INSTALLATION, OPERATION, MAINTENANCE MANUAL

CRUZcontrol®
For NBA® and XP43

IOM P\N: 90480009

Revision Date: March 18, 2019

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Purpose

It is the intent of MHS Conveyor, through this manual, to provide information that acts as a guide in the installation, operation and maintenance of MHS Conveyor conveyors featuring CRUZcontrol Logic.

This manual describes basic installation practices, assembly arrangements, preventive maintenance and assists in replacement parts identification.

This service manual is intended for use by personnel who are knowledgeable of installation and safe working practices on conveyor systems.

Not all applications and conditions can be covered; therefore, this manual is to be used as a guide only.

If additional copies of this manual are needed or if you have any question concerning the conveyor please contact your Business Partner or MHS Conveyor' Customer Support at 231-798-4547 or mhs-conveyor.com.

MHS Conveyor Policies

MHS Conveyor Equipment Warranty

MHS Conveyor warrants that the material and workmanship entering into its equipment is merchantable and will be furnished in accordance with the specifications stated. MHS Conveyor agrees to furnish the purchaser without charge any part proved defective within 2 years from date of shipment provided the purchaser gives MHS Conveyor immediate notice in writing and examination proves the claim that such materials or parts were defective when furnished. For drive components specific to XenoROL® (i.e. Xeno belts, slave Xeno belts, drive spools, standard and speed-up, and spacers), this warranty shall be extended to five years of running use, provided the conveyors are applied, installed and maintained in accordance with MHS Conveyor published standards. Other than the above, there are no warranties which extend beyond the description on the face hereof. Consequential damages of any sort are wholly excluded. The liability of MHS Conveyor will be limited to the replacement cost of any defective part. All freight and installation costs relative to any warranted part will be at the expense of the purchaser. Any liability of MHS Conveyor under the warranties specified above is conditioned upon the equipment being installed, handled, operated, and maintained in accordance with the written instructions provided or approved in writing by MHS Conveyor.

The warranties specified above do not cover, and MHS Conveyor makes no warranties which extend to, damage to the equipment due to deterioration or wear occasioned by chemicals, abrasion, corrosion or erosion; Purchaser's misapplication, abuse, alteration, operation or maintenance; abnormal conditions of temperature or dirt; or operation of the equipment above rated capacities or in an otherwise improper manner.

THERE ARE NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, EXTENDING BEYOND THOSE SET FORTH IN THIS STATEMENT OF WARRANTY.

Rev 03/01/2019

MHS Conveyor Environment Standards

MHS Conveyor equipment is designed to be installed in a clean, dry warehouse environment. Exposure to extreme humidly, direct sunlight, blowing dirt or rain can permanently damage some components of MHS Conveyor. In particular, the curing agents in concrete are known to attack and degrade the urethane conveyor components.

When installing conveyor on a new construction site, be sure that the concrete is properly cured before setting conveyor on it. In addition, if conveyors are stored in the proximity of curing concrete, proper ventilation must be used to direct the curing agent fumes away from the conveyor. Failure to comply with these guidelines will void the MHS Conveyor warranty on any failed components that result from these environment issues.

03/01/2019

CRUZcontrol Logic Assembly

The CRUZcontrol Logic Assembly consists of a polarized retro-reflective type photoelectric sensor, pneumatic valve and logic module integrated into one assembly.

The photoelectric sensor will function reliably on conveyor widths up to 34 inches between frames. The sensor is polarized, and is not affected by shiny surfaces. On NBA®23 applications, the reflector is mounted with a 6 inch offset from the photoelectric sensor, so that the sensor scans across the conveyor on a slight angle.

The sensor bracket as provided allows for easy adjustment of the sensor. An LED function indicator on the back of the sensor aids in the adjustment of the sensor. The LED is off if the sensor is not aligned, flashes if functional but marginally aligned, and is on steady if properly aligned.

The pneumatic valve operates at a range of 0-116 psi, with a flow rate of Cv = 0.100 US Gallons/min. Observe the operating pressure requirements of the conveyor. For example, NBA™ conveyor should never be operated at greater than 14 psi.)

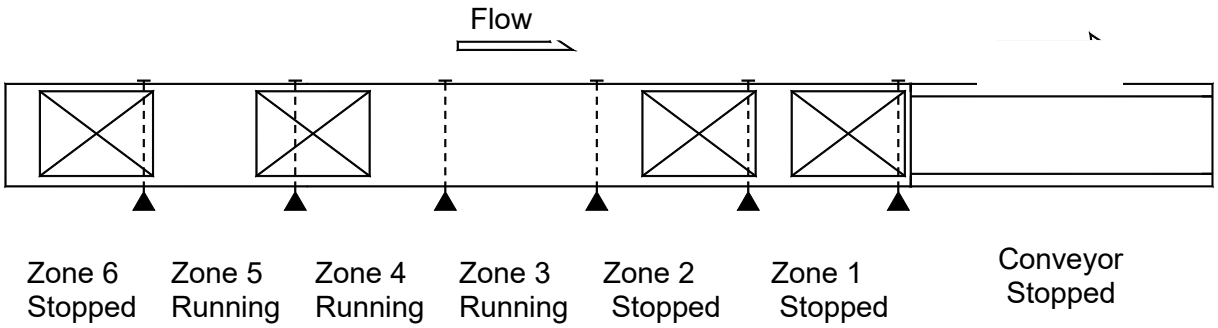
There are four different CRUZcontrol Logic Assemblies:

MHS Conveyor Part No.	CRUZcontrol Logic Assemblies – Description
E0001900A	Basic Logic, XenoROL®
E0001901A	Basic Logic, NBA 23
E0001904A	Progressive Logic, XenoROL
E0001905A	Progressive Logic, NBA 23

The NBA CRUZcontrol Logic Assembly provides an “air to drive” logic output utilizing a normally closed pneumatic valve. The XenoROL CRUZcontrol Logic Assembly provides an “air to brake” logic output, utilizing a normally open pneumatic valve. With both types of logic, the pneumatic valve is energized for a zone to be running.

Each version of CRUZcontrol also comes as either Basic Logic or Progressive Logic. The following describes the differences between the two logic alternatives. The descriptions as written more closely describe product movement on a XenoROL based accumulation conveyor, where accumulated product is actually brought to a full stop. NBA 23 conveyor, where a stopped zone isn’t usually braked but becomes gravity flow, will have very different product flow characteristics. The coasting of product through gravity zones will result in gaps closing up, and could yield higher throughput rates regardless of the type of logic selected.

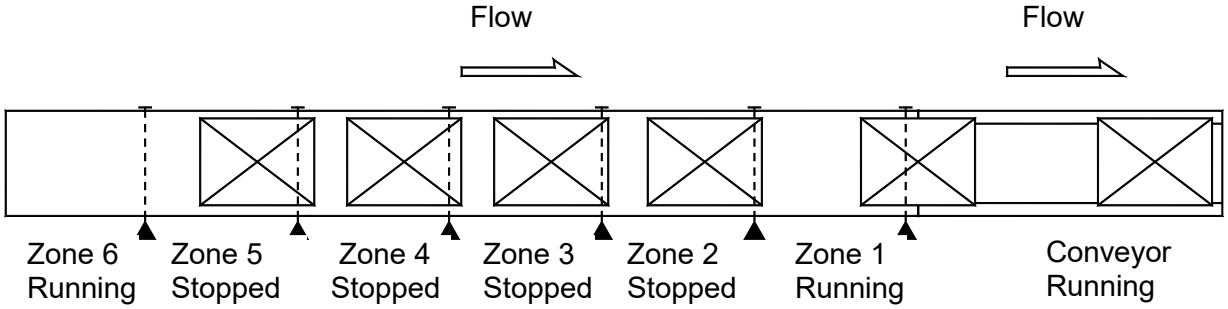
Basic Logic



Basic Logic functions such that when any two successive photoelectric sensors are blocked, the second zone upstream is set to accumulate. In the above example, the discharge zone, Zone 1, is shown stopped, signifying that release from the zone is being inhibited and the Zone 1 sensor is blocked. Zone 1 sensor blocked and Zone 2 sensor blocked results in Zone 2 being stopped. Zone 3 and Zone 4 sensors are not blocked, and the zones are running. Zone 5 sensor is blocked, but the zone is running because the Zone 4 sensor is not blocked. Zone 6 is stopped because both Zone 5 and Zone 6 sensors are blocked.

Note that with Basic Logic products being transported on the conveyor are separated by a gap of at least one zone length. This will reduce the transportation throughput capacity of the conveyor. The rate at which product is introduced onto an accumulation conveyor of this type must not exceed the transportation capacity of the conveyor.

Discharge from Basic Logic

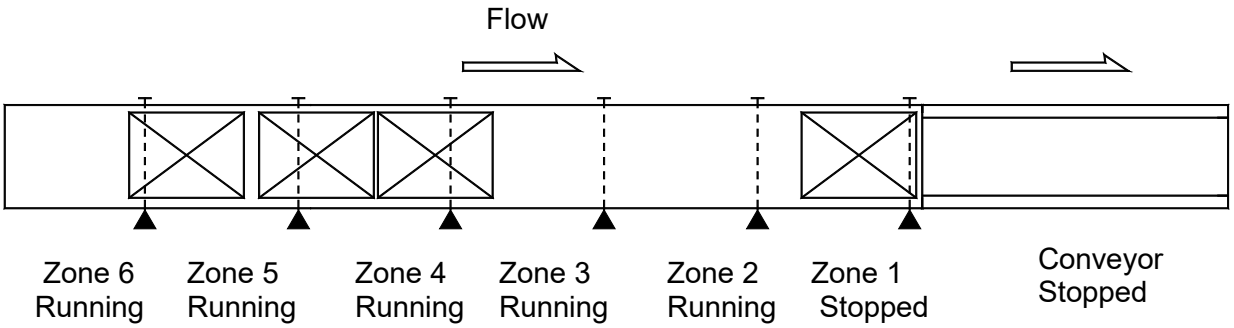


A Singulation Release signal given to the Zone 1 Logic Assembly releases product from that zone. As released product clears a photoelectric sensor, the product stopped at the next upstream zone is released. This will create a one-zone length gap between all released products, assuming conveyor speeds (accumulation conveyor and downstream conveyor) are identical.

If the line is set to Slug Release (Train Release), all affected zones will run, resulting in the release of product with little or no gaps. This overrides the normal Basic Logic function.

All product movement as described for transportation, accumulation, and discharge is based on zone lengths, meaning only one product is in each zone. If more than one product should occupy a single zone, which could occur with small products, they will usually move together or stop together, or they could eventually become separated into different zones. This is true for both Basic Logic and Progressive Logic.

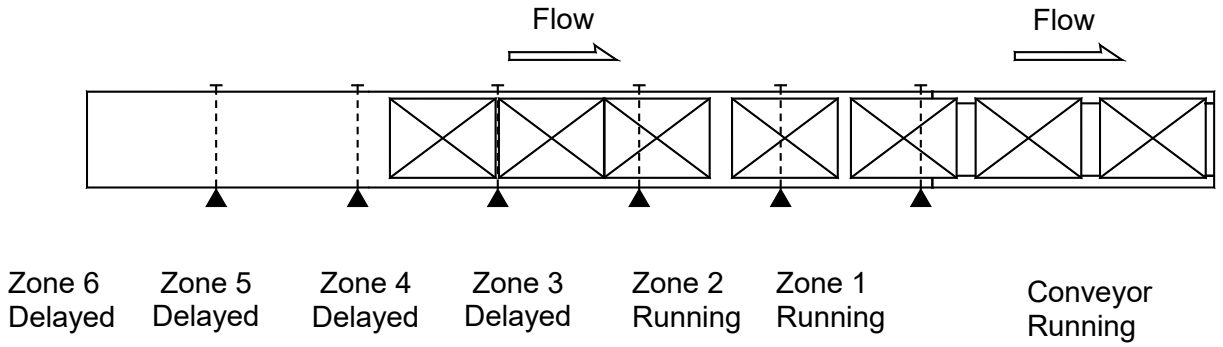
Progressive Logic



Progressive Logic functions such that no zones are set to accumulate unless all downstream zones hold accumulated product and the photoelectric sensors are blocked. In the above example, the discharge zone, Zone 1, is shown stopped which is a result of the release from the zone being inhibited and the Zone 1 sensor being blocked. Zone 2 sensor not being blocked results in all upstream zones, Zone 2 through Zone 6, running.

Note that with Progressive Logic products being transported on the conveyor can remain tightly packed, without any gaps being created.

Discharge from Progressive Logic



A Singulation Release signal given to the Zone 1 Logic Assembly releases product from that zone. Each successive upstream zone will also begin releasing product, but with a two tenths of a second release delay from each zone to the next upstream zone. This will create a small gap between released products, depending on product sizes, the number of products occupying each accumulation zone, and the conveyor speed.

If the line is set to Slug Release (Train Release), all affected zones will run, resulting in the release of product with little or no gaps. This overrides the normal Progressive Logic function. The two tenths of a second release delay between zones does not occur with Slug Release.

Cautions

CRUZcontrol Logic Assemblies are designed to be fail-safe. A loss of module power, a disconnected or severed cable, or a dirty or failed photoelectric sensor will all result in the stopping of a zone, initiating accumulation beginning from the affected zone.

With Progressive Logic, failure of a Logic Assembly to function properly could possibly result in product accumulating with zones not stopping as required. While this should be unlikely due to the fail-safe nature of the Logic Assembly, a product jam preventing product from blocking a zone sensor would also result in a zone not functioning. The effects of such a failure should be considered. This type of failure could result in excessive line pressure, eventually causing product to push through the discharge zone of the conveyor. If needed, jam detection sensors could be used to minimize the effects of such a failure.

Progressive Logic NBA®23 should normally be specified with one Basic Logic Assembly at the discharge end of every 12-foot bed of conveyor. This limits the length of conveyor that could possibly be driving product against a jam point to less than 12 feet. The use of one Basic Logic Assembly on every 12-foot bed will disrupt the flow of product to some degree, but with adequate speed and product weight the flowing product should coast through the basic zones without any appreciable effect on the throughput rate. One exception is at the charge and discharge ends of a length of NBA 23, where the effects of using Basic Logic Assemblies on the throughput rate needs to be considered. If there is a need to maximize throughput rates, the use of all Progressive Logic Assemblies should be retained, but only in those locations.

CRUZcontrol provides the ability to for slug release. If the line is set to Slug Release, all affected zones will run immediately, regardless of downstream conditions, resulting in the immediate release of product with little or no gaps. Both the Basic and Progressive Logic Assemblies release at the maximum possible discharge rate when slug release is enabled. Slug release does create a situation where a product jam will result in excessive line pressure buildup. If the slug release feature is used, it should be used with caution, and for a limited number of successive accumulation zones.

Configuration Options

Basic Logic Assemblies and Progressive Logic Assemblies can be intermixed. An example of where this would be advantageous would be the placing of one Basic Logic conveyor bed at the end of a long length of Progressive Logic conveyor. The Progressive Logic would allow the conveyor to receive and transport product at higher throughput rates, while the Basic Logic discharge section would singulate product being released.

Logic Assembly Specifications

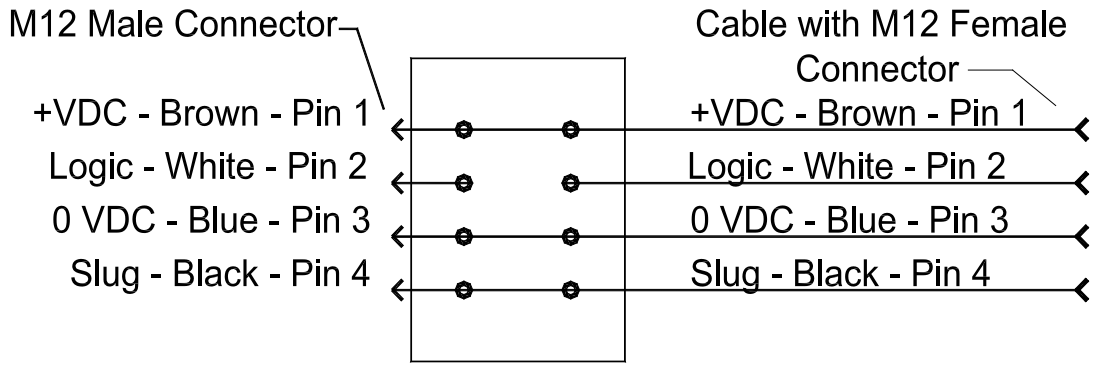
Photoelectric Sensor:	
Sensing Mode	Reflex
Light Source	Red LED
Status Indicator	Red
Life Expectancy	100,000h @ 77°F
Cable length	28 inches from logic module to sensor
Connection to logic module	Hard-wired
Ambient Temperature - Operating	14…130°F
Ambient Temperature - Storage	-13…122°F
Logic Module:	
Cable Length	42 inches logic module to end of connector
Enclosure Rating	IP42
Housing Material	ABS plastic
Supply Voltage	24 VDC (-20% / +15%)
Current Consumption	67mA (includes logic module, MH sensor, & valve)
Response Time	<2.5ms
Connection	M12 4-pin Single Key
Pneumatic Valve:	
Operating Pressure Range	0-116 psi (0-8 bar)
Ventilation capacity	Qn = 100 Nl/min, Cv = 0.100 USGallon/min
Input Air Connection*	3/8 in. straight quick connects
Output Air Connection	¼ in. straight quick connect
Operating Mode	N.O. or N.C. (two models)

The pneumatic valve has a small red lever controlling valve shutoff. This must be set to “0” (not “1”) for proper valve operation.

For zone lengths greater than 36 inches, the following extension cable is used to connect to each Logic Assemblies. These are provided pre-installed on the conveyor with the other CRUZcontrol components:

MHS Conveyor Part No.	**Description**
RK4.4T1RS4.4T	Extension Cable (39 inches)

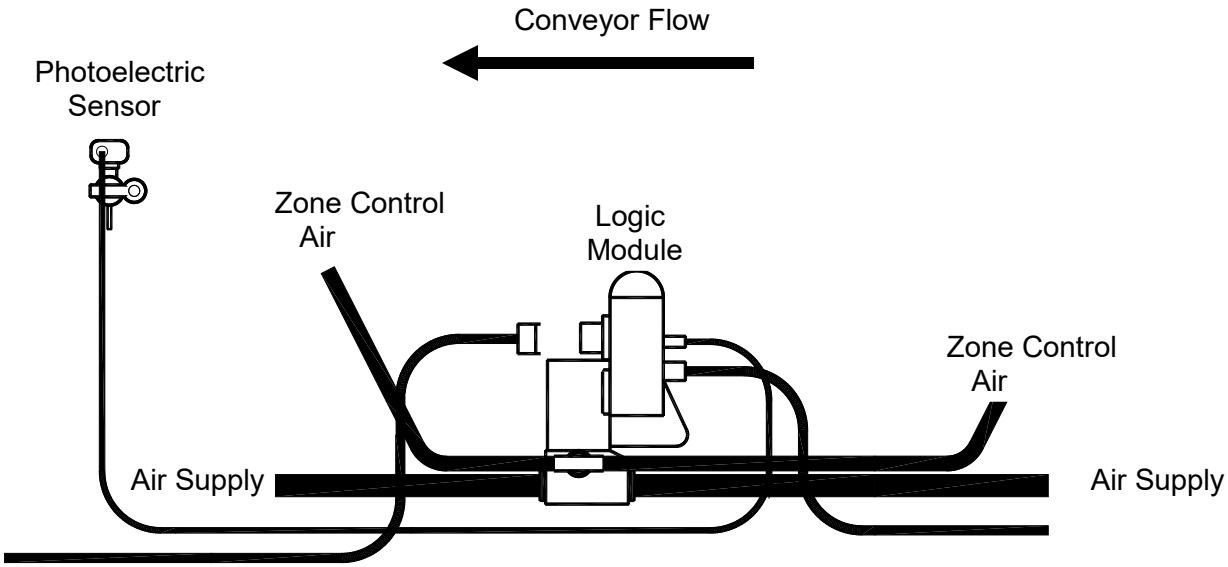
Logic Module Wiring



Installation

CRUZcontrol will come pre-installed on the conveyor:

- The CRUZcontrol Logic Assemblies are installed into the side channel of the conveyor bed.
- The air supply for the conveyor is plumbed the length of the conveyor bed, passing through each Logic Assembly, and provided with push-in quick connectors at the ends of the conveyor bed.
- The zone control air is plumbed from the Logic Assembly to the zone air pucks or cylinders.
- The photoelectric sensors are mounted for each zone, along with the reflector across the conveyor bed. The photoelectric sensors are tested to insure proper alignment with the reflectors, as well as proper functioning of the Logic Assemblies.



