<table>
<thead>
<tr>
<th><strong>GLOSSARY OF TERMS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ConveyLinx</strong></td>
</tr>
<tr>
<td><strong>CNIP</strong></td>
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<tr>
<td><strong>ERSC</strong></td>
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<td><strong>Ethernet I/P</strong></td>
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<td><strong>Modbus TCP</strong></td>
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<td><strong>PLC</strong></td>
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<td><strong>RJ-11 / RJ-12</strong></td>
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<tr>
<td><strong>RJ-45</strong></td>
</tr>
<tr>
<td><strong>TCP/IP</strong></td>
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**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:

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Change / Update</th>
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<tbody>
<tr>
<td>1.0</td>
<td>April 2014</td>
<td>Initial Release</td>
</tr>
</tbody>
</table>

GLOBAL CONTACT INFORMATION

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# Table of Contents

Glossary of Terms .................................................................................................................. 3
Symbol Conventions ................................................................................................................ 4
Important User Information ................................................................................................. 5
Summary of Changes .............................................................................................................. 6
Global Contact Information ................................................................................................... 6
Table of Contents ................................................................................................................... 7
Preface .................................................................................................................................... 9
  Who Should Use This Manual? ....................................................................................... 9
  Not Included in This Manual ..................................................................................... 9
What is ConveyStop? ............................................................................................................. 11
What are the benefits of ConveyStop? ................................................................................ 13
  Replaces Separate Stop Circuit ................................................................................... 13
  Detects Network Loss ................................................................................................. 13
  Provides More Reliable Recovery ................................................................................ 13
Using ConveyStop in an Integrated Stop System ............................................................... 15
  NFPA® 79 .................................................................................................................... 15
    Emergency Operations .............................................................................................. 15
    Stop Function .......................................................................................................... 16
  What Happens when you do not use ConveyStop? ..................................................... 17
  Integrator Responsibility ............................................................................................ 17
ConveyStop Software .......................................................................................................... 19
User Accounts ...................................................................................................................... 19
  Guest ............................................................................................................................. 19
  Administrator ............................................................................................................... 19
Creating a New Project ......................................................................................................... 19
Discovering Modules ............................................................................................................ 19
Creating Stop Groups ......................................................................................................... 21
  First Stop Group .......................................................................................................... 21
Adding STOP Buttons ......................................................................................................... 24
Adding START Buttons ....................................................................................................... 25
Completing Our Example .................................................................................................... 26
Commit All ............................................................................................................................ 27
Status Monitoring ............................................................................................................... 28
How ConveyStop works: ..................................................................................................... 30
  Architecture .................................................................................................................. 30
STOP Command .................................................................................................................. 31
  Issuing a STOP Command ............................................................................................ 31
  Other Stop Command Sources .................................................................................. 32
  How to Know a STOP Command is Active ............................................................... 33
ConveyLinx Functions Affected by STOP Command ......................................................... 34
ConveyLinx Function at Stop Group Boundaries ............................................................... 36
START Command .............................................................................................................. 36
  What Can Initiate a START Command .......................................................................... 36
  How to Know ConveyStop has Been Started ............................................................. 38
Performing STOP and START Commands with a PLC ..................................................... 39
ConveyStop Status Register .............................................................................................. 39
PREFACE

WHO SHOULD USE THIS MANUAL?

This manual is intended for users who need to utilize ConveyStop software and functionality to ConveyLinx Ethernet network to perform controlled stop of all motion and digital outputs for a group or groups of modules.

You should have an intermediate to advanced level of understanding of PLC logic and network structures. Familiarity with Ethernet I/P and Modbus TCP protocols is a plus.

You should have a basic understanding of electrical circuitry and familiarity with relay logic, conveyor equipment, photoelectric sensors, etc. in order to follow example scenarios and sample programs included herein. If you do not, obtain the proper training before using this product.

For basic understanding of ConveyLinx family module hardware and simple application and installation guidelines, please refer to the following Insight Automation publications:

- ConveyLinx User’s Guide (publication ERSC-1000)
- ConveyLinx Developer’s Guide (publication ERSC-1800)
- ConveyNet I/P User’s Guide (publication CNIP-1000)

NOT INCLUDED IN THIS MANUAL

Because system applications vary; this manual assumes users and application engineers have properly sized their power distribution capacity per expected motor loading and expected operational duty cycle. Please refer to conveyor equipment and/or motor roller manufacturer’s documentation for power supply sizing recommendations.
**What is ConveyStop?**

*ConveyStop* is a *ConveyLinx* function that establishes a network based means to signal all *ConveyLinx* modules with a *Stop Command* in order to **physically stop their motion and/or output functions and remain in a stopped state until a separate Start Command network signal is received** to return all connected modules back to their normal function. This is accomplished by utilizing the built-in Ethernet network that already inter-connects the *ConveyLinx* control system.

