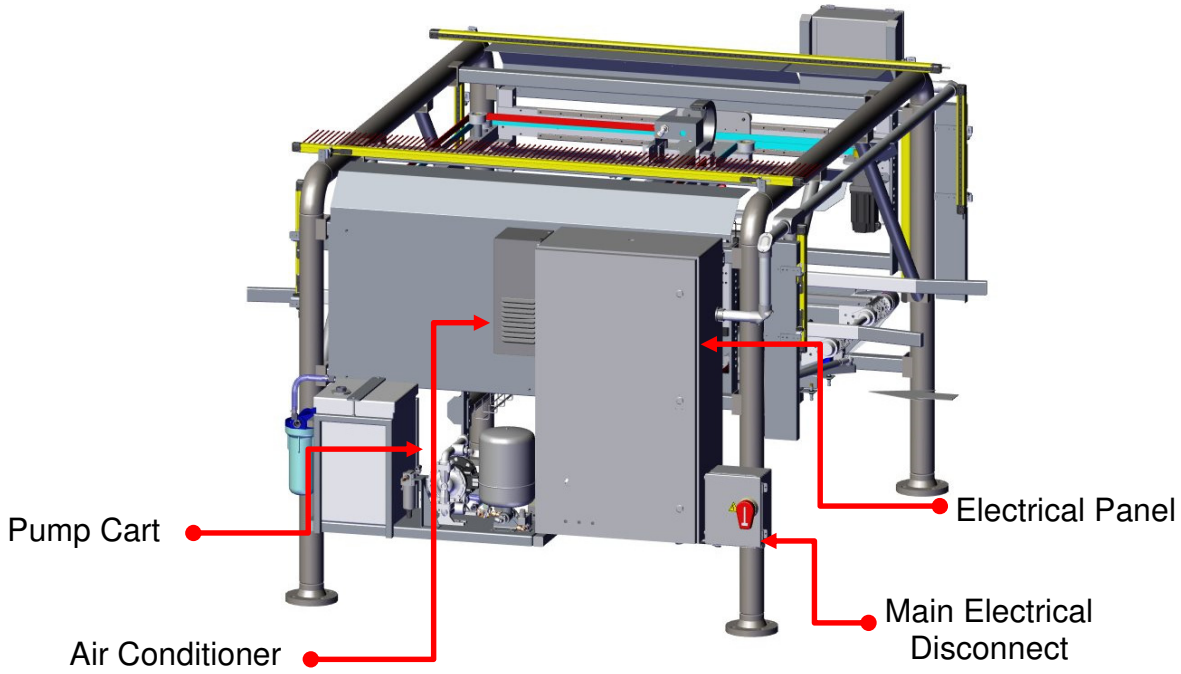
MODELS
HX 1000



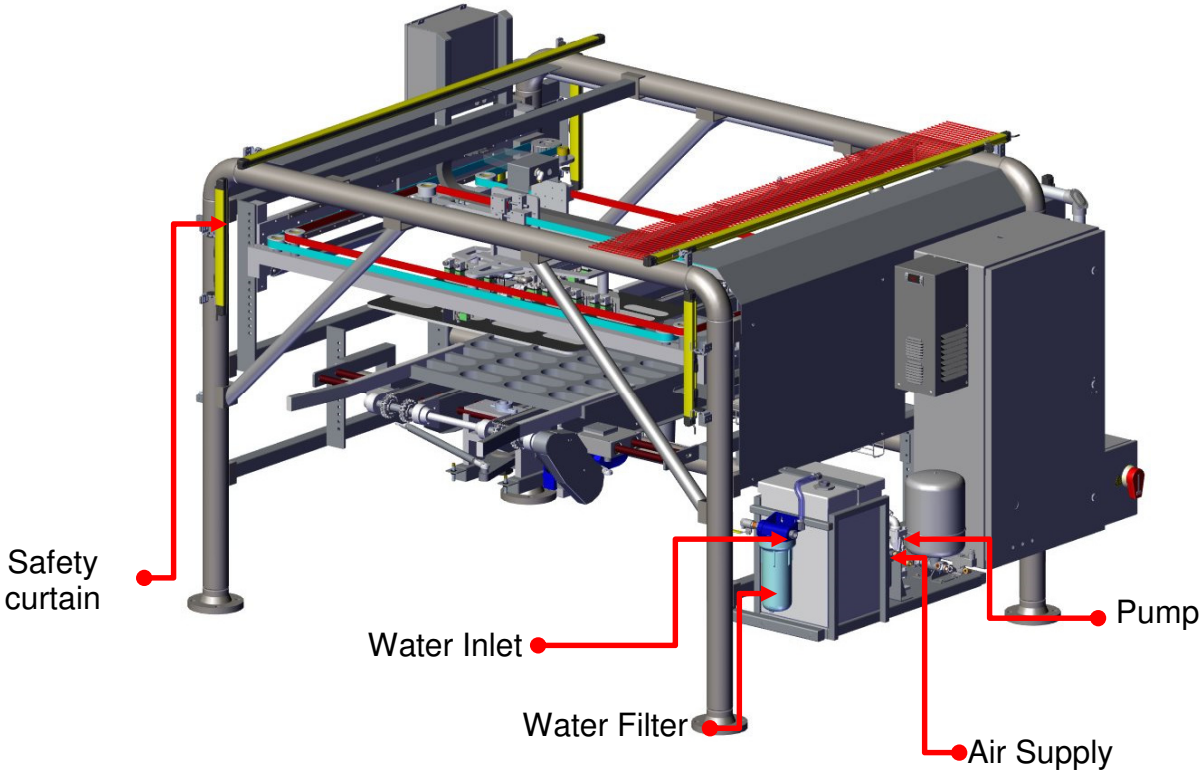
Product Flow

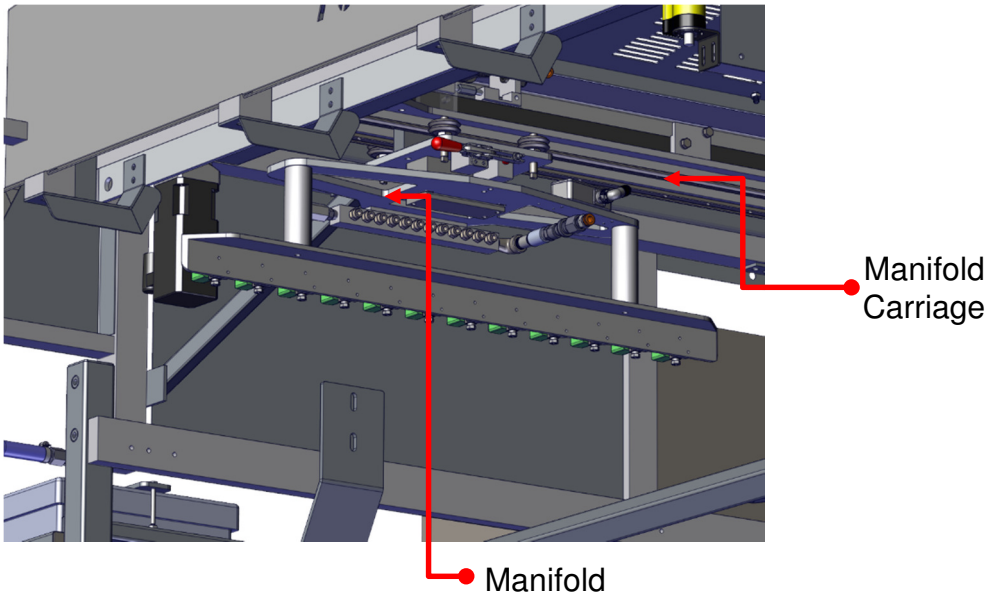
■ Basic identification Splitter





■ Basic Identification Conveyor





Chapter 2

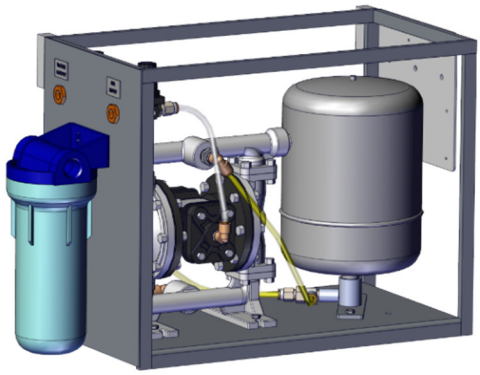
Key Components

CHAPTER 2: KEY COMPONENTS

Below is a list of key components that you must familiarize yourself with to gain a better understanding of this manual and to fully comprehend how the Splitter functions.

■ Pump Cart

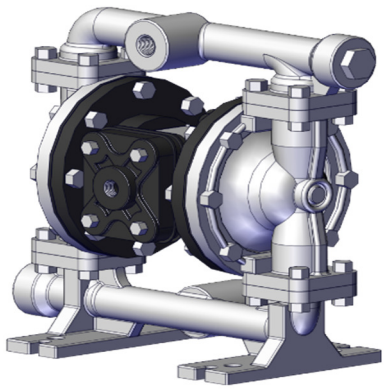
Pump Cart – The Pump Cart contains the necessary components to ensure uniform water pressure during the split sequence. It includes an air regulator, the water filter, reservoir, pump, and accumulator. All of these components work in unison to deliver consistent water pressure during the split sequence.



It is vital that there is not any water pressure fluctuations during the split sequence. Any variations in water pressure will cause undesirable splits in final product.

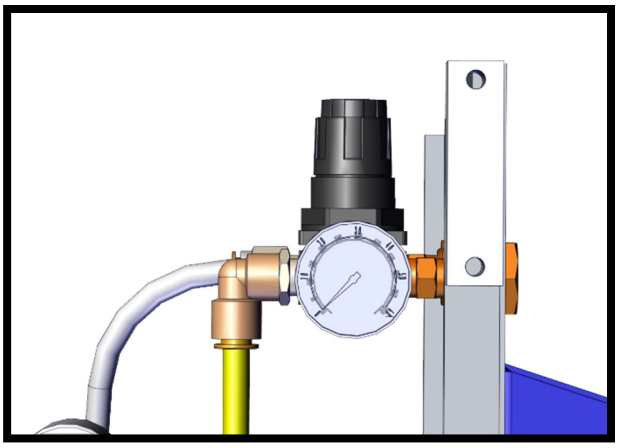
■ Diaphragm Pump

Diaphragm Pump – The Diaphragm Pump is a positive displacement pump that uses a reciprocating rubber diaphragm and valves on either sides to pump the water into the hydraulic system. The pump is powered by a supply of air and pressure can be controlled by the air regulator feeding the pump. The Output pressure of the pump is a 1:1 ratio of the input air pressure.



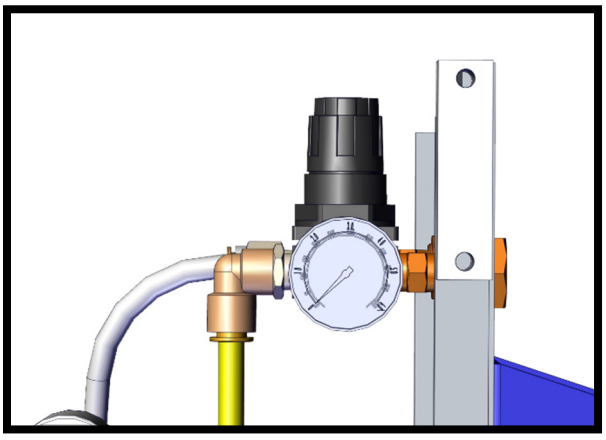
■ Pump Cart Air Regulator

Pump Cart Air Regulator – The Pump Cart Air Regulator controls the pressure of the air operating the diaphragm pump. The air pressure is at a 1:1 ratio of the output water pressure of the pump. The air pressure should be set at 20% above the max operating pressure of the water pressure.



■ Pump Cart Output Water Pressure Regulator

Pressure Regulator – The Pressure regulator is a valve that automatically cuts off the flow of liquid at a certain pressure. An adjustable knob is used to control the amount of pressure desired. In our application it is used to control the amount of water pressure supplied to the split nozzles. The amount of water pressure from the split tips determine the depth of the split into the product. Variations in dough will require adjustments to be made to the water pressure to receive the desire splits.



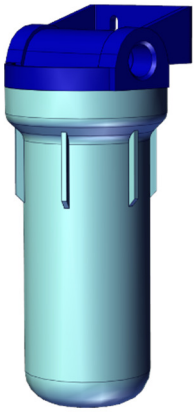
■ Accumulator

Accumulator – The Accumulator is a pressure storage reservoir in which the fluid is held under pressure by an internal bladder filled with compressed gas kept at a constant pressure, also known as a hydro-pneumatic accumulator. The use of an accumulator allows the hydraulic system to respond more quickly to a temporary demand and to smooth out any pulsations that may be present in the system. The internal bladder should be kept at 80% psi of the running pressure and uses a standard Schrader valve. Compressed air may be used to fill bladder.

Example: If running pressure is 100 psi then the accumulator should be filled to 80 psi.

■ Water Filter

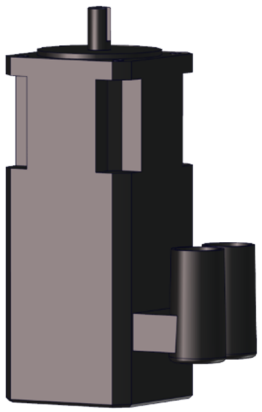
Water Filter – The Water Filter removes any contaminations from the water source. The filter supplied is rated at 10 microns. Replacement is recommended every 4 weeks but may differ depending upon the quality of the source water supply.



Order your replacement filters from Burford®. Call 1-877-Burford (1-877-287-3673) Today. Part Number: C00578

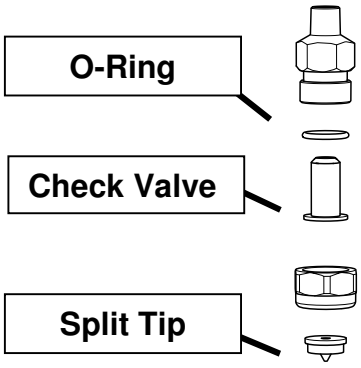
■ Servo Motor

Servo Motor - The unit has two Servo Motors. The motors are linked to the manifold carriage by a set of belts. Depending on the direction of travel the motors are capable controlling the carriage and the manifold position.



■ Split Tip

Split Tip – The Split Tip contains the components to ensure a desirable split. There may be a check valve that is used to close the valve once the pressure reaches a minimum pressure. This prevents dripping and air getting into the hydraulic system. An O-Ring gasket seals the splitter nozzle and prevents any leaking. A tip is then used to direct the water into a narrow stream with an orifice size specific for your needs. Different orifice sizes are available to meet a wide range of applications.



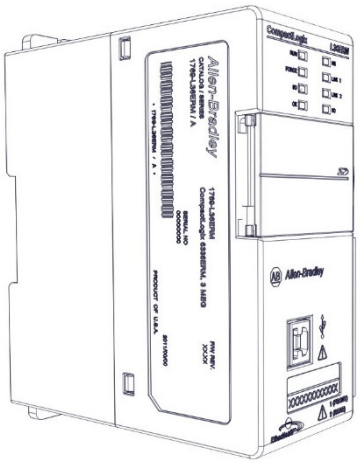
■ Control Panel

Control Panel – The Control Panel contains the Operator Interface (HMI), the E-Stop, Reset and Start buttons.

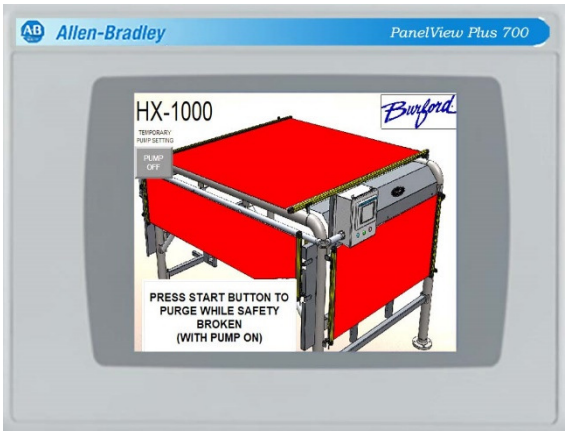
■ PLC / HMI

PLC - (Programmable Logic Controller), is a digital computer used for the automation of the unit. The PLC contains proprietary Burford® software that executes the operations of the Splitter, Manifold Carriage, Pan Guides, and Conveyor.

HMI - (Human Machine Interface), is where the interactions between the unit and software occur. It allows the operator to input parameters that controls the Splitter, Manifold Carriage, Pan Guides, and Conveyor.



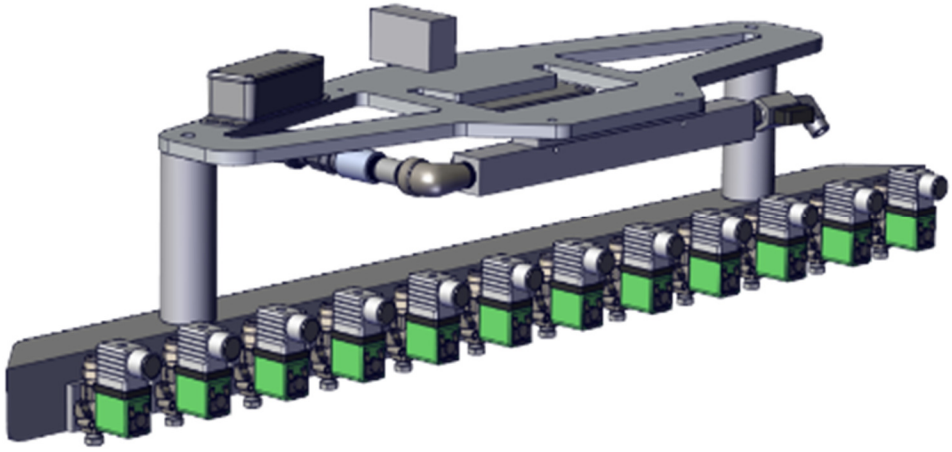
PLC



Allen Bradley Panel View 700 Plus

■ Manifold

Manifold – The Manifold contains the valves for the split. It was specifically designed for your pan based on the pan dimensions supplied at the time of ordering the unit.



Chapter 3

Installation

CHAPTER 3: INSTALLATION

Your HX 1000 is fully assembled when it arrives at your facility.

The area chosen should not allow product to stop under the Splitter.

The area around the Splitter installation site should be clear of any obstructions and the Splitter shall not be installed in such a way as to create a safety hazard, or block a normal passage way. Clearance must conform to all local safety codes.

Installation site should have ample clearance on the operator control side for:

- Easy access
- Removal of Manifolds
- Normal maintenance

Consideration must be made for the manifold storage near installation site.

Installation outline

- Choose an appropriate location
- Place Unit
- Mount unit
- Connect to utilities

Conveyor Mount Requirements

1. The conveyor used should have at least 60 inches of free length. This distance should be measured from the conveyor sides only, since some conveyor chains extend past the conveyor sides.

2. The sides of the conveyor must be free of any interference from bolts, conduit, motors, shafts, junction boxes, guarding, support members, etc.

3. The underside of the conveyor must be clear of the interference from bolts, conduit, motors, shafts, junction boxes, guarding, support members, etc.

4. The top of the conveyor should be an open style, so the pan present sensors have an unobstructed path between them.

5. Pan guides must be used to keep the pans straight when traveling through the splitter. The guides should not extend more than 1-1/2 inches away from the pan.

6. The conveyor chosen should not allow the pans to stop, turn, or back-up.

7. Area around splitter installation site should be clear of any obstructions and splitter shall not be installed in such a way as to create a safety hazard, or block a normal passageway. Clearance must conform to all local safety codes.

8. Installation site should have ample clearance on operator control side for easy access, storage of pump cart and normal maintenance.

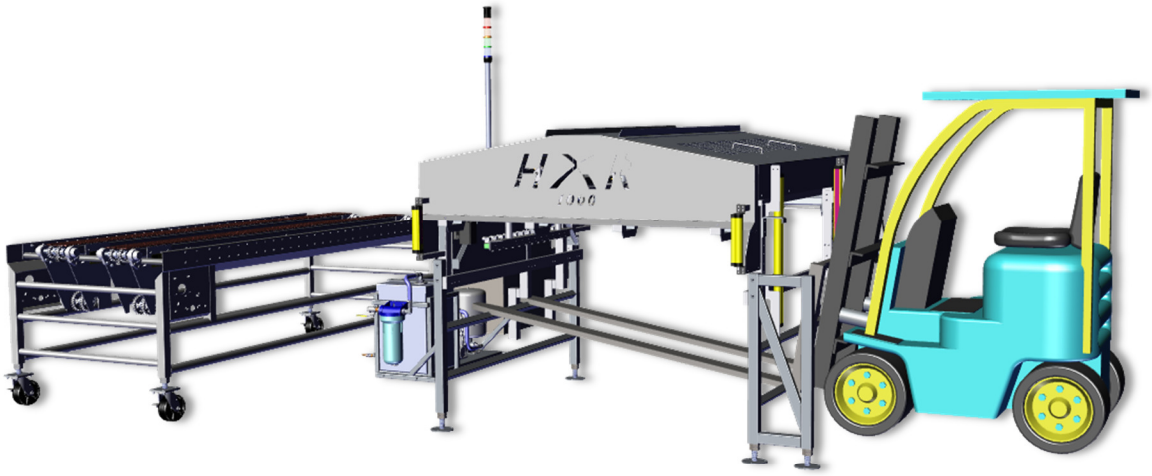
■ Place Unit

1. The unit is mounted on castors for portability.

2. Locate an area that is clear of obstructions. The area chosen should not allow the product to stop, turn, or back-up. A supply of compressed air and power needs to be available at installation site.

3. The unit must be placed onto an existing conveyor.

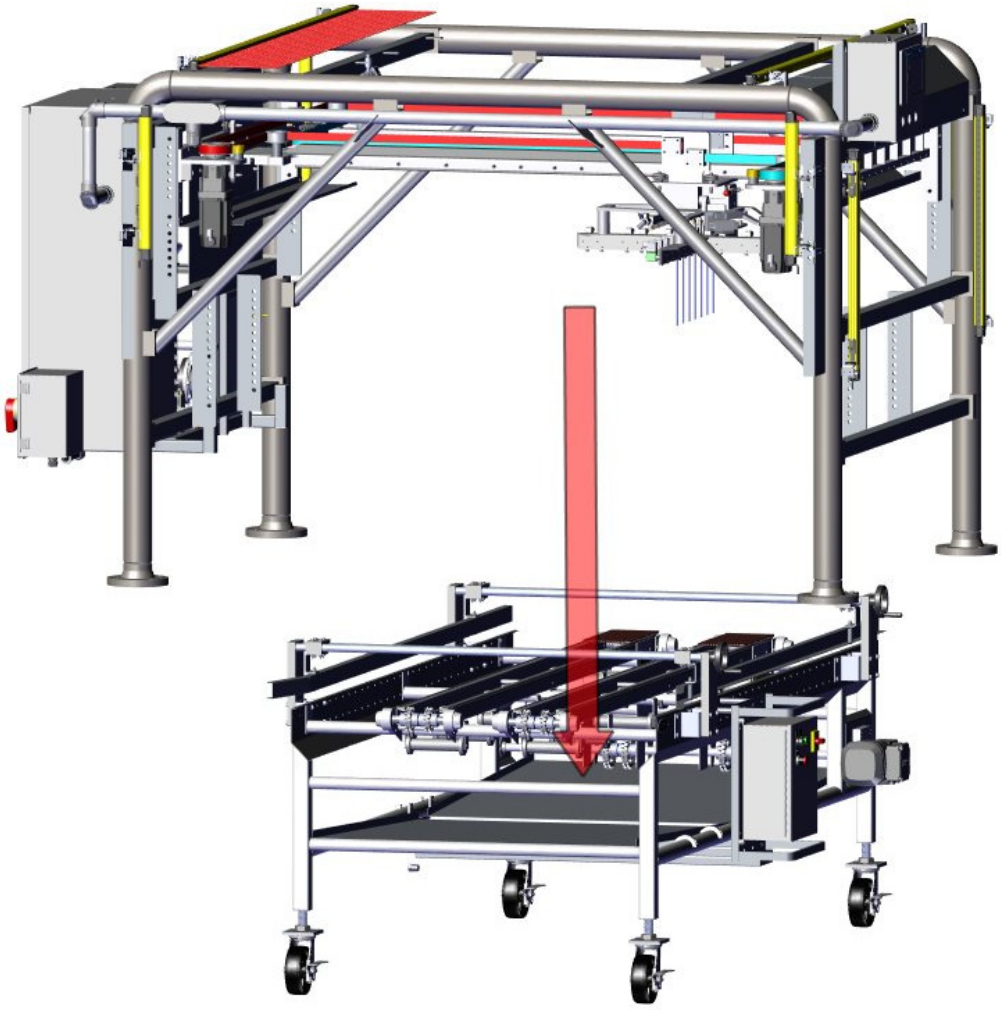
4. The unit is heavy. Machinery may be required to position the unit. Exercise extreme caution when moving the unit into place. Burford is not responsible for damage incurred during installation.



Verify top clearance for unit.

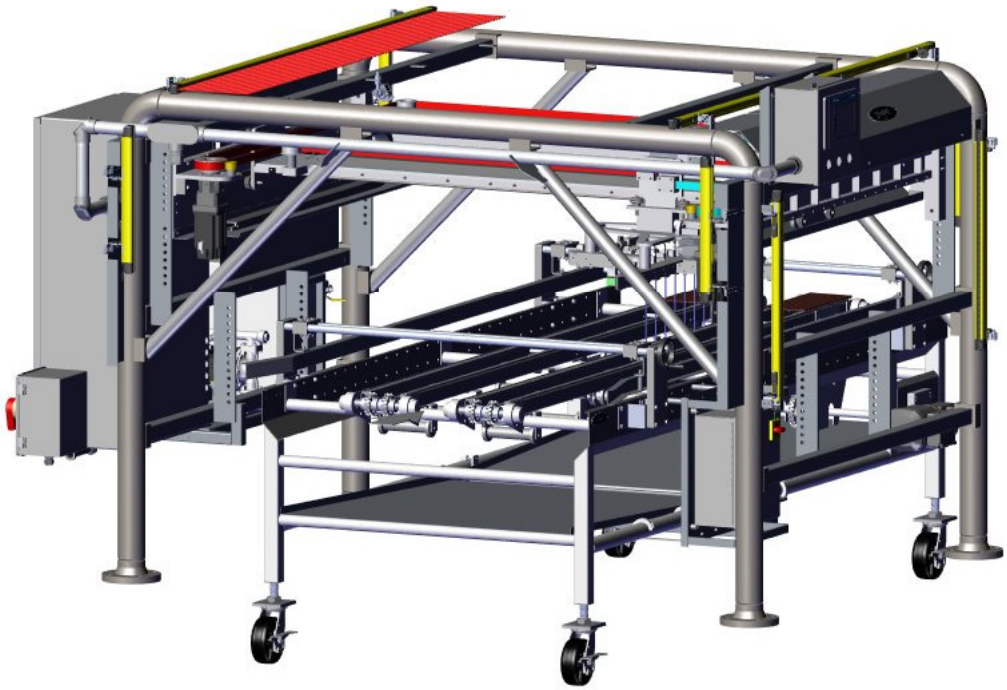
■ Place Unit, cont'd

The Unit can remain on the Castors for portability, or the unit can be permanently fixed to the floor. When the unit is in operation, the Castors must be locked to prevent movement.



■ Position Unit

The height of the support legs are adjustable. Verify at least 4” of clearance from the existing conveyor. There are a total of six leg supports. The foot pads are mounted to a threaded shaft rod. The threaded shaft rod is able to extend and retract approximately six inches of travel within the leg support.

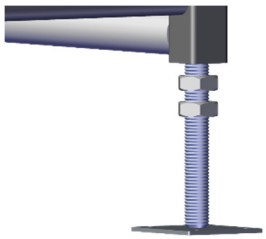


■ Installation

The unit must be permanently fixed to the floor.

Remove any temporary castors.

Loosen the jam nuts.

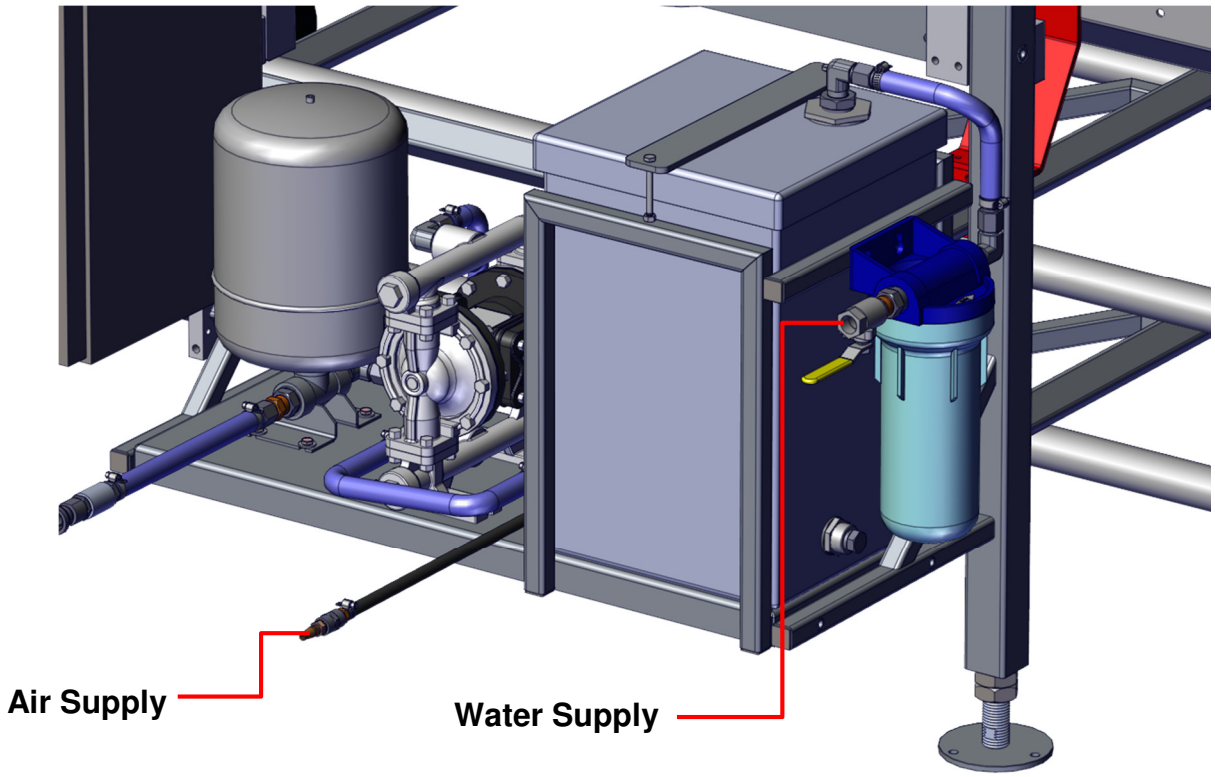


Rotate Tread Shaft to adjust height.

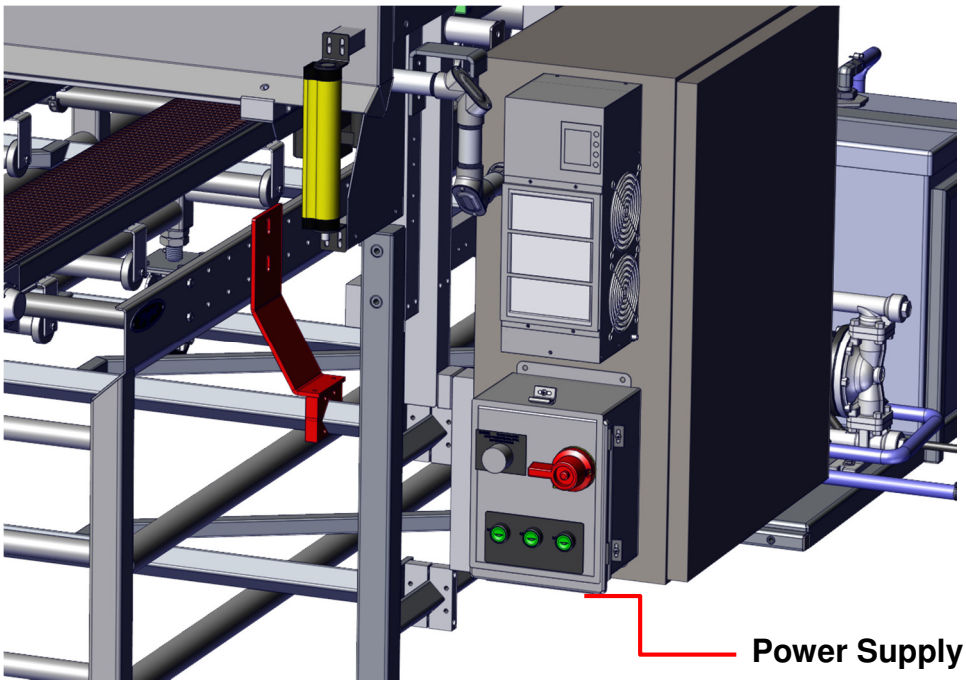
When at desired height tighten the jam nuts.

Drill holes with matching the bolt pattern of castor mount and secure with concrete anchors.

■ Connect Air and Water

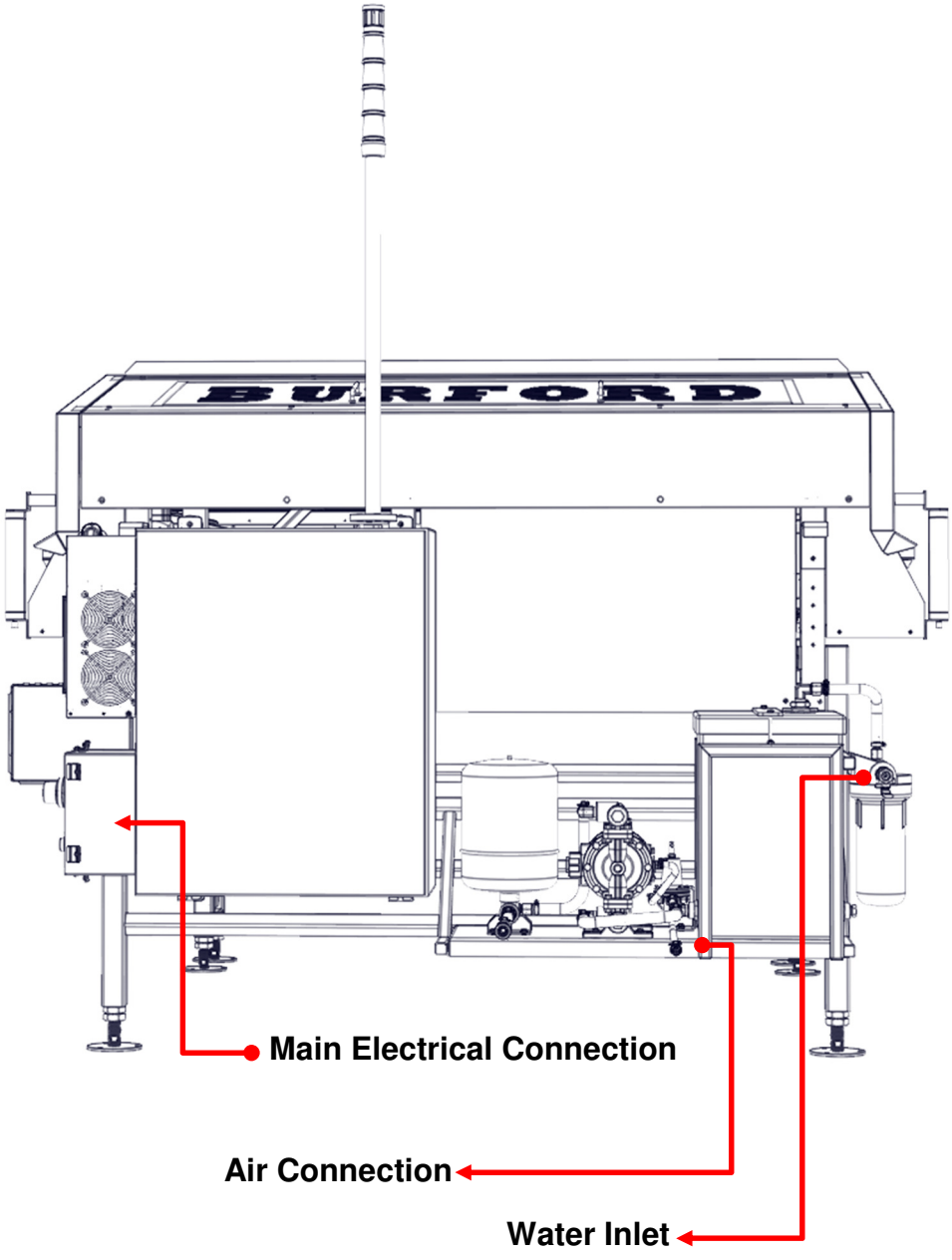


■ Connect Power



■ Power connections

Connect Power to the unit. A qualified electrician must make all electrical hook-ups using a suitable service with all safety requirements and compliance to local codes being followed. Refer to electrical diagram at the end of the manual for connection details.



■ Installation Arrangements

A Burford® factory trained Installation Engineer may be hired for any installation. The arrangement can be made with the Service Manager:

Burford® Corp.
Maysville, Oklahoma
Phone: 1-877-BURFORD® or 405-867-4467
Fax: 405-867-4219

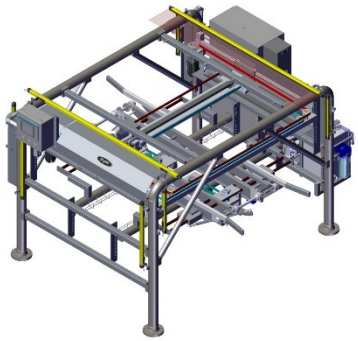
Chapter 4

Operation

CHAPTER 4: OPERATION PROCEDURES

■ Theory of Operation

The Burford® HX 1000 Splitter has been designed to provide a knife-like split on top of proofed dough. This system provides precise split location in relation to the pan shape and program stored in the motion controller. The Splitter brings together precise application, convenience of operation and ease of maintenance in one system.

