



3299 Tower Drive
Newburgh, IN 47630
812.490.1525
www.MatrixTeam.com

Matrix MX3-IZ Controller System Menu

This equipment is not available to the general public and will only be installed by a professional installer.



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Introduction

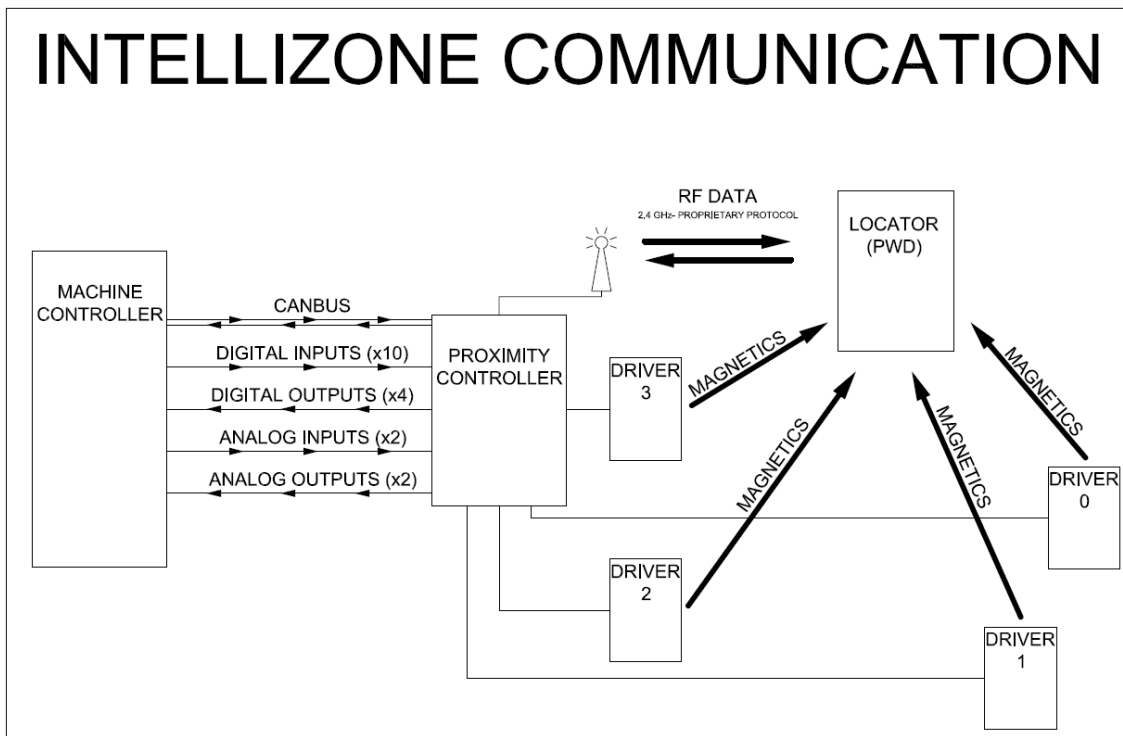
MX3-IZ controller is main device of the MX3 Proximity Detection system, It satisfy the market needs of mine have to meet the MSHA proximity detection role. The intent of IntelliZon Proximity is to provide a practical, mine-duty system that will automatically warn personnel when they are entering a potentially hazardous area around a machine. The system must be able disable some or all machine functions if a particular zone is breached.

Product Overview

A proximity detection system detects when a person enters a dangerous area around a given machine and changes machine operation accordingly. The machine can be configured to stop or slow all or some operations.

The MX3 Matrix Proximity Detection System will be a packaged product that will vastly improve our current proximity detection system by enabling it to function at greater distances, function on any piece of mobile equipment, as well as decrease response time and increase accuracy.

System Overview



The Controller Block Diagram

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Interface Board Block Diagram

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Wireless Board Block Diagram

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The MX3-IZ uses a Atmel Zigbee radio for radio connecting the locator and therefor in controlling the mine machine for miner safty.

