Installation
And
Configuration Manual

Use this manual for software versions from 1.24 forward

Document No. 11240, Revision K00

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Revision Notes

First Release – October 17, 2010

Revision A – March 23, 2011

- Update to include software changes in software version 1.20

Revision B – April 18, 2011

- Minor corrections to alarm setup text

Revision C – June 14, 2011

- Update section on I/O relays
- Update section on bus converter connections
- Add section on deploying remote I/O option

Revision D – August 3, 2011

- Add details for Modbus RS-485 network termination

Revision E – December 1, 2011

- Add note that sensor names are required
- Minor text corrections

Revision F – January 20, 2012

- Add poll delay parameter and notes on input relay assignment
- Update machine drawings for Leg/Bucket Elevator and add Tripper

Revision G – March 19, 2012

- Add relay terminal numbers

Revision H – March 22, 2012

- Added special case low alarms
- Updated screen shoots for machines and screen setup

Revision I – June 3, 2012

- Revised for Revision 2.00 software release

Revision I – October 3, 2012

- Add commissioning checklist appendix

Revision K00 – November 21, 2016

- Added screen Conveyor2
- Proximity switches added

Revision K01 – March 24, 2017

- Added screen Conveyor3

1. Overview

This manual describes the configuration of the EZSentinel 128. The EZSentinel 128 is a combination HMI / Controller to provide comprehensive hazard monitoring for small facilities. It supports up to 128 field sensors for bearing temperature, belt tracking, belt speed and vibration. The HMI consists of a 6" touch screen display. All operations and configurations can be undertaken from the HMI. In addition a Save / Restore function allows the editing of the systems configuration using MS Excel or any other suitable editor.

Documentation for the EZSentinel 128 is contained in the following documents.

11240	EZSentinel 128 Configuration Manual
11242	EZSentinel 128 User's Manual
11243	EZSentinel 128 Editing Configuration Using Excel
11258	Installing HazMon in a Box

The installation of the EZSentinel 128 should be performed by a qualified and licensed electrical contractor. The wiring consists of 120VAC control wiring and low voltage signaling wiring. All wiring must be completed to the required electrical codes for the installed location. The EZSentinel 128 control unit must be mounted in a protected area. The control unit is not suitable for hazardous locations. The field sensing network is certified for installation in hazardous locations.

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Caution

Personnel involved in installing and configuring of the EZSentinel 128 system must read and understand this document before attempting to install or configure the system. Failure to read and understand this document may result in damage to machinery, personal injury or loss of life. It is strongly recommended that all of the documentation listed above be read and understood before an EZSentinel system is installed or operated.

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2. Installation

Installation of the EZSentinel 128 requires the following steps:

1. Mounting the control unit in a suitable location;
2. Connecting the 120 VAC supply;
3. Connecting the machinery control circuits;
4. Alarm horn connections;
5. Connecting the field sensing network.

2.1 Mounting the Control System

The control system should be mounted in a secure, protected location. The control system is not rated for installation in a hazardous area. If possible, the system should be mounted indoors. If an indoor location is not available, the control unit must be mounted with protection from the elements. This would include a large protective rain shield that would protect the electronics when the enclosure door is fully open. Snow and rain must not be allowed to accumulate on the top or sides of the enclosure. In cold climates a self-regulating heater will be required if the unit is mounted outdoors. An optional enclosure heater is available.

Mount the enclosure using the four supplied mounting brackets and screws. The unit should be mounted to a flat surface with at least 6” of clearance around all sides of the enclosure. All cable entries should be made to the bottom of the enclosure.

2.2 Wiring 120VAC Control Power

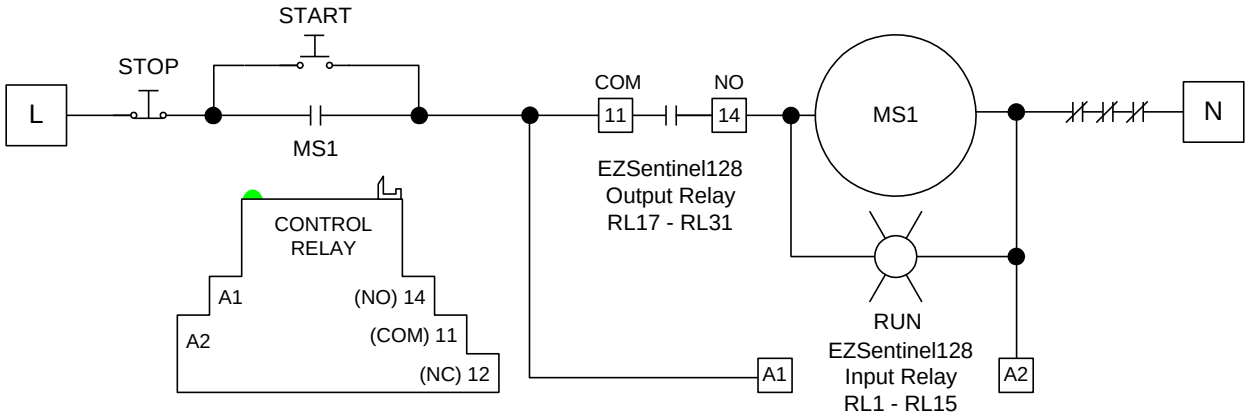
The control system requires 120VAC and is fused at 5A. Terminals are provided for connection of the AC power and ground. A separately fused supply circuit is recommended. AC supply sources that have generators of significant electrical noise such as high intensity arc lighting and variable speed motors should be avoided.

Seperately Fused
120VAC 15A
supply circuit
recommended

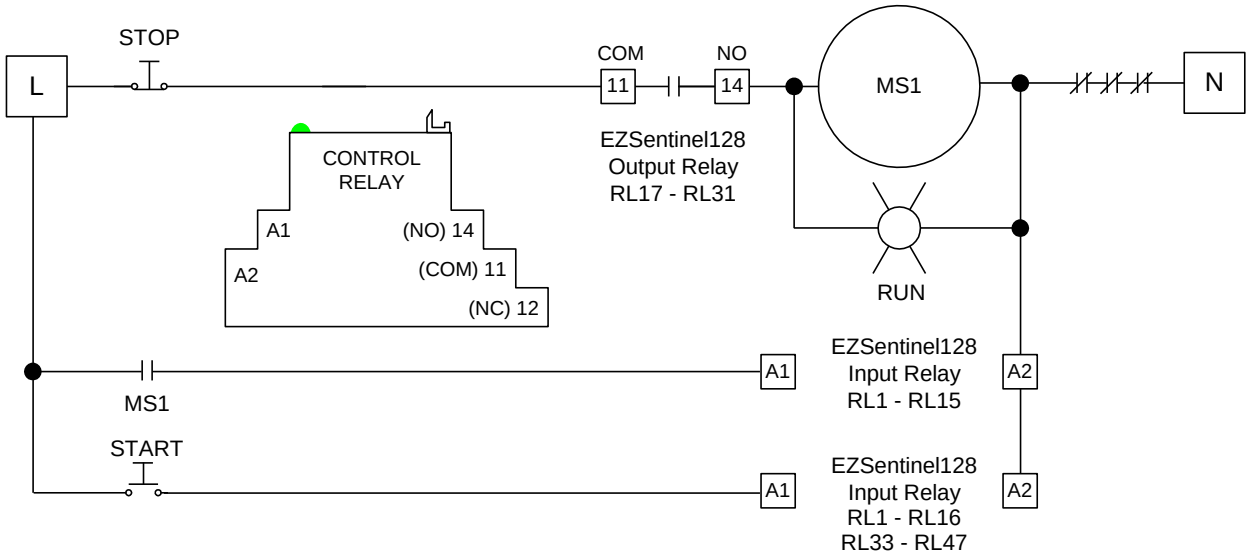
2.3 Machinery Control Wiring

The control system has inputs and outputs to control up to 15 machines. The control circuit consists of an input to indicate the machine is running and output to stop the machine should a hazard be detected. Optional additional inputs can be used for remote start pushbutton inputs.

The wiring diagrams below details the connection of the EZSentinell128 in the machine start/stop control circuit. The location of the relays was selected to ensure that the machine cannot start if an alarm condition is present.



EZSentinel Machinery Control Wiring Diagram



EZSentinel Machinery Control Wiring Diagram with Remote Start Pushbutton

Output relay operation is configured in section **3.2.1.6 Output Setup**.

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Notice

A latching emergency stop pushbutton should be installed to remove power from all control circuits operating machinery. All control systems can have single points of failure that can leave machinery running. The location of the emergency stop in the control circuit must not rely on the control system relays to stop the machinery. Latching emergency stop pushbuttons mounted close to where the machine is controlled and also at the EZSentinel128 will provide an assured method of stopping all machinery in the event of a control system failure.

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Input relays RL1 – RL16 and optional input relays RL33 – RL47 have 120VAC coils. Output relays RL17 – RL32 are dry contacts. Output relays are rated at 6A 120/240VAC and are for pilot duty control of motor starters and external relays and are not intended to switch high current inductive or resistive loads.

Jumper strips are provided to connect groups of relays together. The jumper strips can be cut to length and are inserted just below the screw relay terminals. The input and output relay terminal strips ate shown below:

Input Relays

Output Relays

****

Warning

The control system is not designed to control equipment with simple on/off switch operation. All equipment must have a push on / push off sealed control circuit that cannot be restarted without operator intervention. If the control system is connected to a simple on/off control the machine may be restarted when the alarm condition is acknowledged. Failure to use the correct control circuit could result in injury or loss of life.

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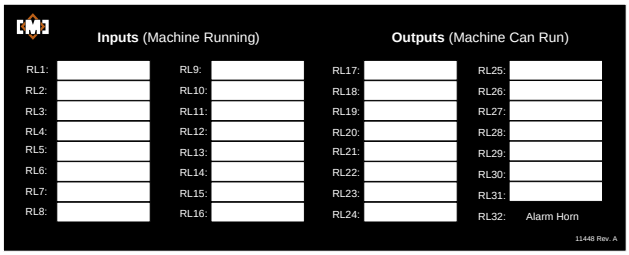
2.4 Assigning Relays to Equipment

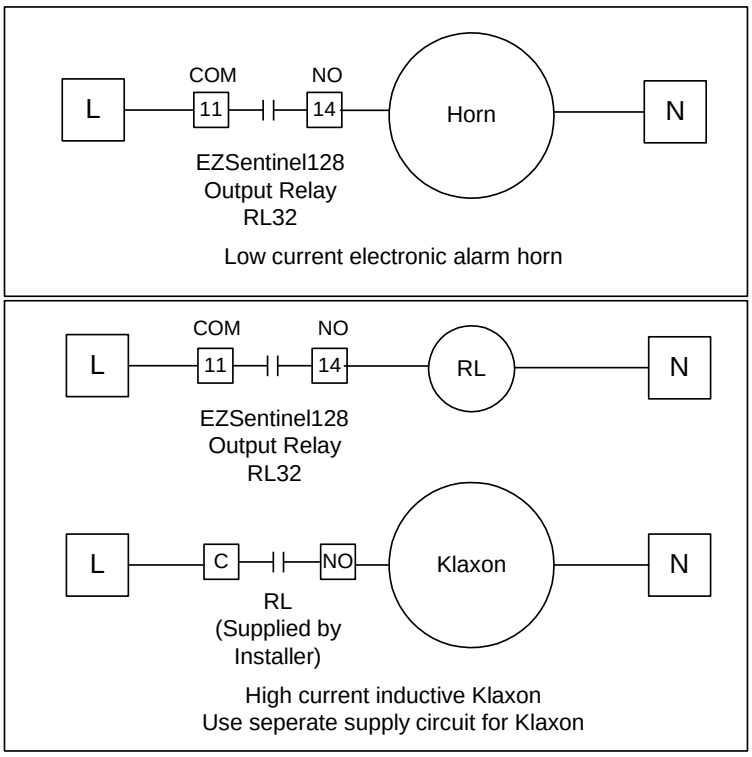
The system has 15 available machine display screens numbered 1 – 15. When assigning input relays to plant machines, use RL1 for the machine to be displayed on screen 1, RL2 for screen 2, etc. This method of assignment will assist in the troubleshooting of the system. It is also good practice to assign the output relays in order of the screens starting with RL17 for screen 1.

