GLIDE-LINE™

Installation and Troubleshooting Guide

P-00258 Smart Conveyor Control Generation III (SCC-3)

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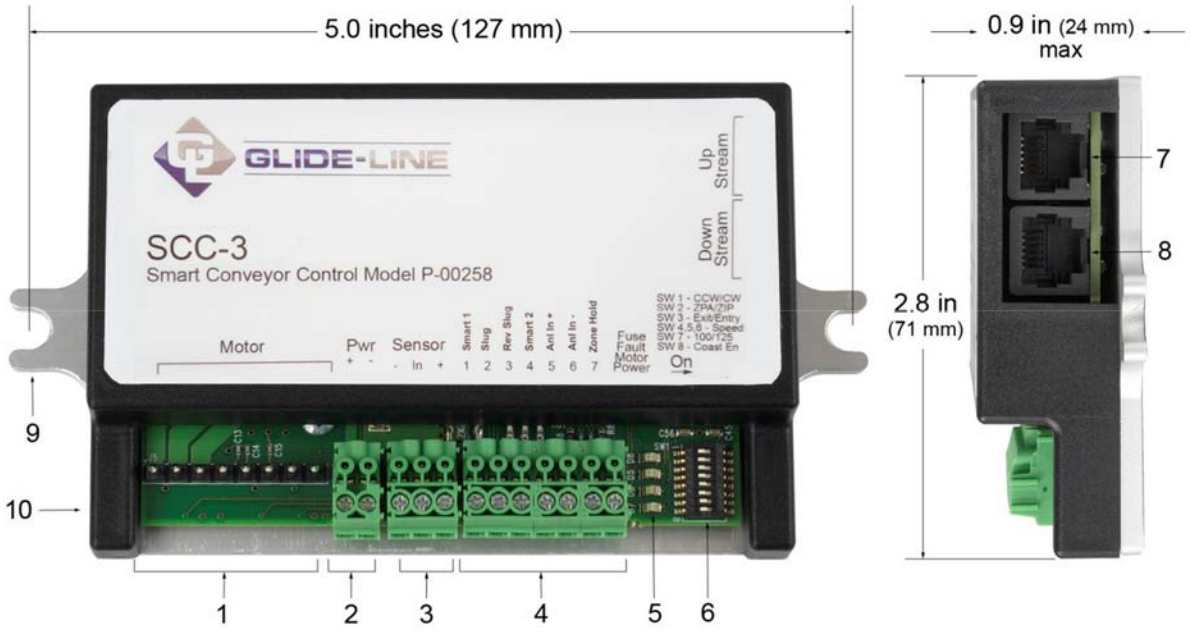

1) Motor Connection Header
2) +24V DC Power Input Header (plug included)
3) PNP Sensor Connection Header (plug included)
4) Smart/User Input-Output Connection Header (plug included)
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9) Mounting Plate/Heat Sink
10) Cover

NOTE: This guide refers to the components by their item number as listed above.

Figure 1: SCC-3 Controller Components

2 General Notes

2.1 Motor Cable & Connection Header

CAUTION: Use of extension cables may cause permanent damage and will void the product warranty.

Glide-Line™ motors and controls are designed to operate together as a complete and compatible drive system. Proper care must be taken to prevent damage to the control, motor and connection cable.

Motors come with a permanent, built-in power & control cable having either a 20 inch or a 72 inch cable length for connection solely to Glide-Line™ compatible controls. See the specific motor or gearbox specification sheet for details. Do not attempt to connect the motor cable to any other control. Do not put tension on the motor cable connection. Tension, cable strain or stress on the motor cable could deform the pressure contacts inside the motor connector. This could result in intermittent motor connections and in extreme cases may bend the pins on the control board.

The motor connector is designed to be installed on the control and then remain connected to the control for the life of the motor. **Do not remove the motor connector except in the rare instance of motor or control replacement. The motor connector must not be used as a power on/off switch.**

If the motor connector must be removed from the control, remove the connector slowly by carefully lifting while also gently rocking the connector from side-to-side ("inch-worming") in order to lift the connector off the control pins a little at a time. Lift the motor connector straight up by grasping the sides of the motor connector and avoid using the cable strain relief as a handle to lift the connector.

