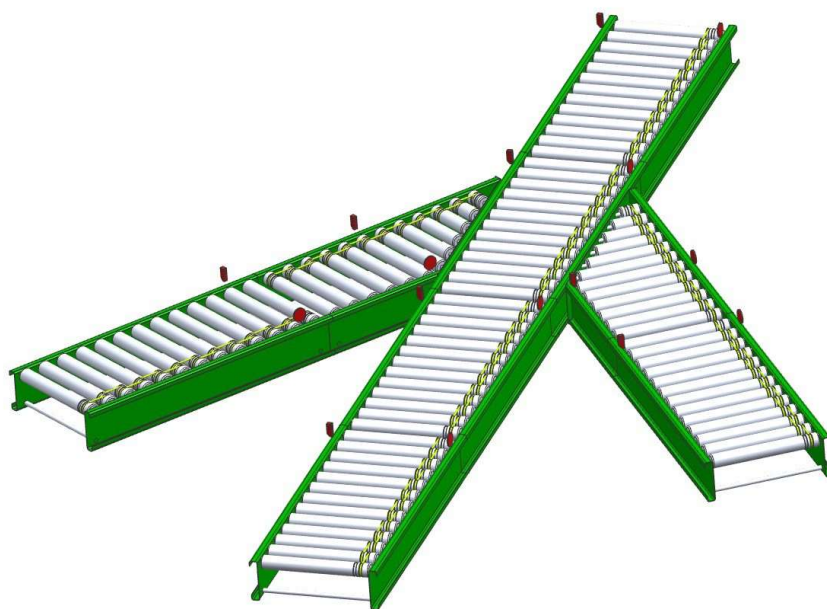


ConveyMerge User's Guide

Version 1.1

April 2020



Publication ERSC-1020

ConveyLinX module firmware and functionality is protected by U.S. and international patents. For complete patent information visit www.pulseroller.com/patents

SYMBOL CONVENTIONS



This symbol indicates that special attention should be paid in order to ensure correct use as well as to avoid danger, incorrect application of product, or potential for unexpected results



This symbol indicates important directions, notes, or other useful information for the proper use of the products and software described herein.

IMPORTANT USER INFORMATION

ConveyLinx ERSC modules contain ESD (Electrostatic Discharge) sensitive parts and components. Static control precautions are required when installing, testing, servicing or replacing these modules. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference any applicable ESD protection handbook. Basic guidelines are:



- Touch a grounded object to discharge potential static
- Wear an approved grounding wrist strap
- Do not touch connectors or pins on component boards
- Do not touch circuit components inside the equipment
- Use a static-safe workstation, if available
- Store the equipment in appropriate static-safe packaging when not in use



Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes, and standards

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Insight Automation Inc. does not assume responsibility or liability (to include intellectual property liability) for actual use based on the examples shown in this publication



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SUMMARY OF CHANGES

The following table summarizes the changes and updates made to this document since the last revision

Revision	Date	Change / Update
1.0	April 2016	Initial Release
1.1	April 2020	Updated Publication Number

GLOBAL CONTACT INFORMATION



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INTRODUCTION TO CONVEYMERGE

ConveyMerge is an optional functionality layer built on top of ConveyLinx's ZPA logic. Users can enable and configure it using *EasyRoll* software. *ConveyMerge* behaves the same as ZPA logic, but allows the engineer to define a special *Merging Zone* that can have up to three upstream zones connecting to it where ZPA logic only supports a single upstream zone. *ConveyMerge* also has a simple priority schemes for the multiple upstream zones as well as the ability to dynamically change those priorities on-the-fly by utilizing the *Merge Line Full* option. It also takes care of passing tracking information properly and has Jam condition detection.

CONVEYMERGE COMPONENTS

ConveyMerge can accommodate product merge control from one or two conveyor paths onto a single take-away conveyor path as shown in Figure 1.

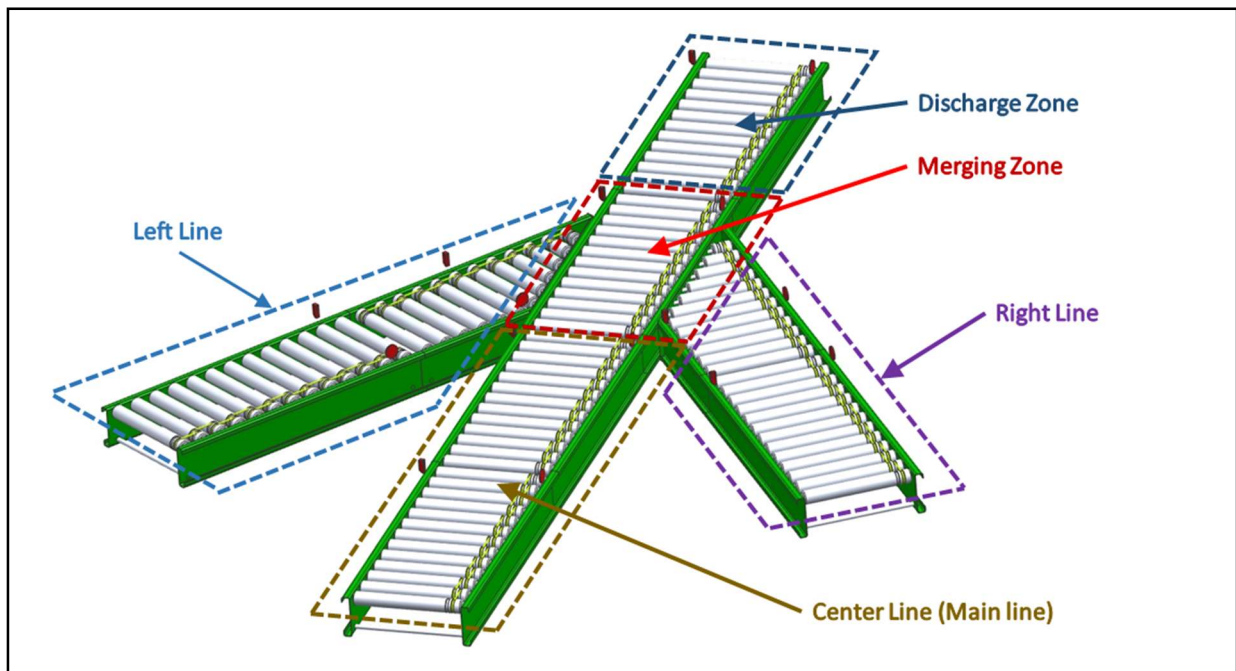


FIGURE 1 – TYPICAL CONVEYMERGE COMPONENTS

The following table identifies and defines these typical components.

<i>Component</i>	<i>Description</i>
Merging Zone	Powered conveyor section that accepts an item from any one of the 3 possible upstream sources
Main Line	Term to describe the 3 in-line conveyor sections - <i>Center Line</i> , <i>Merging Zone</i> and <i>Discharge Zone</i>
Center Line	Part of <i>Main Line</i> that is one of three possible sources of items that can flow into the <i>Merging Zone</i> . This term is used in the configuration screen of <i>EasyRoll</i> to designate the network that serves as the trunk line that contains the <i>Merging Zone</i> .
Discharge Zone	Part of the <i>Main Line</i> that is downstream of the <i>Merging Zone</i> . This conveyor section accepts the item from the <i>Merging Zone</i> .
Left Line	One of the three possible conveyor sections that can discharge items into the <i>Merging Zone</i> .
Right Line	One of the three possible conveyor sections that can discharge items into the <i>Merging Zone</i> .

CONVEYMERGE PREREQUISITES AND REQUIEMENTS

The following items are the prerequisites and constraints required to provide a fully functioning automatic conveyor merge:

- *EasyRoll* version 4.3 or greater
- *ConveyLinx* Firmware version 4.25 or greater
- Only (1) one *Merging Zone* is allowed for any given single ERSC module
- *Merging Zone* cannot have any Extension (slaved) zone
- All ERSC modules controlling *Merging Zone*, Left Line Discharge, Right Line Discharge, and Center Line discharge must be in ZPA mode
- Left, Right, and Center Lines discharges cannot also be included in another instance of *ConveyMerge*.



Please refer to Insight Automation publication *ConveyLinx User's Guide for ConveyLinx ERSC module hardware details and basic function*. The remaining sections of this document assumes reader if familiar with *ConveyLinx ERSC module* and *EasyRoll* software operation.

SETTING UP YOUR CONVEYOR

NETWORK ARCHITECTURE

All lines (*Main*, *Left*, and *Right*) must be on separate subnets of modules, as shown in Figure 2. Each subnet should be Auto-Configured separately and then connected together with an Ethernet switch. Keep in mind that the separate subnets will have to be able to communicate with each other so special care must be taken when setting up the IP Network Mask before performing the Auto- Configuration Procedure. A good starting point is the default mask of 255.255.128.0. With this setting you can vary the third octet in the ranges 0-127 and 128-254 and all three lines will be able to communicate with each other as long as the third octets of their IP addresses are in the same range (either 0-127 or 128-254).