![Diagram of a single physical network with two stop groups](image)

**FIGURE 1 - SINGLE PHYSICAL NETWORK WITH 2 STOP GROUPS**

In a similar fashion to how *ConveyLinx* modules establish logical connections based upon conveyor flow; *ConveyStop*, when applied, establishes *Stop Group* connections between modules such that only modules within a given *Stop Group* are affected by STOP and START network commands. With *ConveyStop*, any given system can be segregated into as many *Stop Groups* as desired as long as all modules within a *Stop Group* are physically connected over Ethernet.
Each Stop Group is independent in that a Stop Command or Start Command occurring in one Stop Group does not affect the modules in another Stop Group even if they are on the same physical Ethernet network. In fact, modules within the same subnet that have logical conveyor flow connections can be in different Stop Groups. This means that an ERSC module in a non-stopped Stop Group will automatically detect if it is discharging into a stopped Stop Group and automatically inhibit product flow accordingly.

**What are the benefits of ConveyStop?**

**Replaces Separate Stop Circuit**

One important feature of a ConveryLinx control system with ConveyStop enabled is that local operator buttons or switches can wire directly to a nearby ERSC or CNIP module. With these locally wired devices, anyone can initiate a controlled stop of a given Stop Group without requiring a separately wired stop circuit. Depending on system size and complexity, this can result in substantial savings in both installation cost and implementation time.

**Detects Network Loss**

Another important feature of a ConveyStop enabled system is that loss of network communication and/or loss of connection to a PLC (if originally connected) will automatically cause a Stop Command to be initiated. Very often in large and/or complex network based control systems; the loss of communications is not easily detected nor does adjacent unaffected devices react in predictable ways. With ConveyStop, not only does every device stop upon communication loss, there can be information taken from the modules to help pin-point where the communication loss occurred.

**Provides More Reliable Recovery**

When any Stop Command is initiated in an ERSC module, not only is all motor commutation stopped, but the ERSC retains pertinent data on its status at the time the Stop Command was initiated. The ERSC will remember that it was discharging or accepting a package along with the packages tracking data. Upon getting a Start Command, the ERSC will pick up where it left off and attempt to finish what it was doing prior to the Stop Command.

This same scenario applies to situations when power is disconnected to all modules within a Stop Group. As part of the power loss procedure in all ERSC modules with ConveyStop enabled; certain pertinent data regarding module status and package tracking is saved to flash memory such that upon power-up and subsequent Start Command, each ERSC will attempt to complete what it was doing at the time of initial power loss.
USING **CONVEYSTOP IN AN INTEGRATED STOP SYSTEM**

The means and methods of stopping automated equipment in an integrated material handling system are governed by many factors including, but not limited to:

- Location and usage of the equipment per the application
- Operator or non-maintenance personnel access to moving equipment
- Federal, State, and/or local ordinance or code
- Accepted electrical design practice
- Customer or end user preference

With all of these variables in play; **ConveyStop** cannot claim or be advertised as a de facto “approved” stopping method for all conveyor system stopping situations including an emergency stop situation. The purpose of this section is to define a recognized standard for control system stop classifications or categories and describe how **ConveyStop** can be applied for each.

It is the responsibility of the integrator of a **ConveyLinx** equipped system utilizing **ConveyStop** to assess all of the aforementioned factors before deeming a **ConveyStop** generated Stop Command as being applicable and suited for an emergency stop situation.

**NFPA® 79**

The National Fire Protection Association (NFPA®) 79 *Electrical Standard for Industrial Machinery 2012 Edition* contains accepted definitions for stopping functionality and emergency operations that are, in general, applicable to the conveyor and material handling industry.

**EMERGENCY OPERATIONS**

NFPA® 79 section 9.2.5.4 *Emergency Operations* is as follows:

1. This section specifies the requirements for the emergency stop and the emergency switching-off functions of the emergency operations, both of which are initiated by a single human action
2. Once active operation of an emergency stop or emergency switching off actuator has ceased following a command, the effect of this command shall be sustained until it is reset. This reset shall be possible only at the location where the command has been initiated. The reset of the command shall not restart the machinery but only permit restarting.
3. It shall not be possible to restart the machinery until all emergency stop commands have been reset. It shall not be possible to re-energize the machinery until all emergency switching off commands have been reset.