Power to the control and motor must be removed by turning off or removing input power at the source (Lock-out & Tag-out preferred). Alternately, by disconnecting the +24V DC Power Input Connection Header (see section 2.2 below) on the control. **The motor connector must not be used as a power on/off switch.**

Do not disassemble the motor cable. If the motor cable becomes damaged obtain a replacement motor.

NOTE: The motor connection cable must be oriented on the control header pins as shown in the figure below.

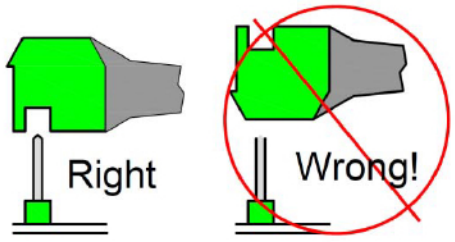


Figure 2: Motor Connector Orientation

2.2 +24V DC Power Input Connection Header

CAUTION: Power must be applied with proper polarity to avoid potentially damaging the controller. Follow the pinout shown in Table 1 below.

A 2-pin Phoenix PT1.2/2-PVH-3.5 plug is supplied. The SCC-3 operates off a +22 to +28 Volt DC power supply. The control reads the configuration switches only when the unit is powering up. Make the power connection only after all other connections have been made.

Pin:	Signal:
1	+22 to +28 Volts DC
2	DC Ground

Table 1: DC Power Inputs Pinout

NOTE: When adjacent zones are operating from separate power supplies you should connect their 0VDC grounds. However, do not connect their positive voltage pins together.

2.3 PNP Sensor Connection Header

CAUTION: If the sensor is mounted on non-conductive equipment, such as a plastic slide, ground the body of the sensor to provide a non-destructive discharge path in the event of a static electric shock.

A 3-pin Phoenix PT1.5/3-PVH-3.5 plug is supplied.

Pin:	Signal:
1	DC Ground
2	Input From Sensor
3	+VDC*

Table 2: Sensor Connections Pinout

***NOTE: The +VDC signal for pin number 3 is fused with a 0.1 Amp self-resetting fuse. Use of this output for any purpose that requires more than 0.1 Amps will cause the fuse to open and temporarily disable this output.**

2.4 Smart User Input-Output Connection Header

A 7-pin Phoenix PT1.5/7-PVH-3.5 plug is supplied. Function depends upon the controller's current configuration based on the configuration switch settings. If the smart I/O is not being used, leave the connector in place to avoid accidentally shorting the pins.

Pin:	Description:
1	Smart Input 1*
2	Slug Input*
3	Rev Slug Input*
4	Smart Output 2
5	Analog Input +
6	Analog Input –
7	Zone Hold Input*

Table 3: Smart PNP Inputs and Outputs Pinout

***NOTE: Smart I/O is active above +18 Volts DC (PNP)**

2.5 Feedback LED Indicators

The control board contains four (4) LED feedback indicators:

- One (1) **Red** Fuse LED
- One (1) **Red** Fault LED
- One (1) **Amber** Motor LED
- One (1) **Green** Power LED

To learn more, see *5.1* Feedback LEDs and *5.2 Firmware Version Display*.

2.6 Configuration Switches

The control reads the configuration switches only when the unit is powering up. To change a setting, disconnect power, set the switch, and then reconnect power. The **OFF** position is to the **Left** and the **ON** position is to the **Right** as seen in Figure 1: SCC-3 Controller Components. Switch descriptions are given in the following table:

Switch:	Description:	OFF Setting	ON Setting
1	Rotation Direction	Counter-Clockwise*	Clockwise*
2	Mode ZPA/ZIP	ZPA	ZIP
3	Zone Type	Exit/Xport	Entry/Xport
4	Target Speed (with SW5, SW6)	See Table 6: Operating Speeds.	
5	Target Speed (with SW4, SW6)		
6	Target Speed (with SW4, SW5)		
7	Motor Selection	100W24	125W24
8	Braking & ZMH	Enabled	Disabled

Table 4: Configuration Switch Settings

***NOTE: The direction of rotation is defined when viewed from the back side of the motor with the shaft extending away from the viewer.**

NOTE: The switches are read during power-up only. Set the switches, and then connect power to the board.