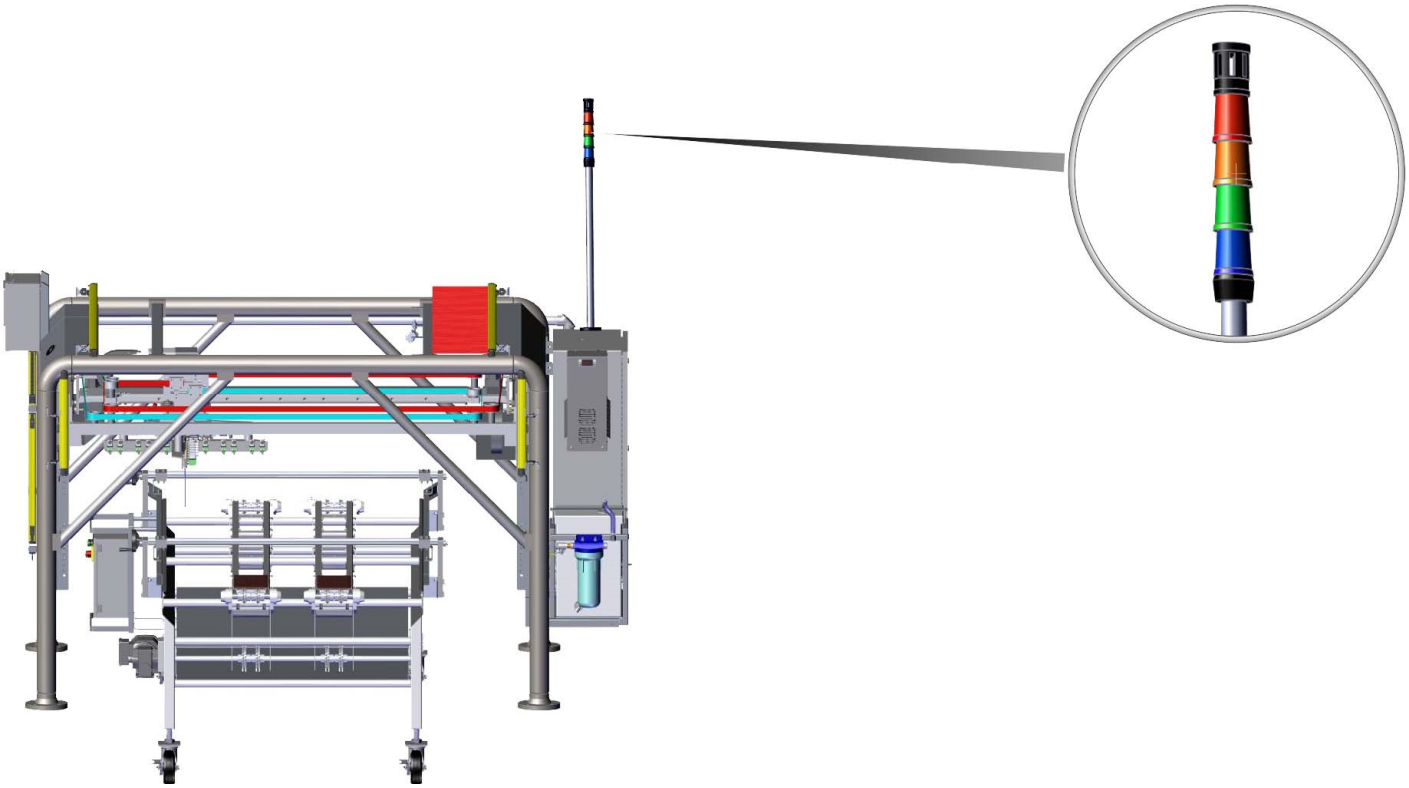


The Burford® HX 1000 Splitter creates one of two different types of split patterns (straight and cross) on the top of the dough piece. The location and type of the split is determined by the data entered by the user when setting up individual varieties (this function is password protected). Individual varieties are selected by using the display located on the control panel.

The cross split and straight split sequences are performed while the pan is moving through the unit. This provides the high speed capability of the unit. As the pan travels toward the splitter, the leading edge of the pan triggers a photoelectric sensor. The pan sensor tells the PLC that a pan is present and that a splitting cycle may begin. The PLC constantly monitors the output of the motion program controller to obtain the exact location of the splitter manifold. Utilizing the selected variety's settings from the operator interface, the unit then completes the split type on the pan. The carriage holds an array of nozzles that are arranged in a pattern, which matches the pattern of the cups in the pan. After completion of the split sequence the carriage awaits a new signal from the pan sensor.

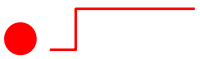
■ Light Tower

The HX 1000 utilizes a Light Tower to convey information to the operator. This is very useful in determining the state of the unit.



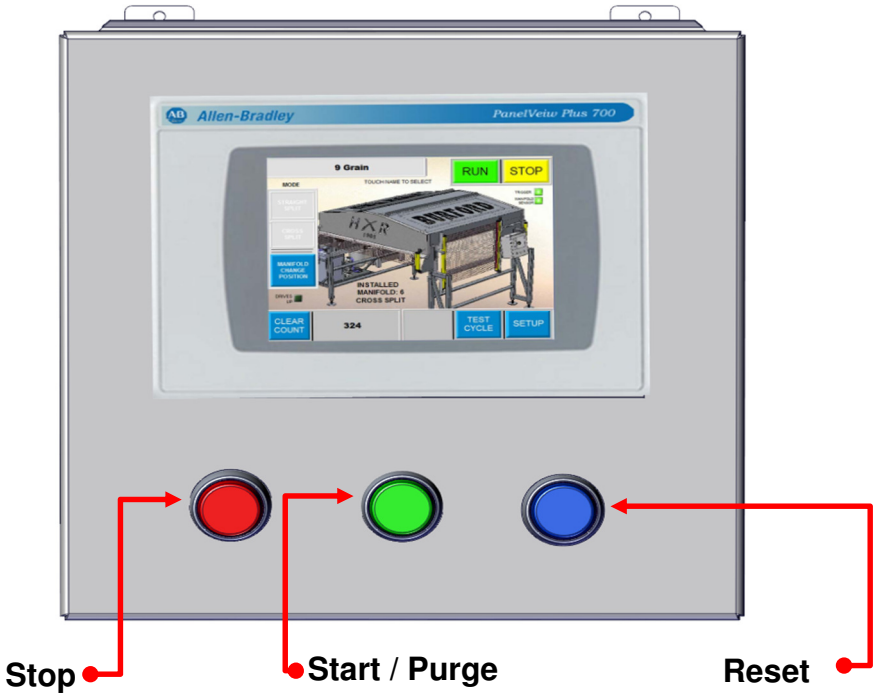
■ Light Tower, cont'd

The Light Tower comprises of four colors; blue, green, amber, and red.

Light Tower Status		
	Solid Blue	Interlocks are not made.
	Green Solid	Both Drives are operational. A variety is selected and active.
	Green Blink	Both Drives are operational. A variety is selected. The unit is loading the selected variety.
	Amber Solid	One or Both drives are disabled. Either no variety is selected or the unit is idle.
	Amber Blink	An over travel sensor has been made.
	Solid Red	A fault has occurred in one or both drives.

■ Operator Panel Lights

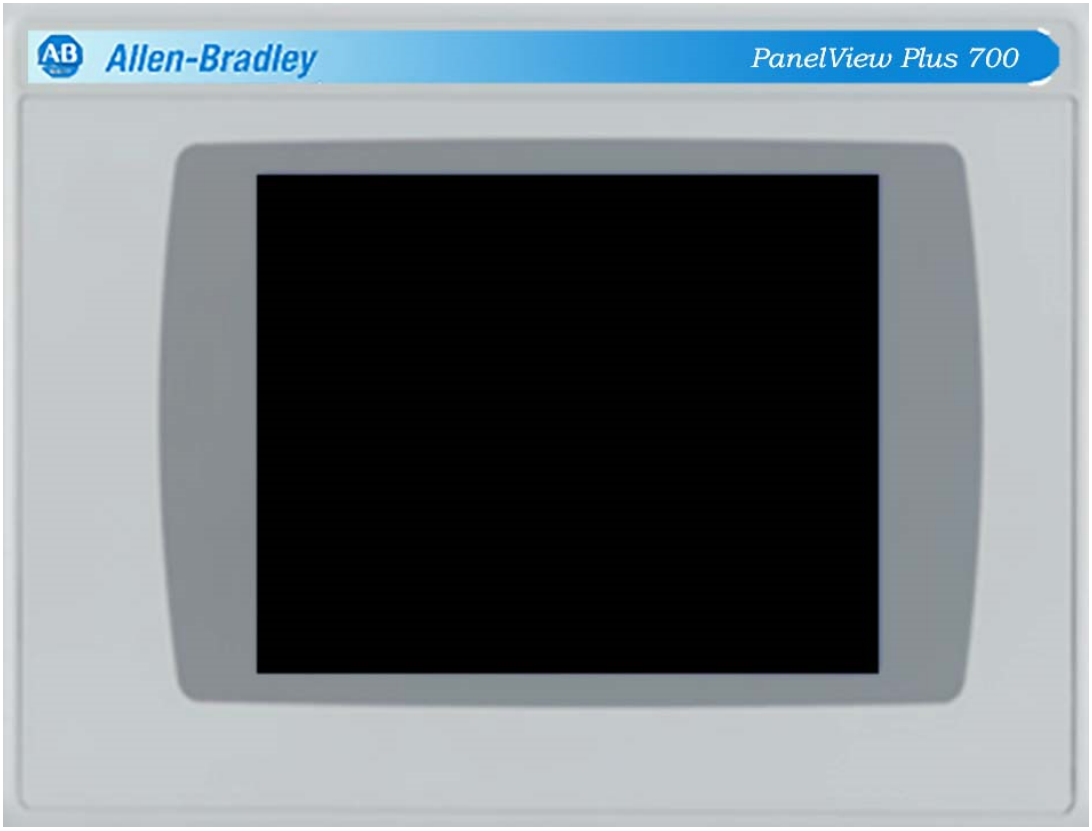
The control panel contains 3 buttons, Stop, Start / Purge, and Reset. Each button has a light.



Control Panel Button Status		
	Solid Blue	Interlocks are not made. Push to reset Interlocks.
	Green Solid	When the interlocks are broken, or when a variety is active, pressing the Start / Purge button will initiate the Purge.
	Green Blink	Anytime that the unit needs to move and the carriage is currently under motion control, the Start / Purge will blink. The button must be pressed before any movement will occur.
	Solid Red	When pushed in the lamp will be on. Must be pulled and lamp off to operate.

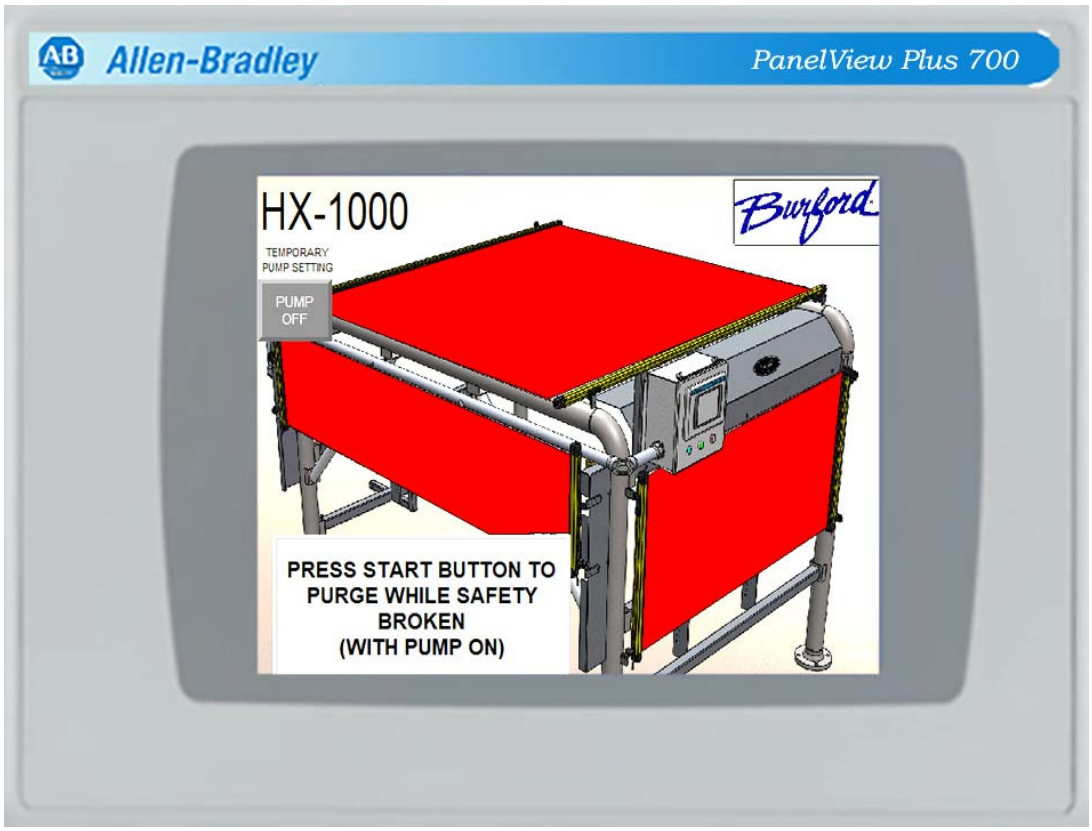
■ User Interface

The unit will be operated and configured using the operator control panel.



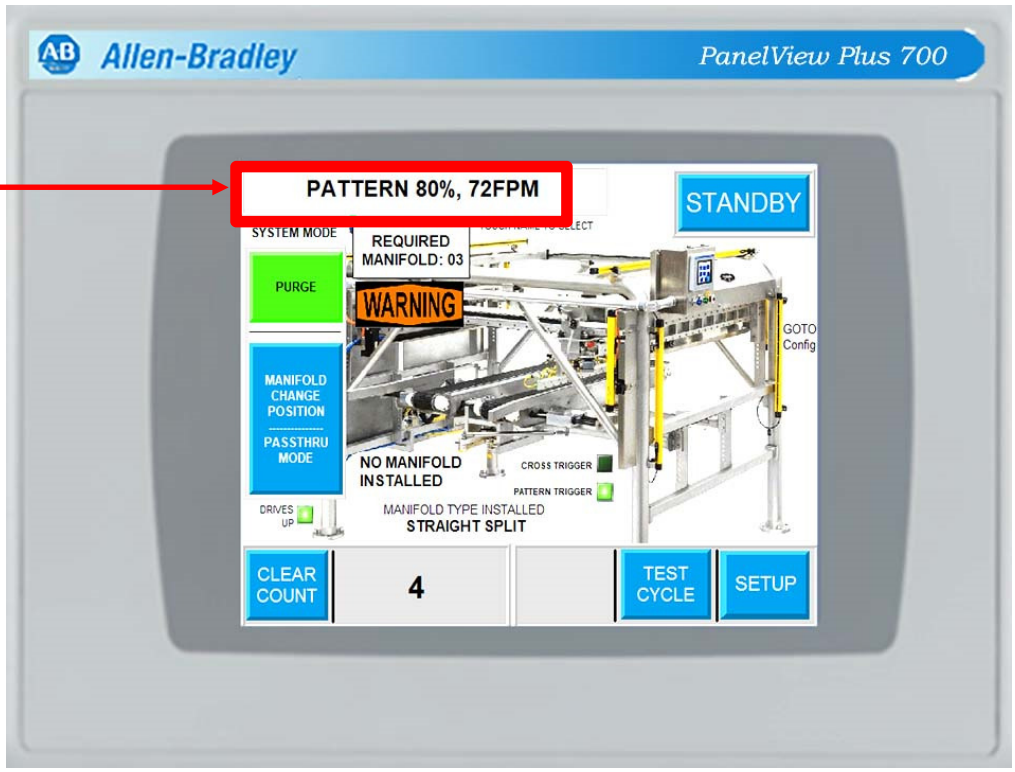
■ Startup Screen

The first screen encountered after power up is the startup screen. Verify that all light curtains are free from any obstructions. Pull the E-stop when safe to do so. Press the Blue Reset Button to start the unit. Press the Green Start / Purge button to purge the unit. Red light curtains on the screen indicate a light curtain that is being obstructed. Clear any obstructions and proceed when safe to do so.



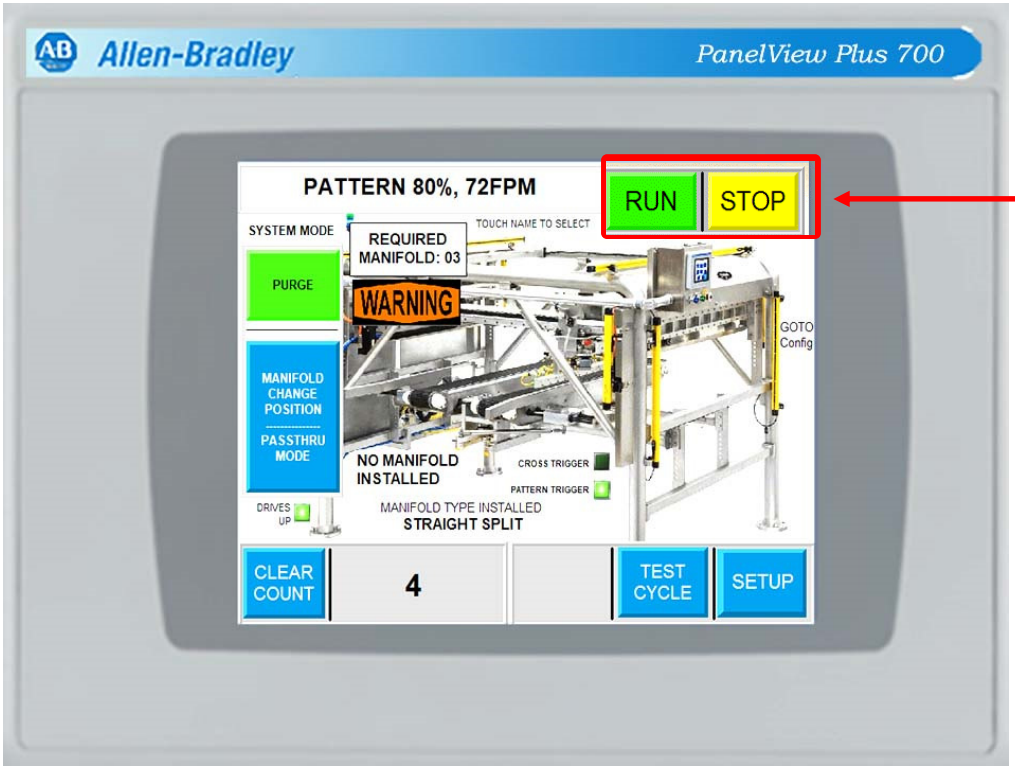
■ Main Run Screen

The Main Run Screen is where the operator will monitor the status and the unit and control the unit. In the following pages we will discuss the different functions on the Main Run screen.



The **Variety Name box** identifies the name of the current variety selected. Press the box to bring up a list of all of the available varieties to select from.

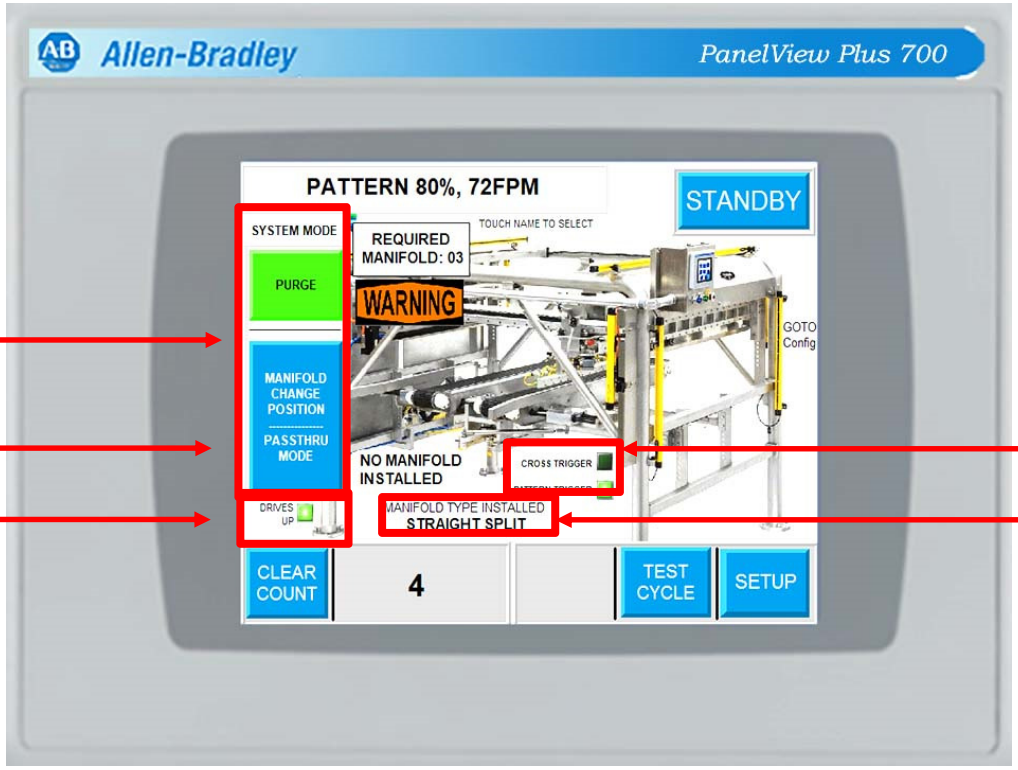
■ Main Run Screen – Run / Stop



Once a variety has been selected press "**RUN**" to enable the unit. Press "**STOP**" to disable the variety.

When a variety is enabled a trigger from the pan sensor will initiate the splitting sequence.

■ Main Run Screen – Mode and indicators



The **DRIVES UP** indicator will be green when both drives are enabled.

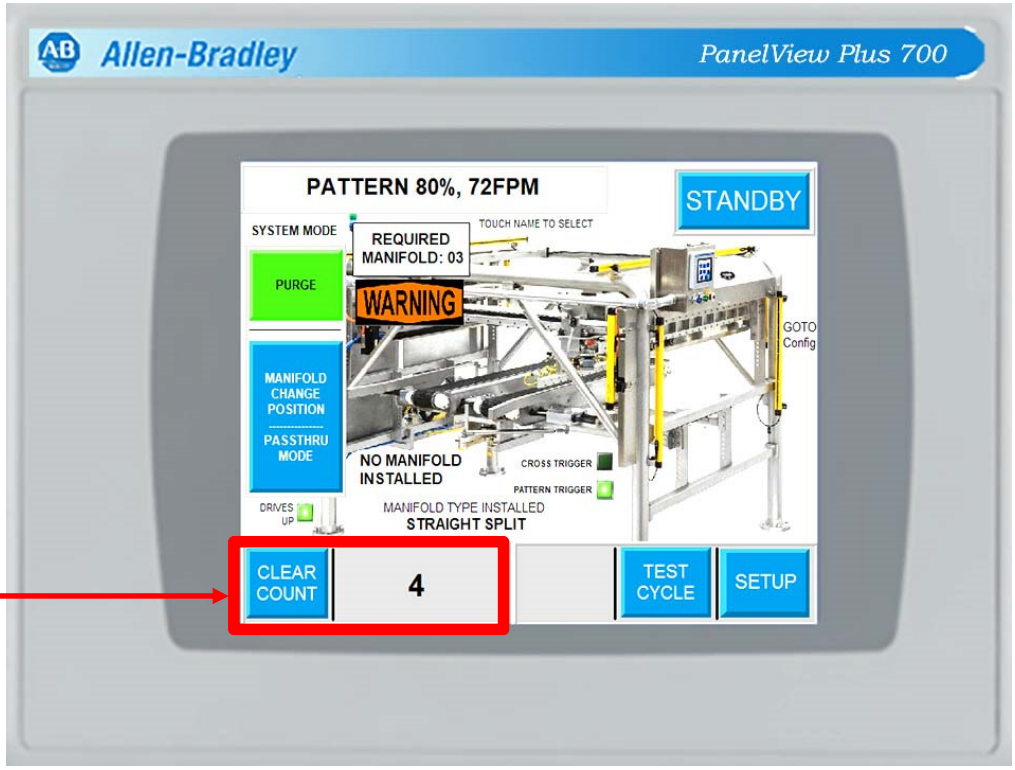
Pressing the **MANIFOLD CHANGE POSITION** will move the carriage to the change position and disable the drives. The operator can now change manifolds.

The mode that is setup for the variety will be green.

The **Installed Manifold** displays the number of the current manifold installed or will display "**No Manifold Installed**" if there is not a manifold installed. The type of manifold will be displayed, straight or cross split.

The **TRIGGER** indicator will turn green when pan sensor is made.

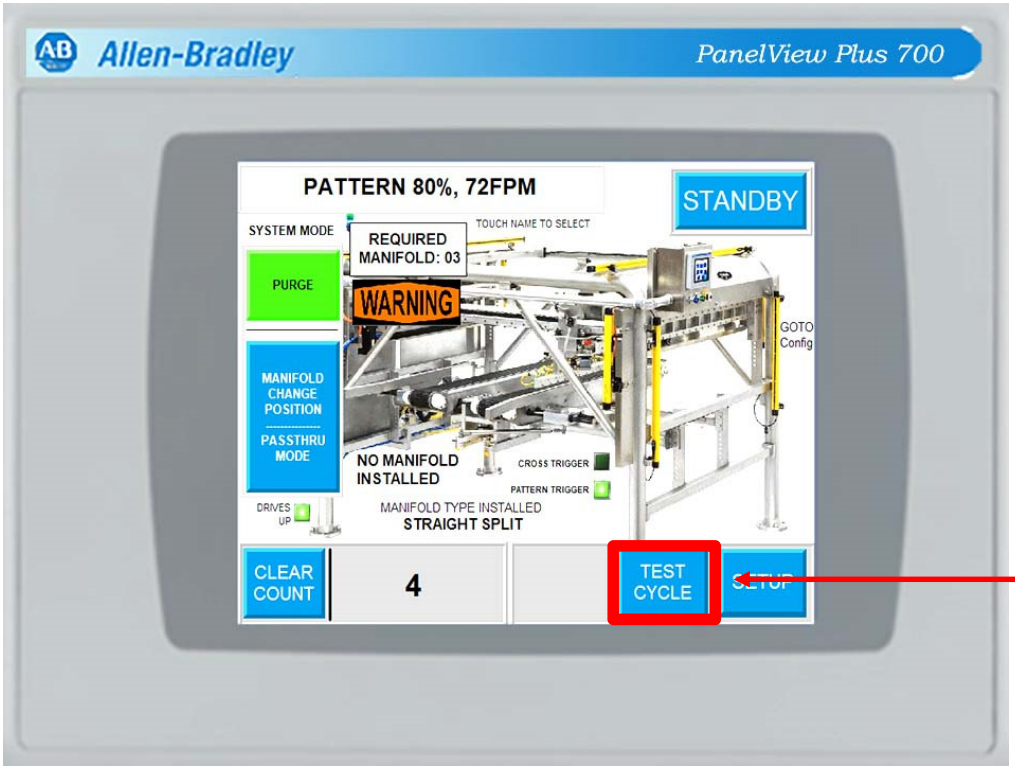
■ Main Run Screen – Count



The unit will count the number of pans that are split. Each cycle of the unit will increment the value up by one.

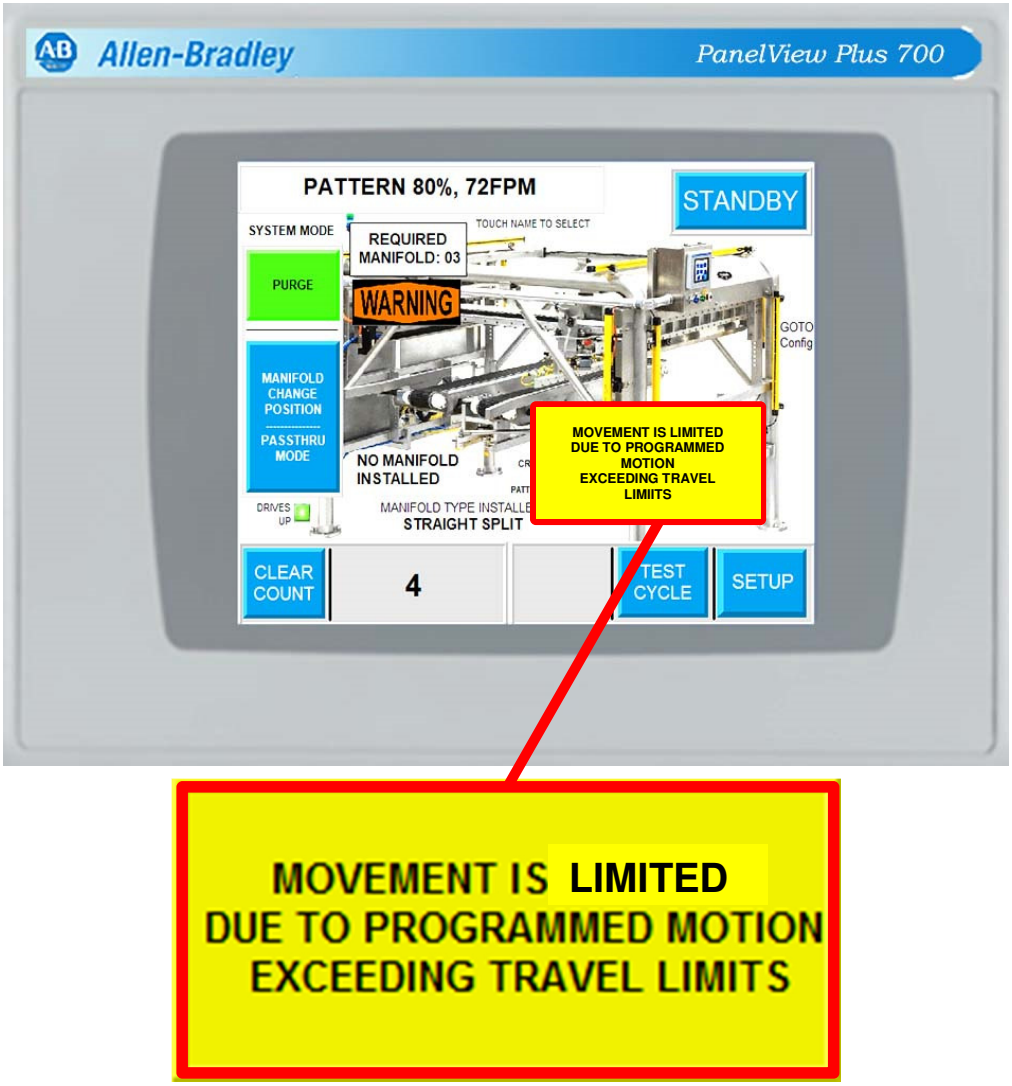
Press "**CLEAR COUNT**" to reset the value to zero (0).

■ Main Run Screen – Test Cycle



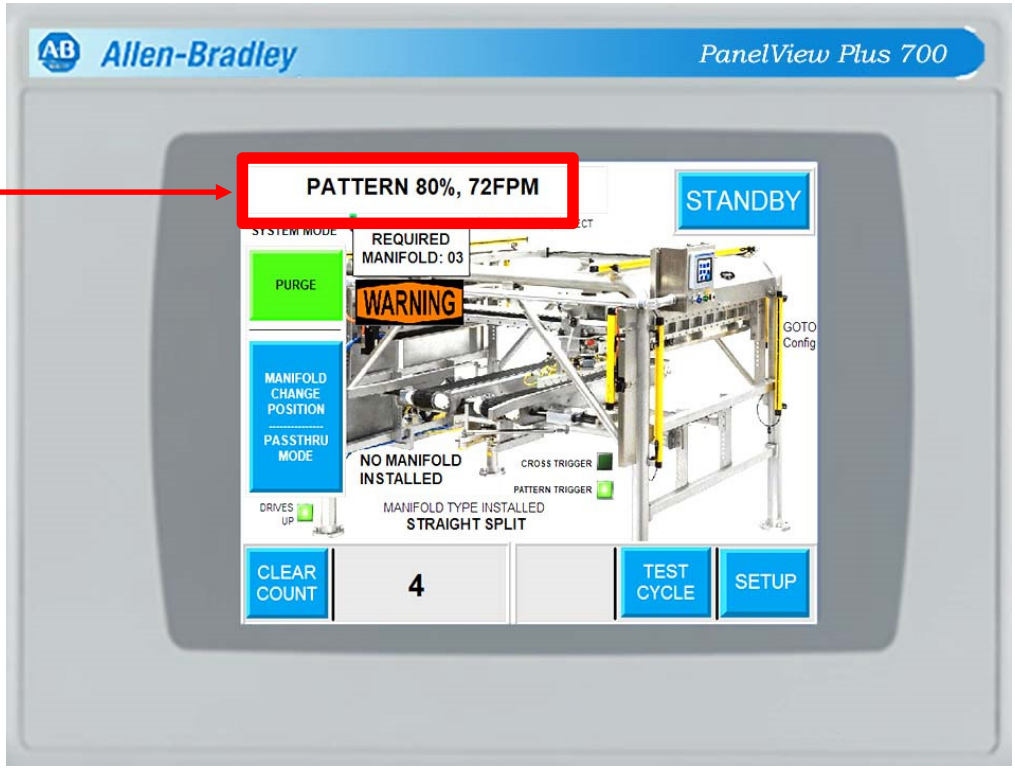
The **TEST CYCLE** button allows the operator to verify the execution of the split sequence. When the button is blue, the operator may press the button to initiate a single split sequence of the unit.

■ Main Run Screen – Exceed Limitations of Unit



A yellow banner will appear if the programmed settings are wider / longer than the unit can accommodate. The unit will still function. The unit will not be able to perform the desired settings and will be limited to the physical capabilities of the unit.

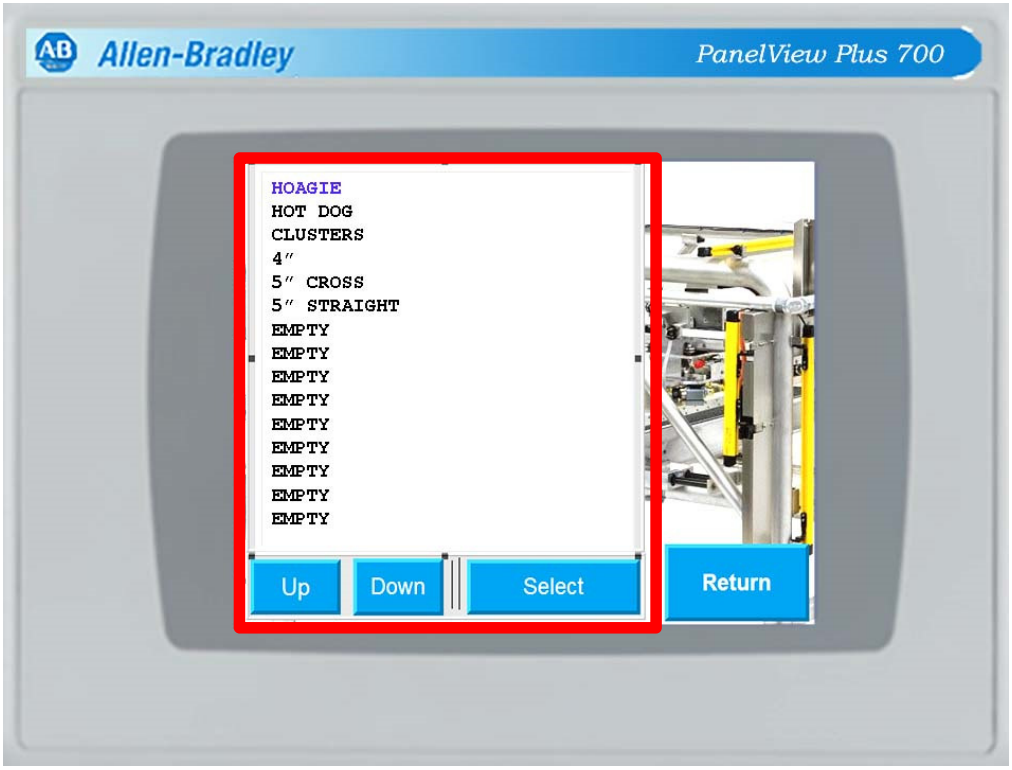
■ Main Run Screen – Select Variety



The Variety box will indicate the variety that is loaded on the unit. If there is not a variety loaded, the message **NO VARIETY** will be displayed.

Touch the box to select a variety. A popup menu will appear.

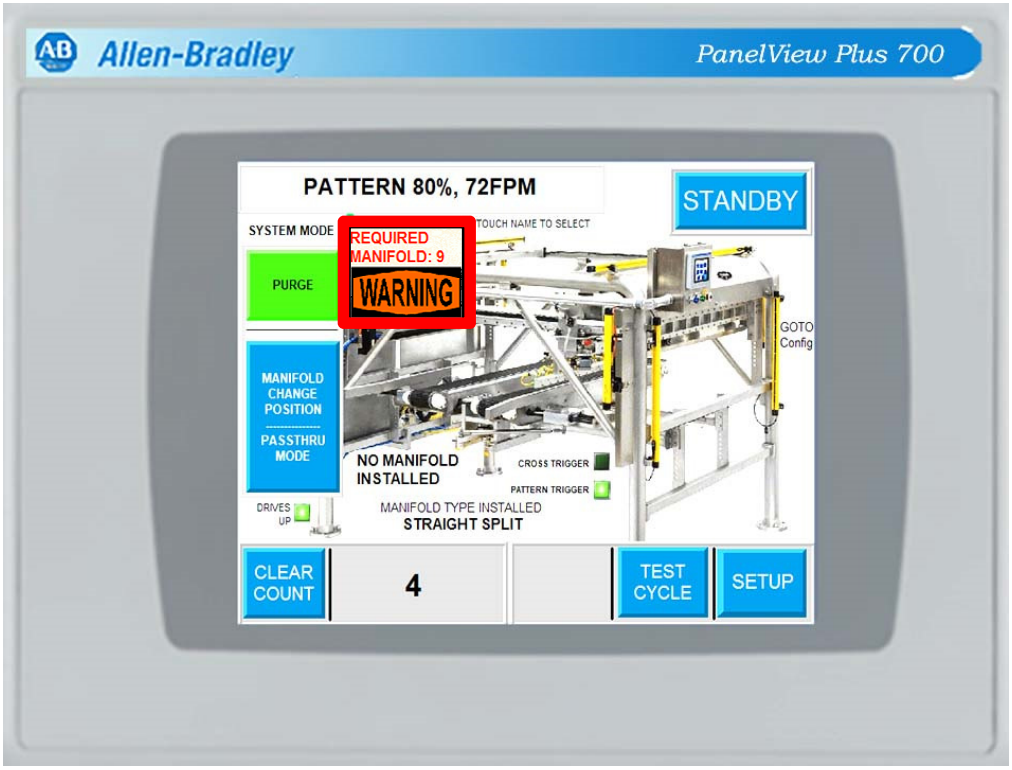
■ Main Run Screen – Select Variety



Press the “**UP**” or “**DOWN**” button to highlight the desired variety. Press “SELECT” to load the highlighted variety.

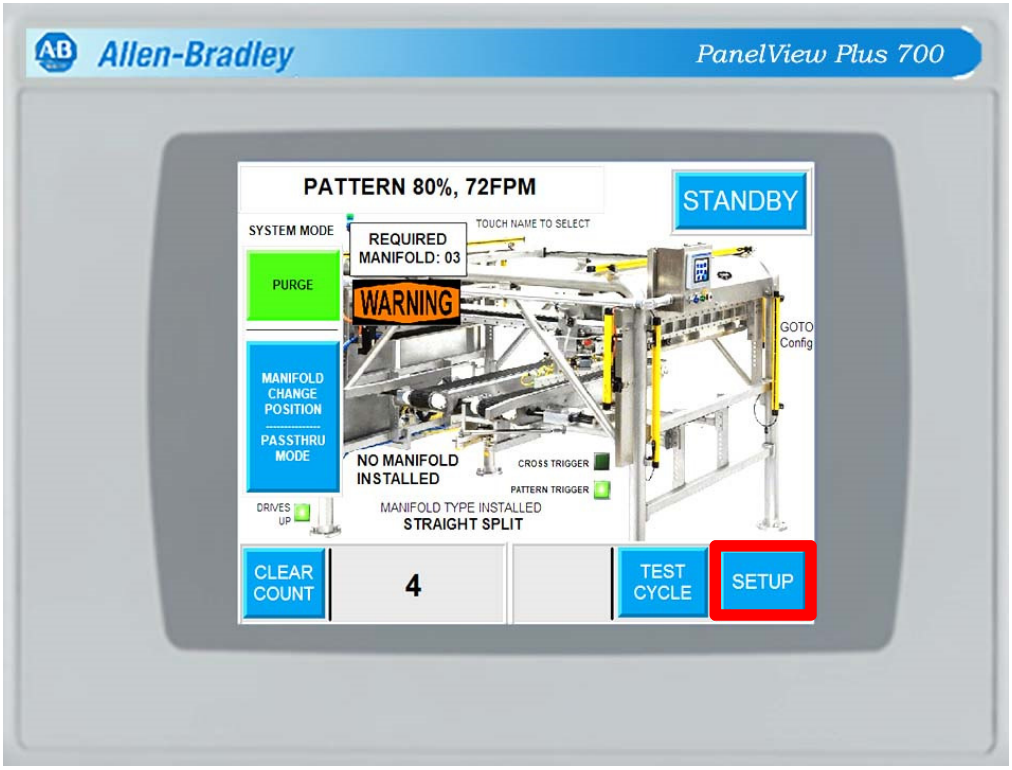
Press “**RETURN**” to go back.

