Description of Operations (DOO)

Amazon OXD – 2023

ONT5

Revision 4

1.0 Revision Log

Rev	Date	By	Description
1.0	03/09/2022	AS	Initial release
2.0	03/31/2022	AS	Changes according to notes
2.1	04/18/2022	AS	Changes according to notes by Escobar Alfaro, Francisco
2.2	05/11/2022	AS	Changes according to notes by Escobar Alfaro, Francisco
3	6/20/2022	AS	MDR's equipment Table for RE1-1
4	5/12/2023	AS	Updated overview. Removed sing recirc. Added ROs.

2.0 Table of Contents

3.0 System Overview

3.1 High Level Overview of the System

Small parcels are unloaded via tipper in area 1A. Volume is transported in area 1B. These areas compose the inbound area, 1. Volume from the inbound area is merged with volume from sorter recirc, and problem solve area. Total volume is inducted into the Singulator in area 2. Singulated volume is transported to the Interroll Line Sorter in area 3A. Packages and parcels are scanned in camera tunnel. Volume is sorted on Interroll Line Sorter in area 3B. These areas compose the sorter area 3. Volume is diverted to load lanes, problem-solve area 4, sorter recirc area 5 or runout to the existing system 6.

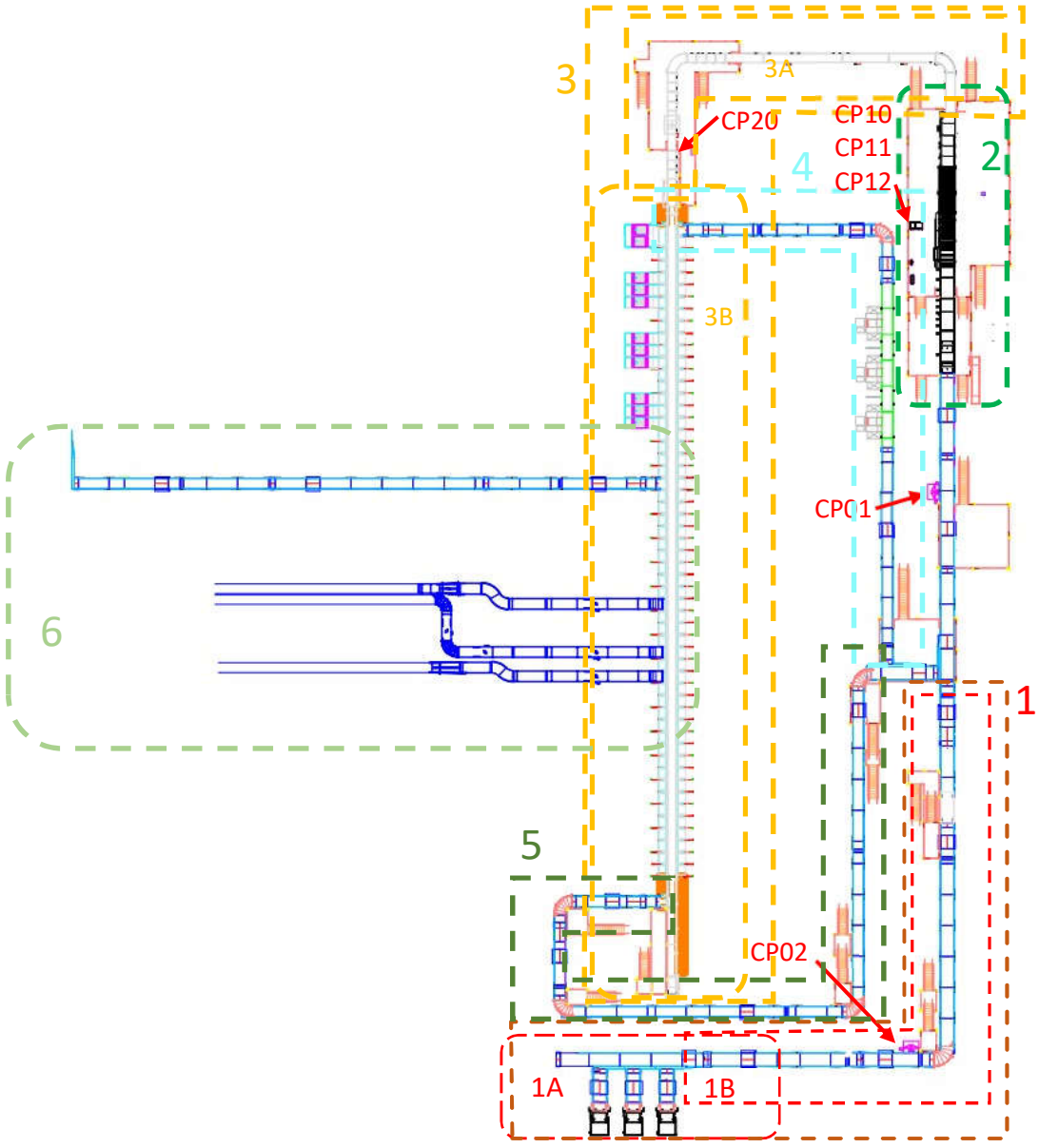


Figure 1. High Level Overview of the System

3.2 Inbound Area

3.2.1 Overview

A) CP02 location
    a. Remote to CP01
B) Gaylord Dumpers (Three)
C) Accumulation chute

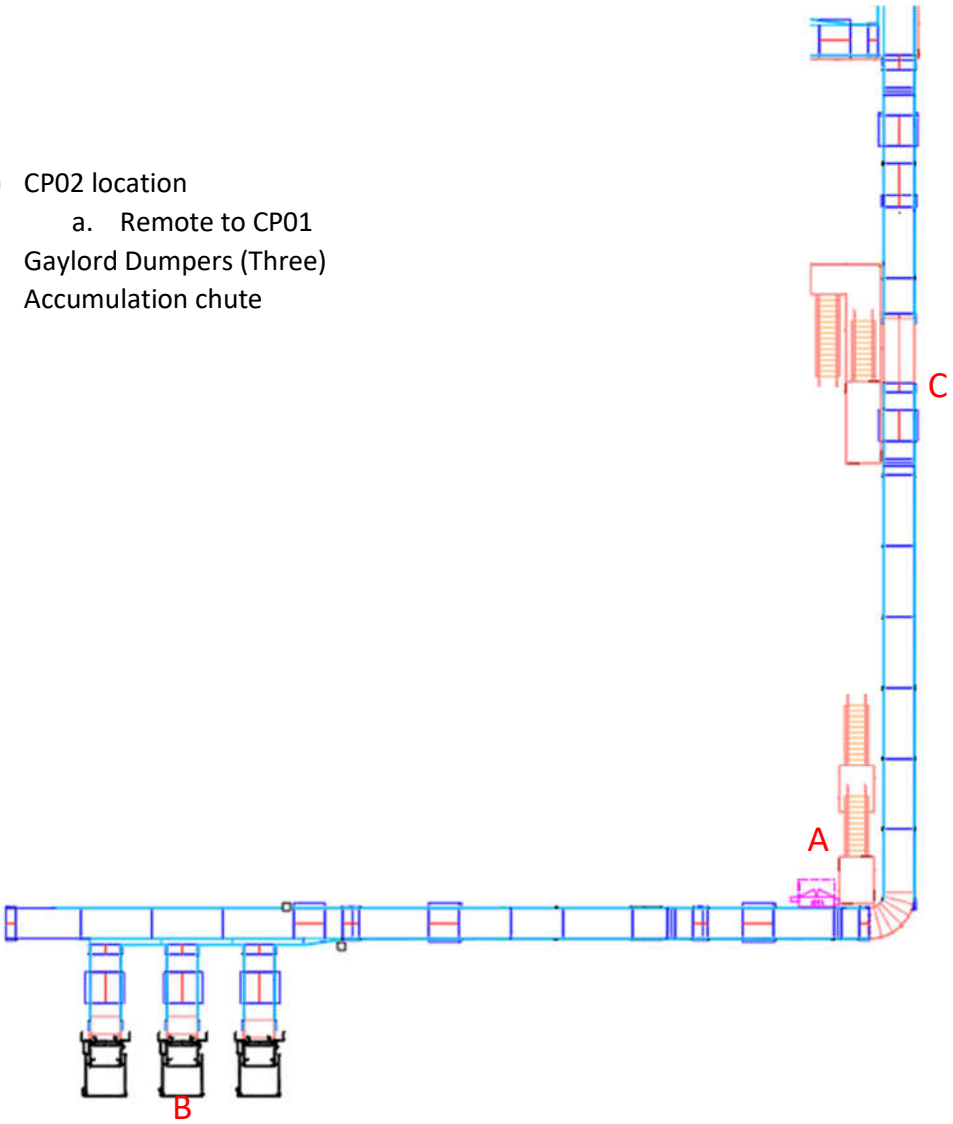


Figure 2. Inbound Area Overview

3.2.2 Gaylord Dumpers

Gaylords/go-carts full of small packages/parcels/envelopes are manually loaded into the tippers. All tippers have a takeaway belt that connected on the discharge end. The takeaway belts, collector belt, and transports belts have photoeyes for jam detection and queuing volume. More information about gaylord tipping cycles and modes can be found in section 7.2.1 Gaylord Dumping Operation.

Additionally, a throw-on line has been provided at the charge end of the gaylords collector belt..

3.2.3 Accumulation Chute

The accumulation chute on the inbound line is meant to act as a buffer between the largely right-justified volume coming from the Gaylord dumpers, and more evenly spread volume that will optimize the singulator. The intention is to always keep the chute 50-75% full, thus dispersing volume across the width of the belt at the bottom of the chute.

One of the purposes of the accumulation chute is to disperse packages across the width of the chute and through that the width of the conveyor downstream as well. This will improve package presentation quality at the Singulator.

However, it also serves a 2nd purpose. This is to allow the MHE upstream of the chute to continue to run (around 20 seconds depending on chute length) while the accumulation chute fills up whenever the downstream MHE has stopped.

3.2.4 Equipment Table

Name(s)	Description	Quantity
DISC	Disconnect Switch	8
VFD	Variable Frequency Drives	8
EPC	E-Stop Pull-Cord Switches	8
FIO	FIELD I/O Blocks	5
SIO	SAFETY I/O Blocks	6
PE	Photo Eye	13
SS	Start/Stop Control Station	8
JR	JAM Restart push Button	2
LTA	AMBER BEACON	7
LTR	RED BEACON	6
LTB	BLUE BEACON	3
LTP	PURPLE BEACON	1

3.2.5 Rates

The Gaylord Dumpers will tip at a rate of 30 cycles per hour for the 3 tippers combined, and together can process 9000 PPH. The takeaway from the unload and transport to the singulator can process 9,000 PPH (AMZ - Linear Sort Center Bundle SOW).

3.3 Singulator Area

Singulator provided by Siemens. Field devices and controls provided by Siemens. A complete Description of Operations for the Siemens Singulator is appended to this document.

3.3.1 Overview

A) CP10 and CP11 location
B) Singulator induct
C) Singulator discharge

Figure 3. Singulator Area Overview

3.3.2 Singulator Induct Merge

Volume is accumulated upstream of the singulator induct. Volume will be inducted based on priority. Priority is determined by gridlock prevention, i.e. keeping the sorter recirculation moving. Order of priority (highest to lowest):

1. Sorter recirculation
2. Problem-solve
3. Inbound area (PS1-7 and upstream)

3.3.3 Singulator Exception Handling

Some non-singulated parcel grouping may emerge from the Visicon. This section will allow one Tender to manually groom the output and remove any errors by simply hold for open resubmission. Smalls processing responsibility ends after Outgoing Flow Control Assembly and Purge exception process. (Siemens)

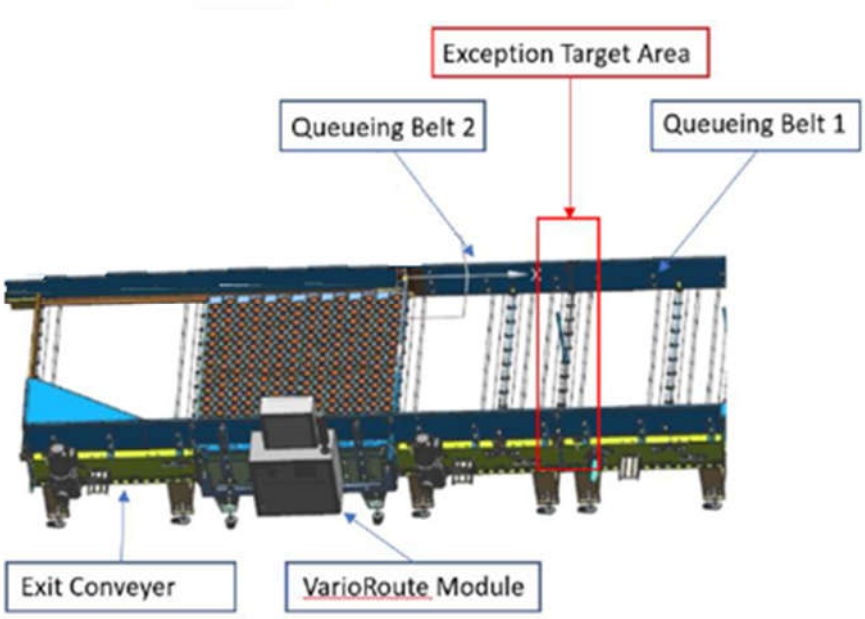


Figure 4. Singulator Exception Handling

3.3.4 Equipment Table

Name(s)	Description	Quantity
VFD	Variable Frequency Drives	16
PE	Photo eye	15
PB	Push button	2
ESS	E-Stop devices	5

3.3.5 MDR's equipment Table

Name(s)	Description	Quantity
PWR	MDR power supply	1
PE	Photo eye	1
ERSC	MDR controller	1

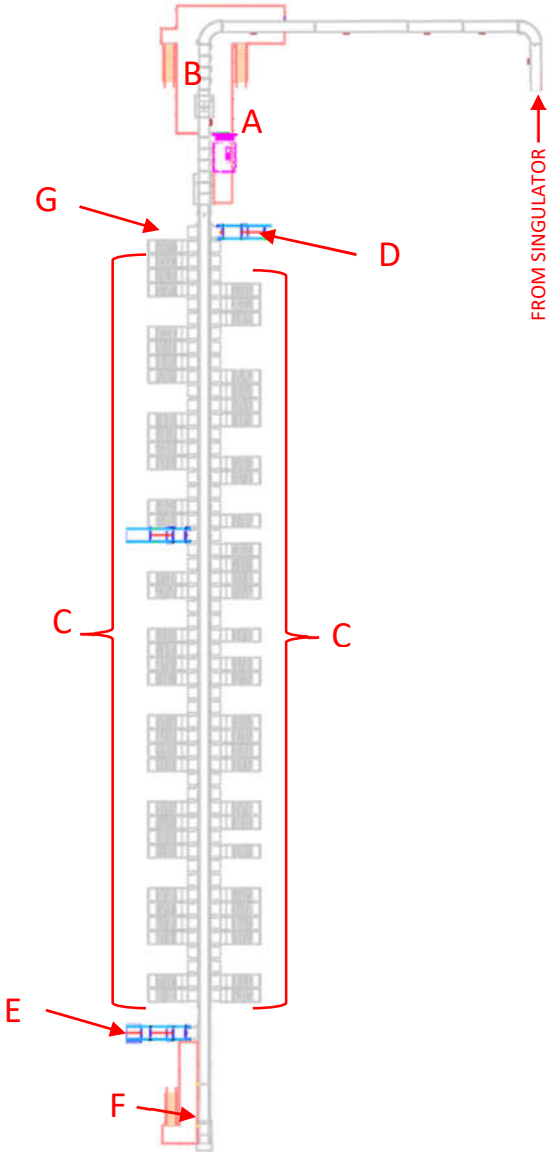
3.3.6 Rates

The singulator can process 9,273 PPH (AMZ - Linear Sort Center Bundle SOW)

3.4 Sorter Area

Sorter provided by Interroll. Field devices and controls provided by Interroll. Transport from Singulator discharge to sorter also Interroll.