2.7 Upstream Cable Connection

This connector is intended for use with a 6-wire modular phone cable to connect to an adjacent upstream SCC board. See Section 5.3 for information on the cable. The cable is not provided.

2.8 Downstream Cable Connection

This connector is intended for use with a 6-wire modular phone cable to connect to an adjacent downstream SCC board. See Section 5.3 for information on the cable. The cable is not provided.

2.9 Mounting Plate/Heat Sink

This component is for mounting the control assembly to the conveyor frame using two ¼ inch or 0.25 in (6.35 mm) bolts to keep the controller cooler.

CAUTION: If mounting the control on a curved section of conveyor, use washers between the mounting plate and the conveyor frame. This is to assure that the mounting plate is not distorted, causing damage to the enclosed printed circuit board assembly.

2.10 Cover

CAUTION: Removal of the cover will void the warranty. The cover does not make the controller waterproof or dustproof.

The cover can help reduce the severity of damage to the controller from foreign objects.

3 Installation Guide

This section describes how to install and use the SCC-3 and Motor in the most common configurations. For additional information, refer to the application notes.

1. Mount the Control
2. Select a Motor
3. Select a Speed
4. Configure the Location
5. Configure the Operating Mode
6. Configure the Rotation
7. Configure Communications
8. Connect User Input/Output

3.1 Mount the Control

Mount the control in a location where the motor cable reaches the connection header without putting strain on the cable connector or the header.

3.2 Select a Motor

Select the motor you will be using. Properly match the control settings to the motor in use to deliver the best and most predictable performance.

SW8:	SW7:	Motor:	Comments:
OFF	OFF	100W24	Previously STD
OFF	ON	125W24	Previously HO.

Table 5: Motor Selection Switch Settings

3.3 Select a Speed

Three switches determine the operating speed, making it simple to match speeds in multiple zones. The actual speed selected also depends on the motor that you selected in the previous step, so set those switches first.

There is also an option to use a 0-10 V differential input for remote, dynamic speed adjustment while the system is running.

Switches:			Speed Selection (RPM):	
SW6	SW5	SW4	100W24	125W24
OFF	OFF	OFF	280	350
OFF	OFF	ON	248	310
OFF	ON	OFF	216	270
OFF	ON	ON	184	230
ON	OFF	OFF	152	190
ON	OFF	ON	120	150
ON	ON	OFF	88	110
ON	ON	ON	56	70

Table 6: Operating Speeds

3.4 Configure the Location

Identify the location of the control and then set Switch 3.

- If this control is placed at the entry end of the conveyor section where objects are loaded, set Switch 3 to the **ON** position.
- If this control is placed between two other SCC-3 controls, set Switch 3 to either **ON** or **OFF**.
- If this control is placed at the exit end of the conveyor section where objects are discharged, set Switch 3 to the **OFF** position.

Entry:	In Between:	Exit:
ON	ON or OFF	OFF

Table 7: Switch 3 Settings for Control Location

3.5 Configure the Operating Mode

Identify the operating mode that this section of conveyor will use for transporting objects and then set Switch 2.

- If the conveyor will be operating in the most conservative, conventional Zero-Pressure Accumulation (ZPA) mode, set Switch 2 to the **OFF** position.
- If the conveyor will be operating in the higher throughput, enhanced accumulation ZIP mode, set Switch 2 to the **ON** position.
- If the conveyor will be operating in the Slug or Slug Reverse mode, or as a stand-alone unit, Switch 2 may be set to the **ON** or **OFF** position because the Slug and Slug Reverse inputs override all of the accumulation logic.

ZPA:	Slug, Slug Reverse, or Stand-alone:	ZIP:
OFF	OFF or ON	ON

Table 8: Switch 2 Settings for Operating Mode

3.6 Configure the Rotation

Identify the proper direction of rotation for the motor shaft in order to move objects from the upstream (entry) end of the conveyor towards the downstream (exit) end of the conveyor. The direction of rotation is defined when viewed from the back side of the motor with the shaft extending away from the viewer.

- For clockwise rotation ↻ set Switch 1 to the **ON** position.
- For counter-clockwise rotation ↺ set Switch 1 to **OFF**.