(Some conveyor configurations will result in the conveyor flow direction being reverse from what is shown in the illustration. In those situations, the Interconnection Cables are routed in reverse from that shown.)

CRUZcontrol On Site Installation

Installation will consist of the following:

- Connection of Air Supply air tubing between conveyor beds, closing and terminating the ends of the Air Supply tubing, and providing the air supply to the conveyor.
- Connection of the Logic Assembly interconnection cables from the last zone of a conveyor bed to the first zone in the next upstream conveyor bed.
- Providing a suitable 24 VDC power supply and connecting it into the string of Logic Assemblies.
- Providing a Singulation Release signal for the discharge zone (using Function Module).
- Providing a Slug Release signal for the discharge zone, if required (using Function Module).
- Obtaining Zone Status indications as required for system control (using Function Module).
- Terminating unconnected M12 cable ends with Termination Plugs. This is suggested to protect the cable ends from damage.
- Adding auxiliary photoelectric sensors as required for discharge and full line condition sensing.

MHS Conveyor Part No.	**Description**
90139992	Male M12 Termination Plug (use for terminating male cable ends)
90139994	Female M12 Termination Plug (use for terminating female cable ends)

NBA®23 to RLC®25 CRUZcontrol Installation

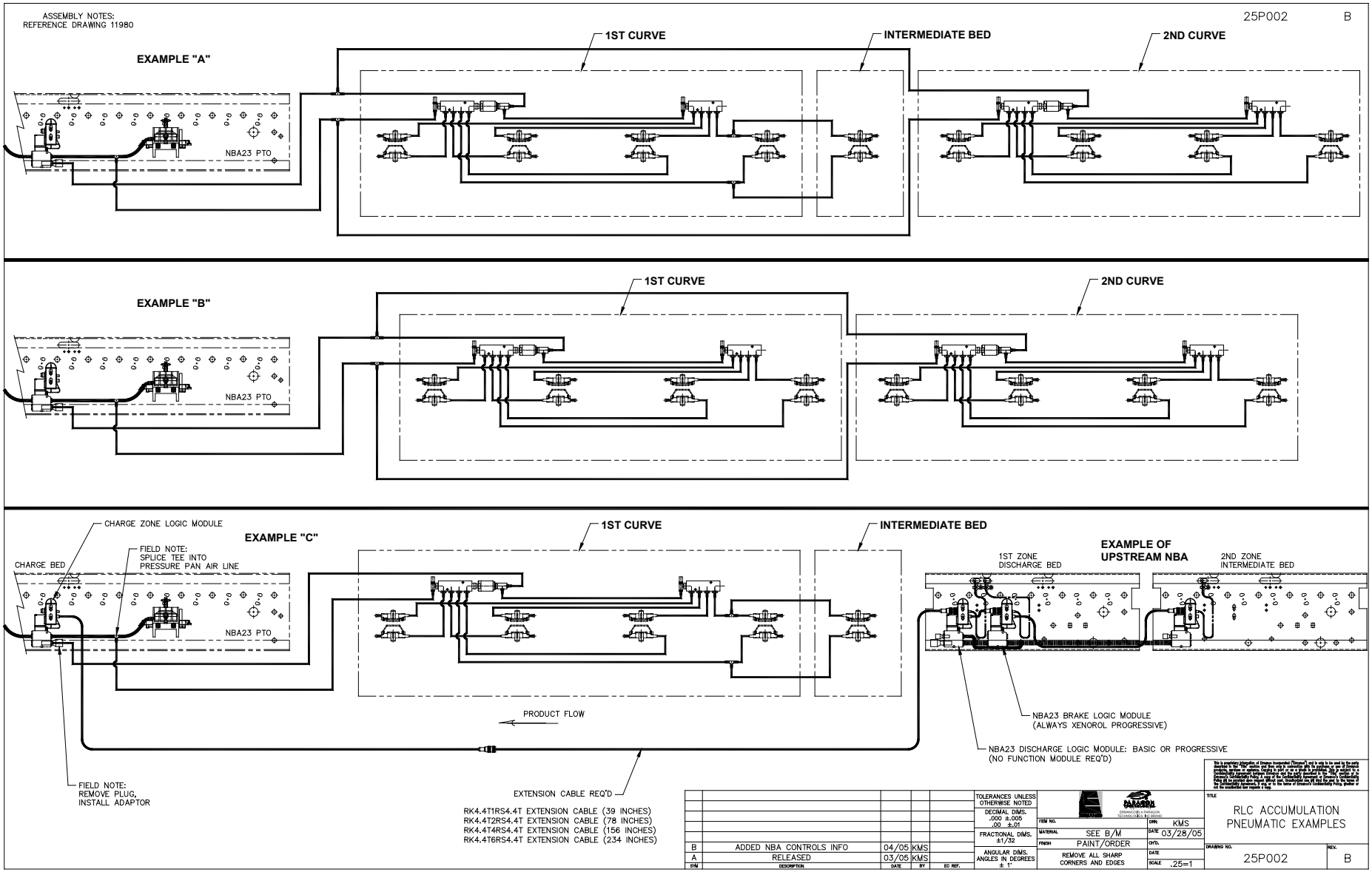
The accumulating option on your RLC 25 curve simply solves all previous problems associated with V-belt driven curves. IT IS NOT NECESSARY TO CLEAR THE CURVE OF PRODUCT when accumulation reaches it. There is no lost accumulation space since THE CURVE IS AN EXTENSION OF THE FOLLOWING ACCUMULATION. When the zone following the curve accumulates, so does the curve. THERE ARE NO CONTROLS YOU NEED TO SUPPLY.

No “full-line” photoeye is required following the curve. No special gaps need to be forced between products entering the curve. THERE IS NO INDEXING OR OTHER DEVICES, MOTORS, CONTROLS OR WIRING that need to be engineered or installed.

NOTE

A roller brake is recommended at the discharge end of any NBA®23 accumulation conveyor preceding the curve, to prevent coasting products from impacting those in the curve.

The examples on the following page show plumbing for several possible configurations of the accumulating option of the RLC 25 product line. Note that Example “C” illustrates the upstream NBA 23 beds with typical plumbing and controls shown.


ASSEMBLY NOTES:
REFERENCE DRAWING 11980
25P002 B
EXAMPLE "A"
1ST CURVE
INTERMEDIATE BED
2ND CURVE
NBA23 PTO
EXAMPLE "B"
1ST CURVE
2ND CURVE
NBA23 PTO
CHARGE ZONE LOGIC MODULE
EXAMPLE "C"
FIELD NOTE:
SPLICE TEE INTO
PRESSURE PAN AIR LINE
CHARGE BED
NBA23 PTO
1ST CURVE
INTERMEDIATE BED
EXAMPLE OF
UPSTREAM NBA
1ST ZONE
DISCHARGE BED
2ND ZONE
INTERMEDIATE BED
PRODUCT FLOW
NBA23 BRAKE LOGIC MODULE
(ALWAYS XENOROL PROGRESSIVE)
NBA23 DISCHARGE LOGIC MODULE: BASIC OR PROGRESSIVE
(NO FUNCTION MODULE REQ'D)
FIELD NOTE:
REMOVE PLUG,
INSTALL ADAPTOR
EXTENSION CABLE REQ'D
RK4.4T1RS4.4T EXTENSION CABLE (39 INCHES)
RK4.4T2RS4.4T EXTENSION CABLE (78 INCHES)
RK4.4T4RS4.4T EXTENSION CABLE (156 INCHES)
RK4.4T6RS4.4T EXTENSION CABLE (234 INCHES)
B ADDED NBA CONTROLS INFO 04/05 KMS
A RELEASED 03/05 KMS
TOLERANCES UNLESS OTHERWISE NOTED
DECIMAL DIMS. .000 ±.005 .00 ±.01
FRACTIONAL DIMS. ±1/32
ANGULAR DIMS. ANGLES IN DEGREES ± 1°
ITEM NO.
DRN KMS
MATERIAL SEE B/M
DATE 03/28/05
FINISH PAINT/ORDER
CHKD.
REMOVE ALL SHARP CORNERS AND EDGES
DATE
SCALE .25=1
TITLE
RLC ACCUMULATION
PNEUMATIC EXAMPLES
DRAWING NO. 25P002
REV. B

Power Supply Requirements

CRUZcontrol operates from a nominal supply voltage of 24 volts DC. The wiring methods and componentry used are such that a Class 2 power supply should be used. This limits the output power to a total of 100 VA. The current required for each CRUZcontrol Logic Assembly is 67mA, which allows for up to 53 zones per power supply. There is also a limit on the maximum number of Logic Assemblies that can be in one continuous string, based on the cable length from the power supply to the first Logic Assembly:

Cable length – power supply to first Logic Module Assembly	3 ft	9 ft	13 ft
Maximum # of Logic Module Assemblies per string	33	32	31
Maximum # based on zones greater than 36 inches	24	23	23

More than one string of Logic Assemblies can be connected to a power supply, up to the maximum of 53 zones.

Power Supplies

The following power supplies are available from MHS Conveyor. Technical specifications for each are included with this manual.

MHS Conveyor Part No.	Description
1101825	100-250 VAC input Power Supply Kit including T cable and Mounting Bracket. (reference Cutler-Hammer # PS256A-01B1)
94510092	342-528 VAC 3 phase input Power Supply Kit including a T cable and a Mounting Bracket. (reference C-H # PS256A-44B1)

Some things to consider regarding the use of these power supplies:

100-250 VAC input Power Supply:

- The output voltage, while rated at 27 VDC, is suitable for use with CRUZcontrol.
- A T Cable is provided with the Power Supply Kit for connection to the Power Supply output terminals.
- There are two sets of output terminals. These are connected in parallel, and provided only as a convenience for the connection of two separate output cables. The T Cable can be connected to either of these sets of terminals.
- The Release In terminals, when provided with a voltage input signal, will put out a 24 VDC level signal which can be used to enable (provide power to) either the Logic Signal or Slug Signal lines of CRUZcontrol. The Release Out switch should be set to Sourcing. (The Release Out feature is not required to operate CRUZcontrol. These same functions are also provided for with the Function Module, which comes with plug in connections.)
- The Power Monitor contact output provides a contact closure indication of 24 VDC power output being on. This is not required to operate CRUZcontrol.

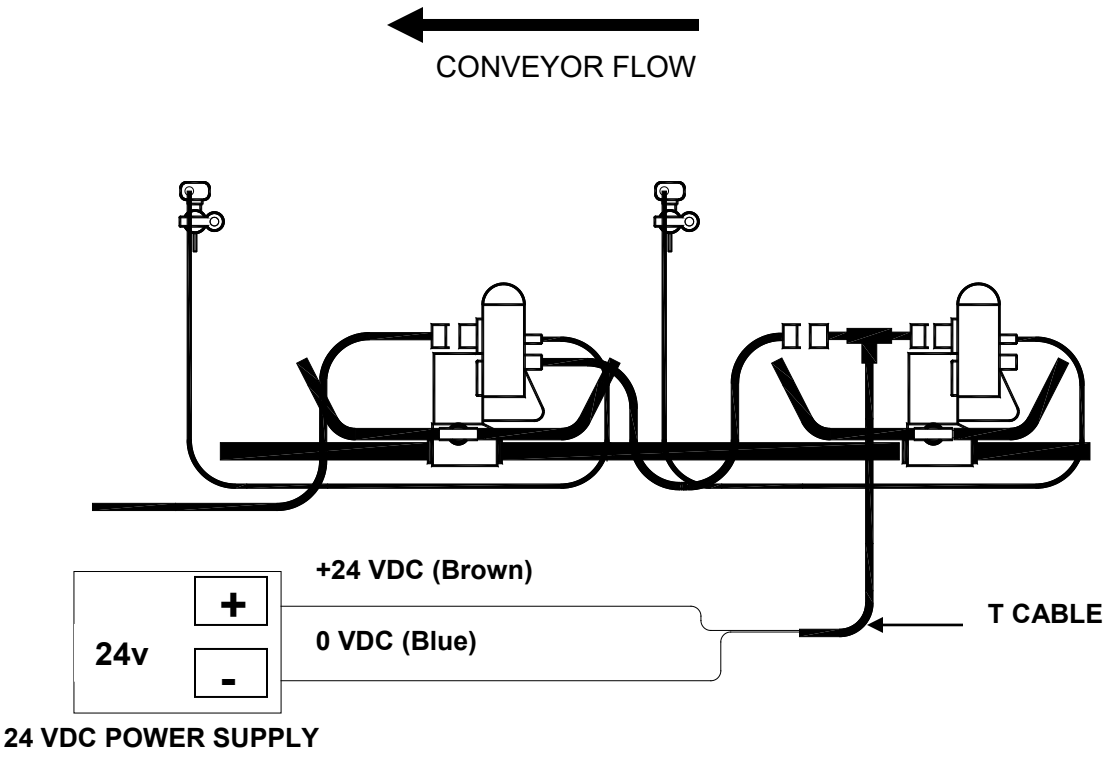
342-528 VAC 3 phase input Power Supply:

- This power supply can be connected into the motor wiring for the conveyor, eliminating the need to run a separate power feed to the power supply. The connections should be made at the output terminals of the motor safety switch (disconnect switch). The effect of the power supply load on the motor overload setting, while minimal, does need to be considered.
- The Three Phase AC Out terminals allow for the connection of a second power supply, if more than one is required.
- The output voltage, while rated at 26VDC, is suitable for use with CRUZcontrol.
- A T Cable is provided with the Power Supply Kit for connection to the Power Supply output terminals.

Power Supply Wiring

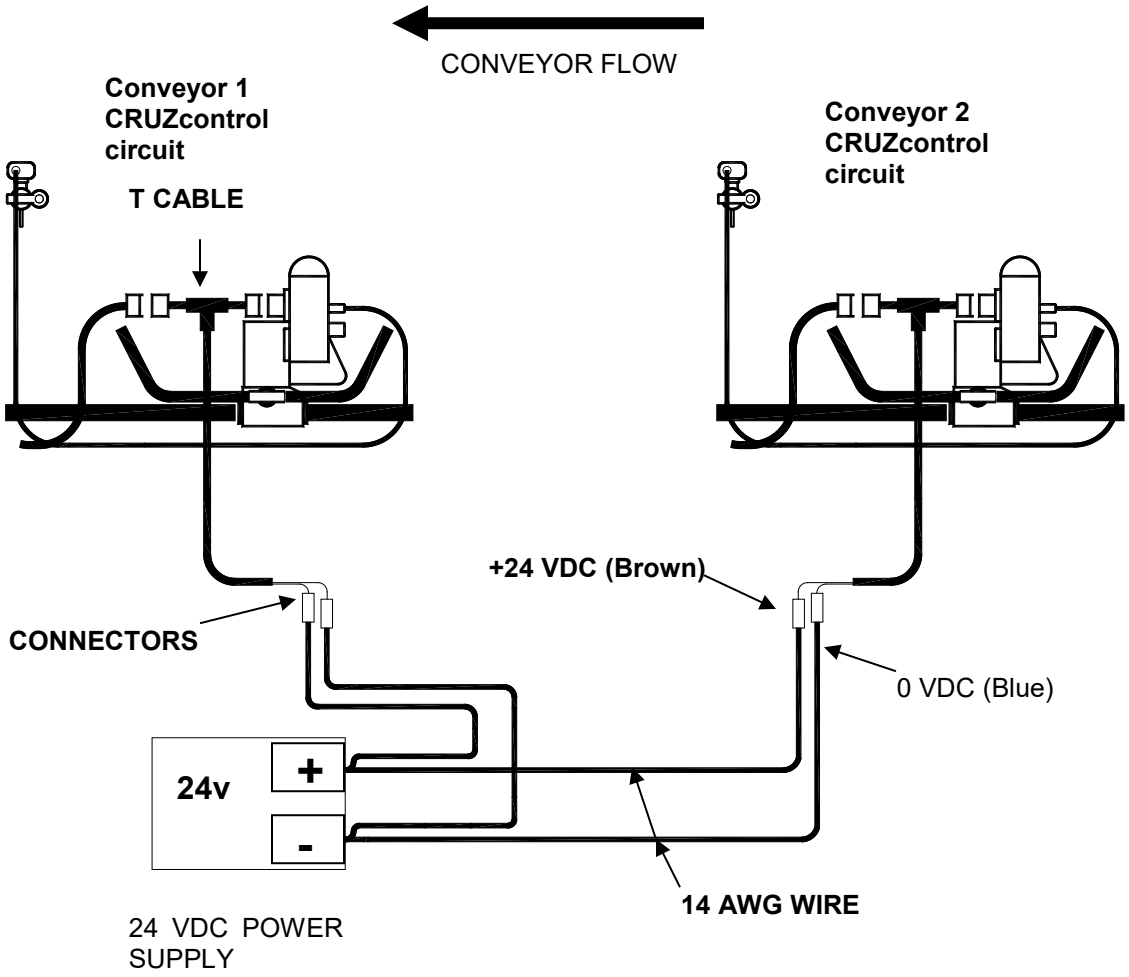
Connection made between two Logic Assemblies using a T Cable:

This drawing illustrates a power connection made between two intermediate accumulation zones making use of a T Cable. Note that all power and control signals, including the Slug and Logic Signals, pass through the T Cable uninterrupted.