■ Main Run Screen – Select Variety



After selecting your variety you may receive the following warning message. This message indicates which manifold must be installed for that variety to run. You must install the manifold indicated to run the variety.

■ Main Run Screen – Setup

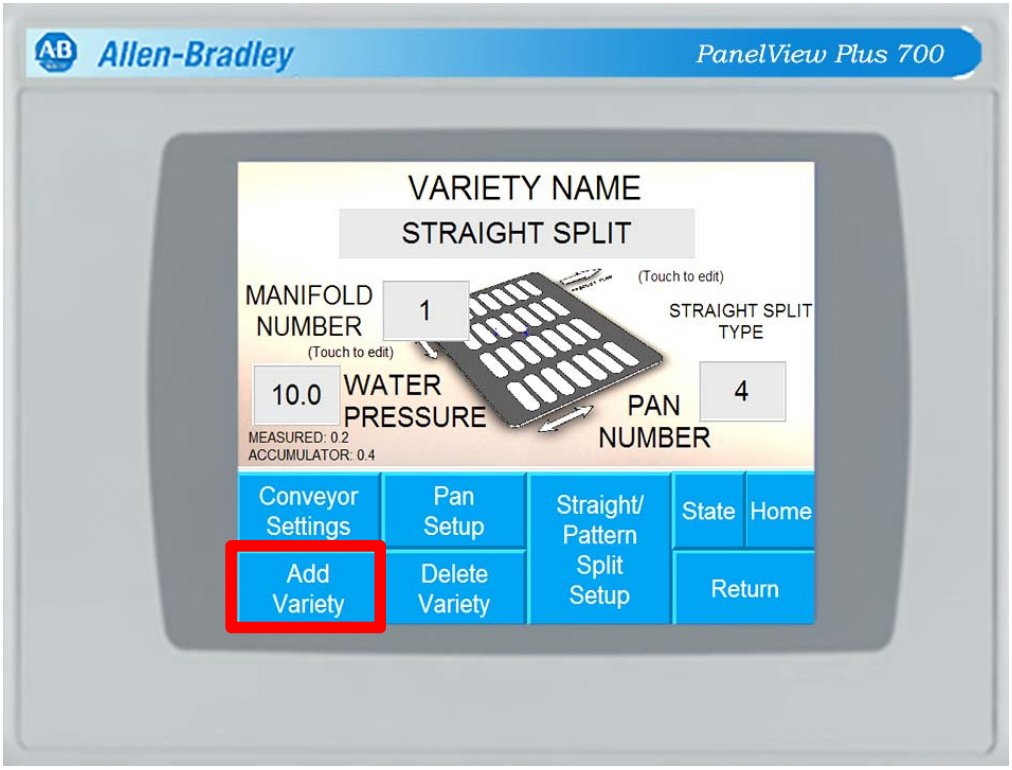


Pressing "**SETUP**" will take you to the setup screens. A password will be required to proceed.

If a cross split manifold is installed on the unit you will go to the Cross Split setup screen.

If a straight split manifold is installed you will go to the Straight Split screen.

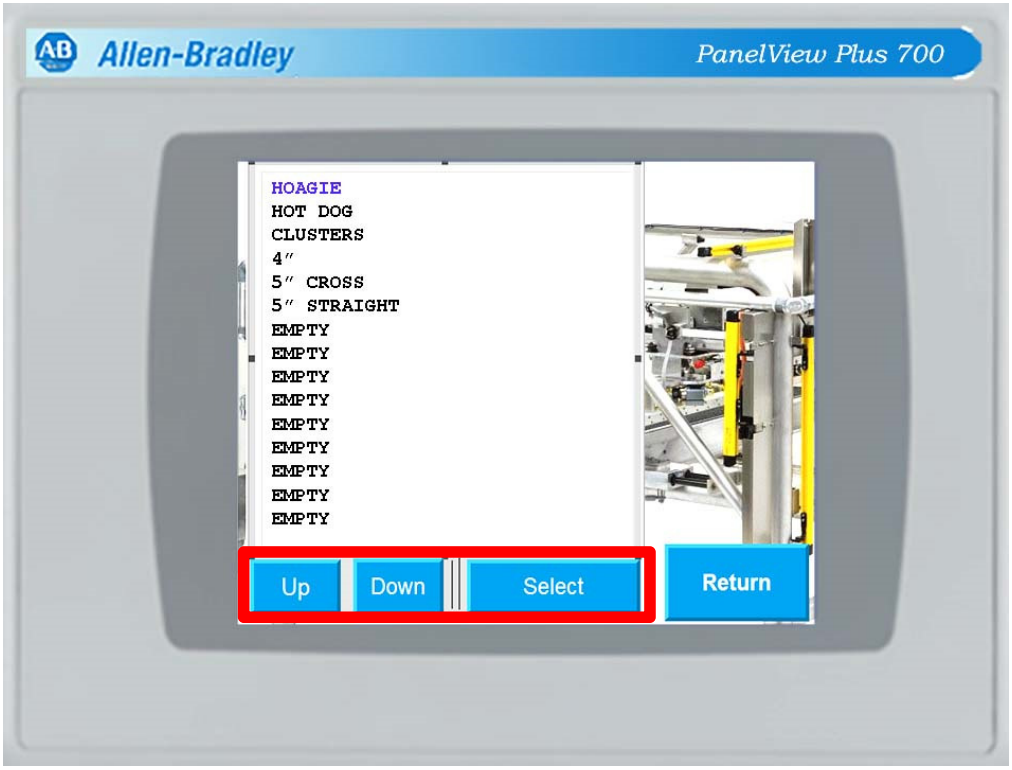
■ Add New Variety



We will add a new variety. If there is not a variety loaded you will receive the message **NO VARIETY SELECTED TO EDIT**.

Press the "**ADD VARIETY**" button.

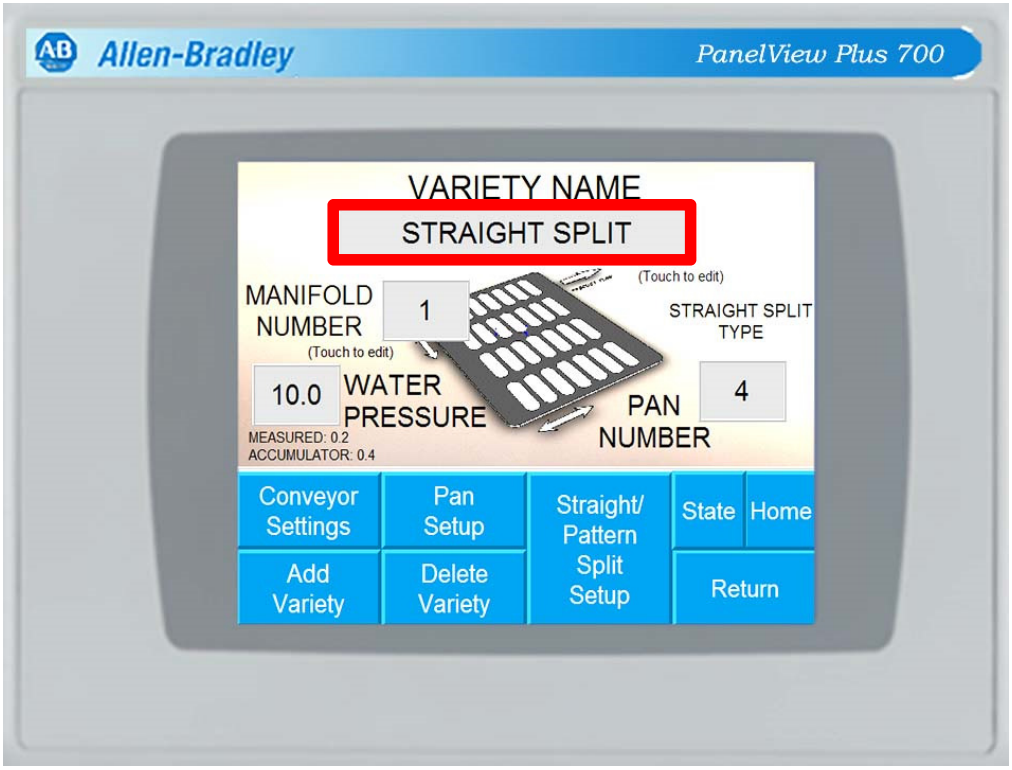
■ Add New Variety



Press the "**UP**" or "**DOWN**" button to highlight an EMPTY slot. Press "**SELECT**" to add a variety.

Press "**RETURN**" to go back.

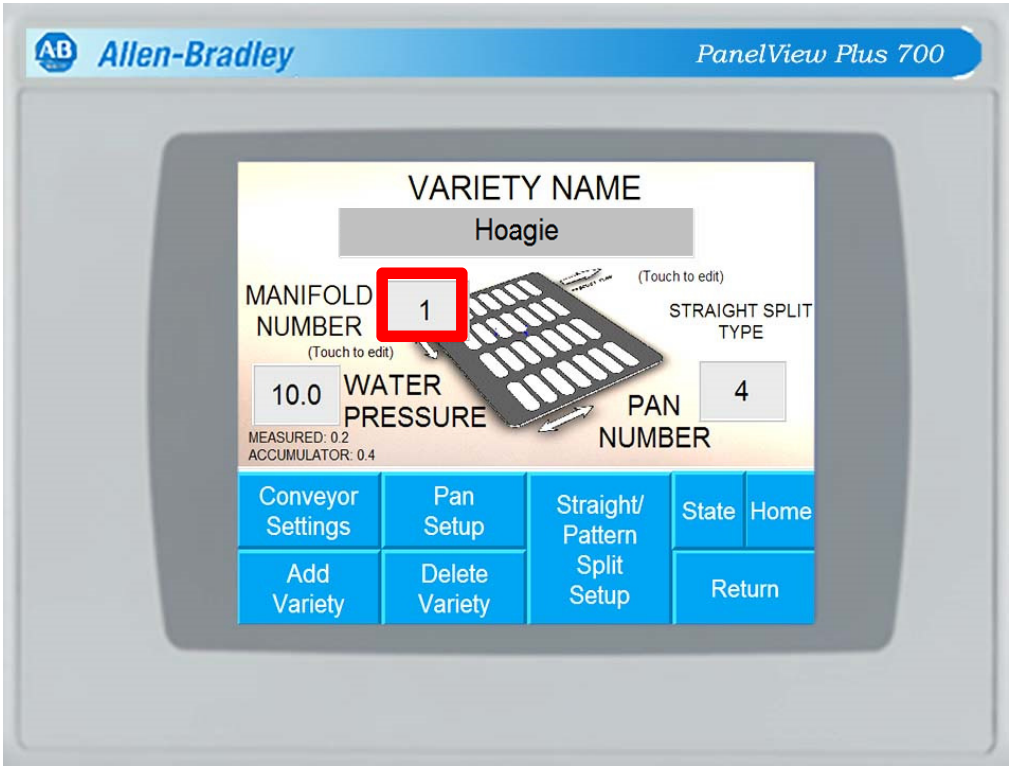
■ Add New Variety



Press the "**VARIETY NAME BOX**" to edit the name. Once pressed, a keypad will appear. Enter the desired name of the variety and press enter.

In our example we will name our new variety "Hoagie".

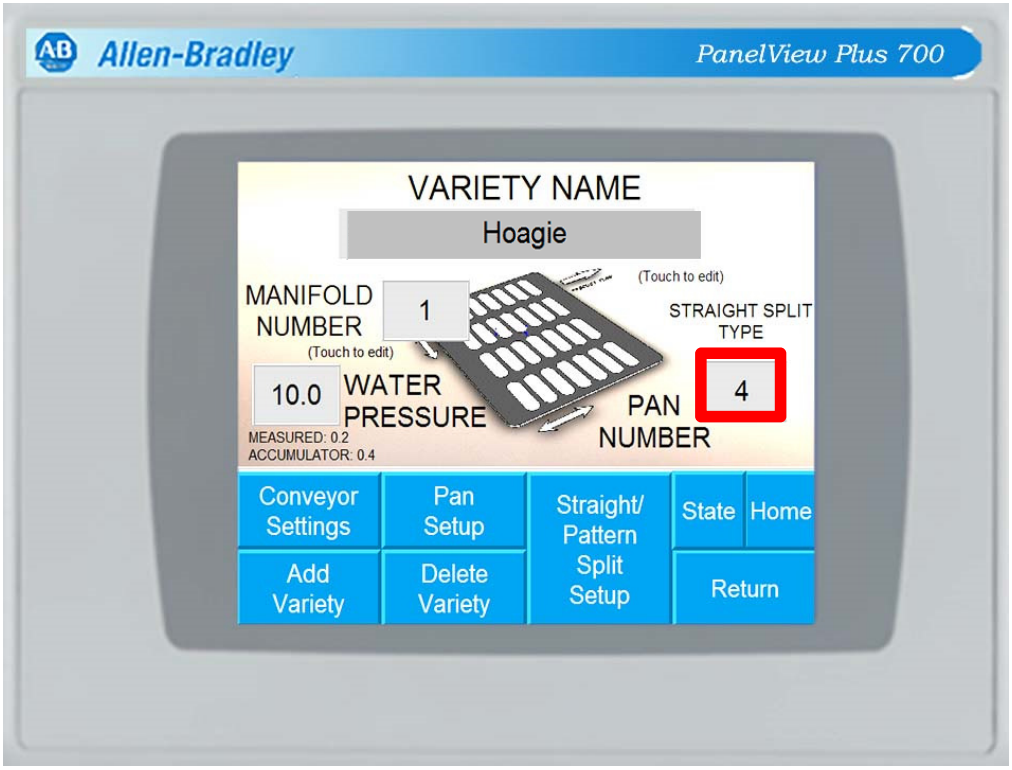
■ Add New Variety



The manifolds supplied with your unit are specifically designed for your pans. Determine the manifold that is going to be used for this new variety. The manifold must match the pan being used.

Press the box labeled MANIFOLD NUMBER. A numeric keypad will appear. Enter the number of the manifold that is being used for this new variety.

■ Add New Variety



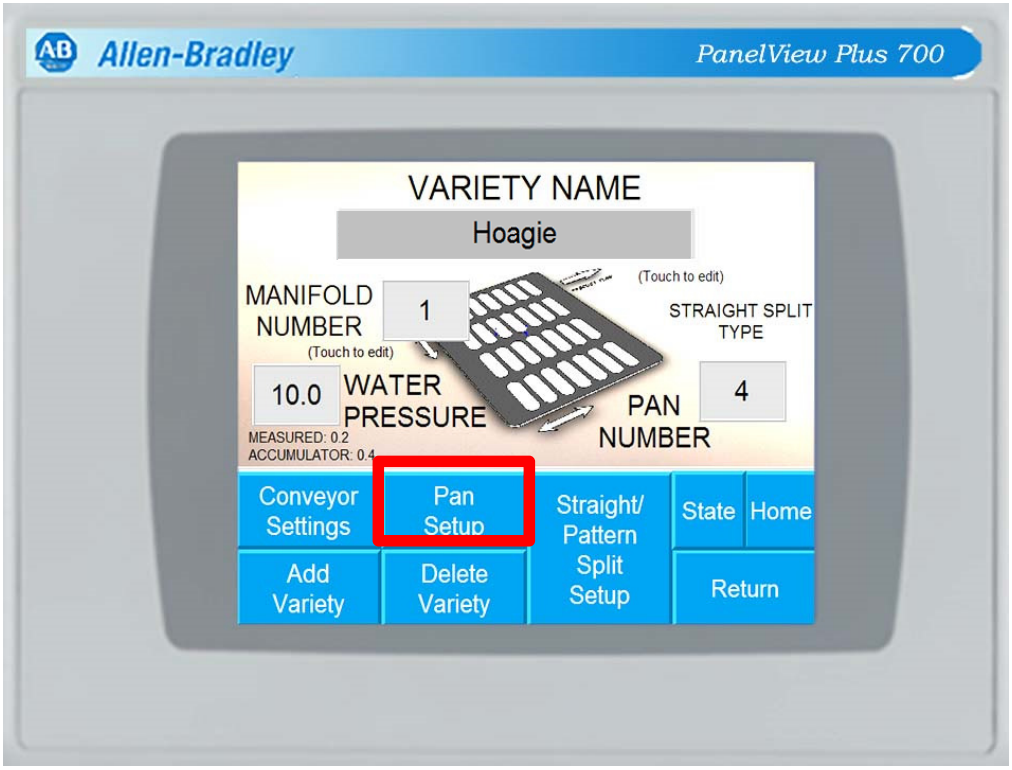
Each individual manifold may have up to 15 varieties setup. Each variety on a manifold is assigned a PAN NUMBER.

Press the box labeled PAN NUMBER. A numeric keypad will appear. Enter the number of the pan, or slot, which is being used for this new variety.

All setup changes made will be assigned to the Manifold Number and Pan Number chosen. In our example, Manifold Number 1 and Pan Number 1 will contain all of the setup parameters that we enter. ***Every setting change will be automatically saved to this Manifold and Pan Number selected.***

Be mindful not to override a variety that is already saved with the manifold and pan number being used.

■ Add New Variety – Pan Setup

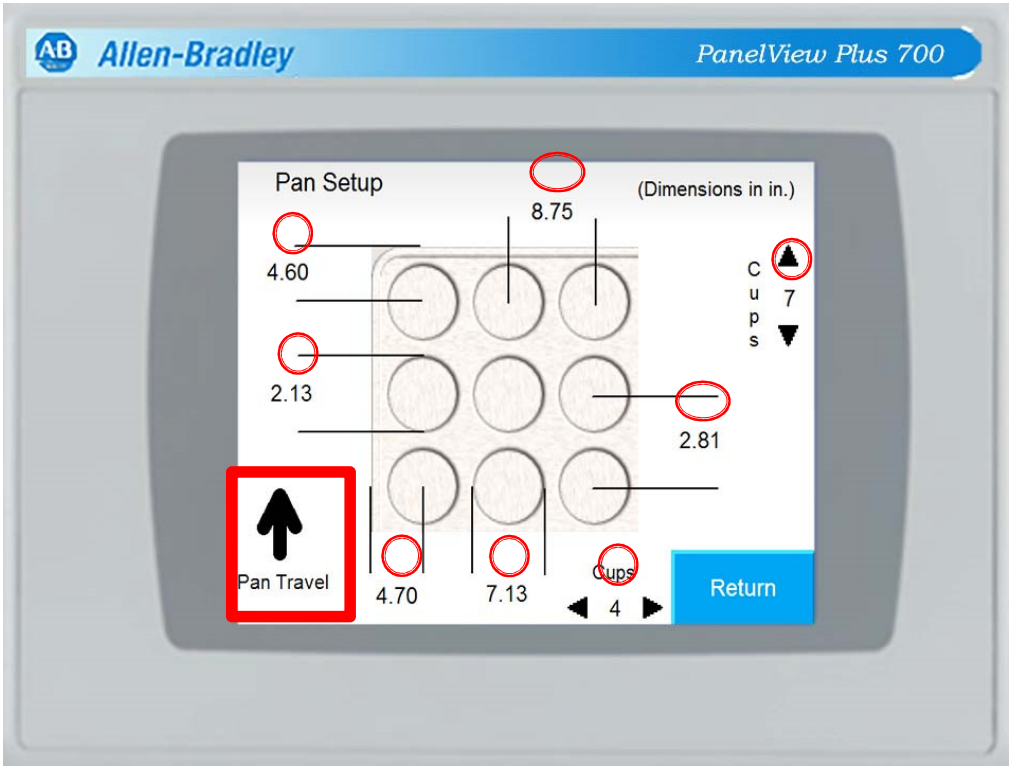


The unit must know the dimensions of the pan that is being used with the variety.

The system performs complex calculations of the pan dimensions entered to position the manifold precisely over the product.

Press the "**PAN SETUP**" button to proceed to pan setup.

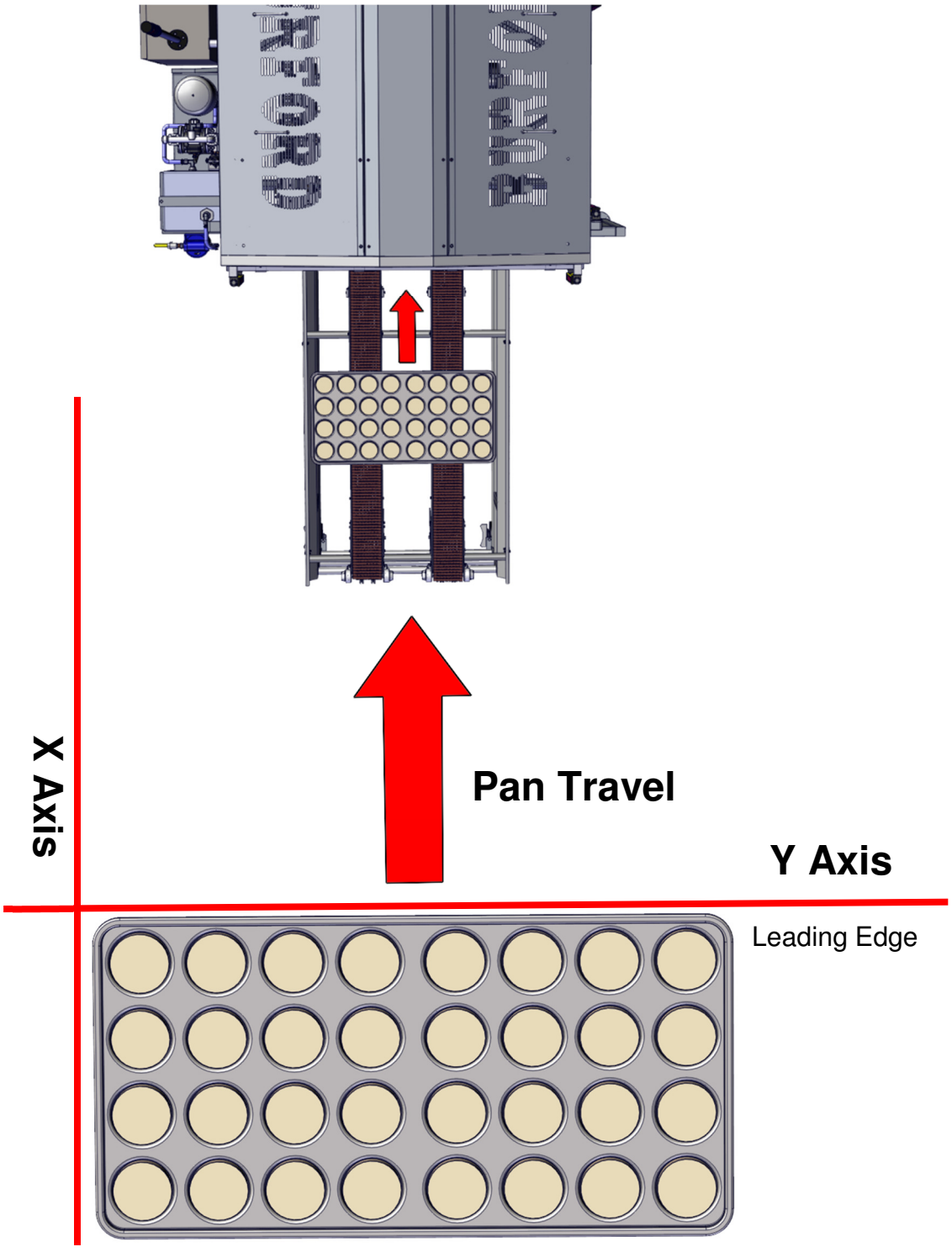
■ Add New Variety – Pan Setup



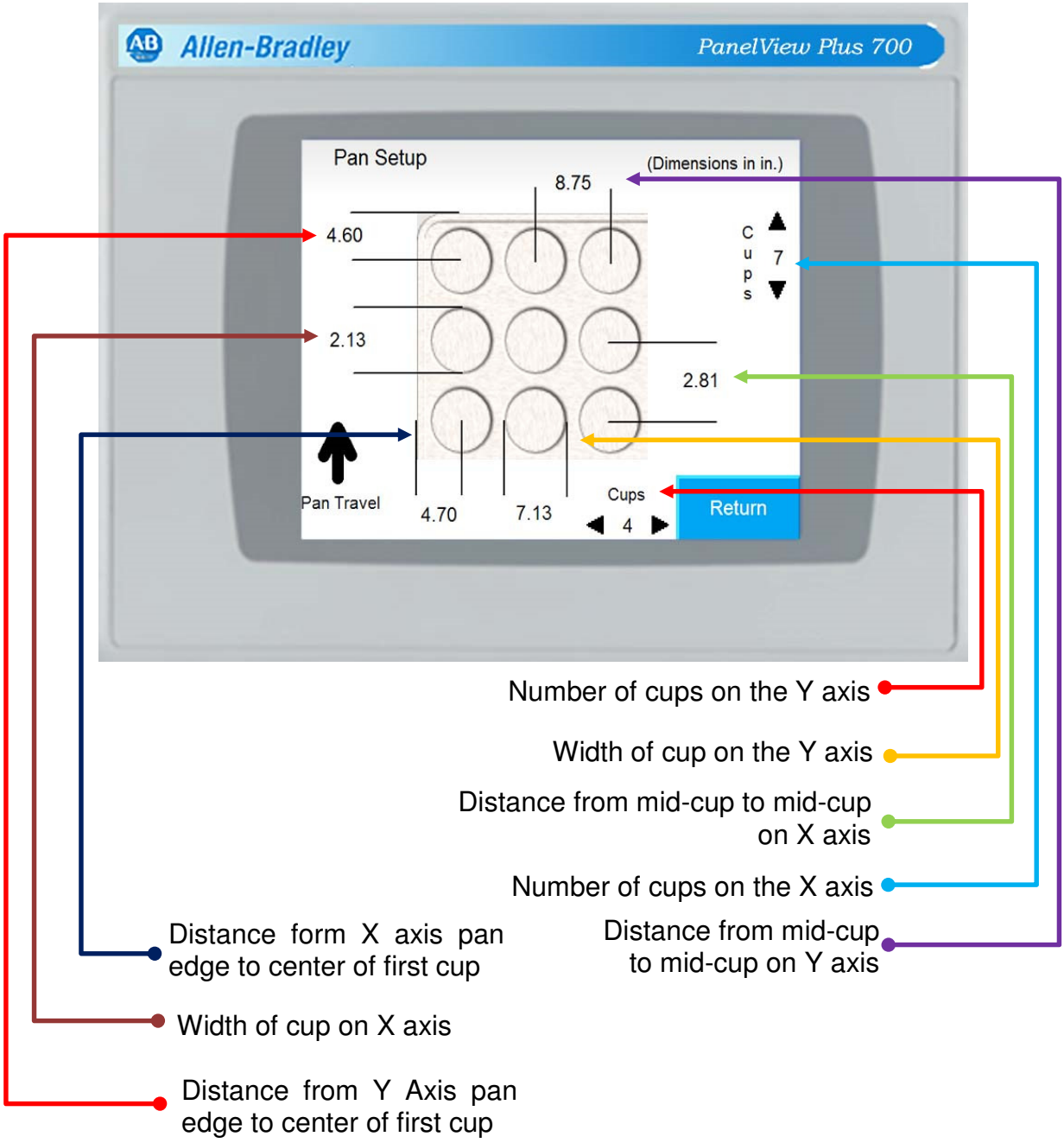
On the pan setup screen, a pan is displayed with data entry points at various locations. Touch the number to edit the values. All values must be in inches.

The Pan Travel arrow indicates the direction that the pan will travel through the splitter. The dimensions entered must be in relation to the direction of pan travel on the screen for the unit to function properly.

■ Pan Definitions



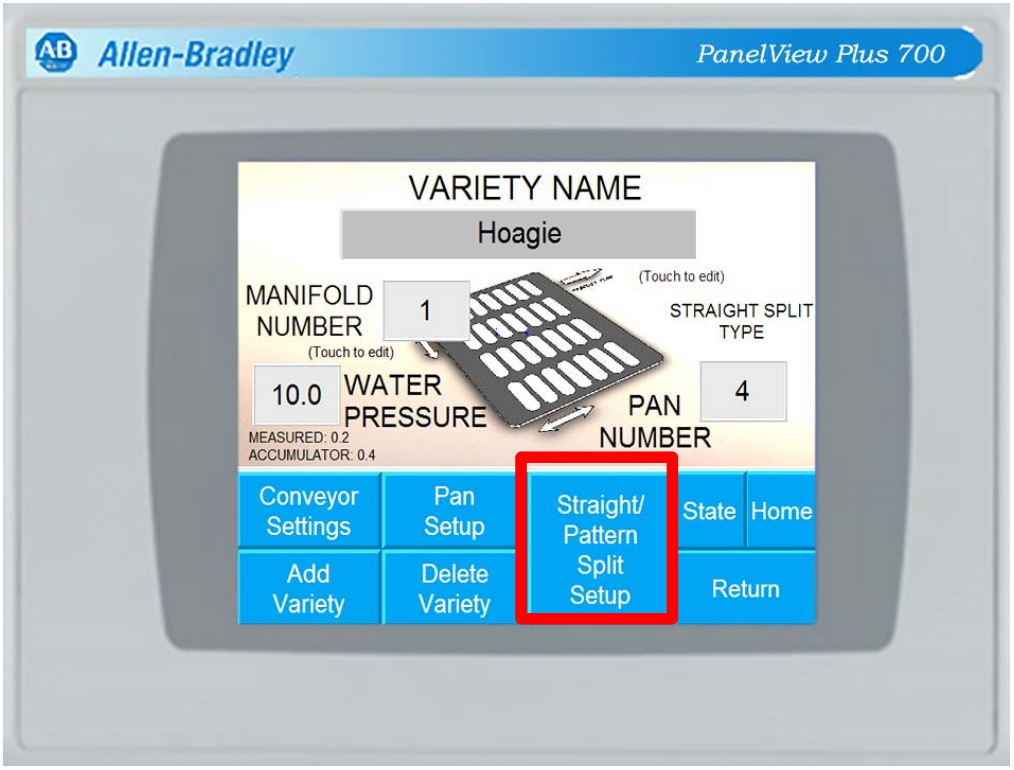
■ Add New Variety – Pan Setup



Enter all of values for the Pan Dimensions in inches. Every dimension must have a value.

Press RETURN when finished to return to the Main Setup screen.

■ Setup – Add New Straight Split Variety



Straight Split Setup

The supplied manifolds feature an automatic Manifold Recognition System, (M.R.S.). When a manifold is installed, the unit will automatically detect the manifold number.

Manifolds 1 through 8 are your Straight/Pattern Split manifolds.

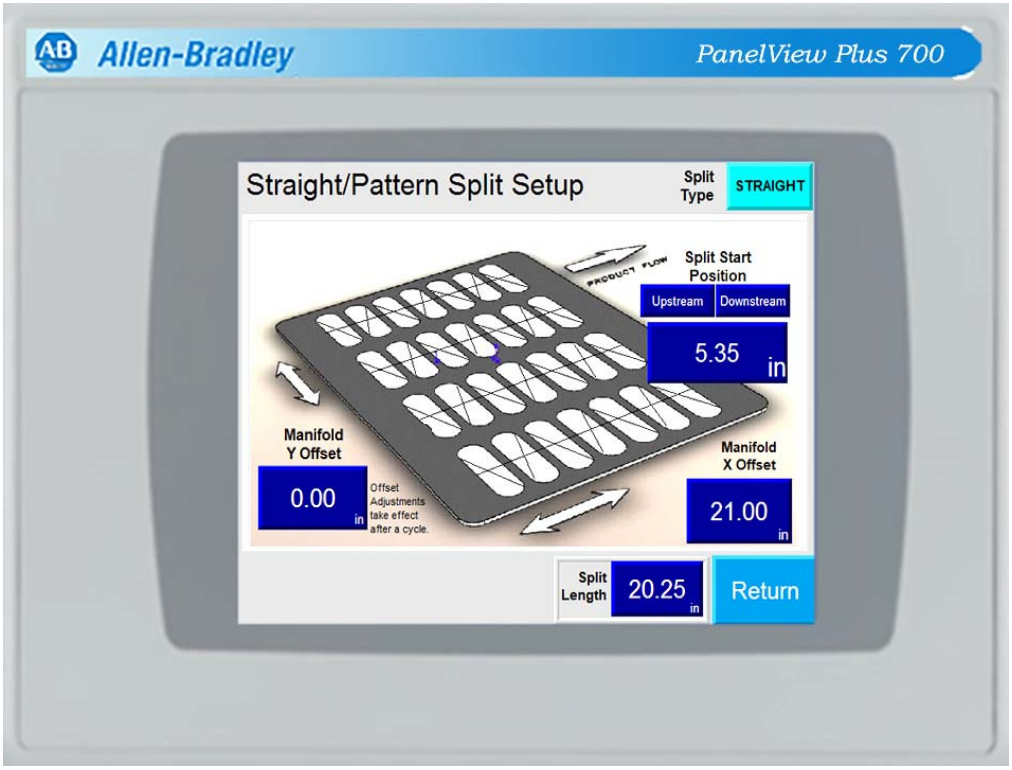
Manifolds 9 through 15 are your Cross Split manifolds.

The setup button will automatically change to Straight Split or Cross Split depending on the Manifold Number entered.

In our example we are adding a variety to manifold 1. This will be for a Straight Split.

Press the **STRAIGHT SPLIT SETUP** button to proceed to setup.

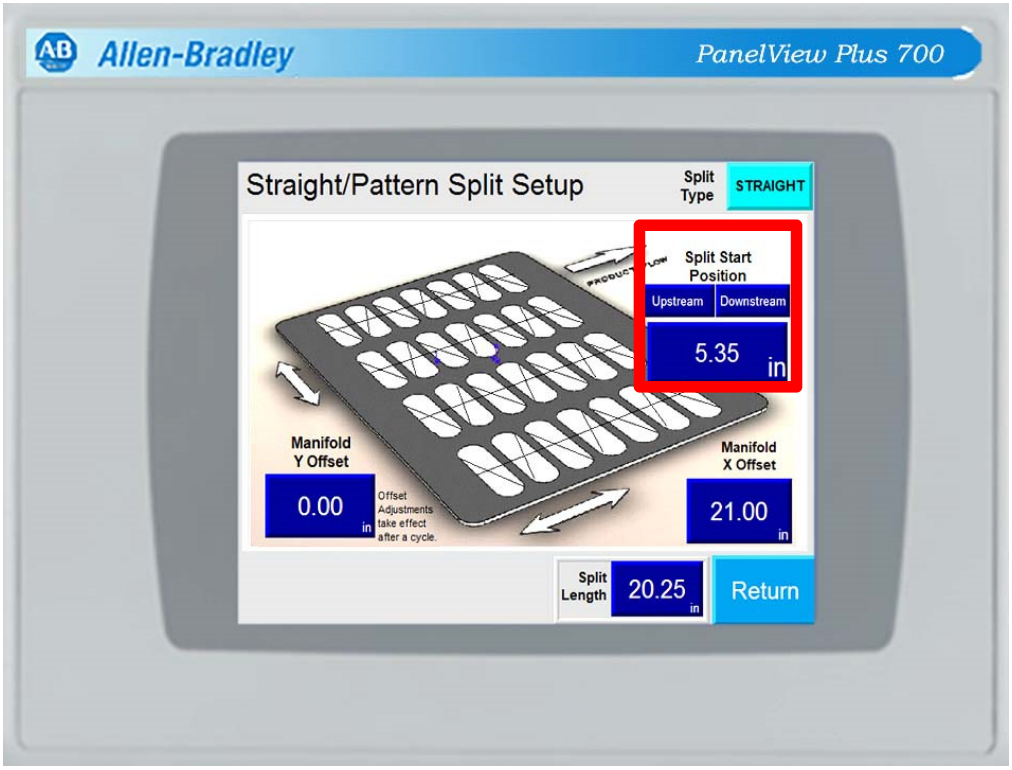
■ Setup – Add New Straight Split Variety



Straight Split Setup

We are at the Straight Split Setup screen. Here will enter the parameters that will position the manifold center of your product and determine the length of the split.

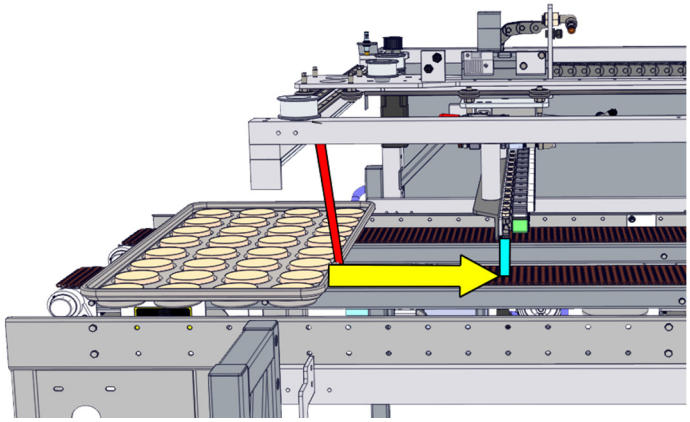
■ Setup – Add New Straight Split Variety



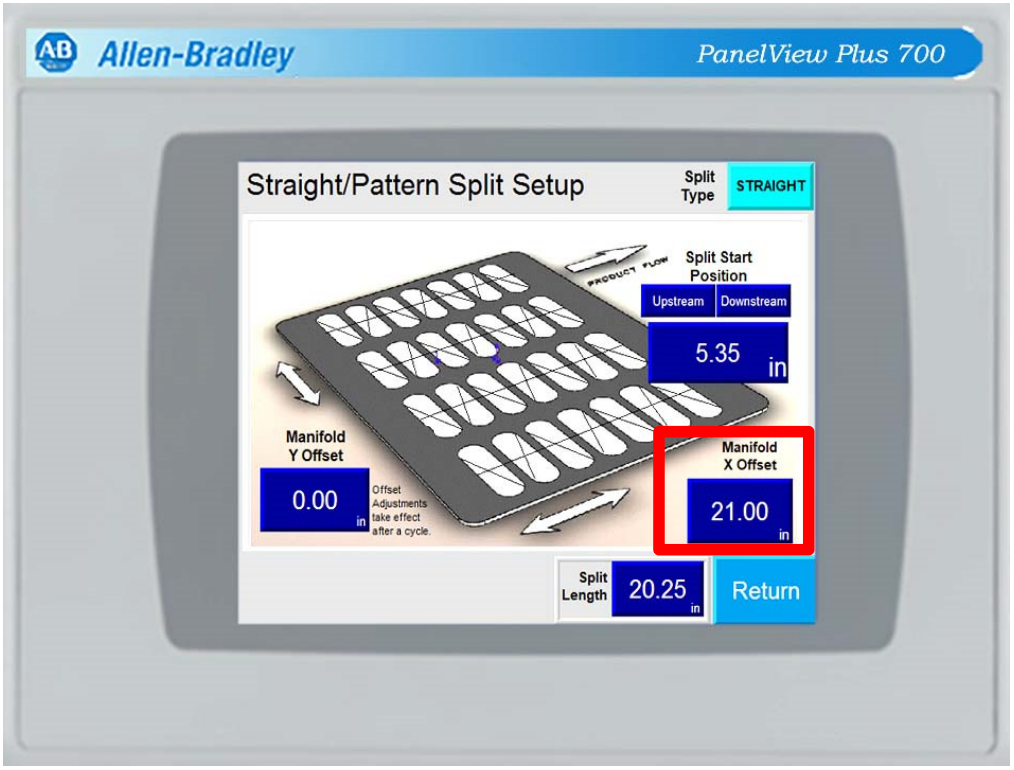
Split Start Position

The pan sensor is located up-stream from the manifold Split nozzles. When the pan activates the pan sensor we must delay the start of the split cycle until the pan is beneath the Split nozzles. We accomplish this with the Split Start Position setting.

Split Start Position is the distance in inches that the pan must travel from the pan sensor to the split nozzles.