3.7 Configure Communications

Make the peer-to-peer communication connections. These controls pass *request* and *permission* signals between adjacent zones over 6-wire modular phone cables. See Section 5.3 for information on the cable orientation.

- At the exit end of the conveyor, do not connect the phone cable to the Downstream Peer-to-Peer NPN RJ-25 Connection (item 8).
- Connect one end of a 6-wire phone cable to the Upstream Peer-to-Peer NPN RJ-25 Connection (item 7) and then connect the other end of the phone cable to the downstream phone jack on the adjacent upstream control.
- At each adjacent intermediate control, connect another 6-wire phone cable to the Upstream Peer-to-Peer NPN RJ-25 Connection (item 7) and then connect the other end of that cable to the downstream phone jack on the adjacent upstream control.
- At the entry end of the conveyor, do not connect a phone cable to the Upstream Peer-to-Peer NPN RJ-25 Connection (item 7).

3.8 Connect User Input/Output

3.8.1 Entry Zone

1. Use Smart 1 (a PNP input called a *request*) to notify the control that there is a parcel ready for input to the zone. If the zone is not already occupied, when this signal is active, it will cause the zone to run. The signal may be provided by any number of alternative sources such as a PLC, a simple switch, a photo sensor, etc. as long as the input voltage is positive and between 18 volts and 29 volts DC.

2. Use Smart 2 (a PNP output called *permission*) to notify an external device that the zone is empty and ready to receive a parcel.
3. Use Slug (a PNP input) to override all logic internal to the control and force this zone to run regardless of whether it is occupied or empty.

NOTE: When this signal is active, parcels are pushed into the next downstream zone even if it is already occupied.

4. Use Rev Slug (a PNP input) in one of two ways:
   - **Alone**: Assert it by itself to cause the zone to coast. The motor will not be energized and will not provide any active braking power.
   - **In Combination**: Assert it in combination with the Slug input to override all logic internal to the control and force this zone to run in the reverse direction regardless of whether it is occupied or empty.

NOTE: When this signal is active, parcels are pushed out of the upstream end of the zone regardless of the availability of any upstream device to accept the parcel. In this scenario, if there is nothing there, any parcels could potentially fall to the floor.

5. Use Analog In+ and Analog In- in combination to provide a 0-10 V differential signal that overrides the settings on the speed control switch. If the voltage differential is less than 0.5 VDC, the control ignores the input and the speed control switch settings will prevail. If the signal is 9.5 VDC or higher, the control operates the motor at its maximum speed setting of 280 or 350 RPM depending on the motor selected.

3.8.2 Intermediate Zone

An intermediate zone is between two adjacent SCC-3 controlled zones.

NOTE: Do not connect anything to Smart Input 1 or Smart Output 2.

1. Use Slug (a PNP input) to override all logic internal to the control and force this zone and all adjacent upstream zones to run regardless of whether they are occupied or empty. Note that when this signal is active parcels will be pushed into the next downstream zone even if it is already occupied.
2. Use Rev Slug (a PNP input) in one of two ways:
   - **Alone**: Assert it by itself to cause this zone and all adjacent upstream zones to coast. The motor will not be energized and will not provide any active braking power.
   - **In Combination**: Assert it in combination with the Slug input to override all logic internal to the control and force this zone and all adjacent upstream zones to run in the reverse direction regardless of whether they are occupied or empty.

NOTE: When this signal is active, parcels are pushed out of the upstream end of the conveyor regardless of the availability of any upstream device to accept the parcels. In this scenario, if there is nothing there, any parcels could potentially fall to the floor.

3. Use Analog In+ and Analog In- in combination to provide a 0-10 V differential signal that overrides the settings on the speed control switch. If the voltage differential is less than 0.5 VDC, the control ignores the input and the speed control switch settings will prevail. If the signal is 9.5 VDC or higher, the control operates the motor at its maximum speed setting of 280 or 350 RPM depending on the motor selected.

3.8.3 Exit Zone

1. Use Smart 1 (a PNP input called *permission*) to notify the control that it has permission to discharge a parcel. The signal may be provided by any number of alternative sources such as a PLC, a simple switch, a photo sensor, etc. as long as the input voltage is positive and between 18 volts and 29 volts DC. Note that when permission is removed the zone will attempt to stop any discharge that may be in process.
2. Use Smart 2 (a PNP output called *request*) to notify an external device that the zone is occupied and ready to discharge a parcel.
3. Use Slug (a PNP input) to override all logic internal to the control and force this zone and all upstream zones to run regardless of whether they are occupied or empty.