3.4.1 Overview



A) CP20 (Interroll CP)
B) Camera/Scan Tunnel
C) Load lanes
   a. Removeable gravity chutes (9)
D) Divert to problem-solve area
E) Divert to sorter recirculation.
F) Divert to sorter overflow
G) Over-length package divert

Figure-5. Sorter Area Overview

3.4.2 Overlength Package Divert

The first two divert destinations on the right side (with respect to flow) of the sorter will handle overlength packages. Overlength packages are those that fall outside the range of acceptable MTBH, which can be seen in section 6.2 Materials to be Handled (MTBH).

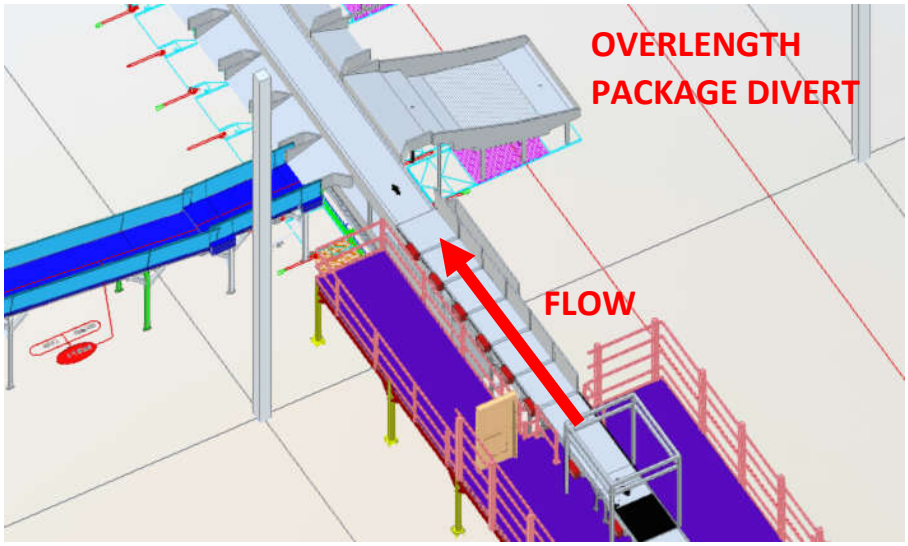


Figure 6. Overlength Package Divert

3.4.3 Equipment Table

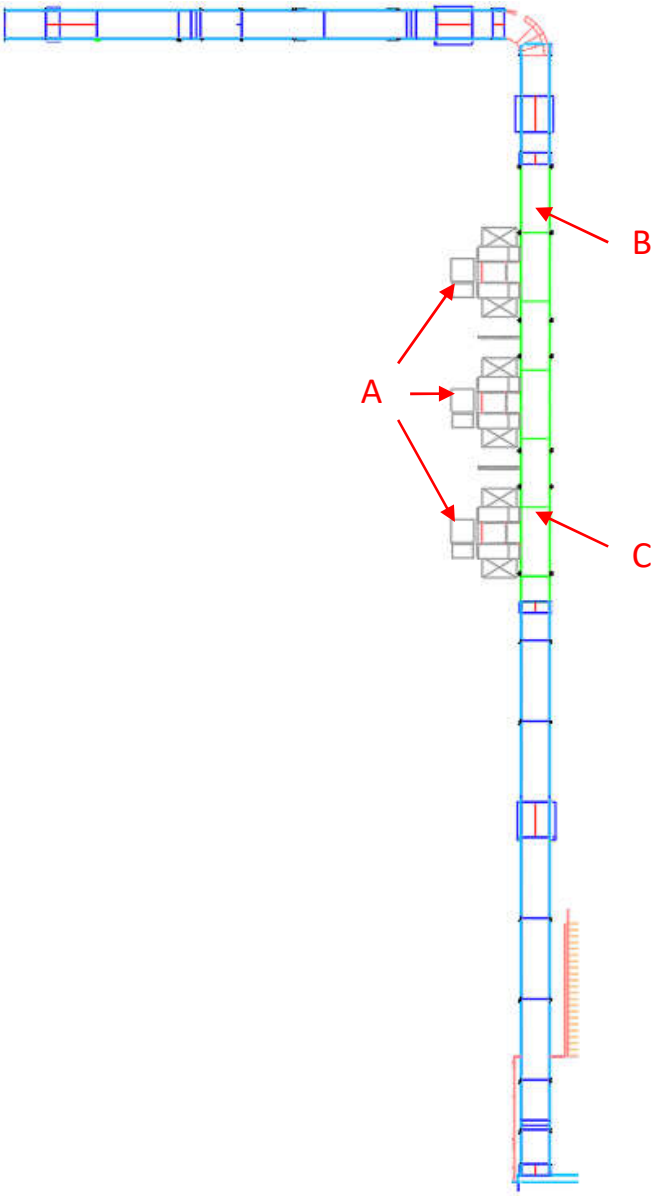
Name(s)	Description	Quantity
DISC	Disconnect switch	22
VFD	Variable Frequency Drives	20
EPC	E-Stop Pull-Cord Switches	4
FIO	FIELD I/O blocks	66
PE	Photo eye	5
PB	Push Button	60
SS	Start/Stop Control Station	4
JR	JAM Restart push button	5
LTA	AMBER BEACON	15
LTR	RED BEACON	5
LTB	BLUE BEACON	60
LTG	GREEN BEACON	60
LTP	PURPLE BEACON	11
HORN	Warning Horn	1

3.4.4 Rates

The sorter can process 9273 PPH (AMZ - Linear Sort Center Bundle SOW).

3.5 Problem Solve Load Area

3.5.1 Overview



A) Problem solve stations
B) Inbound line PRS1-4 MDRs (Bottom)
C) Outbound line PRS1-8 MDRs (Top)

There are six problem solve stations. Per the RFP, it should be one (1) quad power module per Problem Solve station pair (3 total).

Figure 7. Problem Solve Area Overview

3.5.2 Operation

Parcels that are diverted to the Problem Solve area are conveyed away from the sorter on a powered conveyor. This conveyor feeds onto a section of Motor Driven Rollers (MDR), which automatically accumulate the parcels into zones. The first sections of MDRs are skewed to move packages to the operator side of the line. Operators at the stations take packages from the MDRs, solve the problem,

and place them on the bottom MDRs (PRS1-8). This conveyor moves the solved parcels back to the singulator induct, where they are merged to the linear sorter recirc line. Volume from the Problem Solve area will be re-inducted into the singulator infeed based on priority previously outlined and opportunity.

3.5.3 Equipment Table

Name(s)	Description	Quantity
DISC	Disconnect switch	3
VFD	Variable Frequency Drives	3
EPC	E-Stop Pull-Cord Switches	4
FIO	FIELD I/O blocks	2
SIO	SAFETY I/O blocks	2
PE	Photo eye	3
SS	Start/Stop Control Station	4
LTA	AMBER BEACON	1
LTR	RED BEACON	4
LTB	BLUE BEACON	2

3.5.4 MDR's equipment Table

Name(s)	Description	Quantity
PWR	MDR power supply	4
PE	Photo eye	20
ERSC	MDR controller	10

3.5.5 Rates

Problem solve should be designed to handle 3% of the combined sorter capacity that feeds into it (Amazon, Amazon Automated Sort Center MHE Design Standards R0.5 (072420), p. 34). Each problem solve associate (two associates per work station) can process problem packages at a rate of 50 pph (Amazon Automated Sort Center MHE Design Standards R0.5 (072420)).

3.6 Sorter Recirculation Area

3.6.1 Overview

A) PE1-RE2-5
B) PE1-RE2-7
C) PE1-RE2-9

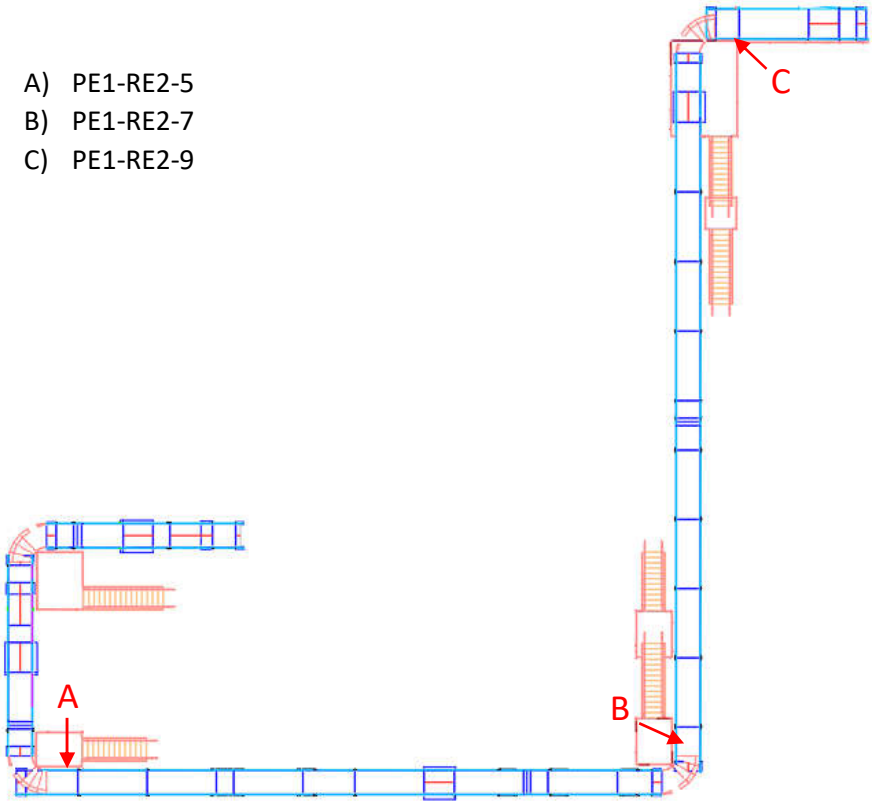


Figure-8. Sorter Recirc Area Overview

3.6.2 Recirculation and Anti-Gridlock

The sorter recirculation will continuously re-feed back into the singulator infeed under normal operations.

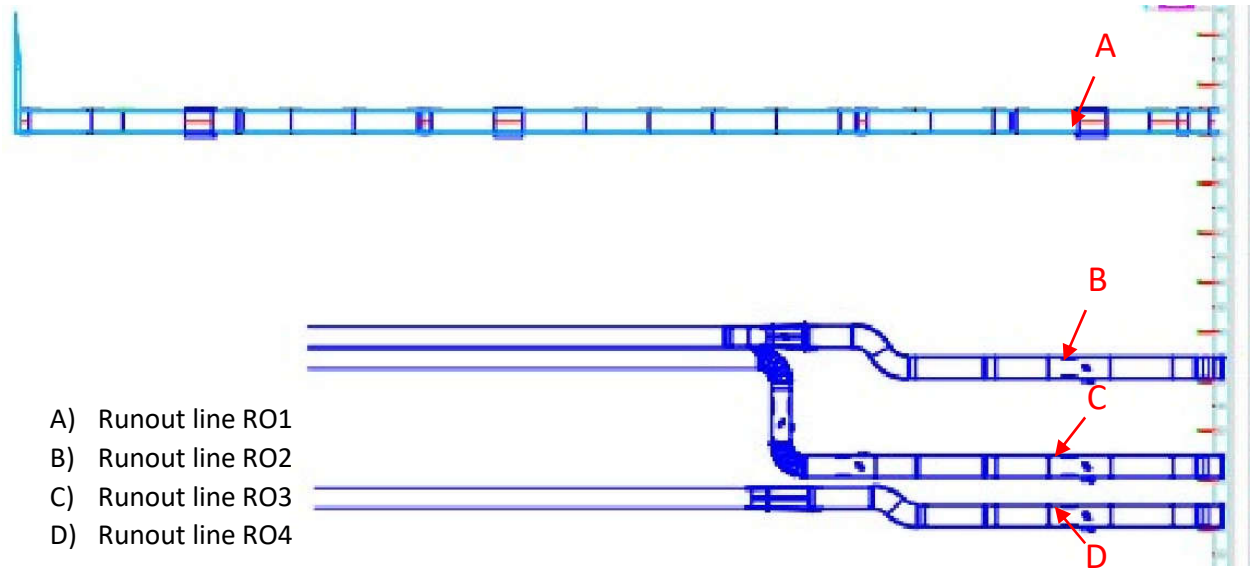
Nothing inhibits the sorter recirc when it is full other than basic downstream running flow control.

3.6.3 Equipment Table

Name(s)	Description	Quantity
DISC	Disconnect switch	5
VFD	Variable Frequency Drives	5
EPC	E-Stop Pull-Cord Switches	5
FIO	FIELD I/O blocks	4
SIO	SAFETY I/O blocks	4
PE	Photo eye	8
SS	Start/Stop Control Station	5
LTA	AMBER BEACON	5
LTR	RED BEACON	5
LTB	BLUE BEACON	2

3.7 Runout area to the existing system

3.7.1 Overview



A) Runout line RO1
B) Runout line RO2
C) Runout line RO3
D) Runout line RO4

Figure-10. Sorter Recirc Area Overview

3.7.2 Runout to Existing System

These diverters serves to convey volume from our system to the existing system. We will place photoeyes upstream of the divert point to the existing system to meter the flow. If the flow is sparse enough, then these lines will run continuously. If volume in the existing line is such that continuous flow would create jams, then volume will be inch and stored on our conveyors.