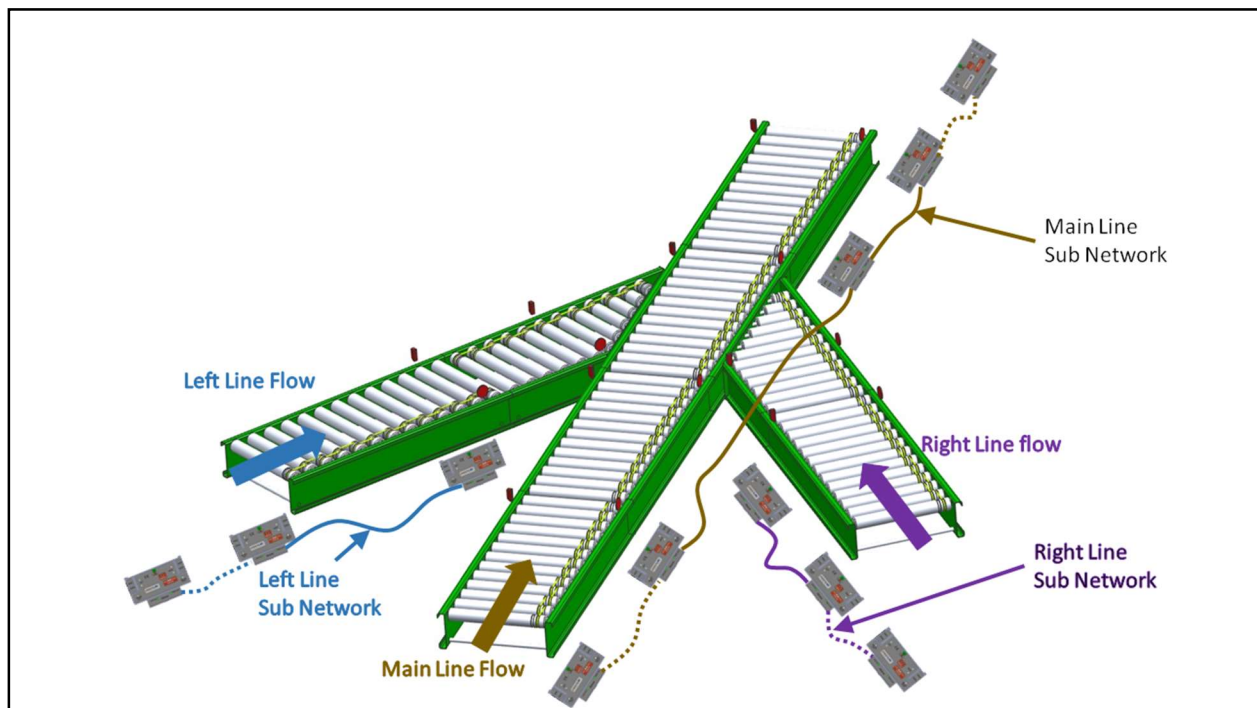


FIGURE 2 - TYPICAL SUBNET ARRANGEMENT

For example, using the default mask of 255.255.128.0 you may setup the Main Line to be in the 192.168.1.XXX subnet, the Left Line in the 192.168.2.XXX subnet, and the Right Line in the 192.168.3.XXX subnet.

ARCHITECTURE SUMMARY

- The *Main Line* is a separate subnet of modules that have been Auto-Configured. The *Merging Zone* and the *Discharge Zone* are part of this subnet. The *Main Line* can consist of any number of *ERSC* modules and the actual position of the *Merging Zone* can be on any *ERSC* within the subnet.
- The *Discharge Zone* has to be the zone immediately downstream of the *Merging Zone*. However, the *Discharge Zone* can be on either the same *ERSC* as the *Merging Zone* or on the adjacent downstream *ERSC* from the *Merging Zone's ERSC*.

- The *Left Line* is a separate subnet of ERSC modules and its most downstream zone has to physically discharge on to the *Merging Zone*.
- The *Right Line* is a separate subnet of ERSC modules and its most downstream zone has to physically discharge on to the *Merging Zone*.
- All three subnets must be connected to a common Ethernet switch only after each subnet has been Auto-Configured.

SENSOR PLACEMENT



It is very important for the internal *ConveyMerge* logic, that the product is seen by only one photo-eye at a time.

STANDARD MERGE SENSOR PLACEMENT

Figure 3 shows a suggested sensor arrangement for Standard Left Line and Right Line arrangement to flow into the *Merging Zone*.

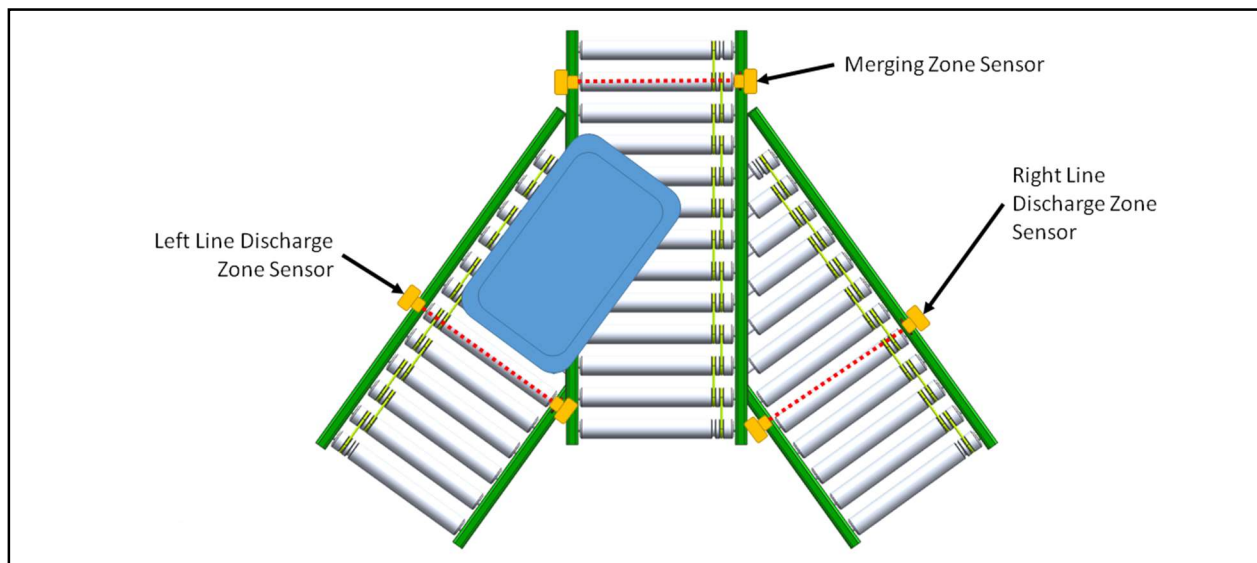


FIGURE 3 - SENSOR PLACEMENT FOR STANDARD MERGE

90° MERGE SENSOR PLACEMENT

Figure 4 shows a suggested sensor arrangement for a 90° Merge (also called “T-Merge”) for both a Left Line and a Right Line merge to the *Merging Zone*.

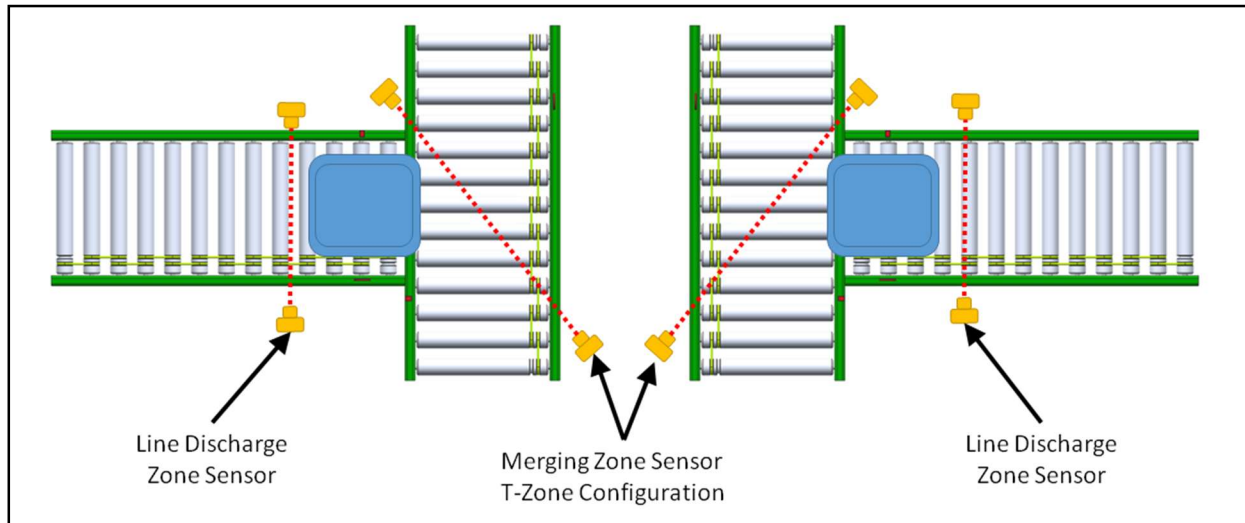


FIGURE 4 - 90° MERGE SENSOR PLACEMENT

MODULE LOGICAL CONNECTIONS FOR MAIN LINE

Depending on the physical arrangement of actual zones on the *Main Line*, the *Merging Zone* can be assigned to either the Upstream or Downstream zone of its particular *ERSC*. This section illustrates some examples.