**HOW **CONVEYSTOP APPLIES TO EMERGENCY OPERATIONS**

The section 9.2.5.4 Item (1) criterion is met when physical buttons or switches are assigned and enabled with **ConveyStop**. Please note that a networked PLC or PC can generate a Stop Command and as such can occur programmatically and not necessarily by “single human action”. In this case, the integrator would be responsible
for assuring that the PLC or PC based *Stop Command* is always initiated from a “single human action” integrated with said PLC or PC controls.

The section 9.2.5.4 Item (2) criterion is met when physical buttons or switches are assigned and enabled with *ConveyStop* and these devices are proper maintained contact type. As long as the button or switch is in its “emergency” position; *ConveyStop* will not issue or respond to any *Start Command* regardless of source (hard-wired button or networked PLC or PC). Also, resetting the physical device to its “non-emergency” state will not restart the modules to operation nor will this resetting of the device initiate any *Start Command*.

The section 9.2.5.4 Item (3) criterion is met in *ConveyStop* by design. If multiple physical buttons or switches are assigned and enabled with *ConveyStop*; all have to be placed into their “non-emergency” state before *ConveyStop* will issue or respond to any *Start Command* regardless of source. This is true regardless of which device first initiated the stop.

**STOP FUNCTION**

NFPA® 79 section 9.2.2 *Stop Functions* defines stop functionality as:

*Stop functions shall operate by de-energizing that relevant circuit and shall override related start functions. The reset of the stop functions shall not initiate any hazardous conditions.*

This section further defines three (3) Categories for stop functionality:

**Category 0 – An uncontrolled stop by immediately removing power to the machines actuators**

**Category 1 - A controlled stop with power to the machine actuators available to achieve the stop then remove power when the stop is achieved**

**Category 2 - A controlled stop with power left available to the machine actuators**

**CONVEYSTOP AND STOP FUNCTION DEFINITION**

In general, *ConveyStop* follows the intent of the Stop Function definition for section 9.2.2. The manner in which “de-energizing that relevant circuit” it is accomplished differs between the *ERSC* and *CNIP* modules.

**CNIP AND STOP FUNCTION**

Four of the six digital output circuits on the *CNIP* modules have their control power source internally wired to a contact relay. When a *Stop Command* is active, this relay is de-energized and control power is disconnected. In this state, the digital output circuit is de-energized regardless of the state of the logical output. This is a common stop circuit design for PLC based I/O systems.

**ERSC AND STOP FUNCTION**

In situations where a *Stop Command* is active and control power is maintained to an *ERSC*, the de-energizing of the relevant circuit is accomplished by the on board processor. The *ERSC* utilizes a single processor and this processor directly controls (among other things) the power MOSFET transistor gates that commutate the motor. When a *Stop Command* is active, the processor places all MOSFET gates in
their open or non-conductive state and then by-passes the task in the processor that produces motor commutation.

**ConveyStop and Stop Function Categories**

**Category 2**
Utilizing ConveyStop as designed and intended adheres to the criterion of Category 2. Maintaining control power to all ConveyLinx modules is desirable because they maintain their “pre stopped” state making for faster and more reliable recovery. Another added benefit of maintaining control power to all ConveyLinx modules is that the diagnostic features of both ConveyLinx and ConveyStop are available to PLC and/or PC (including the ConveyStop PC software monitoring capability) as an aid in troubleshooting and event logging.

**Category 1 and Category 0**
Both of these categories involve disconnecting power to ConveyLinx modules and either of these can be implemented on a ConveyLinx system with or without ConveyStop being enabled.

If ConveyStop is implemented, the behavior would essentially be as described in section 0 Power Loss. ERSC modules will retain their state to flash memory as power is being dropped. When power is restored; each Stop Group affected by the power disconnect will have to receive a Start Command from either an assigned and enabled button or switch or from a network source (PLC or PC).

For CNIP modules, each is equipped with separate power terminals. One set of terminals is for module logic and input bus power and the other set powers only the output bus. In a Category 1 or Category 0 system, the motion producing control power can be disconnected from the CNIP’s output bus while leaving logic and input control power on. This is a typical strategy applied to PLC I/O systems and can be implemented with CNIP modules with or without ConveyStop installed and enabled. It must be noted that this strategy requires 2 separate power systems to be field wired.