■ Straight Split Offset



Y and X Offset

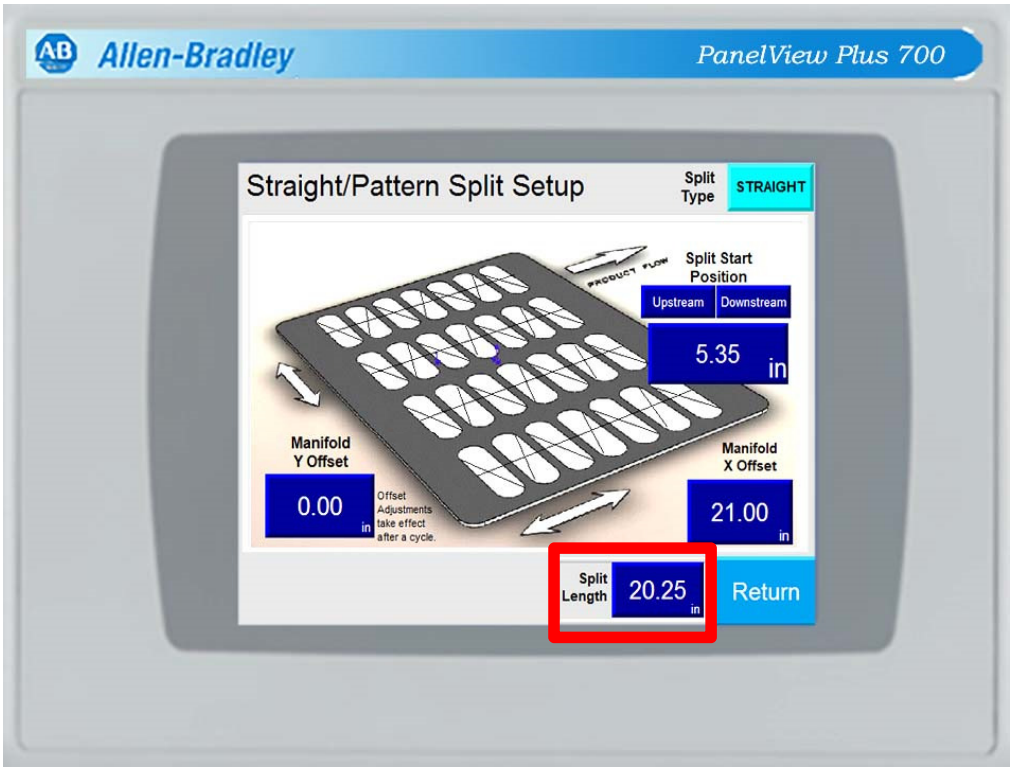
To get the same split on every pan for this variety you must give the Manifold a Home Position. You do this by adjusting the X and Y offset to the desired Home Position.

Adjust the Y offset to bring the manifold up or down stream

Adjust the X offset to bring the manifold center with the pan. Aligning the nozzles with your desire split point.

■ Straight Split Offset

■ Straight Split, Split Length

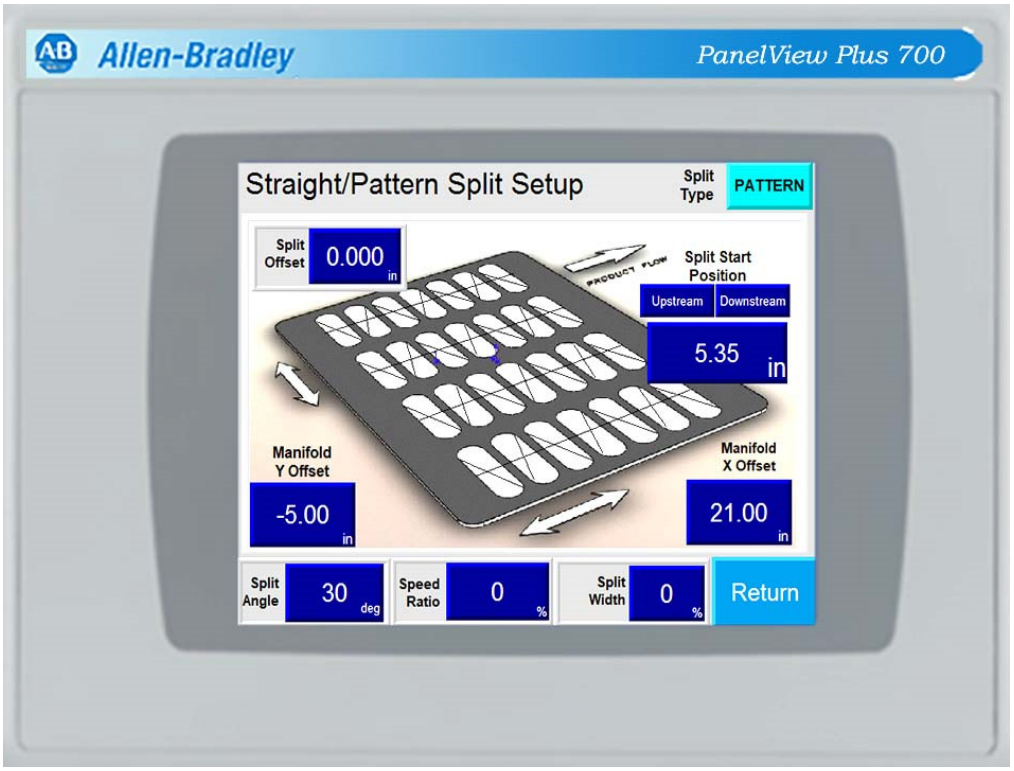


Split Length

The split length option allows you to control the length of time to split nozzles actuate. This allows you to lengthen of shorten the straight split on the product.

Adjust the length in inches to give you the desired split on each cup.

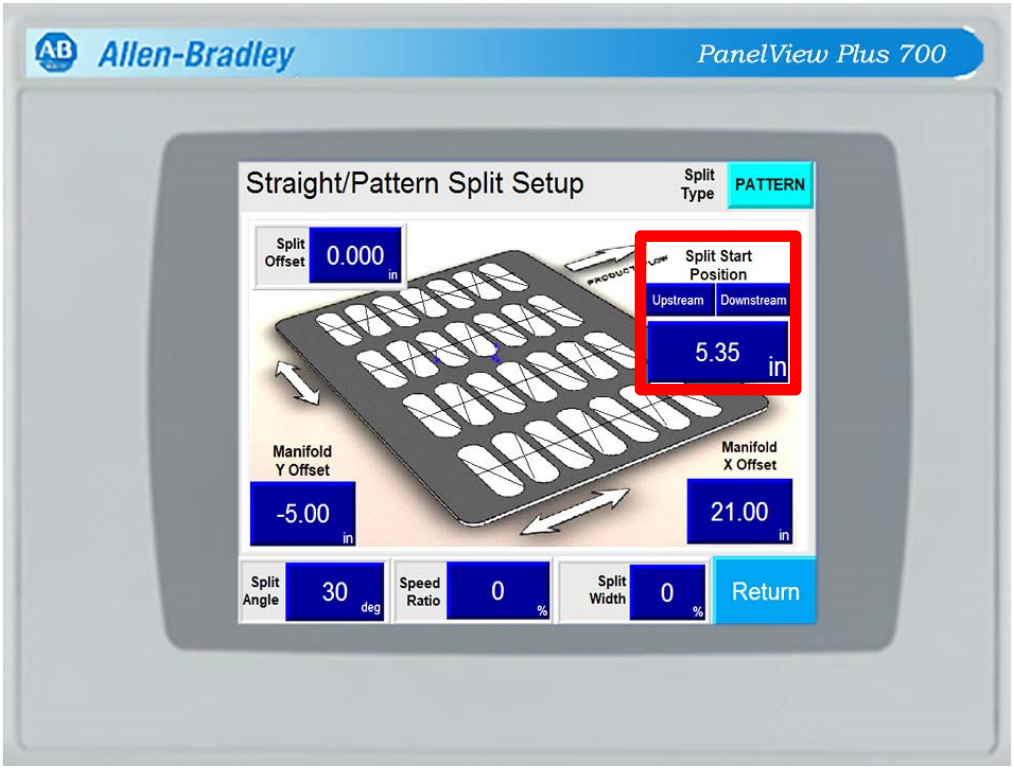
■ Setup – Add New Pattern Split Variety



Pattern Split Setup

We are at the Pattern Split Setup screen. Here will enter the parameters that will position the manifold center of your product and determine the length and pattern of the split.

■ Pattern Split –Split Start Position



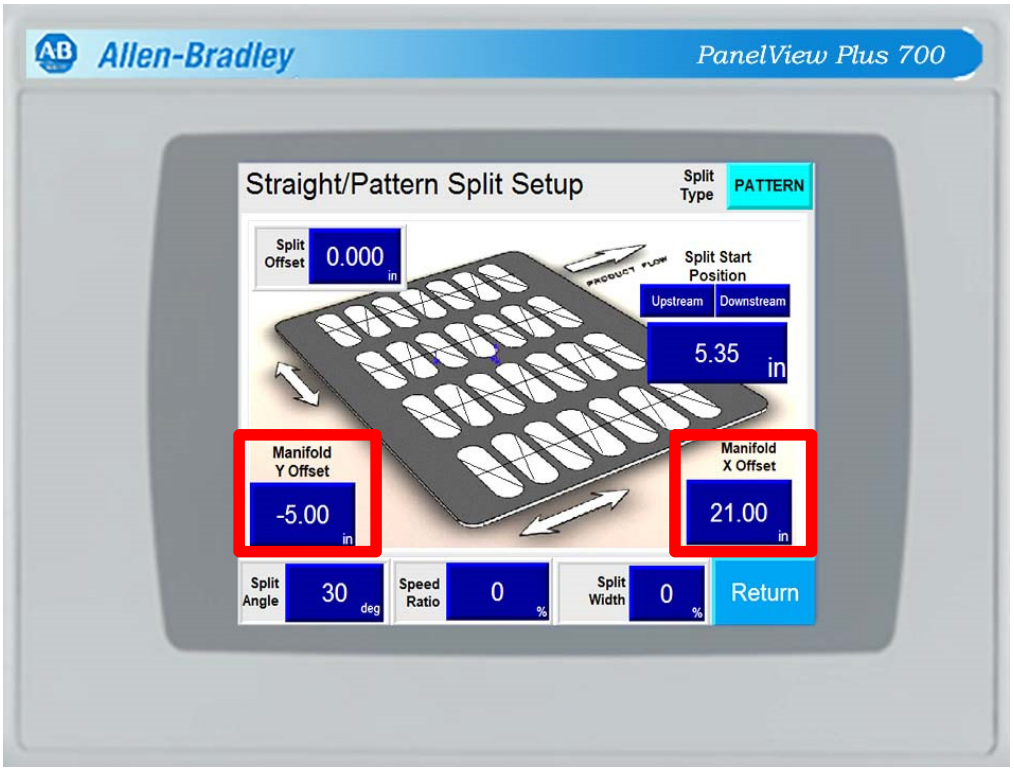
Split Start Position

The pan sensor is located up-stream from the manifold Split nozzles. When the pan activates the pan sensor we must delay the start of the split cycle until the pan is beneath the Split nozzles. We accomplish this with the Split Start Position setting.

Split Start Position is the distance in inches that the pan must travel from the pan sensor to split nozzles.

You will have to adjust this to allow the manifold Split nozzles to delay the start from the left side starting point and right side starting point.

■ Pattern Split - Offset



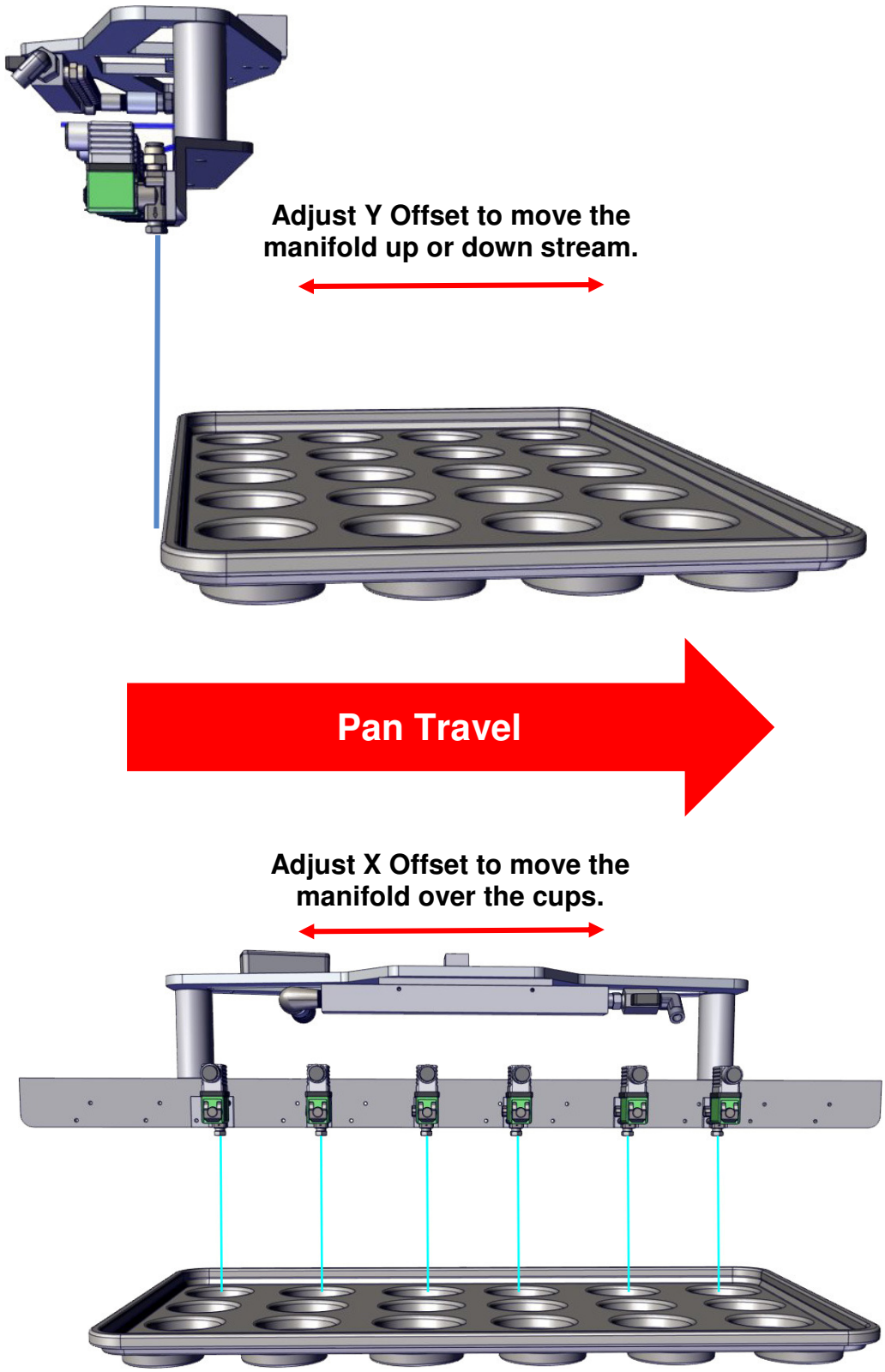
Y and X Offset

To get the same split on every pan for this variety you must give the Manifold a Home Position. You do this by adjusting the X and Y offset to the desired Home Position.

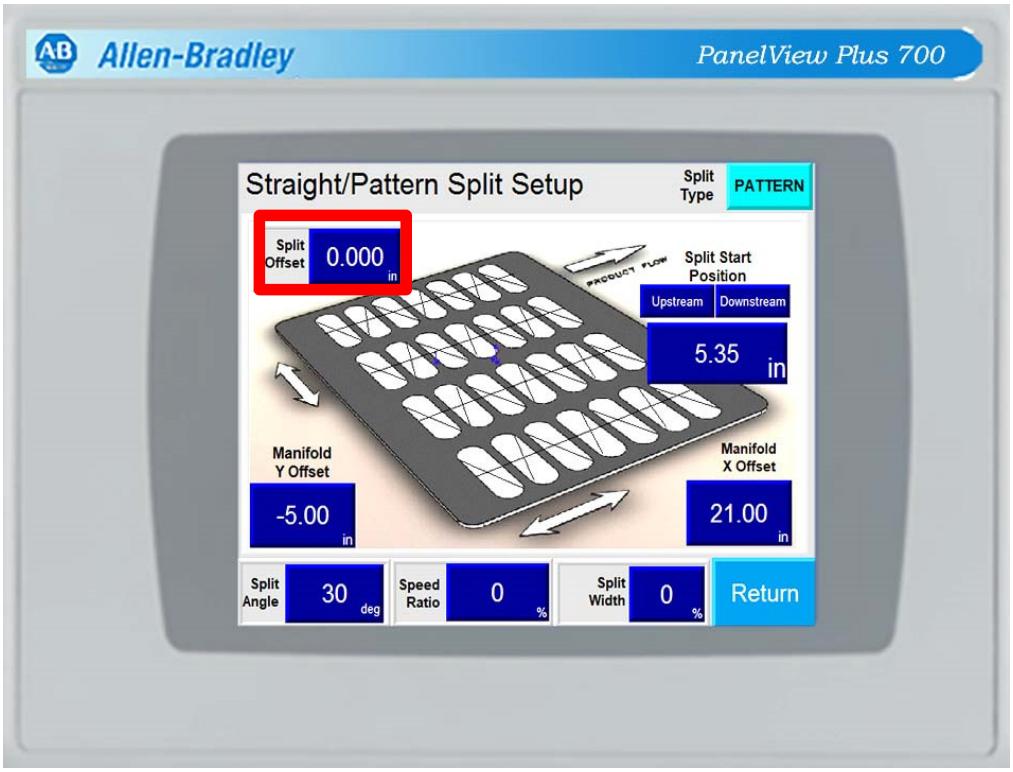
Adjust the Y offset to bring the manifold up or down stream

Adjust the X offset to bring the manifold center with the pan. Aligning the nozzles with your desire split point.

■ Cross Split - Offset



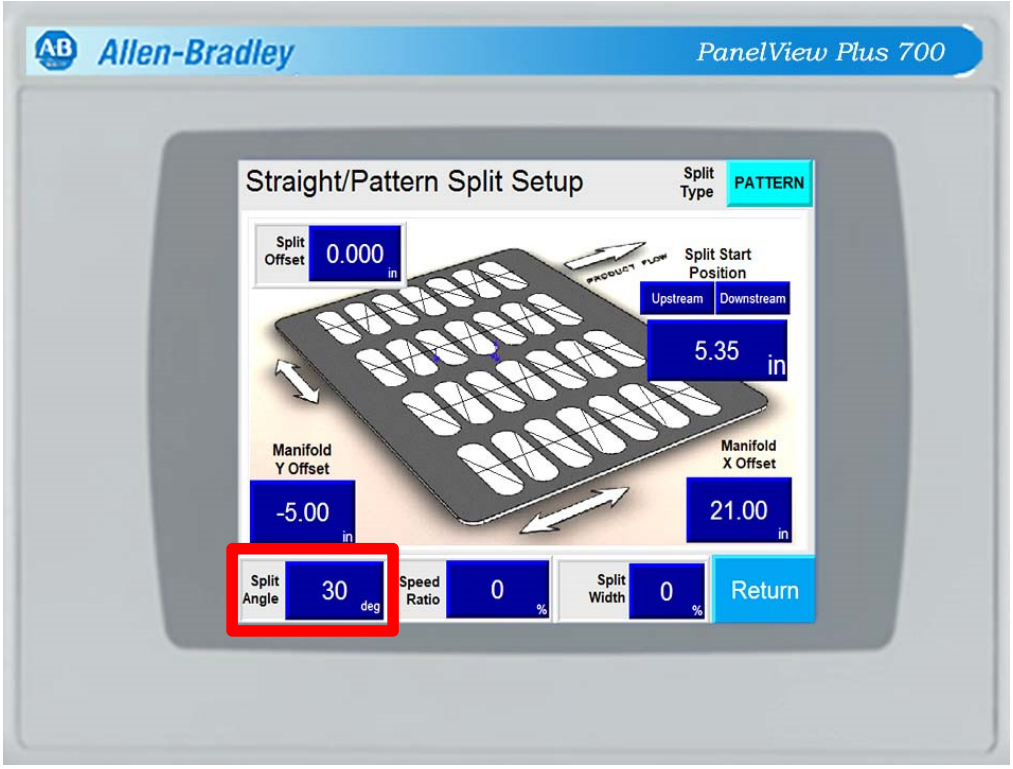
■ Pattern Split – Split Offset



Split Offset

This allows you to determine where the split will begin on each cup. The offset starting point is from the center of the cup.

■ Pattern Split –Split Angle

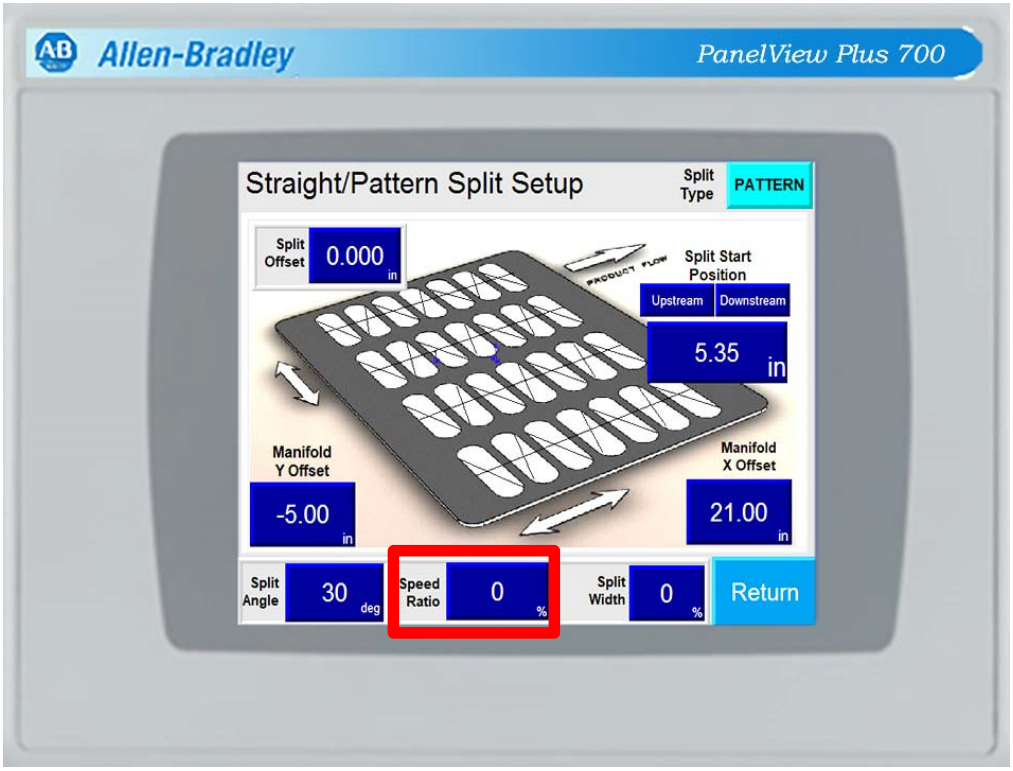


Split Angle

This allows you to set the angle at which the product splits will be.

Adjust the value (in degrees) to increase or decrease the angle of split for the variety

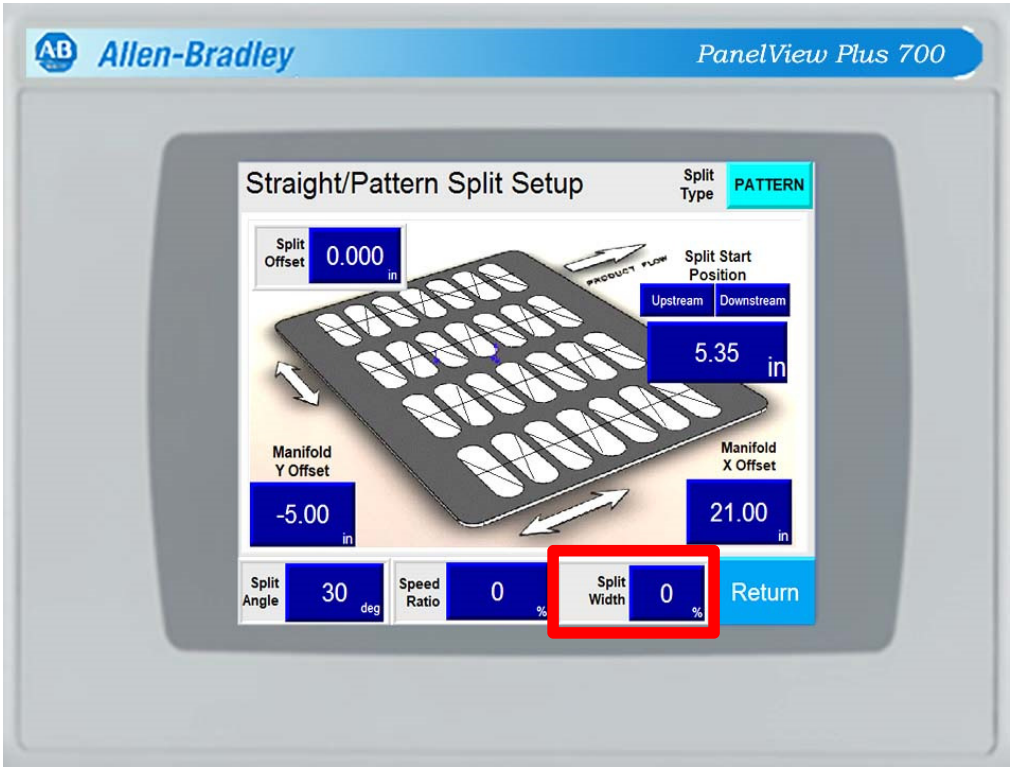
■ Pattern Split –Speed Ratio



Speed Ratio

This allows you to set the speed of the carriage in relation to conveyor speed, effectively slowing the speed of the cut.

■ Pattern Split –Split Width

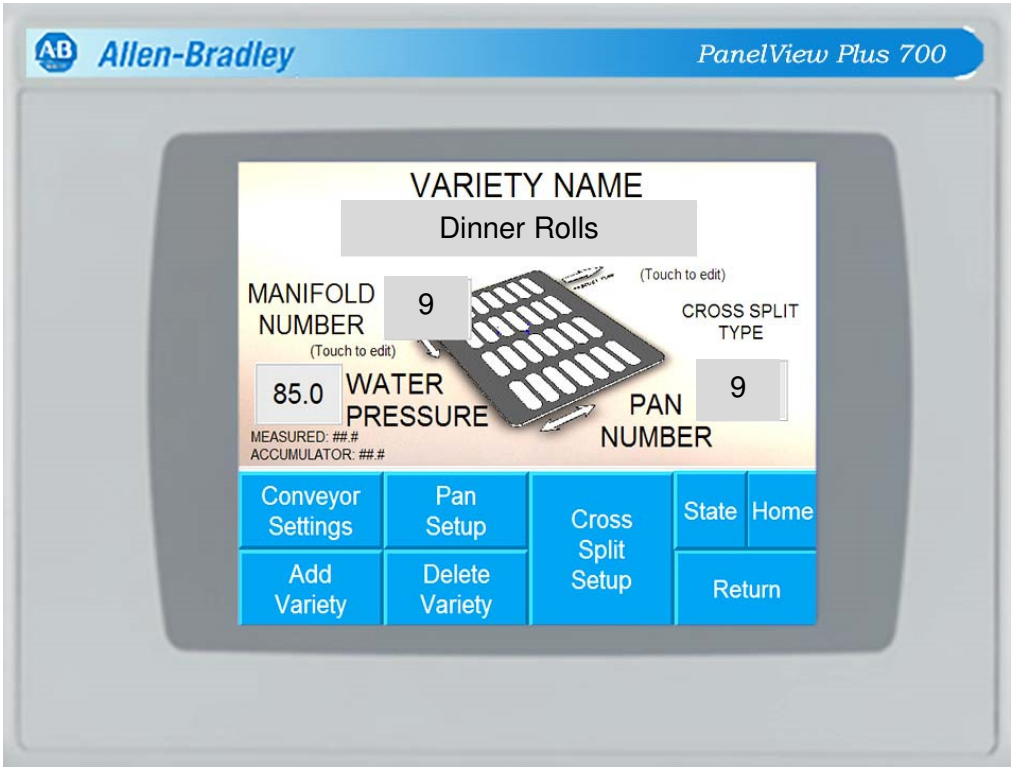


Split Width

This allows you to set how wide the product splits will be.

Adjust the value (in percentage of cup width) to increase or decrease the split width for the variety

■ Setup – Add New Cross Split Variety



Cross Split Setup

The supplied manifolds feature an automatic Manifold Recognition System, (M.R.S.). When a manifold is installed, the unit will automatically detect the manifold number.

Manifolds 1 through 8 are your Straight/Pattern Split manifolds.

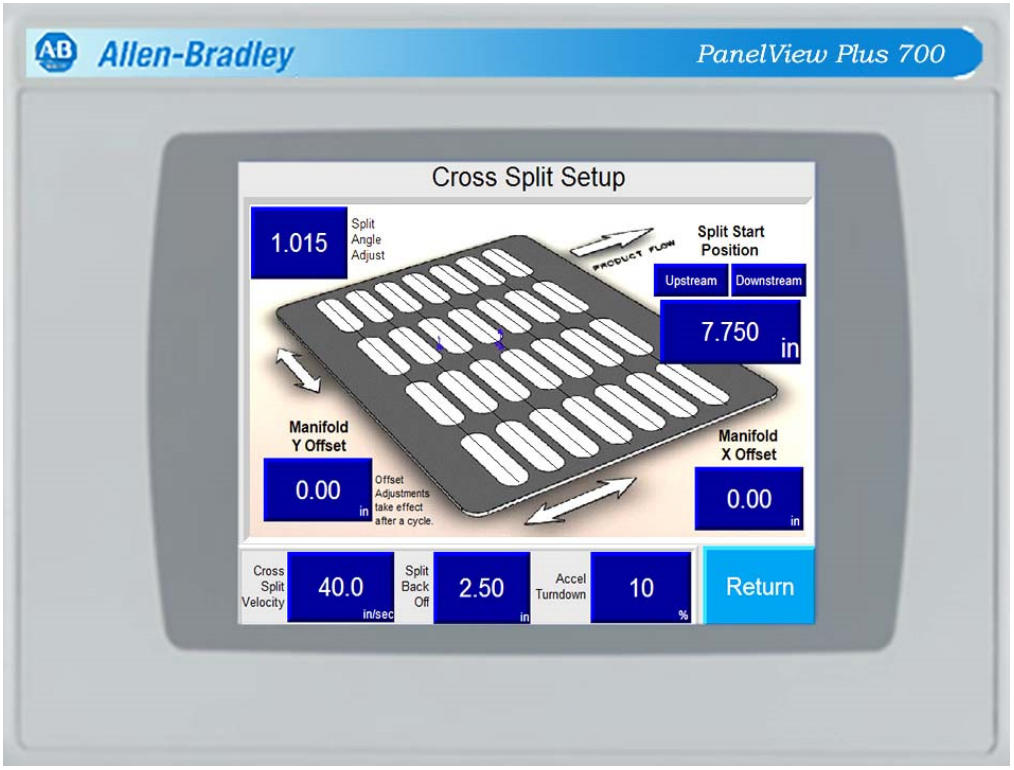
Manifolds 9 through 15 are your Cross Split manifolds.

The Manifold Number setting will automatically change to Straight Split or Cross Split depending on the Manifold Number entered.

In our example we are adding a variety to manifold 9. This will be for a Cross Split.

Press the **CROSS SPLIT SETUP** button to proceed to setup.

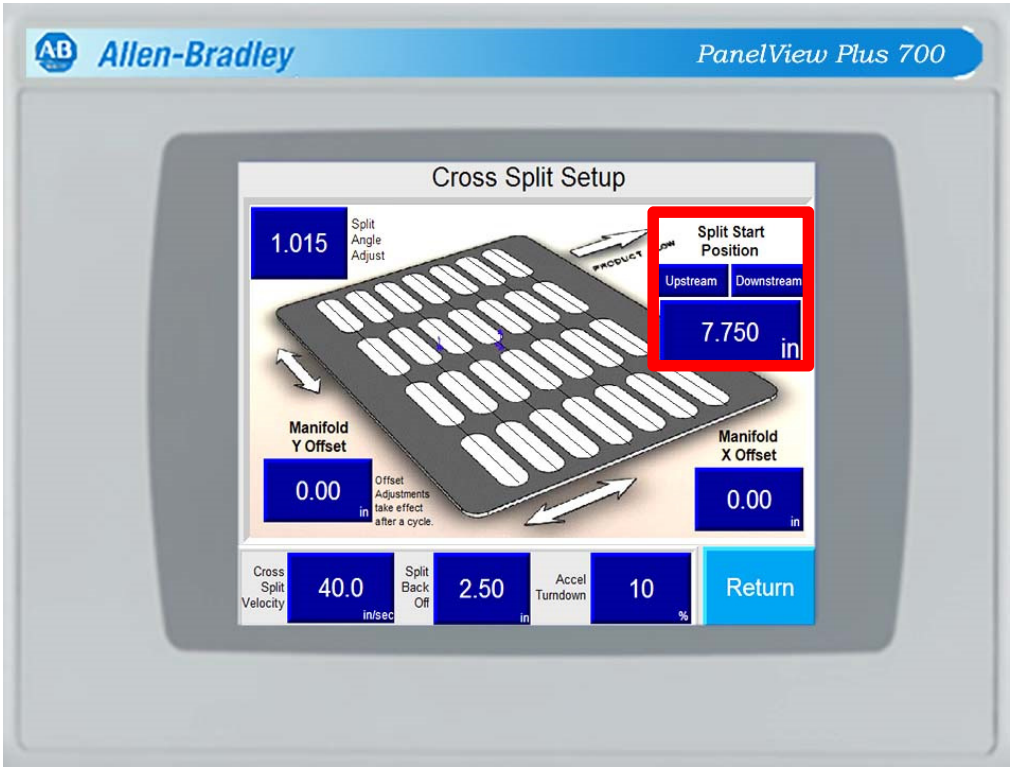
■ Setup – Add New Cross Split Variety



Cross Split Setup

We are at the Cross Split Setup screen. Here will enter the parameters that will position the manifold at the desired locations of the product and determine the length and speed of the split.

■ Cross Split –Split Start Position



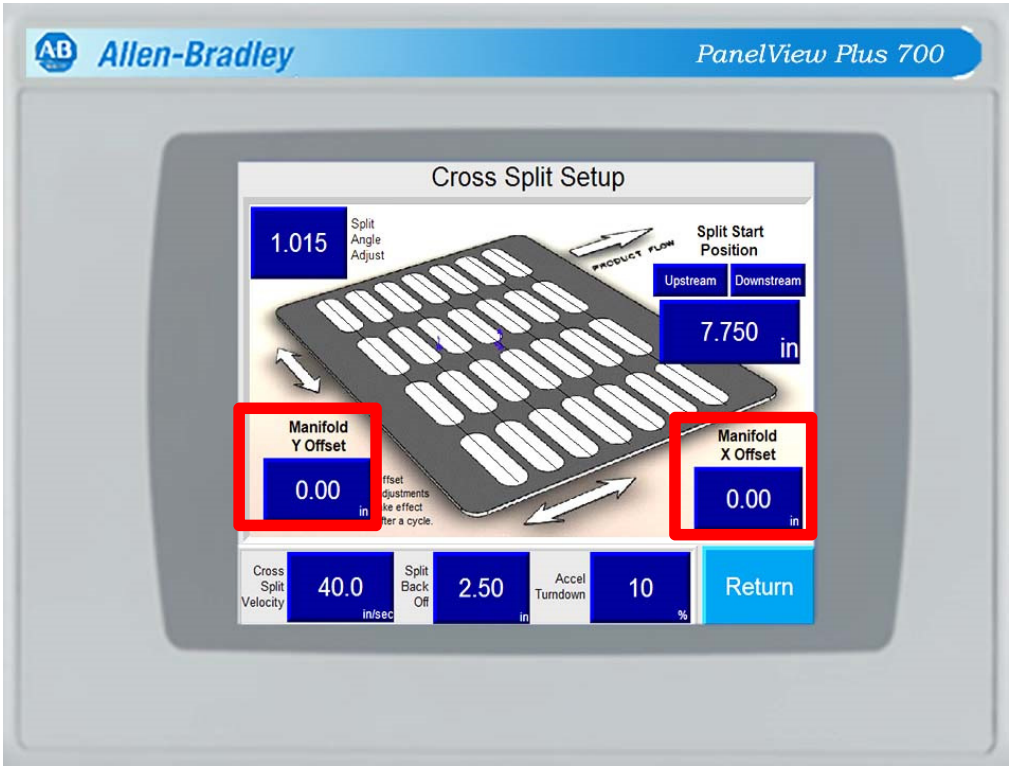
Split Start Position

The pan sensor is located up-stream from the manifold Split nozzles. When the pan activates the pan sensor we must delay the start of the split cycle until the pan is beneath the Split nozzles. We accomplish this with the Split Start Position setting.

Split Start Position is the distance in inches that the pan must travel from the pan sensor to split nozzles.

You will have to adjust this to allow the manifold Split nozzles to delay the start from the left side starting point and right side starting point.

■ Cross Split - Offset



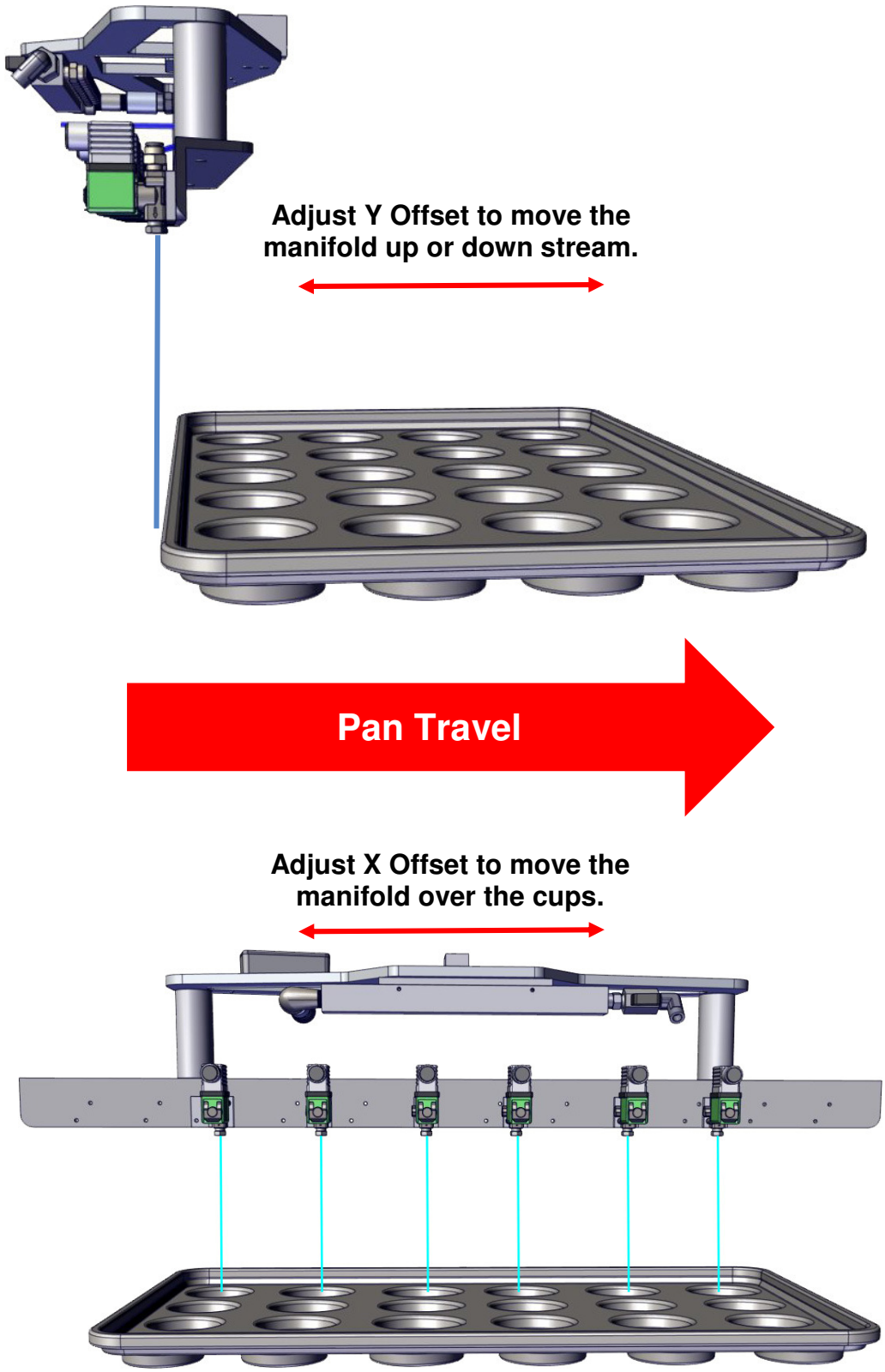
Y and X Offset

To get the same split on every pan for this variety you must give the Manifold a Home Position. You do this by adjusting the X and Y offset to the desired Home Position.