MERGING ZONE ON UPSTREAM ZONE

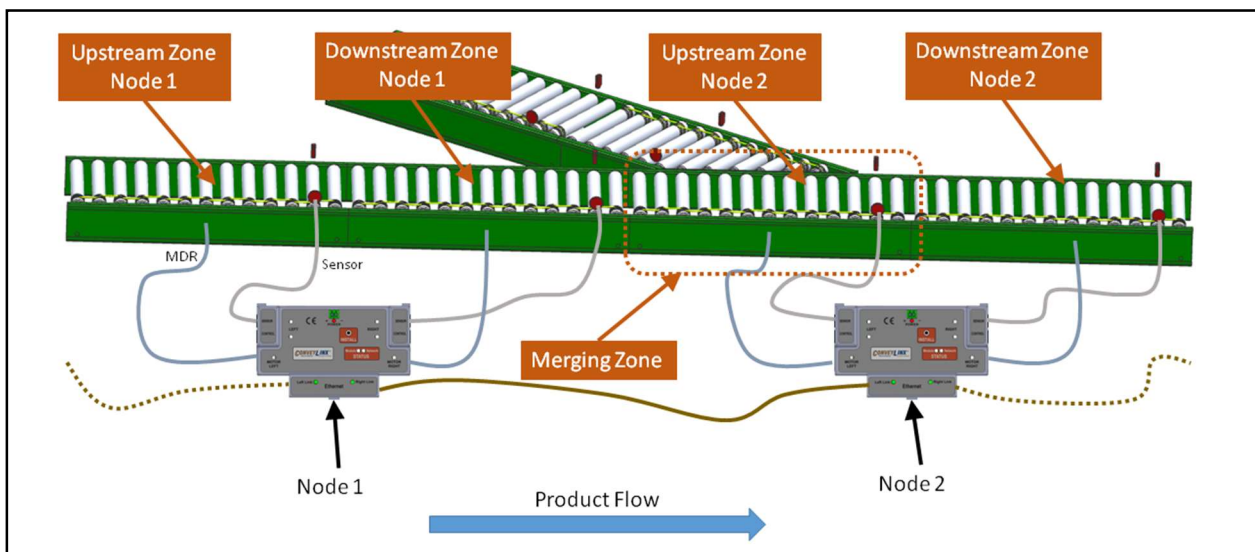


FIGURE 5 - MERGE ZONE ON UPSTREAM ZONE OF LOCAL ERSC

MERGING ZONE ON DOWNSTREAM ZONE

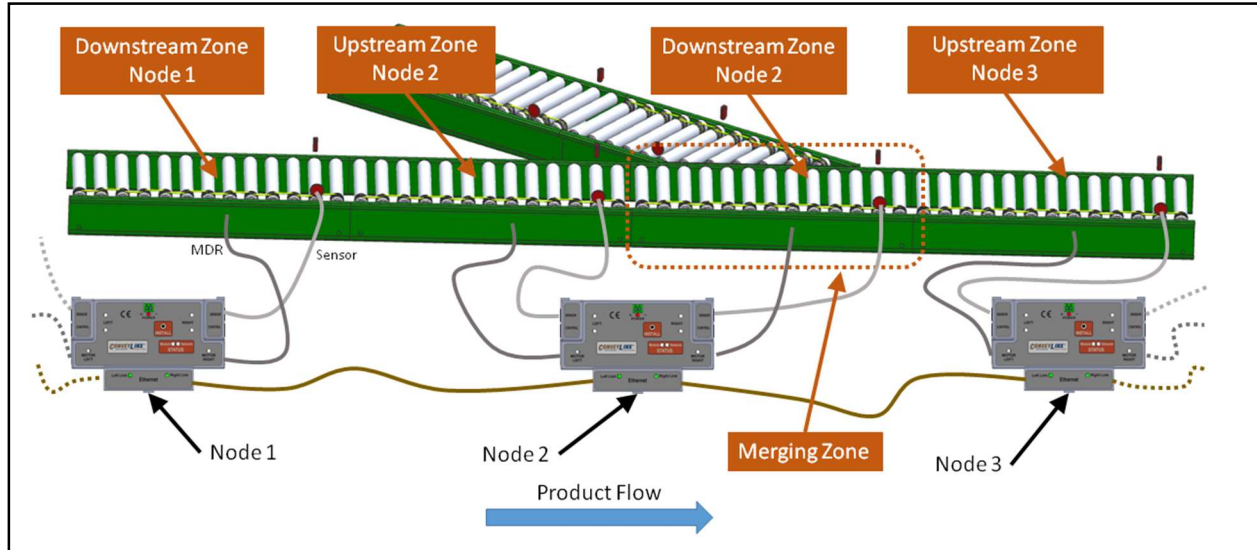


FIGURE 6 - MERGE ZONE ON DOWNSTREAM ZONE OF LOCAL ERSC

SINGLE ZONE ERSC

Whenever an ERSC has been Auto-Configured as a single zone; regardless of whether the single zone is connected to the right side or left side of the ERSC, the logical designation for the zone on the ERSC is always the Upstream Zone. Figure 7 and Figure 8 each show an example of a single zone ERSC using the left and right sides of the module respectively.

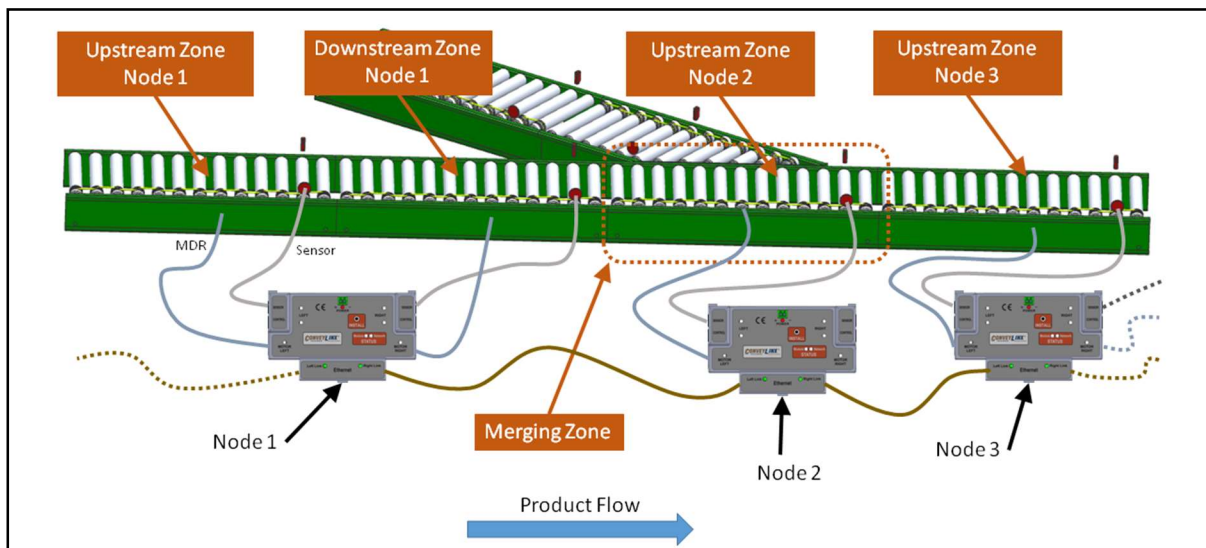


FIGURE 7 – SINGLE ZONE ERSC ON LEFT SIDE OF MODULE

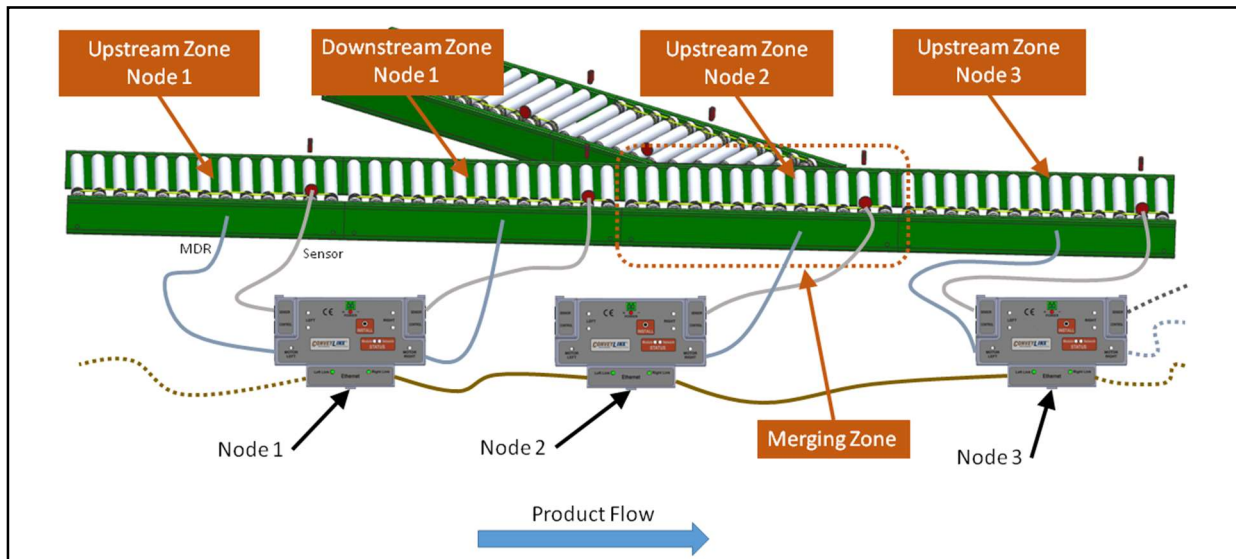


FIGURE 8 – SINGLE ZONE ERSC ON RIGHT SIDE OF MODULE

MERGING LINES

The *Left Line* and *Right Line* are set up in a similar fashion. Each of these lines are in their own separate subnet that is both different from each other and different from the *Main Line*. Regardless of whether these merging lines are an Standard arrangement or a 90° arrangement; the conveyor zone that discharges product onto the *Merging Zone* must be the most downstream zone of its particular subnet. Figure 9 and Figure 10 illustrate this for an Standard *Left Line* and a 90° *Left Line* respectively. The same would apply if these were *Right Line* examples as well.