A decal has been provided that can be completed to provide information to the operator as to which relay has been assigned to each machine. The decal can be applied to the front panel of the system under the touch screen.



2.5 Alarm Horn Connections

Connect an alarm signal horn using the dry contacts on RL16. Note the internal control relays should not be used to control high power buzzer style klaxons as the inductive switching requirements for these devices may damage the relay contact. Use an external control relay if required.



2.6 Bus Converter Network Connections

The EZSentinel 128 uses a low voltage field bus for the bus converter network. The bus converter network connects to the EZSentinel128 using a four conductor shielded cable. For short cable runs, 20ga wire is recommended. Long cable runs may cause excessive voltage drop in the field preventing reliable communications. For long runs, a cable size calculator is available from our website under the Support -> Product manuals -> Files, Tools & Utilities page.

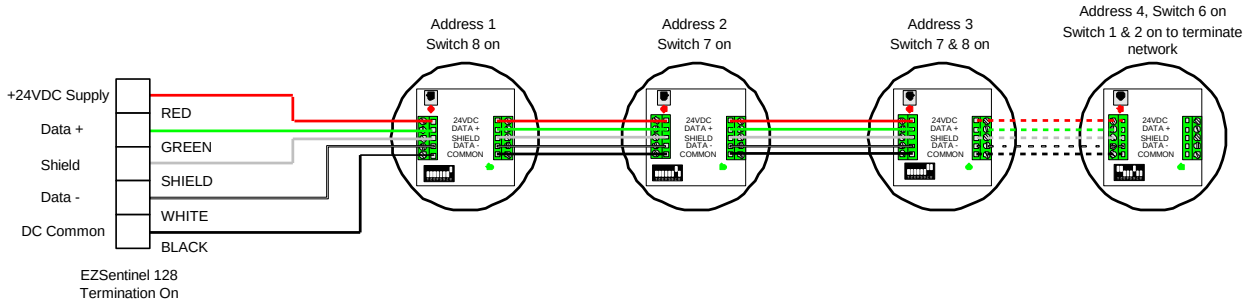
The Bus Converter Modbus RTU RS-485 network requires a four conductor overall shielded cable. Tappan Wire, www.tappanwire.com, is a supplier of suitable cable. The following cable describes the options available:

AWG	#COND	STR/SOLID	NOM. O.D	NOM.CAP.#PF/FT	UL LISTINGS	AVG. LBS PER MFT	SPEC #
22	4	STR	.137	39.7	CMP/CL3P/FPLP	16	**P20270.1**
20	4	STR	.151	43.7	CMP/CL3P/FPLP	22	**P30003.1**
18	4	STR	.184	46.8	CMP/CL3P/FPLP	32	**P40073.1**
16	4	STR	.210	52	CMP/CL3P/FPLP	47	**P50023.1**
14	4	STR	.255	53.6	CL3P/FPLP	71	**P60024.1**

All of the above cable options are UL approved for 300V as PLENUM RATED, MULTI-CONDUCTOR, OVERALL SHIELDED, CMP/CL3P/FPLP under UL E118871 or UL E57497.Note that cables larger than 16Guage will not fit in the bus converter terminal strips and would have to be pigtailed prior to entry into the bus converter enclosure.

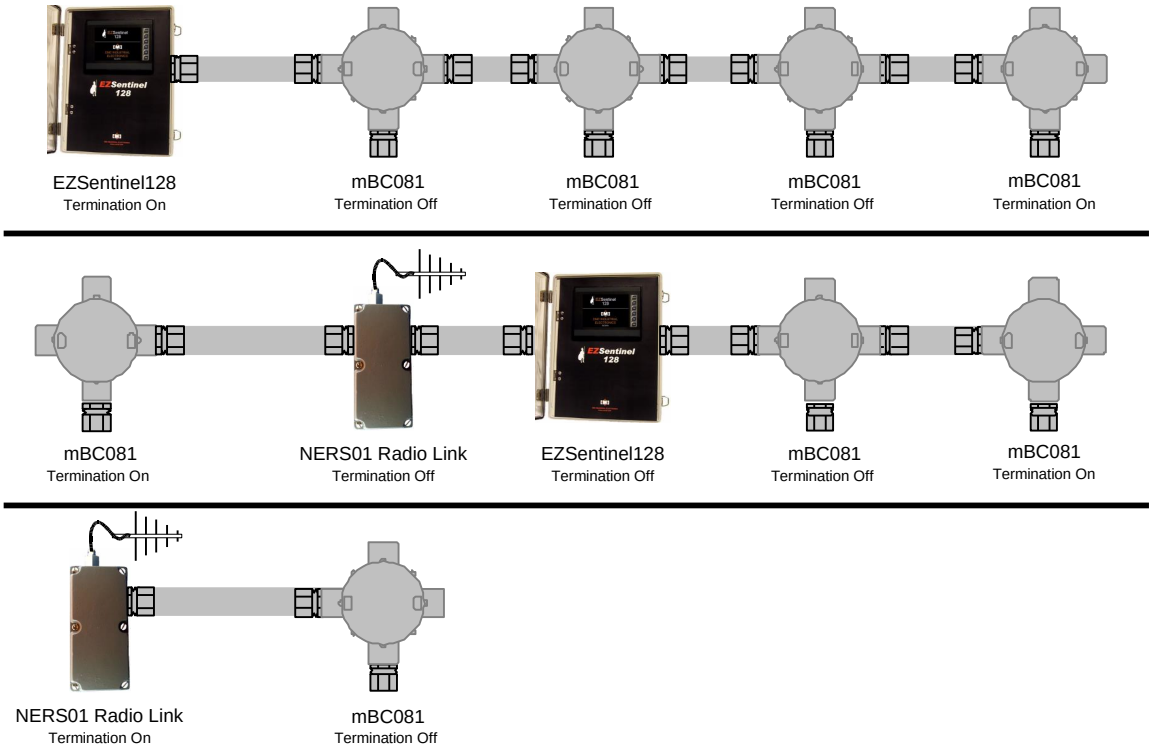
Any cable meeting the above specification can be used for the network. For information on the bus converter wiring see the mBC081 Technical Manual. The EZSentinel128 bus converter connections are as shown below:

The wiring of the bus converters is as shown below:

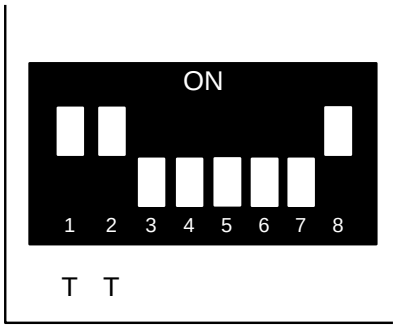


RS-485 networks require termination. Termination is always applied at each end of the cable. Termination is never applied in the middle of a cable.

All CMCIEL products have an active termination system controlled by a DIP switch. Below is a diagram of several possible layouts showing where termination is applied:



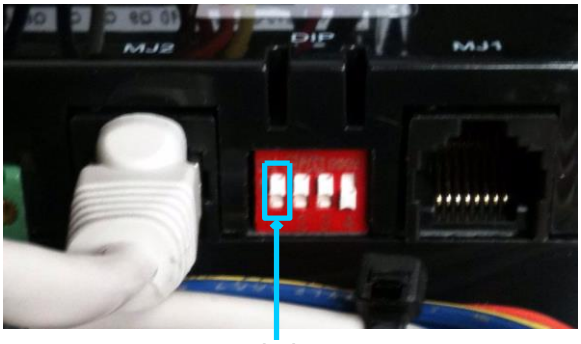
The following illustrates the termination switch on the mBC081 Bus Converter:



Bottom Edge of PCB

To terminate the mBC081 Bus Converter, turn both switches 1 and 2 ON as shown.

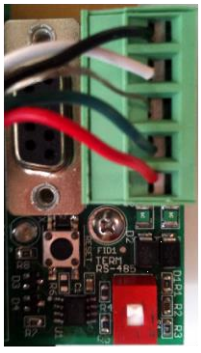
The termination switch on the EZSentinel128 is located on the PLC/HMI unit as shown below:



Switch 1
UP = Termination ON
DOWN = Termination OFF

To terminate the EZSentinel128 turn switch 1 ON or UP as shown. Switch 2 and 3 must be ON.

The termination switch on the NERS01 Network Extender Radio System is shown below:



OFF
TERMINATION SWITCH
ON

To terminate the NERS01 turn the switch ON or DOWN as shown.

2.7 Optional Remote Inputs

The system can accept an additional 15 120VAC inputs using the optional inputs enclosure. The enclosure is supplied with a CsCAN cable and connector. The CsCAN cable connects to the touch screen PLC using the green connector on the right side of the PLC. Do not share conduits or raceways for the CsCAN cable and 120VAC conductors. The PLC is pre-configured to operate with the remote inputs.

The enclosure should be mounted with 3 feet of the EZSentinel128. Connections are provided for the 15 additional inputs as well as 120VAC power for the remote I/O system. A shorting jumper is provided to mass terminate on of the relay input terminals. The relays in the enclosure are marked RL 33 – RL48 and correspond to inputs 17 – 32 on the custom screen setup screen. See ***section 3.2.3 Screens*** for information on using the optional inputs.

3. Configuring the EZSentinel 128

The control system can be fully configured using the HMI touch screen. Worksheets are provided in the Appendix of this manual for each type of machinery supported by the system. These work sheets should be completed by the installers of the field sensing network during the installation process. It is faster and less work to record the sensor serial numbers during installation.

Prior to configuring the system the following information is required:

1. Machinery short name (maximum of 10 characters);
2. Sensor description (should indicate location on the machine);
3. Sensor short name (maximum 10 characters);
4. Bus Converter number for each sensor;
5. Serial number for each sensor.

Two methods can be used to configure the EZSentinel 128. If this is your first installation, we recommend you configure the system using the setup screens provided with the EZSentinel 128.

A configuration Save / Restore utility is provided with the controller. The utility can be used to configure the system using Excel on a PC. If you are experienced with the system's setup requirements, this method can reduce the time required for configuration. Be sure you understand the required configuration of the system before attempting to use the Save / Restore utilities to edit the systems configuration. See sections **3.2.1.8 Save** and **3.2.1.9 Restore** for detailed information on the utilities.

3.1 Getting Started

The EZSentinel 128 system consists of the two major components. These include the field sensor network and the EZSentinel 128 HMI/controller.

The field sensor network includes temperature, speed and vibration. The sensors are connected to bus converters which manage the communications with the sensors. The bus converters are connected to the EZSentinel 128 for control and viewing.