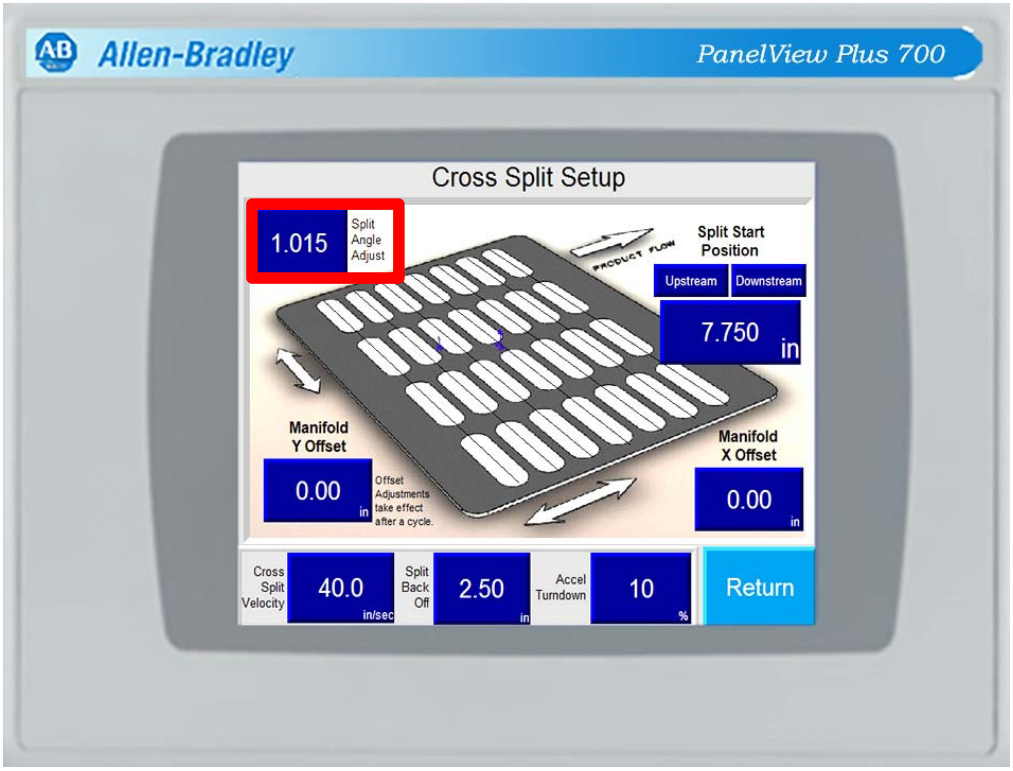
Adjust the Y offset to bring the manifold up or down stream

Adjust the X offset to bring the manifold center with the pan. Aligning the nozzles with your desire split point.

■ Cross Split - Offset



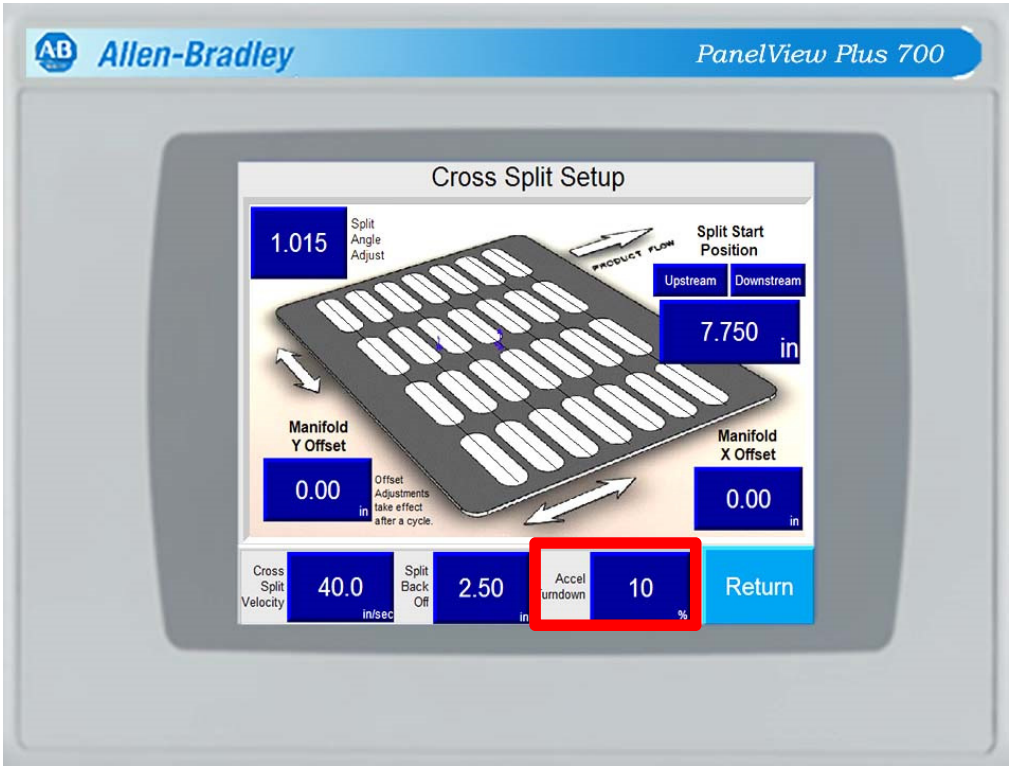
■ Cross Split – Split Angle Adjust



Split Angle Adjust

This allows you to fine tune the desired split by changing the speed of the carriage and manifold downstream in relation to the conveyor speed.

■ Cross Split – Accel Turndown

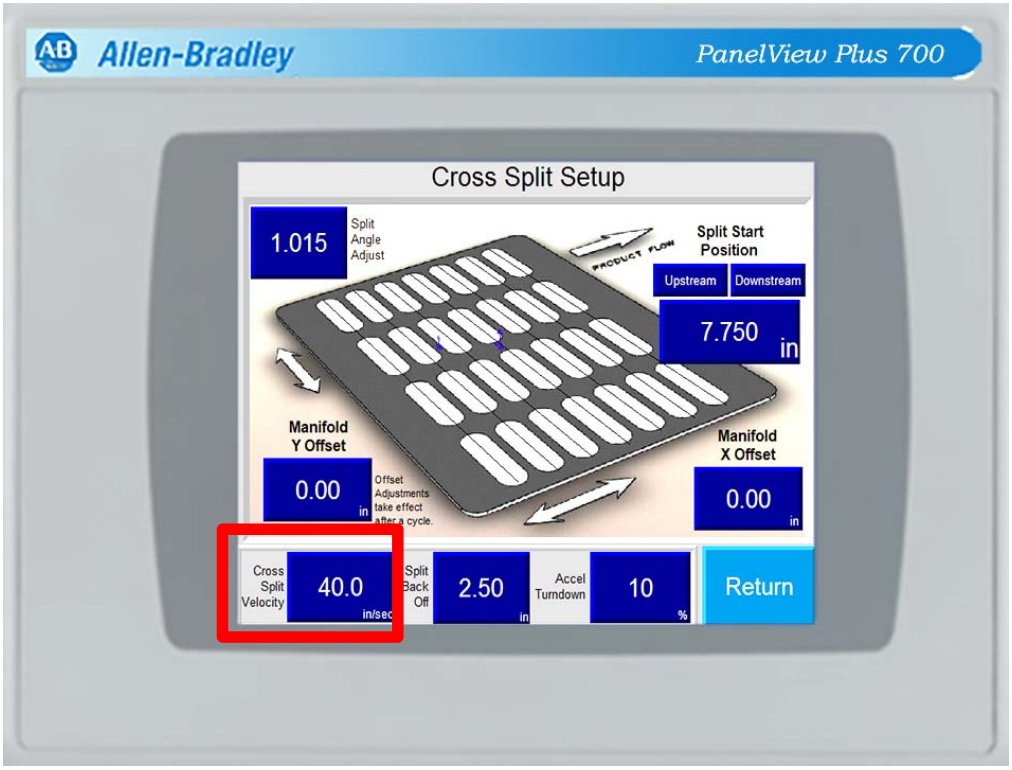


Accel Turndown

This allows you to control the initial acceleration of the Manifold.

Adjust the percentage by place a 1-100 in the box to speed up the manifold.

■ Cross Split – Cross Split Velocity

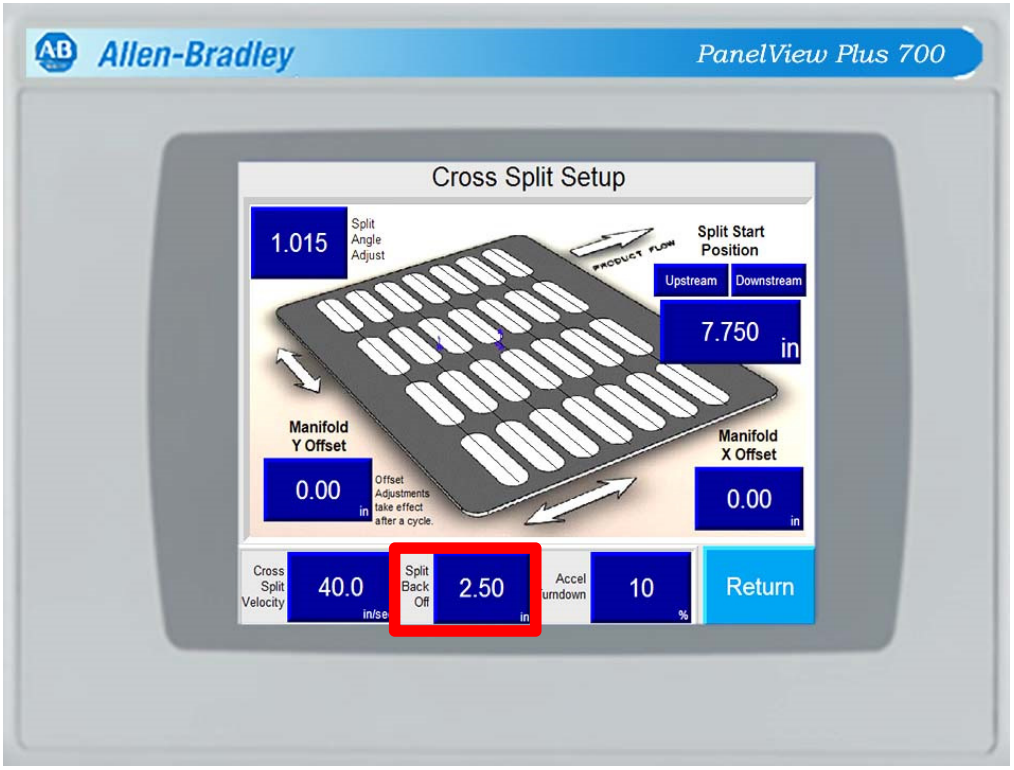


Cross Split Velocity

Controls the speed of the Manifold once the Split Nozzles start actuating and splitting the product.

Adjust the speed of the manifold by placing a number of inches per second in the box. The higher the number the faster the manifold splits the product.

■ Cross Split – Split Back Off



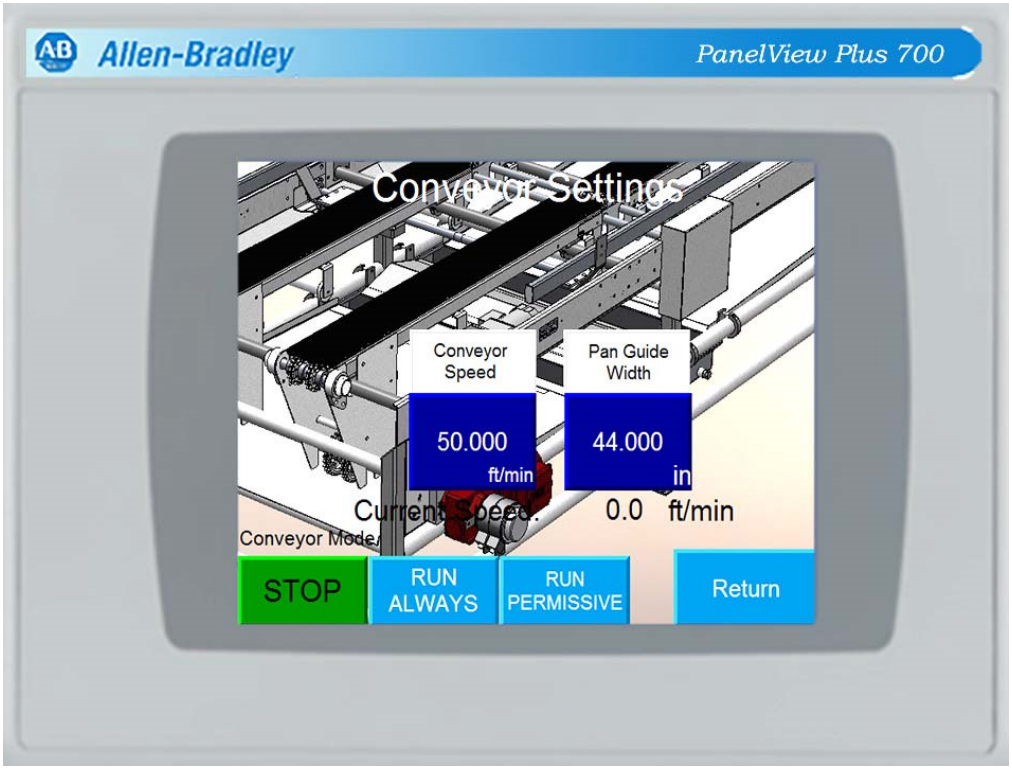
Split Back Off

Sets the allowable distance to make adjustments in speed from the Accel Turndown Speed to the Cross Split Velocity Speed.

Adjust the distance by placing a number of inches per second in the box.

The higher the number the farther away the manifold will start increasing or decreasing speed to split the product.

■ Conveyor



Conveyor

This allows the operator to view and set what the speed of the conveyor is in feet per minute.

Pan Guide Width may also be set from this screen.

RUN ALWAYS – Allows the conveyor to run without utilizing the splitter.

RUN PERMISSIVE – Allows the user to control the activity of the conveyor directly.

This screen is preset prior to the shipment of the machine. Only adjust if you change the Conveyor Drive Sprocket or Encoder.

HX1000 Startup Procedures

1. Set pan guides to hold pan straight during travel under the Splitter.
2. Check pan sensors for the Splitter. Verify that the presence of a pan triggers the sensors properly.
3. Install proper manifold.
4. Purge the unit to ensure the water lines, manifold and splitter nozzles are free of air.
5. Press “RESET” on the Splitter control panel.
6. Select the desired variety that corresponds to the manifold already installed.
7. Press “RUN” to start operation.

Chapter 5

Troubleshooting

CHAPTER 5: TROUBLESHOOTING

■ Light Tower

The light tower is located on top of the control cabinet. It will flash when the processor detects a fatal motor drive fault. See the supplied motor drive owner manual for additional error code information.

Chapter 6

Maintenance

CHAPTER 6: MAINTENANCE

■ Preventive Maintenance

Do NOT use any form of high pressure cleaning systems on this unit.

Burford® Corp. recommends the following preventive maintenance schedule to insure proper performance of your Burford® High Speed Splitter.

Daily

We strongly recommend the following be done periodically to ensure proper performance of the HX1000.

- Check oil in main air supply.
- Visually inspect air and water lines. Replace when needed.
- Keep product sensors clean.

Weekly

- Wipe off frame and conveyor.
- Use a soft cloth to wipe off light curtains.

Monthly

- Replace pump cart water filter.
- Remove the conveyor chain and clean at a sight away from the Splitter

■ Drive Description

This unit is equipped with an AC motor drive to control the automation of the unit. The below programmable motor controller is an example of the drives used in the HX1000. The table below provides a brief description of the function keys. See supplied motor drive manual for additional information.

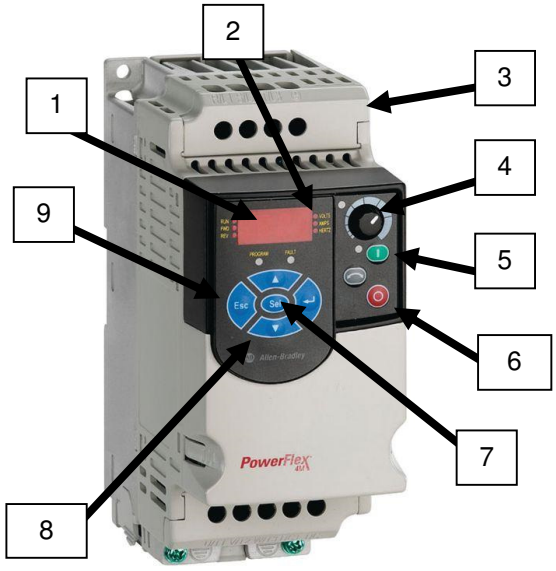


Figure 1 Drive Descriptions

Ref	Function	Description
1	Display	Displays parameter groups and values. Also contains status LEDs. See accompanying owner manual for more information.
2	Mode	Indicates operating mode of drive.
3	Run	Access panel to output wiring.
4	Speed Dial	Control speed of drive in manual mode.
5	Start	Used to start the drive in manual mode.
6	Stop	Used to stop the drive in manual mode.
7	Set	Advance one step in programing menu. Selects digit when viewing parameters.
8	Scroll Pad	Used to navigate menus. Enter key advance one step in menu and enters adjustment mode.
9	ESC	Back one step in programming menu. Cancels a change and exits programming mode.

■ Drive Settings

The motor controllers have been preset at Burford® Corp. for your particular application and require no additional setup. The digital input function is used to configure the controller for remote operation via the programmable logic controller and touch screen interface.

ICEqube

Intelligent Electronic Enclosure Thermal Management Systems

OPERATION AND INSTALLATION MANUAL
Qube Series Air Conditioning Units

*** IMPORTANT ***

PLEASE READ this manual. Follow the instructions for safe and satisfactory installation and operation of this system. Keep this manual for future reference. Some information may not apply to all systems.

TABLE OF CONTENTS

INTRODUCTION:

Ice Qube's Thermal Management System, TMS, is designed to cool, dehumidify or heat the internal environment of modern electrical enclosures. Ice Qube offers efficient and aesthetically appealing packages that can be mounted on top or on the side of your enclosure. Our closed-loop circulation design protects your equipment from air-borne dust and contaminants which may hinder equipment operations, causing unnecessary down time. Ice Qube is able to provide cooling capacities from 1000 to 20,000 BTU per hour - a wide range of cooling systems to satisfy many of your conditioning needs.

BASIC OPERATION:

The Ice Qube's Thermal Management System, TMS, is actually a combination of three independent systems which function simultaneously to maintain environmentally friendly conditions for various types of electronic equipment enclosures. These three thermal related systems are: the closed-loop cool air system; the warm air system; and the vapor-compression refrigeration system. Please refer to Figure 1.

The closed-loop cool air system circulates cold air from the Ice Qube TMS to the electronics enclosure. This air returns to the Ice Qube system bringing with it unwanted heat and humidity from inside the enclosure. Heat and humidity is then removed by a heat exchanger located within the Ice Qube TMS. This heat exchanger is part of the vapor-compression refrigeration system.

At the heart of the vapor-compression refrigeration's system is a quiet, energy efficient rotary compressor which circulates environmentally friendly NON-CFC refrigerant. The main purpose of this compressor is to transfer heat laden refrigerant from the evaporator, located within the closed-loop cool air system, to a condenser, located in the warm air system. In the warm air system, air is circulated from the ambient surrounding the enclosure, through a filter, and across the warm air system heat exchanger. Here, heat from the enclosure is transferred from the warm air heat exchanger into the warm air stream and dissipated to the ambient.

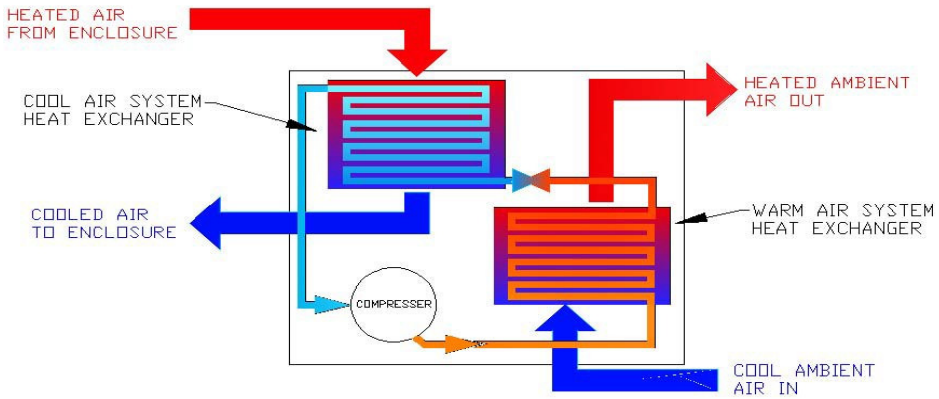


Figure 1: Flow Diagram

UNPACKING INSPECTION:

1. The shipping container leaves the factory banded to a pallet with arrows imprinted on the box. These arrows should be pointing in the proper (upward) direction. The Ice Qube TMS is position sensitive. Ice Qube recommends the unit to remain in the proper upright position for a minimum of 24 hours before initial operation. This is to ensure the oil has returned to the compressor. Operation before the 24 hour time period may cause damage to the compressor, hence shortening the life of the system.

Note: Operating the unit before maintaining an upright position for 24 hours will void all warranties.

2. Check for any damage to the shipping container. If the shipping container has been damaged or marred in any way, carefully check to see if the Ice Qube TMS incurred any damage. Check for scratches, dents, rattles (which may indicate loose components), the presence of oil, and any other irregularities. Any evidence of damage will need to be recorded on the freight bill and reported to the carrier. The freight carrier will provide instructions on filing a claim. **Ice Qube cannot accept responsibility for damages that occur during shipping.**

PRE-INSTALLATION TEST:

Before installing the Ice Qube system on the enclosure, it is recommended the unit operate for 20 to 30 minutes to ensure it is functioning properly.

NOTE

Operation in a humid, open environment or on an open enclosure may cause excess condensate to form on the evaporator coil and may be discharged by evaporator fan.

Although the Ice Qube TMS has been tested at the factory, internal damage may have occurred during shipping which may have not been apparent during the unpacking inspection.

1. Place the system on a solid base such as a workbench or table. Be sure to allow adequate space for airflow. There are two air streams that must not be restricted, the cool air stream and the warm air stream. Units can only be mounted on a flat vertical surface.

2. Check that the warm air system filter is in place, location varies with model type.

Models with the optional rain or wash down hood do not have a warm air filter and may require regular routine condenser maintenance.

3. Check the data tag for proper electrical requirements. The data tag lists the design voltage and amperage requirements of the system. Verify that the electrical outlet where the system will be connected has the proper capacity. After noting the above, connect

the power cord to a properly grounded electrical connection. The use of an extension cord is not recommended.

NOTE: ***If any unusual noise or vibration is present during the testing procedure, immediately disconnect the power cord and inspect the unit for the cause of the noise or vibration. Contact Ice Qube immediately.***

4 As soon as power is supplied to the system, the cool air evaporator blower will begin to operate. The compressor and warm air condenser blower will not operate if the room air temperature is below 80°F. This is due to the fact the programmable controller has a factory setpoint of 80°F. (The digital display on the face of the controller will be displaying room temperature.) If the display is indicating 80°F or warmer, the "Cool" status LED will flash for 3½ minutes before the compressor and the warm air condenser blower will operate.

If the display is indicating a temperature less than 80°F, adjust the setpoint to a temperature lower than the room temperature in order for the compressor and warm air condenser blower to operate. Refer to the "Programming the Controller" section of this manual in order to change the factory set points.

5. With the compressor and both blowers functioning, allow the unit to operate for 20 to 30 minutes. This will provide sufficient time for the vapor compression system to achieve equilibrium. Measure the cool air outlet temperature with an accurate thermometer. This temperature should be at least 10 degrees colder than the inlet air temperature, (if the room temperature is warmer than 70°F). Inlet air temperature will be displayed on the programmable controller. In areas of high humidity, the temperature difference may be less than 10 degrees.

6. After completing the above check points, the electrical enclosure is ready to be prepared for the installation of the Ice Qube system.

PREPARING THE ENCLOSURE:

Ice Qube air conditioning systems have been designed to be light weight for ease of installation. Side enclosure or vertical mount units have been designed with a simple "two stud" alignment feature to make initial fastening to the enclosure quick and easy. A few modifications must be made to the enclosure to provide proper airflow, to maintain enclosure integrity and to assure a secure installation. Required modifications will vary with each air conditioner model.

1. Determine the location of the Ice Qube system on the enclosure.

*** CAUTION ***

Verify the weight of the air conditioning system will not cause the enclosure to become unbalanced. Equipment instability may cause bodily harm or equipment damage. For units mounted on enclosure doors, confirm the hinges will support the weight of the Ice Qube system. Refer to system specifications for model weights.

2. Upon deciding the location of the Ice Qube system on the enclosure, attach the included template to the enclosure surface. This template drawing will assist the installer in placing the air conditioning unit on the enclosure. Be sure that the Ice Qube system will be mounted level and the cool air inlet and outlet connections will not be restricted by equipment or shelving within the enclosure. Also check that the air flow of the warm air stream will not be effected or restricted by the surroundings.

3. Outline the modifications to be made to the enclosure with a marking pencil. Note the bolt hole locations, the cutouts for the inlet and outlet air streams, the power cord, and locations for any optional equipment. Additional cable openings may be required for units with optional heating or alarm outputs, or for units connected to a network communications link.

4. Using a drill, make the holes for the studs, bolts and power cord, and any other option. The bit size will need to vary depending upon the model. Protect any equipment located within the enclosure from debris produced during the installation procedure.

5. Drill a pilot hole for a saber saw to cut the inlet and outlet air passages. File all cuts to provide a uniform cutout.

6. Slide the mounting studs through the matching holes in the enclosure and check to see if all of the openings are aligned. Top mount units do not have mounting studs.

7. After checking that all openings and bolt holes are in alignment, apply the gasket material provided to the Ice Qube air conditioning system cabinet to ensure enclosure integrity.

***** CAUTION *****

Be careful while removing the backing on the gasket material. The material may stretch and the holes will not align.

NOTE: If the enclosure is not air tight, or the air conditioning system operates with the enclosure door(s) open, moisture will condensate inside the air conditioning system and may cause the condensate management system to overflow.

8. After the gasket material has been installed, mount the Ice Qube system onto the enclosure and fasten it using the supplied nuts and bolts. Check to see if the power cord and all optional cables are in place. Fasteners need to be tightened securely and the gasket material needs to be in place in order to maintain enclosure integrity. The gasket material should be slightly compressed with no visible gaps. The Ice Qube system is now ready to begin operation.

NOTE: Near the bottom or on the side of the Ice Qube system cabinet is a nipple for condensate overflow. Although all vertical or side mounted Ice Qube air conditioners have built-in condensate management systems, it may be necessary to attach a drain hose to this nipple on enclosures which are located in extremely humid conditions, or where enclosure doors are left open or the door seals are leaking.

OPERATING THE SYSTEM:

Once the Ice Qube system has been installed onto the enclosure and the power cord has been attached to a properly grounded electrical outlet with adequate voltage and current supply, the unit is ready for operation. As soon as electrical power is supplied to the Ice Qube system, the cool air stream blower will start to operate. The blower will run continuously so that the controller can monitor the enclosure's internal temperature. The enclosure temperature will be displayed on the face of the controller.

*****NOTE*****

Operation in a humid, open environment or on an open enclosure may cause excess condensate to form on the evaporator coil and may be discharged by evaporator fan.

If the enclosure temperature is greater than the factory cooling setpoint of 80°F, the "Cool" status LED will flash. This indicates that the compressor's automatic off cycle timer is working. (The off cycle timer is factory set at 3½ minutes). At the end of 3½ minutes, the compressor and the condenser air blower will begin to operate. This signifies that the cooling system has begun operation to remove heat and humidity from the enclosure. This procedure may take 20 to 30 minutes before it reaches full capacity.

If the heat load within the enclosure is less than the cooling capacity of the Ice Qube system, the temperature on the digital display will begin to decrease. When the temperature inside the enclosure decreases 7 degrees Fahrenheit below the 'cooling on' set point, the compressor and the condenser blower will cycle off. The cool air blower will continue to operate, circulating air within the enclosure. The controller has a factory programmed temperature differential of 7 degrees Fahrenheit. Example: "Cooling on" @ 80°F; "Cooling off" @ 73°F.

NOTE: There is a dead band programmed into the controller that prevents heating and cooling from operating simultaneously.

PROGRAMMING THE CONTROLLER:

The digital controller has many features that may or may not be required for your application. However, the controller has been programmed at the factory with typical default settings for immediate system operation. Please review the following default settings:

1. Cooling system on temperature — 80° F
2. Heating system on temperature — 50° F (optional)
3. High enclosure temperature alarm — 100° F
4. Low enclosure temperature alarm — 40° F
5. Audible and Visual alarm — "ON"
6. Digital display in degrees — Fahrenheit
7. Filter maintenance alarm — 0 days - Disabled
8. High condenser temperature alarm — 170° F

To change the factory default settings, enter the programming code sequence:

"+" (plus sign)
"-" (minus sign)
"Select" "Exit"

After pressing the above sequence the program LED should illuminate along with three alternating flashing boxes on the display face, indicating the code was accepted. If no selection is made within one minute, the system returns to the normal operating mode.

Note: Pressing the "Exit" button at any time while in the programming mode returns the controller to the normal operating mode.

Press the "**Select"** button to continue programming. The set temperature "HI" LED illuminates with the display indicating the 'cooling on' setpoint. The compressor will begin operation at this temperature and will remain operating until the enclosure temperature decreases approximately seven degrees Fahrenheit (four degrees Celsius).

Press the **"+"**or **"-"** buttons until the desired set point is displayed. The range for this adjustment is 70° to 126°F, (21° to 52°C). When the adjustment is complete, press the "**Select"** button to continue.

The set temperature "LO" LED is *on* with the display indicating the (optional) 'heating on' set point. The heating system will begin operation at this temperature and remain operating until the enclosure temperature increases approximately seven degrees Fahrenheit (four degrees Celsius). Press the **"+"**or **"-"** buttons until the desired set point is displayed within a range of 0°F to 63°F (-17.8°C to +17°C).

NOTE: Review alarm settings if the 'cool on' or 'heat on' set points have been changed,

Press the **"Select**" button to continue. The set alarm "HI" LED is *on* with the display indicating the high temperature alarm setpoint. The alarm will activate at this temperature and will automatically reset at two degrees Fahrenheit (one degree Celsius) below this temperature. Press the **"+"** or **"-"** key pads to change the alarm setpoint within a range of 8ºF (or 4ºC) above the set temperature "HI" set point, to 135°F (or 57°C).

Press the **"Select**" button to continue. The set alarm "LO" LED is *on* with the display indicating the low temperature alarm set point. The alarm will activate at this temperature and will automatically reset at two degrees Fahrenheit (or one degree Celsius) above this temperature. Press the **"+"** or **"-"** key pads to change the alarm setpoint within a range of 8ºF (4ºC) below the set temperature "LO" set point, to 34°F (or 1°C).

Press the "**Select"** button to continue. The alarm LED will flash and the display will show "ALL", indicating the "ALL" alarm on/off status. Press **"Select**" and the display will show either "*ON"* or "*OFF",* indicating current alarm status. Press the **"+"** or **"-"** key pads to toggle the mode as desired. If the "*OFF"* mode is selected, no alarms will activate and the audible on/off select function is skipped.

Press the **"Select**" button to continue. The audible LED will flash and the display will show "*AUD",* indicating the audible alarm on/off status. Press "**Select"** and the display shows **"***ON"* or "*OFF"* indicating the current audible alarm status. Press the **"+**" button or the **"-**" button to toggle the mode as desired.

Press the "**Select"** button to continue. The "C" LED flashes and the display shows either "*F"* for degrees Fahrenheit or "*C"* for degrees Celsius. Press the **"+**" button or the **"-**" button to toggle the mode as desired.

Press the **"Select**" button to continue. The code LED is on and the display shows "PIN". To set a new user PIN code, press the "**+"** button. The display will flash "4", prompting an entry of a four button sequence using the **"+", "-", "Select"** and/or **"Exit"** buttons. (Any sequence of the four buttons may be programmed as the code.) As the buttons are pressed, the display will show the number of buttons that were pressed.

NOTE: After pressing a button, there will only be 5 seconds to press the next button. If the next button is not pressed within the allotted time, the system will default to no PIN code, indicated by "0" on the display. Once the sequence is entered the display will no longer flash, and will show "4".

To program the no PIN code mode, press **"-**" and the display will show "0", indicating no PIN code. With no PIN code, pressing any button will permit access to the program.

*** CAUTION ***

Always record the selection sequence (PIN code) and store in a secure place.

Press the **"Select**" button to continue. The filter LED flashes and the display will show "*FIL"*, indicating the filter alarm days selection. Press the **"Select"** button and the display will show the number of days that the alarm is set in one-half day increments. (Example: 10.5 indicates the alarm will activate every ten and one-half days).

Press the **"+"** or the **"-**" key pads to vary the desired number of days. (Range is 0-99 days). Programming 0 days will disable the alarm.

NOTE: The required number of days to set this alarm will be determined by the ambient air conditions. If rain or wash down hoods are installed on the system, no filter is supplied and the filter alarm should be set to "0". This will disable the filter alarm.

Press the **"Select**" button to continue**.** The program LED will be lit and the display will show *"Add".* Press the **"Select**" button again and a value of "*0.0"* will appear. Programming of the microprocessor is now complete.

Press the **"Select**" button to review all of the settings. Press the **"Exit**" button to enter the selected settings and to return to the normal operating mode.

NOTE: If the "Exit" button is not pressed, any changes to the program settings will not be saved.

ALARM OPERATION:

1. **The enclosure temperature is above or below the alarm setpoint**:

The alarm LED will light, the display flashes, either "HI" or "LO" LEDs flash with the display and the audible alarm sounds (if activated). The enclosure temperature must rise or fall two degrees Fahrenheit (one degree Celsius) before the alarm will reset.

2. **The condenser temperature is above the condenser alarm setpoint**:

The alarm LED lights, the display flashes the condenser temperature, and the audible alarm sounds (if activated). The condenser temperature must fall four degrees Fahrenheit (two degrees Celsius) before the alarm will reset. **The above alarms can be manually reset by entering the PIN code into the system.**

3. **The filter day timer has expired**:

The alarm LED lights, the display flashes showing "*FIL"*, the filter LED flashes with the display and the audible alarm sounds (if activated). The filter alarm may be cleared by pressing "**Exit".**

4. **Sensor Malfunctions**:

E-O - Evaporator sensor open
E-C - Evaporator sensor shorted
C-O - Condenser sensor open
C-C - Condenser sensor shorted

NOTE: An alternating E-O … C-O display may indicate the sensor connector has become disconnected from the rear of the controller.

MAINTENANCE:

The Ice Qube air conditioning system is designed to provide many years of trouble-free operation with minimal amount of maintenance. Primary maintenance consists of checking the condition of the ambient air filter and the condensate management system.

1. **Ambient Air Filter**: It is recommended that the ambient air filter be inspected and cleaned regularly, at least every 30 days, or more frequently depending upon ambient conditions. To check the condition of the air filter, it is recommended to first remove electrical power from the Ice Qube system. Next, locate the filter cover and filter, (location will vary by model). Slide the filter from the filter rack through the end slot, and clean by soaking in warm soapy water. Rinse with clean water. Use a shop-vac to remove excess water from the filter before returning it to the system. Replace the filter if it is showing signs of deterioration.

NOTE: If rain or wash down hoods have been installed, a filter would not have been supplied, therefore no filter maintenance is required. However systems equipped with rain or wash down hoods will require regular condensing section maintenance by qualified personnel. For systems equipped with filters, it is recommended to have a spare clean filter in stock in order to prevent prolonged cooling system downtime. The dirty filter may be cleaned at a more convenient time.

2. **Condensate Management System**: The condensate management system should be checked periodically for scale, sludge and debris that may cause the system to fail. On open type enclosures and in areas where the enclosure door is opened frequently within dirty or industrial environments, maintenance should be performed on a regular basis. On sealed enclosures, clean environments, or where the door is not opened frequently, maintenance may be performed annually. *The type of environment will determine the frequency of required maintenance*.

Maintenance of the condensate management system will require removal of electrical power from the Ice Qube system and removal of the cover. *Please contact Ice Qube before removing the cover during the warranty period.*

*** CAUTION ***

Electrical wires are connected from the cover to the base.

Removing the cover will allow access to the primary condensate management pan, which is located below the evaporator. Inspect the condensate pan and the drain nipple for signs of scale, sludge or debris that may prevent water flow through the nipple. To clean the debris from the pan, use a clean absorbent cloth or shop-vac. Nipples may be cleaned using a ¼ inch tubing brush, then flush with clean water.

Also inspect the neoprene tubing that is attached to the nipples on the condensate management system. Replace the tubing if it appears to have internal build-up or has become brittle.

NOTE: If there is a secondary condensate management pan, maintenance will need to be performed in the same manner as explained above.

After all debris has been removed from the system, replace the cover onto the unit – being careful not to damage the wiring connecting the cover to the base.

3. **Cooling system cabinet**: The cooling system cabinet may also need to be cleaned occasionally. To clean the system cabinet, simply wipe it with a damp, lint free cloth. A mild soap solution may be used if necessary.

TROUBLE SHOOTING:

Contact Ice Qube if the air conditioning system should fail to operate satisfactorily during the first year of operation. DO NOT remove the cover without first notifying the factory. **Removal of the cover will immediately void the warranty**.

If an operating problem should occur, please review the items outlined in the following "Trouble Shooting Check List". If the problem persists, contact Ice Qube for technical assistance.