**What Happens When you Do Not Use ConveyStop?**
Operationally, ConveyStop is not required for any ConveyLinx system to function. If ConveyStop is not implemented, disconnecting power does cause all motor motion to stop for ERSC’s and all outputs to be de-energized for CNIP’s. However it is important to note that without ConveyStop enabled and when power is restored; ERSC modules will be enabled to run and if conveyor conditions dictate, motors will run and packages will begin to move with no other or separate start signal or command.

Another important note is that ConveyLinx devices are Ethernet based, and upon cycle of power, modules will individually reinitialize at different rates making exact power up behavior unpredictable.

**Integrator Responsibility**
By no means is NFPA® 79 the only specification or criteria for defining the stop function of an automated system. The NFPA® 79 is a general standard for the USA and the descriptions above are based upon general experience for US installations.
The bottom line is that it is always up to the integrator to understand and adhere to the applicable specifications, codes, and standards on a per system basis. ConveyStop can be a valuable tool to achieve desired system stop functionality, enhanced diagnostics, and lower installed cost.
CONVEYSTOP SOFTWARE

Before any ConveyStop functionality can be realized; you must first configure one or more Stop Groups on your system. In order to do this, you must have the ConveyStop Software. This section details how to:

- Install and enable the software
- Create a new Project
- Create Stop Groups
- Assign STOP Command inputs
- Assign START Command inputs
- Utilize monitoring functions

The ConveyStop PC software connects to a ConveyLinx network and shows all available ERSC and CNIP devices. From this list, the system integrator creates and populates one or more Stop Groups. Within each Stop Group, one or more ERSC’s can be configured to have either its Left or Right Control Port assigned to contain a hard-wired button or switch to issue a STOP Command. Similarly, any CNIP module can be similarly assigned a hard-wired button or switch to a specific dedicated input to issue a STOP Command. Also within each Stop Group, one or more ERSC’s can be configured to have either its Left or Right Control Port assigned to contain a hard-wired button or switch to issue a START Command. Similarly, any CNIP module can be similarly assigned a hard-wired button or switch to a specific dedicated input to issue a START Command.

USER ACCOUNTS

GUEST
Guest access allows access to ConveyStop software monitoring capabilities only and does not allow any access to add, delete, or modify any items

ADMINISTRATOR
Only Administrator accounts are allowed to modify any configuration or assignments. Administrator access is required to:

- Add or remove modules from a Stop Group
- Add or Remove Stop Groups
- Add or Remove STOP Command inputs
- Add or Remove START Command inputs

CREATING A NEW PROJECT

Create a new blank project by selecting “New” from the File menu.

DISCOVERING MODULES

Starting with a blank project as shown in Figure 4, click the “Discover and Redraw” button will cause ConveyStop to search for any and all ConveyLinx devices it can find.
After a few seconds depending on the number of devices located, a list of discovered devices will be displayed in the window on the far left. ConveyStop will also create a graphical image of its discovery as shown in Figure 5.
CIRAS TOP GROUP
First we use the “Show devices on Subnet” to filter the list for the 10 ERSC subnet. Then we select all the items in the list as shown in Figure 6.
Then drag the selection into the ConveyStop Groups window as shown in Figure 7.
This creates a Stop Group from the selected modules and automatically generates a group name. Right click on this name to give it a meaningful name for your project. In this example we will call it “Line A”. You can also expand and collapse the detail of a Stop Group by clicking the + or – icon to the left of the group name. Figure 8 shows the Rename option.
ADDING STOP BUTTONS

In our example, we want to add a Stop Button to node 8 at address 192.168.26.27 and we want the button to connect to the Left Control Port. You do this by right clicking on the desired node and selecting the option from the pop-up menu as shown in Figure 9.
Adding Start Buttons

In our example we want to add a START button to the Right Control Port of the same node. Right click on the node and select the desired option from the pop-up menu as shown in Figure 10.
Completing Our Example

By repeating the same procedures, we want to add a 2nd Stop Group consisting of the remaining unused devices from the Discover window. We want to rename this Stop Group as “Line_B”. We then want a STOP Button on node 1 at I.P. Address 192.168.25.20 connected to the Left Control Port and a START Button on the same node connected to the Right Control Port. When this is complete it should look like Figure 11. The process is not complete because we have only configured ConveyStop within the software; we still need to Commit the functionality to the physical ConveyLinx modules.
Clicking the “Commit All” button sends the current configuration of Stop Groups, buttons, etc. to the actual devices. When complete, ConveyStop screen displays the status of the connected devices. Figure 12 shows what the screen should look like for our example when both Stop Groups are operational and have no stop conditions active and no stop groups awaiting Start.
STATUS MONITORING