The system uses a mapping technique to connect sensors, identified by their serial numbers to the machine viewing screens on the HMI. Three levels of mapping occur:

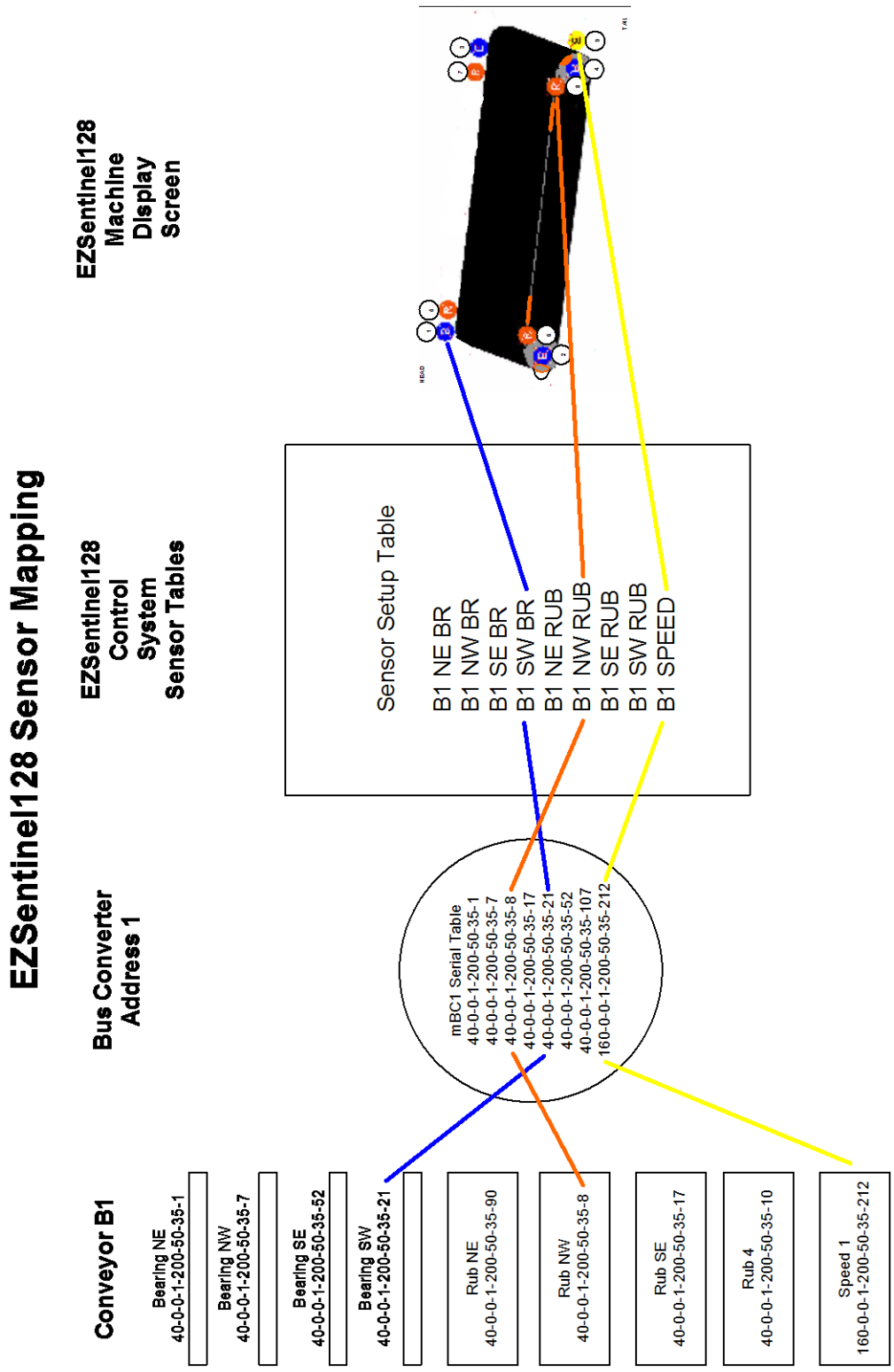
- Each sensor is identified by an eight digit serial number similar to "40-0-0-1-200-45-62-104". The first number of the sensor identifies the type of sensor, 40 for temperature, 160 for speed and 161 for vibration sensors. The serial numbers are stored in the bus converters. The bus converters use the serial numbers to communicate with the sensors.
- The order of the serial number in the bus converter tables determines where the sensor will be located in the Sensor table in the EZSentinel 128. The EZSentinel 128 has storage for up to 128 sensors. The following table indicates how the sensors are saved in the EZSentinel 128:

Bus Converter	Sensor Setup Table
1	1 - 32
2	33 - 64
3	65 - 96
4	97 - 128

- Sensors are named and alarm conditions are set within the EZSentinel 128. This information is stored in the EZSentinel 128's sensor setup tables.
- The EZSentinl128 can display a graphic for up to 15 different pieces of machinery. The machine types can be:
  - Conveyors;
  - Bucket Elevators;
  - Drags;
  - Motor Drives;
  - Fans;
  - Gravity Take up Conveyors;
  - Trippers

  Any of the 15 custom screens can be any type of equipment. Up to 25 sensors can be displayed on an equipment screen, depending on the requirements of the equipment. For each machine sensors are mapped from the systems sensor setup table to locations on the custom screen.

The following diagram shows pictorially how sensors are mapped in the EZSentinel 128:


EZSentinel128 Sensor Mapping
EZSentinel128 Machine Display Screen
EZSentinel128 Control System Sensor Tables
Bus Converter Address 1
Conveyor B1
Sensor Setup Table
B1 NE BR
B1 NW BR
B1 SE BR
B1 SW BR
B1 NE RUB
B1 NW RUB
B1 SE RUB
B1 SW RUB
B1 SPEED
mBC1 Serial Table
40-0-0-1-200-50-35-1
40-0-0-1-200-50-35-7
40-0-0-1-200-50-35-8
40-0-0-1-200-50-35-17
40-0-0-1-200-50-35-21
40-0-0-1-200-50-35-52
40-0-0-1-200-50-35-107
160-0-0-1-200-50-35-212
Bearing NE 40-0-0-1-200-50-35-1
Bearing NW 40-0-0-1-200-50-35-7
Bearing SE 40-0-0-1-200-50-35-52
Bearing SW 40-0-0-1-200-50-35-21
Rub NE 40-0-0-1-200-50-35-90
Rub NW 40-0-0-1-200-50-35-8
Rub SE 40-0-0-1-200-50-35-17
Rub 4 40-0-0-1-200-50-35-10
Speed 1 160-0-0-1-200-50-35-212

3.2 System Setup

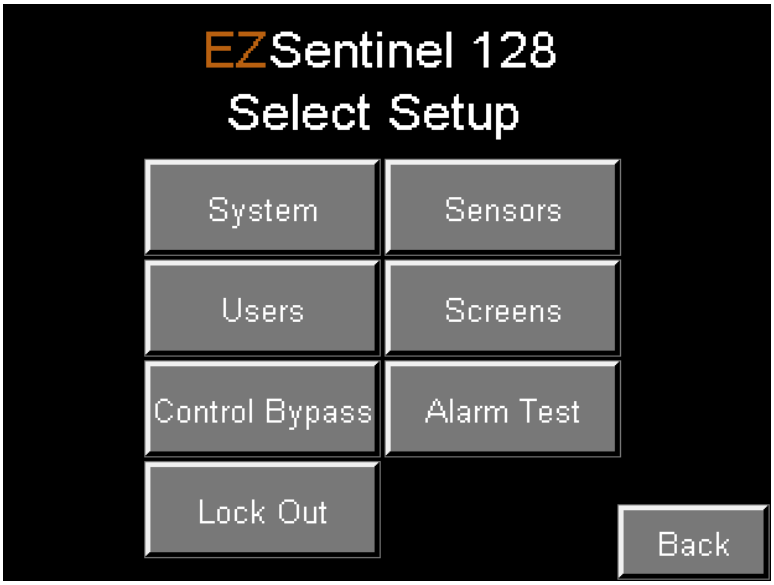
The system is setup in the following order:

1. Serial numbers are loaded into the bus converters either by an ***Acquire*** (**Setup -> System -> mBC's -> Acquire**) or by entering them manually in the sensor setup screen (**Setup -> *Sensors***);
2. The sensors are configured in the ***Sensor Setup*** screen to add names, spans, offsets and any alarm conditions required;
3. The machine display screens are configured using the ***Screens*** setup system;
4. The input timers are configured (**Setup -> System -> Inputs**) for machines that required alarms to be suppressed when the machine is not running.

The system is delivered with security disabled. The security system restricts access to sections of the controller menus. If security has been enabled you will require a User account and PIN to access the setup functions.

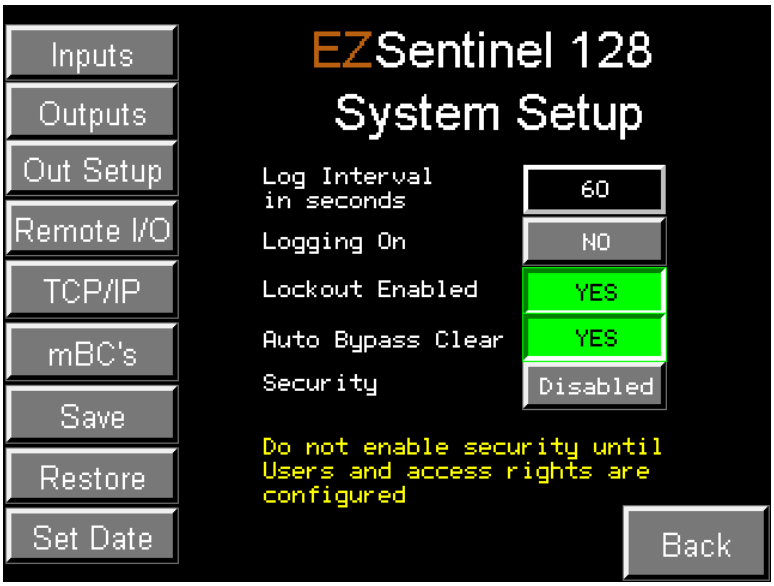
To enter setup, press the Setup button on the main screen.

The system setup screen is shown below:



Function	Section
System setup	3.2.1 System
Sensor setup	3.2.2 Sensor Setup
Screen setup	3.2.3 Screen Setup
User setup	3.2.4 User Setup
Using Control Bypass	3.2.5 Control Bypass
Using Alarm Test	3.2.6 Alarm Test
Using Lock Out	3.2.7 Lock Out

3.2.1 System



The ***System Setup*** screen allows the configuration of three system options and the selection of seven additional setup screens. The three options are:

3.2.1.1 Logging Interval

The controller is supplied with a 2GB micro SD memory card for recording sensor values and alarm event logs. The log interval is the time period between recordings of the sensor values to the SD card. The log file is contained in the \DAT sub-directory on the SD card. A unique file name is created for each day data is recorded. The file name is MMDDYYDT.CSV.

The minimum interval is 10 seconds and the maximum is 36,000 seconds. Each record uses 310 bytes of data. The controller can support SD cards up to a 2GB limit. The following table provides file sizes and storage limits for the data records on the SD card:

Interval (in seconds)	Records / Day	Monthly Storage	Yearly Storage
10	8640	80.35 MB	964.2 MB
60	1440	13.39 MB	160.7 MB
360	24	232.2 KB	2.678 MB

SD card memory is also used for the alarm event logs. When planning for capacity assume that a portion of the SD card will be used for alarm records. Each alarm record requires 44 bytes of SD card space.

3.2.1.2 Logging On

Press the ***Logging On*** pushbutton to enable data logging. Sensor data logging is operational when this pushbutton is green.

3.2.1.3 Lockout Enabled

Press the ***Lockout Enabled*** pushbutton to enable machinery lockout. Lockout is active is operational when this pushbutton is green. Machinery lockout is designed to prevent the repeated start of machinery. If enabled if the run input is energized over 5 times in 5 minutes the machine will be locked out. Machinery lockout can be viewed from the “Status” screen. Machine lockouts can be cleared using the “Lock Out” selection from the main “Setup” screen. See the ***Lock Out*** section for complete details.

3.2.1.4 Auto Bypass Clear

The system allows alarm functions to be temporarily disabled using the ***Control Bypass*** function. See the ***Control Bypass*** section for details. Press the ***Auto Bypass Clear*** pushbutton to configure the system to automatically remove control bypasses each day at midnight. When the ***Auto Bypass Clear*** pushbutton is green this feature is enabled.