ICEqube

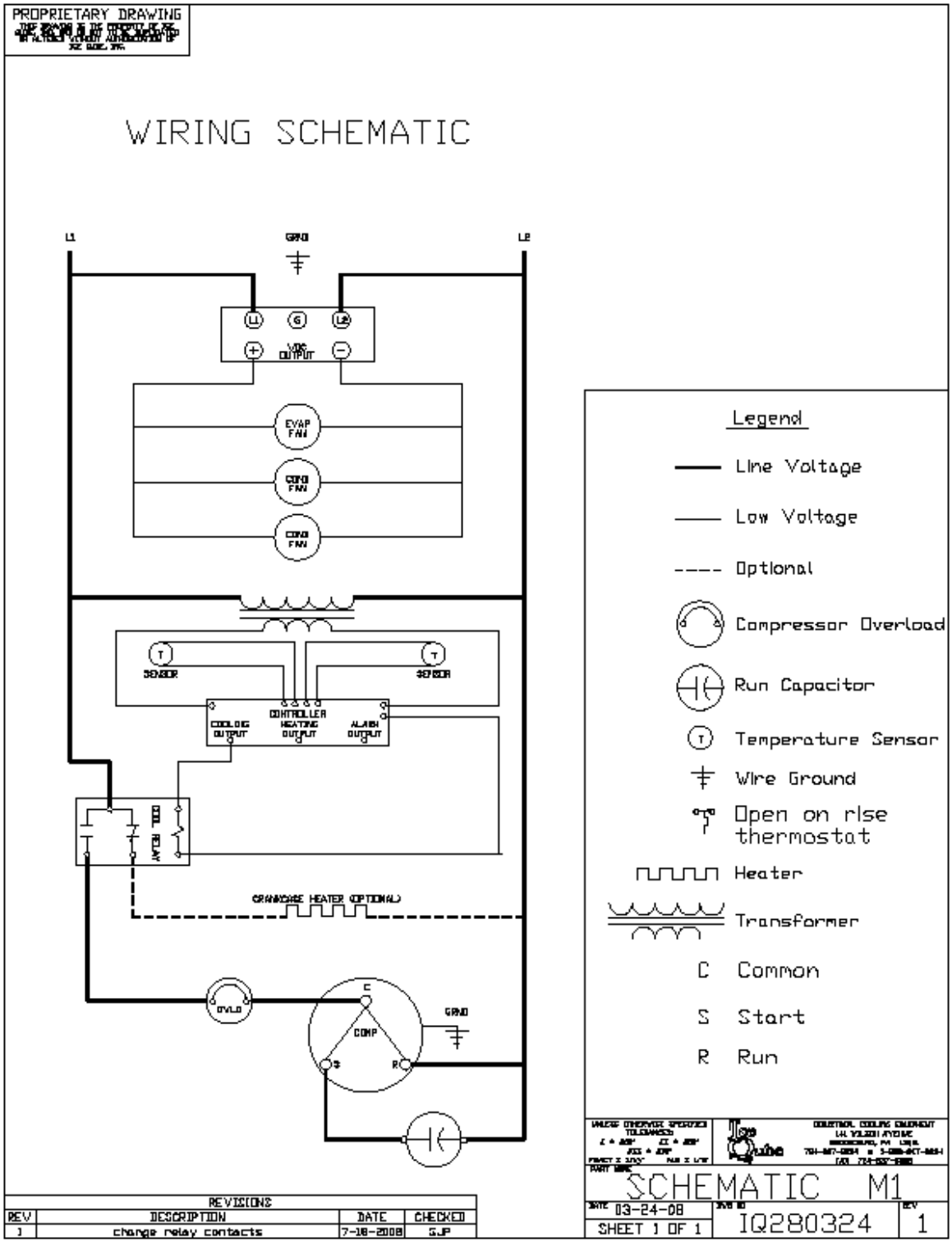
TROUBLE SHOOTING CHECK LIST

Model No:		**S/N Number:**	
Voltage Rating:	Amps:	Phase:	Hz:

Is proper electrical power available at the outlet?	YES Δ	NO Δ
Is the power cord connected to the proper electrical supply?	YES Δ	NO Δ
Is the controller set point temperature above or below the enclosure temperature?	YES Δ	NO Δ
Is the evaporator (cold air stream) blower operating?	YES Δ	NO Δ
Is the compressor and condenser (warm air stream) blower operating?	YES Δ	NO Δ
Is the enclosure door closed tightly?	YES Δ	NO Δ
Are all of the gaskets in place?	YES Δ	NO Δ
Has the condenser (warm air stream) filter been cleaned or changed recently?	YES Δ	NO Δ
Is the system mounted level on the enclosure?	YES Δ	NO Δ
Is there adequate space within the enclosure for air flow?	YES Δ	NO Δ
Is there adequate space around the enclosure for air flow?	YES Δ	NO Δ
Have you recently added electronic equipment to the enclosure?	YES Δ	NO Δ

Still experiencing problems? Call Ice Qube at 1-888-867-8234

SCHEMATIC WIRING DIAGRAM



WARRANTY:

The Seller warrants to the original Buyer that the products manufactured by the Seller are free from defects in material and workmanship. If the Buyer notifies the Seller within ONE YEAR of any such defects (the "Warranty Period"), and returns the products to Seller at Buyer's sole expense, Seller shall, at its option, repair the products, or replace them with products of comparable value. In either case, the Warranty Period for the repaired or replaced products shall extend after the date of repair or replacement for a time equal to the original warranty period. If the Buyer does not notify the Seller of such defects, whether patent or latent, within the Warranty Period, Seller shall have no further liability or obligation to the Buyer. Therefore, in no event shall Seller's liability under this warranty exceed the original purchase price of the products which are the subject of a proper notice of defects.

Excluded from this transaction are all implied warranties, including without limitation, the implied warranties of merchantability and fitness for a particular purpose or use. The express warranties set forth above are the only warranties given by Seller in this transaction.

In no event will Seller be liable for any incidental or consequential damages of the Buyer. The foregoing remedies are the sole and exclusive remedy of Buyer for any breach of warranty in this transaction.

Product Sensor Adjustment

Below is the O.E.M. instructions for the LR-TB2000 Series Sensor.

KEYENCE

96M12738

All-Purpose Laser Sensor

LR-TB2000 Series

Instruction Manual

Read this manual before using the product in order to achieve maximum performance. Keep this manual in a safe place after reading it so that it can be used at any time.

The following symbols alert you to important messages. Be sure to read these messages carefully.

WARNING	It indicates a hazardous situation which, if not avoided, could result in death or serious injury.
NOTICE	It indicates a situation which, if not avoided, could result in product damage as well as property damage.

1 Introduction

Safety Information for LR-TB Series

WARNING	• This product is only intended to detect object(s). Do not use this product for the purpose to protect a human body or part of a human body. • This product is not intended for use as an explosion-proof product. Do not use this product in a hazardous location and/or potentially explosive atmosphere. • This product uses DC power. The product may explode or burn if an AC voltage is applied.
NOTICE	• Do not wire the cable along with power lines or high-tension lines, as the sensor may malfunction or be damaged due to noise. • When using a commercially available switching regulator, ground the frame ground terminal and ground terminal. • Do not use this product outdoors or in a location in which its light-receiving surface will come in direct contact with stray ambient light.

Safety Precautions on Laser Product

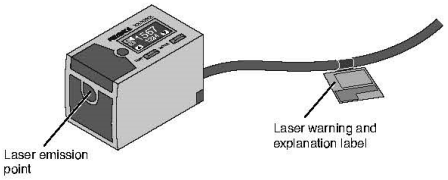
This product uses a semiconductor laser as its light source.

WARNING	• Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure. • Follow the instructions mentioned in this manual. Otherwise, injury to the human body (eyes and skin) may result. • Laser emission from this product is not automatically stopped when it is disassembled. Do not disassemble this product. • Precautions on Class 2 Laser Product - Do not stare into the direct or specularly reflected beam. - Do not direct the beam at people or into areas where people might be present. - Be careful of the path of the laser beam. If there is a possibility that the operator may be exposed to the specular or diffuse reflections, block the beam by installing a protective enclosure. - Install this product so that the path of the laser beam is not as the same height as that of human eye. • Precautions on Class 1 Laser Product - Do not stare into the direct or specularly reflected beam.

Item		Description	
Model		LR-TB2000	LR-TB2000CL
		LR-TB2000C	
Wavelength		660 nm	
Pulse width		4.3 ns	
FDA(CDRH) Part1040.10	Laser class*	Class 2 laser product	Class 1 laser product
	Output	1.0 mW	390 µW
JIS C 6802/ IEC 60825-1	Laser class	Class 2 laser product	Class 1 laser product
	Output	1.0 mW	390 µW

* The laser classification for FDA (CDRH) is implemented based on IEC60825-1 in accordance with the requirements of Laser Notice No.50.

■ **Laser warning and explanation labels**



● **Laser warning and explanation labels**

- Attached to the cable

Class 2 (English) Class 1

- Included with the product

Class 2 (included with the product in each language)

* For a Class 2 laser product, select from the warning and explanation labels included in the package the appropriate warning and explanation label according to the country and region where the Class 2 laser product will be used. Then, affix the warning and explanation label over top of the existing warning and explanation label on the product.

Precautions on Regulations and Standards

■ **CSA Certificate**

LR-TB series complies with the following CSA and UL standards and has been certified by CSA (Class 2252 06 / Class 2252 86).

- Applicable standard: CAN/CSA C22.2 No.61010-1
  UL61010-1
- Use the following power supply.

CSA/UL certified power supply that provides Class 2 output as defined in the CEC (Canadian Electrical Code) and NEC (National Electrical Code), or CSA/UL certified power supply that has been evaluated as a Limited Power Source as defined in CAN/ CSA-C22.2 No. 60950-1/UL60950-1

- Use this product at the altitude of 2000 m or less.
- Use this product at the level of overvoltage category I.
- Use this product at pollution degree 3.
- Indoor use only.

■ **CE Marking**

Keyence Corporation has confirmed that this product complies with the essential requirements of the applicable EC Directive, based on the following specifications.
Be sure to consider the following specifications when using this product in a member state of the European Union.

● **EMC Directive (2004/108/EC)**

- Applicable standard: EMI : EN60947-5-2, Class A
  EMS : EN60947-5-2

● **Low-voltage Directive (2006/95/EC)**

- Applicable standard: EN61010-1, EN60825-1
- Use the power supply that has been evaluated as a Limited Power Source as defined in IEC60950-1/EN60950-1.
- Use this product at the altitude of 2000 m or less.
- Use this product at the level of overvoltage category I.
- Use this product at pollution degree 3.
- Indoor use only

Remarks: These specifications do not give any guarantee that the end-product with this product incorporated complies with the essential requirements of the EMC Directive.
The manufacturer of the end-product is solely responsible for the compliance of the end-product itself according to the EMC Directive.

Package Contents

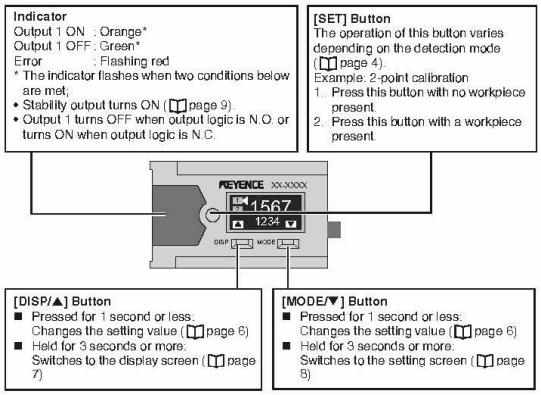
- Main unit
- Instruction manual
- Laser warning and explanation labels (LR-TB2000/TB2000C only)

Specifications

Model	Cable	LR-TB2000	-
	Cable with connector M12	LR-TB2000C	LR-TB2000CL
Detectable distance*1		60 to 2000 mm	
Spot diameter		Approx. 4 mm	
Response time		1 ms/10 ms/25 ms/ 100 ms/1000 ms selectable	2 ms/20 ms/50 ms/ 200 ms/2000 ms selectable
Light source	Type	Red laser (660 nm)	
	Laser class	Class 2 laser product IEC60825-1,FDA(CDRH) Part1040.10*2	Class 1 laser product IEC60825-1,FDA(CDRH) Part1040.10*2
Mutual interference prevention function		4 units (when using the interference prevention function)	
Timer		OFF/OFF delay/ON delay/One-shot	
Power voltage		20 to 30 VDC, including 10% ripple (P-P), Class 2 or LPS	
Current consumption		45 mA or less (without load)*3	
I/O*4*5	Control output	NPN open collector/PNP open collector selectable 30 VDC or less, 50 mA or less, residual voltage: 2 V or less, N.O./N.C. selectable	
	External input	Transmission OFF / Tuning / Reference surface update selectable Short-circuit current: 1 mA or less for both NPN and PNP For the applied voltage, see the wiring diagrams (page 2 in the instruction manual). For the input times, see the time charts (page 3 in the instruction manual).	
Protection circuit		Protection against reverse power connection, power supply surges, output overcurrent, output surge, and reverse output connection	
Environmental resistance	Enclosure rating	IP65/IP67 (IEC60529)	
	Ambient light	Incandescent lamp/Sunlight: 100000 lux or less	
	Ambient temperature	-20 to +55°C (no freezing)	
	Ambient humidity	35 to 85%RH (no condensation)	
	Shock resistance	1000m/s² in X, Y, Z axis directions respectively 6 times	
	Vibration resistance	10 to 55 Hz Double amplitude 1.5 mm in the X, Y, Z axis directions respectively, 2 hours	
Material		Case: Zinc die cast (Nickel chrome plating), Indicator cover and buttons: PES, Lens cover and display: PMMA (scratch-resistant coating specifications), Cable bushing: PBT, Cable: PVC, M12 connector (only for the cable with connector M12 type): TPE, PBT, Nickel-plated brass	
Weight		Cable type: Approx. 125 g (Including cable) Cable with connector M12 type: Approx. 85 g	

*1 The range for displayable distance is from 50 to 2200.
*2 The laser classification for FDA (CDRH) is implemented based on IEC60825-1 in accordance with the requirements of Laser Notice No.50.
*3 145mA or less (with load)
*4 You can select the I/O from the following combinations.
Control output × 2, control output + external input
(For details on the setting method, see page 3 of the instruction manual.)
*5 IO-Link specification v.1.1/COM2 (38.4 kbps) is supported.
You can download a setup file from the KEYENCE website (http://www.keyence.com).
If you are using the product in an environment in which you cannot download files over the Internet, contact your nearest KEYENCE office.

Part Functions



For a more detailed explanation, see "Switching between Display Screens" (page 7).

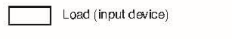
2 Installation and Wiring

Installation

- Tightening torque for the mounting holes: 0.63 N·m (M3 screw)
- If the detecting object has a mirrored surface, install the sensor in a position where specular reflection will not penetrate the optical receiver.

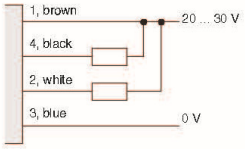
Wiring

With the LR-TB Series, you can select the functions of the I/O wires (black and white) from the combinations shown below during the initial settings. "3 Initial Settings" (page 3) Independently isolate any I/O wires that you will not use.

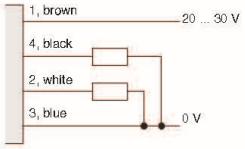


■ **Out1+Out2**

● NPN

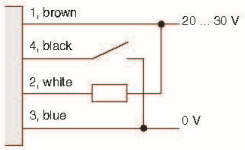


● PNP

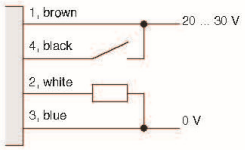


■ **Input+Out1**

● NPN

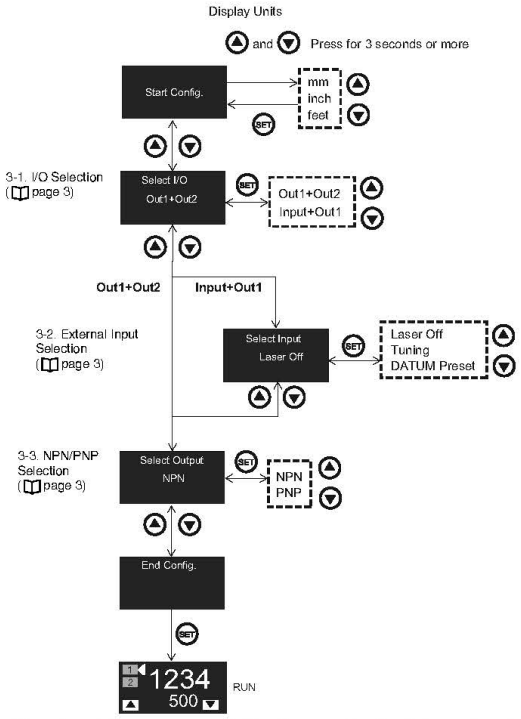


● PNP



3 Initial Settings

When you turn on the LR-TB Series for the first time after you purchase it or when you have initialized the LR-TB Series, the following initial settings must be configured.



- After you have finished configuring the initial settings, you will not be able to reconfigure the unit, I/O, or NPN/PNP selection. To change any of these settings, you will have to initialize the product. "Initialization" (page 7).

3-1. I/O Selection

Select from the following table the functions assigned to the I/O wires (black and white).

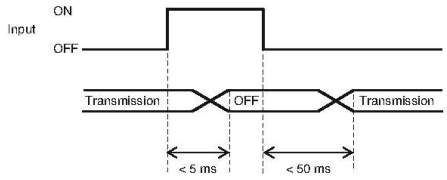
Options	Black Wire	White Wire
Out1 + Out2	Output 1	Output 2
Input + Out1	External input	Output 1

The functions assigned to output 1, output 2, and external input can be changed after you finish configuring the initial settings. "6 Detailed Settings" (page 8).

3-2. External Input Selection

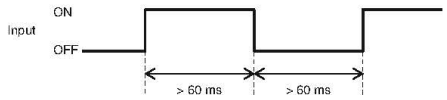
■ Transmission OFF [Laser Off]

The laser beam transmission is stopped.



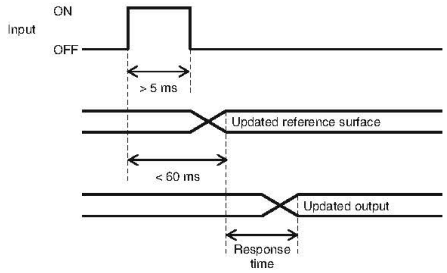
■ External Calibration [Tuning]

When selected, this external input performs the same function as pressing the [SET] button.



■ Reference surface update [DATUM Preset]

When the detection mode ("4 Detection Mode" [page 4]) is set to "DATUM mode," this external input updates the reference surface.



3-3. NPN/PNP Selection

You can select between NPN outputs or PNP outputs. For details, see "Wiring" (page 2).

4 Detection Mode

The LR-TB Series has four output modes and three detection modes.

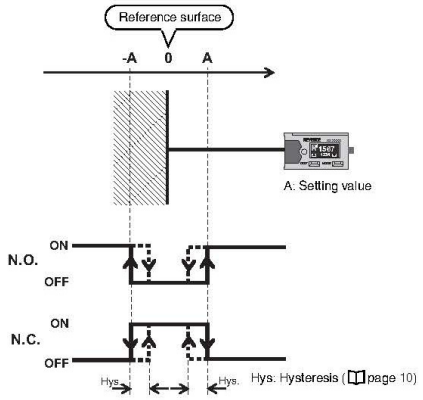
Output Mode (📖 page 9)	Detection Mode
Standard (default value) [Standard]	**4-1. DATUM mode (FGS)**
	4-2. Distance mode (BGS)
Window [Window]	**4-3. Window mode**
Stability [Stability]	(📖 page 9)
Error [Error]	(📖 page 9)

When the output modes for Out1 & Out2 are either [Standard] or [Window], the detection modes can only be set in the below combinations.
[Out1] / [Out2] = [DATUM]/ [DATUM], [Distance]/ [Distance], [Distance]/ [Window], [Window]/ [Distance], [Window]/ [Window]

4-1. DATUM Mode (FGS)

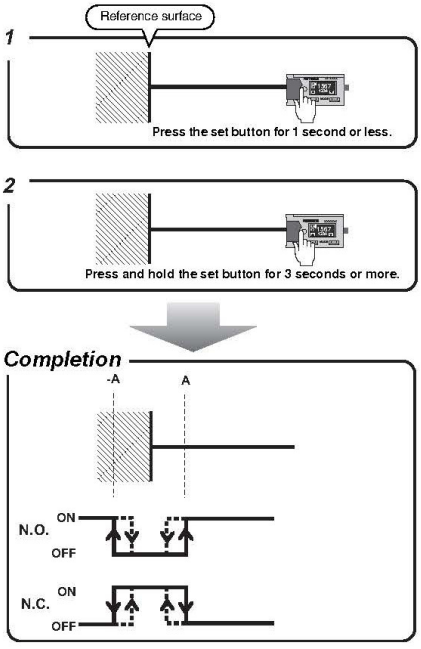
■ Operation

- In this mode, the change in position from a reference surface (which has a value of 0) is displayed.
- This mode is useful in detecting the passage of workpieces in front of a stationary background.



■ Setting

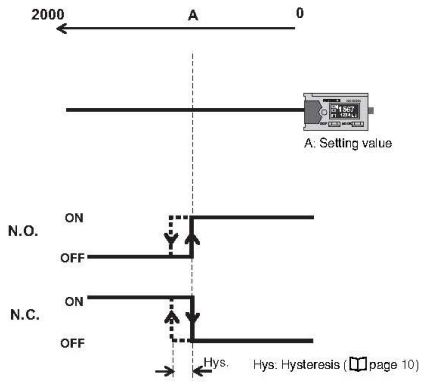
- Set the output mode to [Standard], which is the default mode. 📖"6 Detailed Settings" (page 8)
- For details on setting output 2, see 📖" 4-5. Switching Out1/Out2" (page 6).
- In DATUM mode, a "±" is displayed in front of the setting value.



4-2. Distance Mode (BGS)

■ Operation

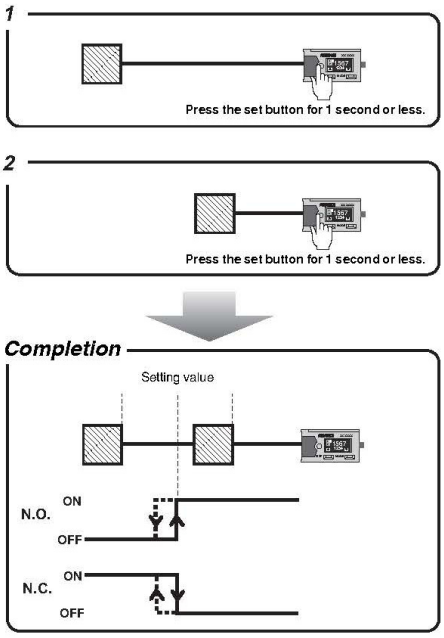
- In this mode, the distance from the sensor is displayed.



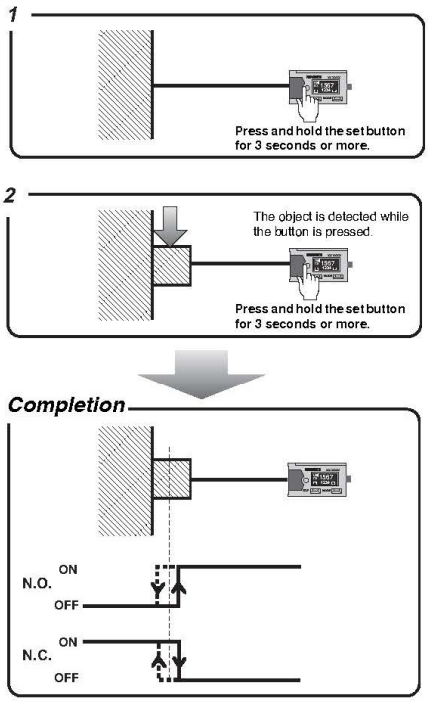
■ Setting

- Set the detection mode to [Standard], which is the default value. 📖"6 Detailed Settings" (page 8)
- For details on setting output 2, see 📖" 4-5. Switching Out1/Out2" (page 6)

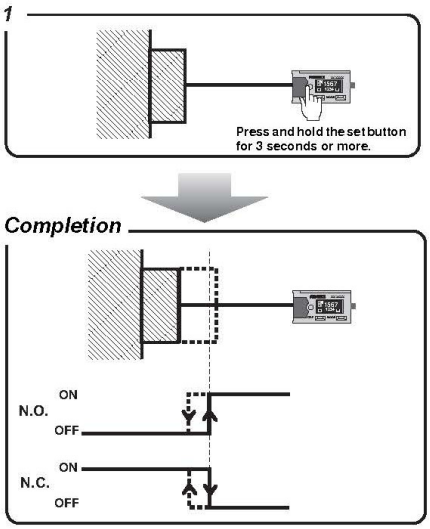
● **2-point calibration**



● **Full auto calibration**
Use this function when the movement of detected objects cannot be stopped.



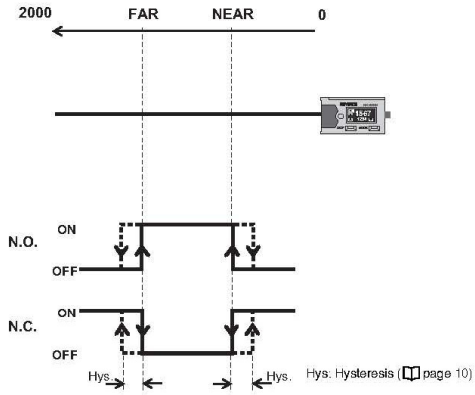
● **1-point calibration**
Use this function to enable the installation of detected objects at the upper limit that you do not want to detect.



4-3. Window Mode

■ Operation

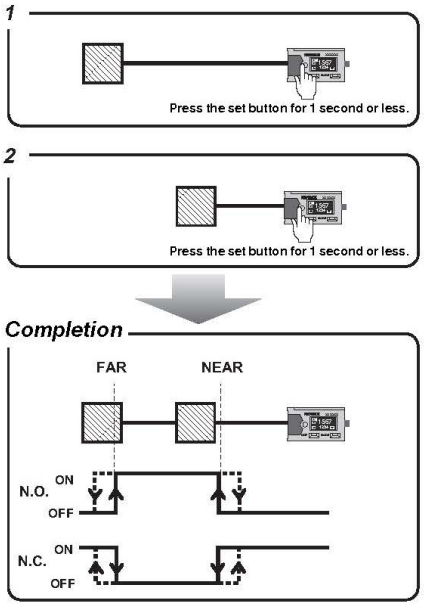
- In this mode, the distance from the sensor is displayed.
- You can assign setting values to the upper and lower limits.



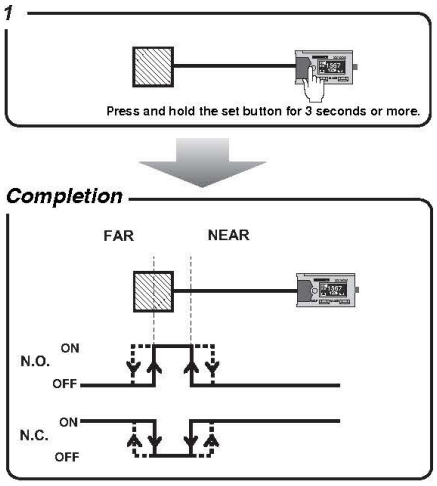
■ Setting

- Set the detection mode to [Window]. "6 Detailed Settings" (page 8)
- For details on setting output 2, see "4-5. Switching Out1/Out2" (page 6).

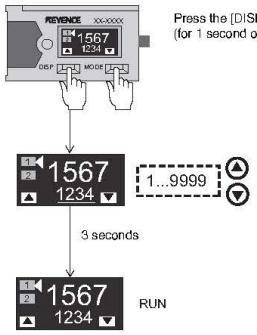
● **2-point calibration**
Use this function to detect objects inside a range of specific upper and lower limits.



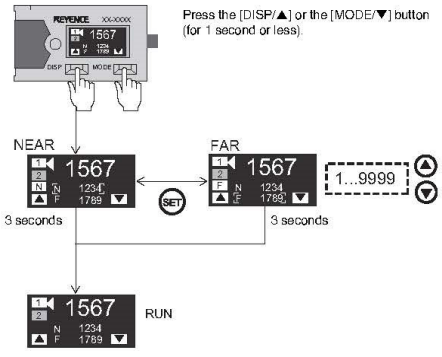
● **1-point calibration**
Use this function when you cannot move detected objects away from the center of the detection range.



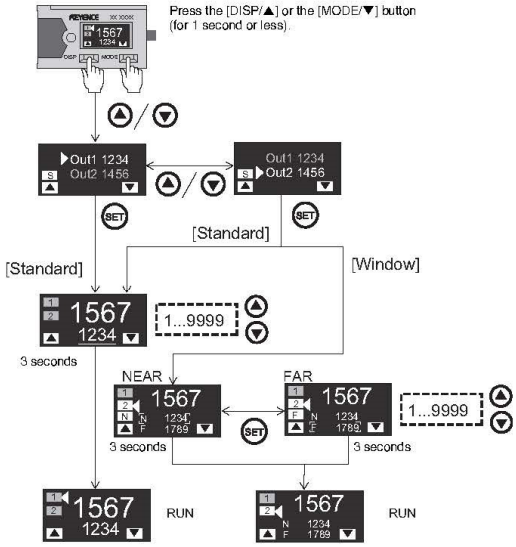
4-4. Manual Tuning



■ **When the detection mode is set to [Window]**

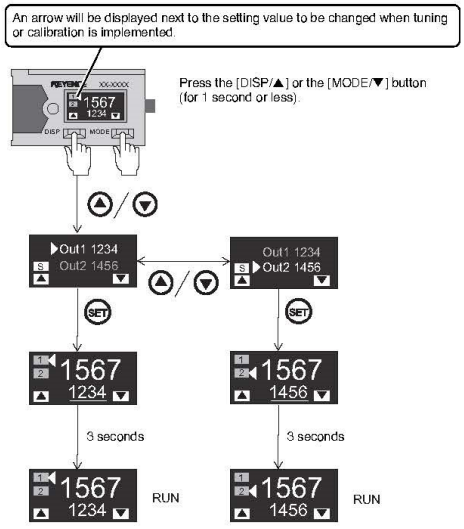


■ **When [Out2] mode is set to [Standard] or [Window]**



4-5. Switching Out1/Out2

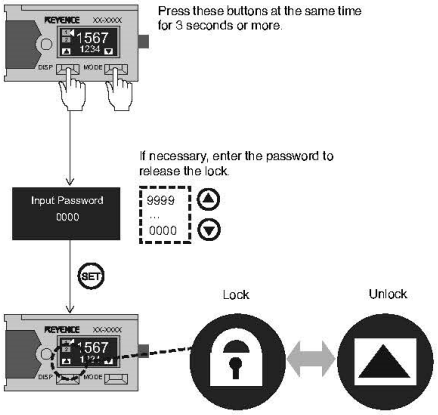
The initial [Out2] mode is [Stability]. "6 Detailed Settings" (page 8)
When [Out2] mode is set to [Standard] or [Window], the setting below could be manipulated.



5 Useful Functions

Key Lock

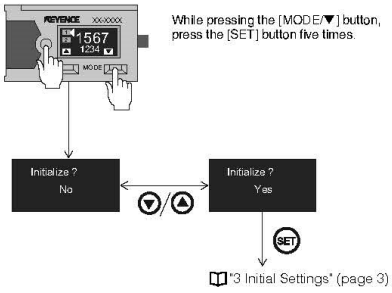
To require a password to release the key lock, see "6-11. Password" (page 10).



Initialization

Initialization resets the product to its factory default settings. After initialization, you will have to configure the "3 Initial Settings" (page 3).

■ **Using the shortcut keys to execute the initialization**



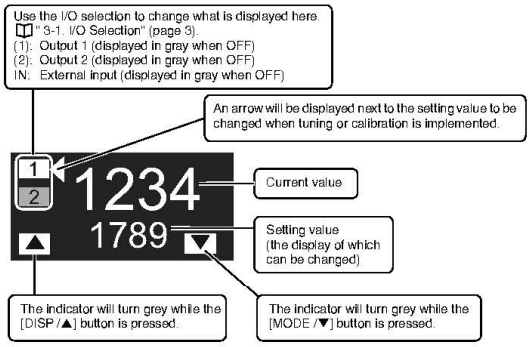
■ **Using the setting menu to execute the initialization**

On the "Initialize?" screen, select "Yes". "6 Detailed Settings" (page 8)

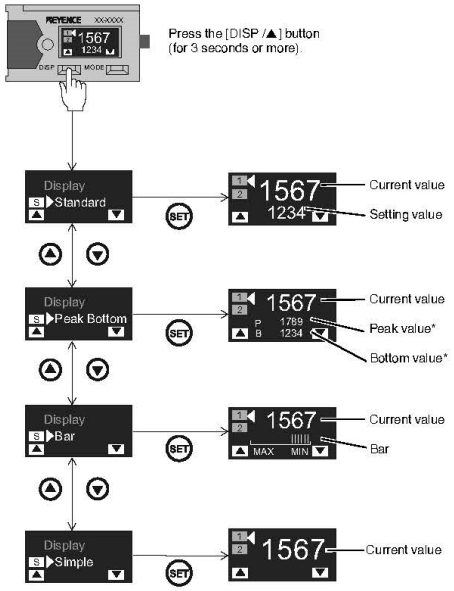
Switching between Display Screens

You can select between four different displays.

■ **Display screen**



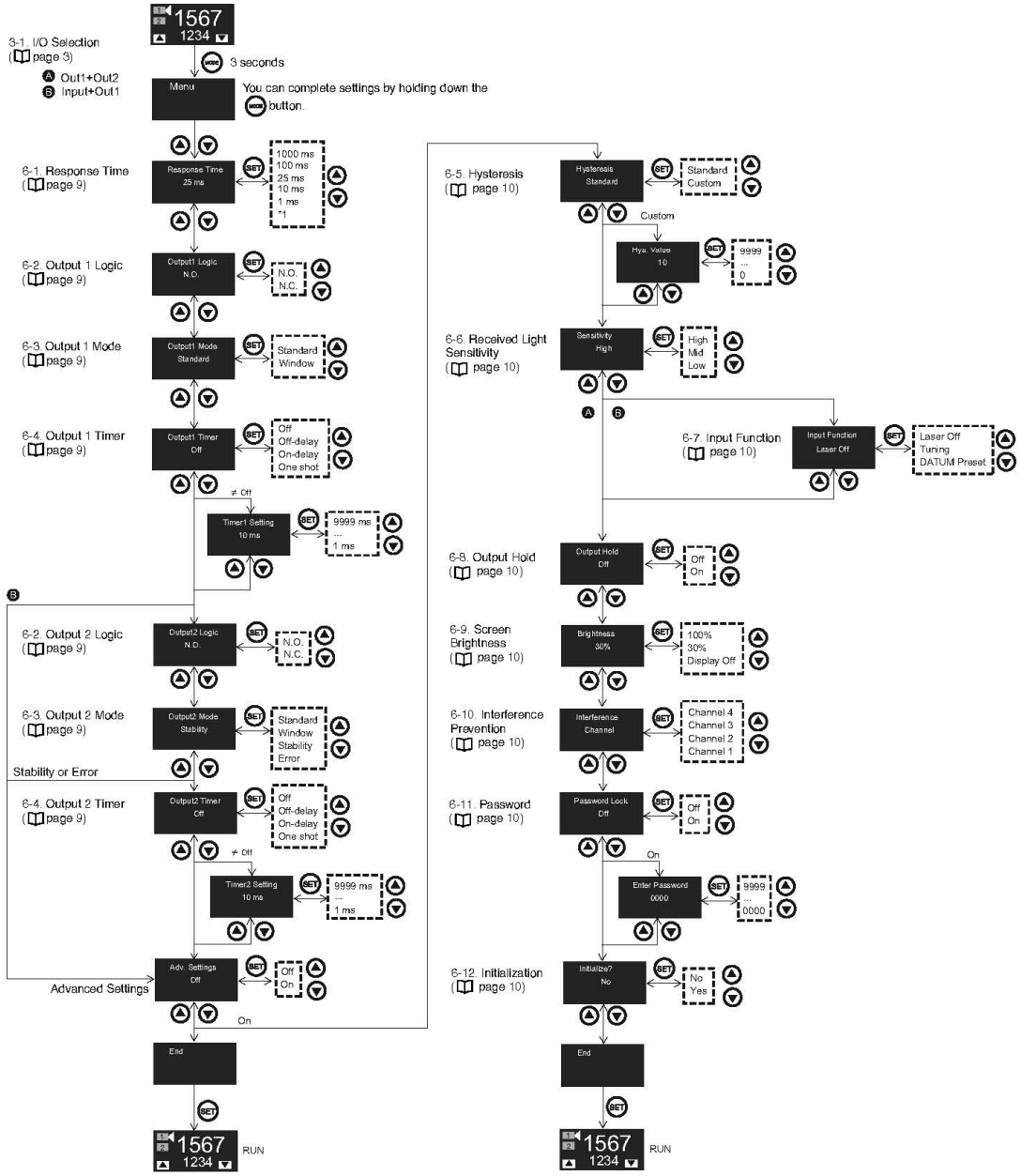
■ **How to switch the display**



* When the output changes from ON to OFF, the bottom value is reset to the current value.
When the output changes from OFF to ON, the peak value is reset to the current value.

6 Detailed Settings

The values shown on the display screen are the initial values.



*1 The LR-TB2000CL has the following response times.
2000 ms
200 ms
50 ms
20 ms
2 ms

6-1. Response Time

Longer response times lead to more stable detection.

■ **LR-TB2000/TB2000C**

Detecting distance [mm]	Repetition Accuracy[mm] (Typical) (Under stable temperature) White Paper (Reflectivity: 90%) Response Time [ms]				
	1	10	25	100	1000
1000	±9	±4	±3	±3	±3
2000	±25	±7	±6	±3	±3

Detecting distance [mm]	Repetition Accuracy[mm] (Typical) (Under stable temperature) Gray Paper (Reflectivity: 18%) Response Time [ms]				
	1	10	25	100	1000
1000	±26	±7	±6	±3	±3
2000	±69	±21	±13	±6	±4

■ **LR-TB2000CL**

Detecting distance [mm]	Repetition Accuracy[mm] (Typical) (Under stable temperature) White Paper (Reflectivity: 90%) Response Time [ms]				
	2	20	50	200	2000
1000	±10	±5	±3	±3	±3
2000	±26	±8	±7	±5	±3

Detecting distance [mm]	Repetition Accuracy[mm] (Typical) (Under stable temperature) Gray Paper (Reflectivity: 18%) Response Time [ms]				
	2	20	50	200	2000
1000	±26	±9	±6	±3	±3
2000	±71	±22	±15	±9	±5

6-2. Output Logic

Select N.O. or N.C. for the output logic. For details, see "4 Detection Mode" (page 4).

6-3. Output Mode

■ Standard [Standard]

The output is activated according to the detecting distance. For details, see "4 Detection Mode" (page 4).

■ Window [Window]

The output is activated according to the detecting distance. For details, see " 4-3. Window Mode" (page 5).

■ Stability [Stability]

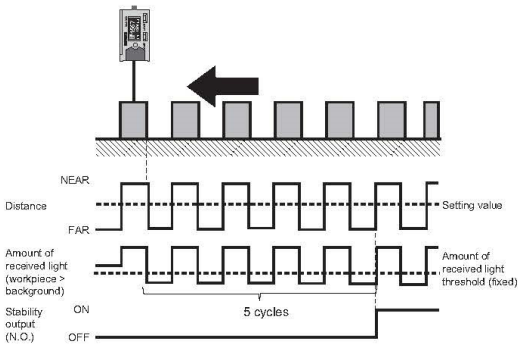
This function can be used to check whether there has been a decrease in the amount of light received due to problems such as dirt on the detected surface.

● **When the I/O selection is [Out1 + Out2]**

Output is activated if the amount of light received falls below the threshold (fixed value) during the observation period.

Detection Mode	Observation Period
DATUM	Negative setting value < detected value < positive setting value
Distance	Detected value < setting value
Window	LOW-side setting value < detected value < HIGH-side setting value

Example) Chart during DATUM mode



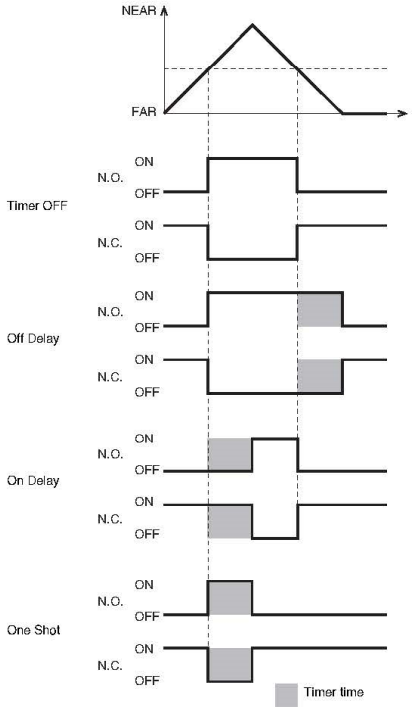
■ Error [Error]

Output is activated when an error occurs. When the error is cleared, the output is also automatically reset. For causes of errors, see " Error Display" (page 10).