The ConveyStop screen gives indication when there is a Stop active and the individual node(s) where the Stop was initiated. The System State area on the screen provides quick status at a glance as to whether any group is in an active stopped state with the stop condition still true, in a stopped state with the condition reset and awaiting Start, and whether at least one Stop Group is started. Figure 13 shows our example system with Line_A in both a stopped state and the stop condition is still active. It also shows Line_B in a started state with not stop conditions active.
FIGURE 13 - ONE STOP GROUP IN A STOPPED STATE

- Red crosshatch indicates group is stopped. Red box indicates the device where the stop condition is still active.
- Indicates there is at least one group in need of Start.
- Indicates there is at least one group that has a stop condition still active.
**HOW CONVEYSTOP WORKS:**

This section assumes you are familiar with ConveyLinx module hardware and functionality including ERSC modes of operation and PLC connectivity as applicable.

**ARCHITECTURE**

The ability to respond to *Stop Commands* and *Start Commands* is built in to every ERSC and CNIP module. The activation of the ConveyStop function requires the ConveyStop PC software package to first define one or more *Stop Groups* of ConveyLinx modules and then enable the ConveyStop functions in the ConveyLinx modules. When enabled, the modules create 2 logical network connection rings within their configured *Stop Group* as shown in Figure 14.

*Figure 14 depicts a “logical” ring of network connections between modules by I.P. address only. ConveyLinx modules within a Stop Group are not physically connected in a closed loop.*

These connections create two logical rings. Each module expects to get data and heartbeat keep-alive messages every 200 ms over both connection rings. If any single module in the group does not receive data or heartbeat message either of its neighbors; the module will immediately disable the gates of its MOSFET transistors and sends a message to all other module over the 2 connection rings to do the same. The disabling of the MOSFET gates immediately halts any possible commutation and rotation of connected motors.
For ConveyLinx ERSC modules, the ConveyStop Stop Command causes all motor commutation to immediately stop. For ConveyLinx ConveyNet I/P (CNIP) modules, the Stop Command causes the CNIP processor to de-energize the output bus relay, thus disconnecting control power to the affected discrete outputs.

Once a Stop Group has been stopped and any and all conditions that caused the STOP Command have been cleared; the Stop Group has to be given a START command to restart the function of the logical ring connections.

**STOP COMMAND**

**ISSUING A STOP COMMAND**

Typical methods for an operator or the control system to issue a STOP Command is either via hardwired STOP push-button or via network command from PLC as shown in Figure 15

![Diagram of ConveyStop setup](image)

**FIGURE 15 - STOP GROUP SHOWIN STOP COMMAND BUTTONS AND PLC**

**HARD-WIRED OPERATOR PUSH-BUTTON**

**ERSC**

You can connect STOP command buttons to any ConveyLinx module’s Control Ports. STOP buttons require 2 sets of contacts and connect to the 2 inputs on the control port. If ANY of these contacts become opened on a given module; it will generate a STOP command to ALL modules within the group over the 2 communication rings. Refer to *Error! Reference source not found.* for connection details and recommendations.
Please note that any given Stop Group can have multiple STOP command buttons.

**CNIP Module**
For the CNIP module, there are dedicated inputs to use to connect a STOP command button. Refer to Error! Reference source not found. for connection details and recommendations.

**STOP Command from PLC**
If a PLC is connected to at least one module in a Stop Group; it can issue a STOP command to that module and all modules within that group will recognize this as a STOP Command. Even if the PLC is connected to more than one module in a Stop Group, it only has to issue the STOP command to only one module in order to STOP the whole group.

**Other Stop Command Sources**
There are other conditions, not necessarily initiated by an operator or the control system, that will cause a STOP Command to be interpreted by a given Stop Group.

**Missing Connection**
If any single device (ERSC or ConveyNet I/P) is missing from a configured group due to for example unplugged or damaged cable or loss of power; the Stop Command will be issued to all modules in the Stop Group.

**Missing PLC**
If a PLC establishes a structured instance connection to any single device (ERSC or ConveyNet I/P) within a Stop Group and that connection is subsequently lost to the PLC, the Stop Command will be issued to all modules in the Stop Group.
How ConveyStop works:

Please refer to Appendix B - PLC Instance Usage for definition of structured instance connections and their application.

**POWER LOSS**

If any individual or multiple modules within a Stop Group has its power disconnected; all modules within that Stop Group will recognize this as a STOP Command.