One Power Supply used to power two separate CRUZcontrol sections:

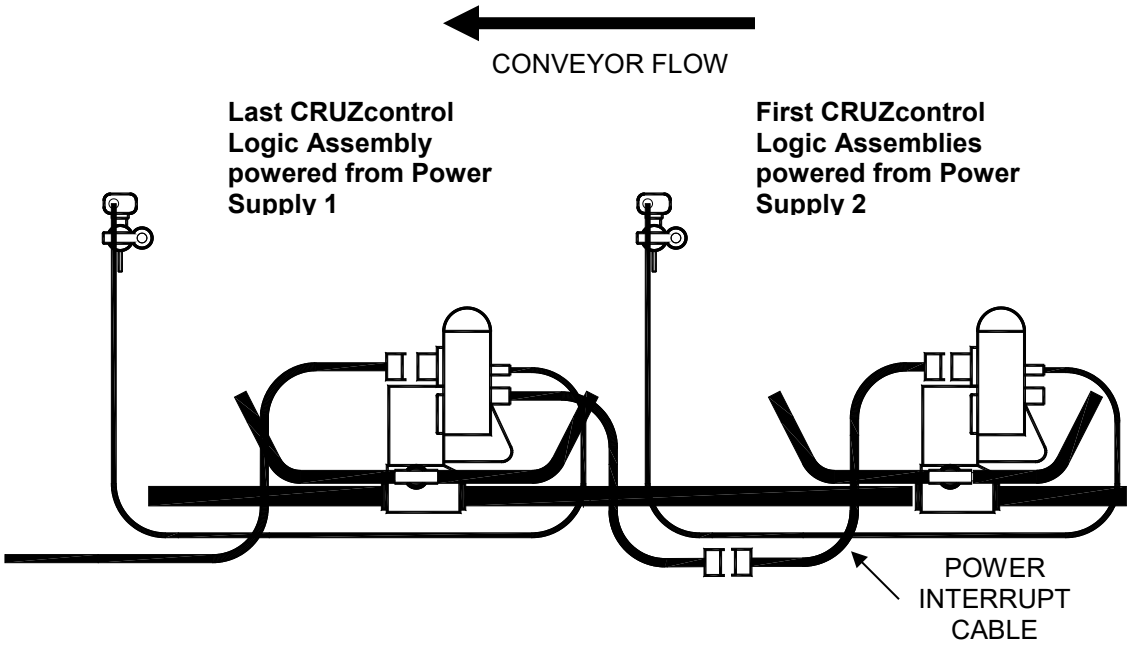
This drawing illustrates the use of one power supply to power two separate, short CRUZcontrol sections on two different conveyors. This can be done to make better use of the full capacity of a power supply, provided that the total number of Logic Assemblies doesn't exceed 53. The number of CRUZcontrol zones that can be connected per string must also be reduced according to the total length of wire and cable used to reach the first CRUZcontrol Logic Assembly of the string (refer to chart under Power Supply Requirements section).



MHS Conveyor Part Number	Description
224-201	Connectors
PS256ADAPT44B3	T Cable (one is already provided with Power Supply Kits)

Using two Power Supplies to power one extended CRUZcontrol string:

A CRUZcontrol string with more than 53 Logic Assemblies would require the use of more than one power supply. This can be done, but it requires that the power supplies be isolated from each other at the +24 volt line. This drawing illustrates how to isolate the two strings making use of a Power Interrupt Cable. The + VDC line, (pin 1), is not passed through, while the Slug Release and Singulation Release Signals as well as DC common (0 vdc) are connected so as to pass the signals through uninterrupted.



MHS Conveyor Part Number	Description
ZPI-P1	Power Interrupt Cable, 8 inches long

Generation 2 Function Modules

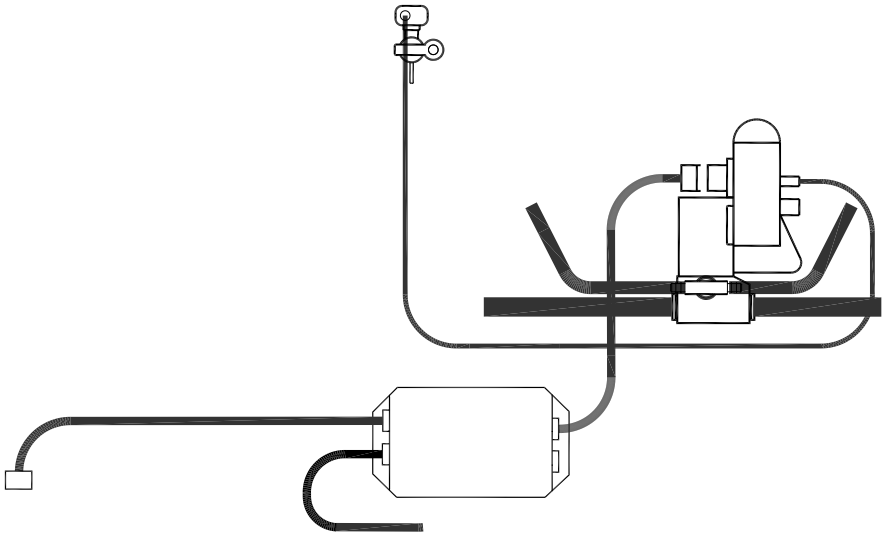
Function Modules (Generation 2)

Function Modules are an important accessory to CRUZcontrol. They provide electrical isolation for external processes and controls and facilitate CRUZcontrol system applications.

There are three different Function Modules, each providing different groups of functions:

MHS Conveyor Part Number	Description
1138074	Full Function Module
1138075	Release Function Module
1138078	Zone Status Function Module

These Function Modules replace the previous (Generation 1) 1138074 Function Module. The Release Function Module, 1138075, should serve most application requirements.



A Function Module is shown connected to the most downstream or discharge Logic Assembly. One cable from the Function Module does not need to be connected in this situation. A Function Module can also be connected between Logic Assemblies or after the last Logic Assembly in the string.

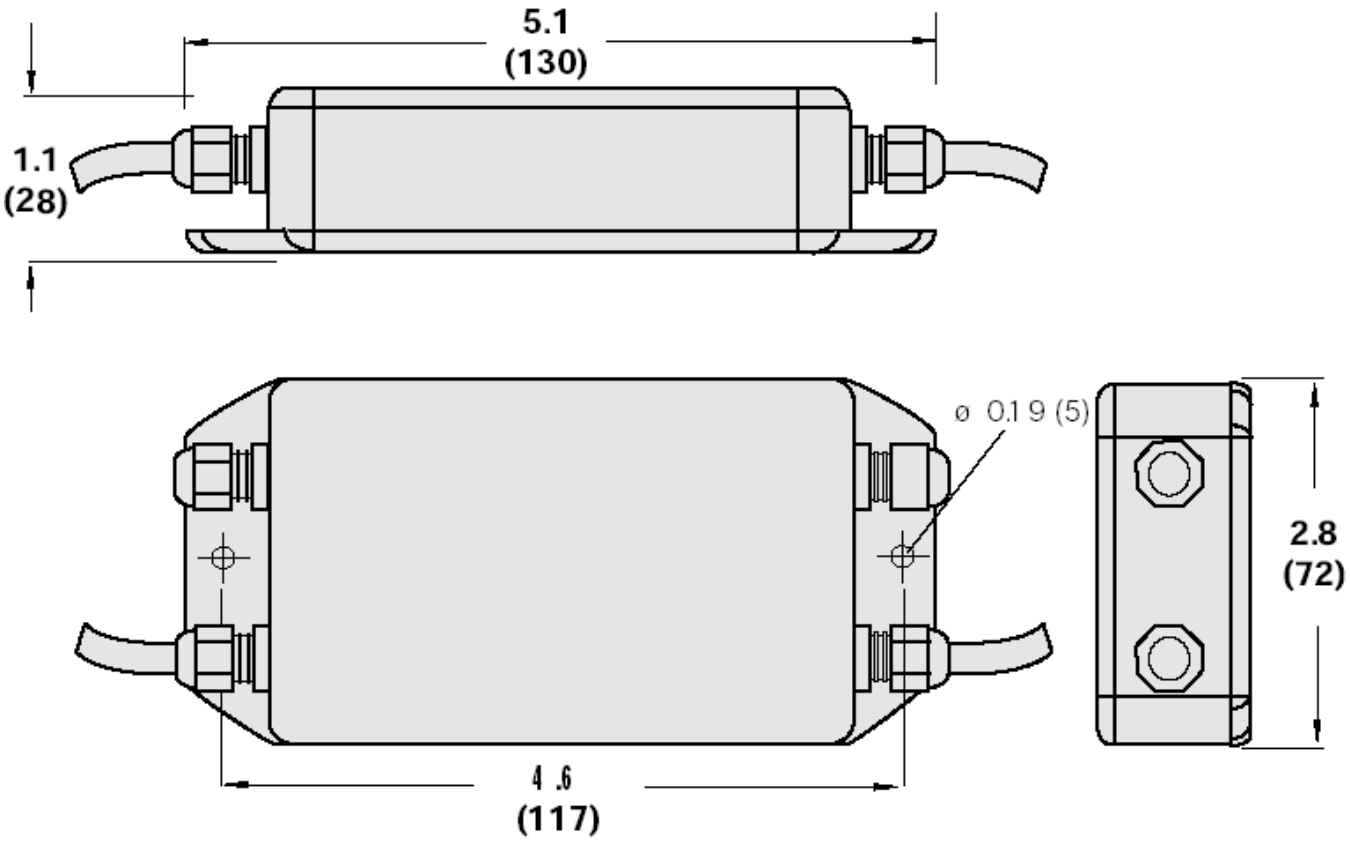
Function Module Power Requirements

The Function Modules get power by being connected into a string of Logic Assemblies. As a result, it will reduce the maximum number of Logic Assemblies that can be connected into one string. This is shown in the following chart, which is based on a 3 foot cable from the power supply to the first Logic Assembly, and 3 foot maximum zone spacing.

Number of Function Modules	0-2	3-7	8-12
Maximum # of Logic Module Assemblies per string	33	32	31

The Function Modules require 10mA of current at 24 VDC. This needs to be considered, as it will reduce the total number of Logic Modules that can be connected to one Class 2 power supply to some quantity less than 53.

Function Module Dimensions



Use of 115 VAC controls with all Function Modules

Important information regarding the use of 115 VAC controls:

These Function Modules will accept 115 VAC level control inputs. There are some cautions that must be observed to avoid Function Module hardware failure.

- Function Module signal inputs are protected against 500 volt spikes. 115 VAC control signal wiring run in conduit along with higher voltage motor wiring could experience voltage spikes that exceed the 500 volt limit. This can be prevented by running control wiring in separate conduit from motor wiring. Additional protection for the Function Module inputs can be achieved by using an MOV (metal oxide varistor) placed across the input terminals within the Function Module. Suggestions of suitable MOV's would include Panasonic ERZV07D241 or Littlefuse V250LA2.

Long conduit runs with motor wiring for multiple motors, and the use of variable frequency drives, all contribute to electrical noise, with a good potential for high voltage spikes. If there is any doubt, the control signals to the Function Modules should be run in conduits separate from motor wiring.

- The Function Module signal inputs have high impedance. When connected to some output devices, such as some PLC triac outputs, the inputs could sense an on state even if the output connected to it is not on. This can be corrected by adding additional loading to the output. This can be done by adding a loading resistor, placed across the output terminals. Do not put this resistor inside of the Function Module. The size and wattage rating of the resistor would depend on the output characteristics. A typical value would be 10,000 ohms (10K ohms) and 2 watts. The resistor would dissipate 1.32 watts at 115 VAC, so it will get warm.

Full Function Module 1138074

All directions of upstream or downstream are given with respect to the Function Module

Logic Interrupt / Stop Zone

Definition: Breaks logic signal from downstream Logic Assembly. Upstream logic line is forced OFF despite Downstream zone status.

Action: Upstream zone accumulates when the upstream Logic Assembly detects a package.

Configuration: Apply a low (OFF) signal input to TB1 when JP3 is on 2-3 OR (not both) a low (OFF) signal input to TB4 when JP4 is on 2-3. When configured for Logic Interrupt/Stop Zone, removing power from the terminal causes a Logic Interrupt/Stop Zone function. (Prior to date code 0520 (week 20 of 2005), a high (ON) signal was required to cause a Logic Interrupt/Stop Zone function.)

Logic Line Delay (Zone Release Delay)

Definition: Delays turning ON the upstream logic line.

Action: After the downstream logic line transitions from OFF to ON, such as after the downstream zone clears, the upstream logic line is turned ON only after the time set by the Logic Delay potentiometer has expired, causing the upstream zone to release.

Configuration: Adjust LOGIC potentiometer from 0 to 20 seconds.

Single Release

Definition: Upstream logic line is turned on.

Action: Upstream Logic Assembly releases despite zone status.

Configuration: Apply a high (ON) signal input to TB1 when JP3 is on 1-2 OR a high (ON) signal input to TB4 when JP4 is on 1-2

Pulse Release

Definition: Upstream logic line oscillates between ON and OFF based on the Zone Status ON and Zone Status OFF potentiometer settings and disables normal operation of logic line signals.

Action: Upstream Logic Assembly releases for a duration of time set by ZS ON (0-20s) and then accumulates for a duration of time set by ZS OFF (0-20s).

Configuration: Apply a high signal (ON) to TB1 when JP3 has no pins shorted (no jumper, or jumper on only one pin).

Slug Release

Definition: The Slug Release line is turned ON. This can occur by applying power (turning ON) the slug line at any point in the CRUZcontrol™ system. The Function Module can be used to supply power to the Slug Release Line and to manipulate the slug signal.

Action: All zones that are connected to the Slug line release regardless of zone status or accumulation status.

Configuration: Use the Function Module in one of 3 ways to activate a Slug Release:

1. Apply power from an external source directly to the Slug Release Line at the Slug connection on TB5 with JP1 on 1-2 and JP2 on 1-2. Power source must be sized appropriately to directly drive all connected Logic Assemblies.
2. Apply a high signal level (ON) to the opto-isolated input TB2 with JP1 on 1-2 and JP3 on 1-2.
3. A down stream logic release signal (Downstream logic line ON) is crossed-over to the upstream slug release line when JP1 is on 4-5 and JP2 on 1-2.

Downstream Slug Interrupt

Definition: The Slug Release line is disconnected going to the downstream Logic Assembly.

Action: Logic Assemblies downstream of the Function Module will not slug release when the Slug Release Line is turned ON either at the Function Module itself or upstream of the Function Module.

Configuration: JP1 is on 2-3 and JP2 is on 1-2.

Upstream Slug Interrupt

Definition: The Slug Release line is disconnected going to the upstream Logic Assembly.

Action: Logic Assemblies upstream of the Function Module will not slug release when the Slug Release Line is turned ON either at the Function Module itself or downstream of the Function Module.

Configuration: JP1 is on 1-2 and JP2 is on 2-3.

Zone Status Indication

Definition: Indicates full or empty status of the downstream zone at two output locations.

Action: Takes an input from one of several user selectable inputs, process it through Zone Status ON Delay and Zone Status OFF Delay and outputs to the ZS Relay on TB3 and Zone Status Output on TB5.

Configuration: Choose the input that determines the zone's empty or full status.

- Downstream logic signal (identical to Downstream Sensor signal of a Single Accumulation Logic Assembly) as the input:
  JP4 is on 1-2 or 2-3 and JP5 is on 1-2 or NC.
- Auxiliary sensor or external signal (from a PLC for example) as the input:
  JP4 is NC and signal is input to TB4

The output transition of the Zone Status from OFF to ON or ON to OFF will only occur if the time delay set by the Zone Status ON and Zone Status OFF Delay potentiometers have expired. A non-zero delay setting will effectively filter out transitions that only occur for the set time. This is typically used to indicate a zone is full only after a product is detected for period of time indicative of a full and accumulated lane.