NOTE: When this signal is active, parcels will be pushed off the end of the conveyor if there is nothing in place to receive them.

4. Use Rev Slug (a PNP input) in one of two ways:
   - **Alone**: Assert it by itself to cause the zone and all upstream zones to coast. The motors will not be energized and will not provide any active braking power.
   - **In Combination**: Assert it in combination with the slug input to override all logic internal to the control and force this zone and all upstream zones to run in the reverse direction regardless of whether they are occupied or empty.

NOTE: When this signal is active, parcels are pushed out of the upstream end of the zone regardless of the availability of any upstream device to accept the parcels. In this scenario, if there is nothing there, any parcels could potentially fall to the floor.

5. Use Analog In+ and Analog In- in combination to provide a 0-10 V differential signal that overrides the settings on the speed control switch. If the voltage differential is less than 0.5 VDC, the control will ignore the input and the speed control switch settings will prevail. If the signal is 9.5 VDC or higher, the control will operate the motor at its maximum speed setting of 280 or 350 RPM depending on the motor selected.

3.8.4 Braking & Zero Motion Hold (ZMH)

When DIP Switch 8 is placed in the OFF position, motor dynamic braking will be used to bring the motor to a stop as quickly as possible. When DIP switch 8 is in the OFF position, Zero Motion Hold (ZMH) will also be active so that if the motor shaft continues rotating due to inertia, increasing current will be applied to the three motor phase windings in an attempt to hold the motor shaft at the requested stop position.

When DIP Switch 8 is placed in the ON position, the motor will be allowed to coast and no motor braking will be applied.

3.8.5 Slug & Reverse Slug Input Operation

1. Use Slug (a PNP input) to override all logic internal to the control and force this zone and all upstream zones to run regardless of whether they are occupied or empty. Slug is sometimes also referred to as Jog

   NOTE: When this signal is active, parcels will be pushed off the end of the conveyor if there is nothing in place to receive them.

2. Use Rev Slug (a PNP input) in one of two ways:
   - **Alone**: Assert it by itself to cause the zone and all upstream zones to coast. The motors will not be energized and will not provide any active braking power.
   - **In Combination**: Assert it in combination with the slug input to override all logic internal to the control and force this zone and all upstream zones to run in the reverse direction regardless of whether they are occupied or empty.

   NOTE: When this signal is active, parcels are pushed out of the upstream end of the zone regardless of the availability of any upstream device to accept the parcel. In this scenario, if there is nothing there, any parcels could potentially fall to the floor.

3.8.6 Other Modes of Operation

If you need to do something other than those things listed above, please contact Glide-Line™ at (215) 721-1900.

4 Special Functions

4.1 Zone Hold Input

When the zone hold input (I/O pin 7) goes active, prior to an object reaching the primary (downstream-edge) sensor, then that object will be held in that zone and will not exit while the zone hold signal remains active.

All objects in the upstream zones will also be held while the zone hold input is active.

When an object is actively exiting the zone hold input will have no effect on that object exiting.

4.2 Configuring an SCC-3 as a BMC

In certain applications it may be necessary to eliminate the 2.5 second motor run-on feature which is a part of the Search & Rescue function (see section 4.3). To accomplish this, the SCC-3 control can be configured as a Basic Motor Control (BMC) or standalone motor control. To accomplish this implement the following steps;

1) Place Control DIP switch 3 in the ON position (slide the switch to the right)
2) On the GREEN 3-pin sensor connector, wire the sensor input (center pin) to the sensor +voltage (pin on the right).
3) Apply a 24Vdc signal to the Slug input (I/O pin 2) to start and stop the motor
4) When the Slug input goes high then I/O pin 4 will go high to indicate that the motor is running

4.3 Search and Rescue

This function has been added to the control in order to avoid situations where parcels could become stranded between photo sensors, creating a nuisance at the very least. The function works under the following circumstances:

- During Power Up
- After Discharge of a Parcel from the Downstream Edge of a Zone
- After Removal of a Slug Signal (if Rev Slug is Not Active)
- After Removal of a Rev Slug Signal (if Slug is Not Active)

4.3.1 During Power Up

When the power is off, parcels are not tracked. When power is first applied, each control goes through a self-check and report its firmware revision as described in *5.2 Firmware Version Display*. Beginning at the Exit end and then flowing zone by zone after very brief intervals to avoid creating high inrush current at the power supply, each zone then runs for up to 2.5 seconds or until a parcel arrives at the respective zone sensor, whichever comes first.