3.7.3 Equipment Table

Name(s)	Description	Quantity
DISC	Disconnect switch	14
VFD	Variable Frequency Drives	14
EPC	E-Stop Pull-Cord Switches	1
FIO	FIELD I/O blocks	5
SIO	SAFETY I/O blocks	4
PE	Photo eye	14
SS	Start/Stop Control Station	1
JR	JAM Restart push button	7
LTA	AMBER BEACON	7
LTR	RED BEACON	1
LTB	BLUE BEACON	2

4.0 Safety

4.1 Estop Zones

LEGEND			
COLOR	ZONE NAME	E-STOP ZONE DEVICES	E-STOP ZONE MOTORS
	E STOP ZONE 1	DEPC1-PS1-1; SEPC1-ULGL1-3; SEPC1-ULGL2-3; SEPC1-ULGL3-3	PS1-1; PS1-2; ULGL1-1; ULGL1-3; ULGL2-1; ULGL2-3; ULGL3-1; ULGL3-3
	E STOP ZONE 2	SEPC1-PS1-3	PS1-2; PS1-3; PS1-5
	E STOP ZONE 3	SEPC1-PS1-5	PS1-5
	E STOP ZONE 4	SEPC1-PS1-7	PS1-7
	E STOP ZONE 5	DEPC1-RE2-9	PS1-8; RE2-9; PRS1-9
	E STOP ZONE 6	SEPC1-PS1-9	PS1-8; PS1-9; PS1-10
	E STOP ZONE 7	SEPC1-RE2-1; SEPC1-RE2-3	RE2-1; RE2-3
	E STOP ZONE 8	SEPC1-RE2-5	RE2-3; RE2-5
	E STOP ZONE 9	SEPC2-RE2-5	RE2-5; RE2-7
	E STOP ZONE 10	SEPC1-RE2-7	RE2-7; RE2-9
	E STOP ZONE 11	DEPC1-PRS1-3; DEPC2-PRS1-3	PRS1-3; PRS1-4; PRS1-8; PRS1-9
	SINGULATOR E STOP ZONE	SEE DWG SINGULATOR INSTALLER	SEE DWG SINGULATOR INSTALLER
	SORTER E STOP ZONE 1	SEE DWG SORTER INSTALLER	SEE DWG SORTER INSTALLER
	SORTER E STOP ZONE 2	SEE DWG SORTER INSTALLER	SEE DWG SORTER INSTALLER
	SORTER E STOP ZONE 3	SEE DWG SORTER INSTALLER	SEE DWG SORTER INSTALLER
	RO LINE E STOP ZONE	SEPC1-RO1-3	RO1-3

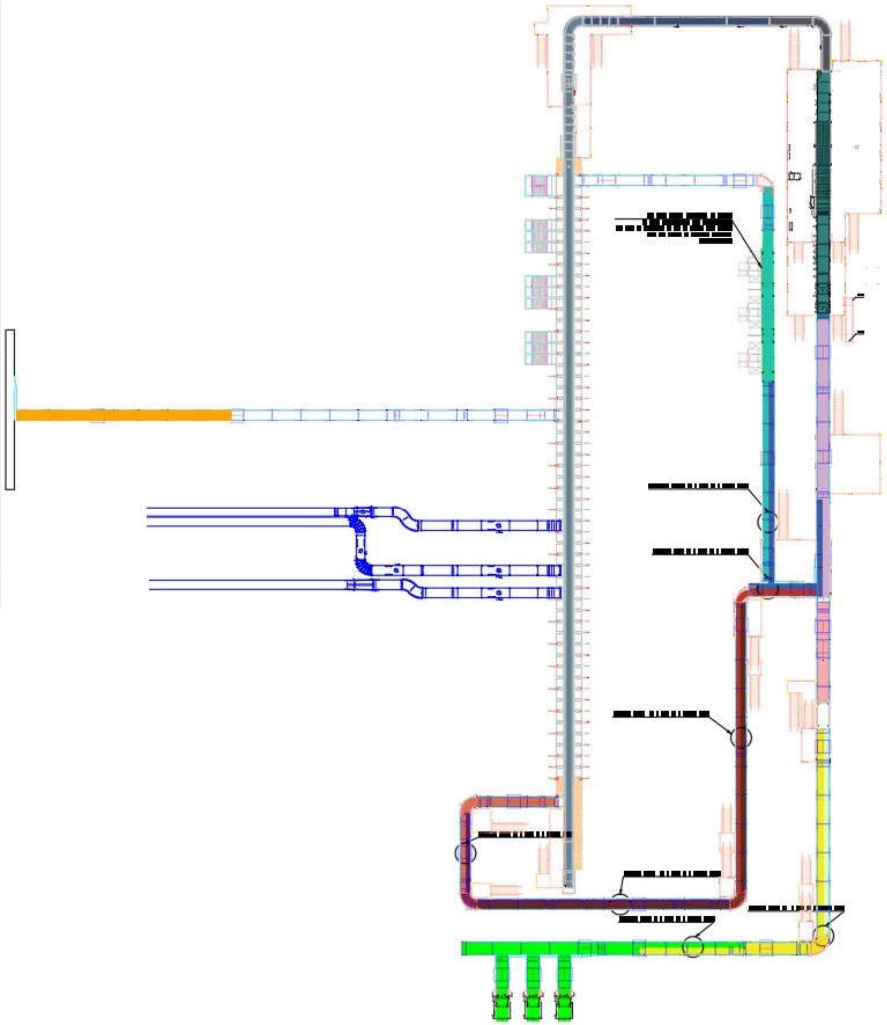


Figure 4-1. Proposed E-Stop Zones and Conveyor Table

4.2 Estop Zones description

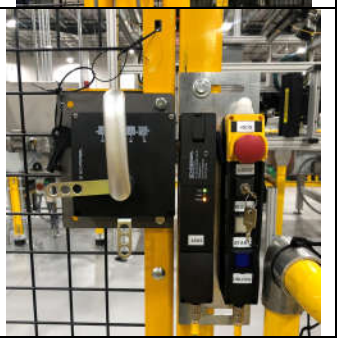
Each zone shown in the table above describes the area covered by the emergency stop device. Each zone has its own color and its own emergency stop devices (see table), which stop the conveyors in this zone, if the emergency stop device spans two different conveyors and at the same time there is another emergency stop device on this conveyor, which in turn queue belongs to another zone, then this conveyor is shown in the diagram in two colors.

4.3 Estop Hardware

For General MHE, field safety devices will be wired to safety armor blocks. 24V enable safety signal to VFDs will also be sourced from field safety armor blocks. This allows for Estop zones to be flexible if necessary, as they can be re-programmed via the PLC.

Description	Part Number	Mfg	Image
Block Module for EtherNet/IP and CIP Safety Safe Digital Inputs and Outputs	TBIP-L4-4FDI-4FDX	TURCK	
Single E-Stop Pull-Cord Switches	440E-L2NNNYS	AB	
Double E-Stop Pull-Cord Switches	440E-L13131-4P	AB	
RED BEACON	SG-TL70-R	BANNER	

The following table shows Estop Hardware provided by Interroll:

Description	Part Number	Mfg	Image
Single E-Stop Pull-Cord Switches	ZQ900-22N	Schmersal	
RED BEACON	856T-BT4	AB	
Start/Stop Gate Switch	BDF200-ST1-AS-NHK-SWS20-LTWH-LTBU-G24 AZ/AZM201-B30-RTAG1P1-SZ AZM201BZ-ST-T-AS-P	Schmersal	
Start/Stop Gate Switch	BDF200-ST1-AS-NHK-SWS20-LTWH-LTBU-G24 AZ/AZM201-B30-LTAG1P1-SZ AZM201BZ-ST-T-AS-P	Schmersal	

4.4 Estop Zone Logic

In general, when a zone is Estopped, any zone that feeds the Estopped zone will be logically flowstopped. If the feeding zone has a photoeye at the discharge between it and the Estopped zone, then the feeding zone can run until a parcel is detected at the discharge photoeye, thus queuing up a packing for when the Estopped zone resumes operation.

4.5 General Precautions

1. Don’t stand on moving belts
2. Use appropriate platforms for breaking jams
3. Don’t interface with or work with machinery unless properly locked and tagged out

4. Use dedicated walking paths
5. Wear appropriate PPE at all time
6. Be aware of forklifts or other machinery moving in the area
7. Maintain 3-points of contact when using ladders

4.6 Warning Labels / Danger Labels

4.6.1 MHE Panel Labels

CP01 and CP02 will have the following warning labels on their panels.

Figure 4-2. MHE Panel Label

4.6.2 Singulator Panel Labels

The Visicon panel will have the following warning labels on its panel.

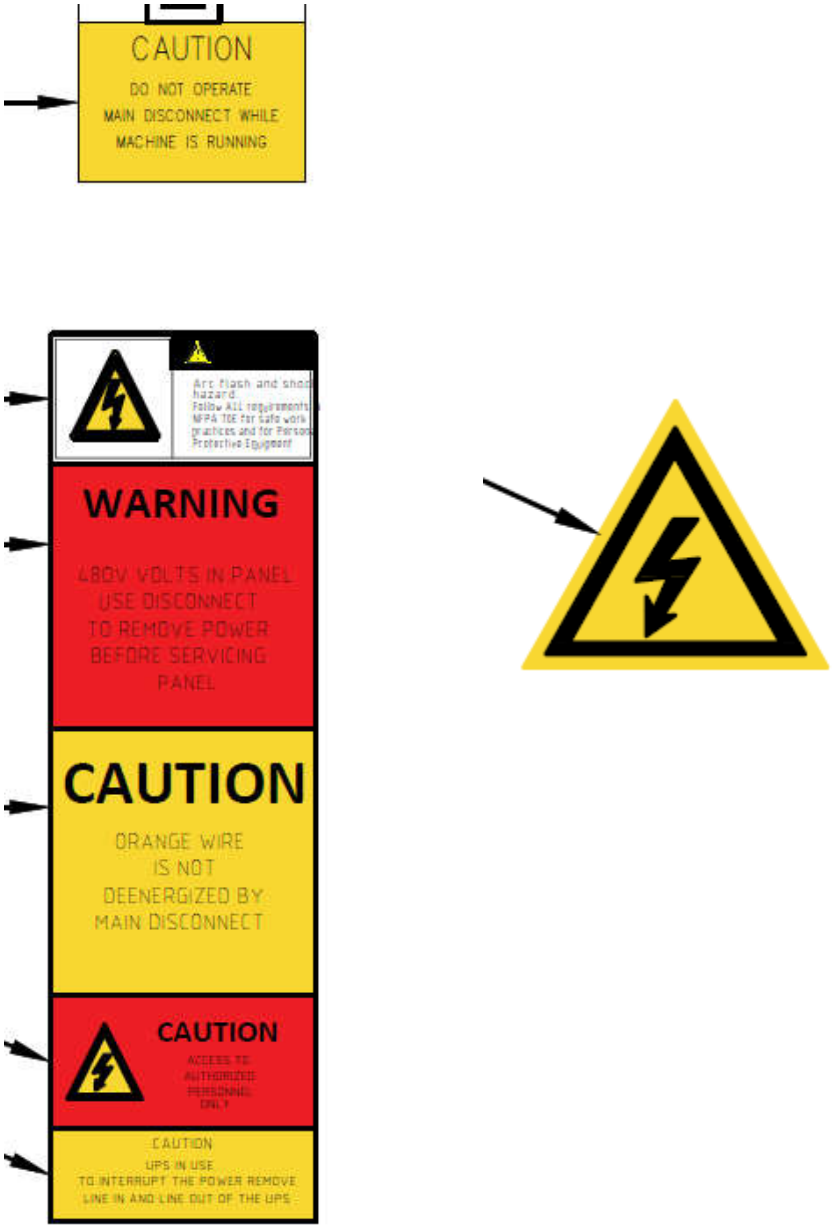


Figure 4-3. Singulator Visicon Panel Labels

The Capella panel will have the following warning label on its panel.

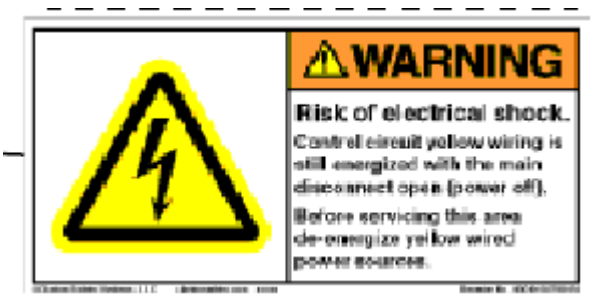


Figure 4-4. Singulator Capella Panel Label

4.6.3 Sorter Panel Labels

The sorter panels will have the following warning labels

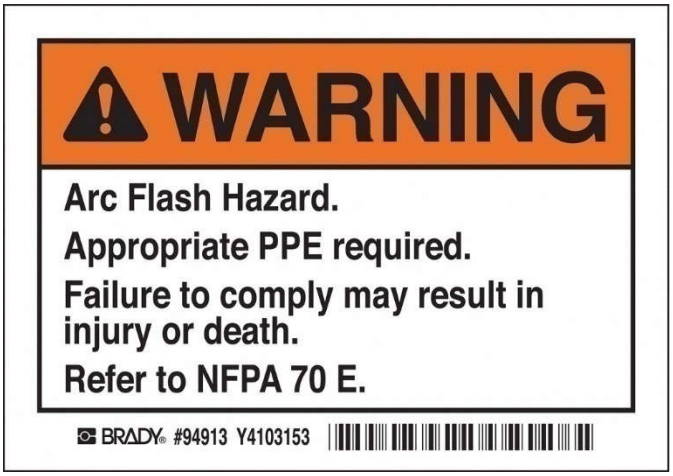


Figure 4-5 Sorter Panel Label

5.0 System Architecture and Hardware

The figures below show the system network architecture for CP01, CP02, Siemen's Singulator, Interroll's sorter panel, Cognex scan tunnel, and SCADA servers. The highlighted green connection shows the ring topology used on the local network in CP01 and CP02.