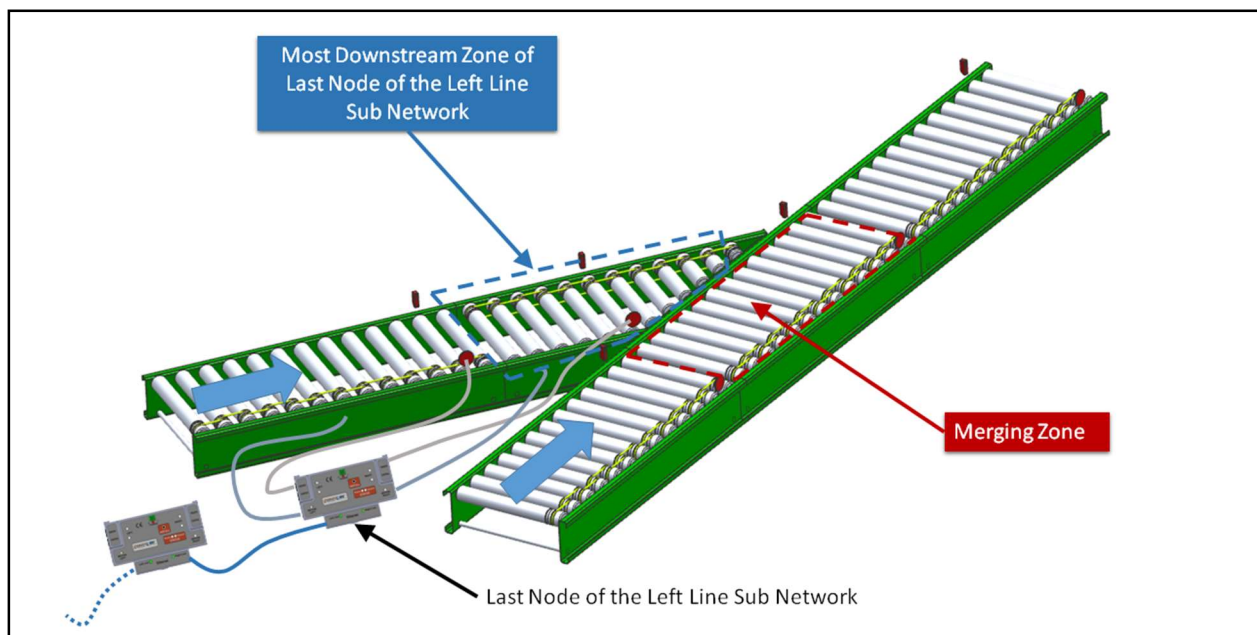


FIGURE 9 - STANDARD LEFT MERGE LINE DOWNSTREAM MODULE

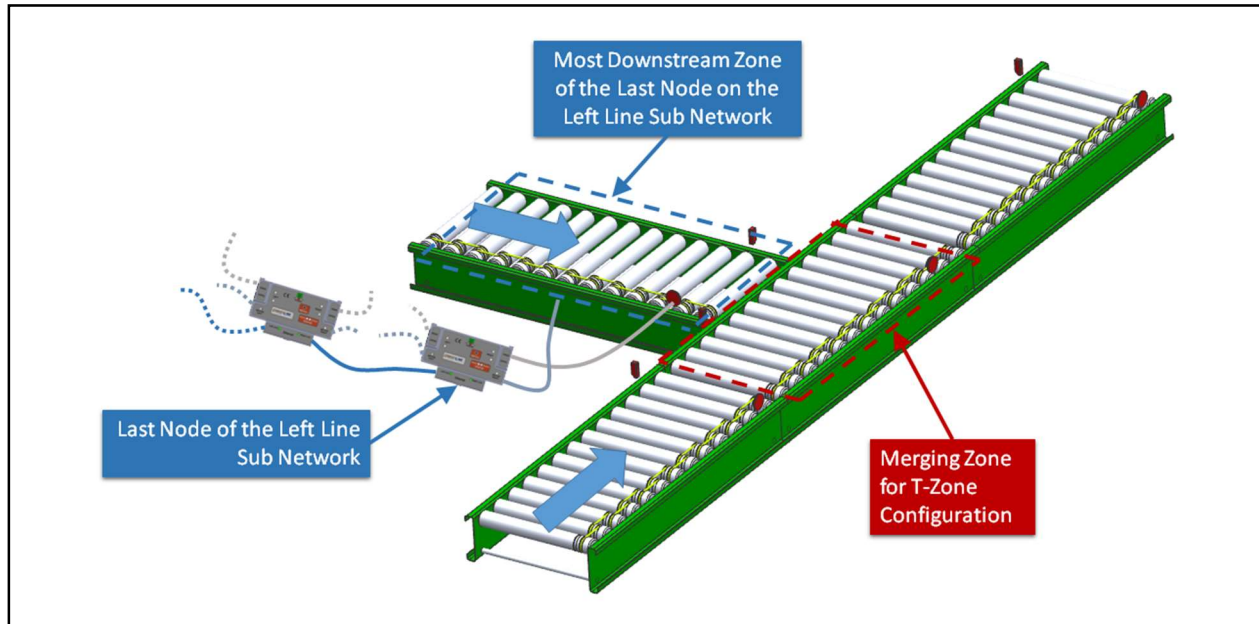


FIGURE 10 - 90° LEFT MERGE LINE DOWNSTREAM MODULE

MERGING FUNCTIONALITY

Previous sections have shown arrangements and connections assuming a “full function” merge from both the left and right sides of the *Main Line*. However, *ConveyMerge* allows for many options in arrangement and configuration, all of which are configurable in *EasyRoll*.

MERGE TYPES

With *EasyRoll*, the basic selections for configuring *ConveyMerge* are:

- Identify the *Merging Zone*
- Select whether to use a Left Line Only, Right Line Only, or Both
- Identify the discharge module(s) address and zone (upstream or downstream)
- Optionally choose an upstream module and zone on any or all of the three lines as a trigger zone to dynamically change release priority

MERGE PRIORITY

EasyRoll provides the ability to adjust which of the merging lines receives priority. The following chart outlines these choices:

EasyRoll Priority Selection	Description
First Come First Served	The logic monitors the arrival status in each of the zones that discharge in to the <i>Merge Zone</i> . The first product that arrives at any of these lines will be allowed to convey into the <i>Merge Zone</i> . When the <i>Merge Zone</i> is clear, the next line that has had a product arrive will be allowed to convey into the <i>Merge Zone</i> .
Center Line Priority	The <i>Center Line</i> will be allowed to release as long as product arrives at the center line zone sensor prior to the previously released product having not cleared the <i>Merge Zone</i> . When the <i>Merging Zone</i> is clear and if there is no product sensed on the center line zone; then the <i>Left</i> and/or <i>Right Lines</i> will be allowed to release if product has arrived at their respective sensors. As long as no product is arriving on the <i>Center Line</i> , if <i>Left</i> and <i>Right Lines</i> are enabled, these will operate as First Come First Served between them.
Left Line Priority	The <i>Left Line</i> will be allowed to release as long as product arrives at the <i>Left Line's</i> most downstream sensor prior to the previously released product having not cleared the <i>Merge Zone</i> . When the <i>Merging Zone</i> is clear and if there is no product sensed on the <i>Left Line's</i> most downstream sensor; then the <i>Center</i> and/or <i>Right Lines</i> will be allowed to release if product has arrived at their respective sensors. As long as no product is arriving on the <i>Left Line</i> , if the <i>Right Line</i> is enabled, the <i>Center</i> and <i>Right</i> will operate as First Come First Served between them.

<i>EasyRoll Priority Selection</i>	<i>Description</i>
Right Line Priority	The <i>Right Line</i> will be allowed to release as long as product arrives at the <i>Right Line's</i> most downstream sensor prior to the previously released product having not cleared the <i>Merge Zone</i> . When the <i>Merging Zone</i> is clear and if there is no product sensed on the <i>Right Line's</i> most downstream sensor; then the <i>Center</i> and/or <i>Left Lines</i> will be allowed to release if product has arrived at their respective sensors. As long as no product is arriving on the <i>Right Line</i> , if the <i>Left Line</i> is enabled, the <i>Center</i> and <i>Left</i> will operate as First Come First Served between them.

90° MERGE SETTING (T-MERGE)

For a T-Merge, the discharging conveyor is arranged perpendicular to the *Merge Zone* and this discharging conveyor needs to “throw” the product across the *Merge Zone's* rollers. In order to mitigate carton alignment issues, the logic controls need to make sure that it keeps the *Merge Zone's* rollers stopped until the discharging conveyor has completely finished “throwing” the product onto the *Merge Zone*. In order to accommodate various conveyor speeds and material handling situations; *EasyRoll* provides some timer adjustments to facilitate proper T-Merge functionality.