**HOW TO KNOW A STOP COMMAND IS ACTIVE**

**ERSC INDICATORS**

Any powered ERSC modules within a Stop Group that has an active STOP Command will flash Red LEDs on the Motor, Sensor, and Control Ports. Please note that the Link, Network, and Status LEDs will be unaffected by the STOP command.

![Image showing how ERSC STOP condition affects LED state]

**FIGURE 16 - ERSC STOP CONDITION LED STATE**

If a given ERSC within a Stop Group has a Stop button assigned; when a STOP command is active, the digital output on the Control Port for which the stop button is assigned will toggle on and off. This signal can be used to illuminate an indicator light or be used as an input to a remote PLC.

**CNIP INDICATORS**

Any powered CNIP modules within a Stop Group that has an active STOP Command will flash their Module and Network Status LEDs in Red. All other LEDs will remain unaffected.
PLC INDICATION

In order for a PLC to be able to either initiate a STOP or START Command; it has to establish an instance connection to at least one ERSC or CNIP within a given Stop Group. Each instance assembly available for both the ERSC and CNIP provides an input register for ConveyStop Status and an output register to issue ConveyStop STOP and START commands.

If the PLC is connected to multiple ERSC’s or CNIP’s in a given Stop Group; any connected ERSC or CNIP can provide ConveyStop status and can accept STOP and START Commands from the PLC.

CONVEYLinx FUNCTIONS AFFECTED BY STOP COMMAND

ERSC MODULE

Regardless of mode (ZPA, PLC I/O, ConveyLogix program); a STOP command completely inhibits any rotation of a motor connected to either Motor Port.

How the module’s digital outputs respond to a STOP Command is dependent upon what mode the module is in and settings in EasyRoll. When placing a module into PLC I/O Mode from the Connections tab from the Advanced Dialog; there is a drop down box for the user to select how to respond when there is a communications loss with the PLC. The choices are to turn off the outputs of leave them in their last state (See Figure 18). This setting also affects how the outputs respond during a STOP command.
How ConveyStop works:

The following chart lists ERSC modes and STOP Command effect by ERSC Mode:

<table>
<thead>
<tr>
<th>ERSC Mode</th>
<th>Left/Right Control Port Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZPA without STOP Inputs assigned</td>
<td>Unaffected</td>
</tr>
<tr>
<td>ZPA with STOP Inputs assigned</td>
<td>Energized when STOP is active</td>
</tr>
<tr>
<td></td>
<td>De-energized when START Command issued</td>
</tr>
<tr>
<td>ZPA with PLC control of Control Ports</td>
<td>State determined by PLC Comm Loss setting on Connections tab in</td>
</tr>
<tr>
<td></td>
<td>EasyRoll</td>
</tr>
<tr>
<td>PLC I/O Mode without STOP Inputs</td>
<td>State determined by PLC Comm Loss setting on Connections tab in</td>
</tr>
<tr>
<td>assigned</td>
<td>EasyRoll</td>
</tr>
<tr>
<td>PLC I/O Mode with STOP Inputs assigned</td>
<td>Energized when STOP is active</td>
</tr>
<tr>
<td></td>
<td>De-energized when START Command issued</td>
</tr>
</tbody>
</table>

For the Left and Right Motor Ports in Digital Mode, the state of these outputs is determined by the PLC Comm Loss setting on the Connections Tab in EasyRoll.

WARNING !!! Integrator / Programmer Responsibility

In any case where output state is determined by EasyRoll setting; it is up to the Integrator to insure that control system programming understands that a STOP Command has no effect on these outputs. It is possible that based upon this setting, any given digital output could remain energized even though there is STOP Command active.
WARNING !!! Integrator / Programmer Responsibility

Motor Port in Digital Mode output state upon STOP Command is determined by PLC Comm Loss setting in EasyRoll and that these outputs could remain energized during a STOP Command.

CNIP MODULE

Upon a STOP Command, the on-board relay is de-energized which in turn disconnects the control power bus that feeds Outputs O2 through O5. This ensures that Outputs O2 thru O5 de-energize during a STOP Command regardless of any logic instructing these outputs to remain energized.

Outputs O0 and O1 are unaffected by a STOP Command and will still respond to any logic from either a remote PLC or on-board ConveyLogix program.

CONVEYLINX FUNCTION AT STOP GROUP BOUNDARIES

If a given system application utilizes multiple Stop Groups (or non-ConveyStop configured modules) that are physically and logically connected such as a conveyor system; ConveyLinx has built in mechanisms for flow control. If the upstream or in feed end of a Stop Group is being fed by the discharge of ConveyLinx controlled conveyor; a STOP condition will cause the most upstream module of the Stop Group to indicate to its upstream zone to not allow any item to be conveyed into the Stop Group’s in feed zone.