3.2.1.5 Security

The EZSentinel 128 has an extensive security system. This system is disabled by default. Enabling the security system will require the use of Users and PIN’s to enter most parts of the systems menus, including the ***System Setup*** screen.

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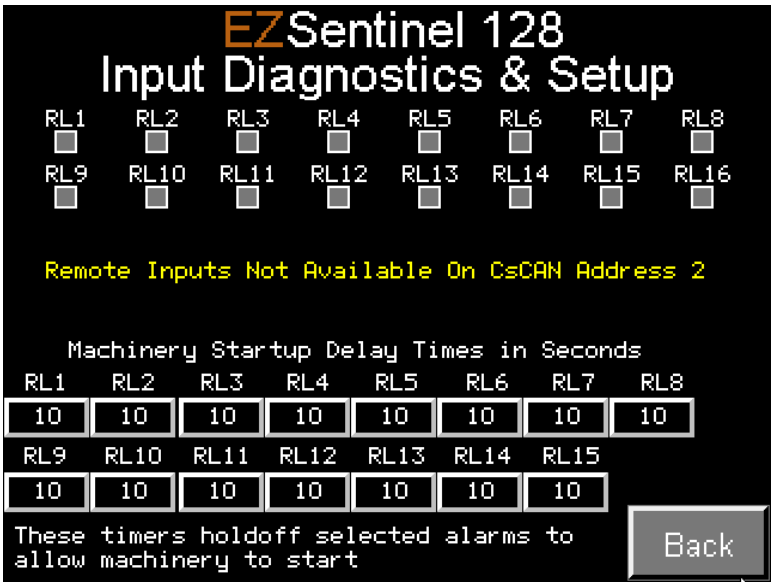
Caution

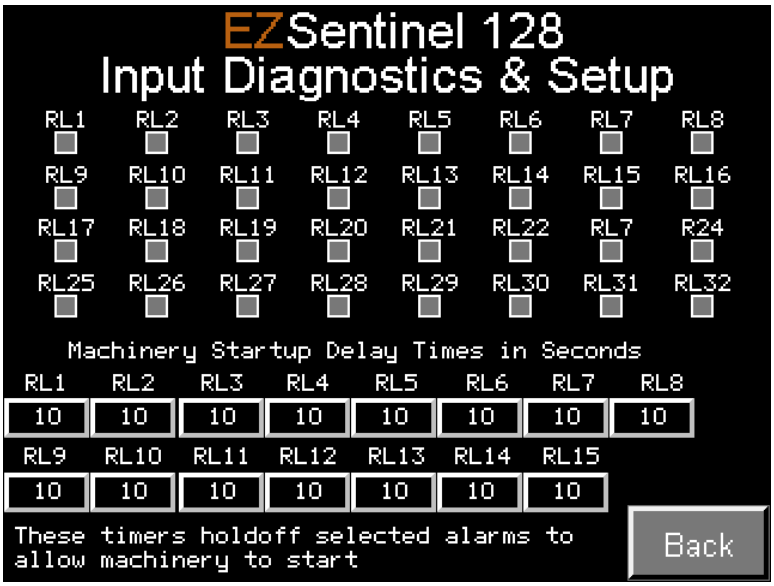
Enabling system security before the User and PIN system has been configured may prevent access to many system menus including the menus required to setup the User and PIN system. Do not enable security until you have setup the User and PIN’s section and ensured that at least one user has access to the ***System Setup*** screen and the ***User Setup*** screen.

****

The seven additional setup functions are:

3.2.1.6 Inputs





The ***Inputs*** screen provides the current status of the controller's 16 internal 120VAC discrete input relays. In addition, an optional 15 input enclosure complete with 15 120VAC discrete relays can be purchased. The screens above show the system without and with the remote inputs.

Inputs RL1 – RL15 (inputs 1 – 15) are primarily used as running inputs to the control logic. There are 16 inputs which correspond to input relays RL1 – RL16. Assign RL1 to the running input for the machine on custom screen 1, RL2 to the machine on custom screen 2, etc.

In the ***Sensor Setup – Alarms 2*** section, these inputs are assigned to specific sensors to suppress specific alarms when the machine is not running. Each of the internal inputs, RL1 –

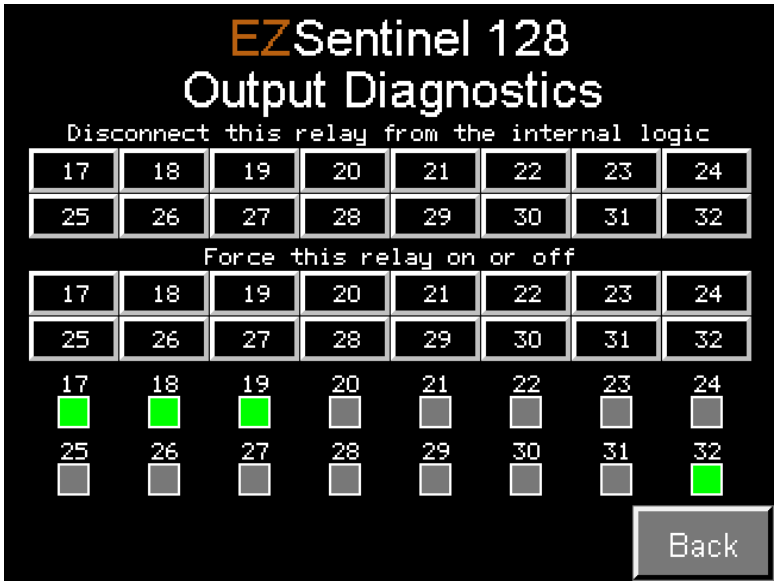
RL15 has an associated timer that suppresses alarms while the machine starts. The input is energized when the machine starts and must remain energized whenever the machine is running. The timers allow for a delay between the time the input is energized and the when the controller recognizes the input as on. The inputs are typically used to suppress low speed warnings and alarms when the machine is not running.

Additionally, these inputs can be used to turn on the output relay assigned to the machine and display a ***"Running"*** annunciator on the machine's display screen. This method of control insures that the input relay is energized while the machine is running. See section ***Output Control*** for information on using the running input to control the machines assigned output relay. For this function to operate, the input relay used for the machine must be specified in the machine's custom screen setup. See the ***Screens*** section for setup information.

Inputs RL1 – RL16 (inputs 1 – 16) and optional inputs RL33 – RL47 (inputs 17 – 31) can also be used to implement start button control of the system. Start button control uses an additional input for the start pushbutton. This allows the system to inhibit starts if a fault condition is present. The input used for the start pushbutton is specified in the machine's custom screen setup. See the ***Screens*** section for setup information.

These inputs can also be used to suppress alarms from machines that do not have continuous power available to their field sensor networks. When the machine stops and power for the bus converter is lost, the sensors supported by that bus converter will indicate faulted. A typical application is for trippers used to set the discharge point on long gallery belts. Power for the bus converter on trippers is derived by an onboard generator powered by the moving belt. When the belt stops, power for the bus converter is lost. When an input is specified, polling to the affected bus converter is stopped and the values remain at the state before power was lost. See ***"Input will suppress bus converter polling"*** in the ***mBC's Setup*** section for details on suppressing bus converter polling.

3.2.1.7 Outputs



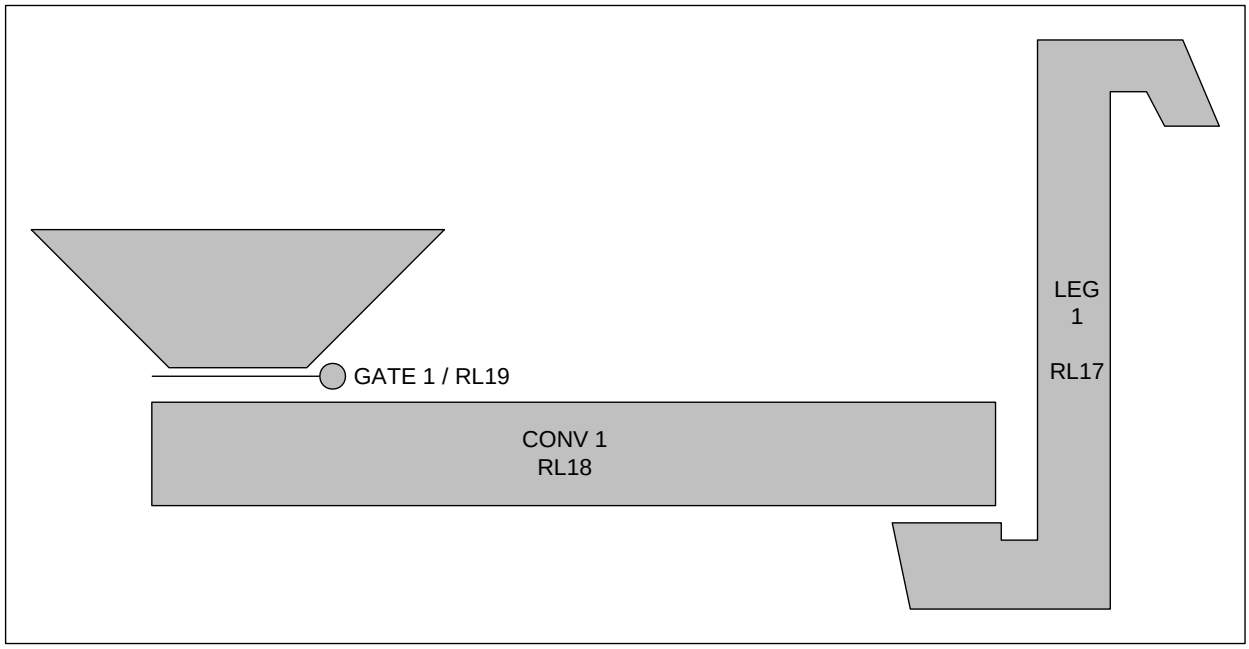
The output screen displays the current state of the controller's outputs. The outputs are connected to the output relays RL17 through RL32. See **Section 3.2.1.6** Out Control for details on how to configure the outputs.

In addition this screen allows the user to take control of any output and change the outputs state. There are two rows of pushbuttons used to control the outputs. The top row of pushbuttons allows the operator to disable control of the output by the internal system logic. The second row of buttons allows the user to set the state of the output, either on or off. These controls are used to diagnose the output system. In addition to these indicators, the relays also have LED indicators showing their state.

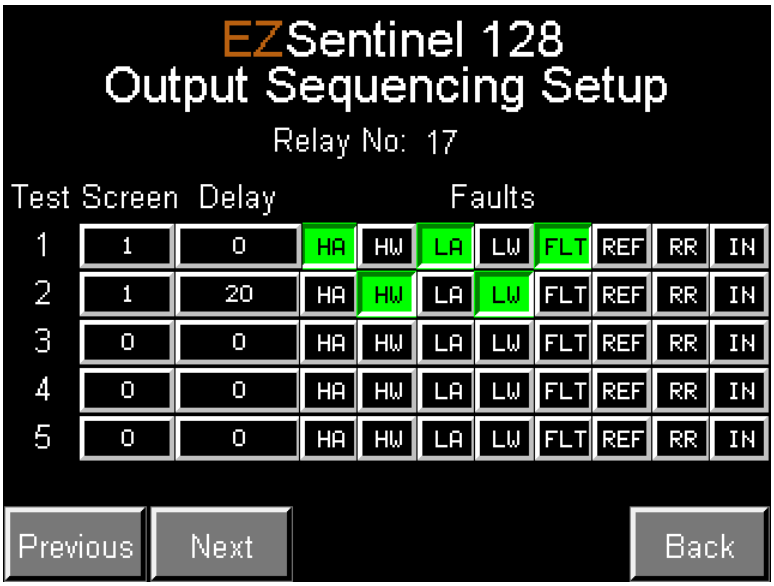
3.2.1.8 Out Setup

The system has 15 relays, RL17 – RL31 that are used to control machinery. Each of the outputs has a programmable interface that allows the output to receive control from up to 5 tests. Each of the five tests has an independent delay timer. The five tests are used to turn off the output if alarm conditions exist for equipment represented by one of the 15 display screens.