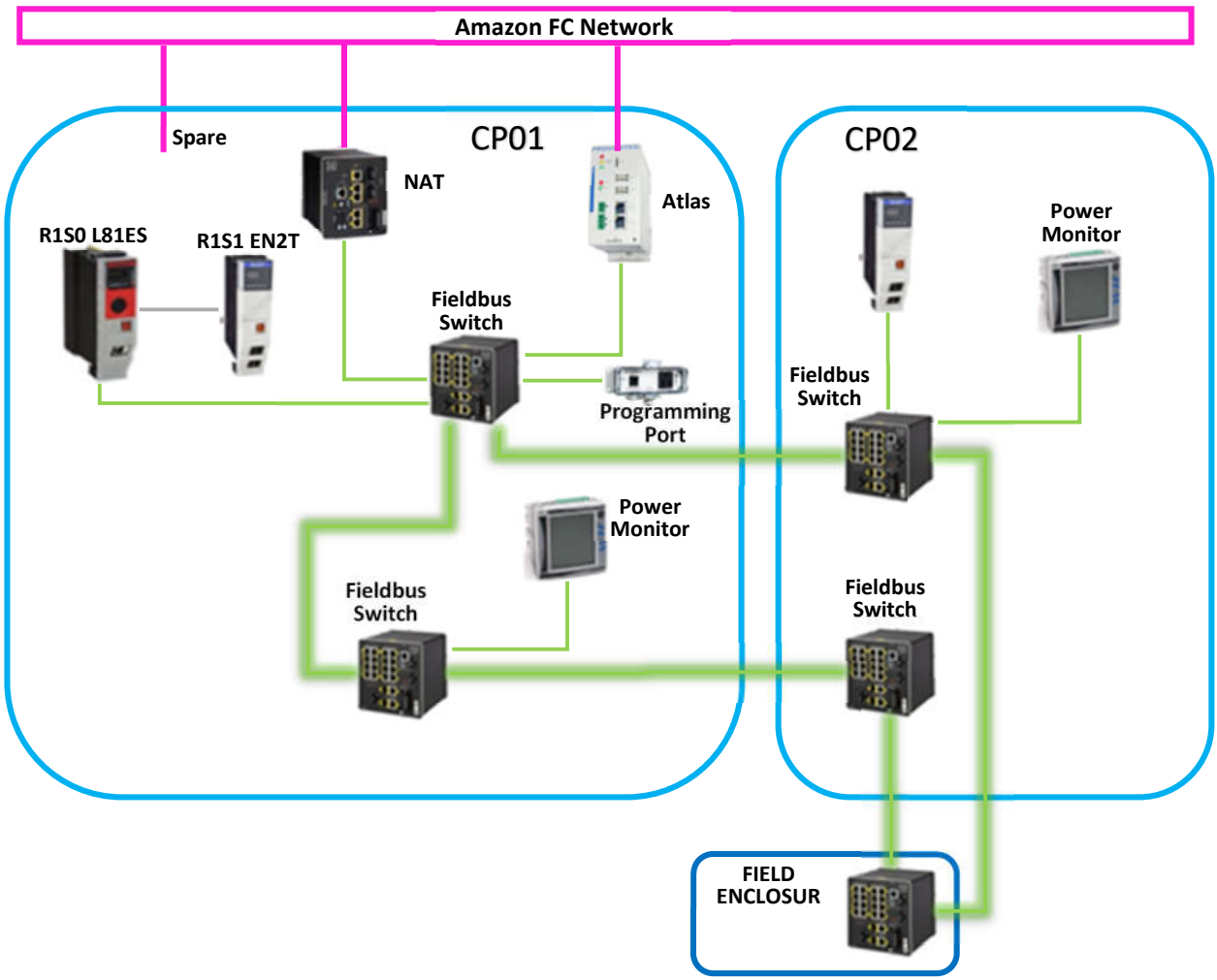


Figure 5-1. System Network Architecture

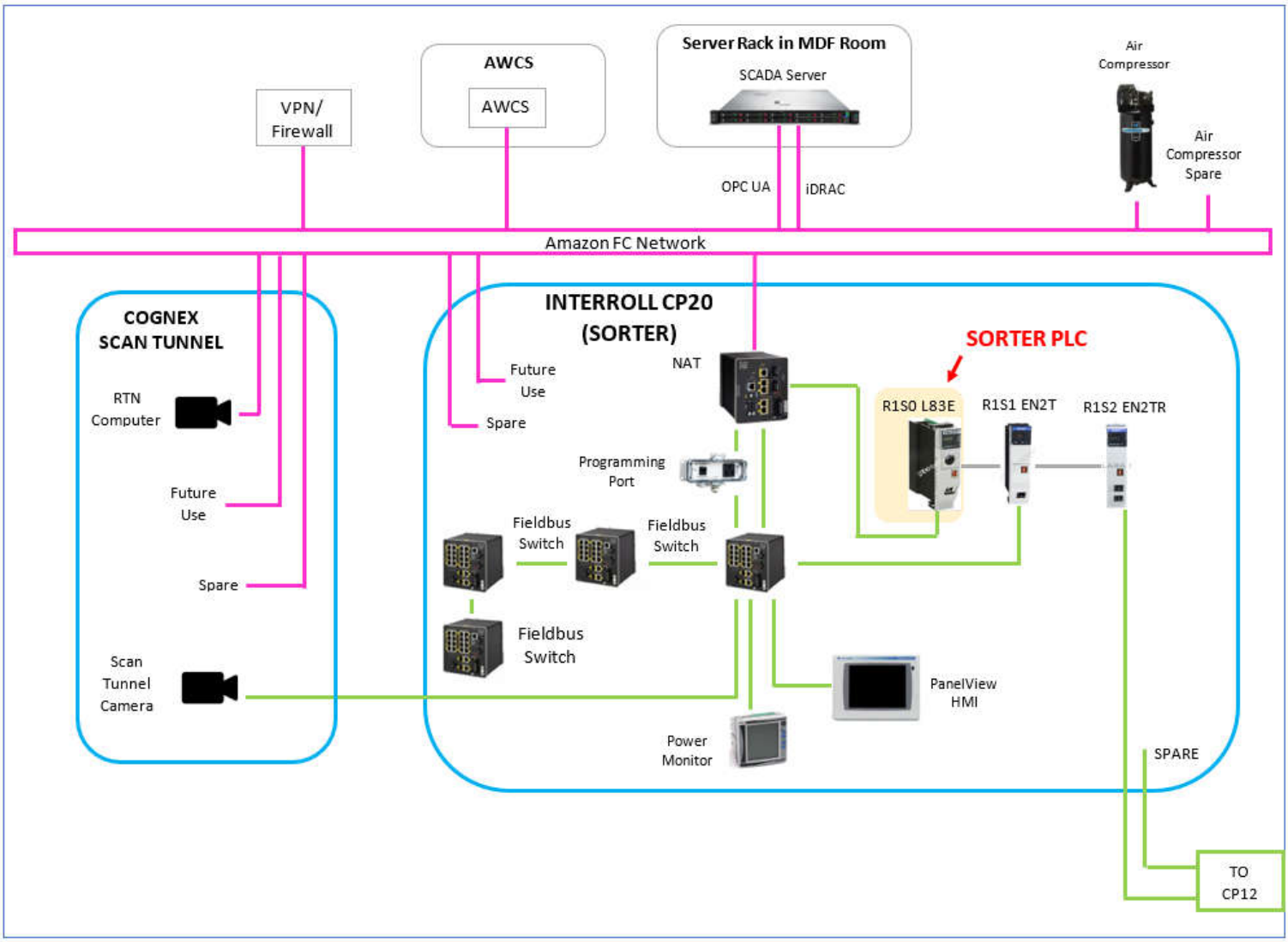


Figure 5-2. System Network Architecture cont.

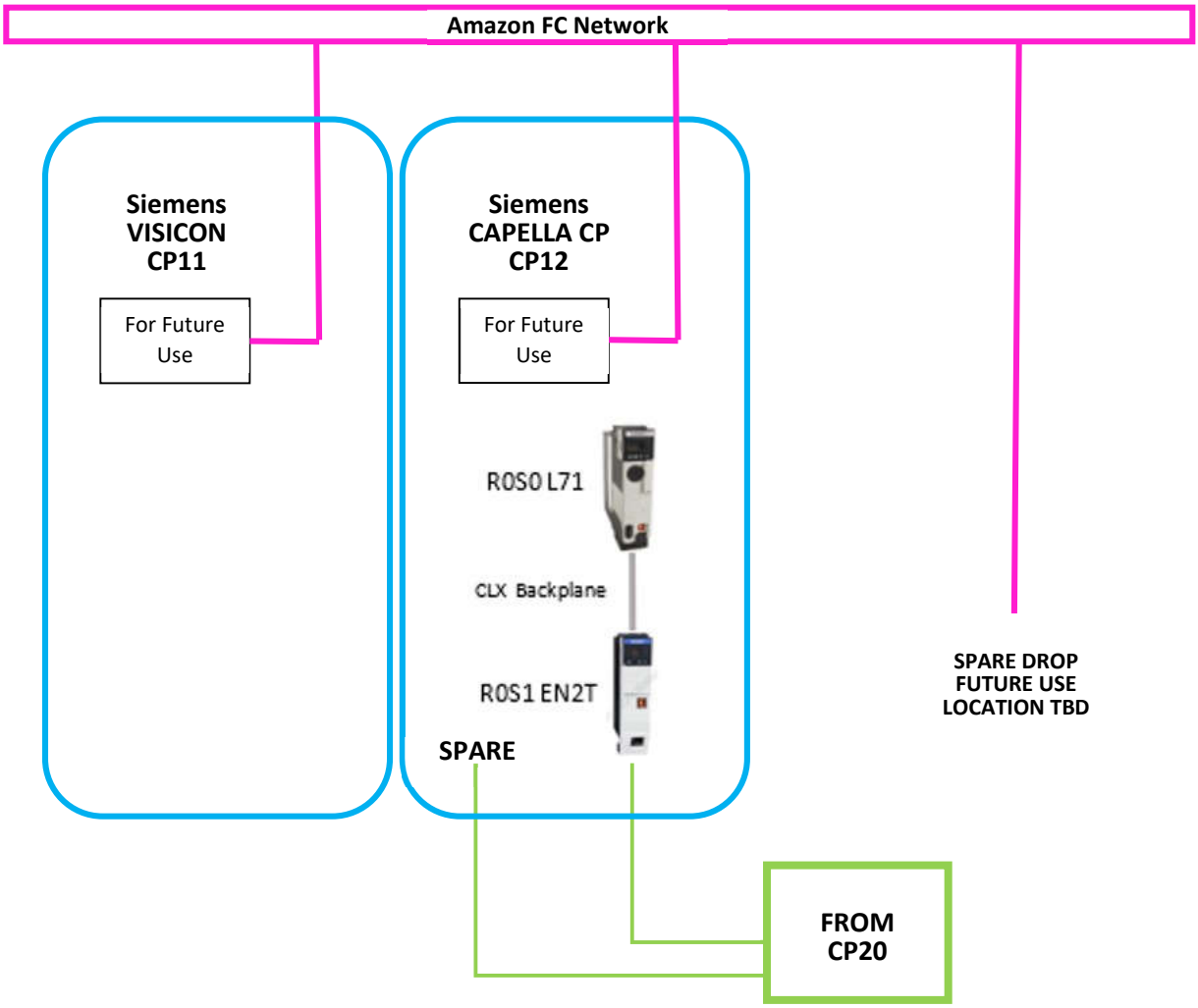


Figure 5-3. System Network Architecture cont.

5.1 Control Panels

5.1.1 Siemens Singulator Panels

The Siemens Visicon Capella singulator system has several control panels within its scope. They are described in the following sections.

5.1.1.1 Power Distribution Panel CP10

The power distribution panel (CP10) will provide feed power to every singulator panel except the Capella panel and Visicon panel.

5.1.1.2 Visicon Panel CP11

The Visicon MSC (Main Singulator Cabinet, CP11) contains the controls, computer system, and VFDs for the Visicon itself. The multiple I/O signals that make up the standard Visicon MSC interface to the external system, hardwired safety stop and reset loops. All IO is transferred via Ethernet between PLC and Visicon Computer.

The MSC computer also features a removable solid-state drive (SSD) that contains both the operating system and the Visicon application software. A backup SSD can be prepared following installation and commissioning. This backup SSD can quickly replace the SSD in the computer in the event of operating system or application software corruption, or an SSD hard-ware failure.

The Visicon computer is an Industrial Windows based system running on a server-class computer NISE 3700P2E Industrial Fieldbus computer (P/N:10J00370003X0). The computer includes Intel i7-4770TE with 8G DDR3L RAM Memory. The computer is a high-reliability, high-availability model that is rated with a high MTBF. Computer failures, while rare, are possible. To mitigate this potential, the Standard Capella™ System configuration includes cold-stand-by computer.

5.1.1.3 Capella Panel CP12

The Capella logic panel (CP12) will provide speed control of all non-Visicon segments of the system and has a ControlLogix L71 processor.

(Siemens)

5.1.2 Interroll Sorter Panel

Interroll will provide a panel (CP20) for their material handling devices and sorter. The Panel will have a FactoryTalk PanelView GDU on it. The panel will communicate with the amazon network via a NAT switch. Interroll will use an Allen-Bradley ControlLogix L83E processor.

5.1.3 General MHE Panels

Every area not controlled from Siemens or Interroll Panels as outlined above will be controlled by CP01 and CP02.

Automation Standard will use an Allen-Bradley ControlLogix L83ES PLC in CP01. CP02 will be a remote panel to CP01. The two panels will communicate through the fieldbus layer as shown in Figure 5-1. System Network Architecture. CP01 will communicate with the Amazon FC Network via the Cisco N.A.T. switch located in the enclosure.

5.2 Beacons

5.2.1 System Indicator Beacons

Beacons shall be stackable type (unless otherwise noted). Beacons shall be provided for (but not limited to) Jams, E-Stops, and Lane Full status.

Beacons shall be mounted at an elevation that makes them clearly visible at associates'/operators' eye-level (minimum elevation of 1.8m (6ft)) above floor/mezzanine surface. Additional beacons, or alternate mounting heights or locations, shall be considered if visibility is impaired by physical obstructions. Mounting of beacons shall not impede associates' operations and/or product flow. Any proposed heights or suspended mounting locations shall be reviewed for approval prior to installation.

All jam and E-Stop beacons as well as all system resets and start/stop station locations shall be easily identified by the use of placards describing and locating system sections that each control station controls.

Unless otherwise noted/approved by Operation Engineering and Controls Engineering, beacons shall be stacked in the following color order (top to bottom):

Color	Function
RED	Emergency Conditions
BLUE	Process/Flow State
PURPLE	Gridlock State
AMBER	Fault Conditions
WHITE	Informational
GREEN	Operating State

Figure 5-4. NA Beacon Colors Hierarchy

Color	Meaning	Explanation	Typical application
YELLOW (AFE ONLY)	Assistance	Associate Call / Problem Solve	• Work/Induct stations to indicate an associate requires assistance
RED	Emergency Stop Active	Emergency Condition	• Essential equipment stopped by action of a protective device
PURPLE	Gridlock	Indication sorter in Gridlock	• Sorter system in Gridlock Mode, unable to receive more product.
BLUE	Full Status	Indication of the full condition of accumulation, chutes, or Shuttle Containers	• AFE Lines 100% full • Post Divert Lane 100% full • Gayloard Full
AMBER	Fault Condition	Indication of equipment fault condition	• Equipment Jam
WHITE	Informational	Indication of general process condition	• Bar Code No Read at AFE Induct Station
GREEN	Lane or Equipment Enabled	Indication of normal operating conditions or operation enabled	• Divert location enabled and enabled for operation • Divert Lane enabled and downstream system ready to receive • Machine or system ready and running

Figure 5-5. NA Beacon Colors

Beacon behavior as it relates to faults can be found in the Faults section of this document.