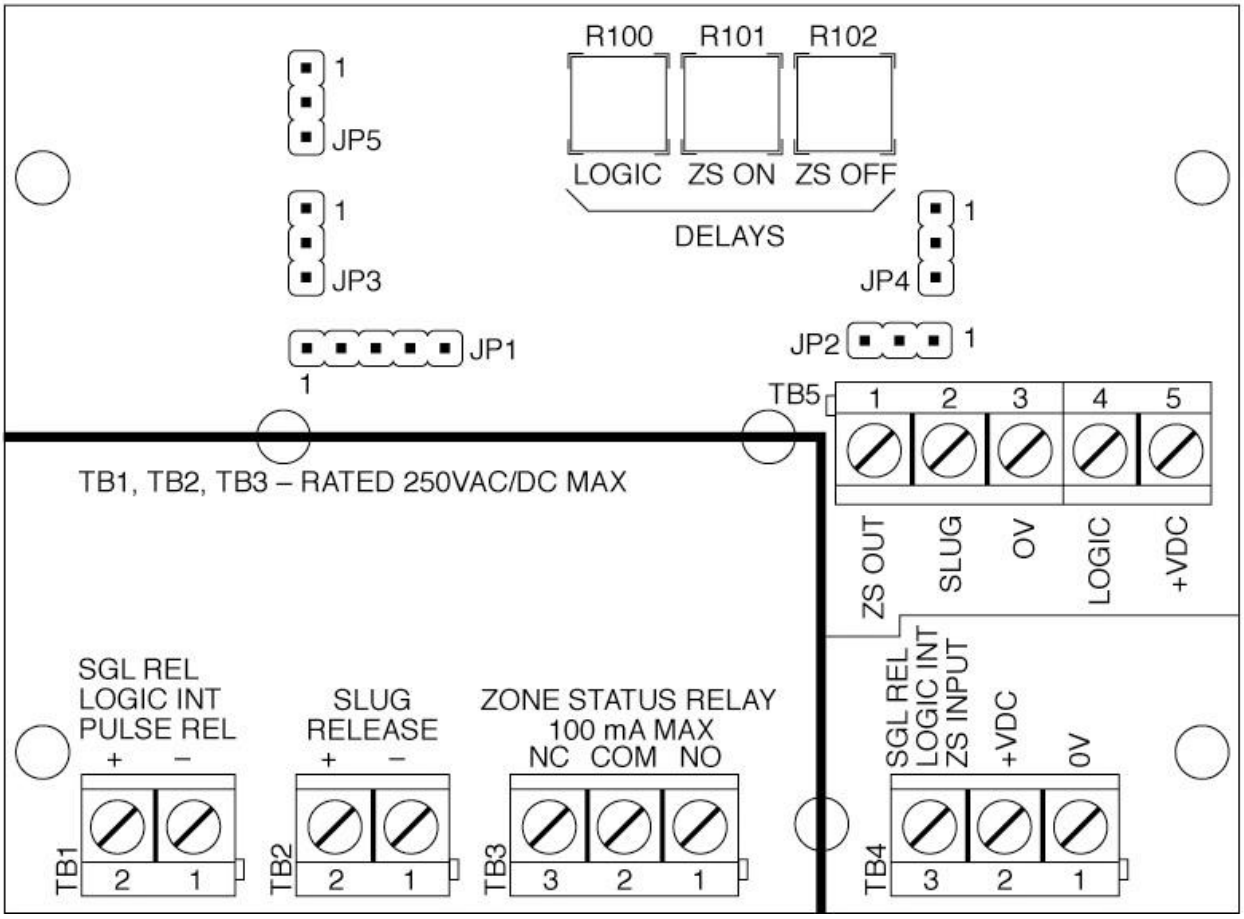
Full Function Module

Technical Data

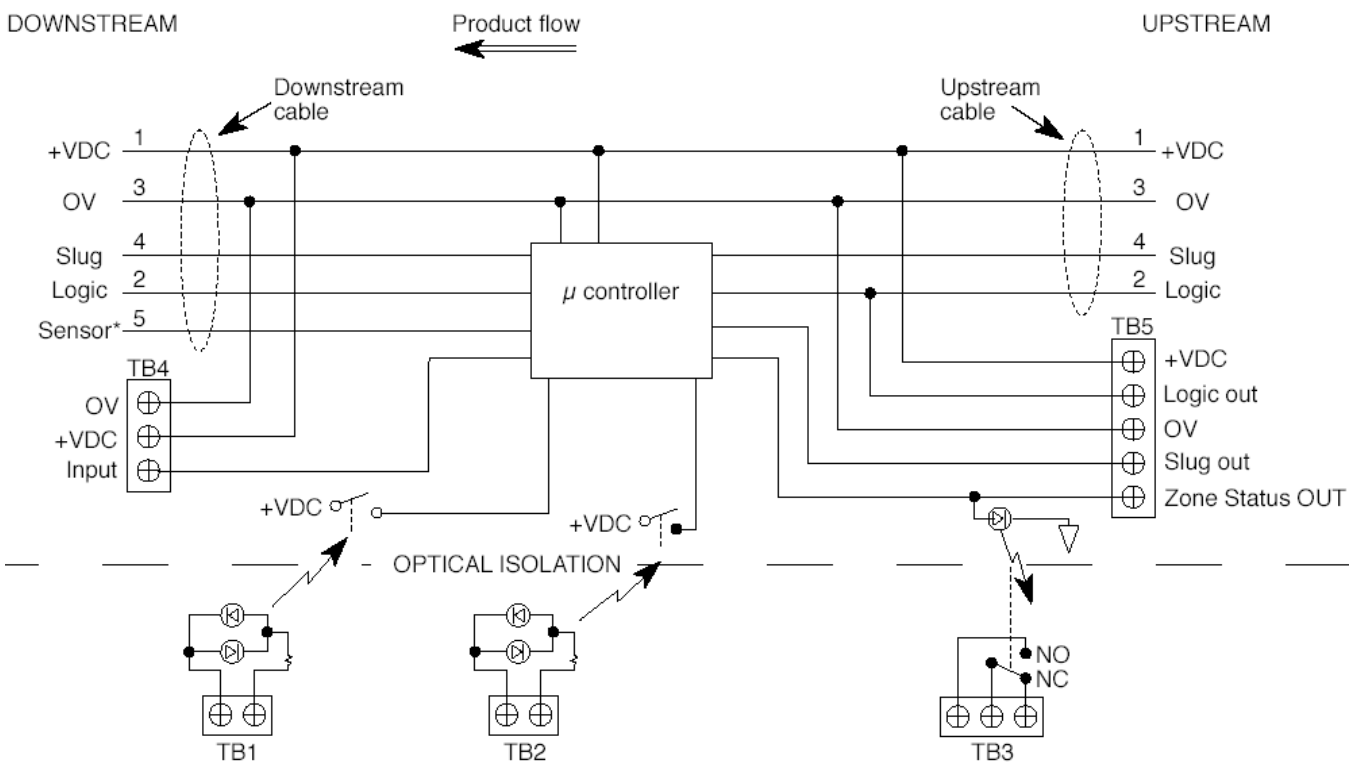
Interface to CRUZcontrol	
Upstream connection	Female, M12, 4-PIN, 300 mm cable
Downstream connection	Male, M12, 4-PIN, 300 mm cable
Power	
Supply voltage from daisy chain	18…30 VDC
Power consumption of ZIM	10 mA, no load
ZoneControl system power TB4 input	24…28 VDC typical. Limit values: 18…30 VDC
Input ratings	
TB4 Power inputs +VDC, Common	24 VDC typical, 30 VDC max.
TB4 Release/Interrupt input	18…30 VDC
	Guaranteed OFF Voltage: <= 4.0 VDC
	Guaranteed ON Voltage: >= 15.0 VDC
	Typical ON state current draw @24V: 4mA
TB1 Single Release/Logic Interrupt/Pulse Release input[1]	18…250 UC[1]
	Guaranteed OFF Voltage: <= 4 UC
	Guaranteed ON Voltage: >= 15.0 VDC
	Typical ON state current draw 2.5 mA
TB2 Slug Release input[1]	18…250 UC[1]
	Guaranteed OFF Voltage: <= 4 UC
	Guaranteed ON Voltage: >= 15.0 VDC
	Typical ON state current draw 2.5 mA
Output ratings	
TB5 Logic output	PNP; 2.21 kohm impedance typical
TB5 Zone Status output	PNP; 2.21 kohm impedance typical
TB3 Zone Status Relay [2]	250 UC max ; 100 mA max. Resistive load[2]
Physical properties	
Terminal block	
Terminal block wire	30 to 12 AWG (2.5 … 0.2mm², strip length ¼" (6.0 mm
Screw terminal torque	5 in-lbs. (0.56 Nm)
Potentiometers	
Mechanical angle	270° nominal
Stop strength	7.0 oz-in minimum
Housing	
Dimensions	5.125" x 3.75" x 1.125" (130mm x 95mm x 29mm)
Mounting	3/16" holes in mounting flange or double sided adhesi
Enclosure rating	IP 42, NEMA 1
Sock and vibration	IEC 68 2-27, IEC 68 2-29, and EC 68 2-6
Operating temperature	-13…131°F (-25…55°C)
Storage temperature	-40…185°F (-40…85°C)
Approximate weight	0.9 lb. (400 g)

1. These inputs are optically isolated from the rest of the Class 2 circuitry. Isolation voltage from Universal-Voltage inputs to Class 2 circuitry: 5000Vrms. Inputs are not sensitive to polarity.
2. Optically isolated solid state relay with 1 Normally Open and 1 Normally Closed contact. Isolation voltage from ZONE STATUS relay terminals to Class 2 circuitry: 5000Vrms.

Full Function Module Board Layout



Full Function Module Circuit



*Fifth wire only available on 5 wire Logic Modules and Interface Modules.

Full Function Module

INPUTS					OUTPUT	
Downstream **LOGIC**	**TB1**	**JP3**	**TB4**	**JP4**	Upstream **LOGIC**	Note
0	0	X	0	X	0	
1	0	X	0	X	1	0 to 1 transition is delayed by Logic Delay Potentiometer
X	1	1-2	0	X	1	Single Release at TB1
X	1	2-3	X	X	0	Logic Interrupt at TB1
X	1	NC	X	X	OSC	Logic output signal oscillates at rate determined by ZS ON and ZS OFF potentiometers. Normal ZS potentiometer functions are disabled.
X	0	X	1	1-2	1	Single Release at TB4 (pin 3)
X	X	X	1	2-3	0	Logic Interrupt at TB4 (pin 3)
X	X	X	1	NC	X	No effect on Logic Output when TB4 is configured as Zone Status Input

Truth Table for Logic Circuit

	STATE	Electrical Definition	Typical System Definition
Downstream **LOGIC**	0	<4.0VDC	Downstream zone is ACCUMULATED (reflective sensor blocked)
	1	>15VDC	Downstream zone is NOT ACCUMULATED (reflective sensor not blocked)
TB1	0	<4VAC/DC	No effect
	1	>15VAC/DC	Single Release or Logic Interrupt or Pulse Release (function determined by JP3 setting)
JP3	1-2	---	TB1 = Single Release
	2-3	---	TB1 = Logic Interrupt
	NC	---	TB1 = Pulse Release
TB4	0	<4VAC/DC	No effect
	1	>15VAC/DC	Single Release or Logic Interrupt or Zone Status Input (function determined by JP4 setting)
JP4	1-2	---	TB4 = Single Release
	2-3	---	TB4 = Logic Interrupt
	NC	---	TB4 = Zone Status Input
Upstream **LOGIC**	0	0VDC (floating)	Send zone ACCUMULATED signal to upstream zone
	1	24VDC (PNP)	Send zone NOT ACCUMULATED signal to upstream zone

Truth Table Definitions

Full Function Module

INPUTS					OUTPUT	
Downstream **LOGIC**	Downstream **SENSOR**	**TB4**	**JP4**	**JP5**	**ZONE STATUS**	Note
0	X	X	1-2 or 2-3	1-2 or NC	0	1 to 0 transistion is delayed by Zone Status OFF delay potentiometer
1	X	X	1-2 or 2-3	1-2 or NC	1	0 to 1 transistion is delayed by Zone Status ON delay potentiometer
X	0	X	1-2 or 2-3	2-3	0	1 to 0 transistion is delayed by Zone Status OFF delay potentiometer
X	1	X	1-2 or 2-3	2-3	1	0 to 1 transistion is delayed by Zone Status ON delay potentiometer
X	X	0	NC	X	0	1 to 0 transistion is delayed by Zone Status OFF delay potentiometer
X	X	1	NC	X	1	0 to 1 transistion is delayed by Zone Status ON delay potentiometer

Truth Table for Zone Status Circuit

	STATE	Electrical Definition	Typical System Definition
Downstream **LOGIC**	0	<4.0VDC	Downstream zone is ACCUMULATED
	1	>15VDC	Downstream zone is NOT ACCUMULATED
Downstream **SENSOR**	0	<4VAC/DC	Downstream sensor is blocked
	1	>15VAC/DC	Downstream sensor is not blocked
TB4	0	<4VAC/DC	No effect
	1	>15VAC/DC	Zone Status input if JP4=NC, otherwise no effect
JP4	1-2 or 2-3	---	**ZONE STATUS** input source is determined by JP5 setting
	NC	---	**ZONE STATUS** is controlled from **TB4** input
JP5	1-2 or NC	---	**ZONE STATUS** is controlled from Downstream **LOGIC** signal
	2-3	---	**ZONE STATUS** is controlled from Downstream **SENSOR** signal
ZONE STATUS	0	0VDC (floating)	
	1	24VDC (PNP)	
ZONE STATUS RELAY (TB3)	0	NO contact: OPEN NC contact: CLOSED	
	1	NO contact: CLOSED NC contact: OPEN	

Truth Table Definitions

Full Function Module

(Note: "ZIM" as found in this table refers to Function Module)

INPUTS			OUTPUTS			
Downstream **LOGIC**	Downstream **SLUG**	**JP1**	**JP2**	Upstream **SLUG**	**TB5 (pin 4)**	Note
X	0	1-2	X	0	0	No Slug signal
X	1	1-2	1-2	1	1	Downstream Slug pass-through, Upstream Slug pass-through
X	1	1-2	2-3	0	1	Downstream Slug pass-through, Upstream Slug interrupt
X	X	2-3	X	0	0	Downstream Slug interrupt
0	X	4-5	X	0	0	Logic Crossover
1	X	4-5	1-2	1	1	Logic Crossover, Upstream Slug pass-through
1	X	4-5	2-3	0	1	Logic Crossover, Upstream Slug interrupt

Truth Table for Slug Circuitry (Downstream Inputs)

INPUTS		OUTPUTS			
Upstream **SLUG**	**JP2**	**JP1**	Downstream **SLUG**	**TB5 (pin 4)**	Note
0	1-2	X	0	0	No Slug signal
1	1-2	1-2	1	1	Upstream Slug pass-through, Downstream Slug pass-through
1	1-2	2-3	0	1	Upstream Slug pass-through, Downstream Slug interrupt
1	1-2	4-5	0	1	Upstream Slug pass-through, Downstream Logic Crossover
X	2-3	X	0	0	Upstream Slug interrupt

Truth Table for Slug Circuitry (Upstream Inputs)

INPUTS	OUTPUTS				
TB5 (pin 4)	**JP1**	Downstream **SLUG**	**JP2**	Upstream **SLUG**	Note
0	X	0	X	0	
1	1-2	1	1-2	1	Downstream Slug pass-through, Upstream Slug pass-through
1	2-3	0	2-3	0	Downstream Slug interrupt, Upstream Slug interrupt
1	4-5	0	1-2	1	Downstream Logic crossover, Upstream Slug pass-through

Truth Table for Slug Circuitry (TB5, pin 4 Input)

INPUTS	OUTPUTS					
TB2	**JP1**	Downstream **SLUG**	**JP2**	Upstream **SLUG**	**TB5 (pin 4)**	Note
0	X	0	X	0	0	
1	1-2	1	1-2	1	1	Downstream Slug pass-through, Upstream Slug pass-through
1	2-3	0	2-3	0	1	Downstream Slug interrupt, Upstream Slug interrupt
1	4-5	0	1-2	1	1	Downstream Logic crossover, Upstream Slug pass-through

Truth Table for Slug Circuitry (TB2 Input)

	STATE	Electrical Definition	Typical System Definition
Downstream **LOGIC**	0	<4.0VDC	Downstream zone is FULL
	1	>15VDC	Downstream zone is EMPTY
Downstream **SLUG**	0	<4.0VDC	**SLUG** line not active.
	1	>15VDC	**SLUG** line active
JP1	1-2	---	Downstream Slug pass-through. Downstream cable **SLUG** line connected directly to ZIM circuitry
	2-3	---	Downstream Slug interrupt. Downstream cable **SLUG** line isolated from ZIM circuitry
	4-5	---	Logic Crossover. Downstream **LOGIC** signal activates ZIM SLUG driver circuitry. Downstream cable **SLUG** line isolated from ZIM circuitry.
Upstream **SLUG**	0	<4.0VDC	**SLUG** line not active
	1	>15VDC	**SLUG** line active
JP2	1-2	---	Upstream Slug pass-through. Upstream cable **SLUG** line connected directly to ZIM circuitry
	2-3	---	Upstream Slug interrupt. Upstream cable **SLUG** line isolated from ZIM circuitry
TB5 (pin 4)	0	<4.0VDC	**SLUG** line not active
	1	>15VDC	**SLUG** line active
TB2	0	<4VAC/DC	No effect
	1	>15VAC/DC	Slug Release (activate ZIM **SLUG** driver circuitry)

Truth Table Definitions

Release Function Module E0006305

All directions of upstream or downstream are given with respect to the Function Module.

Logic Interrupt / Stop Zone

Definition: Breaks logic signal from downstream Logic Assembly. Upstream logic line is forced OFF despite Downstream zone status.

Action: Upstream zone accumulates when the upstream Logic Assembly detects a package.

Configuration: Apply a low (OFF) signal input to TB1 when JP3 is on 2-3 OR (never both) a low (OFF) signal input to TB4 when JP4 is on 2-3. When configured for Logic Interrupt/Stop Zone, removing power from the terminal causes a Logic Interrupt/Stop Zone function. (Prior to date code 0520 (week 20 of 2005), a high (ON) signal was required to cause a Logic Interrupt/Stop Zone function.)

Single Release

Definition: Upstream logic line is turned on.

Action: Upstream Logic Assembly releases despite zone status.

Configuration: Apply a high (ON) signal input to TB1 when JP3 is on 1-2 OR a high (ON) signal input to TB4 when JP4 is on 1-2

Slug Release

Definition: The Slug Release line is turned ON. This can occur by applying power (turning ON) the slug line at any point in the CRUZcontrol system. The Function Module can be used to supply power to the Slug Release Line and to manipulate the slug signal.

Action: All zones that are connected to the Slug line release regardless of zone status or accumulation status.

Configuration: Use the Function Module in one of 3 ways to activate a Slug Release:

1. Apply power from an external source directly to the Slug Release Line at the Slug connection on TB5 with JP1 on 1-2 and JP2 on 1-2. Power source must be sized appropriately to directly drive all connected Logic Assemblies.
2. Apply a high signal level (ON) to the opto-isolated input TB2 with JP1 on 1-2 and JP3 on 1-2.
3. A down stream logic release signal (Downstream logic line ON) is crossed-over to the upstream slug release line when JP1 is on 4-5 and JP2 on 1-2.

Downstream Slug Interrupt

Definition: The Slug Release line is disconnected going to the downstream Logic Assembly.

Action: Logic Assemblies downstream of the Function Module will not slug release when the Slug Release Line is turned ON either at the Function Module itself or upstream of the Function Module.

Configuration: JP1 is on 2-3 and JP2 is on 1-2.

Upstream Slug Interrupt

Definition: The Slug Release line is disconnected going to the upstream Logic Assembly.

Action: Logic Assemblies upstream of the Function Module will not slug release when the Slug Release Line is turned ON either at the Function Module itself or downstream of the Function Module.

Configuration: JP1 is on 1-2 and JP2 is on 2-3.

Zone Status Indication

Definition: Indicates full or empty status of the downstream zone.

Action: Takes an input from one of two user selectable inputs and outputs to the Zone Status Output on TB5.

Configuration: Choose the input that determines the zone's empty or full status:

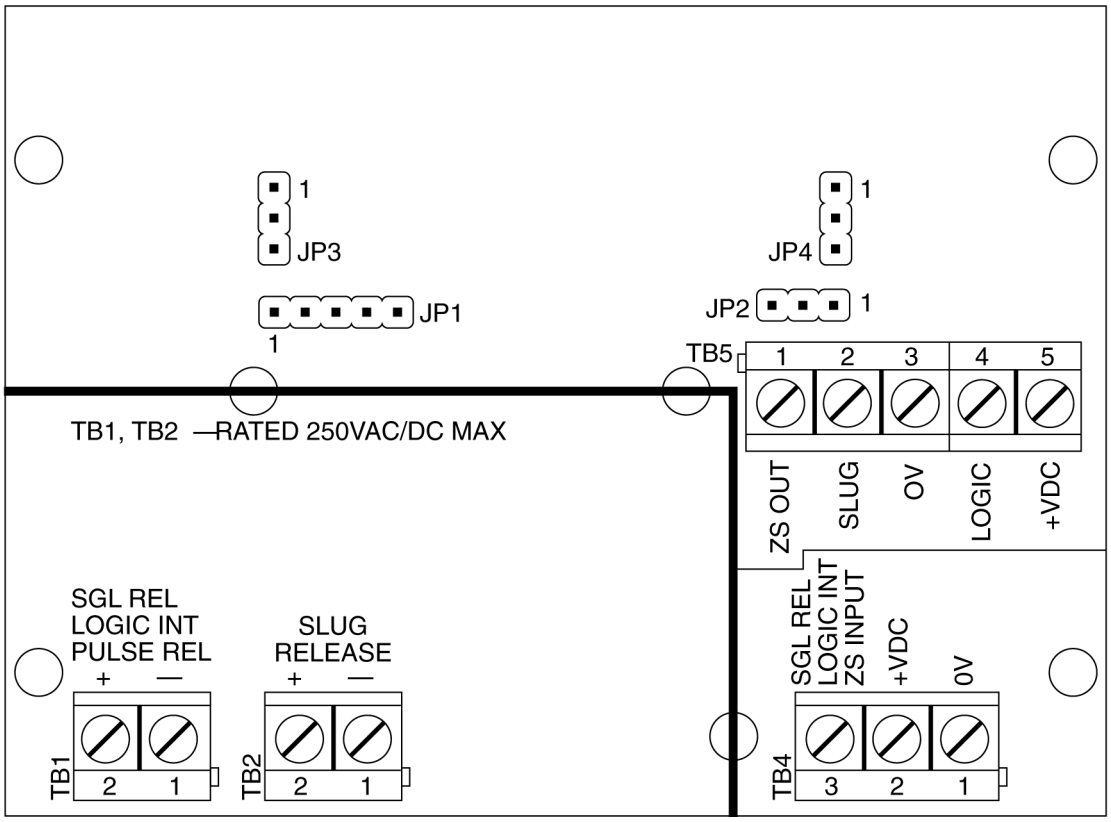
- Downstream logic signal (identical to Downstream Sensor signal of a Single Accumulation Logic Assembly) as the input: JP4 is on 1-2 or 2-3
- Auxiliary sensor or external signal (from a PLC for example) as the input: JP4 is NC and signal is input to TB4