Processor board Block Diagram

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Controller Hardware

MX3-IZ Controller

Overview

This central processor for the **IntelliZone®** Proximity Detection System provides outputs to drive relays, CAN bus for controls interfacing, analog, and digital I/O. Diagnostic tests are run continuously by the Controller during operation to provide users instant feedback of system performance. Power is relayed through the Controller for up to four MX3-IZ Drivers. A MX3-IZ Software Key is necessary for Controller operation. The Controller is not intrinsically safe and must be installed inside an explosion-proof enclosure when used in potentially hazardous MSHA-regulated environments.



Controller specification

As the core of the proximity detection system, the controller provides outputs to drive relays, analog and digital I/O, and CAN bus for equipment interfacing.

Function	Description
Power Input	72VDC (2.0A) and 24VDC (1.0A)
Power Input (Max)	72VDC (2.8A) and 24VDC (4.2A)
Outputs	3X Solid-State, 350mA @ 24VDC
	1X Mechanical Dry Contact, 10A Max
	2X Analog, 4-20mA Current Loop
Inputs	10X Digital, Optically Isolated Actuation level – 65-150VAC or 9-25VDC De-actuation level – 0-55VAC or 0-6VDC
	2X Analog, 4-20mA Current Loop
CAN Bus	2X Channels per ISO 11898



Controller connectors

Description	Manufacturer	Part Number
16-Pin Driver	Tyco	1-963217-1
42-Pin I/O	Tyco	1-967281-1

Pin	Name	Description
1	Common	Driver Common
2	Signal 0 Negative	Data Common Driver 0
3	Common	Driver Common
4	Signal 1 Negative	Data Common Driver 1
5	Common	Driver Common
6	Signal 2 Negative	Data Common Driver 2
7	Common	Driver Common
8	Signal 3 Negative	Data Common Driver 3
9	Switched Voltage 0	Power Driver 0
10	Signal 0 Positive	Data Driver 0
11	Switched Voltage 1	Power Driver 1
12	Signal 1 Positive	Data Driver 1
13	Switched Voltage 2	Power Driver 2
14	Signal 2 Positive	Data Driver 2
15	Switched Voltage 3	Power Driver 3
16	Signal 3 Positive	Data Driver 3

Pin	Name	Description	Machine Circuit Connection	Response Voltage
1	Input A0	Digital Input 0	Configurable	Actuate 65-150VAC or 9-25VDC
2	Input B0	Digital Input 0 Common	Configurable	De-Actuate 0-55VAC or 0-6VDC
3	Input A1	Digital Input 1	Configurable	Actuate 65-150VAC or 9-25VDC
4	Input B1	Digital Input 1 Common	Configurable	De-Actuate 0-55VAC or 0-6VDC
5	Input A2	Digital Input 2	Configurable	Actuate 65-150VAC or 9-25VDC
6	Input B2	Digital Input 2 Common	Configurable	De-Actuate 0-55VAC or 0-6VDC
7	Input A7	Digital Input 7	Configurable	Actuate 65-150VAC or 9-25VDC
8	Input B7	Digital Input 7 Common	Configurable	De-Actuate 0-55VAC or 0-6VDC
9	Output 0	Digital Output 0	Configurable	24VDC @ 1.2W Max
10	Output 1	Digital Output 1	Configurable	24VDC @ 1.2W Max
11	Output 2	Digital Output 2	Configurable	24VDC @ 1.2W Max
12	Relay Out 0	Mechanical Relay 0	Configurable	