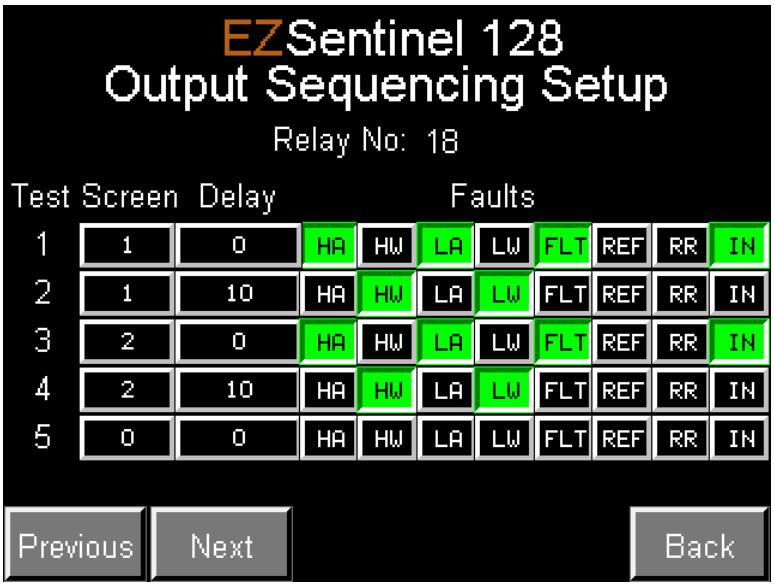
The drawing below details a typical conveying system. It consists of a feed bin with slide gate, a conveyor and a bucket elevator.



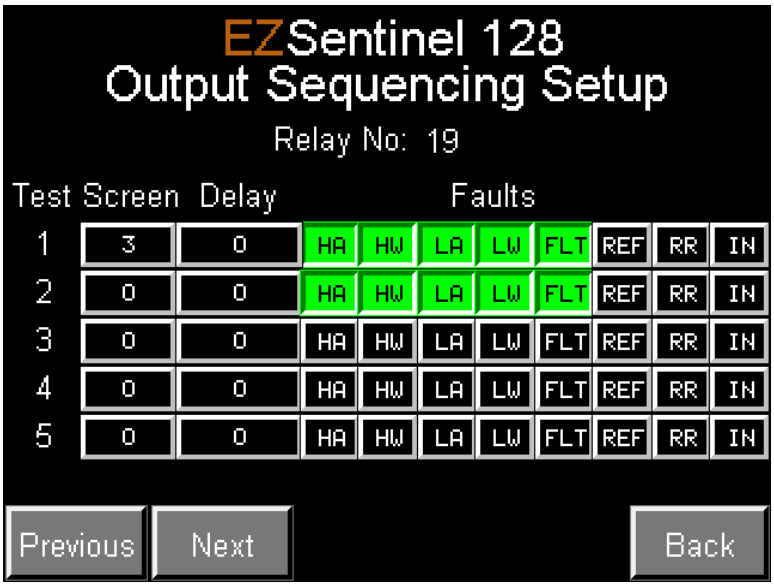
In the event of a fault on any of the conveyors an orderly shutdown of the equipment can be programmed. All alarms for a single screen are aggregated. Any sensor displayed on a screen that alarms will trigger the output sequence. Entering screen 0 disables the test. For the example above, the three outputs are configured as follows:



Screen 1 displays and output RL17 controls the bucket elevator. RL17 will de-energize immediately should a high alarm, low alarm or a sensor fault occur on the bucket elevator. Should a high warning or low warning occur on the bucket elevator RL17 will de-energize after 10 seconds?



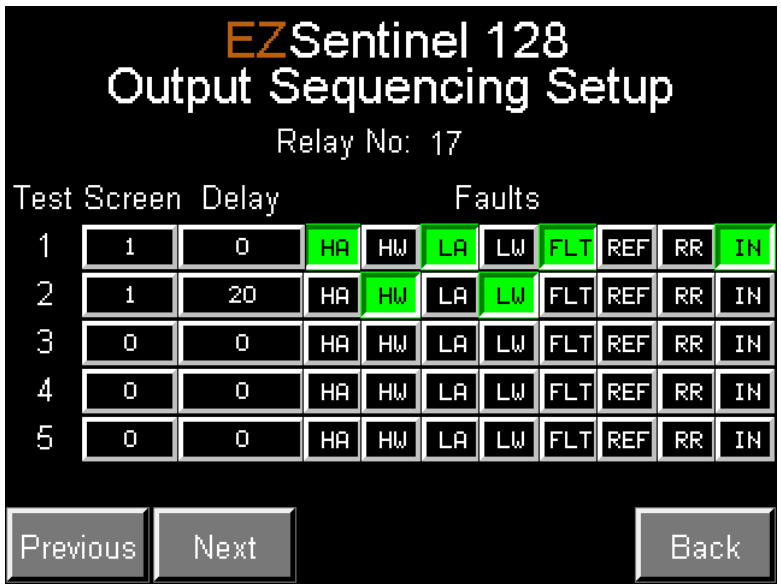
Screen 2 displays and output RL18 controls the feed conveyor. RL18 will de-energize immediately should a high alarm, low alarm or a sensor fault occur on the bucket elevator. Should a high warning or low warning occur on the bucket elevator RL18 will de-energize after 10 seconds. RL18 will also de-energize immediately should a high alarm, low alarm or a sensor fault occur on the feed conveyor. Should a high warning or low warning occur on the feed conveyor RL18 will de-energize after 10 seconds.



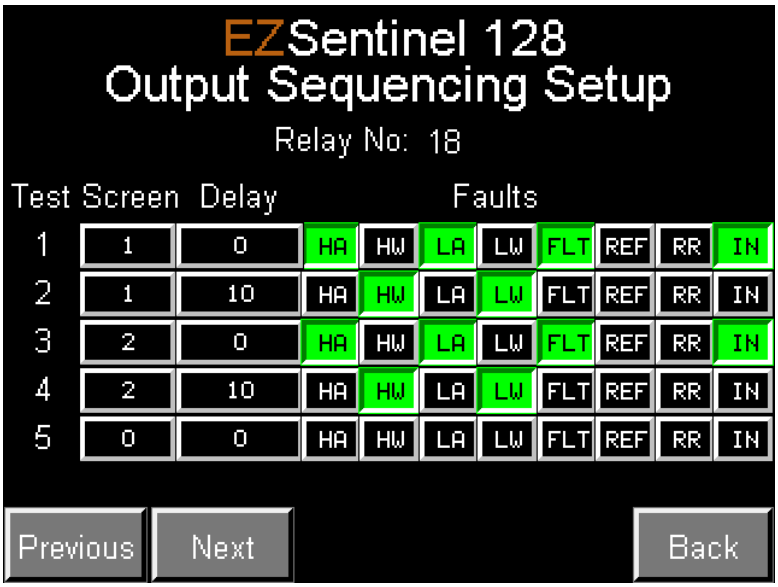
Output RL19 controls the slide gate. No screen is assigned to the slide gate. RL19 will de-energize immediately should a high alarm, low alarm, high warning, low warning or a sensor fault occur on the bucket elevator or the feed conveyor.

On software version 2.0 and above a new feature has been added to allow the control of the output relay from the input running contact. This feature along with the added start button input feature described in section ***3.2.3 Screens*** insures that the machine running signal is received before the output relay will turn on latching the start circuit. Wiring diagrams for this new mode of operation are described in section ***2.3 Machinery Control Wiring***.

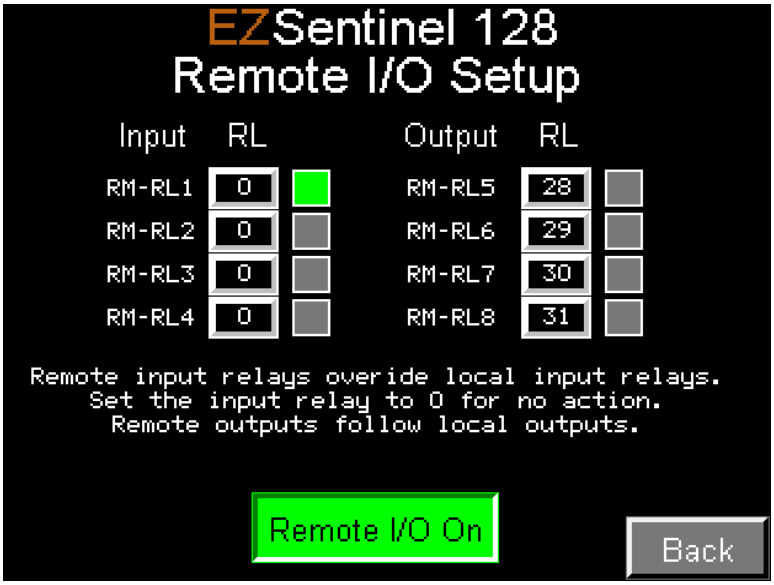
The feature is enabled by selecting the IN button in the output setup. For example if you want the machine running input from custom screen 1 to enable output relay RL17 assigned to machine screen 1 you would enable the IN button on the line defining the test for screen 1 in the output sequence setup for RL17.



In addition to insuring the machine running contact is received, this function also allows the interlocking of machines. For instance a belt feeding a leg could have a test setup to insure that the input of the leg is on before the output relay for the belt will energize. If the start input function is used, the belt would not start if the leg is not running. The output control setup is shown below.



3.2.1.9 Remote I/O



Remote inputs and outputs can be added to the EZSentinel128. The remote I/O can be used when machinery is located a considerable distance from the EZSentinel128. The remote I/O can be connected using low cost radio links as well as hard wired. This remote I/O has 4 inputs and 4 outputs. The inputs are labeled RM-RL1 through RM-RL4. The outputs are labeled RM-RL5 through RM-RL8. The remote I/O system is supplied in a NEMA4X enclosure and includes

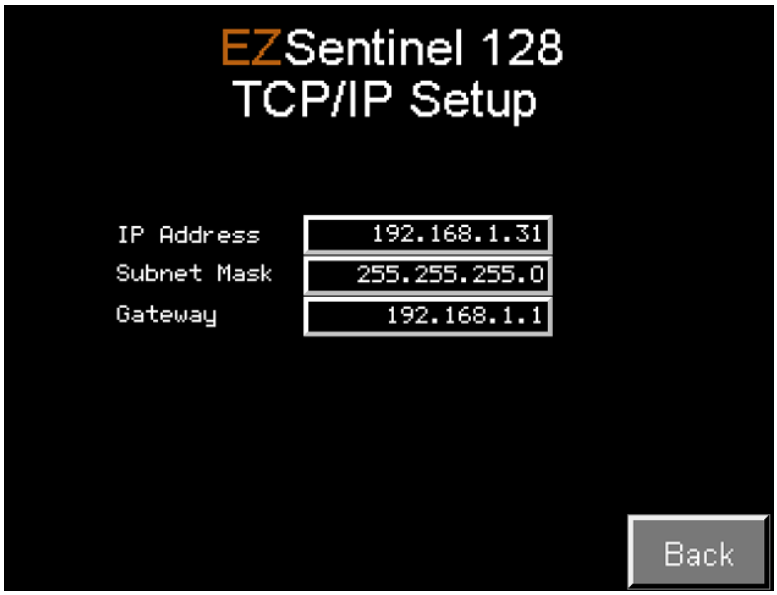
interposing relays on the modules inputs and outputs. If utilized the radio system will also be installed in the enclosure.