Purple beacons shall be installed on the sorter every 5-6 spurs to indicate Gridlock Prevention Mode or that the sorter is in Gridlock as follows. These purple beacons are also installed throughout the rest of the system:

Color	State	Function
Purple	Solid	Sorter is in Gridlock Prevention mode
	Flash	Sorter stopped due to Gridlock

Figure 5-6. Gridlock Beacon Behavior

5.3 Field Devices

Description	Part Number	Mfg	Image
Block Module for EtherNet/IP and CIP Safety Safe Digital Inputs and Outputs	TBIP-L4-4FDI-4FDX	TURCK	
Compact Multiprotocol I/O Module for Ethernet 16 digital channels, configurable as NPN inputs or 1 A outputs	TBEN-L4-16DXP	TURCK	
Single E-Stop Pull-Cord Switches	440E-L2NNNYS	AB	
Double E-Stop Pull-Cord Switches	440E-L13131-4P	AB	
Variable Frequency Drives	PowerFlex 525	AB	

Description	Part Number	Mfg	Image
Disconnect switch	140M-C2E-B40 140M-C2E-B63 140M-C2E-C10 140M-D8E-C16 140M-D8E-C25 140M-F8E-C32	AB	
RED BEACON	SG-TL70-R	BANNER	
AMBER BEACON	SG-TL70-Y	BANNER	
BLUE BEACON	SG-TL70-B	BANNER	
PURPLE BEACON	SG-TL70-RGB14	BANNER	
WARNING HORN	B-TL70-Q5	BANNER	
Start/Stop Control Station	E2PB 800FM-LF3 800F-MN3G 800F-X10 800FM-E4MX01	AB	
JAM Restart push button	800FP-LF7 E1PB	AB	

Description	Part Number	Mfg	Image
Photo eye	QS30LVQ	BANNER	
Encoder	RH-P240AJ/8-30	TRI-TRONIX	

Device Names	Quantity	Description	Mfg.
DISC1-PRS1-1 DISC1-PRS1-3 DISC1-PRS1-9 DISC1-PS1-1 DISC1-PS1-10 DISC1-PS1-2 DISC1-PS1-3 DISC1-PS1-5 DISC1-PS1-7 DISC1-PS1-8 DISC1-PS1-9 DISC1-RE1-2 DISC1-RE2-1 DISC1-RE2-3 DISC1-RE2-5 DISC1-RE2-7 DISC1-RE2-9 DISC1-RO1-1 DISC1-RO1-2 DISC1-RO1-3 DISC1-ULGL1-3 DISC1-ULGL2-3 DISC1-ULGL3-3 DISC-RE1-3 DISC-RE1-4	25	Disconnect switch	AB
SS1-PRS1-3 SS1-PRS1-9 SS1-PS1-1 SS1-PS1-3 SS1-PS1-5	20	Start/Stop Control Station	AB

Device Names	Quantity	Description	Mfg.
SS1-PS1-7 SS1-RE1-1 SS1-RE1-2 SS1-RE1-3 SS1-RE2-3 SS1-RE2-5 SS1-RE2-7 SS1-RE2-9 SS1-RO1-3 SS1-ULGL1-3 SS1-ULGL2-3 SS1-ULGL3-3 SS2-PRS1-3 SS2-PRS1-9 SS2-RE2-5			
EPC1-PRS1-3 EPC1-PS1-3 EPC1-PS1-5 EPC1-PS1-7 EPC1-RE1-1 EPC1-RE2-3 EPC1-RE2-5 EPC1-RE2-5 EPC1-RE2-7 EPC1-ULGL1-3 EPC1-ULGL2-3 EPC1-ULGL3-3 EPC2-PRS1-3	13	Single E-Stop Pull-Cord Switches	AB
EPC1-PRS1-9 EPC1-PS1-1 EPC1-RE1-2 EPC1-RE1-4 EPC1-RE2-9 EPC1-RO1-3 EPC2-PRS1-9	7	Double E-Stop Pull-Cord Switches	AB
VFD-PRS1-1 VFD-PRS1-3 VFD-PRS1-9 VFD-PS1-1 VFD-PS1-10 VFD-PS1-2 VFD-PS1-3 VFD-PS1-5 VFD-PS1-7 VFD-PS1-8 VFD-PS1-9	26	Variable Frequency Drives	AB

Device Names	Quantity	Description	Mfg.
VFD-RE1-2 VFD-RE1-3 VFD-RE1-4 VFD-RE2-1 VFD-RE2-3 VFD-RE2-3 VFD-RE2-5 VFD-RE2-7 VFD-RE2-9 VFD-RO1-1 VFD-RO1-2 VFD-RO1-3 VFD-ULGL1-3 VFD-ULGL2-3 VFD-ULGL3-3			
FIO1-PRS1-3 FIO1-PRS1-9 FIO1-PS1-1 FIO1-PS1-10 FIO1-PS1-3 FIO1-PS1-7 FIO1-PS1-8 FIO1-PS1-9 FIO1-RE1-2 FIO1-RE1-4 FIO1-RE2-1 FIO1-RE2-3 FIO1-RE2-5 FIO1-RE2-7 FIO1-RO1-1 FIO2-PS1-1 FIO3-PS1-1	17	Compact Multiprotocol I/O Module for Ethernet 16 digital channels, configurable as NPN inputs or 1 A outputs	TURCK
SIO1-PRS1-3 SIO1-PRS1-9 SIO1-PS1-1 SIO1-PS1-3 SIO1-PS1-7 SIO1-PS1-8 SIO1-PS1-9 SIO1-RE1-2 SIO1-RE1-4 SIO1-RE2-1 SIO1-RE2-3 SIO1-RE2-5 SIO1-RE2-7 SIO1-RO1-1	17	Block Module for EtherNet/IP and CIP Safety Safe Digital Inputs and Outputs	TURCK

Device Names	Quantity	Description	Mfg.
SIO2-PS1-1 SIO3-PS1-1 SIO4-PS1-1			
JPE1-PS1-1 JPE1-PS1-10 JPE1-PS1-2 JPE1-PS1-3 JPE1-PS1-7 JPE1-PS1-8 JPE1-PS1-9 JPE1-RE1-1 JPE1-RE1-3 JPE1-RE1-4 JPE1-RE2-1 JPE1-RE2-3 JPE1-ULGL1-3 JPE1-ULGL2-3 JPE1-ULGL3-3 JPE2-PRS1-9 JPE2-PS1-1 JPE2-PS1-5 JPE2-PS1-7 JPE2-PS1-8 JPE2-PS1-9 JPE2-RE2-5 JPE2-RE2-7 JPE2-RE2-9 JPE2-RO1-3 JPE3-PS1-1 JPE3-RO1-3	27	Photo eye for JAM detect	BANNER
PE1-PRS1-1 PE1-PRS1-3 PE1-PS1-5 PE1-PS1-6 PE1-QA1-1 PE1-RE1-2 PE1-RE2-5 PE1-RE2-7 PE1-RE2-9 PE1-RO1-2 PE1-RO1-3	12	Accumulation Line photoelectric cell	BANNER

Device Names	Quantity	Description	Mfg.
PE2-PS1-6			
JR1-PS1-1 JR1-PS1-10 JR1-PS1-8 JR1-PS1-9 JR1-RE1-2 JR2-PS1-1	6	JAM Restart push button	AB
LTA1-PRS1-9 LTA1-PS1-1 LTA1-PS1-10 LTA1-PS1-3 LTA1-PS1-5 LTA1-PS1-7 LTA1-RE1-3 LTA1-RE1-4 LTA1-RE2-1 LTA1-RE2-3 LTA1-RE2-5 LTA1-RE2-7 LTA1-RE2-9 LTA1-ULGL1-3 LTA1-ULGL2-3 LTA1-ULGL3-3	16	AMBER BEACON Indication of equipment fault condition. Equipment Jam	BANNER
LTR1-PRS1-3 LTR1-PRS1-9 LTR1-PS1-5 LTR1-PS1-7 LTR1-RE1-1 LTR1-RE1-2 LTR1-RE1-4 LTR1-RE2-3 LTR1-RE2-5 LTR1-RE2-7 LTR1-RE2-9 LTR1-RO1-3 LTR1-ULGL1-3 LTR1-ULGL2-3 LTR1-ULGL3-3 LTR2-PRS1-3 LTR2-PRS1-9 LTR2-PS1-5 LTR2-RE2-5	19	RED BEACON Emergency Condition. Essential equipment stopped by action of a protective device	BANNER
LTB1-PRS1-1 LTB1-PRS1-3 LTB1-PS1-1 LTB1-PS1-5	11	BLUE BEACON Full Status. Indication of the full condition of accumulation, chutes, or Gaylords	BANNER

Device Names	Quantity	Description	Mfg.
LTB1-PS1-6 LTB1-QA1-1 LTB1-RE1-2 LTB1-RE2-5 LTB1-RE2-7 LTB1-RO1-2 LTB1-RO1-3			
LTP1-PS1-1 LTP1-PS1-10 LTP1-RE1-1	3	PURPLE BEACON	BANNER
HORN	2	WARNING HORN	BANNER
ENC1-PS1-1 ENC1-PS1-2 ENC1-PS1-3 ENC1-PS1-5 ENC1-PS1-7 ENC1-PS1-8 ENC1-PS1-9 ENC1-PS1-10	8	Encoder	TRI-TRONIX

The following table shows field devices provided by Interroll:

Description	Part Number	Mfg	Image
4 SAFETY INPUTS	BWU2284	B+W	
AS-I DIGITAL I/O MODULE	BWU3032	B+W	
AS-I DIGITAL I/O MODULE	BWU2547	B+W	
16 INPUTS/OUTPUTS, SELF-CONFIGURABLE	TBEN-L4-16DXP	TURCK	
Single E-Stop Pull-Cord Switches	440E-L2NNNYS	AB	
Variable Frequency Drives	PowerFlex 525	AB	

Description	Part Number	Mfg	Image
Disconnect switch	194E-Y25-1753-6N	AB	
RED BEACON	856T-BT4	AB	
GREEN BEACON	856T-BT3	AB	
AMBER BEACON	856T-BT5	AB	
BLUE BEACON	856T-BT6	AB	
MAGENTA BEACON	856T-BT9	AB	
HORN	855H-SG30GPE	AB	

Description	Part Number	Mfg	Image
Start/Stop Control Station	SCE-2PB1 800FM-LF3 800FM-E4	SCE AB AB	
JAM Restart push button	SCE-1PB1 800FM-LF7	SCE AB	
ENABLE push button	SCE-1PB1 800FM-LF3	SCE AB	
Double ENABLE push button	SCE-2PB1 800FM-LF3	SCE AB	
Encoder	AFM60A-S41B018X12	SICK	
Start/Stop Gate Switch	BDF200-ST1-AS-NHK-SWS20-LTWH-LTBU-G24 AZ/AZM201-B30-RTAG1P1-SZ AZM201BZ-ST-T-AS-P	Schmersal	

Description	Part Number	Mfg	Image
Start/Stop Gate Switch	BDF200-ST1-AS-NHK-SWS20-LTWH-LTBU-G24 AZ/AZM201-B30-LTAG1P1-SZ AZM201BZ-ST-T-AS-P	Schmersal	
Photo eye	RAY26P-34162530A00	SICK	
Reflector	PL80A	SICK	
Photo eye	GTB6-P7211	SICK	
Photo eye	WTB16P-24161120A00	SICK	
Photo eye	DT35-B15251	SICK	
Photo eye	GSE6-P4111	SICK	

Description	Part Number	Mfg	Image
Zero Carrier Photo eye	ZLD18-7PF4B2	SICK	
Camera – Trispector	1075605	SICK	
Limit Switch	NB G112KP-DM0.2S1	Pizzato	

6.0 System Parameters

6.1 MHE Table

Device Names	Quantity	Description	Mfg.
DISC1-PRS1-1 DISC1-PRS1-3 DISC1-PRS1-9 DISC1-PS1-1 DISC1-PS1-10 DISC1-PS1-2 DISC1-PS1-3 DISC1-PS1-5 DISC1-PS1-7 DISC1-PS1-8 DISC1-PS1-9 DISC1-RE1-2 DISC1-RE2-1 DISC1-RE2-3 DISC1-RE2-5 DISC1-RE2-7 DISC1-RE2-9 DISC1-RO1-1 DISC1-RO1-2 DISC1-RO1-3 DISC1-ULGL1-3 DISC1-ULGL2-3 DISC1-ULGL3-3 DISC-RE1-3 DISC-RE1-4	25	Disconnect switch	AB
SS1-PRS1-3 SS1-PRS1-9 SS1-PS1-1 SS1-PS1-3 SS1-PS1-5 SS1-PS1-7 SS1-RE1-1 SS1-RE1-2 SS1-RE1-3 SS1-RE2-3 SS1-RE2-5 SS1-RE2-7 SS1-RE2-9 SS1-RO1-3 SS1-ULGL1-3 SS1-ULGL2-3	20	Start/Stop Control Station	AB

Device Names	Quantity	Description	Mfg.
SS1-ULGL3-3 SS2-PRS1-3 SS2-PRS1-9 SS2-RE2-5			
EPC1-PRS1-3 EPC1-PS1-3 EPC1-PS1-5 EPC1-PS1-7 EPC1-RE1-1 EPC1-RE2-3 EPC1-RE2-5 EPC1-RE2-5 EPC1-RE2-7 EPC1-ULGL1-3 EPC1-ULGL2-3 EPC1-ULGL3-3 EPC2-PRS1-3	13	Single E-Stop Pull-Cord Switches	AB
EPC1-PRS1-9 EPC1-PS1-1 EPC1-RE1-2 EPC1-RE1-4 EPC1-RE2-9 EPC1-RO1-3 EPC2-PRS1-9	7	Double E-Stop Pull-Cord Switches	AB
VFD-PRS1-1 VFD-PRS1-3 VFD-PRS1-9 VFD-PS1-1 VFD-PS1-10 VFD-PS1-2 VFD-PS1-3 VFD-PS1-5 VFD-PS1-7 VFD-PS1-8 VFD-PS1-9 VFD-RE1-2 VFD-RE1-3 VFD-RE1-4 VFD-RE2-1 VFD-RE2-3 VFD-RE2-3 VFD-RE2-5 VFD-RE2-7 VFD-RE2-9 VFD-RO1-1 VFD-RO1-2	26	Variable Frequency Drives	AB