13	Relay Out 1	Mechanical Relay 1 Common	Configurable	
14	Input B9	Digital Input 9 Common	Configurable	De-Actuate 0-55VAC or 0-6VDC
15	Chassis	Chassis Ground	Machine Ground	
16	Input A4	Digital Input 4	Configurable	Actuate 65-150VAC or 9-25VDC
17	4-20 Input 0 +	Analog Input 0	Configurable	
18	Input B3	Digital Input 3 Common	Configurable	De-Actuate 0-55VAC or 0-6VDC
19	Input A6	Digital Input 6	Configurable	Actuate 65-150VAC or 9-25VDC
20	CAN Bus 1 High	CAN Communication 1 High	Configurable	
21	CAN Bus 1 Low	CAN Communication 1 Low	Configurable	
22	Common	Power Supply Common		
23	Input B5	Digital Input 5 Common	Configurable	De-Actuate 0-55VAC or 0-6VDC
24	Input A8	Digital Input 8	Configurable	Actuate 65-150VAC or 9-25VDC
25	4-20 Input 1 -	Analog Input 1 Common	Configurable	
26	+24VDC	Power Supply Input Voltage		
27	CAN Bus 0 High	CAN Communication 0 High	Configurable	
28	Input A9	Digital Input 9	Configurable	Actuate 65-150VAC or 9-25VDC
29	+72VDC	Power Supply Input Voltage		
30	4-20 Output 0 +	Analog Output 0	Configurable	
31	Input B4	Digital Input 4 Common	Configurable	De-Actuate 0-55VAC or 0-6VDC
32	Input A3	Digital Input 3	Configurable	Actuate 65-150VAC or 9-25VDC
33	4-20 Output 0 -	Analog Output 0 Common	Configurable	
34	Input B6	Digital Input 6 Common	Configurable	De-Actuate 0-55VAC or 0-6VDC
35	4-20 Input 1 +	Analog Input 1	Configurable	
36	4-20 Input 0 -	Analog Input 0 Common	Configurable	
37	Input A5	Digital Input 5	Configurable	Actuate 65-150VAC or 9-25VDC
38	Input B8	Digital Input 8 Common	Configurable	De-Actuate 0-55VAC or 0-6VDC
39	4-20 Output 1 +	Analog Output 1	Configurable	
40	4-20 Output 1 -	Analog Output 1 Common	Configurable	
41	CAN Bus 0 Low	CAN Communication 0 Low	Configurable	
42	Common	Power Supply Common		

Controller Inputs

Digital Inputs

There must be 10 optically isolated digital inputs available. The actuation / de-actuation levels are listed in Table 3. All inputs must remain in the de-actuated state when left floating. The usage of each input is specified in the Interface Specification for each application of the proximity detection system.

Analog Inputs

There must be 2 analog inputs that support 4-20mA current loops.

Controller Outputs

Solid State Outputs

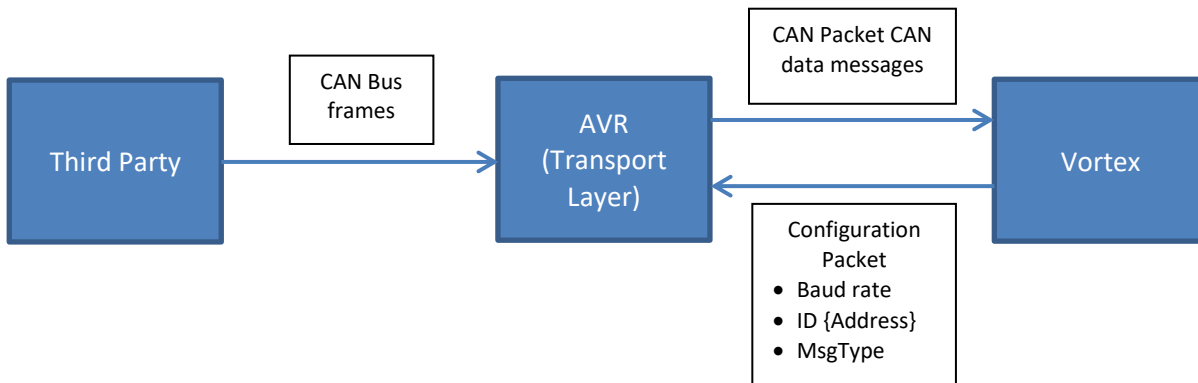
The proximity detection system must provide at least 3 Solid-state relay outputs. These solid-state digital outputs must provide 24VDC when activated and must be able to supply up to 50mA individually at nominal voltage (each must be able to source up to 1.2W).

Analog Outputs

There must be 2 analog outputs that support 4-20mA current loops.

CAN Bus

AVR to Vortex CAN Bus Interface



CAN Packet Definition

```

typedef struct
{
  union
  {
    CAN_PDU_MsgID_t PDU;
    uint32_t MsgID;
  } Header_U;
}
  
```

```
                //TODO enum protocol  
uint16_t  DataLength;  
uint8_t   Data[CAN_DATA_BYTES];  
} CAN_frame_t;
```

USB

The CAN Bus interface of the proximity detection system must conform to ISO 11898 at the Physical Layer, utilizing a “full CAN” implementation of the CAN 2.0B protocol, transmitting at 125 k baud, using 11 bit identifiers. Cabling of the CAN Bus between the Proximity Detection System and FaceBoss will be Belden 3072F cable (Joy P/N 100172283), or equivalent. There will be no provision internal to the Proximity Detection system for the addition of the 120 ohm terminating resistor required for CAN communications. This resistor will be added external to the system.