The 4 inputs and 4 outputs can be programmed to shadow any of the 15 inputs and 16 outputs in the main controller. When enabled, remote inputs assume control of the associated local input. Setting the remote input local relay number to 0 disables the remote input. The remote output follows the selected local output.

In the event of loss of communications, all remote outputs will de-energize after 10 seconds.

If remote I/O is not used, the REMOTE I/O ON/OFF button should be selected to OFF.

3.2.1.10 TCP/IP Setup



The PLC controller has an Ethernet port that can be used for several standard functions, including FTP for retrieving files from the controller.

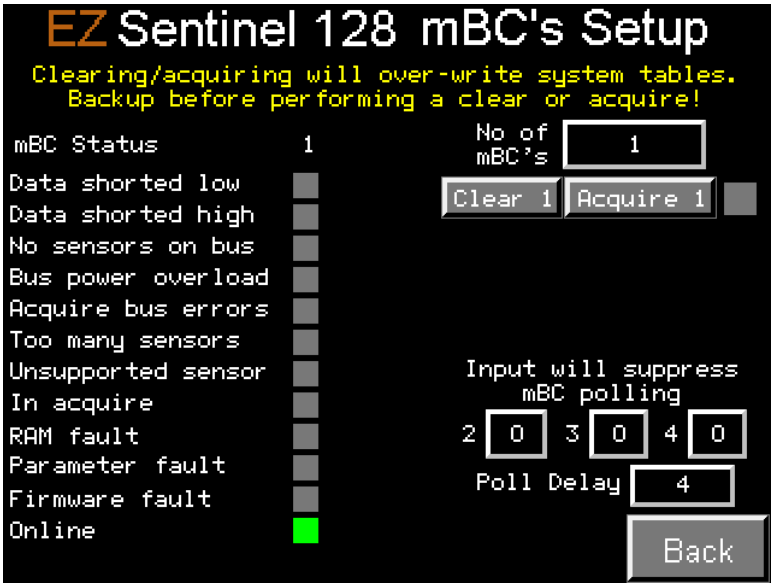
This screen allows the setup of the IP address, Subnet mask and Gateway for Ethernet communications.

There are three files that the user can download from the controller:

Description	**File name**
Sensor data log	\DAT\MMDDYYDT.CSV
Alarm log	\ALM\MMDDYYAL.CSV
Configuration backup	BACKUPSY.CSV

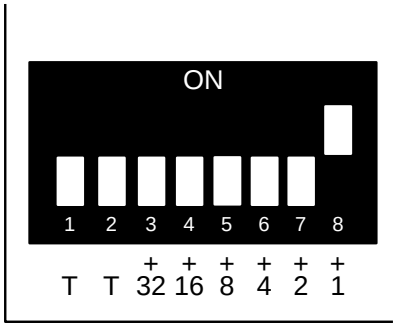
Any generic FTP client can be used to retrieve the files. The FTP login is: admin and the password: cmciel. The FTP client “Filezilla” is freely distributed and has been tested to work with this controller.

3.2.1.11 mBC Setup



The controller can manage up to four mBC081 Bus Converters. Set the number of bus converters connected to the controller on this screen. The status display and selection buttons will automatically adjust to the number of mBC's selected.

The bus converters collect the sensor data from the 1-Wire® field sensor networks. Each bus converter processes 32 field sensors. Bus converters communicate with the EZSentinel 128 over a Modbus RTU RS-485 network. Each bus converter requires a unique address, from 1 – 4. Bus converters are added in address order with address 1 used first. The following diagram details how the address is set on the bus converter:



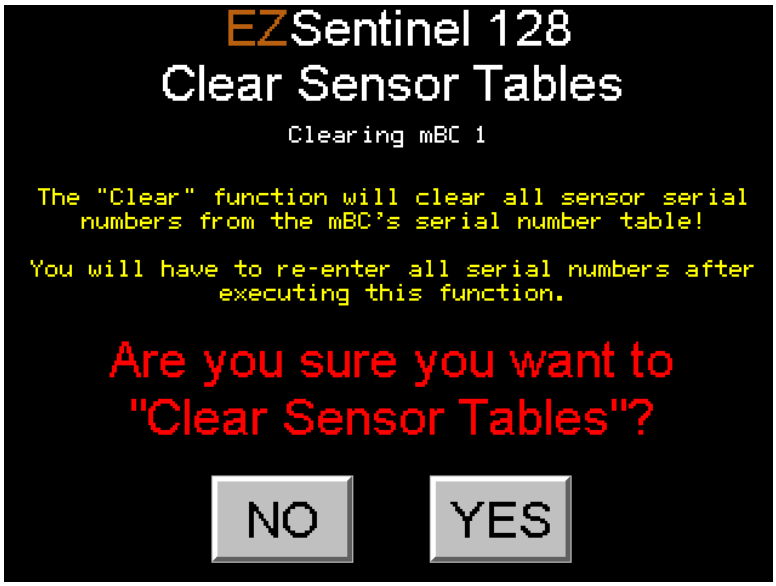
Bottom Edge of PCB

To set an address turn on the switches that add up to the address required. Switch is shown set for address 1. For address 5, switches marked +1 and +4 would be turned on. If the address setting is changed while the power is on the address change will not take effect until the power is cycled.

The bus converter network must be terminated using switches 1 & 2 marked "T" above. See section ***2.6 Bus Converter Network Connections*** for full details on termination.

The bus converters contain the lists of sensor serial numbers used to communicate with the sensors. The serial are factory assigned and are shown on a label attached to the sensors cable near the connector. An example of a serial number is shown below.

There are two pushbuttons for each bus converter on this screen. Pressing the **Clear** pushbutton for a bus converter will erase all of the serial numbers from the bus converter tables. Up to four Clear buttons will be available depending on how many bus converters are enabled on the system. The buttons are labeled Clear 1 through Clear 4 indicating bus converters 1 to 4. The following warning message will appear when a ***Clear*** button is pressed:



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Caution

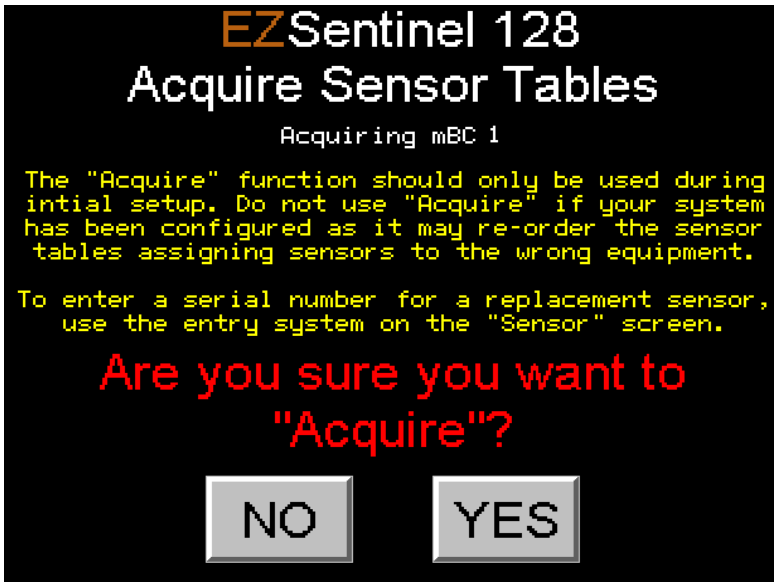
Pressing ***Clear*** for a bus converter will remove all serial number information for the bus converter. All serial numbers entered using the ***Sensor Setup*** screen or through an ***Acquire*** will be lost. It is recommended if this is a new installation that the bus converters be cleared of all serial numbers before beginning configuration.

****

There are two methods for entering the serial numbers into the bus converter. The first is manually through the ***Sensor Setup*** screen; see Section **3.2.2.1 Setting the Serial Number**. The second is automatically through the ***Acquire*** function.

The ***Acquire*** function can be used to automatically retrieve all of a bus converter's serial numbers. Pressing the ***Acquire*** pushbutton for a bus converter will scan the sensor bus and read the sensor serial numbers into the bus converter tables in serial number numerical order. If an Acquire is performed without first clearing the tables, any previously existing serial numbers will occupy the same positions in the table. New serial numbers will first occupy positions that were previously occupied but not located on this scan. Any remaining new sensors will added to the end of the table.

When an ***Acquire*** button is pressed the following warning message will appear:



****

Caution

Pressing **Acquire** for a bus converter may re-order the serial number information for the bus converter. Do not use the ***Acquire*** function on systems that have already been setup. If you need to enter a new serial number for a replacement sensor use the serial number entry system on the ***Sensor Setup*** screen, section ***3.2.2.1 Setting the Serial Number***.

****

For systems where the bus converter is mounted on a moving machine with a generator such as a tripper, the bus converter will lose power when the belt stops. To suppress alarms when the belt is stopped, enter the input number for the machine in the "Input will suppress mBC polling" dialog box. Only bus converters 2 – 4 can be suppressed. This feature is available in versions 1.22 and above.

If the system uses radios to communicate to the bus converters or remote I/O, the "Poll Delay" may have to be adjusted. The Poll Delay setting is on the Bus Converter Setup screen. The default setting is 4 for a 40 millisecond delay between polls. The default setting has been tested with CMC NERS01 radio systems. The range is 1 – 100 for 10 through 1000 milliseconds of delay. Increase the delay by 10 millisecond interval until reliable radio communications is achieved.

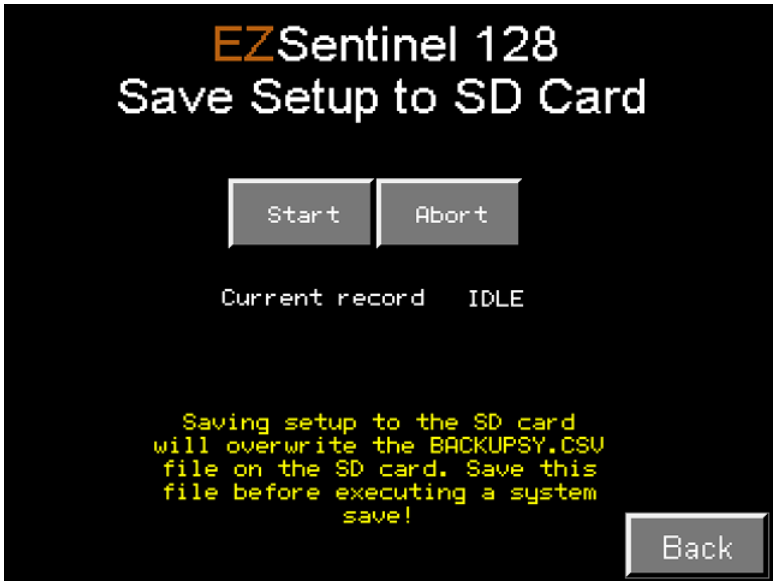
****

Caution

Pressing **Acquire** for a bus converter may re-order the serial number information for the bus converter. Serial number information entered by hand on the ***Sensor Setup*** screen or through an Acquire may be lost or re-ordered. If a single sensor is being added or replaced, use the ***Sensor Setup*** screen to enter the serial number.

****

3.2.1.12 Save



The system has a comprehensive backup utility. This utility writes the entire system setup to the SD card. The backup information is saved in the BACKUPSY.CSV file on the SD card as plain text in standard Excel .csv file format.

The backup can be used to pre-configure additional units. Template BACKUPSY.CSV files are available on our website.

To execute a ***Save***, make certain a SD card is installed in the controller and press the ***Save*** key. The status display will indicate which record being processed. When the operation is complete the display will indicate ***Idle***. If the SD card cannot be written, an error message will be displayed.