ACCEPT TIMEOUT

This timer specifies how much time the *Merge Zone* will wait after its sensor is blocked until the logic allows it's motor to run. Once the timer has expired, the *Merge Zone's* motor will be allowed to run. Keep in mind that conditions downstream of the *Merge Zone* also dictate if the motor is allowed to run. Figure 11 illustrates how the Accept Timeout operates.

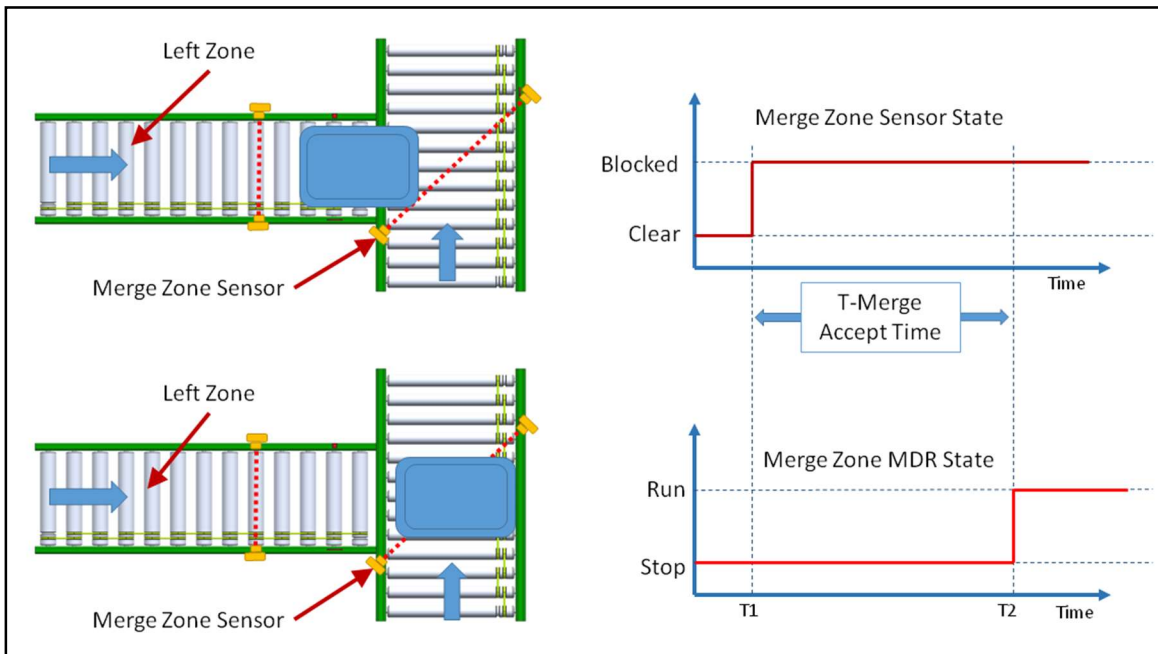


FIGURE 11 - ACCEPT TIMEOUT EXAMPLE

SEND TIMEOUT

This timer specifies how much time the discharging zone has to wait after the *Merge Zone* sensor is clear before it is allowed to release the next product into the *Merge Zone*. This timer helps ensure that the *Merge Zone* is clear when sensor placement cannot guarantee that the zone is clear.

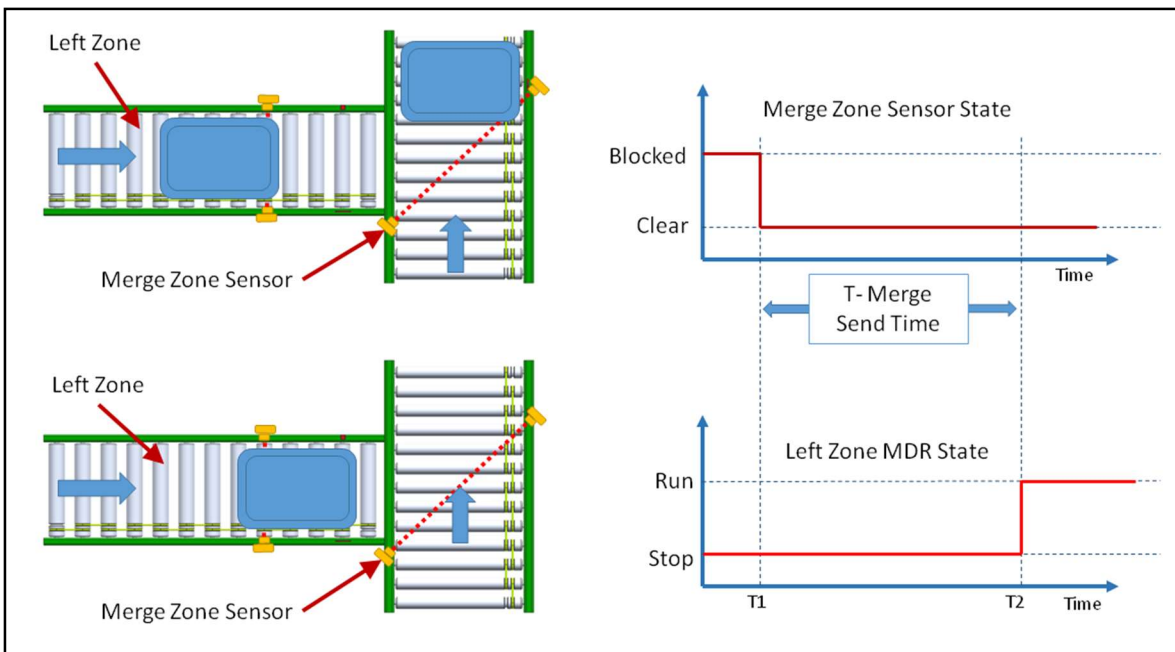


FIGURE 12 - SEND TIMEOUT EXAMPLE

CONFIGURING DYNAMIC PRIORITY (MERGE LINE FULL)

In situations where the full status of a given merge line needs to determine merge priority, *ConveyMerge* provides the ability to monitor the status of one or all merging lines and base the release priority accordingly. *EasyRoll* provides the option to select a given upstream zone on a given line and the *Monitor Zone*. When the *Monitor Zone* becomes occupied for a given time value; its line will be given release priority into the *Merge Zone*. There are two adjustable time values for this function:

<i>EasyRoll Selection</i>	<i>Description</i>
Block Timeout	Specified the amount of time the <i>Monitor Zone</i> must be occupied before the <i>Monitor Zone's</i> line will receive priority to release into the <i>Merge Zone</i> . This timer starts when the <i>Monitor Zone</i> first becomes accumulated (sensor blocked and motor stopped) and continues to time as long as the <i>Monitor Zone</i> stays accumulated.
Clear Timeout	Specified amount of time that the priority release will continue to be active once the priority release has begun. When this time value expires, the priority setting will return to its original <i>EasyRoll</i> configured setting.



If multiple lines are configured for Dynamic Priority and each of their respective Block Timers have expired; *ConveyMerge* logic will revert to the First Come First Serve release mode until one or more of the releasing lines' Clear Timer has expired.

DYNAMIC PRIORITY EXAMPLE

Please refer to Figure 13 for this example. In *EasyRoll*, Node 2 upstream zone of the Central Line has been selected as the *Merge Zone* and the merge type is *Up Left*. The *EasyRoll* setting for priority is *Center Line Priority*. Also in *EasyRoll*, the Merge Line Full function has been enabled as assigned to Node 3 downstream zone of the Left Line.

As shown in Figure 13, assuming we did not enable the Merge Line Full function for the Left Line; if there is a steady flow of product on the central line; the Left Line will never be able to release because the central line was set as the default line for priority in *EasyRoll*. Now, with the Merge Line Full feature enabled on the Left Line; once Left Line Node 3 downstream zone remains accumulated for the *Block Timer's* timeout; priority will dynamically change to the Left Line. This Left Line priority will remain in effect until the *Clear Timer's* timeout has expired. When this occurs, the priority will automatically revert to the *EasyRoll* configured priority (center line in this example). Figure 14 illustrates the *Clear Timeout* function.