Device Names	Quantity	Description	Mfg.
VFD-RO1-3 VFD-ULGL1-3 VFD-ULGL2-3 VFD-ULGL3-3			
FIO1-PRS1-3 FIO1-PRS1-9 FIO1-PS1-1 FIO1-PS1-10 FIO1-PS1-3 FIO1-PS1-7 FIO1-PS1-8 FIO1-PS1-9 FIO1-RE1-2 FIO1-RE1-4 FIO1-RE2-1 FIO1-RE2-3 FIO1-RE2-5 FIO1-RE2-7 FIO1-RO1-1 FIO2-PS1-1 FIO3-PS1-1	17	Compact Multiprotocol I/O Module for Ethernet 16 digital channels, configurable as NPN inputs or 1 A outputs	TURCK
SIO1-PRS1-3 SIO1-PRS1-9 SIO1-PS1-1 SIO1-PS1-3 SIO1-PS1-7 SIO1-PS1-8 SIO1-PS1-9 SIO1-RE1-2 SIO1-RE1-4 SIO1-RE2-1 SIO1-RE2-3 SIO1-RE2-5 SIO1-RE2-7 SIO1-RO1-1 SIO2-PS1-1 SIO3-PS1-1 SIO4-PS1-1	17	Block Module for EtherNet/IP and CIP Safety Safe Digital Inputs and Outputs	TURCK
JPE1-PS1-1 JPE1-PS1-10 JPE1-PS1-2 JPE1-PS1-3 JPE1-PS1-7 JPE1-PS1-8 JPE1-PS1-9	27	Photo eye for JAM detect	BANNER

Device Names	Quantity	Description	Mfg.
JPE1-RE1-1 JPE1-RE1-3 JPE1-RE1-4 JPE1-RE2-1 JPE1-RE2-3 JPE1-ULGL1-3 JPE1-ULGL2-3 JPE1-ULGL3-3 JPE2-PRS1-9 JPE2-PS1-1 JPE2-PS1-5 JPE2-PS1-7 JPE2-PS1-8 JPE2-PS1-9 JPE2-RE2-5 JPE2-RE2-7 JPE2-RE2-9 JPE2-RO1-3 JPE3-PS1-1 JPE3-RO1-3			
PE1-PRS1-1 PE1-PRS1-3 PE1-PS1-5 PE1-PS1-6 PE1-QA1-1 PE1-RE1-2 PE1-RE2-5 PE1-RE2-7 PE1-RE2-9 PE1-RO1-2 PE1-RO1-3 PE2-PS1-6	12	Accumulation Line photoelectric cell	BANNER
JR1-PS1-1 JR1-PS1-10 JR1-PS1-8 JR1-PS1-9 JR1-RE1-2 JR2-PS1-1	6	JAM Restart push button	AB
LTA1-PRS1-9 LTA1-PS1-1 LTA1-PS1-10 LTA1-PS1-3	16	AMBER BEACON Indication of equipment fault condition. Equipment Jam	BANNER

Device Names	Quantity	Description	Mfg.
LTA1-PS1-5 LTA1-PS1-7 LTA1-RE1-3 LTA1-RE1-4 LTA1-RE2-1 LTA1-RE2-3 LTA1-RE2-5 LTA1-RE2-7 LTA1-RE2-9 LTA1-ULGL1-3 LTA1-ULGL2-3 LTA1-ULGL3-3			
LTR1-PRS1-3 LTR1-PRS1-9 LTR1-PS1-5 LTR1-PS1-7 LTR1-RE1-1 LTR1-RE1-2 LTR1-RE1-4 LTR1-RE2-3 LTR1-RE2-5 LTR1-RE2-7 LTR1-RE2-9 LTR1-RO1-3 LTR1-ULGL1-3 LTR1-ULGL2-3 LTR1-ULGL3-3 LTR2-PRS1-3 LTR2-PRS1-9 LTR2-PS1-5 LTR2-RE2-5	19	RED BEACON Emergency Condition. Essential equipment stopped by action of a protective device	BANNER
LTB1-PRS1-1 LTB1-PRS1-3 LTB1-PS1-1 LTB1-PS1-5 LTB1-PS1-6 LTB1-QA1-1 LTB1-RE1-2 LTB1-RE2-5 LTB1-RE2-7 LTB1-RO1-2 LTB1-RO1-3	11	BLUE BEACON Full Status. Indication of the full condition of accumulation, chutes, or Gaylords	BANNER
LTP1-PS1-1 LTP1-PS1-10 LTP1-RE1-1	3	PURPLE BEACON	BANNER

Device Names	Quantity	Description	Mfg.
HORN	2	WARNING HORN	BANNER
ENC1-PS1-1 ENC1-PS1-2 ENC1-PS1-3 ENC1-PS1-5 ENC1-PS1-7 ENC1-PS1-8 ENC1-PS1-9 ENC1-PS1-10	8	Encoder	TRI-TRONIX

6.2 Materials to be Handled (MTBH)

Inbound package volume for the building is shown in Table 1. Packages expected to be inducted into the Inbound and Gaylord Dumping area are all shown in Table 1. The system is expected to handle X-Large items through the singulator prior to being flushed from the system at the singulator discharge.

			Cartons				Bags				Envelopes			
			L	W	H	Wt	L	W	H	Wt	L	W	H	Wt
Small	min	cm/kg	15.2	10.1	3.0	0.2	36.0	25.0	5.5	0.02	23.5	12.5	0.5	0.02
		inches/lbs	6.0	4.0	1.0	0.5	14.0	10.0	2.0	0.04	9.0	5.0	0.2	0.04
	max	cm/kg	45.7	35.6	15.2	4.5	45.7	35.4	15.2	4.5	45.7	35.6	15.2	4.5
		inches/lbs	18.0	14.0	6.0	10.0	18.0	14.0	6.0	10.0	18.0	14.0	6.0	10.0
Medium	min	cm/kg	41.0	31.0	5.5	5.0	41.0	31.0	5.5	4.6	35.5	25.0	2.6	0.02
		inches/lbs	16.1	12.1	2.2	11.0	16.1	12.0	2.2	10.1	14.0	10.0	1.1	0.04
	max	cm/kg	61.0	49.0	16.0	22.6	61.0	49.0	16.0	22.6	35.5	25.0	5.0	1.0
		inches/lbs	24.0	19.2	6.3	50.0	24.0	19.2	6.3	50.0	14.0	10.0	2.0	2.2
Large	min	cm/kg	61.1	49.1	16.1	5.4	94.0	69.0	15.0	2.2				
		inches/lbs	24.1	19.3	6.4	11.2	37.0	27.0	6.0	5.0				
	max	cm/kg	94.0	76.0	61.0	22.6	94.0	84.0	15.0	22.6				
		inches/lbs	37.0	30.0	24.0	70.0	37.0	33.0	6.0	70.0				
X-Large	min	cm/kg	94.1	76.1	61.1	22.7								
		inches/lbs	37.1	30.1	24.1	70.0								
	max	cm/kg												
		inches/lbs												

Table 1. Materials to be Handled.

- These are actual sizes and accommodations need to be made for slightly deformed, dented or not perfectly square containers and packages.
- Small, medium, and large packages are AR sortable. X-Large is considered Non-Conveyable.
- Maintain minimum parcel height clearance of 30 inches between conveyable surface and any obstruction for all MHE. Sprinklers are often obstructions and eight (8) extra inches of clearance needs to be accounted for when sprinklers are present.

6.2.1 Package Definitions

6.2.1.1 Cartons

Cartons will be cuboid in shape and made from corrugated containerboard and/or polymer. Cartons will include single and double corrugated walled boxes. The box sizes are defined by

the MTBH table provided above. The cartons can be made from various corrugated containerboard including but not limited to E-FLUIT, BC FLUTE.

6.2.1.2 Bags

Bags can consist of polybags/PacJacket intended for individual orders or sortable bags intended to hold multiple small packages to a destination.

6.2.1.2.1 Polybag/PacJacket

Defined as bags made from plastic material with/without padding. The polybags have limited structural strength. The bags can be made from various material including but not limited to PE film.

6.2.1.2.2 Sortable bags

Used to consolidate small packages intended for same destination. Infinity bags are made from Polypropylene. They have a dimension of 37”L x 34”W x 6” H.

6.2.1.3 Envelopes

Envelopes consist of Wallets, Jiffy’s, and Folders.

6.2.1.3.1 Wallets

Made from paper. Envelopes will be available in small and medium sizes.

6.2.1.3.2 Jiffy’s

Jiffy’s are wallets with additional layers of cushioning material. Jiffy’s will come in small and medium sizes.

6.2.1.3.3 Folders

Made from corrugated containerboard (typically E-Flute).

MTBH information sourced from SOW (AMZ - Linear Sort Center Bundle SOW).

6.3 Committed Rates

Throughput for the system should be approximately 9,273 pph.

6.4 Material Flow Diagram

Rate data is sourced from the SOW (AMZ - Linear Sort Center Bundle SOW).

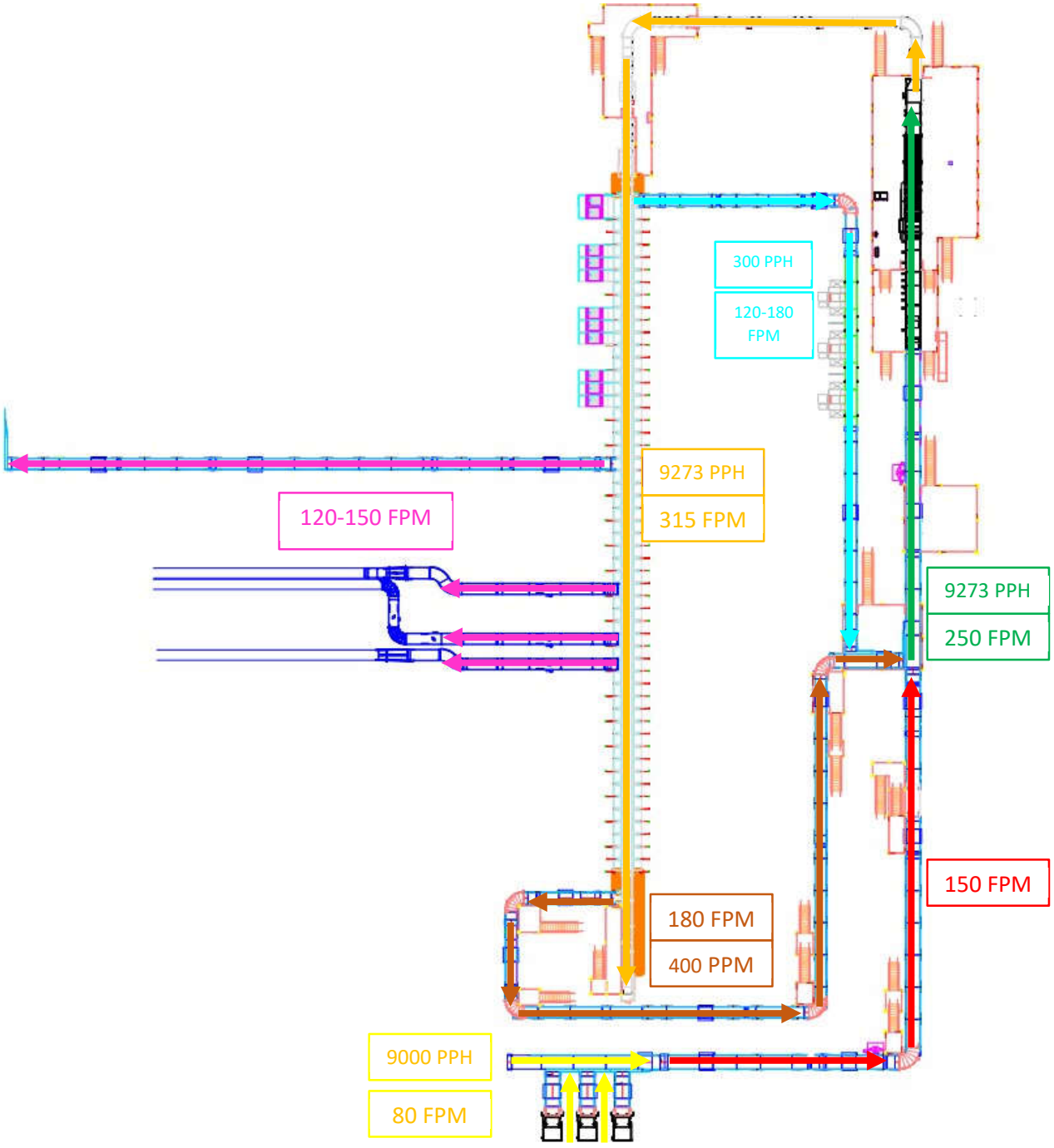


Figure 6-1. Material Flow Diagram with Rates and Speeds

6.4.1 Speeds

All MHE conveyor speeds can be found in Table 9. Conveyor Speeds are in the appendix.

7.0 Description of Operations

7.1 Startup Procedure

The entire system can be started from the following locations

1. SCADA
2. CP01 Start PB
3. CP02 Start PB
4. CP20 Start PB

A warning horn shall sound for 5 seconds each time a system/machine is started or restarted from any stopped situation, I.E. fault, jam, or energy management. If Energy Management (EM) does not stop the system/machine, this might result in the horn sounding continuously which is not the spirit of this requirement. In such EM cases, the horn does not have to sound. Warning horns shall be added to provide adequate coverage in warning associates and personnel of the starting of equipment, machine, or system. (WWDE-CNTRL-STND-GLOBAL-SPEC-R215-121620)

7.2 Elements of the System

The handoff between systems from different vendors will be accomplished via PLC interlocks over ethernet, specifically produce-consume. Ready to receive and ready to discharge signals will occur at the induct and discharge of the singulator, the induct and discharge of the sorter, the pass off between Gaylords and their takeaway belts, and the problem solve area sorter takeaway belt and the problem solve area MDRs.

Any occurrence which stops a belt from running (local stop, jam, fault, etc) while the system is active shall flow-stop the belts immediately upstream of the stopped belts regardless of the sub-system which the stoppage takes place. To clear the fault, see the description of faults in this document and re-start characteristics.

The Siemens singulator will be hard-wire interlocked with the first zone of the Interroll sorter area. The effect is that when an estop occurs in the singulator zone, it will emergency stop the first area of the Interroll system. If this occurs, then the Siemens area must be reset either at the actuated device, or the Siemens CP. Additionally, the first zone of the Interroll area will need to be reset at CP20.

Conversely, emergency stop devices in the first Interroll zone will also stop the singulator.

7.2.1 Gaylord Dumping Operation

For status and permissive communication, the MHE system will use an ethernet connection to each Gaylord dumper. For emergency stopping the dumpers from the MHE system, we will interlock with each dumper using a Class 3 pulse tested circuit to safety relays provided by the dumper manufacturer in each dumper's panel.