To stop a ***Save*** in progress, press the ***Abort*** key. If ***Abort*** is pressed during the save, only a partial save will have occurred and the BACKUPSY.CSV file will not be usable for a complete restore.

The backup file can be used to configure the system using Excel as an editor. The document **11243 – EZSentinel 128 Editing Configuration Using Excel** details the method for editing the BACKUPSY.CSV file using Excel.

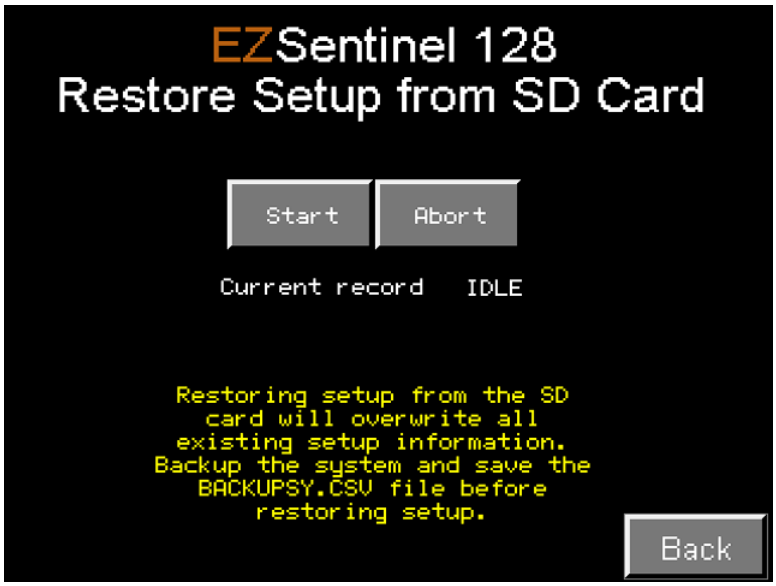
****

Recommendation

Once a system setup is completed, it is recommended that a ***Save*** be executed and the BACKUPSY.CSV file be saved externally to the system. A system can be quickly restored without any additional setup if a BACKUPSY.CSV file is available.

****

3.2.1.13 Restore

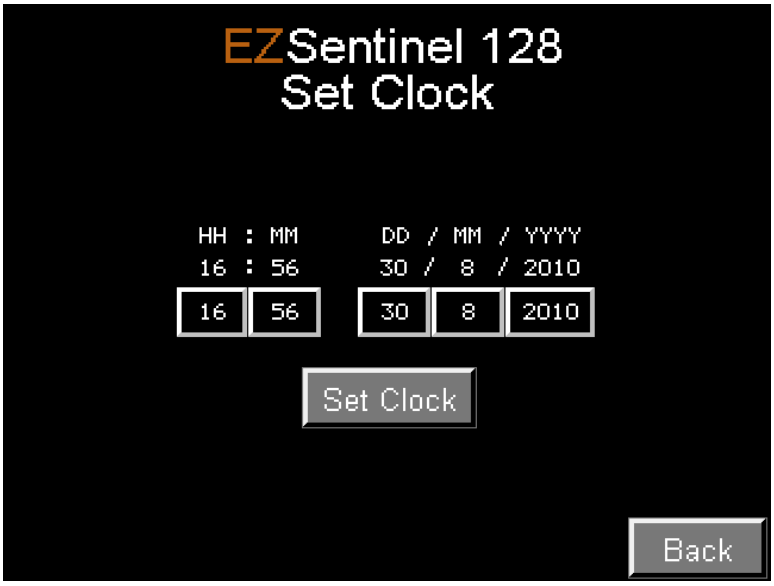


The system can be restored to a known good state by executing the ***Restore*** function. In order for the system to be restored a BACKUPSY.CSV file must have been created using the ***Save*** function. See Section **3.2.1.8 Save** for details on saving a known good configuration.

To execute the restore, make certain a SD card is installed in the controller with a valid BACKUPSY.CSV file and press the ***Restore*** key. The status display will indicated the record being processed. When the operation is done, the display will indicate **Idle**. If the SD card cannot be read, an error message will be displayed.

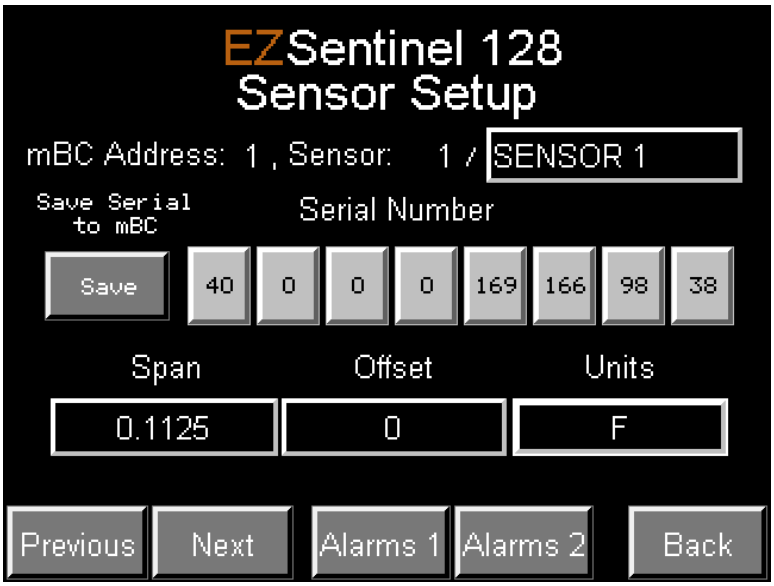
To stop a ***Restore*** in progress, press the ***Abort*** key. If ***Abort*** is pressed during the restore, only a partial restore will have occurred.

3.2.1.14 Set Date



The system has a crystal controlled real time clock. To set the clock, enter the current time and date and then press ***Set Clock***.

3.2.2 Sensors



The EZSentinel 128 supports up to 128 field sensors. The sensors are arranged in groups of 32 corresponding to the bus converter the sensor is attached to. The following table describes the mapping of bus converters to the EZSentinel 128:

Bus Converter	Sensor Setup Table
1	1 - 32
2	33 - 64
3	65 - 96
4	97 - 128

The Sensor Setup main screen provides for the setup of a sensor's serial number, name, span, offset and displayed units.

3.2.2.1 Setting the Serial Number

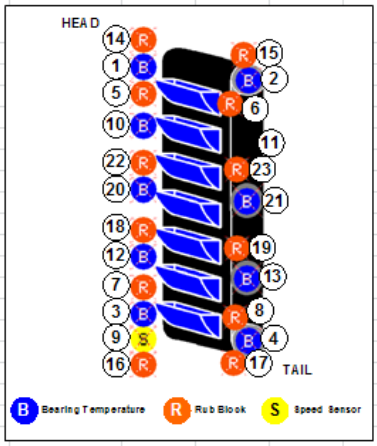
The bus converters contain the lists of sensor serial numbers used by the system. The serial numbers are factory assigned and are shown on a label attached to the sensors cable near the connector. An example of a serial number is shown below.

During the installation of the field sensors, the serial numbers for each sensor and the location of the sensor should be recorded. Worksheets for recording the serial number, based on the machine type, are included in the Appendix of this document. Original Excel spreadsheet versions of the worksheets can be obtained from our website. An example worksheet is below:

EZSentinel128
Bucket Elevator Worksheet

Machine Short Name (max 10 characters)

Leg



Position	Description	Short Name	Bus Converter	SN 1	SN 2	SN 3	SN 4	SN 5	SN 6	SN 7	SN 8	Sensor no
1	Leg head east bearing	LEG HEB	1	40	0	0	1	149	216	227	197	2
2	Leg head west bearing	LEG HWB	1	40	0	0	1	124	227	37	198	1
3	Leg tail east bearing	LEG TEB	1	40	0	0	1	149	201	65	70	8
4	Leg tail west bearing	LEG TWB	1	40	0	0	1	149	235	17	19	7
5	Leg head north east rub	LEG HNER	1	40	0	0	1	149	202	110	154	4
6	Leg head north west rub	LEG HNWR	1	40	0	0	1	149	234	15	150	3
7	Leg tail north east rub	LEG TNER	1	40	0	0	1	149	203	229	69	10
8	Leg tail north west rub	LEG TNWR	1	40	0	0	1	149	199	85	99	9
9	Leg speed	LEG SD	1	160	0	0	16	0	88	23	71	13
10												0
11												0
12												0
13												0
14	Leg head south east rub	LEG HSER	1	40	0	0	1	149	220	62	84	6
15	Leg head south west rub	LEG HSWR	1	40	0	0	1	149	246	157	57	5
16	Leg tail south east rub	LEG TSER	1	40	0	0	1	149	197	88	170	12
17	Leg tail south west rub	LEG TSWR	1	40	0	0	1	149	214	119	10	11

The serial numbers can be displayed and edited using this screen. To view a serial number, use the ***Previous*** and ***Next*** keys to select the sensor number. The current bus converter, sensor number and sensor name are displayed below the title bar.

To edit the serial number, enter the new serial number values in each of the eight screen locations by touching the displayed number. Serial number digits can be from 0 – 255. Sensors that do not have serial numbers assigned will display 255-255-255-255-255-255-25-255 for the serial number. If a bus converter is not connected, the serial number will display as 0-0-0-0-0-0-0-0. Both of these serial numbers are not valid. You cannot set a serial number if the bus converter is not connected to the EZSentinel 128.

****

Caution

It is possible to write a serial number to a bus converter that does not have the sensor connected to it. If this is done, the bus converter will not be able to locate the sensor on its network and the sensor will indicate as faulted on the EZSentinel 128.

****

Once the new serial number has been entered, press the ***Save*** key to write the serial number to the bus converter. Serial numbers become effective immediately when written to the bus converter. The bus converter that receives the serial number is indicated below the screen title bar. Don't forget to save a serial number after it has been entered. Using the ***Previous***, ***Next*** or ***Back*** keys will discard the new serial number entry if a ***Save*** has not been executed.

An alternate method can be used to populate the serial number tables in the bus converter. Under the ***Setup -> Systems -> mBC's*** section, the sensors connected to a bus converter can be discovered by pressing the ***Acquire*** key for each bus converter. Refer to Section **3.2.1.9 mBC Setup** for details on using the Acquire function.

If you use the Acquire function, the serial numbers will already be displayed on the ***Sensor Setup*** screen as you scroll through the sensors using the ***Previous*** and ***Next*** keys. The current bus converter, sensor number and sensor name are displayed below the title bar.

Complete the worksheets at this time by identifying which serial number is located at each sensor number. This information will be needed to build the custom screens for the equipment. While you are completing the worksheet you can enter the name, span, offset and units for each sensor as described below.

3.2.2.2 Setting the Name

The sensor names can be displayed and edited using this screen. To view a name, use the ***Previous*** and ***Next*** keys to select the sensor number. The current bus converter, sensor number and sensor name are displayed below the title bar.

To edit the name, touch the name on the screen and enter the new name. Names can be a maximum of 10 characters.