Release Function Module

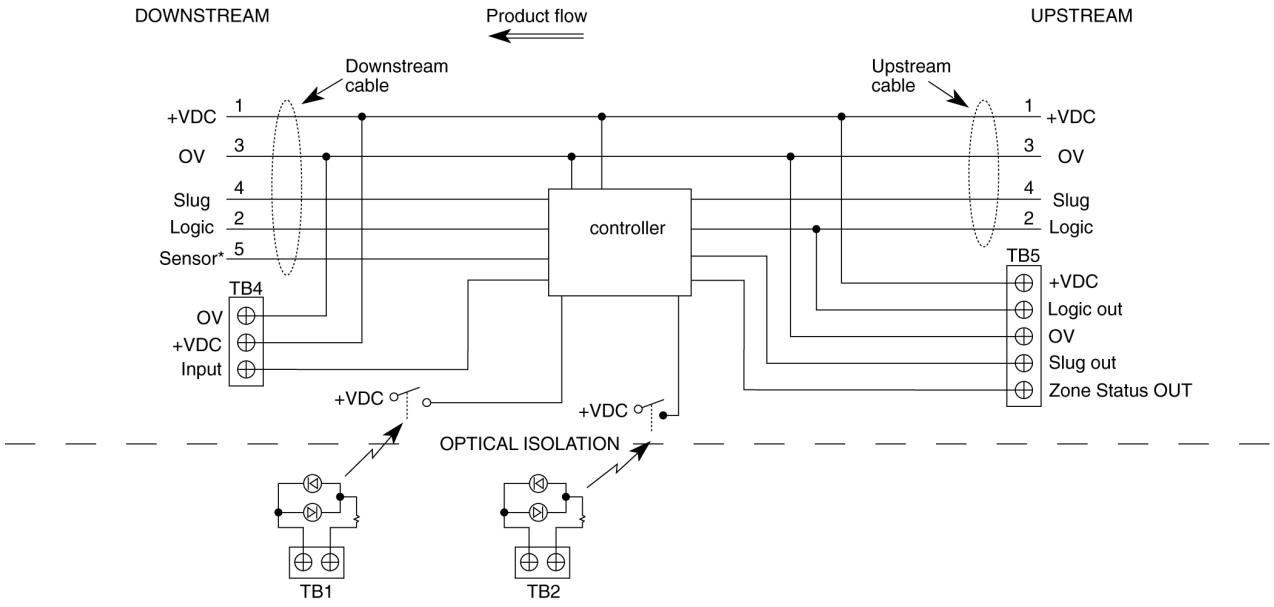
Technical Data	
Interface to CRUZcontrol	ZLM1, WLR2100-D
Upstream connection	Female, M12, 4-PIN, 300 mm cable
Downstream connection	Male, M12, 4-PIN, 300 mm cable
Power	
Supply voltage from daisy chain	18…30 VDC
Power consumption of ZIM	10 mA, no load
ZoneControl system power TB4 input	24…28 VDC typical. Limit values: 18…30 VDC
Input ratings	
TB4 Power inputs +VDC, Common	24 VDC typical, 30 VDC max.
TB4 Release/Interrupt input	18…30 VDC
	Guaranteed OFF Voltage: <= 4.0 VDC
	Guaranteed ON Voltage: >= 15.0 VDC
	Typical ON state current draw @24V: 4mA
TB1 Single Release/Logic Interrupt[1]	18…250 UC[1]
	Guaranteed OFF Voltage: <= 4 UC
	Guaranteed ON Voltage: >= 15.0 UC
	Typical ON state current draw 2.5 mA
TB2 Slug Release input[1]	18…250 UC[1]
	Guaranteed OFF Voltage: <= 4 UC
	Guaranteed ON Voltage: >= 15.0 UC
	Typical ON state current draw 2.5 mA
Output ratings	
TB5 Logic output	PNP; 2.21 kohm impedance typical
TB5 Zone Status output	PNP; 2.21 kohm impedance typical
Physical properties	
Terminal block	
Terminal block wire	30 to 12 AWG (2.5 … 0.2mm², strip length ¼" (6.0 mm)
Screw terminal torque	5 in-lbs. (0.56 Nm)
Housing	
Dimensions	5.125" x 3.75" x 1.125" (130mm x 95mm x 29mm)
Mounting	3/16" holes in mounting flange or double sided adhesive, any orientation
Enclosure rating	IP 42, NEMA 1
Sock and vibration	IEC 68 2-27, IEC 68 2-29, and EC 68 2-6
Operating temperature	-13…131°F (-25…55°C)
Storage temperature	-40…185°F (-40…85°C)
Approximate weight	0.9 lb. (400 g)

1. These inputs are optically isolated from the rest of the Class 2 circuitry. Isolation voltage from Universal-Voltage inputs to Class 2 circuitry: 5000Vrms. Inputs are not sensitive to polarity.
2. Optically isolated solid state relay with 1 Normally Open and 1 Normally Closed contact. Isolation voltage from ZONE STATUS relay terminals to Class 2 circuitry: 5000Vrms

Release Function Module Board Layout



Release Function Module Circuit



*Fifth wire only available on 5 wire Logic Modules and Interface Modules.

Release Function Module

Logic Truth Tables

INPUTS					OUTPUT	
Downstream **LOGIC**	**TB1**	**JP3**	**TB4**	**JP4**	Upstream **LOGIC**	Note
0	0	X	0	X	0	
1	0	X	0	X	1	
X	1	1-2	0	X	1	Single Release at TB1
X	1	2-3	X	X	0	Logic Interrupt at TB1
X	0	X	1	1-2	1	Single Release at TB4 (pin 3)
X	X	X	1	2-3	0	Logic Interrupt at TB4 (pin 3)
X	X	X	1	NC	X	No effect on Logic Output when TB4 is configured as Zone Status Input

Truth Table for Logic Circuit

	STATE	Electrical Definition	Typical System Definition
Downstream **LOGIC**	0	<4.0VDC	Downstream zone is ACCUMULATED (reflective sensor blocked)
	1	>15VDC	Downstream zone is NOT ACCUMULATED (reflective sensor not blocked)
TB1	0	<4VAC/DC	No effect
	1	>15VAC/DC	Single Release or Logic Interrupt or Pulse Release (function determined by JP3 setting)
JP3	1-2	---	TB1 = Single Release
	2-3	---	TB1 = Logic Interrupt
	NC	---	TB1 = Pulse Release
TB4	0	<4VAC/DC	No effect
	1	>15VAC/DC	Single Release or Logic Interrupt or Zone Status Input (function determined by JP4 setting)
JP4	1-2	---	TB4 = Single Release
	2-3	---	TB4 = Logic Interrupt
	NC	---	TB4 = Zone Status Input
Upstream **LOGIC**	0	0VDC (floating)	Send zone ACCUMULATED signal to upstream zone
	1	24VDC (PNP)	Send zone NOT ACCUMULATED signal to upstream zone

Truth Table Definitions

Release Function Module

INPUTS					OUTPUT	
Downstream **LOGIC**	Downstream **SENSOR**	**TB4**	**JP4**		**ZONE STATUS**	Note
0	X	X	1-2 or 2-3		0	
1	X	X	1-2 or 2-3		1	
X	0	X	1-2 or 2-3		0	
X	1	X	1-2 or 2-3		1	
X	X	0	NC		0	
X	X	1	NC		1	

Truth Table for Zone Status Circuit

	STATE	Electrical Definition	Typical System Definition
Downstream **LOGIC**	0	<4.0VDC	Downstream sensor blocked (Single Acc.) or accumulated (Slug Acc.)
	1	>15VDC	Downstream sensor not blocked (Single Acc.) or not accumulated (Slug Acc)
Downstream **SENSOR**	0	<4VAC/DC	Downstream sensor is blocked
	1	>15VAC/DC	Downstream sensor is not blocked
TB4	0	<4VAC/DC	No effect
	1	>15VAC/DC	Zone Status input if JP4=NC, otherwise no effect
JP4	1-2 or 2-3	---	No effect
	NC	---	**ZONE STATUS** is controlled from **TB4** input
ZONE STATUS	0	0VDC (floating)	
	1	24VDC (PNP)	

Truth Table Definitions

Release Function Module

(Note: "ZIM" as found in this table refers to Function Module)

INPUTS			OUTPUTS			
Downstream **LOGIC**	Downstream **SLUG**	**JP1**	**JP2**	Upstream **SLUG**	**TB5**	Note
X	0	1-2	X	0	0	No Slug signal
X	1	1-2	1-2	1	1	Downstream Slug pass-through, Upstream Slug pass-through
X	1	1-2	2-3	0	1	Downstream Slug pass-through, Upstream Slug interrupt
X	X	2-3	X	0	0	Downstream Slug interrupt
0	X	4-5	X	0	0	Logic Crossover
1	X	4-5	1-2	1	1	Logic Crossover, Upstream Slug pass-through
1	X	4-5	2-3	0	1	Logic Crossover, Upstream Slug interrupt

Truth Table for Slug Circuitry (Downstream Inputs)

INPUTS		OUTPUTS			
Upstream **SLUG**	**JP2**	**JP1**	Downstream **SLUG**	**TB5**	Note
0	1-2	X	0	0	No Slug signal
1	1-2	1-2	1	1	Upstream Slug pass-through, Downstream Slug pass-through
1	1-2	2-3	0	1	Upstream Slug pass-through, Downstream Slug interrupt
1	1-2	4-5	0	1	Upstream Slug pass-through, Downstream Logic Crossover
X	2-3	X	0	0	Upstream Slug interrupt

Truth Table for Slug Circuitry (Upstream Inputs)

INPUTS	OUTPUTS				
TB5	**JP1**	Downstream **SLUG**	**JP2**	Upstream **SLUG**	Note
0	X	0	X	0	
1	1-2	1	1-2	1	Downstream Slug pass-through, Upstream Slug pass-through
1	2-3	0	2-3	0	Downstream Slug interrupt, Upstream Slug interrupt
1	4-5	0	1-2	1	Downstream Logic crossover, Upstream Slug pass-through

Truth Table for Slug Circuitry (TB5)

INPUTS	OUTPUTS					
TB2	**JP1**	Downstream **SLUG**	**JP2**	Upstream **SLUG**	**TB5**	Note
0	X	0	X	0	0	
1	1-2	1	1-2	1	1	Downstream Slug pass-through, Upstream Slug pass-through
1	2-3	0	2-3	0	1	Downstream Slug interrupt, Upstream Slug interrupt
1	4-5	0	1-2	1	1	Downstream Logic crossover, Upstream Slug pass-through

Truth Table for Slug Circuitry (TB2 Input)

	STATE	Electrical Definition	Typical System Definition
Downstream **LOGIC**	0	<4.0VDC	Downstream zone is FULL
	1	>15VDC	Downstream zone is EMPTY
Downstream **SLUG**	0	<4.0VDC	**SLUG** line not active.
	1	>15VDC	**SLUG** line active
JP1	1-2	---	Downstream Slug pass-through. Downstream cable **SLUG** line connected directly to ZIM circuitry
	2-3	---	Downstream Slug interrupt. Downstream cable **SLUG** line isolated from ZIM circuitry
	4-5	---	Logic Crossover. Downstream **LOGIC** signal activates ZIM SLUG driver circuitry. Downstream cable **SLUG** line isolated from ZIM circuitry.
Upstream **SLUG**	0	<4.0VDC	**SLUG** line not active
	1	>15VDC	**SLUG** line active
JP2	1-2	---	Upstream Slug pass-through. Upstream cable **SLUG** line connected directly to ZIM circuitry
	2-3	---	Upstream Slug interrupt. Upstream cable **SLUG** line isolated from ZIM circuitry
TB5	0	<4.0VDC	**SLUG** line not active
	1	>15VDC	**SLUG** line active
TB2	0	<4VAC/DC	No effect
	1	>15VAC/DC	Slug Release (activate ZIM **SLUG** driver circuitry)

Truth Table Definitions

Zone Status Function Module E0006306

All directions of upstream or downstream are given with respect to the Function Module.

Logic Interrupt / Stop Zone

Definition: Breaks logic signal from downstream Logic Assembly. Upstream logic line is forced OFF despite Downstream zone status.
Action: Upstream zone accumulates when the upstream Logic Assembly detects a package.
Configuration: Apply a low (OFF) signal input to TB4 when JP4 is on 2-3. When configured for Logic Interrupt/Stop Zone, removing power from the terminal causes a Logic Interrupt/Stop Zone function.

Single Release

Definition: Upstream logic line is turned ON.
Action: Upstream Logic Assembly releases despite zone status.
Configuration: Apply a high (ON) signal input to TB4 when JP4 is on 1-2

Slug Release

Definition: The Slug Release line is turned ON. This can occur by applying power (turning ON) the slug line at any point in the CRUZcontrol system. The Function Module can be used to supply power to the Slug Release Line.
Action: All zones that are connected to the Slug line release regardless of zone status or accumulation status.
Configuration: Apply power from an external source directly to the Slug Release Line at the Slug connection on TB5. Power source must be sized appropriately to directly drive all connected Logic Assemblies.

Zone Status Indication

Definition: Indicates full or empty status of the downstream zone at two output locations.
Action: Takes an input from one of several user selectable inputs and outputs to the ZS Relay on TB3 and Zone Status Output on TB5.
Configuration: Choose the input that determines the zone's empty or full status.

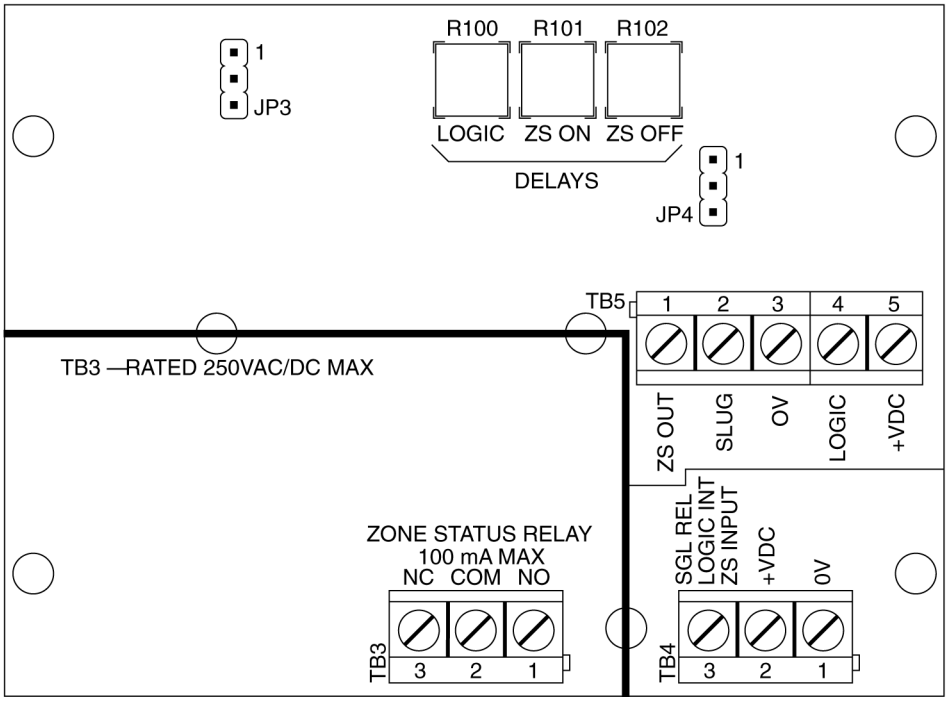
- Downstream logic signal (identical to Downstream Sensor signal of a Single Accumulation Logic Assembly) as the input:
  JP4 is on 1-2 or 2-3 and JP5 is on 1-2 or NC.
- Auxiliary sensor or external signal (from a PLC for example) as the input:
  JP4 is NC and ON signal is input to TB4
- Downstream Sensor as the input (available only on 5 wire Logic Assemblies):
  JP4 is on 1-2 or 2-3 and JP5 is on 2-3

Zone Status Function Module

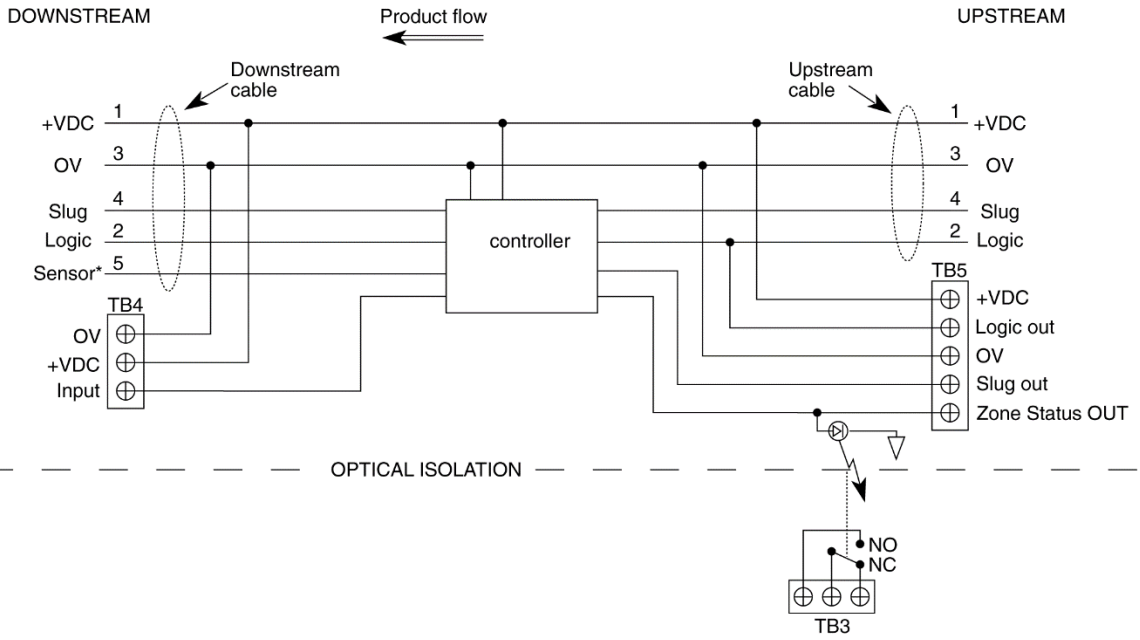
Technical Data	
Interface to CRUZcontrol system	
Upstream connection	Female, M12, 4-PIN, 300 mm cable
Downstream connection	Male, M12, 4-PIN, 300 mm cable
Power	
Supply voltage from daisy chain	18…30 VDC
Power consumption of ZIM	10 mA, no load
ZoneControl system power TB4 input	24…28 VDC typical. Limit values: 18…30 VDC
Input ratings	
TB4 Power inputs +VDC, Common	24 VDC typical, 30 VDC max.
TB4 Release/Interrupt input	18…30 VDC
	Guaranteed OFF Voltage: <= 4.0 VDC
	Guaranteed ON Voltage: ? 15.0 VDC
	Typical ON state current draw @24V: 4mA
Output ratings	
TB5 Logic output	PNP; 2.21 kohm impedance typical
TB5 Zone Status output	PNP; 2.21 kohm impedance typical
TB3 Zone Status Relay[1]	250 UC max ; 100 mA max. Resistive load[1]
Physical properties	
Terminal block	
Terminal block wire	30 to 12 AWG (2.5 … 0.2mm², strip length ¼" (6.0 mm)
Screw terminal torque	5 in-lbs. (0.56 Nm)
Housing	
Dimensions	5.125" x 3.75" x 1.125" (130mm x 95mm x 29mm)
Mounting	3/16" holes in mounting flange or double sided adhesive, any orientation
Enclosure rating	IP 42, NEMA 1
Sock and vibration	IEC 68 2-27, IEC 68 2-29, and EC 68 2-6
Operating temperature	-13…131°F (-25…55°C)
Storage temperature	-40…185°F (-40…85°C)
Approximate weight	0.9 lb. (400 g)

1. Optically isolated solid state relay with 1 Normally Open and 1 Normally Closed contact. Isolation voltage from ZONE STATUS relay terminals to Class 2 circuitry: 5000Vrms

Zone Status Function Module Board Layout



Zone Status Module Circuit



*Fifth wire only available on 5 wire Logic Modules and Interface Modules.

Logic Truth Tables

INPUTS					OUTPUT	
Downstream **LOGIC**			**TB4**	**JP4**	Upstream **LOGIC**	Note
X			1	1-2	1	Single Release at TB4
X			1	2-3	0	Logic Interrupt at TB4
X			1	NC	X	No effect on Logic Output when TB4 is configured as Zone Status Input

Truth Table for Logic Circuit

	STATE	Electrical Definition	Typical System Definition
Downstream **LOGIC**	0	<4.0VDC	Downstream zone is ACCUMULATED (reflective sensor blocked)
	1	>15VDC	Downstream zone is NOT ACCUMULATED (reflective sensor not blocked)
TB4	0	<4VAC/DC	No effect
	1	>15VAC/DC	Single Release or Logic Interrupt or Zone Status Input (function determined by JP4 setting)
JP4	1-2	---	TB4 = Single Release
	2-3	---	TB4 = Logic Interrupt
	NC	---	TB4 = Zone Status Input
Upstream **LOGIC**	0	0VDC (floating)	Send zone ACCUMULATED signal to upstream zone
	1	24VDC (PNP)	Send zone NOT ACCUMULATED signal to upstream zone

Truth Table Definitions

Zone Status Function Module

INPUTS					OUTPUT	
Downstream **LOGIC**	Downstream **SENSOR**	**TB4**	**JP4**	**JP5**	**ZONE STATUS**	Note
0	X	X	1-2 or 2-3	1-2 or NC	0	
1	X	X	1-2 or 2-3	1-2 or NC	1	
X	0	X	1-2 or 2-3	2-3	0	
X	1	X	1-2 or 2-3	2-3	1	
X	X	0	NC	X	0	
X	X	1	NC	X	1	

Truth Table for Zone Status Circuit

	STATE	Electrical Definition	Typical System Definition
Downstream **LOGIC**	0	<4.0VDC	Downstream zone is ACCUMULATED
	1	>15VDC	Downstream zone is NOT ACCUMULATED
Downstream **SENSOR**	0	<4VAC/DC	Downstream sensor is blocked
	1	>15VAC/DC	Downstream sensor is not blocked
TB4	0	<4VAC/DC	No effect
	1	>15VAC/DC	Zone Status input if JP4=NC, otherwise no effect
JP4	1-2 or 2-3	---	**ZONE STATUS** input source is determined by JP5 setting
	NC	---	**ZONE STATUS** is controlled from **TB4** input
JP5	1-2 or NC	---	**ZONE STATUS** is controlled from Downstream **LOGIC** signal
	2-3	---	**ZONE STATUS** is controlled from Downstream **SENSOR** signal
ZONE STATUS (TB5)	0	0VDC (floating)	
	1	24VDC (PNP)	
ZONE STATUS RELAY (TB3)	0	NO contact: OPEN NC contact: CLOSED	
	1	NO contact: CLOSED NC contact: OPEN	

Truth Table Definitions

Zone Status Function Module

INPUTS				OUTPUTS		
Downstream **LOGIC**	Downstream **SLUG**			Upstream **SLUG**	**TB5**	Note
X	0			0	0	No Slug signal
X	1			1	1	Downstream Slug pass-through, Upstream Slug pass-through

Truth Table for Slug Circuitry (Downstream Inputs)

INPUTS			OUTPUTS		
Upstream **SLUG**			Downstream **SLUG**	**TB5**	Note
0			0	0	No Slug signal
1			1	1	Upstream Slug pass-through, Downstream Slug pass-through

Truth Table for Slug Circuitry (Upstream Inputs)

INPUTS	OUTPUTS				
TB5		Downstream **SLUG**		Upstream **SLUG**	Note
0		0		0	No Slug signal
1		1		1	Downstream Slug pass-through, Upstream Slug pass-through

Truth Table for Slug Circuitry (TB5 input)

	STATE	Electrical Definition	Typical System Definition
Downstream **LOGIC**	0	<4.0VDC	Downstream zone is FULL
	1	>15VDC	Downstream zone is EMPTY
Downstream **SLUG**	0	<4.0VDC	**SLUG** line not active.
	1	>15VDC	**SLUG** line active
Upstream **SLUG**	0	<4.0VDC	**SLUG** line not active
	1	>15VDC	**SLUG** line active
TB5 (pin 4)	0	<4.0VDC	**SLUG** line not active
	1	>15VDC	**SLUG** line active

Truth Table Definitions

Generation 2 Function Modules - Definitions

Downstream or Upstream: In this manual, it is always in reference to the Function Module. For example, when referencing a downstream cable, this is the Function Module cable that is on its downstream side.

OFF: Indicates a logical low signal and/or no power. For example if a logic line is OFF, there is no power on the logic line.

ON: Indicates a logical high signal and/or powered. For example if a slug line is ON, then there is power on the slug line.

Zone status: The zone is considered full if the local zone's sensor detects a package. The zone is empty if it does not detect a package

JP# on #-#: JP stands for "jumper" and the number indicates which jumper group is being referred to. The terms "on #-#" refer to the pins that are shorted by the actual jumper.

TB#" TB stands for "terminal block" and the number indicates which terminal group is being referred to.

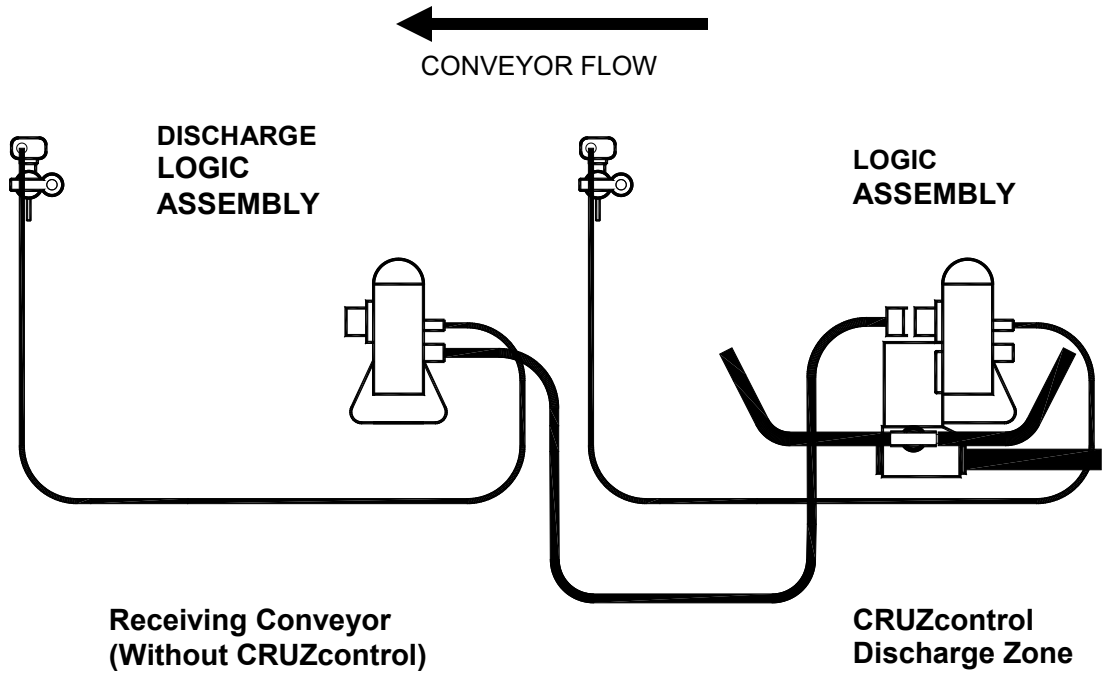
Warnings and Cautions

NOTE: To ensure safe operation of this product, a qualified electrician must perform installation and servicing. Check with local codes before installation.

- For maximum protection, follow UL listing requirements. The input line cable and line fuses must be sized in accordance with the rated input current of the unit.
- Do not make any connections when the Function Module is connected to the AC/DC utility/supply line.
- Before applying power to the module, make sure that the cover of the Function Module is closed.
- Any motor cables should cross CRUZcontrol cables at an angle of 90 degrees.
- If conduit is being used for wiring, use separate conduits for the input power wiring, the output power wiring, the signal wiring and the control wiring.
- Serviceability / Field Repair: Device is not serviceable.

Discharge Logic Assembly

A Discharge Logic Assembly is a Basic Logic Assembly without a solenoid valve attached. It can be used to control the release from the last, discharge zone of a length of CRUZcontrol. Since there is no solenoid valve, the same Discharge Logic Assembly will work for either NBA™23 or XenoROL® applications.



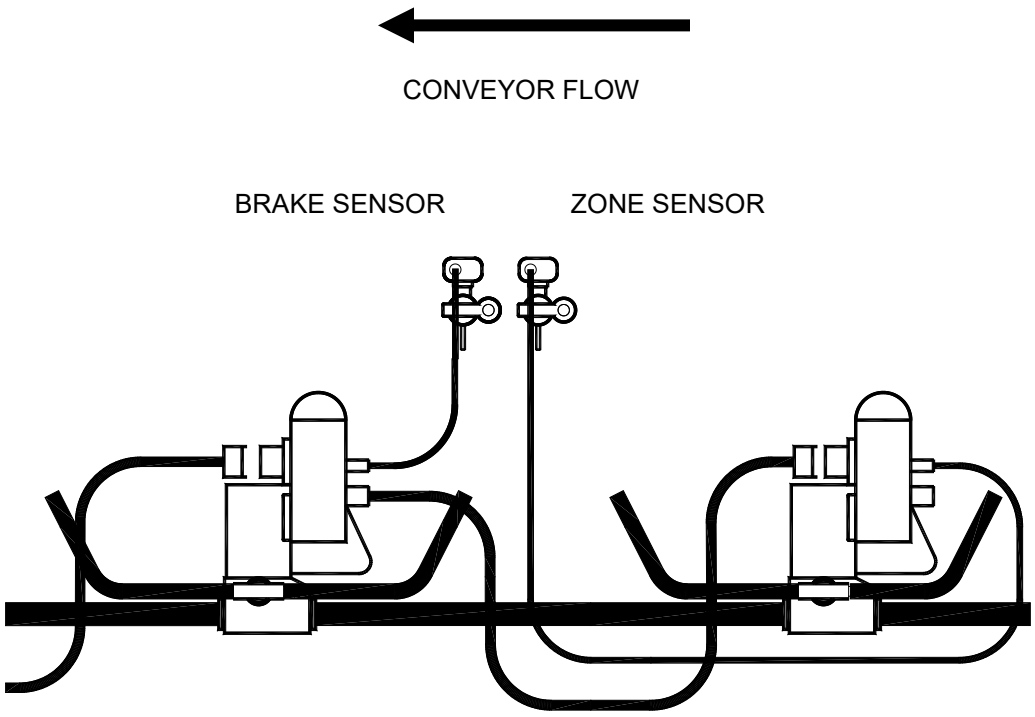
The Discharge Logic Assembly is mounted on the charge end of the conveyor immediately downstream of the last (discharge) zone of a length of CRUZcontrol accumulation conveyor. It is connected to the Logic Assembly of the discharge zone as shown. There is no need for a Function Module to be attached to it. The DLA does not need to be given a release signal. Product blocking that photoelectric sensor will stop release from the CRUZcontrol discharge zone, until the photoelectric sensor clears again. This operation can usually be left enabled and ready to function regardless of whether the receiving conveyor is running or off. There would be no need to interface the CRUZcontrol operation with the receiving conveyor operation, since the functioning of it is based solely on product movement.

The following hardware listing is for two Discharge Logic Assembly kits consisting of the Discharge Logic Assembly, a reflector, and mounting brackets. The mounting brackets provide for the mounting of the Discharge Logic Assembly and reflector either ½ inch or 3 inches above a standard XenoROL side channel. Since every application is different, there will usually be a need to drill mounting holes for the brackets.

MHS Conveyor Part Number	Description
E0006240	Discharge Logic Assembly Kit, ½ inch above rollers scan height
E0006236	Discharge Logic Assembly Kit, 3 inch above rollers scan height

NBA®23 Brake Control

When a discharge zone brake assembly is provided with NBA 23 conveyor, the brake control comes already wired and plumbed from the factory. The following is provided to explain how it functions.



BRAKE LOGIC ASSEMBLY
PROGRESSIVE LOGIC
XENOROL E0001904A

NBA 23 LOGIC ASSEMBLY
BASIC OR PROGRESSIVE

The two photoelectric sensors as shown are located in the discharge zone, sharing the same hole through the conveyor side channel and aimed at the same reflector. In this way they will always simultaneously sense the presence or lack of product. The Brake Logic Assembly is progressive logic, which passes the run or accumulate status upstream to the next logic assembly, which in this situation is the same zone. The Brake Logic Assembly is also XenoROL®, since an accumulated condition requires air to activate the brake.

Auxiliary Photoelectric Sensors

There is often a need to sense product presence on a CRUZcontrol equipped conveyor, with the sensors connected to a control system other than CRUZcontrol. To allow for this, adequate space has been provided along side of the CRUZcontrol photoelectric sensors to allow for the mounting of a second independent photoelectric sensor, sharing the same holes through the conveyor side channels and the same reflector. Appropriate holes are provided for the photoelectric sensor mounting bracket. The discharge end of NBA 23 conveyor is also provided with an additional mounting location for a photoelectric sensor and reflector (straight across scanning, no offset).

The following kits are available, which include the photoelectric sensor and appropriate bracket. Even though not normally needed, an extra reflector and adhesive mounting tape is also included with each kit.

MHS Conveyor Part Number	Description
94510097	Photo sensor with bracket, 10-30 VDC NPN output
94510099	Photo sensor with bracket, 10-30 VDC PNP output
94510098	Photo sensor with bracket, 20-264 VAC or 15-30 VDC (NPN) operation

The 10-30 VDC photo sensors are similar to the CRUZcontrol sensors. They are dark switching, with a 50 mA maximum output current, and come with a 6-foot cable (no connector).

The 20-264 VAC / 15-30 VDC photo sensor is an 18 mm barrel type. It is light or dark switching, with a 300 mA maximum output current, and comes with a 6-foot cable (no connector).

Reflectors

Replacement photoelectric reflectors can be ordered with the following part number:

MHS Conveyor Part Number	Description
400004	Reflector

Sensor Valve Assemblies

A Sensor Valve Assembly is used for applications not requiring accumulation logic, but the solenoid valve and photoelectric sensor configuration as used in the CRUZcontrol channel is still desired.

MHS Conveyor Part Number	Description
E0006229	Sick, CRUZ Sen Valve PLC Controlled

Extension Cables

The following extension cables are available to meet application requirements where longer zone lengths or skipped zones must be accommodated. Each cable has 4 conductors, with male and female M12 connector ends.

MHS Conveyor Part Number	Description
RK4.4T1RS4.4T	Extension Cable (39 inches)
RK4.4T2RS4.4T	Extension Cable (78 inches)
RK4.4T4RS4.4T	Extension Cable (156 inches)
RK4.4T6RS4.4T	Extension Cable (234 inches)

MHS Conveyor Controls Guidelines See following pages.

MHS Conveyor Controls Guidelines
ECG 2.3
Rev. 5.20.08
CRUZcontrol Applications

This guideline provides various suggestions on how to apply CRUZcontrol to meet some specific control requirements. For CRUZcontrol general information and specifications, refer to the CRUZcontrol Installation, Operation, and Maintenance Manual. This ECG assumes that the reader has a good understanding of the topics covered in that manual. Unless stated otherwise, the controls techniques as described in this ECG are applicable to both NBA 23 and XenoROL® applications of CRUZcontrol.

Example 1: Applying Progressive CRUZcontrol. While this example is based specifically on NBA®23, the principals covered also apply to XenoROL. The CRUZcontrol manual states the following:

"CRUZcontrol Logic Assemblies are designed to be fail-safe. A loss of module power, a disconnected or severed cable, or a dirty or failed photoelectric sensor will all result in the stopping of a zone, initiating accumulation beginning from the affected zone.

With Progressive Logic, failure of a Logic Assembly to function properly could possibly result in product accumulating with zones not stopping as required. While this should be unlikely due to the fail-safe nature of the Logic Assembly, the effects of such a failure should be considered. This type of failure could result in excessive line pressure, eventually causing product to push through the discharge zone of the conveyor. Jam detection sensors should be used as appropriate to minimize the effects of such a failure. "

A product jam on the conveyor, stopping the free flow of product, could also create a situation where Progressive CRUZcontrol can't function properly due to product not blocking one or more of the photoelectric sensors. This would probably be the most common cause of excessive line pressure resulting from the use of Progressive CRUZcontrol.

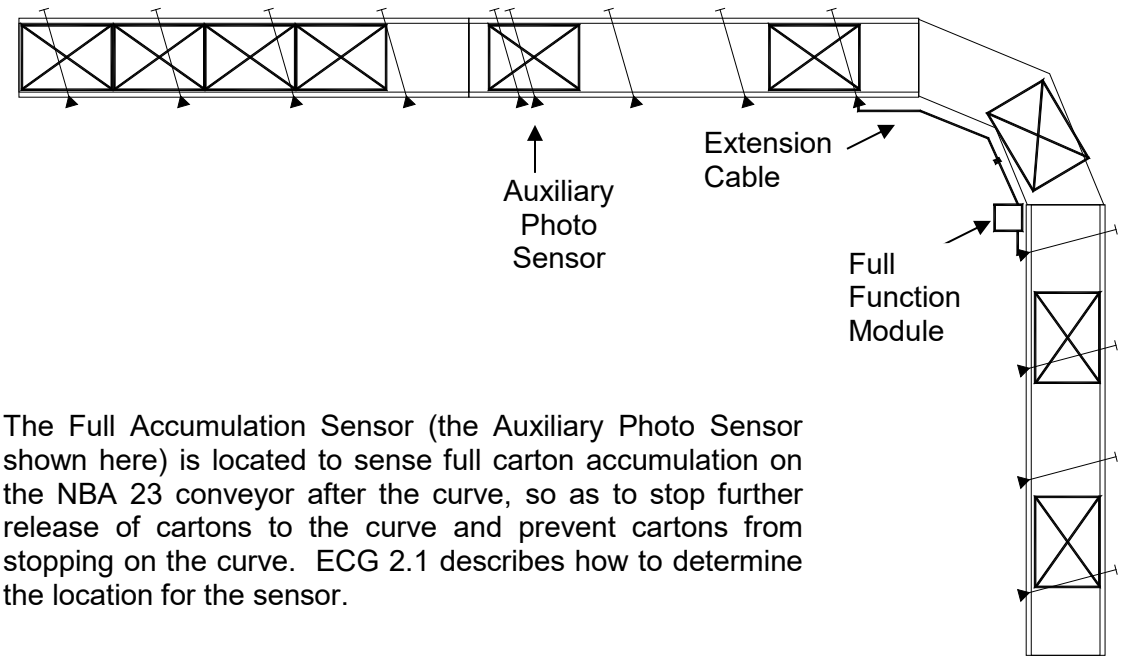
A solution to this problem is to provide one Basic Logic Assembly at the discharge end of every 12-foot bed of conveyor. This would limit the length of conveyor that could possibly be driving product against a jam point to under 12 feet.

The use of one Basic Logic Assembly on every 12-foot bed will disrupt the flow of product to some degree, but with adequate speed and product weight the flowing product should coast through the basic zones without any noticeable effect on the throughput rate. One exception is at the charge and discharge ends of a length of NBA 23, where the effects of using Basic Logic Assemblies on the throughput rate needs to be considered. If there is a need to maximize throughput rates, the use of all Progressive Logic Assemblies should be retained in those locations.

CRUZcontrol does provide an option for slug release. Both the Basic and Progressive Logic Assemblies will release at the maximum possible discharge rate when slug release is enabled. It will also create a situation where a product jam could result in excessive line pressure buildup. If the slug release feature is used, it should be used with caution, and for a limited number of successive accumulation zones.

Example 2: Accumulation control around a curve, where the curve rollers don't ever stop. Product should never accumulate on the curved section of the conveyor. The conveyor shown is NBA 23, with the curve being driven through a power takeoff.

Conveyor Flow



The Full Accumulation Sensor (the Auxiliary Photo Sensor shown here) is located to sense full carton accumulation on the NBA 23 conveyor after the curve, so as to stop further release of cartons to the curve and prevent cartons from stopping on the curve. ECG 2.1 describes how to determine the location for the sensor.

The hardware required in this example, in addition to that already provided with CRUZcontrol, includes the following:

Description	MHS Conveyor Part Number	Comments
Full Function Module	1138074	
Extension Cable	RK4.4T2RS4.4T	78 inches long. Other lengths available if required.
Auxiliary Photoelectric Sensor	94510099	PNP, Dark Switching

The Full Function Module is connected as shown just downstream of the last accumulation zone prior to the curve. Release from that zone is stopped if the Auxiliary Photo Sensor senses full accumulation (blocked for a time delay period), or if the Logic Assembly just downstream of the curve stops the upstream release due to being accumulated. The Full Function Module is set up as follows:

- Jumper JP3 is on 2-3 (Logic Interrupt)
- Jumper JP4 is not connected
- Zone Status On and Zone Status Off timing is set by potentiometers in function module. Time delays are from 0 to 20 seconds. A normal operating range would be about 3 seconds for each.

The Full Function Module is internally wired and connected to the photoelectric sensor as follows. All terminal references are as found in the Full Function Module.

Photoelectric sensor wiring:

Brown wire to TB4, + VDC
Blue wire to TB4, 0V
Black wire to TB4, ZS Input

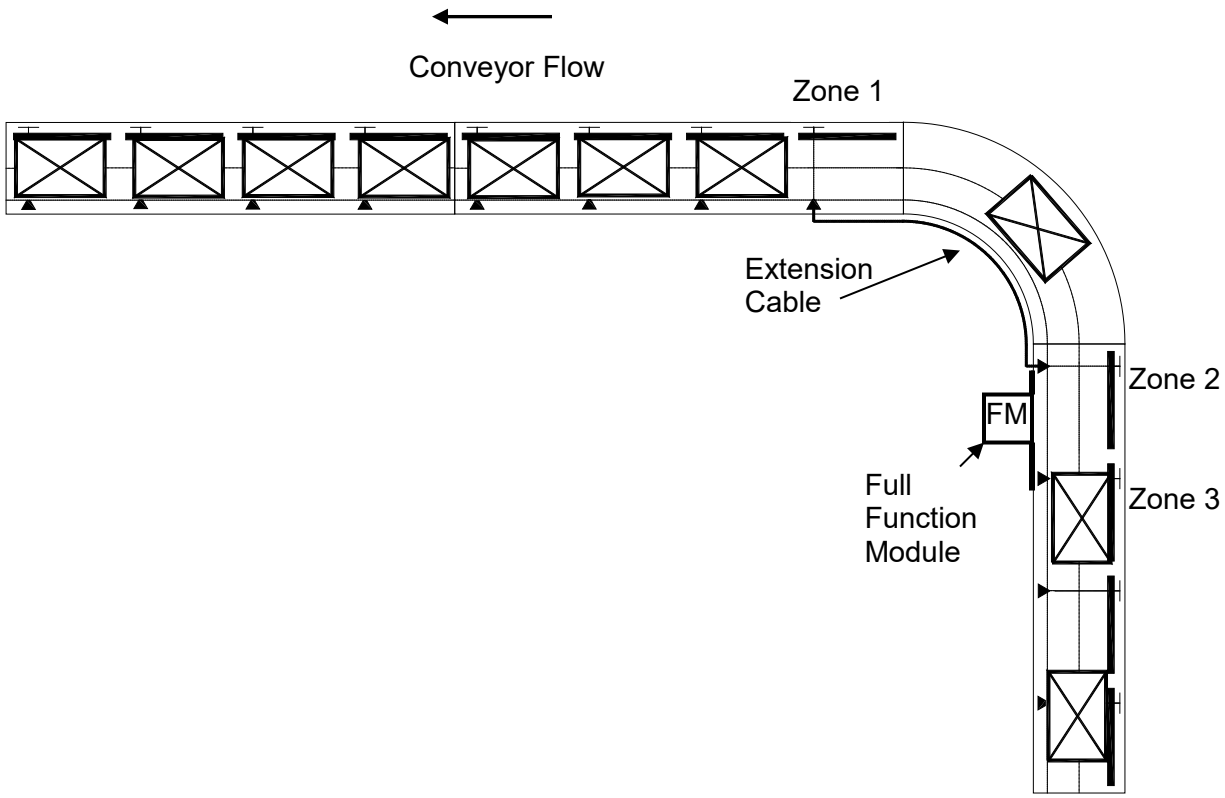
TB4, + VDC also connects to TB3, NC
TB4, 0 VDC also connects to TB1 (-)
TB3 COM connects to TB1 (+)

(TB5, + VDC and 0 VDC can also be used if the connection of too many wires to TB4 is a problem.)

If the Logic Assembly just downstream of the curve is Basic Logic, the release rate into the curve would be affected. The use of Progressive Logic Assemblies after the curve would allow for higher rates.

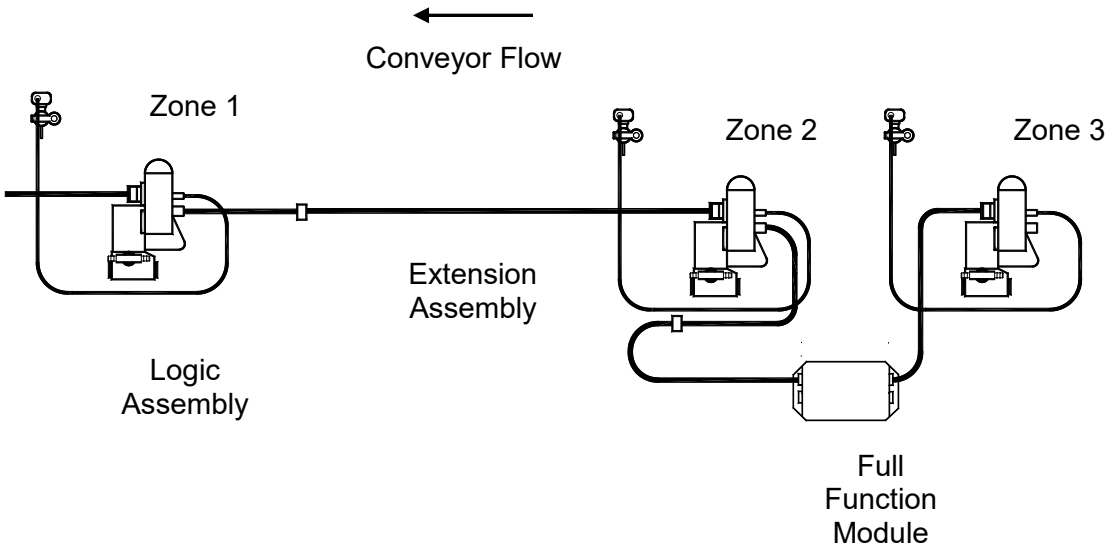
Note that stopping the release of product as done in this example could result in a product left partially on the powered curve with the trailing end on the stopped discharge end of the accumulation conveyor. If this is a concern, a photo sensor should be added to the discharge zone, with appropriate logic to insure that no products are stopped partially released. This could require the addition of PLC based logic.

Example 3: This example is similar to Example 1, but will only work if the throughput rate is low. The CRUZcontrol Logic Assemblies must be Basic Logic. Product does not accumulate on the curved section of the conveyor. The conveyor shown is XP43CZ.



The hardware required in this example, in addition to that already provided with CRUZcontrol, includes the following:

Description	MHS Conveyor Part Number	Comments
Extension Cable	RK4.4T4RS4.4T	156 inches long. Other lengths available if required.
Full Function Module	1138074	



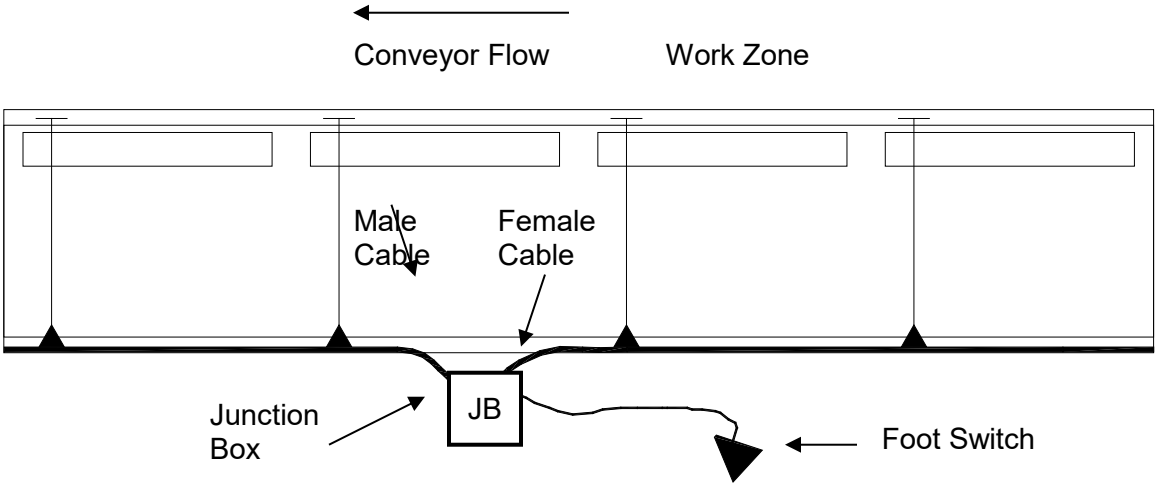
The Full Function Module does not require any external logic signals. It is used, connected as shown, for the internal Zone Release Delay feature.

Operation:

Carton flow and accumulation from Zone 3, to Zone 2, to Zone 1, occurs as would normally be expected of Basic Accumulation. The singulation of cartons around the curve is accomplished by the use of the Full Function Module Zone Release Delay. When a carton first clears the Zone 2 photoelectric sensor, the release of the next carton upstream, from Zone 3, needs to be inhibited until the carton released from Zone 2 reaches Zone 1. This delay in release from Zone 3 is accomplished simply by the proper setting of the Singulation Release Delay.

It should be pointed out that the release delay is not retained in the event of a system shut down. What this means is that if a carton is flowing around the curve and the system is shut down, a second carton could be released from Zone 2 to the curve before the first carton has had the chance to clear the curve. In that event, manual intervention might be required to clear the curve of the extra carton.

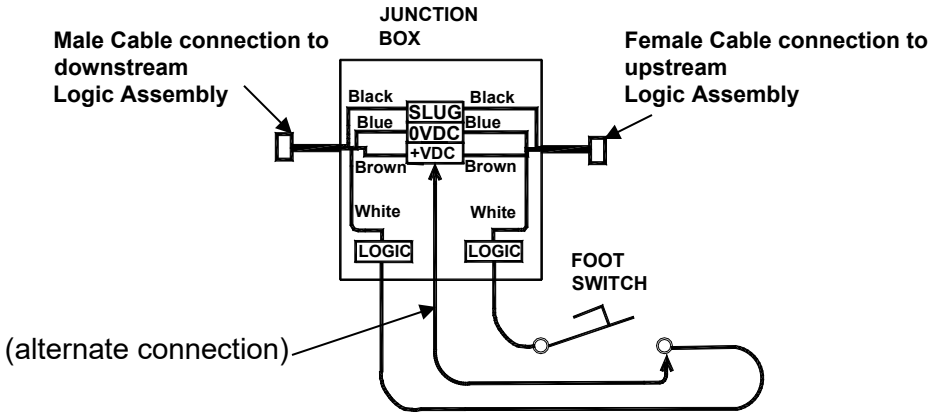
Example 4: Creating a work zone without using a Function Module. All cartons stop at a specific accumulation zone, and are released with a foot switch. The conveyor shown is XP43CZ with CRUZcontrol.



The control of the Work Zone could be accomplished with PLC control, where the Foot Switch is an input to a PLC, and a PLC output controls the release from the Work Zone through a Release Function Module. What this example will show is a method for control done locally, meaning that it requires no additional external logic.

The hardware required in this example, in addition to that already provided with CRUZcontrol, includes the following. The junction box shown is not included in this listing.

Description	MHS Conveyor Part Number
Male Cable, 78 inches with one pigtail end, one male M12 end.	RS4.4T2
Female Cable, 78 inches with one pigtail end, one female M12 end.	RK4.4T2
Foot Switch	FS



Operation: All cartons stop at the Work Zone when the CRUZcontrol photoelectric sensor in that zone is blocked. To release cartons stopped at the zone, the Foot Switch needs to be depressed until the carton clears the photoelectric sensor.

Carton release will only occur if the next downstream zone sensor isn't blocked. If the alternate wire connection from the Foot Switch to the Function Module is made, (terminal +VDC instead of the downstream Logic line), carton release can occur regardless of the state of the next downstream zone sensor.

Adding a selector switch with one normally open contact, wired in parallel with the footswitch, would allow for selecting with or not to enable the work zone operation.

Example 5: Progressive Logic accumulation release control.

The Progressive Logic CRUZcontrol Logic Assemblies provide for high throughput rates and efficient release, compared to Basic Logic. In simple terms, Basic Logic tries to create zone length gaps in the flow of product, where as Progressive Logic allows product to flow without creating gaps.

The product throughput rate for Progressive Logic, measured in case-feet per minute, can equal the conveyor speed. This can create problems. If, for example, an NBA®23 conveyor running at 180 feet per minute is feeding product to an induction belt conveyor running at 100 feet per minute, the belt conveyor will be overrun, meaning that excessive line pressure will build up at the discharge end of the NBA 23.

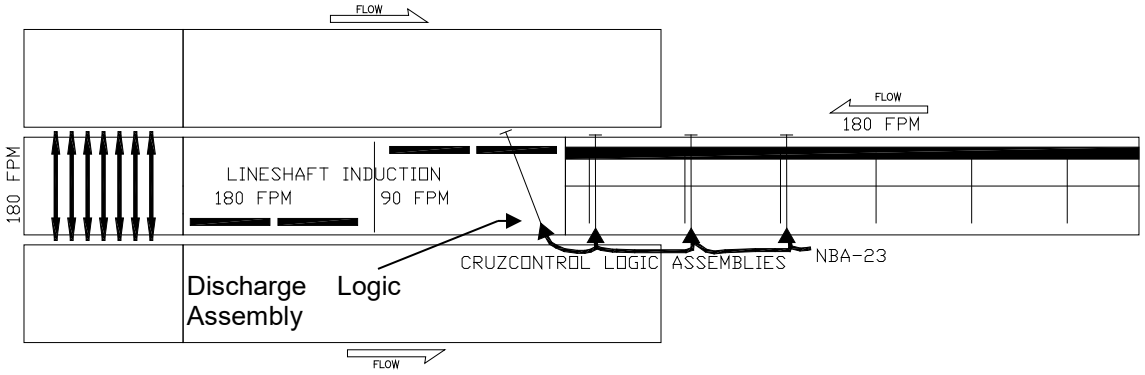
There are several possible solutions to handle this situation:

1. The speed of the accumulation conveyor could be set at less than the speed of the next conveyor down-stream. In the example mentioned, if the NBA 23 were running at 100 feet per minute, there wouldn't be an issue. This is not often possible. If the accumulation conveyor needed to receive product at a higher input rate, the speed would have to be higher. If densely packed accumulation were desired, that would also require the speed to be above 100 feet per minute.

2. The release of product from the accumulation conveyor could be logically controlled so as to limit the release rate. If the NBA®23 running at 180 feet per minute were to be given a CRUZcontrol Singulation Release signal for 3.3 seconds, and then kept off for 2.7 seconds, with that sequence repeating, the theoretical release rate should be close to 100 product-feet per minute (180 fpm x 3.3 sec. / (3.3 sec. + 2.7 sec.)). The actual release rate could be more, with product coast and shorter than zone length product lengths allowing more product than expected to progress past the release point. Assuming that the release signal is PLC controlled, an advantage to this approach is that the release sequence timing could be easily altered to increase or decrease the release rate.
3. The CRUZcontrol Logic Assembly at the final discharge zone could be Basic Logic, with all other upstream Logic Assemblies Progressive Logic. This would reduce the NBA 23 release rate while still retaining the infeed and throughput rate benefits of Progressive Logic. The release rate would be a function of the speed of the accumulation conveyor, the speed of the receiving conveyor, and also the size and weight characteristics of the conveyed product. If the NBA 23 running at 180 feet per minute had a Basic Logic Assembly at only the discharge end, the release rate would be closer to the 100 product-feet per minute capacity of the downstream induction belt conveyor.

Example 6: NBA 23 accumulation release to XenoROL®.

NBA 23 conveyor, when accumulating and subsequently releasing accumulated product, will result in some amount of line pressure at the discharge end of the conveyor. This is caused by the momentum of moving product coasting to a stop as it accumulates. In applications where the NBA 23 feeds XenoROL conveyor, controlling the release so as to avoid problems caused by the line pressure is essential. The following is shown as an example:



The NBA 23 is running at 180 feet per minute, feeding the lineshaft induction section prior to a pick zone module diverter. Without proper control of the discharge from the NBA 23, cartons released to the lineshaft induction could possibly overdrive it and push past the 90 fpm section onto the 180 fpm section, not permitting product gapping to occur as required for the diverter to function properly. This is a concern when using Basic accumulation, and even more so when using Progressive accumulation.

A simple solution for accumulation release control is to add a CRUZcontrol Discharge Logic Assembly (DLA) just downstream of the last NBA®23 Logic Assembly. A Discharge Logic Assembly is a Basic Logic Assembly without a solenoid valve attached. Since there is no solenoid valve, the DLA will work for either NBA 23 or XenoROL® applications.

The following hardware listing is for two DLA kits consisting of the Discharge Logic Assembly, a reflector, and mounting brackets. The mounting brackets provide for mounting of the DLA and reflector either ½ inch or 3 inches above a standard XenoROL side channel. Since every application is different, there will usually be a need to drill mounting holes for the brackets.

Description	MHS Conveyor Part Number
Discharge Logic Assembly Kit, ½ inch above rollers scan height	E0006240
Discharge Logic Assembly Kit, 3 inch above rollers scan height	E0006236

The mounting location of the photoelectric sensor and the reflector will determine release performance. A good starting point would be to locate the photoelectric sensor 12 inches downstream from the charge end of the induction conveyor, and the reflector 18 inches downstream from the charge end. The final locations should be determined based on system performance.

The Discharge Logic Assembly is connected to the Logic Assembly at the discharge end of the NBA 23. There is no need for a Function Module to be attached to it. The DLA does not need to be given a release signal. Product blocking that photoelectric sensor will stop release from the NBA 23 discharge zone, until the photoelectric sensor clears again. This operation is left enabled and ready to function regardless of whether the induction conveyor is running or off. There is no need to interface the CRUZcontrol operation with the induction conveyor operation, since the functioning of it is based solely on product movement.

Example 7: Power Monitoring.

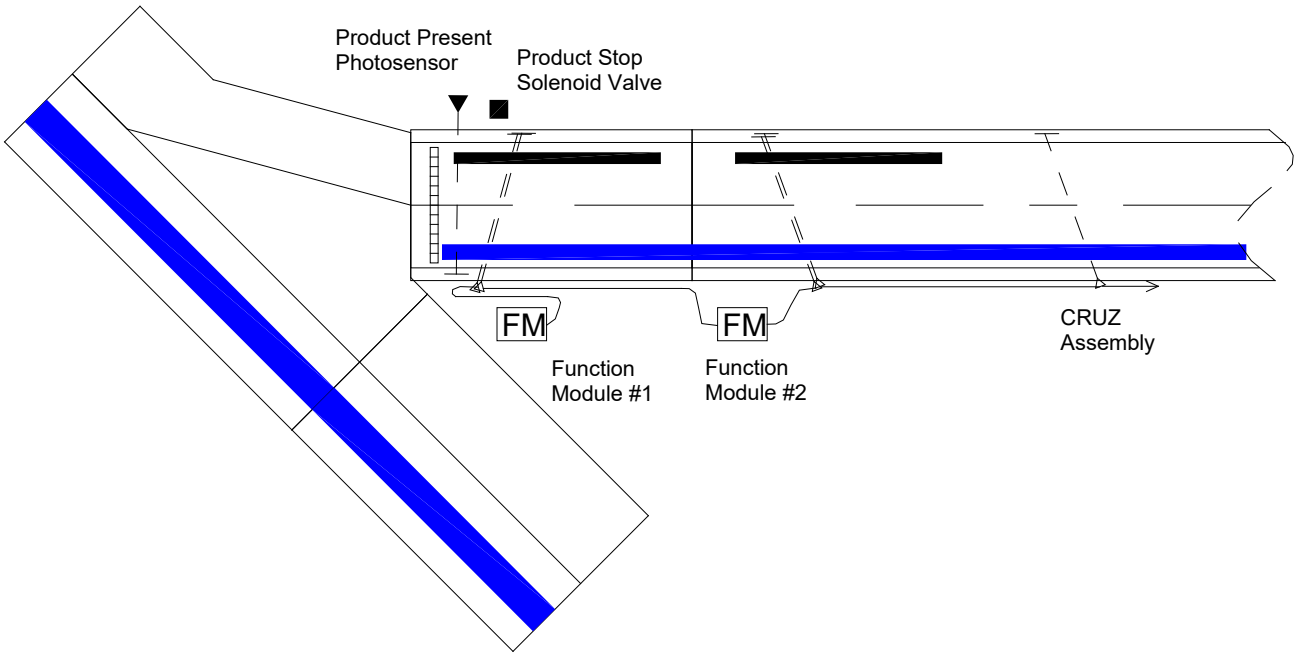
There could be situations where it is desirable to monitor the 24 VDC power source for the CRUZcontrol. A loss of power, for whatever reason, will result in all zones going into accumulation, immediately stopping all product movement. This would be a problem if the accumulation conveyor were fed by a section of non-accumulating conveyor, such a belt conveyor.

The 115 VAC Input Power Supply (MHS Conveyor part number 1101825) is provided with a power monitor contact which is closed whenever 24 VDC output power is available. If using other power supplies, the 24 VDC power could be monitored directly by being connected into a 24 VDC PLC input, for example. Another approach is to power a 24 VDC relay, and use the relays' contact as an indication of power on.

Example 8: Product Gapping

The following describes a technique, using CRUZcontrol, which creates a gap in a train of moving product. In the situation described, the gap is used to allow for the raising of a product stop. This would apply primarily to the progressive mode of accumulation control, which accumulates and discharges from accumulation with only very minimal gaps between products.

The following illustrates an NBA®23 accumulation lane used to release product to a merge conveyor. A Product Stop is located at the end of the accumulation lane, controlled by the solenoid valve as shown. The last two accumulation zones are also provided with brakes, as shown. These brakes are provided with CRUZ™ Brake Logic Assemblies. Also shown just prior to the Product Stop is a Product Present Photosensor.



Operation:

The Product Present Photosensor is connected to a PLC (programmable logic controller). The Photosensor is used to sense if product is accumulated behind the Product Stop, ready to be released. The Photosensor is also used to sense a gap in the flow of product adequate enough to raise the Product Stop after releasing product from the lane.

The Product Stop is solenoid activated, and controlled by the PLC. The stop is lowered by energizing the solenoid.

Function Module #1 (a Release Function Module) is configured and wired for Single Release operation. (Refer to the CRUZcontrol Installation, Operation, and Maintenance Manual for additional Function Module information). The signal provided to the Product Stop solenoid is also connected to Function Module #1.

When the Product Stop is raised (solenoid and Function Module not energized), product blocking the Photosensor of the CRUZcontrol Logic Assembly will result in the conveyor zone going into accumulation. Since the Photosensor of the Brake Logic Assembly is also blocked at the same time, the brake will be

activated. This in turn enables accumulation beginning with the next upstream accumulation zone, once the Photosensor in that zone is blocked.

Function Module #2 (also a Release Function Module) is configured and wired for Logic Interrupt operation. When it receives a signal (from the PLC), it passes the signal from the down stream accumulation zone to the upstream accumulation zone. Accumulation and release function normally, meaning as if there no Function Module installed.

To create a gap in the flow of product, the PLC signal to Function Module #2 is turned off. This puts the zone upstream of Function Module #2 into accumulation mode, once its Photosensor is blocked. The brake in the zone is also set automatically whenever the zone is set to accumulate.

Cutler-Hammer Cut Sheet – IM08302001E Rev 02 See following pages.

Cutler-Hammer Cut Sheet – P50244 Rev 02 See following pages.

Installation Instructions — Conveyor Sensors Power Supply

⚠ WARNING

IN ORDER TO AVOID ELECTRIC SHOCK OR OTHER POSSIBLE INJURY:

- **DO NOT USE THIS PRODUCT FOR HUMAN SAFETY APPLICATIONS. IT WAS NOT DESIGNED, TESTED OR RECOMMENDED FOR THIS USE.**
- **DO NOT USE THIS PRODUCT IN HAZARDOUS LOCATIONS (E.G. EXPLOSIVE ATMOSPSHERES). IT WAS NOT DESIGNED, TESTED OR RECOMMENDED FOR THIS USE.**

MODELS COVERED IN THIS MANUAL

PS256B-01B1	Standard selectable release
PS256B-04B1	High-current sinking release
PS256B-05B1	PS256B-04B1 with 12mm threaded DC connector

INTRODUCTION

The Sensor Power Supply was specially designed to be used with Cutler-Hammer's Zero Pressure Accumulation products, but is suitable for use in a wide variety of material handling applications. The unit delivers 100 W at 27V DC and supports easy AC and DC-side wiring. The power supply is a tamper-resistant, rugged component easily mounted to a conveyor side-channel or support. The power supply is fully sealed for use in harsh environments.

GENERAL INSTALLATION AND MOUNTING

Junction box features are integrated into the housing of the supply to provide for AC connections. Therefore, it is not necessary to mount the supply in a separate enclosure to comply with applicable wiring codes.

Mount the supply to a secure surface using integral mounting flanges and 3/8 inch mounting hardware (not provided). Mounting holes are set on 3 inch centers. Remove applicable gasketed cover and wire as indicated by the wiring diagram and as described below. Route wiring through knockouts in the enclosure and secure using threaded 1/2 inch NPT conduit fittings or cord grips as required (not provided). Replace the gasketed cover, tightening 6 screws to 9-10 inch-pounds.

DC Wiring

Output terminals provide the DC Power and Release Connection for use with an accumulation sensor system. The two terminals are wired in parallel to provide a convenient extra connection point. Connect to the sensor system using cable accessories from Table 3 and considering the wiring arrangement pros and cons from Table 2 (both at right).

Release Wiring and Operation (if installed)

There are two release modes commonly used in Zero Pressure Accumulation conveyor systems. *Slug* or *Train* Release causes the conveyor zones to drive without singulation or accumulation. *Singulate* or *Zone* Release causes the discharge zone to drive, thereby releasing product from the conveyor. This release function only effects the discharge zone; all other upstream zones continue to operate normally. To use the release function, wire external release signal to "Release In". This signal can be 15-30 VDC or 115 VAC.

TABLE 1 - SWITCH POSITIONS FOR PS256B-01B1

SENSOR TYPE	SLUG RELEASE	SINGULATE RELEASE
14256 Series	Sinking	N/A
14276 Series	Sinking	Sinking
14266/14286 Series (NPN)	Sinking	Sourcing
14266/14286 Series (PNP)	Sourcing	Sourcing
E68-SV Series	Sinking	Sinking

3. Connect the sensor system to the "Release Out" terminal on the DC terminal strip using one of the wiring arrangements described (including pros and cons) in Table 2 below, and the requisite cable accessories listed in Table 3 below.

TABLE 2 - WIRING ARRANGEMENTS

	++	--
Center Tap	Allows for the longest run of sensors from a single power supply. Provides for slug release of product from the conveyor.	For singulated product release from the discharge zone, an additional release cable is required.
End Tap	Allow for power, slug, and singulate release with a single cable connection to the power supply.	Reduces the total number of zones from a single power supply.

TABLE 3 - CABLE ACCESSORIES

Center Tap	Power & Slug Release	Singulate Release
142x6	BUS266PWR-01B1	BUS266REL-01B1
E68...-xyC	E68-SVAPWR-C2	E68SVAREL2-C2
E68...-xyP	E68-SVAPWR-P2/-P02	E68SVAREL2-P2
End Tap	**Power, Slug & Singulate Release**	
142x6	BUS266REL-02B1	
E68...-xyC	E68-SVAREL2-C2	
E68...-xyP	E68-SVAREL2-P2	

NOTE: For Slug Release, connect the "Slug" wire of an appropriate release cable in the table above to the power supply release terminal. For Singulate Release, connect the "Comms" wire of an appropriate release cable in the table above (physically connected to the discharge sensor) to the release terminal.

Power Monitor Wiring (if installed)

This contact is provided to allow monitoring of the DC Supply by a remote device. This contact opens when the DC power is off or has failed due to short-circuit or other conditions. Wire as indicated by the wiring diagram. See specifications for electrical operation.

TROUBLESHOOTING

The supply provides two indicators to allow for easy troubleshooting:

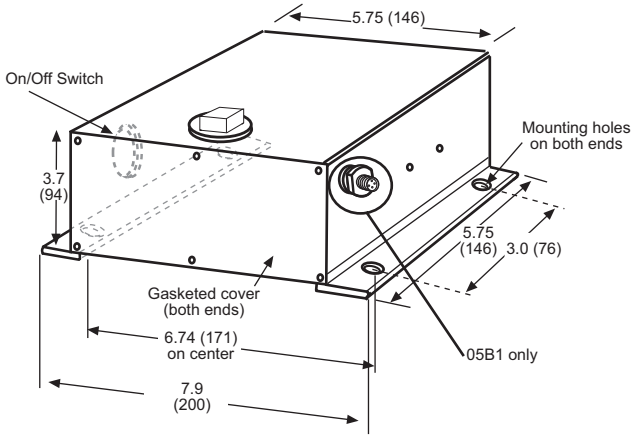
AC IN	DC OUT	SUPPLY STATUS	TROUBLESHOOTING STEPS
ON	ON	Normal Operation	Verify load properly connected to DC terminals.
ON	OFF	DC Supply OFF	The supply is likely in short-circuit protection mode. 1. Locate and remove short or overload. 2. Turn OFF AC input power for 2 minutes. 3. Restore AC input power.
OFF	OFF	No AC applied or primary fuse blown	Verify AC voltage is present and is wired properly. If problem persists, the main fuse is blown or supply is physically damaged and must be replaced.

SPECIFICATIONS

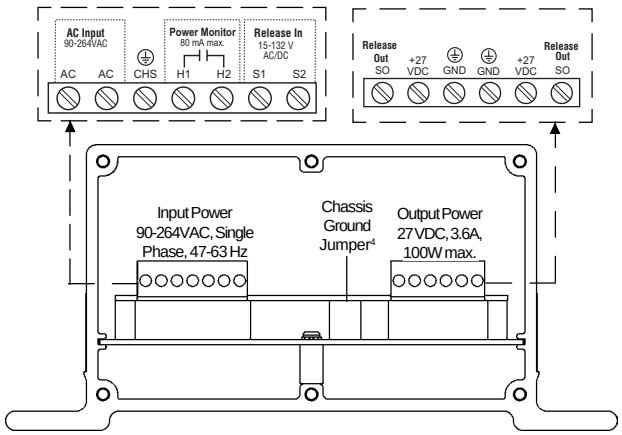
	PS256B-01B1	PS256B-04B1 (-05B1)[1]
Input Power	144W, Maximum inrush 30A from cold start	
Input Voltage	100 - 250 V AC	
Input Current (Maximum)	115V AC - 2A, 230 V AC - 1A	
Output Voltage	27VDC	
Output Power	100W	
Output Protection	Short circuit, overload and overvoltage protection (cycle input power to reset)	
Regulation	+/- 3%	
Release Input	15 - 30V DC; 90-132V AC	
Release Output	Sinking or Sourcing, switch selectable; 100 mA maximum; short circuit protected (cycle power to reset)[2]	Sinking only; 3.7A maximum current short circuit, overload & overvoltage protection (cycle power to reset)[1&2]
Indicators	Red LED: AC In; Green LED: DC Out	
Power Monitor	Solid state relay; 400V isolation; 132V AC/DC maximum switching voltage; 80 mA current switching capacity; 10 mA maximum off-state leakage; 25 ohms on-state resistance; N.O. contact; contacts open when DC power fails.	
Temperature Range	-13° to 131°F (-25° to 55°C)	
Enclosure Material	Aluminum	
Enclosure Rating	NEMA 4	

[1]**NOTE:** Total maximum output of supply is 100W. Total supply (100 Watts) = main output power + release output power.
[2]**NOTE:** The power supply may require several minutes off to reset, depending on the severity of the overload.

APPROXIMATE DIMENSIONS[3]



WIRING DIAGRAM



[3]**NOTE:** On model PS256B-05B1 a single 12mm DC key threaded micro-connector is mounted to the side of the junction box, as shown.
[4]**NOTE:** Install jumper for single power supply systems. In systems where multiple power supplies are connected to a DC bus, install the jumper in only one supply.

Installation Instructions — Conveyor Sensors Power Supply

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- **DO NOT USE THIS PRODUCT IN HAZARDOUS LOCATIONS (E.G. EXPLOSIVE ATMOSPSHERES). IT WAS NOT DESIGNED OR TESTED AND IS NOT RECOMMENDED FOR THIS USE.**

MODELS COVERED IN THIS MANUAL

PS256A-44B1
PS256A-44B2

INTRODUCTION

The Sensor Power Supply is suitable for use in a wide variety of material handling applications. The unit delivers 100 W at 26VDC and supports easy, Class II wiring. The power supply is a tamper-resistant, rugged component that is easy to mount to a conveyor side-channel or support. The unit is sealed in a rugged aluminum enclosure with threaded fittings for all cable entries.

GENERAL INSTALLATION AND MOUNTING

The supply is constructed with an integral junction box to enclose AC connections. Therefore, it is not necessary to mount the supply in an enclosure to comply with applicable wiring codes.

Mount the supply to a secure surface using integral mounting flanges and 3/8 inch mounting hardware (not provided). Mounting holes are set on 6 inch centers. Remove applicable gasketed cover(s) and wire as indicated by the wiring diagram and as described below. Route wiring through knockouts in the enclosure and secure using threaded 1/2 inch NPT conduit fittings or cord grips as required (not provided). Replace the gasketed cover(s).

DC Wiring

The Output Side terminals shown in the wiring diagram provide the DC power output connection for use with a sensor system. Two sets of terminals are wired in parallel to provide a convenient second set of connection points. Connect the corresponding wires from the sensor system to +VDC and –VDC as necessary.

TROUBLESHOOTING

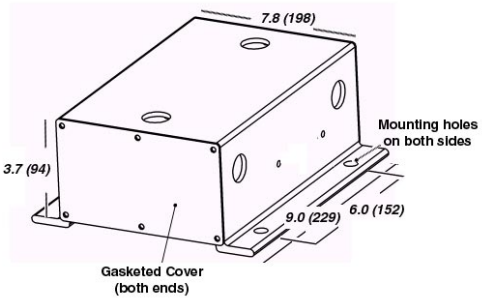
The supply provides two indicators to allow for easy troubleshooting:

(RED) AC IN	(GREEN) DC OUT	SUPPLY STATUS	TROUBLESHOOTING STEPS
ON	ON	Normal Operation	Verify load properly connected to DC terminals.
ON	OFF	DC Supply OFF	The supply is in short-circuit mode. Turn OFF AC power then locate and remove the output short.
ON	Flashing	Exceeding Class II output limit	Reduce output load to less than 100 watts.
OFF	OFF	AC not applied or primary fuse blown	Verify AC voltage is present and is wired properly. If problem persists, the main fuse is blown or supply has been physically damaged. Replace the power supply.
OFF	ON	One input phase missing	Turn OFF AC power and reconnect all 3 input phases.

In addition, a separate indicator is provided inside the enclosure housing on the Input Side to aid in troubleshooting. As noted above, the main power supply AC indicator LEDs will go off if one phase of the incoming AC power is lost. AC voltage may still be present on one or both of the remaining phases. This RED indicator LED, if on, confirms voltage is still present. De-energize all circuits prior to work on the supply.

NOTE: Even if this internal AC indicator is not lit, physically verify all circuits are de-energized prior to any work on the supply.

APPROXIMATE DIMENSIONS



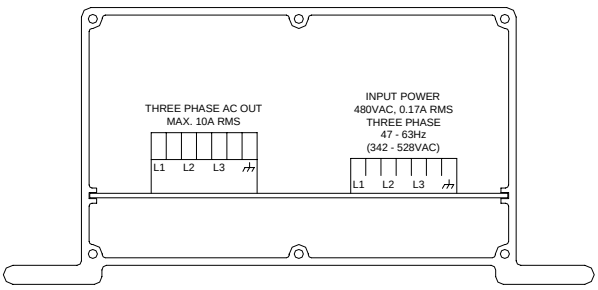
SPECIFICATIONS

Input Voltage	342-528 VAC, 47-63 Hz, 3-phase, Delta or Wye
Input Current	170mA @ 480 VAC input, nominal
Input Wiring	4-wire system, 3 phases plus ground[1]
Output Voltage	26VDC (measured at 20% load)
Output Power	100W
Output Protection	Short circuit, overload and overvoltage protection (auto reset)
Regulation	+/- 3% from 20% to 100% load
Power Up Delay	Output voltage delayed 3 +/- 0.5 seconds from application of the AC source
Indicators	Red LED: AC In; Green LED: DC Out (2x)
Temperature Range	32° to 131°F (0° to 55°C)
Enclosure Material	Aluminum
Enclosure Rating	IP 54
Connections	See below

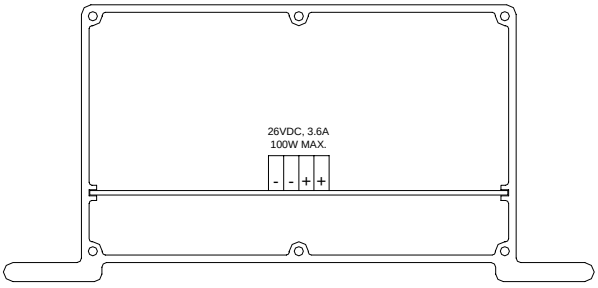
[1] Ground wire must be properly connected.

WIRING DIAGRAM

INPUT SIDE



OUTPUT SIDE



Still Need Help?

Contact the Cutler-Hammer Sensor Application Engineers

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General Information

Website Link:

mhs-conveyor.com

MHS Conveyor Information

Mission

MHS Conveyor, located in Spring Lake, Michigan, is a leading deliverer of “smart” material handling systems, technologies, products, and services, creating solutions for material flow applications. As a global supplier of conveyor systems and equipment since 1964, MHS Conveyor provides sorters, conveyors, and accessories to satisfy a broad spectrum of accumulation, transportation, and sortation applications.

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