6-4. Timer

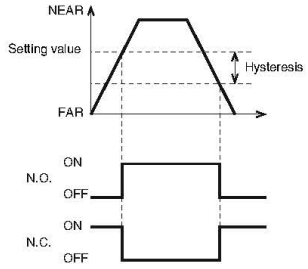
This function can be used to delay the timing with which the sensor output is switched.

- Off delay [Off-delay]
- On delay [On-delay]
- One shot [One shot]

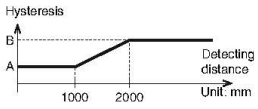


6-5. Hysteresis

Hysteresis is the difference between the value at which the output turns ON and the value at which the output turns OFF.



- With [Standard], the hysteresis varies depending on the response time and the detecting distance.



Response Time (ms)	A(mm)	B(mm)
25 to 2000	15	20
10, 20	30	40
1, 2	60	80

- With [Custom], you can specify an arbitrary value regardless of the detecting distance.
- For details on the operation differences between the detection modes, see "4 Detection Mode" (page 4).

6-6. Received Light Sensitivity

By lowering the received light sensitivity level, you can reduce the number of times that malfunctions such as the following occur.

- Detections of dirt and mist between the sensor and the detected object.
- Detections of translucent objects when passing through translucent objects to detect the target.

You cannot change the received light sensitivity when "6-1. Response Time" (page 9) is set to [1ms/10ms]/[2ms/20ms].

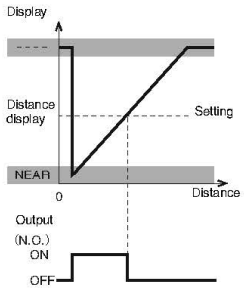
6-7. Input Function

For details, see "3-2. External Input Selection" (page 3).

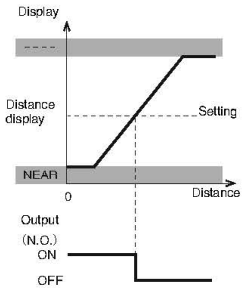
6-8. Output Hold

This function holds the display value and the output status that were in use immediately prior to the LR-TB Series becoming unable to receive light.

■ When Output Hold is OFF



■ When Output Hold is ON



6-9. Screen Brightness

You can set the operation to perform when no button operations are performed for a set length of time.

Item	Description
100%	The display brightness is always kept at 100%.
30% (default value)	After a certain length of time elapses, the display brightness is set to 30%.
Display Off	After a certain length of time elapses, the display is turned OFF.

- If you use the LR-TB Series for a long period of time, the display brightness will decrease.
- If you set this to [100%], the display brightness will decrease at a faster rate.

6-10. Interference Prevention

With the LR-TB Series, you can prevent the effect of mutual interference by changing the laser emission channel. If you are using multiple LR-TB Series units in close proximity to each other, set each one to have a different laser emission channel.

6-11. Password

If you set this to [ON], you can set a personal identification number that must be entered to release the "Key Lock" (page 7). You can set the personal identification number to a value from 0 to 9999.

6-12. Initialization

Initialize the sensor settings. You can also use the shortcut keys to execute the initialization. "Initialization" (page 7)
After initialization, you will have to configure the "3 Initial Settings" (page 3).

7 Other

Error Display

Error Display	Cause and Remedy
NEAR*	The detected object is not within the detectable range (the detected object is too close).
- - - -*	Light reflected from the detected object could not be received. • The amount of light received from the detected object is low. • The detected object is not within the detectable range of the LR-TB (the detected object is too far away).
Over Current	An overcurrent is flowing through the output wire. • Check whether the output wire is connected correctly. • Check whether the output wire is in contact with other wires.
Laser Error	A laser diode error has occurred. • If you cannot fix the problem by restarting the product, the product must be replaced.
EEPROM Error	1) Settings have been rewritten more than 1,000,000 times. • The memory has reached the end of its service life. 2) A recording memory error has occurred. • If you cannot fix the problem by restarting the product, the product must be replaced.
System Error	An internal system error has occurred. • If you cannot fix the problem by restarting the product, the product must be replaced.

* When Output mode is set to [Error], while "Near" or "- - - -" is on display, the output would not switch.

Output When an Error Occurs

Error Display	Output ON or OFF	
	N.O.	N.C.
NEAR	ON	OFF
- - - -	OFF	ON
Over Current*1	OFF	OFF
Laser Error*2	OFF	ON
EEPROM Error*2	The same as during normal operation	
System Error*2	OFF	ON

*1 When Output mode is set to [Error], despite the setting of N.O. or N.C., LR-T would remain OFF to protect the output circuit.
*2 When Output mode is set to [Error], LR-T would turn ON with N.O. and turn OFF with N.C.

Chapter 7

Drawing and Parts

CHAPTER 7: DRAWINGS AND PARTS

■ Recommended Spare Parts List

In order to prevent unnecessary down time, Burford® Corp. recommends the list of parts located in the Drawings and Parts section be kept in stock.

Contents

Call 1-877-BURFORD or fax
405-867-4219 to order your parts.

Drawings & Parts

Recommended Spare Parts

Please have the following machine information on hand before calling Burford®.

- Machine Voltage
- Model Number
- Serial Number

QTY.	PART #	DESCRIPTION
1	612282	Servo Motor, VPL, 480V
1	612283	Gear Motor, 90W, WD, 100:1, 220V 3Ph
1	612284	Gear Motor, 1/3HP, 220/460-60-3, 25:1
1	C00579	Replacement Water Filter
2	612008	Solenoid Valve, SS 1/8" NPT 2-Way 24VDC
4	612018	Splitter Tip, BETE, .020", 1/8" NPT
1	612061	Laser Sensor, Keyence, 2M
1	304269-001	Prox Sensor, 12MM, 10-30V, PNP, NC
4	612125	Vee Wheel Series 3 Washdown
2	612285	Vee Track Series 3 @43" W/15 Holes
2	612286	Vee Track Series 3 @61.5" W/21 Holes
1	612129	Cable M12 90 Deg 10M
2	716716	Urethane Belt, 5mm HTD x 25mm x 20.5'
25'	612128	Cable, Hi-Flex, 18AWG, 7G Cond.*sold per ft*
25'	612130	Hose, Hi-Flex, 1/2" OD, Blue *sold per ft*
1	612057	PLC, CompactLogix, L27ERM, 1MB
1	610913	Power Supply, 480VAC-24VDC, 10A, 3Ph
1	612145	Power Supply, 480VAC-48VDC, 5A, 3Ph
1	612178	Servo Driver, KINTX5500, 190-528V, 6.3
1	612179	Servo Driver, KINTX5500, EMC-Filter
1	612323	Kinetix 5500, EMC Filter, 3-Ph
1	612324	PowerFlex 527, 480V, 0.5HP
1	612223	PowerFlex 527, Encoder Card
1	612326	Encoder, 260, 1024, Line Driver
1	612170-004	Controller, PowerFlex 527, 480-3, 480-3

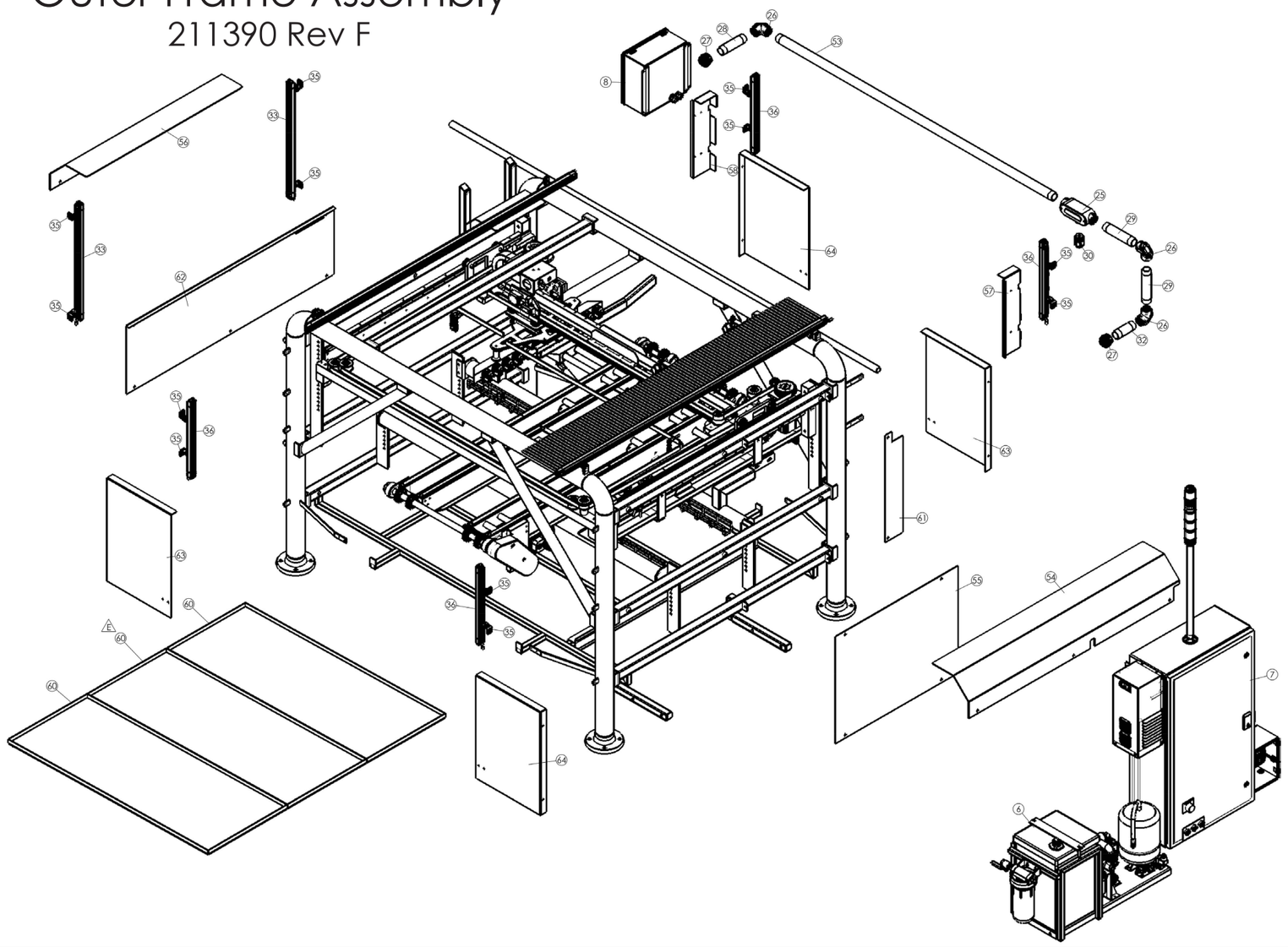
Fold Out to View Table of Contents

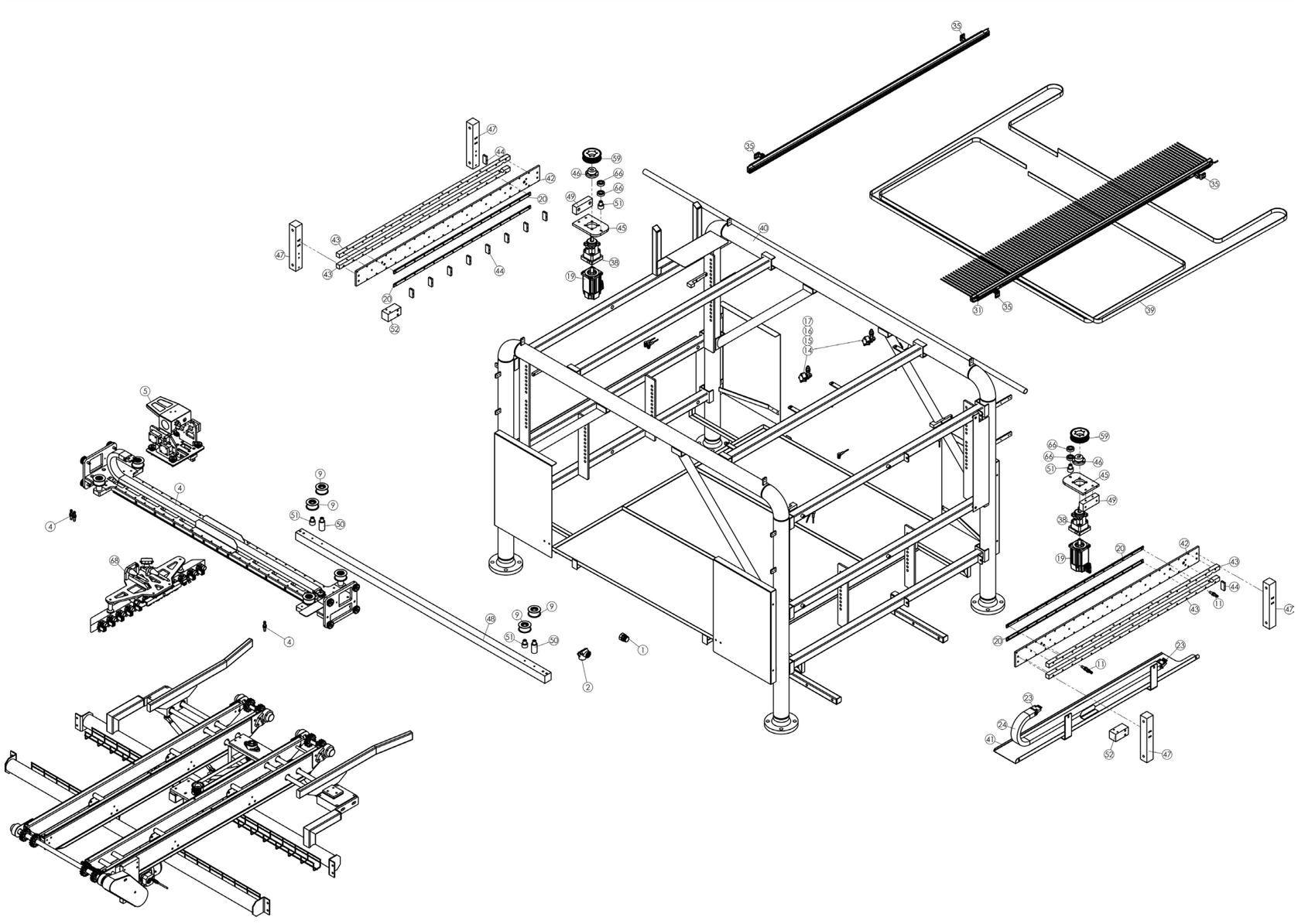
Outer Frame Assembly
211390 Rev F

ITEM #	QTY.	PART#	DESCRIPTION
1	1	115733-400	CONNECTOR,COMPRESSION,1" CONDUIT,SST
2	1	115733-402	CONDUIT, PULLING ELBOW, 1" SST
3	1	1831T23	CONDUIT, 1" RIGID, SST, THIN WALL
4	1	211205	X-AXIS CARRIAGE
5	1	211206	Y-AXIS CARRIAGE
6	REF.	211392	ASSY., PUMP CART AUTO. PSI HX1000
7	1	211393	ASSY, MAIN ELECTRICAL ENCLOSURE
8	1	211396	ASSY, HMI ENCLOSURE
9	4	211399	ASSY., IDLER HXR1000
10	1	211403	ASSY. CABLE, HX1000
11	3	304269-001	SENSOR,PROX,12MM,10-30V,PNP,NC
12	2	304430	CABLE,SENSOR,M12,5WIRE,F,QC,STR
13	3	304431	CABLE,SENSOR,M12,5WIRE,F,QC,90
14	2	612061	SENSOR, KEYENCE LASER DISTANCE, 2M
15	2	612062	COVER, KEYENCE LASER PROTECTION, 2M
16	2	612063	MOUNT, KEYENCE ADJUSTABLE, 2M
17	2	612064	ARM, KEYENCE ADJUSTABLE, 12mm X 85mm
18	3	612129	CABLE M12 90DEG 10M
19	2	612282	VPL MOTOR, 480V, SIZE2, M WINDING
20	4	612285	VEE TRACK SERIES 3 @43" W/15 HOLES
21	1	612321	KINETIX SINGLE CABLE, 14AWG 6METER
22	1	612322	KINETIX SINGLE CABLE, 14AWG 3METER
23	2	612346	MOUNTING BRACKET EZ CHAIN
24	60"	612347	ENERGY CHAIN SERIES 14 60IN.
25	1	612350	TEE, ALUMINUM ACCESS 1 1/4
26	3	612351	ELBOW, PULL 90 DEG 1 1/4
27	2	612352	HUB, ENCLOSURE FITTING 1 1/4
28	1	612355	NIPPLE, ALUM. 6 1/2 L
29	2	612356	NIPPLE, ALUM. 8.0 L
30	1	612357	FITTING, STR. CORD GRIP 1 1/4
31	1	612358	LIGHT CURTAIN 96IN
32	1	612360	NIPPLE, ALUM. 5.0 L
33	1	612361	LIGHT CURTAIN 36IN
34	4	612362	LIGHT CURTAIN, 5M MAIN CONNECTOR
35	16	612363	MOUNTING BRACKET LIGHT CURTAIN
36	2	612364	LIGHT CURTAIN 24IN
37	4	612365	LIGHT CURTAIN, 3M SERIES CONNECTOR
38	2	612366	GEARBOX, 10:1 STOBER
39	2	716716	BELT, URETH 5MM HTD X 25MM X 246"L
40	1	717410	A/W, MAIN OUTER FRAME
41	1	717412	A/W, TRAY SUPPORT
42	2	717413	PLATE, MAIN VERT. X-AXIS
43	4	717414	BAR, VEE TRACK MNT. X-AXIS
44	18	717415	BAR, BRACE MAIN CARRIAGE
45	2	717416	PLATE, MOTOR MNT. LRG. PULL.
46	2	717417	BUSHING REWORK 16MM 305633
47	4	717419	BAR, MAIN UPRIGHT CORNERS
48	1	717420	BAR, IDLER MNT.
49	2	717421	BLOCK, MOTOR BRACE
50	2	717422	STANDOFF, BELT IDLER MED.
51	4	717423	STANDOFF, BELT REMOTE IDLER SHORT
52	2	717424	BLOCK, IDLER BAR MNT.
53	1	717425	REWORK, CONDUIT 1 1/4 x 77L
54	1	717426	GUARD, MAIN FRAME NON-OP.
55	1	717427	GUARD, NON-OP. PANEL
56	1	717428	GUARD, MAIN FRAME OPER., A
57	1	717431	GUARD, LIGHT LH
58	1	717432	GUARD, LIGHT RT
59	2	717614	REWORK,PULLEY, 5MM HTD 64T 25MM w
60	3	718032	A/W, CATCH TRAY HX1000
61	1	718050	GUARD, REAR ENCLOSURE GAP HX
62	1	718051	GUARD, FRONT LOWER HX
63	2	718052	GUARD, INFEED LOWER HX
64	2	718053	GUARD, INFEED LOWER HX 2
65	4	718056	BLOCK, STOP X-AXIS
66	4	A05471	BEARING, 3/4 ID SST
67	1	A08049	NAMEPLATE,BURFORD LOGO,LARGE
68	REF.	HX-CS-1-12-281-000	ASSY., MANIFOLD 12GUN @2.81 CEN

Outer Frame Assembly

211390 Rev F





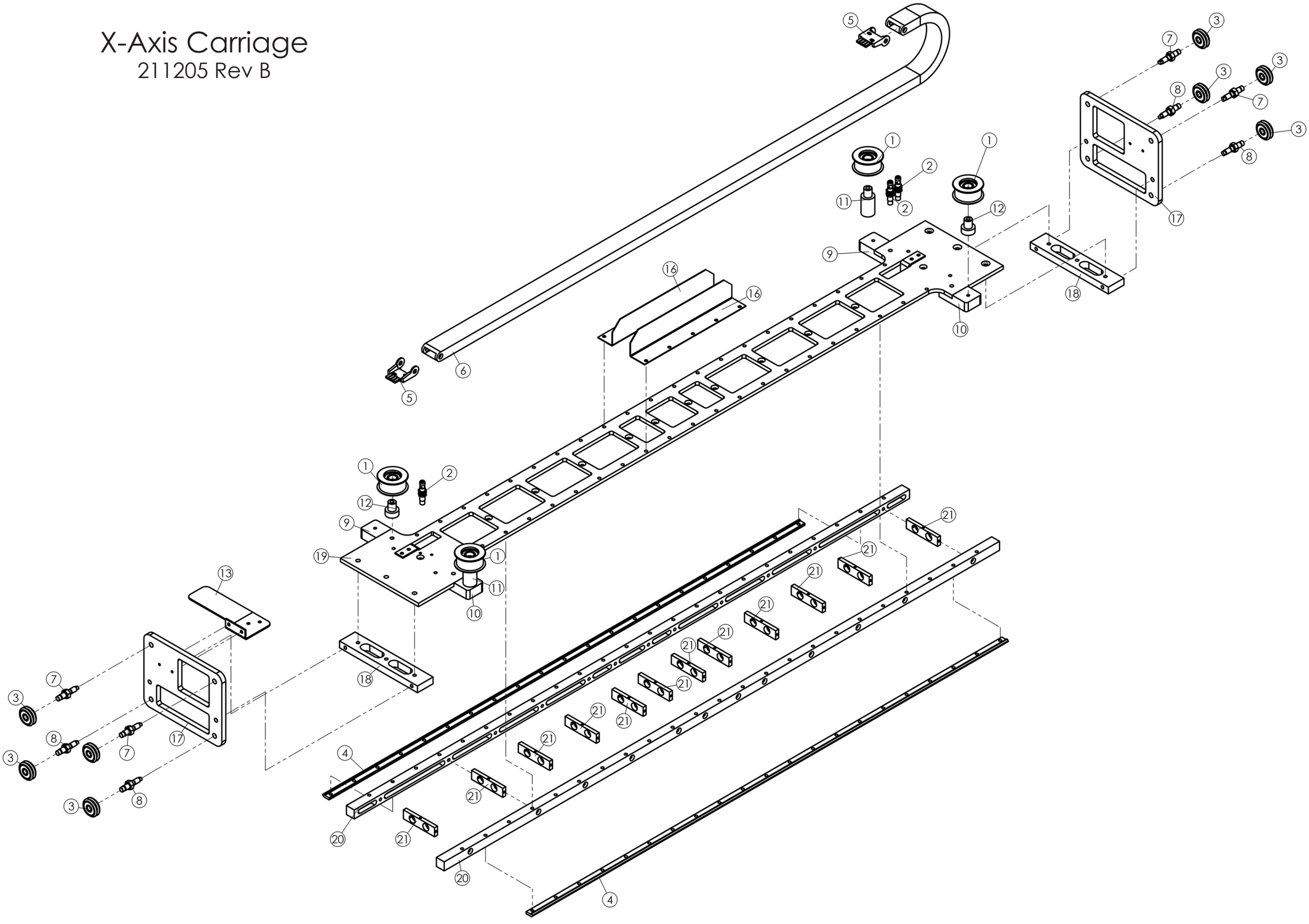
FOLD OUT TO VIEW DRAWING

X-Axis Carriage
211205 Rev B

ITEM #	QTY.	PART #	DESCRIPTION
1	4	211399	ASSY., IDLER HXR1000
2	3	304269-001	SENSOR,PROX,12MM,10-30V,PNP,NC
3	8	612125	VEE WHEEL SERIES 3 WASHDOWN
4	2	612286	VEE TRACK SERIES 3 @61" W/21 HOLES
5	2	612346	MOUNTING BRACKET EZ CHAIN
6	60"	612347	ENERGY CHAIN SERIES 14 60IN.
7	4	612369	STUD, CONCENTRIC VEE WHEEL
8	4	612371	STUD, ECCENTRIC VEE WHEEL
9	2	717433	BLOCK, IDLER MNT. 1
10	2	717434	BLOCK, IDLER MNT. 2
11	2	717435	STANDOFF, BELT IDLER LONG
12	2	717436	STANDOFF, BELT IDLER SHORT
13	1	717438	A/W, CABLE MGR. Y-AXIS
14	1	717439	BRACKET, SENSOR HOME
15	1	717440	BRACKET, SENSOR OT
16	2	717631	BRACKET, CABLE MGR. BRACE
17	2	717640	PLATE, X-AXIS VEE ROLLER MNT.
18	2	717647	BLOCK, X-AXIS PLATE MNT.
19	1	717648	PLATE, MAIN Y-AXIS
20	2	717649	BAR, VEE TRACK MNT. Y-AXIS
21	12	717659	BAR, BRACE MAIN Y-AXIS CARRIAGE

X-Axis Carriage

211205 Rev B



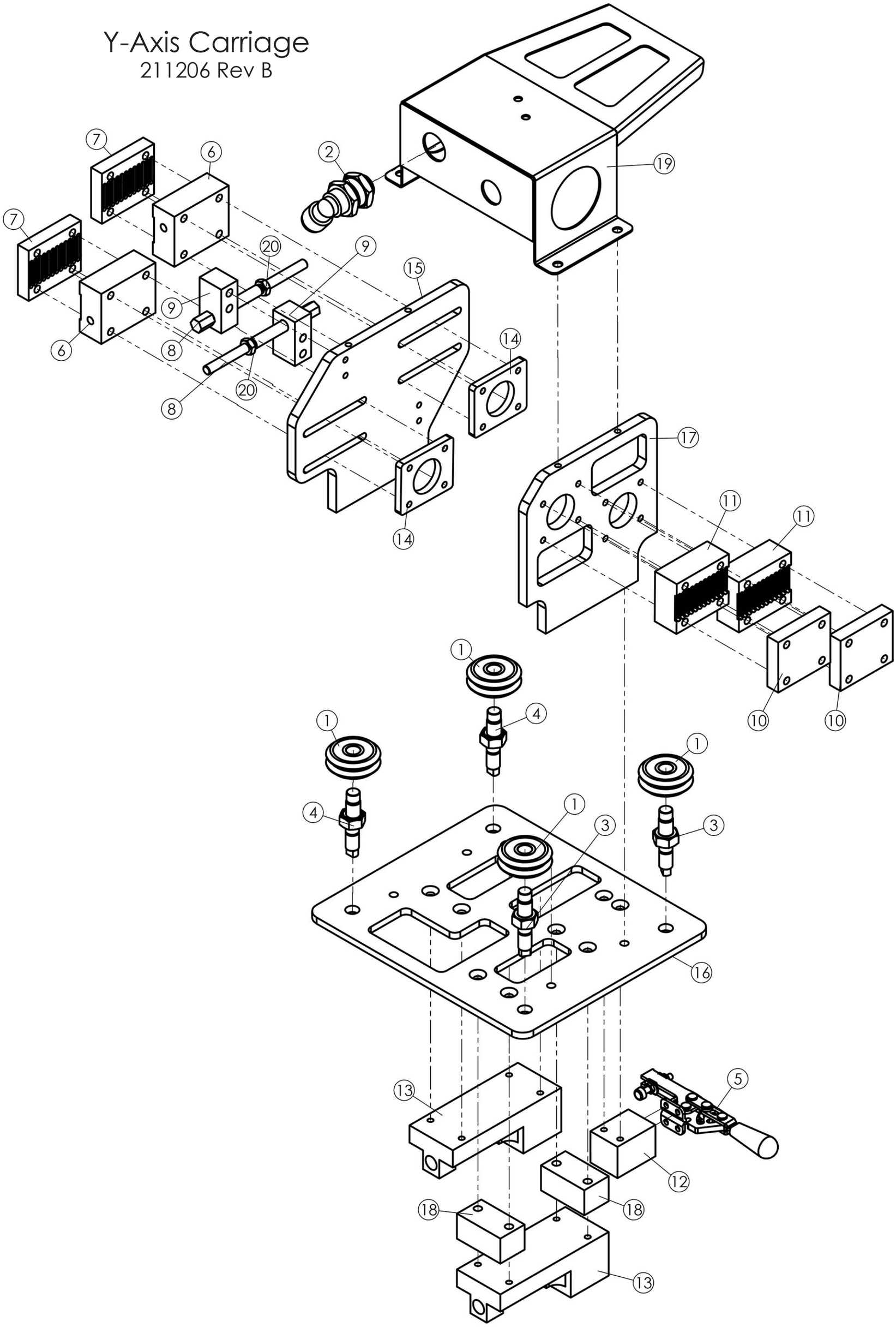
FOLD OUT TO VIEW DRAWING

Y-Axis Carriage
211206 Rev B

ITEM #	QTY.	PART #	DESCRIPTION
1	4	612125	VEE WHEEL SERIES 3 WASHDOWN
2	1	612368	FITTING, ELL BULK. 1/2 OD X 1/2 OD
3	2	612369	STUD, CONCENTRIC VEE WHEEL
4	2	612371	STUD, ECCENTRIC VEE WHEEL
5	1	612373	CLAMP TOGGLE
6	2	717442	BLOCK, BELT CLAMP TENSION ANCHOR
7	2	717443	BLOCK, BELT CLAMP
8	2	717444	BOLT, BELT CLAMP TENSION
9	2	717445	BLOCK, BELT TENSION
10	2	717447	BLOCK, BELT CLAMP
11	2	717448	BLOCK, BELT CLAMP ANCHOR
12	1	717456	BLOCK, CARRIAGE MNT.
13	2	717457	BLOCK, MANIFOLD ALIGNMENT
14	2	717678	BLOCK, BELT CLAMP THREADED
15	1	717679	PLATE, BELT TENSION MNT.
16	1	717685	PLATE, MAIN CARRIAGE Y-AXIS
17	1	717874	PLATE, BELT ANCHOR MNT.
18	2	717993	BLOCK, MANIFOLD ALIGH. SPACER
19	1	717996	A/W, CABLE MGR. MNT.
20	2	955406	NUT HEX JAM 5/16-24 UNF SST

Y-Axis Carriage

211206 Rev B



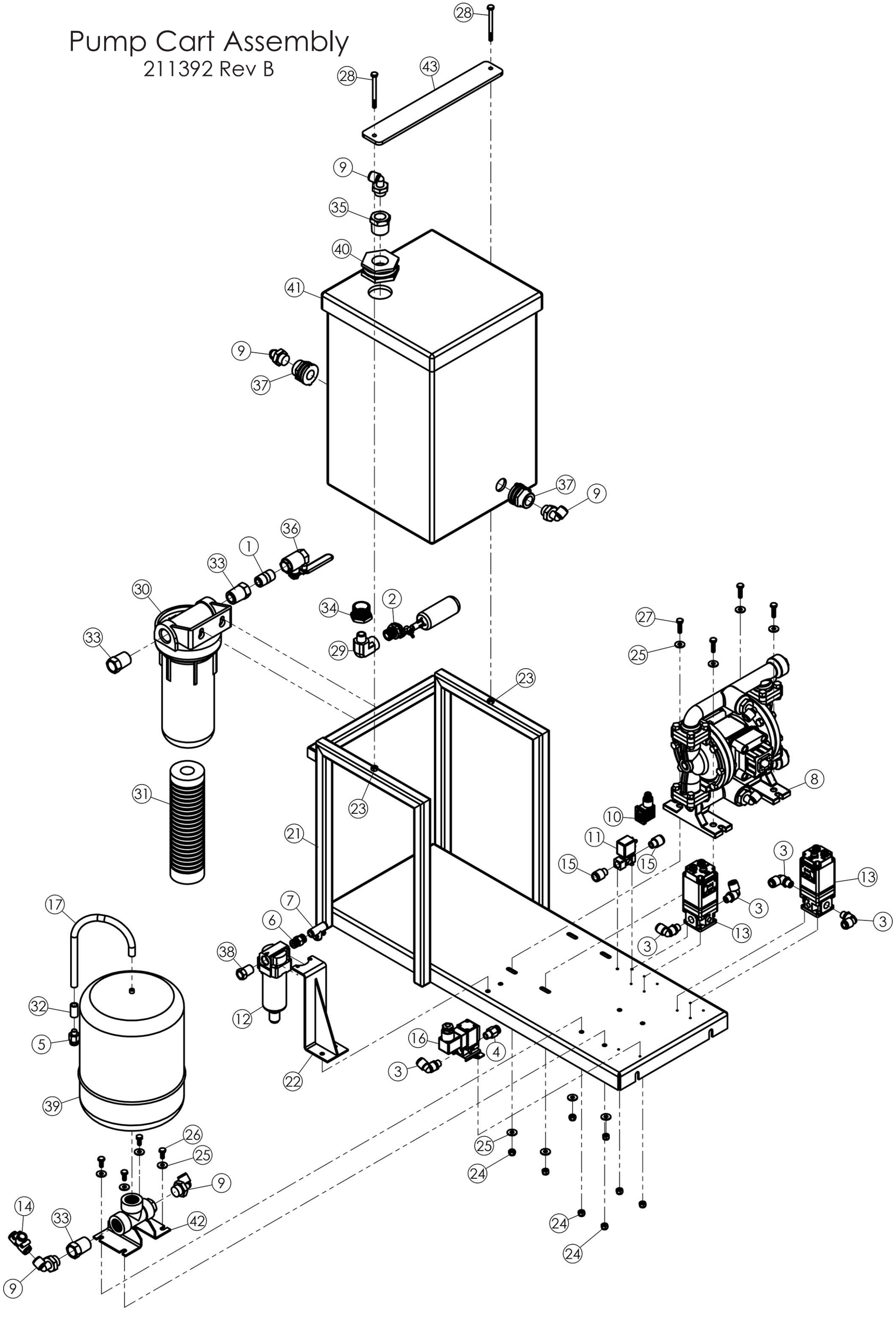
FOLD OUT TO VIEW DRAWING

Pump Cart Assembly
211392 Rev B

ITEM #	QTY.	PART#	DESCRIPTION
1	1	110426	FITTING,NIPPLE,CLOSE,1/2 NPTM,BRS
2	1	305716	FLOAT VALVE MINI ADJ 1/2"
3	5	610505	FITTING,ELL,1/4NPT X 3/8T, ENP, Q.R
4	1	610507	FITTING,CONN,1/4NPT X 3/8T,ENP,Q.R.
5	1	610508	FITTING CONN 1/8 NPT X 3/8 T ENP QR
6	1	610827	FITTING,CONN,3/8NPT X 3/8T,ENP,Q.R.
7	1	610828	FITTING,UNION TEE,3/8 TUBE,PUSH ON
8	1	611121	PUMP, AIR POWERED DBL DIAPHRAGM
9	7	611343	FITTING,ELL,1/2NPT X 1/2,ENP,Q.R.
10	1	611943	CONNECTOR, 24V VALVE DINCON M12
11	1	611944	VALVE, SOL SS 1/4 NPT 2 WAY 6.9VDC
12	1	612374	FILTER, 3/8NPT AUTO-DRAIN
13	2	612375	REGULATOR, PNEUMATIC ETHERNET
14	1	612376	FITTING, TEE 1/2 TUBE QR
15	2	612377	FITTING, 1/4MNPT X 1/2 TUBE QR
16	1	612378	VALVE, 2 PORT 24VDC SINGLE
17	1	612400	16" SST HOSE TIRE PRESS STRAIGHT
18	1	612525	CABLE,ITV POWER, 90 DEG. 3M
19	1	612526	CABLE, ITV ETHERNET, RJ45 TO M12
20	1	612527	CABLE, ITV ETHERNET, M12 TO M12
21	1	717459	A/W, HXR1000 PUMP TANK
22	1	717460	A/W, FILTER BRACKET
23	2	955409	NUT HEX JAM 1/4-20 UNC SST
24	8	955661	NUT HEX NYLOC 1/4-20 UNC SST
25	12	955977	WASHER FLAT 1/4" SST
26	4	989910	SCREW FIN HEX 1/4-20 X 5/8" SST
27	4	989916	SCREW FIN HEX 1/4-20 X 1 SST
28	2	989948	SCREW FIN HEX 1/4-20 X 3 SST
29	1	A06856	FITTING, REDUCING ELL 1/2F X 3/8M SS
30	1	C00578	FILTER, WATER, 3/4" NPTF
31	1	C00579	FILTER REPLACEMENT # AP110
32	1	C00914	FITTING,COUPLING,1/8 NPTF,SST
33	4	C01947	FITTING, BUSHING, 3/4 X 1/2 BRASS
34	1	C01958	FITTING,REDUCER,1" MPT X 3/8FPT,SST
35	1	C05339	FITTING, REDUCER, 1" x 1/2" PVC
36	1	C05431	VALVE, 1/2 NPT 2-WAY, BALL, SST
37	2	C05576	FITTING, 1/2 NPT BULKHEAD, PL.
38	1	C05591	FITTING, REDUCER, 3/8 X 1/4, SST
39	1	C06171	TANK, WATER RECHARGER
40	1	C06174	FITTING, BULKHEAD 1" POLY
41	1	C06176	RWK, TANK & COVER
42	1	C06183	TEE MOUNT A/W
43	1	C06195	PLATE, COVER CLAMP

