GLIDE-LINE™

Installation and Troubleshooting Guide

P-00409 Smart Conveyor Control
Generation III (SCC-3 Hi Performance)

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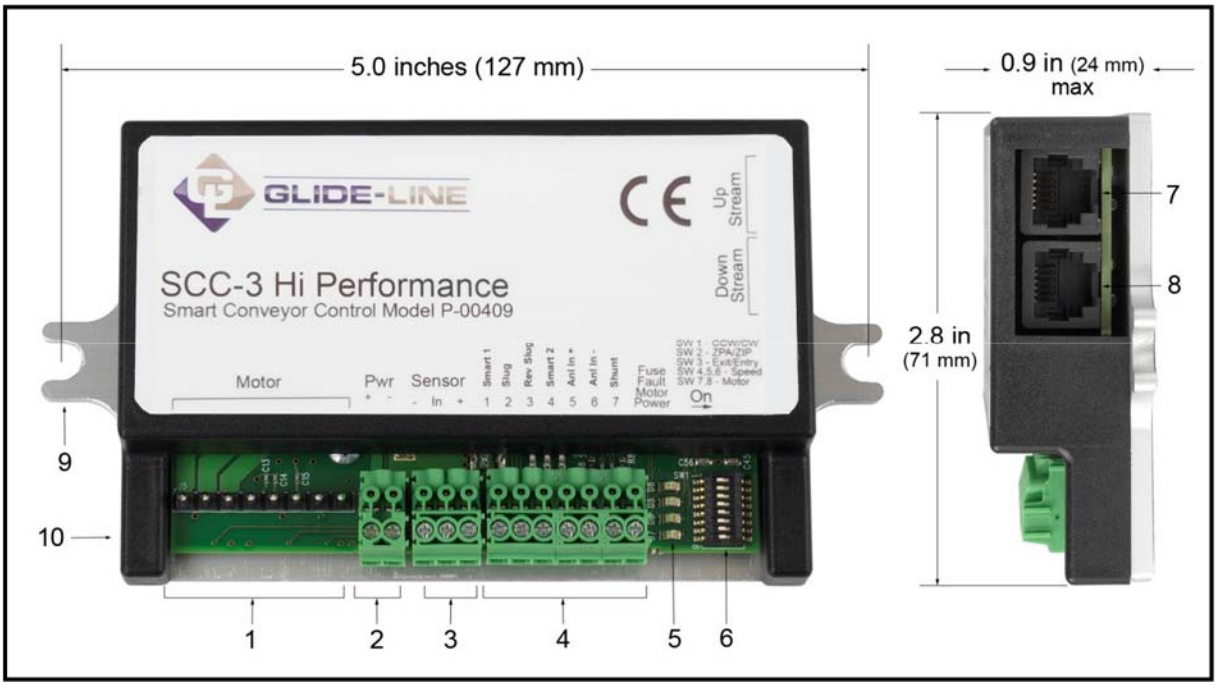


Figure 1: SCC-3 High Performance Controller Components

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)**
5) **Feedback LED Indicators**
6) **Configuration Switches**
7) **Upstream Peer-to-Peer NPN RJ-25 Connection**
8) **Downstream Peer-to-Peer NPN RJ-25 Connection**
9) **Mounting Plate/Heat Sink**
10) **Cover**

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

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 controls.

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.

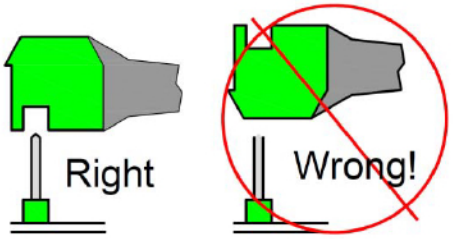


Figure 2: Motor Connector Orientation

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 2: Sensor Connections Pinout*.

A 2-pin Phoenix PT1.2/2-PVH-3.5 plug is supplied. The SCC-3HP control 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 DC 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. The function of Smart Input 1 and Smart Output 2 depends on the current switch 3 settings for the controller. If these I/O connections are not being used, leave the connector in place to avoid accidentally shorting the pins.

Pin:	Description:
1	Smart Input 1
2	Slug Input
3	Reverse Slug Input
4	Smart Output 2
5	Analog Input +
6	Analog Input –
7	Shunt*

Table 3: Smart/User Input-Output 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 Current Limiting 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** (see Figure 1: SCC-3 High Performance Controller Components). Switch descriptions are given in the following table:

Switch:	Description:	OFF Setting:	ON Setting:
1	Rotation Direction	↺ Counter-Clockwise*	↻ Clockwise*
2	Singulation Type	ZPA Mode	ZIP Mode
3	Zone Type	Exit or Transport	Entry or Transport
4 5 6	Speed Selection	See Table 6: Operating Speed Selection Switch Settings.	
7 8	Motor Selection	See Table 5: Motor Selection Switch Settings.	

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 before delivering power to the board.

2.7 Upstream Cable Connection

This RJ-25 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 6-Wire Modular Cable Orientation. The Modular Cable is not provided.

2.8 Downstream Cable Connection

This RJ-25 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 6-Wire Modular Cable Orientation. The Modular 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

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

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

3 Installation Guide

This section describes how to install and use the SCC-3 Hi Performance Control 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.

In addition to the standard 100 watt motor, this control provides maximum performance with our 125 watt, 160 watt, and 200 watt motors at their higher speeds. You can also use this control with an optional shunt regulator that enables regenerative braking mode without creating excess voltages on the power supply line.