Gaylord dumpers have 3 hard-coded dumping positions from the manufacturer. The duration the dumpers remain at each position is also hard-coded by the manufacturer. Each dumper can dump simultaneously and have its volume queue up on its takeaway belt. However, only one takeaway belt at

a time will be permitted to discharge its volume onto the collector line. If a dumper's takeaway belt is already queued with volume, the dumper will not be permitted to raise past its first position. Only when the queued volume has been discharged will the dumper gain its "Okay to dump" signal from the MHE system.

The timing of the release of queued volume will be based on avoiding discharging product into product already on the collector line.

NOTE: Gaylord dumper's emergency stop devices (panel pushbutton, control box pushbutton, and light curtains) will NOT emergency stop the MHE system

Gaylord dumpers status will be shown on SCADA. Estop, system fault, auto/manual mode, communication fault, and actively dumping in auto mode will be shown on the SCADA. Operations can manually inhibit the PS1 line and allow the gaylord line to discharge via SCADA. A notification on SCADA will be visible when this manual override is active.

7.2.1.1 Auto Mode

1. Close and latch safety door

2. Auto / Manual selector to Auto (On HD-72B model dumper, this is inside the panel)

3. To dump a container push “Reset” then “Cycle Start” to begin the auto cycle

    a. The dumper will tilt up to the first intermediate position set by a 25 second PLC timer and hold for 8 seconds. **NOTE:** If used, the dumper will wait for the “ok to dump” signal from the conveyor system before proceeding.

    b. The dumper will continue to tilt for 2 seconds and hold for 8 seconds.

    c. The dumper will continue to the full UP position then hold for 10 seconds.

    d. The full up position is set by the AB spring arm limit switch.

4. The dumper will automatically tilt down to the home position. The AB rocker arm limit switch sets the full down home position and shuts off the motor.

5. To interrupt the Auto cycle, select the “Force Down” button (white). The dumper will stop rotation and return to the home position. **It is NOT recommended to do this with a full Gaylord. The flow control down speed is set for an empty bucket. Selecting “Force Down” with a full Gaylord will result in a fast down speed and a hard impact. Damage to equipment is possible.**

6. Open the door, load a container, return to step #1

7.2.1.2 Manual Mode

1. Close and latch safety door.

2. Auto / Manual selector to Manual

3. To dump a container, push “Reset” then hold the “UP” momentary push button.

    a. The dumper will stop and hold in place when the button is released.

    b. The dumper will stop at the top of the dump cycle, automatically, when the tilt limit switch is actuated.

4. To return to the home position, push and hold the “Down” momentary push button.

7.3 Operator Interaction

7.3.1 Control Panel

Operators will be able to monitor system status via illuminated pushbuttons on each CP. A table of illuminated pushbuttons and their function can be found in the appendix Table 6 (WWDE-CNTRL-STND-GLOBAL-SPEC-R215-121620). Subsystems can be started, stopped, and faults cleared at the respective CP.

7.3.2 Diverter Controls

Divert/Enable Control Station shall be provided at each Flats Sorter divert location (except for the Jackpot divert location) for enabling and disabling the divert location (WWDE-CNTRL-STND-GLOBAL-SPEC-R215-121620). A table of illuminated pushbuttons and their function can be found in the appendix Table 7

Diverter controls can also be accessed on via the SCADA.

7.3.3 Start/Stop Stations

Start/Stop stations shall be provided to allow associates to conveniently start, stop, or restart a machine, equipment or an area process (WWDE-CNTRL-STND-GLOBAL-SPEC-R215-121620). A table of illuminated pushbuttons and their function can be found in the appendix Table 8.

7.4 Faults and Statuses

7.4.1 Jam

To protect associates, and to minimize damage to equipment and product, jam detection of product flow shall be provided at (but not limited to):

- Merging points
- Divert Spurs
- Charge and Discharge of high speed sorters (slat)
- Curves (feeding into)
- Gravity and Powered Spirals
- Gravity Chutes
- Empty Carton transition points (elevation/change in direction)
- Product alignment (narrowing of product flow)

Jam detection shall be comprised of an appropriate sensing device that can detect the presence of all product height/width being handled by the machine/equipment/system. Jam sensing device can serve dual purposes (I.E. product present, pull-up eye, etc.)

A ***Jam Fault*** shall be generated when a Jam sensing device(s) (I.E. photo-eye) continuously senses product (blocked) for a specific amount of time. The “Block” time shall take into consideration the conveyor speed, time it would take for product to “Pile Up” and fall out of machine/equipment (possibly injuring associates), and equipment damage due to blockage of product flow.

Under a ***Jam Fault***, the associated unit along with the immediate upstream and (if applicable) the immediate downstream units shall be logically stopped to inhibit movement. The fault condition is to be annunciated by:

- Illuminating the *Jam Restart* illuminated pushbutton at the associated Jam Reset Station and main control panel.
- Illuminating (strobe) a local Jam beacon(s.)
- Displaying the Jam fault condition on the HMI/SCADA by changing unit to the appropriate fault color, and/or showing an alarm message.
- Updating the SCADA logs (where applicable) with open access to Amazon for reporting/data collection.

Recovering from a ***Jam Fault*** requires clearing the affected jam photo-eye sensing path of product. Upon detecting that the affected jam photo-eye(s) sensing path has cleared, the local jam beacon(s) illuminates solid to indicate that the affected conveyor units can be restarted by:

- Pressing the *Jam Restart* illuminated pushbutton at the associated local jam restart station.
- Alternatively, by pressing the jam restart illuminated pushbutton at the main panel, or at the SCADA system.

Restarting of a jam fault condition is acknowledged by:

- Extinguish the Jam Restart illuminated pushbutton at the main panel and associated jam restart control station.
- Extinguish local Jam beacon(s.)
- Clearing the jam fault condition on the SCADA system.
- Sound Start-Up Warning Horn prior to initiating motion

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Photoeye Name	Conveyor Speed (FPM)	Suggested Jam Time (Seconds)
PE1-ULGL1-3	80	24
PE1-ULGL2-3	80	24
PE1-ULGL3-3	80	24
PE1-PS1-1	80	24
PE2-PS1-1	80	24
PE3-PS1-1	80	24
PE1-PS1-2	150	15
PE1-PS1-3	150	15
PE2-PS1-5	150	15
PE1-PS1-7	150	15
PE2-PS1-7	150	15
PE1-PS1-8	250	5
PE2-PS1-8	250	5
PE1-PS1-9	250	5
PE2-PS1-9	250	5
PE1-PS1-10	250	5
PE1-RE1-1	150	15
PE1-RE1-3	150	15
PE1-RE1-4	150	15
PE1-RE2-1	200	10
PE1-RE2-3	200	10
PE2-RE2-5	250	5
PE2-RE2-7	250	5
PE2-RE2-9	250	5
PE2-RO1-3	120	20
PE3-RO1-3	150	15
PE1-PRS1-9	120	20

Table 2. Suggested Jam PE Jam Times

7.4.2 Bulk-Jam

For package collector belt applications (I.E. Bulk Flow), a Jam sensing device shall be located at the discharged end of each conveyor/chute feeding the Bulk Flow Main Trunk Take-away conveyor section.

When a Jam is detected at the discharge of the feeding conveyor/chute, the feeding conveyor shall stop while the Main Collector (Bulk) Take-away conveyor is permitted to continue to index for a specified "Clearing" time. If the Jam condition is cleared before reaching the "Clearing" time, the feeding conveyor/chute is permitted to resume normal operation and the "Clearing" time is reset.

When the "Clearing" time is reached, the Main Collector (Bulk) Take-away conveyor section associated with the feeding conveyor/chute shall stop (along with all upstream Collector (Bulk) Take-away conveyor sections.) Under this condition the same ***Jam Fault*** annunciation and resetting as noted in ***Section 5.3.3.2.1 – Conveyance Jam Detection*** should be followed.

The "Clearing" time will be established on a per application basis by accounting for conveyor speeds and volume.

(WWDE-CNTRL-STND-GLOBAL-SPEC-R215-121620)

Because we are using FMS which varies the speeds of the belts, the timer for each jam photoeye is dynamic. For example, a 10 second jam on a belt moving at 10 FPM is vastly different than a 10 second jam on a belt moving at 100 FPM.

7.4.3 Motor Disconnect

For all non-VFD motor or standalone equipment, the disconnect state shall be monitored.

A ***Disconnect Fault*** is to be generated when either:

- A disconnect switch is detected in the OFF position while an area/equipment is running (started.)
- Or when a disconnect switch is detected in the OFF position when starting an area/equipment (re-starting)

Under a ***Disconnect Fault***, the associated unit along with the immediate upstream (and if applicable the downstream units) shall be logically stopped to inhibit movement (or processes.) The fault condition is to be annunciated by:

- Illuminating the Motor Fault illuminated pushbutton at the main panel.
- Displaying the fault condition on the HMI/SCADA by changing unit/equipment to the appropriate fault color, or showing an alarm message.
- Updating the SCADA logs (where applicable) with open access to Amazon for reporting/data collection.

Recovering from a ***Disconnect Fault*** requires placing the disconnect switch to the ON position and pressing the *Motor Fault* illuminated pushbutton at the main panel.

(WWDE-CNTRL-STND-GLOBAL-SPEC-R215-121620)

7.4.4 VFD

For all motors controlled through a drive controller (I.E. VFD, Soft-Starter, etc.) the operating state of the controller shall be monitored for any fault condition. A ***Motor Fault*** is to be generated upon detecting a fault condition.

Under a ***Motor Fault***, the associated unit along with the immediate upstream (and if applicable the downstream units) shall be logically stopped to inhibit movement (or processes.) The fault condition is to be annunciated by:

- Illuminating the Motor Fault illuminated pushbutton at the main panel.
- Displaying the fault condition on the HMI/SCADA by changing unit to the appropriate fault color, and/or showing an alarm message.
- Updating the SCADA logs (where applicable) with open access to Amazon for reporting/data collection.

Recovering from a ***Motor Fault*** requires fixing the controller fault and pressing the *Motor Fault* illuminated pushbutton at the main panel.

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7.4.5 Emergency Circuit/Controller Fault

Emergency Stop circuits shall be constantly monitored for potential wiring/circuit failures and/or for faulted emergency stop devices. Failures/faults to be monitored should include but not limited to:

- The local E-Stop relay (controller) is energized, but one or more E-Stop devices in the E-Stop circuit is activated.
- The local E-Stop relay (controller) is not energized and no E-Stop devices in the E-Stop circuit is activated.
- E-Stop Relay / Safe PLC faulted.

Upon detecting an E-Stop fault, An ***Emergency Circuit/Controller Fault*** shall be generated.

Under an ***Emergency Circuit/Controller Fault***, the equipment associated with the emergency stop zone is to be brought to a stop and restarting functionality of the affective zone is to be disabled. The fault condition is to be annunciated by:

- Flashing the E-Stop Actuated pilot light at the main panel at .5 second on/off interval.
- Displaying the fault condition on the HMI/SCADA by changing unit(s) to the appropriate fault color, and/or showing an alarm message.
- Updating the SCADA logs (where applicable) with open access to Amazon for reporting/data collection.

Recovering from an ***Emergency Stop Fault*** requires repairing the faulty E-stop circuit/device and pressing the *Start* illuminated pushbutton at the main panel.

(WWDE-CNTRL-STND-GLOBAL-SPEC-R215-121620)

7.4.6 Motion/Encoder Fault

All equipment/machines controlled by a motion sensing device (I.E. encoder, pulse positioning, or similar devices) shall monitor the operating state of the motion sensing devices. Should a failure in detecting expected motion and/or of any fault conditions is detected, a ***Motion/Encoder Fault*** is to be generated upon detecting a fault or loss of position.

Under a ***Motion/Encoder Fault***, the associated unit along with the immediate upstream and downstream units shall be logically stopped to inhibit movement (or processes.) The fault condition is to be annunciated by:

- Flash the Jam Reset illuminated pushbutton at the main panel at 2 second on/off interval.
- Displaying the fault condition on the HMI/SCADA by changing unit to the appropriate fault color, and/or showing an alarm message.
- Updating the SCADA logs (where applicable) with open access to Amazon for reporting/data collection.

Recovering from a ***Motion/Encoder Fault*** requires clearing the motion sensor fault or correcting the motion error, then pressing the *Jam Reset* illuminated pushbutton at the main panel.

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Sick encoders (part number: Sick AFM60A-S4IB018X12) will be used on the sorter and other belts supplied by Interroll for tracking purposes.

7.4.7 Communication Fault

All equipment/machines requiring critical communication with subsystems and/or Amazon services shall be monitored for proper communications.

A ***Communication Fault*** is to be generated upon detecting loss of communications or communication buffers exceeding 95% utilization.

Under a ***Communication Fault***, the associated control panel shall be brought to a logical controlled stop (to inhibit movement) and all associated start functionality disabled. The fault condition is to be annunciated by:

- Illuminating the Communication Fault illuminated pushbutton at the main panel.
- Displaying the fault condition on the HMI/SCADA by changing unit to the appropriate fault color, and/or showing an alarm message.
- Updating the SCADA logs (where applicable) with open access to Amazon for reporting/data collection.

Recovering from a ***Communication Fault*** requires fixing the communication issue and pressing the *Communication Fault* illuminated pushbutton at the main panel.

(WWDE-CNTRL-STND-GLOBAL-SPEC-R215-121620)

From	To
CP01	CP02
	CP12 (Singulator PLC)
	CP20 (Sorter PLC)
	Amazon Network
	SCADA
CP02	CP01 Gaylord Dumpers
CP12 (Singulator PLC)	CP01
	CP20
	SCADA
CP20 (Sorter PLC)	CP01
	CP12
	Amazon Network
	SCADA
	Scan Tunnel
Air Compressor	Amazon Network
Gaylord Dumpers	CP02
Amazon Network	CP01 CP20 Air Compressor

Table 3. Communication Fault Table

7.4.8 Low Air Pressure Fault

For pneumatic control equipment/systems, an air pressure sensing device shall be used in monitoring equipment/machines supply air pressure. A ***Low Air Pressure Fault*** shall be generated when the pneumatic supply air pressure falls below acceptable operating level.

Under a ***Low Air Pressure Fault***, the associated pneumatic equipment is to be brought to a controlled stop and all restarting functionally of the affective equipment is to be disabled. The fault condition is to be annunciated by:

- Illuminating the Low Air Pressure illuminated pushbutton at the main panel.
- Displaying the fault condition on the HMI/SCADA by changing unit/equipment to the appropriate fault color, or showing an alarm message.
- Updating the SCADA logs (where applicable) with open access to Amazon for reporting/data collection.