START COMMAND

Before any module will respond to a START Command:

• All modules in the Stop Group must be powered
• All Stop buttons must be physically reset
• All expected communications between modules must be present
• All expected PLC connections to modules must be present

WHAT CAN INITIATE A START COMMAND

Similarly to the STOP Command, there are multiple ways to issue a START command to a given Stop Group in order to command the group to allow motion to occur.
How ConveyStop works:

Hard-wired START Button

Please note that any given Stop Group can have multiple START command buttons.

ERSC
You can connect START command buttons to any ConveyLinx module’s Control Ports. START buttons require a single momentary normally open (N.O.) contact. Once the contact is closed, if all START command criteria are met, the Stop Group will resume its normal function. Refer to Appendix A - Sample Wiring Diagrams for connection details and recommendations.

CNIP Module
For the CNIP module, there is a dedicated input to use to connect a START command button. Refer to Appendix A - Sample Wiring Diagrams for connection details and recommendations.

START COMMAND FROM PLC
If a PLC is connected to at least one module in a Stop Group; it can issue a START command to that module and all modules within that group will recognize this as a START Command. Even if the PLC is connected to more than one module in a Stop Group, it only has to issue the START command to only one module in order to STOP the whole group.
**HOW TO KNOW CONVEYSTOP HAS BEEN STARTED**

**ERSC INDICATION**
Only ERSC modules that have START Buttons assigned will give an active indication that ConveyStop has been started. If a given ERSC has a START Button assigned to a given Control Port, then the digital output signal of that Control Port will energize when ConveyStop is started and the Stop Group is functioning. If any STOP condition exists, then this output is de-energized.

**CNIP INDICATION**
There are no active indicators on a CNIP module that ConveyStop has been started. Even for modules that have a START Button assigned; there is not default digital output on the module to indicate a started condition.
Performing STOP and START Commands with a PLC

All PLC communications assemblies for ConveyLinx modules include a reserved set of registers for ConveyStop command output and status input. Please refer to Appendix B - PLC Instance Usage for details on the particular PLC and instance connection you want to use.

Regardless of which network the PLC uses (Ethernet I/P, Modbus TCP, or Profinet), the data transfer between ConveyLinx modules (ERSC or CNIP) is organized in blocks of registers defined as Assemblies. Each Assembly is part of an input / output pair. The input assembly provides status input data to the PLC to read and the output assembly is used by the PLC to write data to the ConveyLinx module.

Within each Input assembly is a ConveyStop Status Register and within each output assembly is a ConveyStop Command Register. Regardless of PLC, each register is a 16-bit value.

**ConveyStop Status Register**

The data in this register is to be interpreted bit wise regardless of the PLC used. The following chart lists the bit definitions for the ConveyStop Status Register:

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 thru 4</td>
<td>Reserved</td>
</tr>
<tr>
<td>5</td>
<td>1 = STOP Command issued from button on module in Stop Group&lt;br&gt;0 = No STOP command issued from button on module in Stop Group</td>
</tr>
<tr>
<td>6</td>
<td>1 = STOP condition is because of loss of Ethernet connectivity&lt;br&gt;0 = Ethernet connectivity OK</td>
</tr>
<tr>
<td>7</td>
<td>1 = STOP condition is because of loss of connection to PLC&lt;br&gt;0 = PLC connectivity is OK</td>
</tr>
<tr>
<td>8</td>
<td>1 = STOP command being issued from local module’s Left Control Port (or CNIP I0/I1)&lt;br&gt;0 = Stop button OK on local module’s Left Control Port</td>
</tr>
<tr>
<td>9</td>
<td>1 = STOP command being issued from local module’s Right Control Port (or CNIP I2/I3)&lt;br&gt;0 = Stop button OK on local module’s Right Control Port</td>
</tr>
<tr>
<td>10</td>
<td>1 = STOP command being issued from PLC&lt;br&gt;0 = PLC is not issuing STOP command</td>
</tr>
<tr>
<td>11 thru 15</td>
<td>Reserved</td>
</tr>
</tbody>
</table>

If all bits are reset in the ConveyStop Status Register, then there is no STOP condition active in the Stop Group.

**ConveyStop Command Register**

The PLC writes integer values to this register to command the Stop Group to either STOP or START. The following is an example of the values to write:
**STOP COMMAND**
Writing a value of “1” will cause a STOP Command to be issued to the STOP Group. In any module (ERSC or CNIP) that is connected to the PLC, bit10 will be set in their corresponding ConveyStop Status Register.