Wireless

The proximity detection system must be capable of providing a wireless access point. This access point may utilize an external antenna connection

Wired

The proximity detection system must be capable of providing a 10/100BaseTX Ethernet connection (4-wire Ethernet) via a secondary interface connection. The connection speed setting must be software configurable between 10Mbps and 100Mbps.

Environmental Requirement

Operating Temperature Range: -10°C to +55°C

Power Supply

Power Supply Input Voltage: 72V and 24V

Note: If Power source uses AC line power: A line power filter is required to use for AC line emission noise suppressions.

System Operation

System

The drivers emit a magnetic field around the machine they are mounted on. The locators respond to this magnetic field and communicate via radio frequency with the controller. The controller performs an algorithm to determine where, in relation to the machine, the locators are. When a locator breaches one of the configurable zones created around the machine, the proper configurable action is performed.

Zoning

Fully configurable zones based on inputs from Machine (e.g. High, Medium, Low, Cutter On, Forward, Reverse) and outputs for the Proximity Detection System.

Multiple zones can be active simultaneously.

Each zone can have multiple personnel types applied to it.

Minimum Zone Requirements

Zone	Continuous Miner	Shuttle Car
Red Zone	<ul style="list-style-type: none"> Operator zone (applies only to the PWD associated as this machines operator; Only apply "cutter zone" to operator-associated PWD) Non-operator zone (encompassing all PWDs that are not associated to this specific CM as an operator) 	<ul style="list-style-type: none"> Forward Zone Reverse Zone
Yellow Zone	Non type-specific zone (this warning zone by default will apply to all PWDs, both operator and non-operator)	<ul style="list-style-type: none"> Forward Zone Reverse Zone
Green Zone	Operator zone (this operator zone allows the associated PWD to operate the machine not shutdown the machine)	Operator zone (this operator zone allows the associated PWD to operate the machine not shutdown the machine)

Personal Association



The controller will be able to distinguish between a machine operator and all other personnel.

Multi-Machine Operation

Shuttle car has to have the ability to approach the Miner without shutting either machine down while maintaining safe distances for personnel. A button press by the operator will start the process of modifying or reducing the zones.

Tests

Port Test: There shall be a port test on the machine. The boot sequence on the controller should run the port test automatically for a configurable number of seconds.

Support

GUI communication will be provided in the form of a laptop operating on Linux or Windows. There will be wired and wireless communications available on the controller. PWDs will have the ability to be updated over the air.

Logging

Logging will be provided in the system in the binary and text forms.

Can Bus

The CAN bus is used to communicate with the equipment the system is installed on. The CAN bus supports multiple CAN protocols as needed for the installation.

Customer Support / Contact Information

For technical support or product returns, contact:

Matrix Design Group, LLC

3299 Tower Drive

Newburgh, IN 47630

Phone: 812-490-1525



FCC Compliance Statements

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and 2. This device must accept any interference received, including interference that may cause undesired operation.

Warning: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- * Reorient or relocate the receiving antenna.
- * Increase the separation between the equipment and receiver.
- * Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- * Consult the dealer or an experienced radio/TV technician for help.

Canadian Compliance Statements

This Device complies with Industry Canada License-exempt RSS standard(s). Operation is subject to the following two conditions: 1. This device may not cause harmful interference, and 2. This device must accept any interference, including interference that may cause undesired operation of the device.

Note: Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Ce dispositif est conforme aux normes CNR exemptes de licence d'Industrie Canada. Le fonctionnement de ce dispositif est autorisé sous réserve des deux conditions suivantes: 1. Ce dispositif ne doit pas produire de brouillage et 2. L'utilisateur du dispositif doit être prêt à accepter tout brouillage radioélectrique reçu même si ce brouillage est susceptible de compromettre le fonctionnement du dispositif.

Remarque: Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.