Recovering from a ***Low Air Pressure Fault*** requires 1) restoring the air pressure to an acceptable sustainable level; 2) pressing the *Low Air Pressure* illuminated pushbutton to reset the Low Air Pressure Fault, and 3) pressing the START pushbutton at the main panel to restart the affected equipment.

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7.4.9 Accumulation Fault

An ***Accumulation Fault*** shall be generated when an Accumulation unit's 100% full sensing device(s) (I.E. photo-eye) continuously senses product (blocked) for a specific amount of time while the Accumulation unit's discharge is clear. The "Block" time shall take into consideration the conveyor speed, and accumulation unit's length.

An ***Accumulation Fault*** is annunciated by:

- Illuminating the Jam Reset illuminated pushbutton at the main panel.
- Illuminating a Jam beacon that is located adjacent to the Accumulation unit's 100% full sensing device.
- Displaying the fault condition on the HMI/SCADA by changing unit to the appropriate fault color, and/or showing an alarm message.
- Updating the SCADA logs (where applicable) with open access to Amazon for reporting/data collection.

Recovering from an ***Accumulation Fault*** requires clearing the affected 100% full photo-eye sensing path of product. Once clear the fault is automatically cleared and normal operations resume.

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7.4.10 Sensor Fault

Equipment/machines with critical sensing devices (I.E. Over Travel Limit Switches, Tension Sensor, or similar devices) shall monitor the state of the sensing devices (I.E. fail to make, failed to break, loss of fail-safe signal, etc.)

A ***Sensor Fault*** is to be generated upon detecting sensor fault.

Under a ***Sensor Fault***, the associated faulted unit shall be logically stopped to inhibit upstream units (or processes) from feeding product to the stopped/faulted unit and annunciating the fault condition by:

- Illuminating a Sensor Fault illuminated pushbutton at the main panel (optional).
- Displaying the fault condition on the HMI/SCADA by changing unit to the appropriate fault color, and/or showing an alarm message.
- Updating the SCADA logs (where applicable) with open access to Amazon for reporting/data collection.

Recovering from a ***Sensor Fault*** requires fixing the sensing device issue and pressing the *System Start* illuminated pushbutton at the main panel.

(WWDE-CNTRL-STND-GLOBAL-SPEC-R215-121620)

7.4.11 Energy Management

Vendor shall provide Energy management logic to conserve energy and equipment longevity. Every running machine, from single belt sections to more complex systems, must stop after minimum of 15 minutes of inactivity. The default timeout must be easily adjustable by Amazon without requiring additional Vendor/software support (I.E. adjust from SCADA, HMI, or programing application).

(WWDE-CNTRL-STND-GLOBAL-SPEC-R215-121620)

Default timeout will be adjustable from the SCADA. (SCADA-HMI - Layout Guide - 2021 OXD)

8.0 Appendices

Device Names	Quantity	Description	Mfg.
DISC1-PRS1-1 DISC1-PRS1-3 DISC1-PRS1-9 DISC1-PS1-1 DISC1-PS1-10 DISC1-PS1-2 DISC1-PS1-3 DISC1-PS1-5 DISC1-PS1-7 DISC1-PS1-8 DISC1-PS1-9 DISC1-RE1-2 DISC1-RE2-1 DISC1-RE2-3 DISC1-RE2-5 DISC1-RE2-7 DISC1-RE2-9 DISC1-RO1-1 DISC1-RO1-2 DISC1-RO1-3 DISC1-ULGL1-3 DISC1-ULGL2-3 DISC1-ULGL3-3 DISC-RE1-3 DISC-RE1-4	25	Disconnect switch	AB
SS1-PRS1-3 SS1-PRS1-9 SS1-PS1-1 SS1-PS1-3 SS1-PS1-5 SS1-PS1-7 SS1-RE1-1 SS1-RE1-2 SS1-RE1-3 SS1-RE2-3 SS1-RE2-5 SS1-RE2-7 SS1-RE2-9 SS1-RO1-3 SS1-ULGL1-3 SS1-ULGL2-3	20	Start/Stop Control Station	AB

Device Names	Quantity	Description	Mfg.
SS1-ULGL3-3 SS2-PRS1-3 SS2-PRS1-9 SS2-RE2-5			
EPC1-PRS1-3 EPC1-PS1-3 EPC1-PS1-5 EPC1-PS1-7 EPC1-RE1-1 EPC1-RE2-3 EPC1-RE2-5 EPC1-RE2-5 EPC1-RE2-7 EPC1-ULGL1-3 EPC1-ULGL2-3 EPC1-ULGL3-3 EPC2-PRS1-3	13	Single E-Stop Pull-Cord Switches	AB
EPC1-PRS1-9 EPC1-PS1-1 EPC1-RE1-2 EPC1-RE1-4 EPC1-RE2-9 EPC1-RO1-3 EPC2-PRS1-9	7	Double E-Stop Pull-Cord Switches	AB
VFD-PRS1-1 VFD-PRS1-3 VFD-PRS1-9 VFD-PS1-1 VFD-PS1-10 VFD-PS1-2 VFD-PS1-3 VFD-PS1-5 VFD-PS1-7 VFD-PS1-8 VFD-PS1-9 VFD-RE1-2 VFD-RE1-3 VFD-RE1-4 VFD-RE2-1 VFD-RE2-3 VFD-RE2-3 VFD-RE2-5 VFD-RE2-7 VFD-RE2-9 VFD-RO1-1 VFD-RO1-2 VFD-RO1-3 VFD-ULGL1-3	26	Variable Frequency Drives	AB

Device Names	Quantity	Description	Mfg.
VFD-ULGL2-3 VFD-ULGL3-3			
FIO1-PRS1-3 FIO1-PRS1-9 FIO1-PS1-1 FIO1-PS1-10 FIO1-PS1-3 FIO1-PS1-7 FIO1-PS1-8 FIO1-PS1-9 FIO1-RE1-2 FIO1-RE1-4 FIO1-RE2-1 FIO1-RE2-3 FIO1-RE2-5 FIO1-RE2-7 FIO1-RO1-1 FIO2-PS1-1 FIO3-PS1-1	17	Compact Multiprotocol I/O Module for Ethernet 16 digital channels, configurable as NPN inputs or 1 A outputs	TURCK
SIO1-PRS1-3 SIO1-PRS1-9 SIO1-PS1-1 SIO1-PS1-3 SIO1-PS1-7 SIO1-PS1-8 SIO1-PS1-9 SIO1-RE1-2 SIO1-RE1-4 SIO1-RE2-1 SIO1-RE2-3 SIO1-RE2-5 SIO1-RE2-7 SIO1-RO1-1 SIO2-PS1-1 SIO3-PS1-1 SIO4-PS1-1	17	Block Module for EtherNet/IP and CIP Safety Safe Digital Inputs and Outputs	TURCK
JPE1-PS1-1 JPE1-PS1-10 JPE1-PS1-2 JPE1-PS1-3 JPE1-PS1-7 JPE1-PS1-8 JPE1-PS1-9 JPE1-RE1-1 JPE1-RE1-3 JPE1-RE1-4	27	Photo eye for JAM detect	BANNER

Device Names	Quantity	Description	Mfg.
JPE1-RE2-1 JPE1-RE2-3 JPE1-ULGL1-3 JPE1-ULGL2-3 JPE1-ULGL3-3 JPE2-PRS1-9 JPE2-PS1-1 JPE2-PS1-5 JPE2-PS1-7 JPE2-PS1-8 JPE2-PS1-9 JPE2-RE2-5 JPE2-RE2-7 JPE2-RE2-9 JPE2-RO1-3 JPE3-PS1-1 JPE3-RO1-3			
PE1-PRS1-1 PE1-PRS1-3 PE1-PS1-5 PE1-PS1-6 PE1-QA1-1 PE1-RE1-2 PE1-RE2-5 PE1-RE2-7 PE1-RE2-9 PE1-RO1-2 PE1-RO1-3 PE2-PS1-6	12	Accumulation Line photoelectric cell	BANNER
JR1-PS1-1 JR1-PS1-10 JR1-PS1-8 JR1-PS1-9 JR1-RE1-2 JR2-PS1-1	6	JAM Restart push button	AB
LTA1-PRS1-9 LTA1-PS1-1 LTA1-PS1-10 LTA1-PS1-3 LTA1-PS1-5 LTA1-PS1-7 LTA1-RE1-3 LTA1-RE1-4 LTA1-RE2-1	16	AMBER BEACON Indication of equipment fault condition. Equipment Jam	BANNER

Device Names	Quantity	Description	Mfg.
LTA1-RE2-3 LTA1-RE2-5 LTA1-RE2-7 LTA1-RE2-9 LTA1-ULGL1-3 LTA1-ULGL2-3 LTA1-ULGL3-3			
LTR1-PRS1-3 LTR1-PRS1-9 LTR1-PS1-5 LTR1-PS1-7 LTR1-RE1-1 LTR1-RE1-2 LTR1-RE1-4 LTR1-RE2-3 LTR1-RE2-5 LTR1-RE2-7 LTR1-RE2-9 LTR1-RO1-3 LTR1-ULGL1-3 LTR1-ULGL2-3 LTR1-ULGL3-3 LTR2-PRS1-3 LTR2-PRS1-9 LTR2-PS1-5 LTR2-RE2-5	19	RED BEACON Emergency Condition. Essential equipment stopped by action of a protective device	BANNER
LTB1-PRS1-1 LTB1-PRS1-3 LTB1-PS1-1 LTB1-PS1-5 LTB1-PS1-6 LTB1-QA1-1 LTB1-RE1-2 LTB1-RE2-5 LTB1-RE2-7 LTB1-RO1-2 LTB1-RO1-3	11	BLUE BEACON Full Status. Indication of the full condition of accumulation, chutes, or Gaylords	BANNER
LTP1-PS1-1 LTP1-PS1-10 LTP1-RE1-1	3	PURPLE BEACON	BANNER
HORN	2	WARNING HORN	BANNER
ENC1-PS1-1 ENC1-PS1-2 ENC1-PS1-3 ENC1-PS1-5 ENC1-PS1-7 ENC1-PS1-8	8	Encoder	TRI-TRONIX

Device Names	Quantity	Description	Mfg.
ENC1-PS1-9 ENC1-PS1-10			

Table 4. MHE Device List – Automation Standard

Device Names	**Quantity**	**Part #**	**Description**	**Mfg.**
F-3 F-3 F-1 D-6 D-5 D-4 D-3 D-2 D-1 D-0 AL PRVR-2 PRVR-1 SBS TAVR MG	16		VFD	
D-1 D-2 D-3 D-4 D-5 D-6 F-1 F-2 F-3 PRVR-1 TAVR U-1 U-2 U-3 U-4	15		PE	
PB605 PB606	2		TENDER ASSIST PUSH BUTTON	

Table 5. MHE Device List – Siemens Singulator

Name	Type	Color	Function
Power On	Flush pilot light	White	Illuminates when panel control circuit power is active.
Start	Flush illuminated pushbutton	Green	Used in starting all associated equipment controlled by the control panel. Illuminates solid to indicate in the started (running) state. Flashes at 1 second intervals when in Energy Management.
Stop	Extended pushbutton	Red	Used in control stopping all associated equipment controlled by the control panel.
E-Stop	Illuminated mushroom push/pull	Red with Yellow background	Used in immediately shutting down all equipment controlled by the control panel. Illuminates when button is pushed (active) and extinguishes when the button is pulled (deactivated.)
E-Stop Actuated	Extended pilot light	Red	Solid when any E-Stop device associated with the control panel has been actuated. Flashes at every 0.5 second intervals when a fault in the e-stop circuit has been detected. Flashes at 1 second intervals while VFDs are powering up after resetting of an E-Stop condition. Flashes at 2 second intervals when an interlocking panel E-Stop is active/activated.
Jam Restart	Flush illuminated pushbutton	White	Illuminates when a local jam condition been detected within the control panels area of control. Flashes at 2 second intervals to indicate a Motion (Encoder/PPI) fault been detected.

			Press to reset and restart local Jam or Motion Fault, after clearing Jam/Motion fault condition.
Motor Fault	Flush illuminated pushbutton	Amber	Illuminates when any Motor, Motor Controller (VFD), or Disconnect fault been detected within the control panels area of control. Press to reset Motor, Motor Controller (VFD), or Disconnect fault, after clearing fault condition.
Low Air Pressure (if pneumatics is present)	Flush illuminated pushbutton	Blue	Illuminates when any air pressure fault has been detected within the panels area of control. Press to rest after restoring air pressure, then pressing Start to restart the effective areas.
Communication Fault (as required)	Flush illuminated Pushbutton	Yellow	Illuminates when: • Loss of critical communication with subsystems • Loss of communications with Amazon services • Communication buffers >95% utilized
Heartbeat (as required)	Flush pilot light	Green	Flashes at a predefined rate to indicate internal critical process or subsystem interface active. Illuminate solid when process or interface is faulted (non-active).

Table 6. Control Panel Pushbuttons

Name	Type	Color	Function
Divert Enable / Disable	Flush illuminated pushbutton	Green	**Initial Press** – Enables the Flats Sorter divert location (provide Gaylord is detected present and not full). Illuminates solid to indicate divert is enabled. **Second Press** – Disables the Flats Sorter divert location. Flashes (at 2 second on/off intervals) to indicate when the Flats Sorter completed diverting to the location and has disabled further diverts to the location.

Table 7. Divert Control Station

Name	Type	Color	Function
Start	Flush illuminated pushbutton	Green	Used in starting local conveyors/area, and in resetting local faults/estops. Illuminated to indicate running state, or flashing when equipment is in energy management mode
Stop	Extended pushbutton	Red	Used to stop local conveyors/area.
E-Stop (optional)	Illuminated mushroom push/pull	Red with Yellow background	Illuminates when active
Jam Restart (optional)	Flush illuminated pushbutton	White	Illuminates when a local jam condition has been detected within the control stations area of control Press to reset and restart after clearing a local Jam fault

Table 8. Start/Stop Station

Conveyor	Speed (FPM)
ULGL1-3	80
ULGL2-3	80
ULGL3-3	80
PS1-1	80
PS1-2	150
PS1-3	150
PS1-5	150
PS1-7	150
PS1-8	250
PS1-9	250
PS1-10	250
RE1-2	150
RE1-3	150
RE1-4	150
RE2-1	200
RE2-3	200
RE2-5	250
RE2-7	250
RE2-9	250
PRS1-1	150
PRS1-3	150
PRS1-9	120
RO1-1	150
RO1-2	150
RO1-3	120
RO2-1	150
RO2-2	150

Conveyor	Speed (FPM)
RO2-3	150
RO2-5	150
RO3-1	150
RO3-2	150
RO3-4	150
RO4-1	150
RO4-2	150
RO4-3	150
RO4-4	150

Table 9. Conveyor Speeds

9.0 References

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