In this fashion, any parcels that may have been stranded between sensors when power was removed are discovered and will then be processed by the conveyor in either ZPA or ZIP control mode as determined by the switch settings.

NOTE: 2.5 seconds is a nominal time period. The actual time is adjusted up if zones are set to a lower than maximum speed. For example, if a zone is set to half its maximum speed, the run time is doubled to 5.0 seconds.

4.3.2 After Discharge of a Parcel from the Downstream Edge of a Zone

It is not unusual for operators who are manually loading parcels onto a conveyor to place two small parcels in a single zone. If the zone stopped immediately after a parcel passed its downstream sensor the second parcel could become stranded. Therefore each zone will operate for up to 2.5 seconds after these events. When the zone is already running, very little additional power is consumed. This is a local function that directly affects only the zone that just discharged its parcel.

4.3.3 After Removal of a Slug Signal

(If Rev Slug is Not Active)

During Slug mode of operation, parcels are not tracked by the system logic. Some parcels will likely be between sensors at the time the Slug signal is removed.

Beginning with the zone where the Slug signal was asserted and cascading upstream, each zone will run for up to 2.5 seconds until either the time expires or a parcel is discovered.

4.3.4 After Removal of a Reverse Slug Signal

(If Slug is Not Active)

Since Reverse (Rev) Slug causes the zones to coast, parcels that were in motion will come to rest in more or less random

locations. Beginning with the zone where the Rev Slug signal was asserted and cascading upstream, each zone will run for up to 2.5 seconds until either the timer expires or a parcel is discovered.

5 Diagnostics & Troubleshooting

5.1 Feedback LEDs

The SCC-3 provides four (4) LED indicators shown as item 5 in Figure 1: SCC-3 Controller Components. These LEDs are often useful in diagnosing various wiring and connection problems. If power is connected there will always be at least one LED illuminated or flashing. When no LED is illuminated, there is no power.

5.1.1 Fuse LED (Red)

CAUTION: This robust next-generation fuse will not blow under normal circumstances. Inspect all wiring connections to assure that there are no short circuits.

This LED is off under normal circumstances. It illuminates constantly if the 10 amp replaceable fuse is blown and power is applied with the proper polarity. The 10 amp fuse on the board is not user-accessible. If the blown fuse LED is illuminated, return the board to your distributor or supplier for analysis or repair.

NOTE: The control's on-board fuse is NOT replaceable.

5.1.2 Fault LED (Red)

This LED is off under normal circumstances. If a problem is detected, it provides one of the following five signals:

- **One (1) flash in 4 seconds:** The board has a hardware problem. Return it to your supplier.
- **Two (2) flashes in 4 seconds:** The input voltage is too high. Reduce the voltage.
- **Three (3) flashes in 4 seconds:** The input voltage is too low. Increase the voltage.
- **Four (4) flashes in 4 seconds:** There is a problem with the motor cable or connection. Check to see that the cable is not damaged and that all of the wires are secure.
- **Five (5) flashes in 4 seconds:** Control over temperature.
- **Six (6) flashes in 4 seconds:** Extreme over current.
- **Constantly ON:** The motor is stalled or the sensor is continuously blocked. Check for mechanical obstructions.

5.1.3 Motor LED (Amber)

- **Four flashes in 4 seconds**: Components on the board have overheated and the circuit is limiting the power to the motor to about half (50%) of normal. This problem will correct itself when the board has cooled adequately. Check for mechanical obstructions.
- **Constantly ON:** Motor current is at the maximum allowed and is being electronically limited. Check for mechanical obstructions.
- **Flickering:** If the motor starts under significant load, the current may be limited briefly causing the LED to flicker. If the LED flickers constantly, this is an indication that the motor is operating at its upper limit and may never reach the full speed. This is not a cause for concern and no corrective action is required.

5.1.4 Power LED (Green)

Constantly ON: Power is properly applied as long as the fuse is not blown.

5.2 Firmware Version Display

Three (3) of the feedback LEDs are used to communicate the firmware revision of the control assembly during the start-up sequence. Each time that power is applied to the board, the green (power) and red (fault) LEDs will turn on immediately. After 1.0 second the amber LED will flash on for 0.75 seconds followed by an off period. An off period of 1.5 seconds represents a decimal point separating major revisions from minor revisions. An example is shown below.

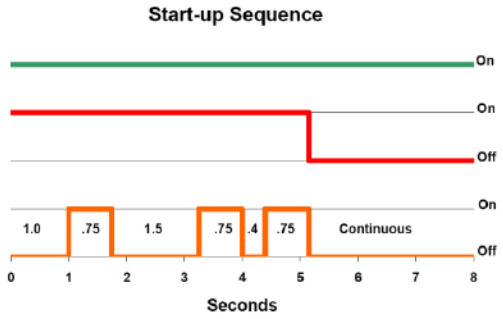
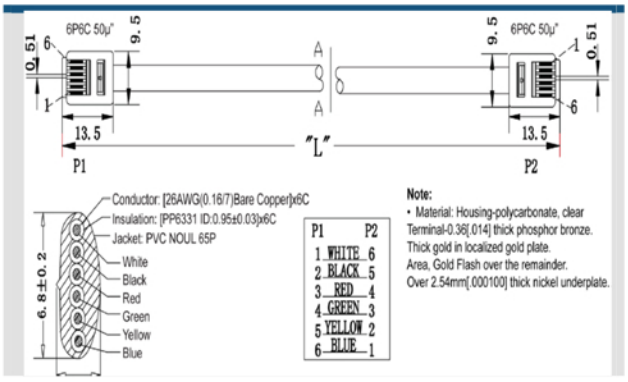


Figure 3: Firmware Version Display Example

The example sequence above represents firmware revision 1.2. When the red (fault) LED turns off, the start-up sequence has ended and normal operation begins.

5.3 RJ25,6-Wire,Modular Cable Orientation, L<10ft



5.4 Additional Assistance

To request the latest revision to our user manual or for additional assistance, please contact Glide-Line™ at (215)-721-1900.

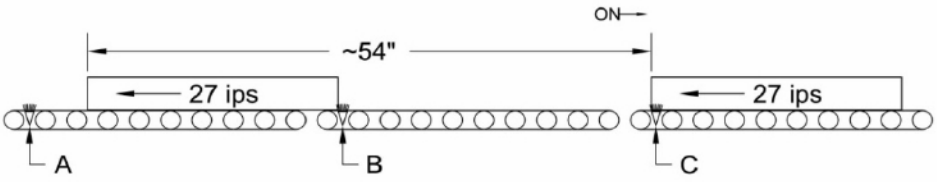
6 Document Revision History

Rev:	Date:	Summary:
1.0	Feb 2014	Original Release.
1.1	May 2016	Eliminate reference to 450 and 560 RPM
1.2	Apr 2018	Add Zone Hold, BMC Conversion & Cable info
1.3	Apr 2018	Add Braking & ZMH and Appendix Information

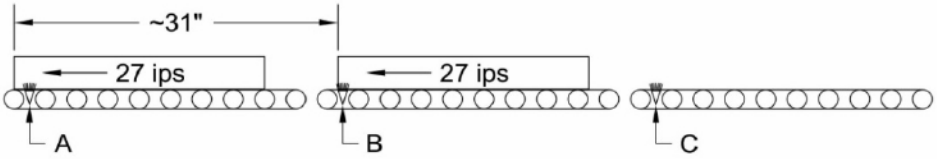
Appendix A

ZPA Mode (Standard Sigulation) compared to ZIP Mode

Assume: 30" zones, 24" parcel, 135 fpm (27 ips)



Std. Singulation: Upstream parcel cannot leave sensor C until downstream parcel is past sensor B. Throughput is ~30 per minute.



ZIP Mode: Upstream parcel leaves sensor B briefly after downstream parcel begins to leave sensor A. Throughput is ~52 per minute. Almost double with no increase in conveyor speed.