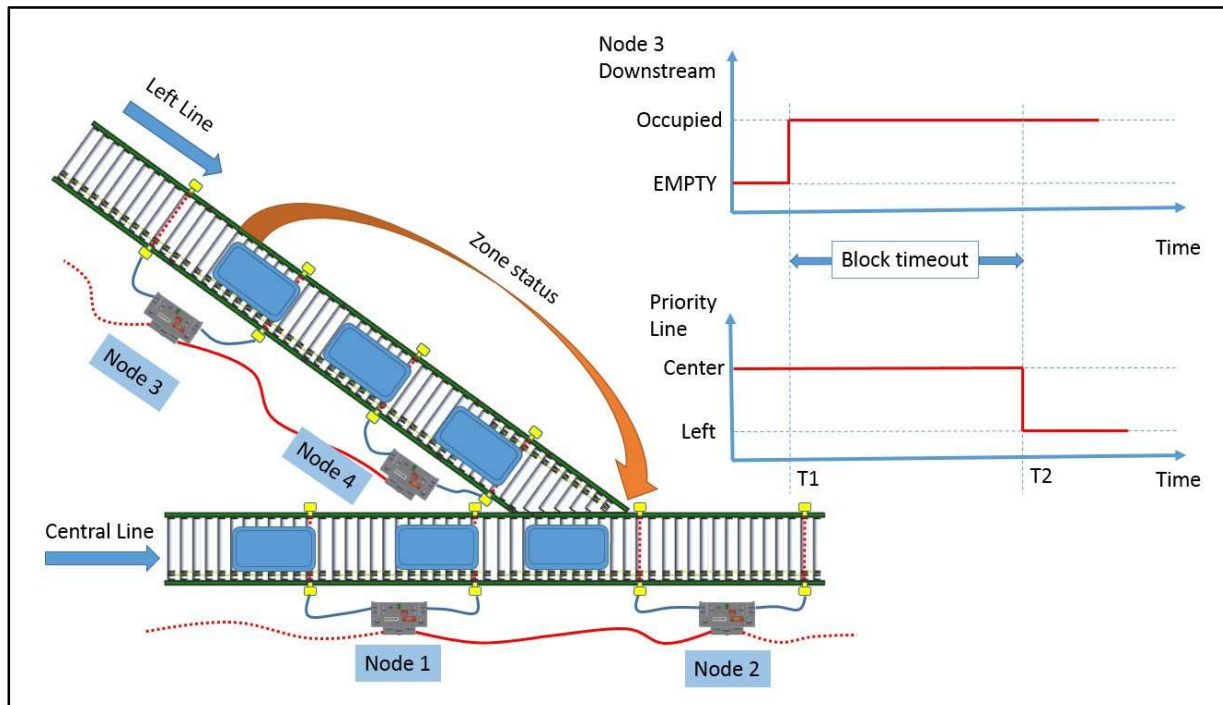


FIGURE 13 - MERGE LINE FULL PRIORITY EXAMPLE - BLOCK TIMER

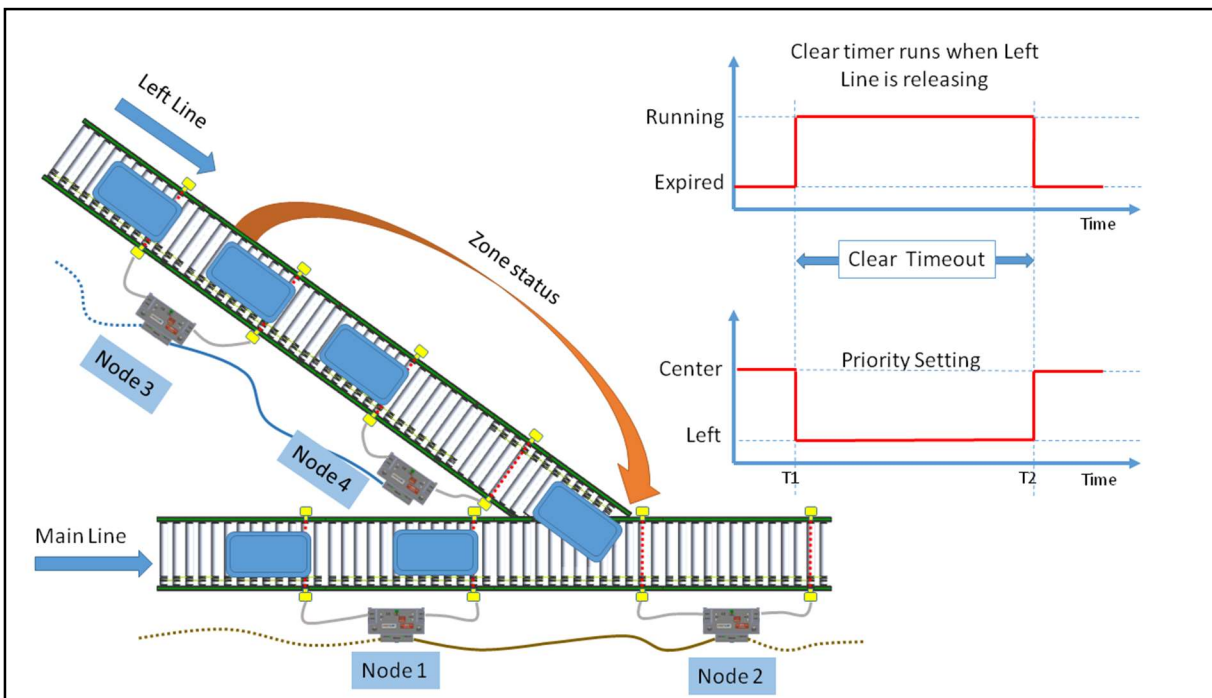


FIGURE 14 - MERGE LINE FULL PRIORITY EXAMPLE - CLEAR TIMER

USING *EASYROLL* WITH *CONVEYMERGE*

- Open *EasyRoll*
- Connect to the ERSC that will control the *Merge Zone*. See indicated area in Figure 15
- Press CTRL+SHIFT+M to open the *ConveyMerge* Configuration Screen

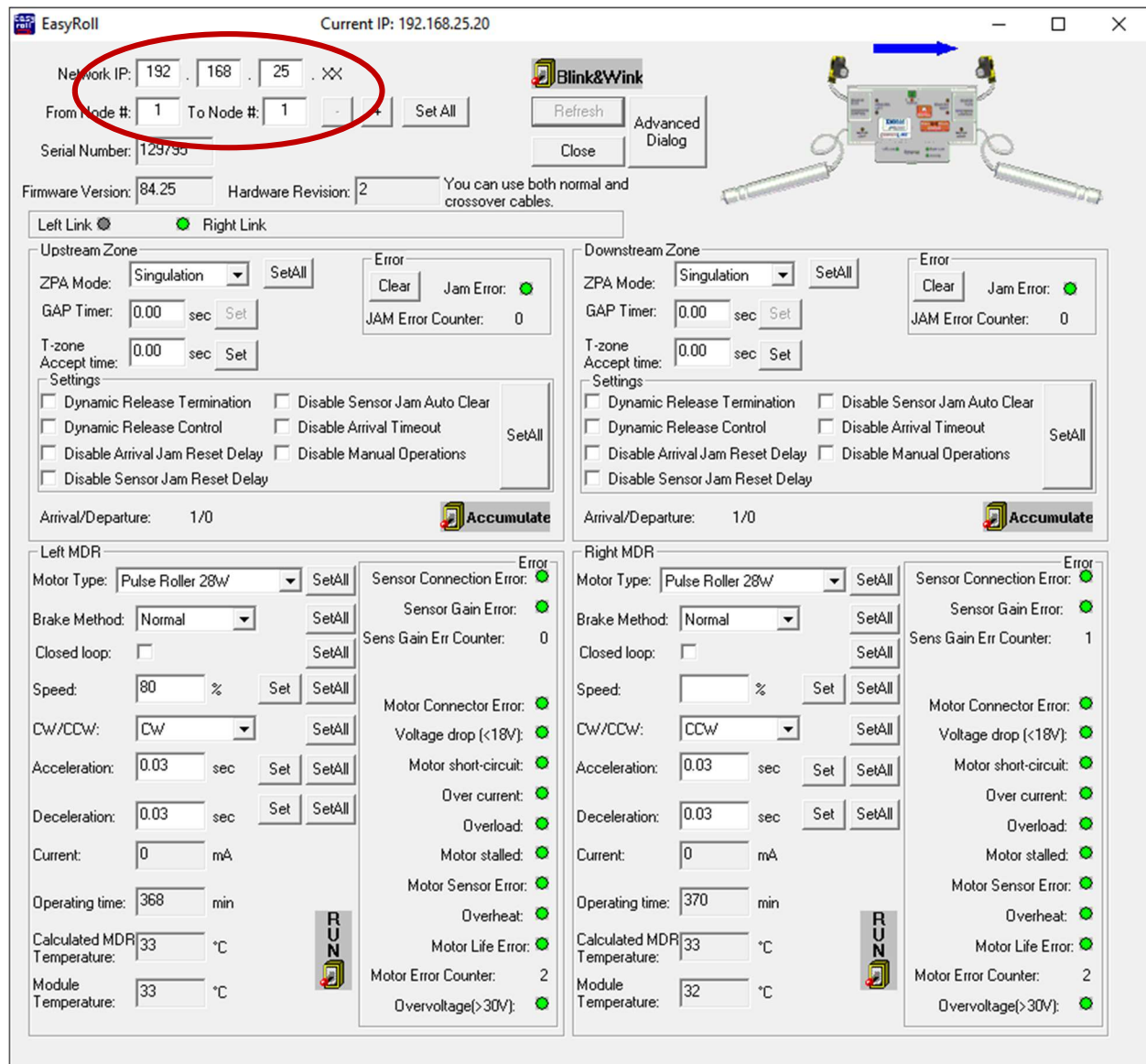


FIGURE 15 - EASYROLL MAIN SCREEN

CONVEYMERGE CONFIGURATION SCREEN

The screenshot displays the 'ConveyMerge' configuration window. It features three main sections for lane configuration: 'Left Lane', 'Center Lane', and 'Right Lane'. Each section includes fields for IP addresses (e.g., 192.168.24.31 for Left, 192.168.25.20 for Center, 192.168.26.58 for Right) and radio buttons for 'Conventional' or 'T-Merge' settings. A 'Lane Full' checkbox is present in each lane section. The 'Center Lane' section also includes a 'Merge Zone on:' dropdown (Upstream/Downstream), a 'Merge from:' dropdown (Both, Left, Right), and a 'Priority:' dropdown (First Come, First Served). A central diagram shows a 3D perspective of the conveyor merge system with a central lane merging into two side lanes. To the right of the diagram are two timer sections: 'Lane Full Timers' with 'Block' (5.00 sec) and 'Release' (5.00 sec) settings, and 'T-Merge Timers' with 'Accepting' (3.00 sec) and 'Sending' (0.00 sec) settings. At the bottom right are 'Apply' and 'Cancel' buttons. Numbered callouts (1-17) point to various UI elements: 1 points to the 'Browse Nodes' button; 2 points to the 'Merge from:' dropdown; 3 points to the 'Priority:' dropdown; 4 points to the IP address field in the Center Lane; 5 points to the 'Apply' button; 6 points to the 'Cancel' button; 7 points to the IP address field in the Left Lane; 8 points to the 'Lane Full' checkbox; 9 points to the IP address field in the Left Lane; 10 points to the 'Upstream Zone' radio button; 11 points to the IP address field in the Right Lane; 12 points to the 'Conventional' radio button; 13 points to the central conveyor diagram; 14 points to the 'Block' timer value; 15 points to the 'Release' timer value; 16 points to the 'Accepting' timer value; and 17 points to the 'Sending' timer value.