**START COMMAND**
Before issuing a START command, the PLC should first verify that the ConveyStop Status Register is “0” indicating there are no STOP conditions active.

If only bit 10 in the ConveyStop Status Register is set; then the PLC is still writing a “1” in the ConveyStop Command register. So, the PLC must write a “0” to the ConveyStop Command Register in order for the ConveyStop Status Register to be equal to “0”. The PLC then must write a “2” to send the START Command to the Stop Group. The PLC must hold this value of “2” for at least 500 msec and then write a value of “0”.
APPENDIX A - SAMPLE WIRING DIAGRAMS

ERSC MODULE

STOP BUTTON

Figure 20 shows the wiring diagram for a typical STOP Button with an indicator light. Please note that the indicator output requires the use of an ERSC-SE4 interface module.

Please note that using the Control Port output is optional and not required for ConveyStop operation. If indicator light is used, the SE-4 module is required. If indicator output is not required; then the ERSC-SE4 can be eliminated and a direct connection with RJ-12 cable can be made to the Control Port as shown in Figure 21.
START BUTTON

Figure 22 shows the wiring diagram for a START Button with the Control Port outputs being used for an indicator light. Please note that the indicator output is 24V DC sourcing and required the ERSC-SE4 interface module.

Please note that using the Control Port output is optional and not required for ConveyStop operation. If indicator light is used, the SE-4 module is required. If indicator output is not required; then the ERSC-SE4 can be eliminated and a direct connection with RJ-12 cable can be made to the Control Port as shown in Figure 23.
FIGURE 23 - START BUTTON WITHOUT INDICATOR OUTPUT

CNIP MODULE

STOP BUTTON

STOP button inputs for CNIP can be wired to either input terminals I0/I1 or I2/I3. The selection as to which pair of inputs to use is selected in the ConveyStop software when the STOP Button is assigned to the CNIP Module. Figure 24 and Figure 25 show wiring diagrams for each of the options. Please note that there is no default output designated for STOP function indicator.

FIGURE 24 - STOP BUTTON WIRED TO CNIP INPUTS 0/1
START BUTTON

START Button input is wired to either input terminal I0 or I2. The selection of which input to use is selected in the ConveyStop software when the START Button is assigned to the CNIP module. Figure 26 and Figure 27 show the wiring diagram for each of these options.
FIGURE 27 - START BUTTON WIRED TO INPUT 2
APPENDIX B - PLC INSTANCE USAGE

For full details on PLC Instance Assembly usage, please refer to ConveyLinx PLC Developer’s Guide available for download at www.insightautomation.cc.

ETHERNET I/P
If a PLC establishes an Ethernet I/P assembly instance connection to at least one ERSC or CNIP module within a Stop Group, then the ConveyStop control within the Stop Group will expect this connection to always be present. If this connection is ever lost, then a STOP condition is triggered for the Stop Group. If the PLC has established connections to multiple modules within a Stop Group; the loss of connection to any one of these connections will trigger a STOP condition for the Stop Group.

Please Note: ERSC and CNIP modules will also respond to unsolicited MSG instruction requests from the PLC. This form of communication does not require the ERSC or CNIP to be configured as a “permanent” Ethernet module on the PLC’s logic Ethernet backplane. If the PLC establishes communication with an ERSC or CNIP within a Stop Group with a MSG instruction request; the ConveyStop control does not treat this as an expected connection and does not generate a STOP condition for any MSG instruction communication presence or loss.

MODBUS TCP
Modbus TCP is a request/response type protocol and each ERSC or CNIP module acts as a Modbus TCP server and will respond to holding register read/write requests. Holding Register addresses 4:1000 and above are reserved for assembly instances. If a PLC establishes communications to at least one module in a Stop group to read/write to any block of holding registers at address 4:1000 or above and these read/write communication requests from the PLC is missing for more than 100 msec; a STOP condition will be generated.

If a PLC establishes a connection to read/write to Holding Registers whose addresses are in the range of 4:0001 thru 4:999; a loss of connection for this communication will not result in a STOP condition.

PROFINET I/O
Profinet I/O connection works similarly to Ethernet I/P with ConveyStop. If a PLC establishes a connection to one or more modules within a STOP group; then the ConveyStop control within the Stop Group will expect all of these connections to always be present. If any one of these connections is lost, then a STOP condition is triggered for the Stop Group.
NOTES: