Reference Manual

Version 1.2

IQZonz / IQMap

January 2018

Publication IQ-1100

IQ-Zonz module firmware and functionality is protected by U.S. and international patents.
For complete patent information visit www.pulseroller.com/patents
### Glossary of Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>JST</td>
<td>This is the name of a particular connector manufacturer that produces a specific plug/socket arrangement for MDR connection to control cards. This name is accepted within the conveyor and MDR industry as a simple description of the particular socket style used on IQZonz hardware.</td>
</tr>
<tr>
<td>LED</td>
<td>Light Emitting Diode – In the context of this document, LED’s are used on IQZonz to provide visual indication of module status.</td>
</tr>
<tr>
<td>Light / Dark Energized</td>
<td>Term used to describe how the signaling output circuit of a photo-sensor is configured when it detects its reflected light. A photo-sensor that is light energized will activate its output circuit when it detects its reflected light. A dark energized photo-sensor will activate its output circuit when it does not detect its reflected light.</td>
</tr>
<tr>
<td>MDR</td>
<td>Motorized Drive Roller or Motor Driven Roller - Brushless DC motor and gearbox assembly integrated into a single conveyor roller.</td>
</tr>
<tr>
<td>NPN / PNP</td>
<td>Electronics term that indicates the type of transistor circuit used for a logical input or output for controllers. NPN devices will provide a common or ground connection when activated and a PNP device will provide a logic voltage connection when activated.</td>
</tr>
<tr>
<td>Photo-sensor</td>
<td>A device, mounted near the end of the conveyor zone to sense the presence of a load on the zone.</td>
</tr>
<tr>
<td>Retro-reflective / Diffuse</td>
<td>Term used to describe the two basic types of photo-sensors. Retro-reflective photo-sensors utilize a reflective target that must be aligned with the photo-sensor such that the light emitted by the photo-sensor is reflected back to it. Diffuse (or sometimes known as reflex or proximity) type photo-sensors emit light to be reflected back from an object located sufficiently close to the sensor. For both types of photo-sensors, when they detect their reflected light source, their signaling output circuit changes state.</td>
</tr>
<tr>
<td>RJ-11 / RJ-12</td>
<td>Registered Jack Style 11 / 12 – Standard connector / receptacle format utilizing 4 or 6 pin connections. The typical standard connection for telephones. RJ-11 utilizes 4 pins and RJ-12 utilizes 6 pins but both styles use the same physical size.</td>
</tr>
<tr>
<td>Senergy ECO</td>
<td>IQZonz controllers control only Senergy brand MDRs and only provide ECO mode performance.</td>
</tr>
<tr>
<td>Singulation Release</td>
<td>Conveyor control method for zoned controlled conveyor that dictates that when a zone is discharging its load, the upstream load waiting to enter must wait until the discharged load is completely clear before it is allowed to enter.</td>
</tr>
<tr>
<td>Slave Rollers</td>
<td>A set of non-motorized conveyor rollers mechanically linked to an MDR. The MDR and slave rollers make up a physical zone. All of the slave rollers in a zone rotate at the same speed and direction as the MDR because of their mechanical linkage.</td>
</tr>
<tr>
<td>Train Release</td>
<td>Conveyor control method for zone configured conveyor that dictates that when a zone is discharging, the upstream zone’s load can move in unison with the discharging load.</td>
</tr>
<tr>
<td>Zone</td>
<td>A basic (linear or curved) cell of the conveyor consisting of a set of slave rollers driven by one or more MDR's and a single photo-sensor.</td>
</tr>
<tr>
<td>------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>ZPA</td>
<td>Zero Pressure Accumulation – Term that describes the conveyor controls and mechanical scheme that will cause loads to queue on a conveyor in discrete zones such that loads do not touch each other</td>
</tr>
</tbody>
</table>

**Symbol Conventions**

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

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

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

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

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

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

Reproduction of the contents of this manual, in whole or in part, without written permission of Insight Automation Inc. is prohibited.
SUMMARY OF CHANGES
The following table summarizes the changes and updates made to this document since the last revision

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Change / Update</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>April 2014</td>
<td>Initial Release</td>
</tr>
<tr>
<td>1.1</td>
<td>January 2015</td>
<td>Update to sensor port polarity and IQTool</td>
</tr>
<tr>
<td>1.2</td>
<td>January 2018</td>
<td>Removed Ai options</td>
</tr>
</tbody>
</table>

GLOBAL CONTACT INFORMATION

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### IQMap User’s Guide

**Notes:**

**Appendix B**

- Communication Ports Specification:
  - IQMap I/O
  - Motor Port Specification
  - Sensor Port inputs
- Certifications & Standards

**Electrical Specification:**

- Power Connector (included):
  - IQTool
    - Installation
      - iqtool screen
      - iqtool screen for iqmap
  - IQMap
    - IQMap Hardware
    - IQMap in Most Upstream Location
      - Digital Inputs
      - Digital Outputs
    - IQMap in Most Downstream Location
      - Digital Inputs
      - Digital Outputs
    - IQMap in Intermediate Location
      - Digital Inputs
      - Digital Outputs
    - Changing speeds
      - Changing Speed for entire conveyor line
      - Changing speed for select modules within a conveyor line

**Appendix A – Dimensions and Mounting**

- IQZonz Module
- IQMap Module

**Appendix B – Electrical Specifications**

- Power Connector (included):
  - Electrical Specification:
    - Absolute Maximum Ratings
    - Certifications & Standards
    - Sensor Port inputs
      - Sensor Port Power Pins
    - Motor Port Specification
    - IQMap I/O
      - Inputs
      - Outputs
    - Communication Ports Specification
  - Notes:

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*Publication IQ-1100 Rev 1.2 – January 2018*
**Preface**

**Who Should Use This Manual?**

This manual is intended for users who need basic product information and simple application procedures to implement IQZonz modules to control simple linear conveyor.

You should have a basic understanding of the desired operation of conveyor equipment, Motorized Drive Rollers (MDRs), photo-sensors, etc. If you do not, obtain the proper training before using this product.

**Purpose of This Manual**

The purpose of this manual is to:

- Identify the components and ports available on IQZonz
- Provide guidelines for proper installation and wiring
- Provide examples on basic conveyor operation with IQZonz
- Provide examples on advanced operation with the IQMap module

**Not Included in This Manual**

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

IQZonz provides simple Zero Pressure Accumulation (ZPA) conveyor control for conveyors utilizing Pulse brand Senergy model Motorized Drive Rollers (MDRs). IQZonz modules require no manual set up or configuration by either on-board switches or dials nor are any configuration required by connecting a PC based software package and downloading.

IQZonz modules interconnected via standard shielded Ethernet cabling to form an integrated solution for MDR (Motorized Drive Roller) conveyor functionality. Each IQZonz module can accommodate up to 2 MDR’s and 2 photo-sensors to provide control for up to 2 conveyor zones.

A companion module to IQZonz is the IQMap module that allows you to add functionality to the basic ZPA operation of your conveyor. Details of the IQMap module begin on page 35

**TYPICAL IQZonz CONVEYOR COMPONENTS**

These are the typical components for a simple linear ZPA conveyor:

- IQZonz modules
- MDRs – one or two per IQZonz
- Photo-sensors – one or two per IQZonz
- 24VDC Power Supplies
- Communication Cables
**IQZonz Module Features**

Each individual IQzon module has the following features:

- Modular RJ style connection ports for photo-sensors
- Modular JST style connectors for Senergy MDR
- Modular RJ-45 style connection ports for module to module communications
- Single 24VDC power connection for motor and control
- Context-sensitive multi-colour LED indicators
- Thermal and over-current protection for MDRs
- Automatic PNP/NPN detection for photo-sensor inputs

**IQZonz Control System Features**

When one or more IQzon modules are installed and interconnected, there are several operational and configurable features of the control system that are accessible by simply altering the way the sensors and MDR’s are connected to the module as well as how the modules are connected to each other with communication cables. Some of these features are:

- Single zone to zone zero pressure accumulation (ZPA) control as default mode.
- Change conveyor flow by simply rotating the module
- External control of zone accumulate and release

**More Options Available**

With the addition of one or more IQMap modules you can accomplish even more:

- Change conveyor speed globally or in segregated zone areas
- Utilize on board I/O for external control of zone accumulate and release
- Utilize on board I/O to acquire zone occupied or clear status
- Utilize on board I/O to acquire global jam and MDR fault states

By installing the complimentary software application IQTool, you can use your PC to:

- Change speed, acceleration, and deceleration individually for each zone or globally for all zones
- Change MDR rotation direction individually for each zone or globally for all zones
- Manually jog individual zone’s MDR for maintenance and diagnostics
- Change zones from default Singulation mode to Train mode.
IQZonz Module Hardware Overview

IQZonz modules are designed to be installed and integrated into the conveyor’s mechanical side frame assembly. Please refer to Appendix A – Dimensions on page 53 for module mounting details.

The IQZonz module is a controller for up to 2 Motorized Drive Roller (MDR) conveyor zones. Each IQZonz provides connection points for 2 MDR units with their corresponding 2 photo-sensors as well as upstream and downstream communication cable interconnections to form a complete control system for zoned MDR conveyors. Figure 1 identifies the connection points for the module and Figure 2 shows a side view.
HARDWARE CONNECTIONS

MOTOR ROLLER PORTS

Both of the left and right ports utilize a 9-pin JST brand male receptacle header that mates with a standard Senergy motor roller’s 9-pin male JST plug. Each receptacle is mechanically keyed to assure proper orientation upon plugging in.

![FIGURE 3 - SENERGY WITH JST CONNECTOR](image)

![FIGURE 4 - MOTOR PLUG-IN EXAMPLE](image)
SENSOR PORTS
Each sensor port is a standard RJ-12 style jack with the following pin-out:

![IQZONZ STANDARD SENSOR PORT DIAGRAM](image)

The signals are defined by the following chart:

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Not Used</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>Module DC Common</td>
</tr>
<tr>
<td>3</td>
<td>Not Used</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Sensor</td>
<td>Logical Input for Sensor’s state output – Auto detect for NPN or PNP</td>
</tr>
<tr>
<td>5</td>
<td>Vcc</td>
<td>Module 24VDC Supply</td>
</tr>
<tr>
<td>6</td>
<td>Not Used</td>
<td></td>
</tr>
</tbody>
</table>

COMMUNICATION PORTS
Both of these ports are standard RJ-45 jacks conforming to standard Ethernet connection pin-out.

![IQZONZ STANDARD SIDE VIEW OF SENSOR PORT](image)

![IQZONZ SIDE VIEW OF COMMUNICATION PORT](image)
**Getting Started**

This section will show you how to get up and running with only the IQZonz module and the options available without using the optional IQMap module. First let’s get familiar with the IQZonz module. Figure 9 shows the module and its connection points along with some default settings.

**IQZonz Control Defaults**

IQZonz operates ZPA conveyor in standard singulation mode which means an upstream zone will not discharge to its downstream zone unless and until the downstream zone is clear. The following chart lists the default settings and device connection requirements.

**MDR Settings**

- Pulse Senergy Eco Mode
- 100% PWM Speed

**Sensor Port**

- RJ-12 Connection
- PNP or NPN – Port auto detects electrical polarity
- Light Energized, Normally Open sensor signal such that output energized means zone is clear
**POWER SUPPLY REQUIREMENTS**

Power requirements can vary depending upon the application. For typical carton handling applications, 8 to 10 motor rollers per 20A circuit is sufficient.

It is ultimately up to the integrator to verify power supply requirements. Insufficient power supply sizing can result in unexpected performance.

**PROPER GROUNDING PRACTICE**

It is important that all power supplies have their 0V terminals connected together and that at least one of these connected power supply’s 0V terminal is connected to earth ground. Figure 10 shows an example of proper grounding practice.
SE-4 TERMINAL BREAKOUT MODULE

For functions that require external hard-wired signals to IQZonz Standard modules, the SE-4 Terminal Breakout module is used. On the SE-4, only the P4 terminal is used and the signal to logically energize P4 is connection to GND.

![SE-4 Terminal Breakout Module](image)

**FIGURE 11 – SE-4 TERMINAL BREAKOUT MODULE WITH CABLE**
SETTING UP YOUR CONVEYOR

Senergy motor cables should be exiting the roller tube on the same side of the conveyor as you mount your IQZonz modules. The direction of flow is indicated by the arrow on the IQZonz module. To change the direction, simply rotate the module 180 deg so the arrow points the other way as shown in Figure 12.

FIGURE 12 - HOW TO CHANGE DIRECTION OF FLOW

4 EASY STEPS

1. Plug sensors into sensor ports
2. MDRs into the MDR ports
3. Plug in standard RJ-45 Ethernet Communication Cables between each IQZonz module
4. Supply 24V to the power terminals for each IQZonz module

Upon power up and module initialization, IQZonz modules immediately begin ZPA operation without any further adjustment or configuration.
COMMON FUNCTIONS

HOW TO WAKE UP MOST UPSTREAM ZONE

To wake up the most upstream zone with a sensor; your first IQZonz module must not utilize its most upstream side for controlling a zone. This means that your most upstream IQZonz module will control only one zone. The Sensor port on the unused side is then used as a means to wake up the first zone. You can do this one of two ways: with a Sensor or hardwired signal.

WAKE-UP WITH A SENSOR

When the Wake-up Sensor is blocked; the single zone on the first IQZonz module will wake up and run its MDR. As long as this sensor is blocked, the first zone (Zone 1 in Figure 13) will run to accept an item.

WAKE-UP WITH WIRED SIGNAL

Plug in SE-4 breakout module into the sensor port and then connect a hardwired signal to the P4 terminal on the SE-4 as shown in Figure 14. When the signal between P4 and GND is connected; the single zone (Zone 1 in Figure 14) on the first IQZonz module will wake up and run its MDR.
FIGURE 14 - WAKE-UP FUNCTION WITH WIRED SIGNAL
HOW TO ACCUMULATE MOST DOWNSTREAM ZONE

This function is also known as Lane Full Interface

Similarly to the Wake up function; to accumulate the most downstream zone requires that the most downstream zone on the last IQZonz module be unused. The Sensor port on this unused zone will provide the means to accumulate the last MDR zone. Same as for the Wake up, this can be accomplished one of two ways: Plug in a sensor or connect a wired signal to the unused sensor port.

Please note that by default with no interaction; the most downstream zone of any IQZonz controlled conveyor will attempt to convey any item that arrives at its sensor further downstream.

LANE FULL INTERFACE WITH SENSOR

When the Lane Full Sensor is blocked; the single zone on the last IQZonz module (Zone n in Figure 15) will accumulate and stop any item that shows up at its sensor. When the Lane Full Sensor is clear; if an item is accumulated in the last zone, the zone will run and the item will discharge.
**LANE FULL INTERFACE WITH WIRED SIGNAL**

Plug in SE-4 breakout module into the sensor port and then connect a hardwired contact between to the P4 terminal and GND on the SE-4 as shown in Figure 16. When the contact is closed between P4 and GND; the single zone on the last *IQZonz* module (*Zone*n in Figure 16) will accumulate and stop any item that shows up at its sensor. Please note that when the contact is closed; the last zone will still run, but only to accept an item from its next upstream zone (i.e. when an item needs to convey from *Zone*n-1 to *Zone*n as shown in Figure 16). When the contact is opened between P4 and GND; if an item is accumulated in the last zone, the zone will run and the item will discharge.
**DIFFERENT ZONE CONFIGURATIONS**

By simply changing how MDRs and sensors are connected within the intermediate IQZonz modules, you can change the operation of the zones.

**SINGLE MDR ZONE**

For applications where there is not an even number of zones; one IQZonz module will have to only control one zone. Figure 17 shows an example of a single motor roller zone.

---

**FIGURE 17 - SINGLE MOTOR ROLLER ZONE**
**SINGLE ZONE WITH 2 MDRs**

For any intermediate *IQZonz* module (i.e. not the most upstream or most downstream module); by simply plugging in 2 MDRs and one sensor; you will create a single 2 MDR zone. This could be useful for creating a single long zone or perhaps a belted incline zone. Both MDRs will run and stop together and act as a single logical zone. *Zone 3* in Figure 18 is configured this way.

![Diagram of zones with 2 MDRs connected](image)

**FIGURE 18 - 2 MDR'S IN ONE LOGICAL ZONE**
SLAVE MDRS TO DOWNSTREAM ZONE

For any intermediate IQZonz module, by simply plugging in 2 MDRs and NO sensors, the two MDRs will automatically logically slave to the next downstream zone located on the next downstream IQZonz module. Anytime this next downstream zone runs, the 2 MDRs on this “Slaved” IQZonz module will also run. Zone 3 in Figure 19 is configured this way.

![Diagram showing slave MDRs to downstream zone](image)

**FIGURE 19 - DUAL MDR SLAVE TO DOWNSTREAM ZONE**
**Accumulate a Single Intermediate Zone**

For any intermediate zone that needs to have its accumulation function controlled by an external signal requires that the IQZonz module control only one zone. The unused zone’s Sensor port is used for accumulation control by external signal.

Please note that the MDR and zone sensor must be plugged into the downstream side of the IQZonz module and the external signal must connect to the upstream sensor port on the same module for accumulation control to operate. When the external signal is activated; the zone will accumulate the next item that arrives. When the external signal is removed; the zone will return to normal ZPA function.

For the IQZonz module; the external signal is connected utilizing an SE-4 module and wiring a contact between terminals P4 and GND. Zone 3 in Figure 20 is configured to be controlled by the external signal.

**Accumulate 2 Adjacent Intermediate Zones**

Some applications may require 2 adjacent intermediate zones to be accumulated by external signals. One way to do this is by inserting an IQZonz module in the network between the 2 adjacent zones and using the sensor ports with external signals to control accumulation.

Figure 21 depicts an example of using SE-4 breakout modules on the inserted IQZonz module to control accumulation release for the zones adjacent to it. In Figure 21, the upstream sensor port on the inserted IQZonz module controls Zone 2 and the downstream sensor port controls Zone 3.
Wake up and Accumulate Most Upstream Zone

Some applications may require that the most upstream zone gets awakened and then the item needs to be accumulated or stopped in the most upstream zone. This can be accomplished by adding an IQZone module to the upstream side of the most upstream conveyor zone. This added module then becomes the most physical upstream module on the communications line. On this added module, the upstream sensor port provides the Wake-up function and the downstream sensor port provides the accumulate zone function.

Figure 22 shows how this function is accomplished using SE-4 module(s) to provide the signals to Wake-up and control accumulation and discharge for Zone 1.
LANE FULL AND ACCUMULATE MOST DOWNSTREAM ZONE

Some applications may require that even if the Lane Full condition is clear, some external control may still want to hold back or accumulate an item in the most downstream zone. This can be accomplished by adding an IQZonz module to the downstream side of the last physical conveyor zone so that this added module becomes the last connected module on the communications line. On this added module, the upstream sensor port provides the accumulation/release function for the last conveyor zone and the downstream sensor port provides the Lane Full Interface function for the last conveyor zone.

Figure 23 shows how this function is accomplished using SE-4 module(s) to provide the signals to accumulate/release and Lane Full Interface for Zone 4.
FIGURE 23 - LANE FULL AND ACCUMULATE MOST DOWNSTREAM ZONE
STATUS INDICATORS

IQZonz module status is indicated by several LED’s as shown in Figure 24. All LED’s with the exception of the two Network LEDs and the Power LED are tri-coloured and context sensitive. The colours used are green and red and when both green and red are on, the LED is amber. The following chart indicates the various meanings of all the LED indicators. By definition Blinking is approximately ½ second on/off cycle and Flashing is approximately ¼ second on/off cycle. As a further note in interpreting the chart, in cases where it is shown “green ON and red BLINK” will actually look like a greed LED that changes to amber for the duration of the blink and then back to green.

POWER STATUS

<table>
<thead>
<tr>
<th>LED State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>No power is applied to the module</td>
</tr>
<tr>
<td>Solid Blue</td>
<td>24V power is on</td>
</tr>
<tr>
<td>Blinking Blue</td>
<td>Power has dropped below 18V</td>
</tr>
</tbody>
</table>
### Module Status

<table>
<thead>
<tr>
<th>LED State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>No power is applied to the module</td>
</tr>
<tr>
<td>Blinking Amber</td>
<td>Connection is lost</td>
</tr>
<tr>
<td>Blinking Green</td>
<td>Module OK</td>
</tr>
<tr>
<td>Solid Amber</td>
<td>Upgrade in process</td>
</tr>
<tr>
<td>Blinking Red</td>
<td>Module is Initializing</td>
</tr>
</tbody>
</table>

### Upstream / Downstream Motor

<table>
<thead>
<tr>
<th>LED State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>Motor is not configured</td>
</tr>
<tr>
<td>Green at 10% brightness</td>
<td>Motor is configured, connected, but not running</td>
</tr>
<tr>
<td>Green at 100% brightness</td>
<td>Motor is configured, connected, and running</td>
</tr>
<tr>
<td>Blinking Red</td>
<td>Motor is configured and is in overload</td>
</tr>
<tr>
<td>Flashing Red</td>
<td>Motor is in short circuit</td>
</tr>
<tr>
<td>Solid Red</td>
<td>Motor is any or more of the following:</td>
</tr>
<tr>
<td></td>
<td>• not connected</td>
</tr>
<tr>
<td></td>
<td>• stalled</td>
</tr>
<tr>
<td></td>
<td>• power supply is under 18V</td>
</tr>
<tr>
<td></td>
<td>• power supply is above 30V</td>
</tr>
<tr>
<td></td>
<td>• motor temperature is over 105 °C</td>
</tr>
</tbody>
</table>

### Upstream / Downstream Sensor

<table>
<thead>
<tr>
<th>LED State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>Zone empty or SE-4 input not active</td>
</tr>
<tr>
<td>Solid Green</td>
<td>Zone occupied or SE-4 signal active</td>
</tr>
<tr>
<td>Flashing Green</td>
<td>Zone occupied and zone being told to accumulate by another IQZonz or IQMap</td>
</tr>
<tr>
<td>Green with Blinking Amber</td>
<td>Zone is occupied and is in a Jam state</td>
</tr>
<tr>
<td>Blinking Red</td>
<td>Zone jam or sensor unplugged</td>
</tr>
<tr>
<td>Solid Red</td>
<td>Sensor’s health/fault signal is energized</td>
</tr>
</tbody>
</table>

### Upstream / Downstream Network

<table>
<thead>
<tr>
<th>LED State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>No Data Activity occurring on port</td>
</tr>
<tr>
<td>Blinking Blue</td>
<td>Data Activity occurring on port</td>
</tr>
</tbody>
</table>
JAM DETECTION

Jam detection by the IQZonz logic is always in reference to the discharging zone. IQZonz utilizes internal timer functions to detect 2 possible conditions:

SENSOR JAM

A sensor jam is detected when an item is discharging a zone with the motor roller running and the sensor remains blocked for 10 seconds. After the 10 seconds has expired and the sensor is still blocked; the motor roller is stopped and a Jam condition is indicated on the zone’s Sensor LED. The item must be physically removed and the sensor becoming clear in order to reset a Sensor Jam.

WAIT FOR ARRIVAL

The discharging zone must wait for indication of a successful arrival from the downstream zone before allowing a new item to discharge. The discharging zone waits for this arrival confirmation for 10 seconds after the item has cleared the sensor. During the 10 second time period while the discharging zone is waiting for confirmation of arrival downstream; if another item arrives at the discharging zone’s sensor, the discharging zone’s motor roller will stop. When the 10 seconds has elapsed; the discharging zone automatically resets the timer and attempts to discharge the newly arrived item.

You must be sure that the combinations of zone length, item length, and motor roller speed will accommodate normal item flow within these time value limits. The normal travel time between zones must be less than 10 seconds and the length of items conveyed at your chosen conveyor speed must not allow a zone sensor to be blocked for more than 10 seconds.
In the previous sections some of the same functionality that can be accomplished with an IQMap module was show being accomplished by adding an IQZonz module. Depending upon your application, using the IQMap may prove to be a more economical solution.

The IQMap is an optional module that provides functionality enhancements to your IQZonz controlled conveyor. The module contains:

- 4 Digital inputs
- 4 Digital outputs
- RJ-12 port for sensor
- Speed control adjustment
- Communication cable ports

The IQMap is intended to be connected into the daisy chained IQZonz communication cables network and depending on its location among the modules can provide the following functions:

- Wake-up of most upstream zone
- Accumulate the most downstream zone
- Accumulate up to 4 adjacent intermediate zones
- Provide zone occupied status for up to 4 adjacent zones
- Provide speed adjustment for a group of IQZonz modules at a single point
- Change sensor operation from retro-reflective to diffuse
- Provide global indication of MDR error and Jam error on a given network of IQZonz module

Please note that not all of these functions are available at the same time from a single IQMap module.
IQMAP HARDWARE

Figure 25 shows the ports, terminals, LEDs and controls available on the IQMap module.
**IQMap in Most Upstream Location**

**Digital Inputs**

When *IQMap* is connected in the most upstream location; its digital inputs can perform:

- Wake-up Function
- Sensor Polarity Change Function
- Accumulate Function for the next downstream *IQZonz* module

**Sensor Polarity Change Function**

The default sensor configuration for *IQZonz* is for the zone sensor signals to be energized when the zone is clear; which would be the case for retro-reflective photo sensors. Some applications and/or user preference can require diffuse type sensors. A typical diffuse sensor’s signal is energized when blocked; which is the opposite of a retro-reflective sensor. The Sensor Polarity Change function allows you can change a line of conveyor to use diffuse sensors instead of the default retro-reflective type.

Figure 26 shows the *IQMap* inputs to use for each of these functions. Please note that the wake-up function can also be accomplished by plugging a sensor into the *IQMap* sensor port. In this case you do not use Input 2 to for this function.

![Diagram of IQMap inputs for wake-up, sensor polarity change, and accumulate functions](image-url)
DIGITAL OUTPUTS

For the most upstream IQMap, the digital outputs have the following indications:

<table>
<thead>
<tr>
<th>Output</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>At least one MDR in the IQZonz chain is in a Motor Error state. Output will remain energized as long as the condition is true and will remain energized for 2 seconds after the condition is false</td>
</tr>
<tr>
<td>2</td>
<td>At least one zone in the IQZonz chain is in a Jam Error state. Output will remain energized as long as the condition is true and will remain energized for 2 seconds after the condition is false</td>
</tr>
<tr>
<td>3</td>
<td>Indicates that the upstream zone of the 1st IQZonz module has its Sensor blocked</td>
</tr>
<tr>
<td>4</td>
<td>Indicates that the downstream zone of the 1st IQZonz module has its Sensor blocked</td>
</tr>
</tbody>
</table>

Figure 27 shows an example of IQMap outputs when the IQMap is connected upstream of the most upstream IQZonz module.
**IQMap in Most Downstream Location**

**Digital Inputs**
When *IQMap* is connected in the most upstream location; it’s digital inputs can perform:

- Lane Full Function
- Sensor Polarity Change Function
- Accumulate Function for the next upstream *IQZonz* module

Figure 28 shows the *IQMap* inputs to use for each of these functions. Please note that the Lane Full function can also be accomplished by plugging a sensor into the *IQMap* sensor port. In this case you do not use Input 4 to for this function.

**Digital Outputs**
For the most downstream *IQMap*, the digital outputs have the following indications:

<table>
<thead>
<tr>
<th>Output</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Indicates that the upstream zone of the last <em>IQZonz</em> module has its Sensor blocked</td>
</tr>
<tr>
<td>2</td>
<td>Indicates that the downstream zone of the last <em>IQZonz</em> module has its Sensor blocked</td>
</tr>
<tr>
<td>3</td>
<td>At least one MDR in the <em>IQZonz</em> chain is in a Motor Error state. Output will remain energized as long as the condition is true and will remain energized for 2 seconds after the condition is false</td>
</tr>
<tr>
<td>4</td>
<td>At least one zone in the <em>IQZonz</em> chain is in a Jam Error state. Output will remain energized as long as the condition is true and will remain energized for 2 seconds after the condition is false</td>
</tr>
</tbody>
</table>

Figure 29 shows an example of *IQMap* outputs when the *IQMap* is connected downstream of the most downstream *IQZonz* module.
**IQMap in Intermediate Location**

**Digital Inputs**

When *IQMap* is connected in an intermediate location (neither the most upstream or most downstream); it’s digital inputs can perform:

- Accumulate Function for the next upstream *IQZonz* module
- Accumulate Function of the next downstream *IQZonz* module

Figure 28 shows the *IQMap* inputs to use for each of these functions. Please note that the Lane Full function can also be accomplished by plugging a sensor into the *IQMap* sensor port. In this case you do not use Input 4 to for this function.
**DIGITAL OUTPUTS**

For the most downstream *IQMap*, the digital outputs have the following indications:

<table>
<thead>
<tr>
<th>Output</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Indicates that the upstream zone of the next upstream <em>IQZonz</em> module has its Sensor blocked</td>
</tr>
<tr>
<td>2</td>
<td>Indicates that the downstream zone of the next upstream <em>IQZonz</em> module has its Sensor blocked</td>
</tr>
<tr>
<td>3</td>
<td>Indicates that the upstream zone of the next downstream <em>IQZonz</em> module has its Sensor blocked</td>
</tr>
<tr>
<td>4</td>
<td>Indicates that the downstream zone of the next upstream <em>IQZonz</em> module has its Sensor blocked</td>
</tr>
</tbody>
</table>

Figure 31 shows an example of *IQMap* outputs when the *IQMap* is connected in an intermediate location between two *IQZonz* modules.
FIGURE 31 - DIGITAL OUTPUTS OF INTERMEDIATE IQMAP

**IQMap Outputs**
- Output 1: Indicates Zone 1 Sensor blocked
- Output 2: Indicates Zone 2 Sensor blocked
- Output 3: Indicates Zone 3 Sensor blocked
- Output 4: Indicates Zone 4 Sensor blocked
CHANGING SPEEDS

The IQMap module contains a rotary dial for speed control. Depending upon where in the network the IQMap is inserted and the setting of this dial; you can achieve flexible speed control results. The speed control dial has 3 functions depending upon its rotary position:

- Turned all the way to 0 – use default speed setting in IQZonz module
- Turned all the way to max – use speed reference from next upstream IQMap
- In between 0 and max – use speed setting (10% to 97%) from insertion point on downstream

Figure 32 shows a close-up of the IQMap speed control adjustment and LED indicators and their respective meanings.

FIGURE 32 - IQMAP SPEED ADJUSTMENT AND LED INDICATORS
CHANGING SPEED FOR ENTIRE CONVEYOR LINE

In its simplest usage, *IQMap* speed control for an entire line is accomplished by attaching the *IQMap* module to the network ahead of the most upstream module. In this configuration, the position of the rotary dial between 0 and max will provide speed setting of between 10% and 97% PWM for all *IQZonz* modules.

![Diagram showing speed control for all modules](image)

**FIGURE 33 - SPEED CONTROL FOR ALL MODULES**

Please note that in the configuration shown in Figure 33, setting the rotary dial to the “0” position will cause all *IQZonz* to use their default or memory stored speed setting.
CHANGING SPEED FOR SELECT MODULES WITHIN A CONVEYOR LINE

The most upstream IQMap module can set the speed for the entire line. However, by inserting a 2nd IQMap module in the network and setting its rotary dial to 0, you can return the IQZonz modules to default speed from the insertion point on downstream. Figure 34 shows how to do this.

FIGURE 34 - SPEED CONTROL CHANGE AT INTERMEDIATE POINT
SEPARATE SPEED ZONES

By changing the rotary dial of the inserted IQMap module; you can independently change the speed of all IQZonz modules downstream of the inserted IQMap module. Figure 35 shows the same physical configuration as Figure 34, but by setting the rotary dial of the intermediate IQMap to a position between 0 and max, the speed of all downstream IQZonz modules will change to this rotary dial setting.

**FIGURE 35 - INDEPENDENT SPEED CONTROL AREAS**
PASS THRU SPEED CONTROL

There could also be applications when an area of zones needs to have independent speed control for some operations and then return to a single overall speed based upon the most upstream IQMap setting. With the same configuration as shown in Figure 34 and Figure 35; by setting the rotary dial to max on the intermediate IQMap, this will cause the zones downstream of the intermediate IQMap to follow the speed setting of the most upstream IQMap and shown in Figure 36.

![Pass Thru Speed Control Diagram](image)
IQTool

IQTool is an optional PC based software installation that allows you to monitor and/or modify select parameters on individual or a whole group of IQZonz modules. Here are IQTool’s basic features:

- Change speed, acceleration, and deceleration individually for each zone or globally for all zones
- Change MDR rotation direction individually for each zone or globally for all zones
- Manually jog individual zone’s MDR for maintenance and diagnostics

Installation

Once IQTool is installed on your PC, it runs in the background and notifies you from the System Tray if it “sees” any IQZonz modules. By clicking on the icon in the System Tray, a window opens up that shows the status of the first IQZonz module the software detected.

![Image of System Tray with IQTool icon and notification]

Click on System Tray icon to open IQTools screen

**FIGURE 37 - PC SYSTEM TRAY INDICATING IQTOOL FOUND MODULES**

IQTool Screen

The following figures indicate the functions and options available from the IQTool screen.
FIGURE 38 - MODULE DATA AND NAVIGATION TO NEXT/PREVIOUS MODULE

FIGURE 39 - SELECTING UPSTREAM OR DOWNSTREAM ZONE ON SELECTED MODULE
FIGURE 40 - CHANGING PARAMETERS AND SET ALL NODES TO SAME SETTINGS

- Click to reverse the rotation of the MDR
- Click to change the zone to Train Mode
- Click to jog the zone’s MDR
- Click and drag to set Speed, Acceleration, and Deceleration for the zone’s MDR
- Click to change polarity of zone sensors from default light operate to dark operate
- Click to set the zone to always accumulate
- Clicking Set All will change all zones to the settings you made on this screen
IQTTool Screen for IQMap

When you click to view the next or previous node as shown in Figure 38 and the current node happens to be an IQMap module; then the IQTool screen changes to display a graphic of the IQMap module and clickable items associated with the IQMap as shown in Figure 41.

FIGURE 41 - IQMAP SCREEN
APPENDIX A – DIMENSIONS AND MOUNTING

IQZonZ Module

The IQZonZ module is intended to be mounted either directly into the conveyor side frame or separate mounting bracket. For either case, the hole pattern and size of holes are shown below in Figure 42. Please note that the mounting for IQZonZ modules is symmetrical such that the module attaches identically regardless of the direction of flow for the control. All dimensions in mm.
**IQMap Module**

The IQMap module is available with 2 mounting options. One is for flat mount and the other is for DIN Rail mount.

**FIGURE 43 - IQMAP FLAT MOUNT OPTION**

**FIGURE 44 - IQMAP WITH DIN RAIL OPTION**
APPENDIX B – ELECTRICAL SPECIFICATIONS

POWER CONNECTOR (INCLUDED):

| Part Number                     | Phoenix Contact PN: 1827127 MCVR 1.5/2-ST-3.81 |

ELECTRICAL SPECIFICATION:

| Power supply voltage     | 24.0V +/- 10% |
| Standby current consumption | < 110mA < 70mA |
| Motor Starting Current   | ≤ 4.0A Not Applicable |
| Motor Rated Current      | ≤ 3.2A Not Applicable |
| Motor PWM Frequency      | 17.5 kHz +/- 0.1% Not Applicable |

ABSOLUTE MAXIMUM RATINGS

Operating outside these parameters may result in permanent module failure or unexpected device behavior.

| Minimum Operating Voltage | 21V |
| Maximum Operating Voltage | 30V |
| Storage temperature       | -40°C to 150°C (-40°F to 300°F) |
| Ambient Operating temperature | 0°C to 80°C (32°F to 176°F) |
| Humidity                  | 5% to 95% non-condensing |
| Vibration                 | 0.152 mm (0.006 in.) displacement, 1G peak |
| Mechanical Shock          | 20G peak for 10ms duration (1.0 ms) |
| Enclosure IP Rating       | IP20 |
| Maximum peak current      | 21.5A* Not Applicable |
| Maximum motor start current | 12A Not Applicable |

*This is the maximum current that will be allowed by the hardware over current protection circuitry. On board firmware limits the amount of current.
## Certifications & Standards

IQZonz and IQMap are CE Certified and tested to comply with the following standards:

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BDS EN 61131-2:2008</td>
<td>Programmable controllers -- Part 2: Equipment requirements and tests</td>
</tr>
<tr>
<td>BDS EN 61000-6-2:2006</td>
<td>Electromagnetic compatibility (EMC) -- Part 6-2: Generic standards - Immunity for industrial environments</td>
</tr>
<tr>
<td>BDS EN 61000-6-4:2007</td>
<td>Electromagnetic compatibility (EMC) -- Part 6-4: Generic standards - Emission standard for industrial environments</td>
</tr>
<tr>
<td>BDS EN 55016-2-1+A1:2006</td>
<td>Specification for radio disturbance and immunity measuring apparatus and methods Part 2-1 Methods of measurement of disturbances and immunity. Conducted disturbance measurements</td>
</tr>
<tr>
<td>BDS EN 55014-1:2007</td>
<td>Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus -- Part 1: Emission</td>
</tr>
<tr>
<td>BDS EN 61000-4-2+A1+A2:2004</td>
<td>Electromagnetic compatibility (EMC) Part 4-2: Electromagnetic discharge Immunity test</td>
</tr>
<tr>
<td>BDS EN 61000-4-3/A1:2008</td>
<td>Electromagnetic compatibility (EMC) Part 4-3 Radiated radio-frequency, electromagnetic field immunity test.</td>
</tr>
<tr>
<td>BDS EN 61000-4-4:2006</td>
<td>Electromagnetic compatibility (EMC) Part 4-4 Electrical fast transient/burst immunity test.</td>
</tr>
<tr>
<td>BDS EN 61000-4-6:2007</td>
<td>Electromagnetic compatibility (EMC) Part 4-6 Immunity to conducted disturbances, induced by radio-frequency field.</td>
</tr>
<tr>
<td>BDS EN 61000-4-11:2006</td>
<td>Electromagnetic compatibility (EMC) Part 4-11 Voltage dips, short interruptions and voltage variations immunity tests.</td>
</tr>
</tbody>
</table>
**Sensor Port Inputs**

The Sensor ports each have 1 input. Sensor port inputs are auto-sensing for the connected circuit type. Input function as either PNP or NPN. Please note that both sourcing and sinking current will activate the input.

- Minimum ON current: 1.5mA
- Maximum OFF current: 0.4mA

**Sensor Port Power Pins**

Pin5 of all RJ-12 ports provides 24V for powering up a photo-eye. The current that those pins can supply is limited internally. The maximum current consumption combined for both Sensor ports (or single Sensor port on IQMap) is 100mA. Sensor port power pins are short circuit protected.

**Motor Port Specification**

<table>
<thead>
<tr>
<th>Supported motor types</th>
<th>3 phase BLDC motors with 3 Hall Effect sensors</th>
</tr>
</thead>
<tbody>
<tr>
<td>PWM frequency</td>
<td>17.5 kHz +/- 0.1%</td>
</tr>
<tr>
<td>Maximum starting current</td>
<td>4A</td>
</tr>
<tr>
<td>Maximum rated current</td>
<td>3.2A</td>
</tr>
<tr>
<td>Motor Protection*</td>
<td>Coil-to-coil short, coil-to-Vcc short, over-heating, over-voltage, under-voltage, stall sensing and protection</td>
</tr>
</tbody>
</table>
**IQMAP I/O**

**INPUTS**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Voltage</td>
<td>0 – 30V</td>
</tr>
<tr>
<td>Maximum OFF Voltage</td>
<td>6V</td>
</tr>
<tr>
<td>Minimum ON Voltage</td>
<td>13V</td>
</tr>
<tr>
<td>Maximum rated current</td>
<td>3.2A</td>
</tr>
</tbody>
</table>

**OUTPUTS**

<table>
<thead>
<tr>
<th>Quantity</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Current per Output</td>
<td>20mA</td>
</tr>
<tr>
<td>Internal Resistance</td>
<td>110 Ohms</td>
</tr>
<tr>
<td>Short Circuit Protection</td>
<td>180mA (includes Sensor Port)</td>
</tr>
<tr>
<td>Output Voltage</td>
<td>Same as input supply voltage</td>
</tr>
</tbody>
</table>

**COMMUNICATION PORTS SPECIFICATION:**

- 3 port integrated switch (2 external ports and 1 port for the on-board processor)
- Automatic speed setup (10Base-T / 100Base-TX)
- Automatic duplex configuration (Full / Half)
- Automatic straight/crossover cable detection (Auto MDI/MDI-X)
- PAUSE frame support
- Back pressure flow control support
- Maximum segment length: 100m / 328ft