Pump Cart Assembly

211392 Rev B



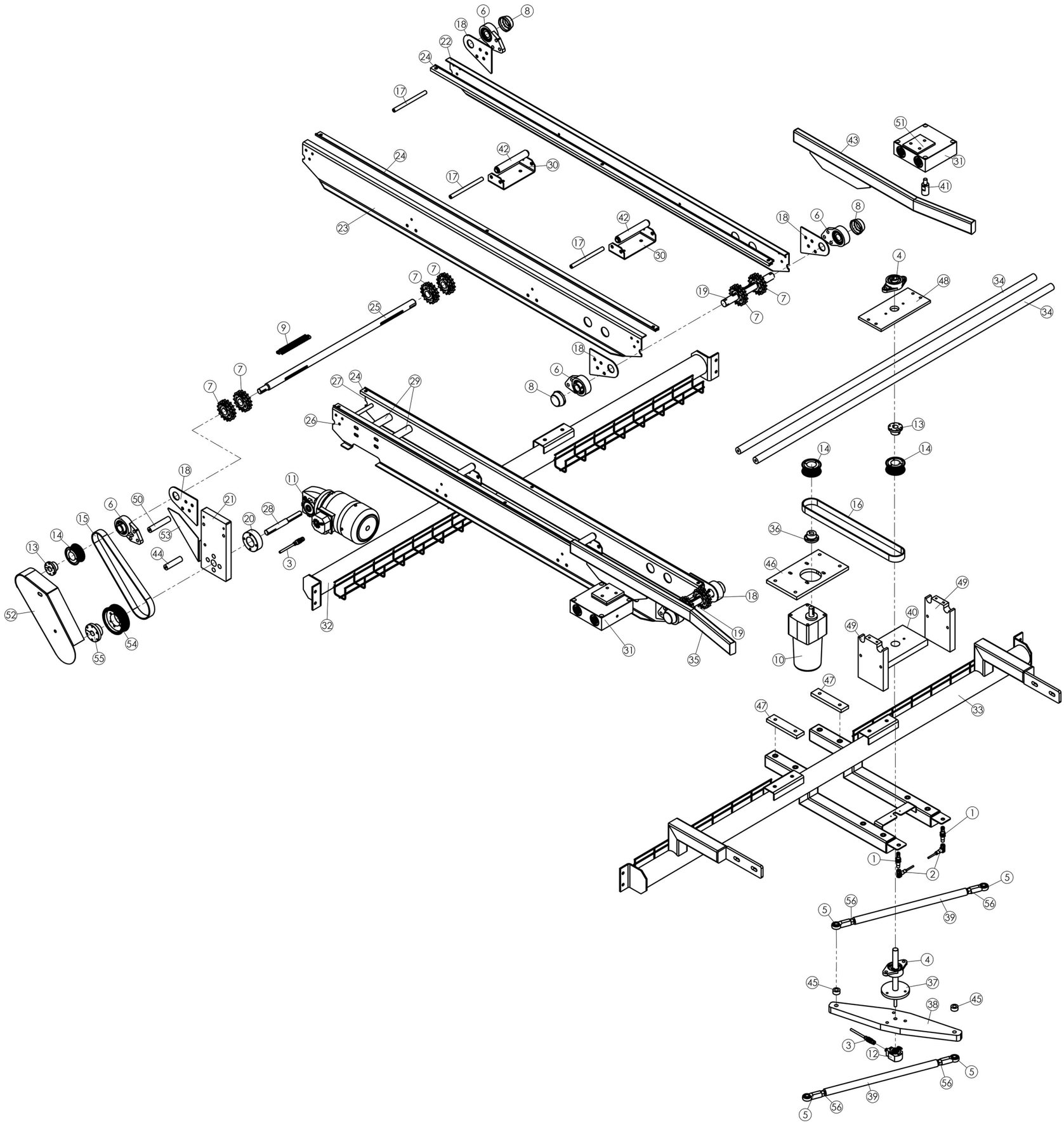
FOLD OUT TO VIEW DRAWING

Conveyor Assembly
211394 Rev D

ITEM #	QTY	PART#	DESCRIPTION
1	2	304269-001	SENSOR,PROX,12MM,10-30V,PNP,NC
2	2	304431	CABLE,SENSOR,M12,5WIRE,F,QC,90
3	2	610024-001	ENCODER,CABLE,8WIRE,F,QC,STR,6M
4	2	611387	BEARING, 3/4", 2 BOLT FLANGE, SST
5	4	611389	BEARING,ROD END,1/2" ID,1/2-20,SST
6	6	611635	BEARING, 1" BORE 3 HOLE FLANGE
7	8	611723	SPROCKET, 16T, 3.11" OD EZ CLEAN
8	5	611868	END CAP, BEARING (611635)
9	26 FT	611938	BELT,6"WIDEX.5P FLUSH GRID FRICT
10	1	612283	GEARMTR, 90W WD 220V, 3PH 100:1
11	1	612284	GEARMTR, 1/3HP, 220/460-60-3,25:1
12	1	612326	ENCODER, 260, 1024, LINE DRIVER
13	2	612380	RWRK, BUSHING, QD JA .75 BORE
14	3	718044	PULLEY, 5MM HTD 40T 25MM w RWK
15	1	612382	BELT, 5MM HTD X 25MMw X 810 PL
16	1	612384	BELT, 5MM HTD X 25MMw X 1050PL
17	8	712782	SHAFT, SPACER, CHAIN GUIDE
18	6	714329-001	GUARD, INFEED DRIVE, BBU
19	2	714872	SHAFT, IDLER, M-QNB SPROCKET
20	1	716038	SPACER MOTOR REDUCER MOUNT
21	1	717462	PLATE, CONV. MTR. MNT. HX
22	1	717463	SIDEWALL, HX 1000 CONV. 2
23	1	717464	SIDEWALL, HX 1000 CONV. 1
24	4	717465	GUIDE, WEARSTRIP, 68"
25	1	717466	SHAFT, HXR CONV. DRIVE
26	1	717467	SIDEWALL, HX 1000 CONV. MTR
27	1	717468	SIDEWALL, HX 1000 CONV. MTR 2
28	1	717469	SHAFT, CONV. DRIVE

ITEM #	QTY	PART#	DESCRIPTION
29	2	717470	STANDOFF, MOTOR BRACE
30	4	717471	BRACKET, CONV. MNT 2
31	2	717472	REWORK, LINEAR BEARING BLOCK
32	1	717473	A/W, CONV. CROSSBRACE MNT.
33	1	717474	A/W, PAN GUIDE MNT.
34	2	717475	SHAFT, PAN GUIDE SLIDE
35	1	717476	A/W, PAN GUIDE, HX1000 1
36	1	717477	REWORK, BUSHING QD 18MM BORE
37	1	717478	A/W, PAN GUIDE MAIN SHAFT
38	1	717479	ARM, PAN GUIDE MAIN
39	2	717480	SHAFT, PAN GUIDE ADJUSTMENT
40	1	717481	BAR, PAN GUIDE MNT.
41	2	717482	SHAFT, LINEAR BEARING MNT.
42	4	717483	ROLLER, CONV. RETURN
43	1	717484	A/W, PAN GUIDE, HX1000 2
44	1	717485	STANDOFF, CONV. BELT GUARD
45	2	717486	SPACER, 1 OD x .515 ID x .5 L
46	1	717487	PLATE, MOTOR MNT. PAN GU.
47	2	717488	BAR, MTR. PLATE SPACER
48	1	717489	PLATE, UPPER BEAR. MNT.
49	2	717490	BLOCK, SLIDE BRACE
50	1	717491	STANDOFF, CONV. BELT GUARD
51	2	717492	PLATE, PAN GUIDE MNT. SPACER
52	1	717493	A/W, CONV. DRIVE GUARD
53	1	717494	GUARD, CONV. DRIVE BOTTOM
54	1	717614	RWRK,PULLEY, 5MM HTD 64T 25MM w
55	1	717616	REWORK, BUSHING, QD .75 BORE
56	4	955370	NUT HEX FIN 1/2-20 SST

Conveyor Assembly
211394 Rev D



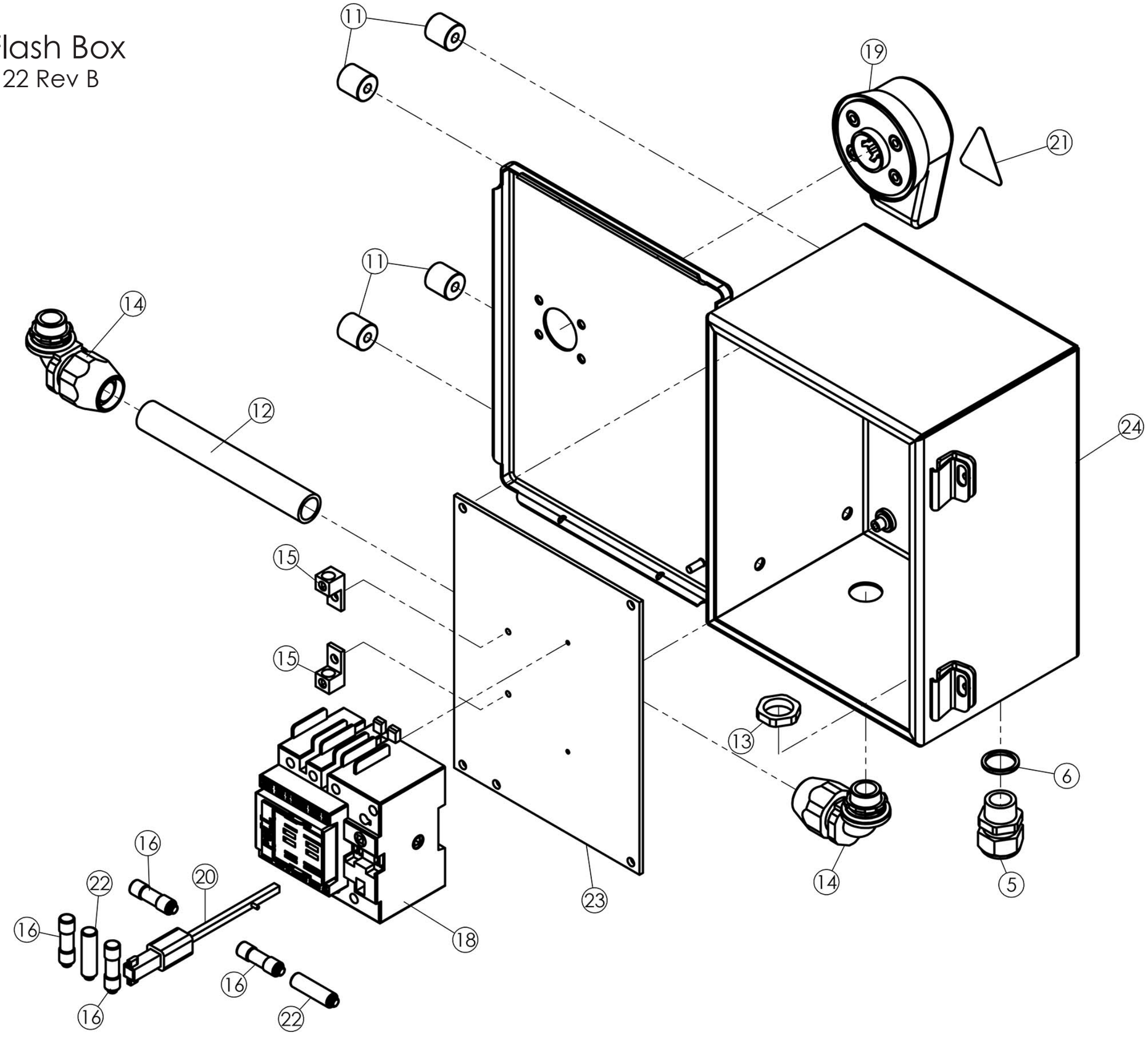
FOLD OUT TO VIEW DRAWING

Arc Flash Box
210122 Rev B

ITEM #	QTY.	PART#	DESCRIPTION
1*	4'	610114-01	WIRE 14AWG WHITE
2*	4'	610114-02	WIRE 14AWG BLACK
3*	4'	610114-03	WIRE 14AWG RED
4*	4'	610114-28	WIRE 14AWG GRN/YEL
5	1	610954	CONNECTOR, CORD, .39-.56, DOME, NYLON
6	1	610955	CONNECTOR,SEAL RING,1/2NPT,POLYETH
7*	8	612000-101	WIRE CONDUCTOR MARKER (1)
8*	2	612000-102	WIRE CONDUCTOR MARKER (2)
9*	2	612000-103	WIRE CONDUCTOR MARKER (3)
10*	6	612000-10L	WIRE CONDUCTOR MARKER (L)
11	4	715521	SPACER, 5/16-18 ID, .75 OD .75 L, SST
12	1'	C00171	CONDUIT, 1/2" NON-METTALIC
13	1	C00174	LOCKING NUT, 1/2 NPT, NYLON
14	2	C00178	CONNECTOR,CONDUIT,1/2"-90 NYLON
15	2	C06488	LUG, GROUNDING, ENCLOSURE
16	4	C07062	FUSE,LPCC,20A,600V,13/32 X 1-1/2
17*	8	C07168	FERRULE,BLUE,14 AWG
18	1	C07631	SWITCH,DISC,CIRCUIT BREAKER,FUSIBLE
19	1	C07632	SWITCH,DISC,CIRCUIT BREAKER,HANDLE
20	1	C07633	SWITCH,DISC,CIRCUIT BREAKER,SHAFT
21	1	C07695	DECAL, LIGHTNING BOLT
22	2	C07707	FUSE,NEUTRAL,0A,0V 13/32X1-1/2
23	1	C07741	PANEL,ELEC,REWORK,MIST COLLECTOR
24	1	C07750	ENCLOSURE,REWORK,ARC-FLASH

Arc Flash Box

210122 Rev B



FOLD OUT TO VIEW DRAWING

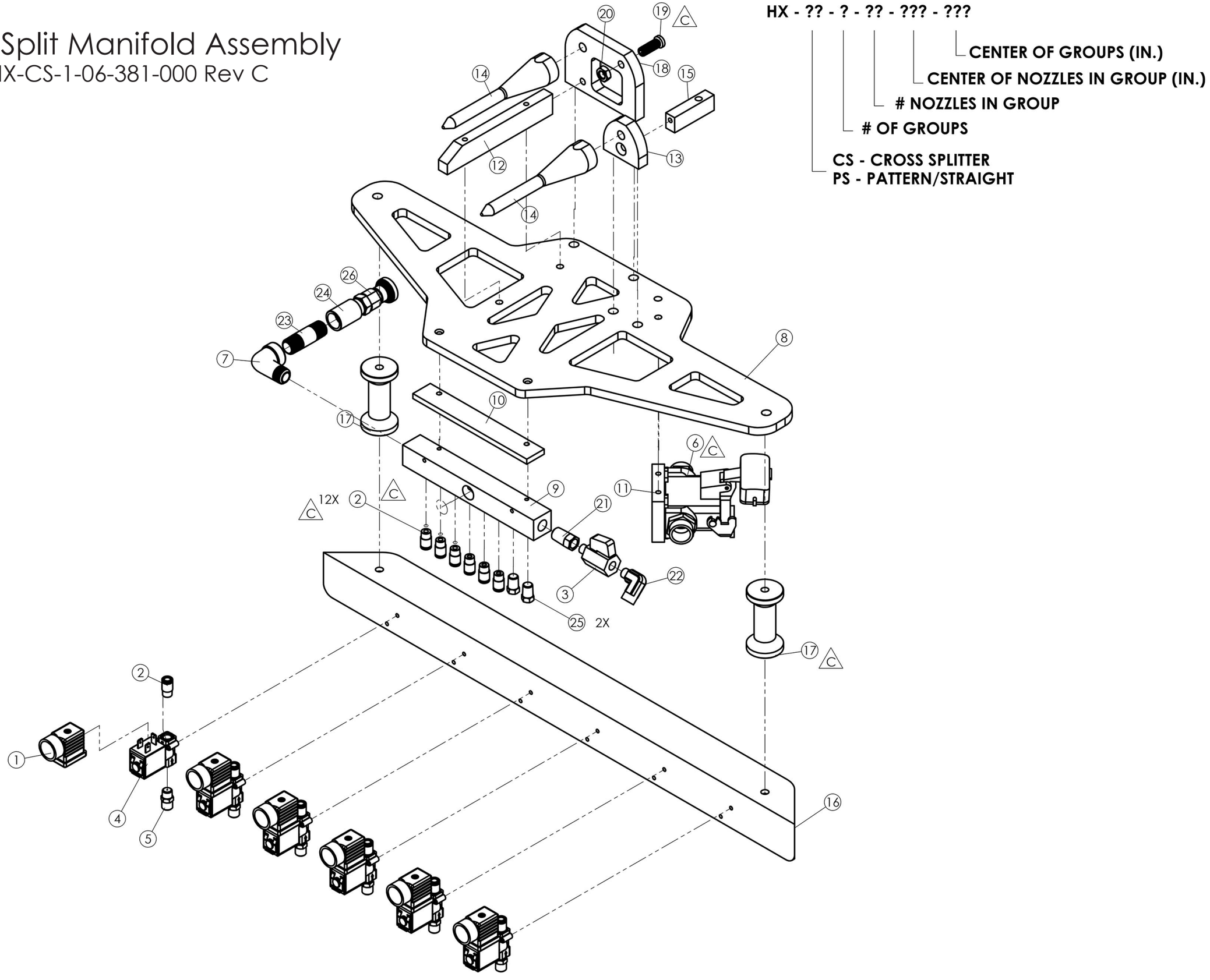
Cross Split Manifold Assembly

HX-CS-1-06-381-000 Rev C

ITEM #	QTY.	PART #	DESCRIPTION
1	6	610189-003	CONNECTOR, 24V DINCON 1/2NPT
2	12	610966	FITTING,CONN,1/8NPT x 1/4T, Q.R.,HEX
3	1	611545	VALVE, 1/8 NPT, M-F
4	6	612008	VALVE,SOL SS 1/8NPT 2 WAY 24VDC
5	6	612018	TIP, SPLIT, BETE, .020", 1/8" NPT
6	1	612212	BASE, SURFACE MOUNT EPIC HA10
7	1	612385	FITTING, ELL SST 3/8FNPT X 3/8MNPT
8	1	717498	PLATE, DOMM MAIN
9	1	717499-008	BLOCK, MANIFOLD, 8 PORT
10	1	717501	PLATE SPACER
11	1	717502	PLATE, CONNECTOR MNT.
12	1	717504	PLATE, DOMM GUSSET
13	1	717505	BLOCK. DOMM PIN MNT. 2
14	2	717506	PIN, MANIFOLD ALIGNMENT
15	1	717507	BLOCK, DOMM GUSSET
16	1	717560-1-06-381	ANGLE, GUN MNT. 6P @3.81 CEN
17	2	718018	SPACER, MANIFOLD MNT.
18	1	718019	BLOCK, DOMM PIN MNT.
19	1	718048	PIN MANIFOLD HX1000
20	1	955405	NUT HEX JAM 3/8-16 UNC SST
21	1	A05470	FITTING,REDUCER,1/4MPT X 1/8FPT,SST
22	1	A06942	FITTING,STREET ELL,1/8M X 1/8F,SST
23	1	C00909	FITTING,NIPPLE,3/8 NPTM X 2,SST
24	1	C00915	FITTING 3/8" SS COUPLING
25	2	C00916	FITTING,PLUG,1/8 NPTM,SST
26	1	C06213	DISCONNECT BODY, 3/8 NPT X 3/8

Cross Split Manifold Assembly

HX-CS-1-06-381-000 Rev C



HX - ?? - ? - ?? - ??? - ???

- CENTER OF GROUPS (IN.)
- CENTER OF NOZZLES IN GROUP (IN.)
- # NOZZLES IN GROUP
- # OF GROUPS
- CS - CROSS SPLITTER
  PS - PATTERN/STRAIGHT

FOLD OUT TO VIEW DRAWING

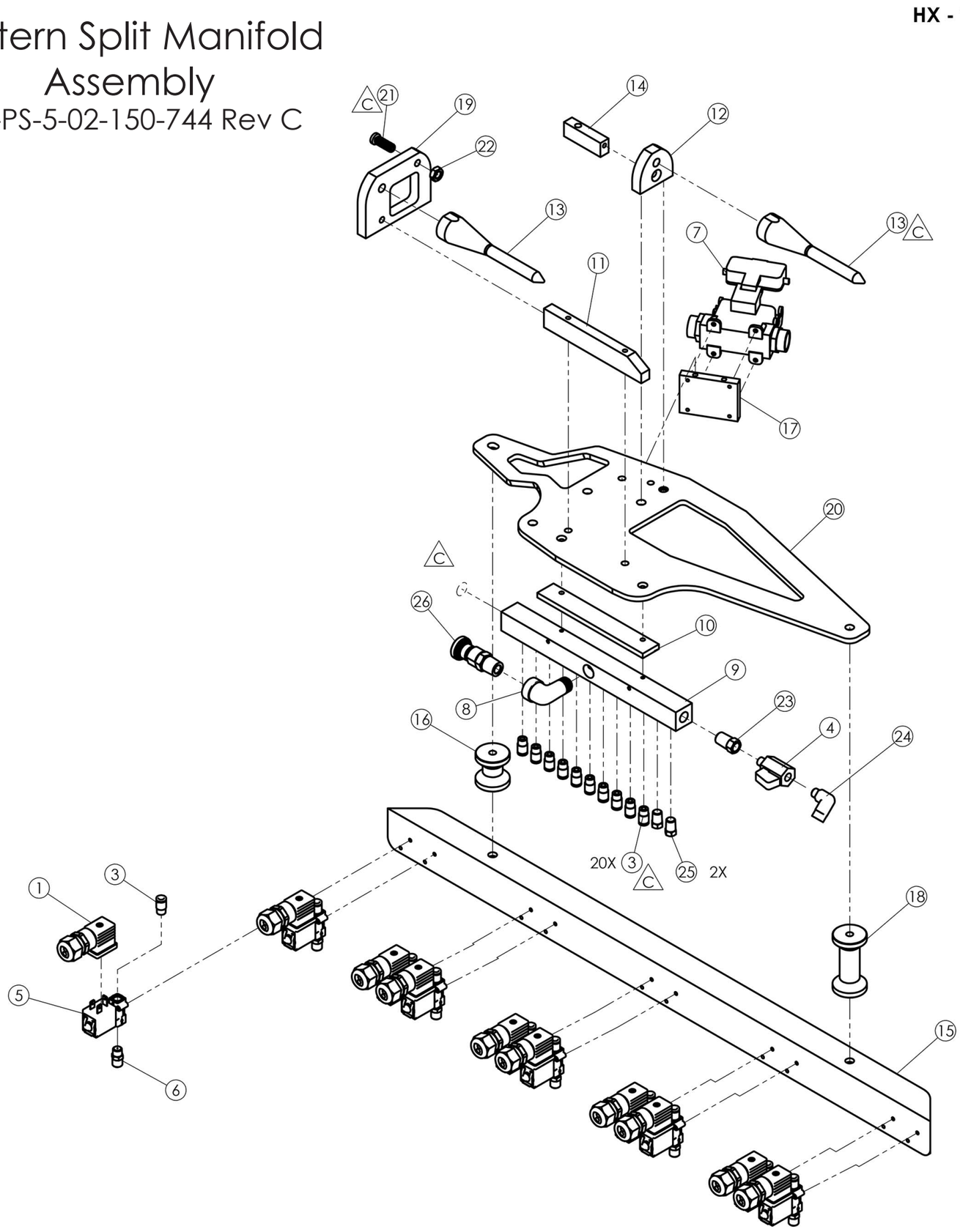
Pattern Split Manifold Assembly

HX-PS-5-02-150-744 Rev C

ITEM #	QTY.	PART #	DESCRIPTION
1	10	610189-003	CONNECTOR, 24V DINCON 1/2NPT
2	10	610950	CONNECTOR,SEAL INSERT,.200 2HOLES
3	20	610966	FITTING,CONN,1/8NPT x 1/4T, Q.R.,HEX
4	1	611545	VALVE, 1/8 NPT, M-F
5	10	612008	VALVE,SOL SS 1/8NPT 2 WAY 24VDC
6	10	612018	TIP, SPLIT, BETE, .020", 1/8" NPT
7	1	612212	BASE, SURFACE MOUNT EPIC HA10
8	1	612385	FITTING, ELL SST 3/8FNPT X 3/8MNPT
9	1	717499-012	BLOCK, STRAIGHT SPLIT MANIFOLD 12P
10	1	717501	PLATE SPACER
11	1	717504	PLATE, DOMM GUSSET
12	1	717505	BLOCK. DOMM PIN MNT. 2
13	2	717506	PIN, MANIFOLD ALIGNMENT
14	1	717507	BLOCK, DOMM GUSSET
15	1	717689-5-02-150-744	ANGLE, VALVE MOUNT
16	1	718013	SPACER, MANIFOLD PATTERN SPLIT
17	1	718014	PLATE, CONNECTOR MNT.
18	1	718018	SPACER, MANIFOLD MNT.
19	1	718019	BLOCK, DOMM PIN MNT.
20	1	718021	PLATE, MAIN PATTERN SPLIT
21	1	718048	PIN MANIFOLD HX1000
22	1	955405	NUT HEX JAM 3/8-16 UNC SST
23	1	A05470	FITTING,REDUCER,1/4MPT X 1/8FPT,SST
24	1	A06942	FITTING,STREET ELL,1/8M X 1/8F,SST
25	2	C00916	FITTING,PLUG,1/8 NPTM,SST
26	1	C06213	DISCONNECT BODY, 3/8 NPT X 3/8

Pattern Split Manifold Assembly

HX-PS-5-02-150-744 Rev C



HX - ??- ? - ?? - ??? - ???

- CENTER OF GROUPS (IN.)
- CENTER OF NOZZLES IN GROUP (IN.)
- # NOZZLES IN GROUP
- # OF GROUPS
- CS - CROSS SPLITTER
- PS - PATTERN/STRAIGHT

Electrical Schematics

FOLD OUT TO VIEW DRAWING

Electrical BOM
114698-WD

Electrical BOM
114698-WD

211392 – PUMP CAART

CBL13	3M	612525	CABLE, ITV POWER, 90 DEG.
CBL12	1	612526	CABLE, ITV ETHERNET, RJ45 TO M12
SOL14	1	612378	VALVE, 2 PORT 24VDC SINGLE
SOL13	1	611944	VALVE, SOL SS 1/4 NPT 2 WAY 24VDC
CBL10	1	612527	CABLE, ITV ETHERNET, M12 TO M12
PR1,PR2	2	612375	REGULATOR, PNEUMATIC ETHERNET
SYMBOL	QTY	PART #	DESCRIPTION

211394 – PAN CONVEYOR

MTR3–ENC01	1	612284	GEARMOTOR, 1/3HP, 220/460–60–3,25:1
MTR4	1	612283	GEARMOTOR, 90W WD 220V, 3PH 100:1
PRS8–9	2	304269–001	SENSOR,PROX,12MM,10–30V,PNP,NC TURCK
PRS8–9	2	304431	CABLE,SENSOR,M12,5WIRE,F,QC,90
ENC02	1	612326	ENCODER, 260, 1024, LINE DRIVER
ENC01,2 P/O	2	610024–001	SENSOR,CABLE,M12,8WIRE,F,QC,STR
SYMBOL	QTY	PART #	DESCRIPTION

211390 – ASSY,UPPER FRAME,CIRCUIT

CBL8	1	612322	KINETIX SINGLE CABLE, 14AWG 3M
CBL9	1	612321	KINETIX SINGLE CABLE, 14AWG 6M
LTC1,2	2	612364	LIGHT CURTAIN 24IN
LTC3	1	612361	LIGHT CURTAIN 36IN
LTC4	1	612358	LIGHT CURTAIN 96IN
CBL11	1	211403	ASSY, CABLE, HX1000
LTC1,2,3,4	4	612365	LIGHT CURTAIN, 3M SERIES CONNECTOR
LTC1,2,3,4	4	612362	LIGHT CURTAIN, 5M MAIN CONNECTOR
MTR1,2	2	612282	VPL MOTOR, 480V, SIZE2, M WIN
PRS2–7	6	304269–001	SENSOR,PROX,12MM,10–30V,PNP,NC TURCK
PRS2–4	3	304431	CABLE,SENSOR,M12,5WIRE,F,QC,90
PSC1,2	2	304430	SENSOR,CABLE,M12,5WIRE,F,QC,STR
PSC1,2	2	612061	SENSOR,LASER,24VDC
PSC1,2 P/O	2	612062	SENSOR,LASER,FACE COVER
PSC1,2 P/O	2	612063	SENSOR,LASER,MOUNT
PSC1,2 P/O	2	612064	SENSOR,LASER,MOUNT ARM
PRS 5–7	3	612129	CABLE M12 90DEG 10M
SYMBOL	QTY	PART #	DESCRIPTION

ASSY,MAN. STRAIGHT SPLIT (12 GUNS)

PL1 P/O	1	612386	BASE, SURFACE MOUNT EPIC HA10
PL1 P/O	1	612402	CONNECTOR, INSERT, 14PIN MALE
SOL1–12	12	612088	VALVE,SOL,SS 1/8NPT,2WAY,24VDC,.3AMP
SOL1–12	12	610189–003	CONNECTOR,24VDCVALVE,DINCON,1/2NPT
SYMBOL	QTY	PART #	DESCRIPTION

211396 – ASSY,ENCLOSURE,DISPLAY

CBL2	1	304502–010	CABLE,YELLOW PATCH,10FT SHIELDED
DISP1	1	611131–001	PLC,DISPLAY,PANELVIEW+700,ETHERNET
ENCL2	1	717510	ENCLOSURE,REWORK,DISPLAY (A07383)
PB1	1	C07715	SWITCH,PUSH/PULL,RED,MUSHROOM
PB1	1	111659	SWTCH,EXTRA CONTACT
PB1	1	C05397	NAMEPLATE,PUSH–STOP/PULL–START
PB2	1	C07205	SWITCH,PUSHBUTTON,BLUE W/LIGHT
PB2	1	C07208	NAMEPLATE,RESET
PB3	1	C07714	SWITCH,PUSHBUTTON,GREEN W/LIGHT
PB3	1	108340	NAMEPLATE,START
SYMBOL	QTY	PART #	DESCRIPTION

210122 ARC–FLASH DISCONNECT ENCLOSURE ASSY

DISC1	1	C07631	DISCONNECT,CIRCUIT BREAKER,FUSIBLE
DISC1	1	C07632	DISCONNECT,CIRCUIT BREAKER,HANDLE
DISC1	1	C07633	DISCONNECT,CIRCUIT BREAKER,SHAFT
ENCL3	1	C07750	ENCLOSURE,REWORK,ARF–FLASH(301128)
FU1,2,3	3	C07063	FUSE,LPCC,25A,600V,13/32x1–1/2
GND	1	C06488	LUG,GROUNDING,ENCLOSURE
PNL3	1	C07741	PANEL,ELEC,REWORK,MIST (C06676)
SYMBOL	QTY	PART #	DESCRIPTION

211393 – ASSY,MAIN ENCLOSURE

PRS1	1	304430	SENSOR,CABLE,M12,5WIRE,F,QC,STR
PRS1	1	304269–001	SENSOR,PROX,12MM,10–30V,PNP,NC TURCK
AC0	1	611662–001	PLUG,GFCI,120V,3A,ETHERNET
CBL1,5,6,7	4	304502	CABLE,YELLOW PATCH,2FT SHIELDED
CBL3	1	304502–003	CABLE,YELLOW PATCH,3FT SHIELDED
CBL4	1	304502–005	CABLE,YELLOW PATCH,5FT SHIELDED
CB1	1	C07650–315	CIRCUIT BREAKER,600V,15AMP
CB2,3	2	C07650–303	CIRCUIT BREAKER,600V,3AMP
CB4	1	C07650–305	CIRCUIT BREAKER,600V,5AMP
CB1–3 P/O	1	C07701–002	CIRCUIT BREAKER,BUS BAR,12POS.
CB5	1	C07649–010	CIRCUIT BREAKER,250V,10AMP
CB6	1	C07649–005	CIRCUIT BREAKER,250V,5AMP
CR1–8,11,12	14	610404	RELAY,TERM–MTG,24VDC,6AMP (WHITE)
CR9–10	2	DR06D06	RELAY,TERM–MTG,24VDC,6AMP,SSR (BK)
CR13	1	610421	RELAY,TERM–MTG,24VDC,2AMP (BLACK)
CR1–10 P/O	11	610387	RELAY,TERM–MTG,SEPARATION PLATE
DRV1,DRV2	1	612323	KINETIX 5500, EMC FILTER, 3 PH
DRV1,DRV2	2	612405	KINETIX 5500,DRIVER,12.5A,480–3 PH
DRV1,DRV2	2	612406	KINETIX 5500,INPUT CONNECTOR
DRV1,DRV2	2	612407	KINETIX 5500,AC BUS CONNECTOR
DRV1,DRV2	1	612408	KINETIX 5500,FIRST DRIVER KIT
DRV1,DRV2	1	612409	KINETIX 5500,DC BUS CONNECTOR
DRV1,DRV2	1	612410	KINETIX 5500,CONTROL CONNECTOR
DRV1,DRV2	2	612411	KINETIX 5500,DLC CONNECTOR
DRV3,DRV4	2	612170–004	DRIVER,PWR–FLX527,460–3,460–3
ENCL1	1	717561	A/W, ENCLOSURE HX1000 (304434)
ENCL1	1	611811	ENCLOSURE,LOCK,COVER,1/4 TURN
EXC1	1	612143	AIR CONDITIONER,48VDC,1000BTU
FB4,FB5,FB6	3	C07076–001	FUSE,HOLDER,AC,600V,13/32X1–1/2,IND
FU4,FU5,FU6	3	C07063	FUSE,LPCC,25A,600V,13/32x1–1/2
GND	1	C06488	GROUND LUG
HUB1	1	304500	HUB,ETHERNET MODULE,N–TRON(8PORT)
LT2/AH1	1	C01399	LIGHT TREE,24VDC,W/HORN TOP MTG
LT2/AH1	1	C01298–004	LIGHT TREE,24VDC,BLUE LIGHT
LT2/AH1	1	612073	LIGHT TREE,MOUNT POLE,60MM
PLC1	1	612057	PLC,COMPACTLOGIX,L27ERM
PLC1	1	610494	PLC,COMPACTLOGIX,END CAP
PNL1	1	717567	PANEL, REWORK, MAIN HXR1000
PSM1	1	610913	POWER SUPPLY,460–3PH,24VDC,10AMP
PSM2	1	612145	POWER SUPPLY,460–3PH,48VDC,5AMP
RES1	4	610094–5.1K	RESISTOR,1/4WATT,5.1Kohm
RES1	4	C07113	TERMINAL,DIODE,COMPONENT BASE
RES1	4	C07114	TERMINAL,DIODE,COMPONENT PLUG
RES1	1	C07115	TERMINAL,DIODE,END COVER
SR1	1	611423	RELAY,SAFETY MONITORING MODULE
SRX	1	612072	RELAY,SAFETY CONTACTER,24VDC
T1	1	C06604	TRANSFORMER,0.5VA,200/600–110VAC
T1 P/O	2	C07749	TRANSFORMER,FINGER SAFE COVER KIT
TB1	60	C05843	MARKER,STRIP,BLANK
TB1	50	C06461	TERMINAL,BLOCK
TB1	1	C06462	TERMINAL,END COVER
TB1	2	C06463	JUMPER,TERMINAL,10–POS
TB1–3	60"	C06464	RAIL,DIN,MOUNTING
TB1–3	8	C06465	ANCHOR,END CLAMP
TB1	10	C06525	TERMINAL,GROUNDING
TB1	23	C07117	TERMINAL,BLOCK,DUAL
TB1	5	C07118	TERMINAL,END COVER,DUAL
	1	611660	VOLTAGE,PRE–TEST POINTS KIT
	1	611661	VOLTAGE,VISION (R–3W) KIT
	5'	C07687	DUCT,WIRE,1" x 1" x 6'
	5'	C07689	DUCT,COVER,WIRE,1" x 6'
SYMBOL	QTY	PART #	DESCRIPTION

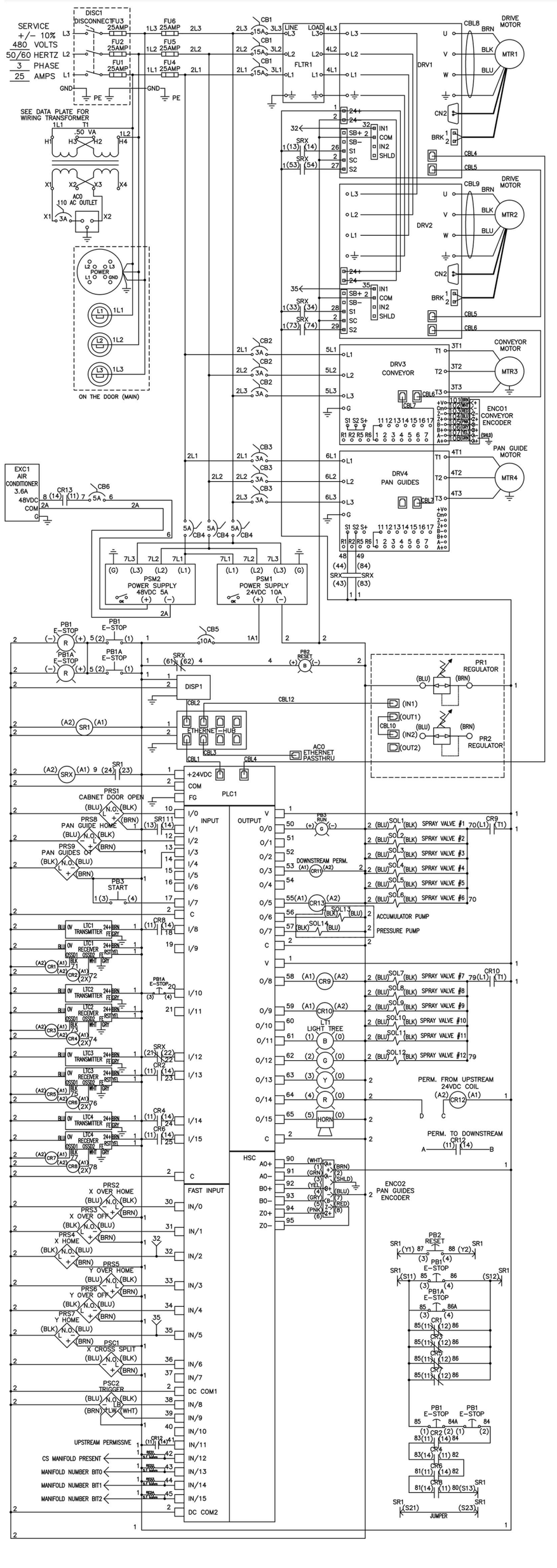
FOLD OUT TO VIEW DRAWING

Electrical Ladder

114698-WD

Electrical Ladder

114698-WD

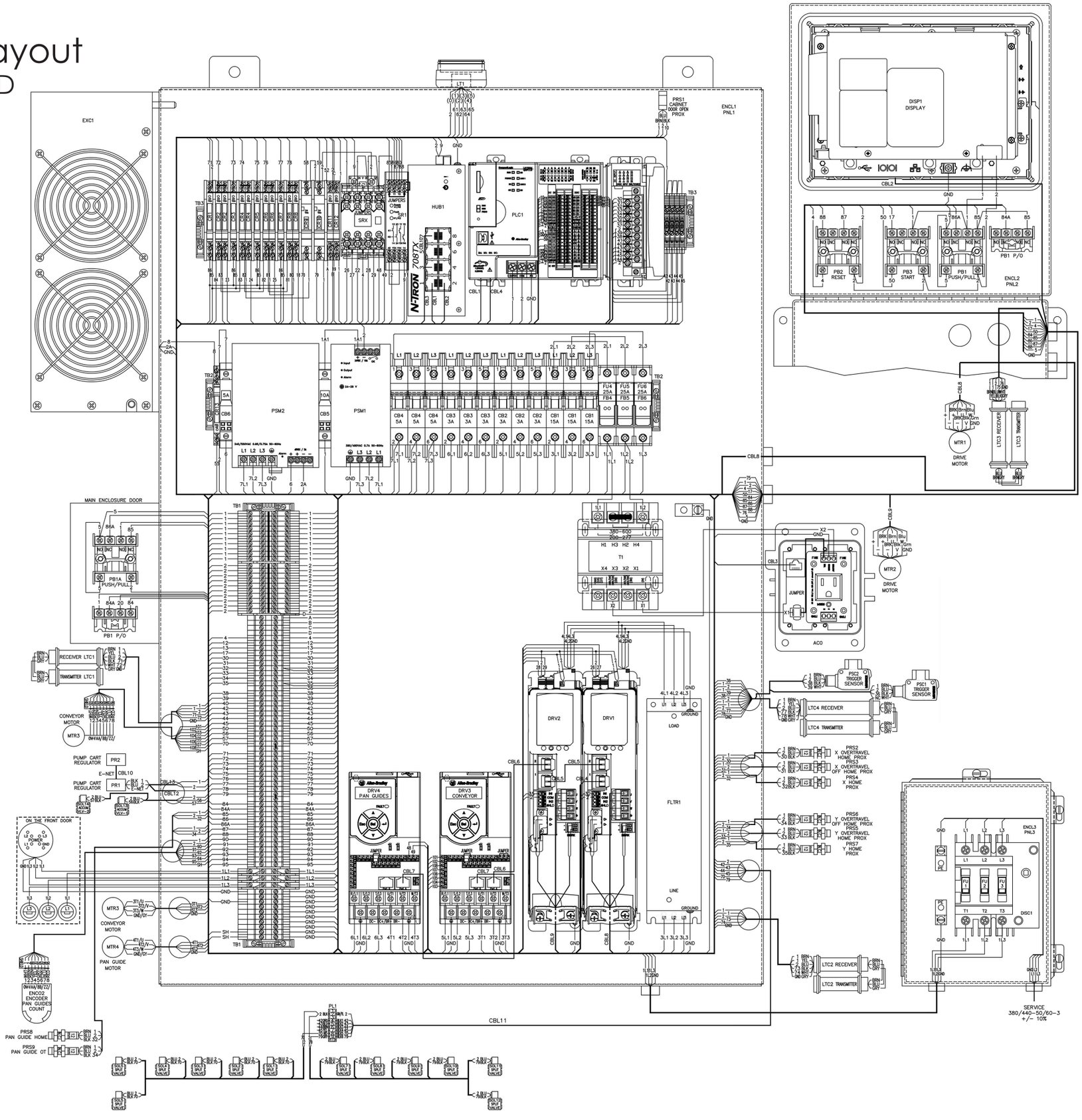


FOLD OUT TO VIEW DRAWING

Electrical Layout
114698-WD

Electrical Layout

114698-WD



FOLD OUT TO VIEW DRAWING