FIGURE 16 - CONVEYMERGE CONFIGURATION SCREEN

Item	Description
1	Browse Nodes
2	Drop down selector for Merge Type – from Left, Right, or Both
3	Drop down selector for Merge Priority
4	Display of IP Address for the ERSC selected for the Merge Zone
5	User button to click to apply changes made during configuration

<i>Item</i>	<i>Description</i>
6	User button to click to Cancel and exit the <i>ConveyMerge</i> Configuration Screen
7	IP Address of Left Line's most downstream ERSC
8	User checkbox to enable the Merge Line Full function
9	IP Address of the ERSC that contains the zone being defined as the <i>Monitor Zone</i> for the <i>Merge Line Full</i> function
10	Radio buttons to select whether the upstream or downstream zone of the ERSC identified in Item 9 will be used as the <i>Monitor Zone</i> .
11	IP Address of Right Line's most downstream ERSC
12	User checkbox to select T-Merge type
13	Graphical representation of the merge. Please note this will update and change as settings and configuration is modified.
14	Merge Line Full Block Timer preset value
15	Merge Line Full Clear Timer preset value
16	T-Merge Accept Timer preset value
17	T-Merge Send Timer preset value

STANDARD MERGE EXAMPLE

Figure 17 depicts a standard Standard spur merge example with a single merge line on the left. In the example, we wish to set the Merge Priority to First Come First Served.

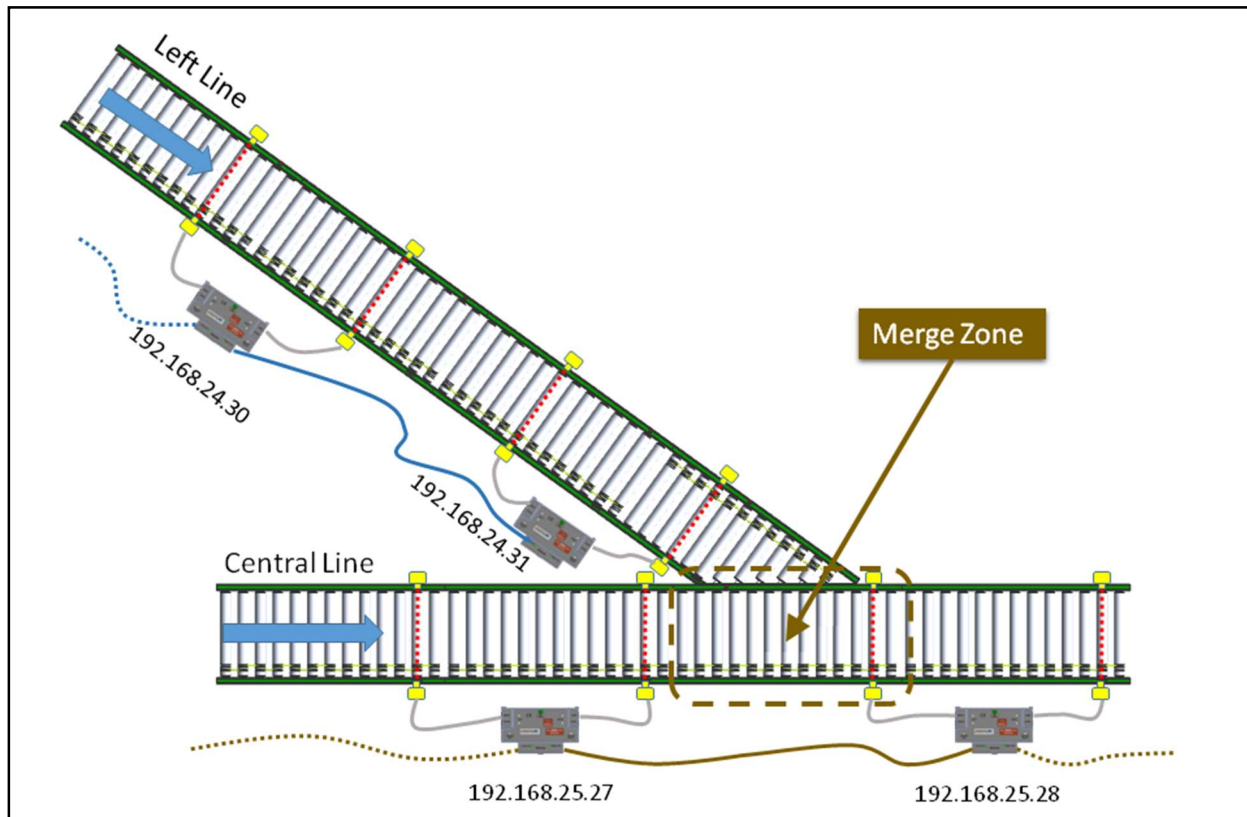


FIGURE 17 - STANDARD MERGE EXAMPLE

The *Merge Zone* is the upstream zone of the module at 192.168.25.28 and the most downstream ERSC for the *Left Line* is at 192.168.24.31. Figure 18 shows the *ConveyMerge* Configuration screen with these values entered.

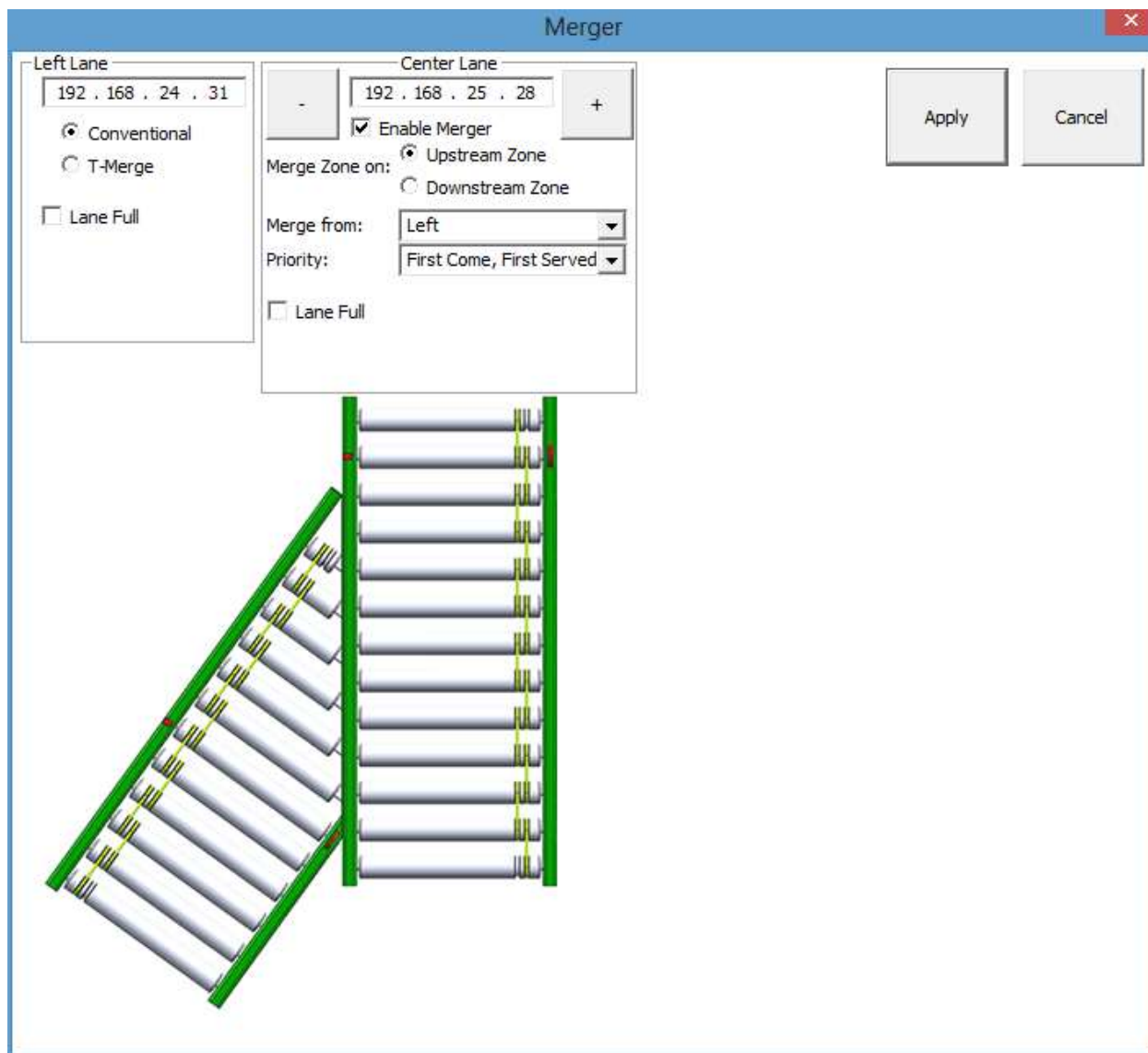


FIGURE 18 - CONVEYMERGE SCREEN FOR STANDARD MERGE EXAMPLE

The last step for configuration is to click the “Apply” button.



Please note that after clicking the “Apply” button, if the configuration has changed, the affected modules will reboot. It will take a few seconds for the reboot to finish and some of all of the affected zones may briefly run their motors.

T-MERGE EXAMPLE

Figure 19 depicts a T-Merge line on the right. In the example, we wish to set the Merge Priority to First Come First Served.

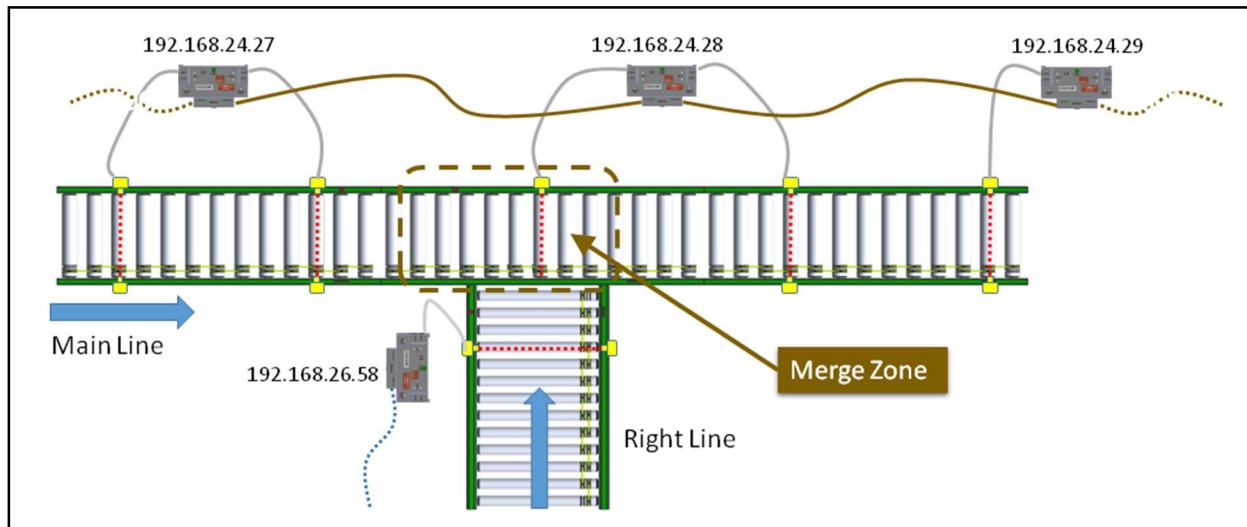


FIGURE 19 - T-MERGE EXAMPLE

The *Merge Zone* is the upstream zone of the module at 192.168.24.28 and the most downstream ERSC for the *Right Line* is at 192.168.26.58. Figure 20 shows the *ConveyMerge* Configuration screen with these values entered.

✕
Merger

Center Lane

-
192 . 168 . 25 . 28
+

☒ Enable Merger

Merge Zone on:
☒ Upstream Zone
☐ Downstream Zone

Merge from: Right

Priority: First Come, First Served

☐ Lane Full

Right Lane

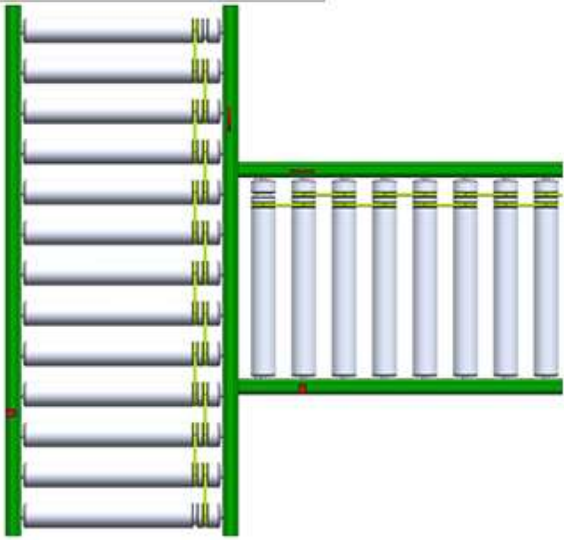
192 . 168 . 26 . 58

☐ Conventional
☒ T-Merge

☐ Lane Full

Apply

Cancel



T-Merge Timers

Accepting 3.00 , sec

Sending , sec

FIGURE 20 - CONVEYMERGE SCREEN FOR T-MERGE EXAMPLE

MERGE WITH MERGE LINE FULL EXAMPLE

Figure 21 shows an example of a Left Line merge with the Merge Line Full function.

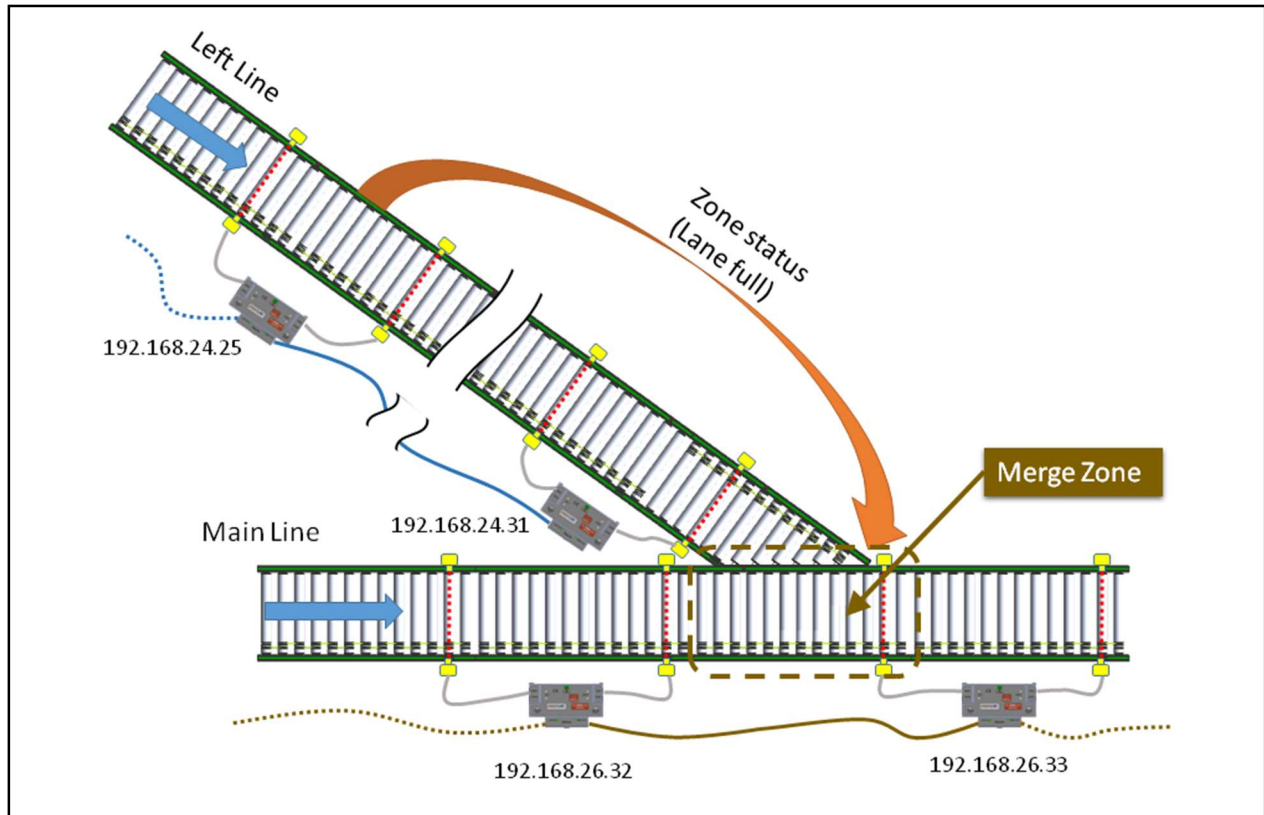


FIGURE 21 - MERGE LINE FULL EXAMPLE

The *Merge Zone* is the upstream zone of ERSC 192.168.26.33 and the merge line's most downstream node is 192.168.24.31 and we want this line to have the Merge Line Full function enabled. On the merge line (Left Line), we would like for the upstream zone of ERSC 192.168.24.25 to be the Merge Line Full function's *Monitor Zone*. We would also like that once the *Monitor Zone* has been accumulated (or blocked) for 5 seconds, we want the Left Line to release for 5 seconds and then return the priority to the Center Line. Figure 22 shows the *ConveyMerge* Configuration Screen with the values entered for this example.

FIGURE 22 - CONVEYMERGE CONFIGURATION SCREEN FOR MERGE LINE FULL EXAMPLE

NOTES:



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