SW8:	SW7:	Motor:	Comments:
OFF	OFF	100W24	Previously STD
OFF	ON	125W24	Previously HO.
ON	OFF	160W24	New Product
ON	ON	200W24	New Product

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	160W24	200W24
OFF	OFF	OFF	280	350	450	560
OFF	OFF	ON	248	310	399	496
OFF	ON	OFF	216	270	348	432
OFF	ON	ON	184	230	297	368
ON	OFF	OFF	152	190	246	304
ON	OFF	ON	120	150	195	240
ON	ON	OFF	88	110	144	176
ON	ON	ON	56	70	93	112

Table 6: Operating Speed Selection Switch Settings

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 Hi Performance 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: Zone Type Selection Switch Settings

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: Singulation Type Selection Switch Settings

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**.

NOTE: See Switch 1 in Table 4: Configuration Switch Settings.

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. Starting with the exit zone control at the most downstream zone of conveyor line.

- At the exit end of the conveyor, leave the downstream peer-to-peer NPN RJ-25 connection (item 8) unconnected.
- 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 zone control at the most upstream zone, leave the upstream peer-to-peer NPN RJ-25 connection (item 7) unconnected.

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, 350, 450, or 560 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, 350, 450, or 560 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, 350, 450, or 560 RPM depending on the motor selected.

3.8.4 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 Configuring an SCC-3HP 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 below). To accomplish this, the SCC-3HP 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

4.2 Shunt Input (I/O Pin 7)

The Shunt Input (I/O pin 7) is presently not used.

If, however, the Shunt input were to be made active high (input voltage > 18Vdc), the control's over-voltage shutdown limit will be increased from 29Vdc to 31Vdc, thereby providing additional operating margin before the control shuts down due to an over-voltage condition.

A separate 6A, 10W Shunt Regulator module is available (P/N 110547) and connects directly to the +24V DC power supply and is typically used, if needed, to help limit any increase in the +24V DC power supply voltage to less than 28Vdc, in the event that the motor and control regenerate energy back into the power supply.

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. This function is active after the following events:

- 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 reports 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.

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 Rev Slug Signal

(If Slug is Not Active)

Since 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.

NOTE: 2.5 seconds is a nominal time period. The actual time is adjusted upward if zones are set for lower speeds than the maximum. As an example, if a zone is set for half of its maximum speed, the run time would be doubled to 5.0 seconds.

5 Diagnostics & Troubleshooting

5.1 Feedback LEDs

The SCC-3 Hi Performance provides four (4) LED indicators shown as item 5 in *Figure 1: SCC-3 High Performance Controller Components* **Error! Reference source not found.**.

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 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.

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. If the cable has been cut or the wires disconnected refer to section 1 in the General Notes.
- **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)

- **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.

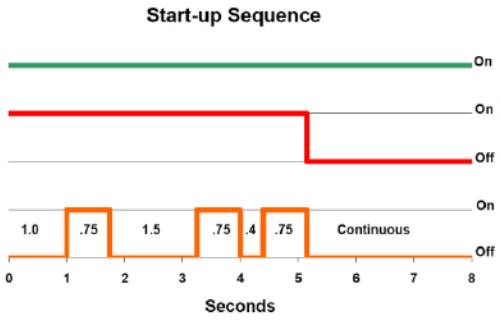
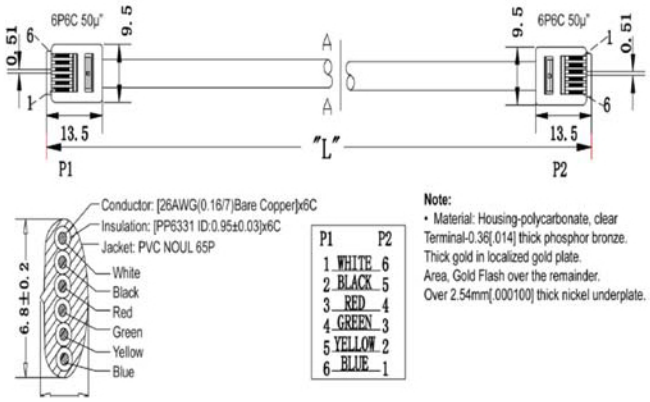


Figure 3: Firmware Version Display Example

This example sequence represents firmware revision 1.2. When the red fault LED turns off, the startup 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

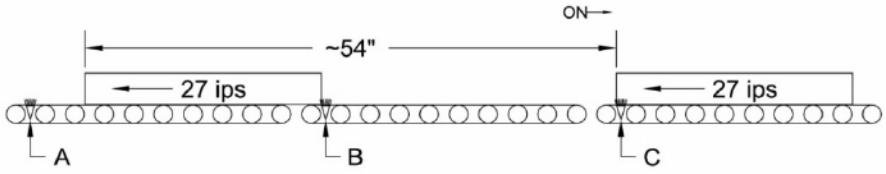
The following changes have been made to this document:

Rev:	Date:	Summary:
1.1	Oct 2017	Updated Zone Type in Config Table 4
1.2	April 2018	Updated Motor Cable & Added Modular Cable
		Added Appendix A and BMC conversion

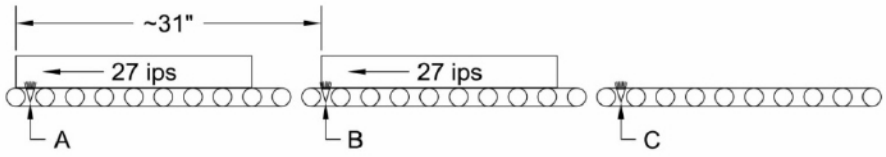
Appendix A

ZPA Mode (Standard Singulation) 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.