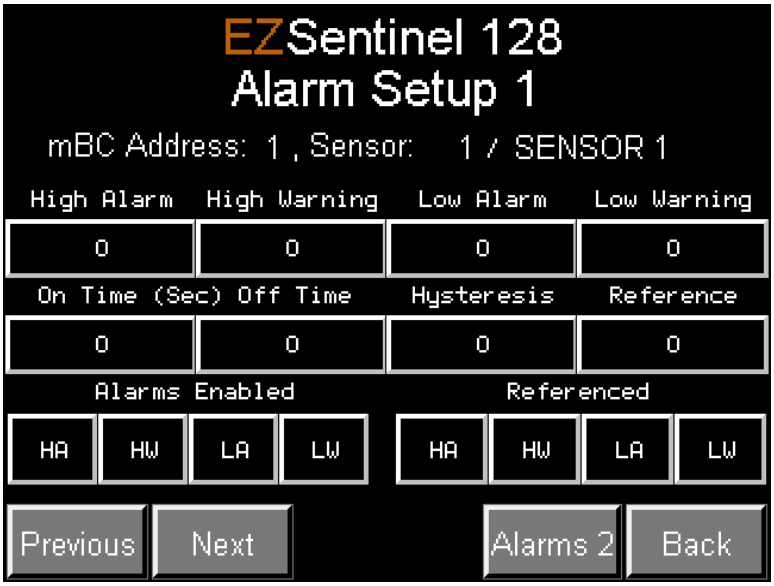
Note: Sensors are only scanned if a name is entered. Sensors that do not have a name will not be scanned and will read "0". To remove a sensor from the scan list, enter a name of all spaces.

3.2.2.3 Setting the Span, Offset and Units

Each type of sensor has a span, offset and units that are used to scale the readings. The type of sensor can be determined by the first digit of the serial number. The table below shows the spans, offsets and units for the three sensors supported by the EZSentinel 128. Two entries are provided for temperature sensors, one for readings in Celsius and one for readings in Fahrenheit.

Type	First Digit of Serial Number	Units	Span	Offset
Temperature	40	C	0.0625	0
Temperature	40	F	0.1125	-32
Speed	160	RPM	1.0000	0
Vibration	161	IPS	1.0000	0

3.2.2.4 Setting the Alarms, Screen 1



There are four primary alarms: high alarm, high warning, low warning and low alarm. An additional alarm for rate of rise can be setup on the ***Alarms 2*** page. In addition to value based alarms there are 2 alarms for sensor status. If a sensor has been setup and the sensor name is not blank the sensor will indicate a Fault alarm if it is not active on the network,

The four primary value alarms can also be referenced to a second sensor. Reference or comparative alarms allow the comparison of two sensors. For referenced alarms to reference sensor value is first subtracted from the primary sensor value before the alarm comparison is made. If a sensor has a reference sensor assigned and that sensor is faulted, a Reference fault will be declared.

Alarms on the EZSentinel 128 are persistent. Once an alarm has been set, the alarm annunciator will remain active until the alarm has been acknowledged by pressing the ***Silence*** key on any screen where the key is present. ***Silence*** keys can be found on the ***Main***, ***Custom Displays***, ***Sensors, Alarms*** and ***Alarm Test*** screens. In addition, if machinery control is enabled, the machines control output will not be reset until the alarm is acknowledged.

If an alarm condition is still present, pressing the ***Silence*** key will silence the alarm horn but will not clear the screen annunciator or allow the restart of the machine. The screen annunciator

can only be cleared and the machine restarted by pressing ***Silence*** when the alarm condition has been removed.

The following table outlines the alarm functions:

Alarm	Operation
High Alarm	Alarm is set when sensor value is equal to or greater than the setpoint
High Warning	Alarm is set when sensor value is equal to or greater than the setpoint
Low Warning	Alarm is set when sensor value is equal to or less than the setpoint
Low Alarm	Alarm is set when sensor value is equal to or less than the setpoint

Alarm set points are entered by touching the box where the value is displayed.

If an alarm is to be used it must be made active by pressing the corresponding button in the ***Alarms Enabled*** section. If the button is green the alarm is enabled. Disabling an alarm with this function completely disables all functions of the alarm.

Alarms can be referenced against a second sensor by entering the reference sensor number in the ***Reference*** box and selecting which alarms are to be referenced. The ***Referenced*** buttons will be green if an alarm is referenced.

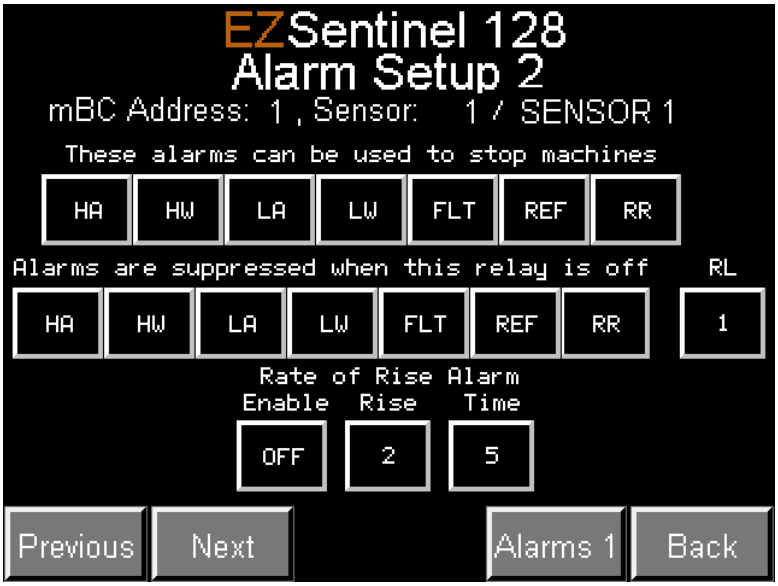
To help prevent false and repetitive alarms two entries are provided. The first are on and off timers to delay the onset and termination of an alarm. Entering a time value in seconds in the ***On Time*** box will delay the declaration of the alarm. Entering a time value in seconds in the ***Off Time*** box will delay the clearing of the alarm. Alarm annunciators cannot be cleared until the alarm condition is no longer valid and the alarm off timer has expired.

Entering a value in the **Hysteresis** box will alter the clearing setpoint for the alarm. If the high alarm had been set to 50 and a hysteresis value of 5 had been entered, then the alarm would be declared at 50 and cleared at 44. The process is reversed for low alarms. If a low alarm was set at 20 with a hysteresis of 4 then the low alarm would declare at 20 and clear at 25.

A special case is enabled for low alarms used with speed sensors. When an input is assigned to a sensor in **Section 3.2.2.5 Setting Alarms Screen 2**, and low alarms are enabled to stop the machine, the system monitors the run relay input to verify the input is on when the machine is moving. Two special cases are monitored. They both utilize the delay time set for each input in **Section 3.2.1.4 Inputs**. The logic is as follows:

1. If the machine speed goes from < 5 RPM to => 5 RPM the timer is started with a value equal to the startup time;
2. If the machine running input goes from ON to OFF, the timer is started with a value equal to six times the startup value;
3. If the timer was started by the machine starting to turn (above 4RPM) and the timer expires, with the machine running input OFF, a low alarm is declared and the machine is stopped;
4. If the timer was started by the input going off, when the timer expires, if the machine is turning at 50% of the low alarm setpoint, a low alarm is declared and the machine turned off.

3.2.2.5 Setting the Alarms, Screen 2



The EZSentinel 128 can stop machinery when an alarm condition is detected. The first row of buttons on this screen select which alarms will stop the machine. If a button is green, this alarm will stop the machine when the alarm is declared and the alarm annunciator is on. The machine cannot be restarted until the alarm condition is removed and the ***Silence*** key pressed.

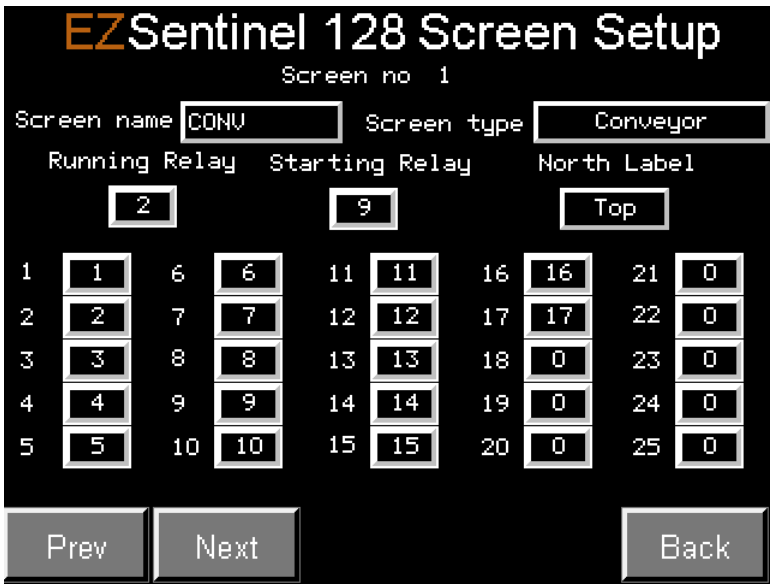
Some alarms, such as under speed alarms and warnings, need to be suppressed when the machine is not running. This prevents false alarms when the machine is stopped. Select the alarms to suppress on the second row of buttons. A green button means this alarm will be suppressed when the machine is not running.

In order to suppress the alarms the system needs to know which input relay the machine is connected to. Touch the last box on the second row to enter the relay number from 1 – 15. The relay number should correspond to the custom screen display for the machine where the sensor is located. Only select those alarms that are affected by the machine stopping. Alarms such as over temperature and fault should not be suppressed when the machine stops.

These selections can also be used to suppress alarms from machines that do not have continuous power available to their field sensor networks. When the machine stops and power for the sensor network is lost, these sensors will indicated faulted. A typical application is for trippers used to set the discharge point on long gallery belts. Power for the sensors on trippers is derived by an onboard generator powered by the moving belt. When the belt stops, power for the bus converter and sensors is lost. For this equipment, in addition to the low speed alarms, fault and reference fault alarms would be suppressed.

The rate of rise alarm system is also setup on this screen. Three settings are required. The first button on the third row, ***Enable***, enables the rate of rise alarm. Rate of rise is enabled if the button is green. The second box, ***Rise***, sets the amount the sensor value can rise over the time period set in the third box, ***Time***. If the rise amount is 5 and the time is 2, then a change in reading from 60 to 62 over a 5 second period will trigger the alarm.

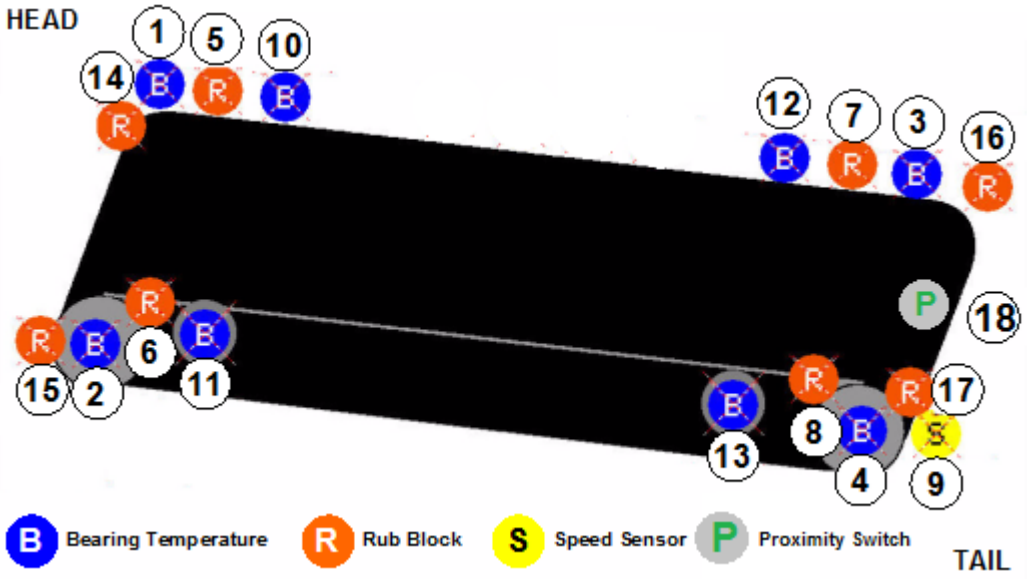
3.2.3 Screens



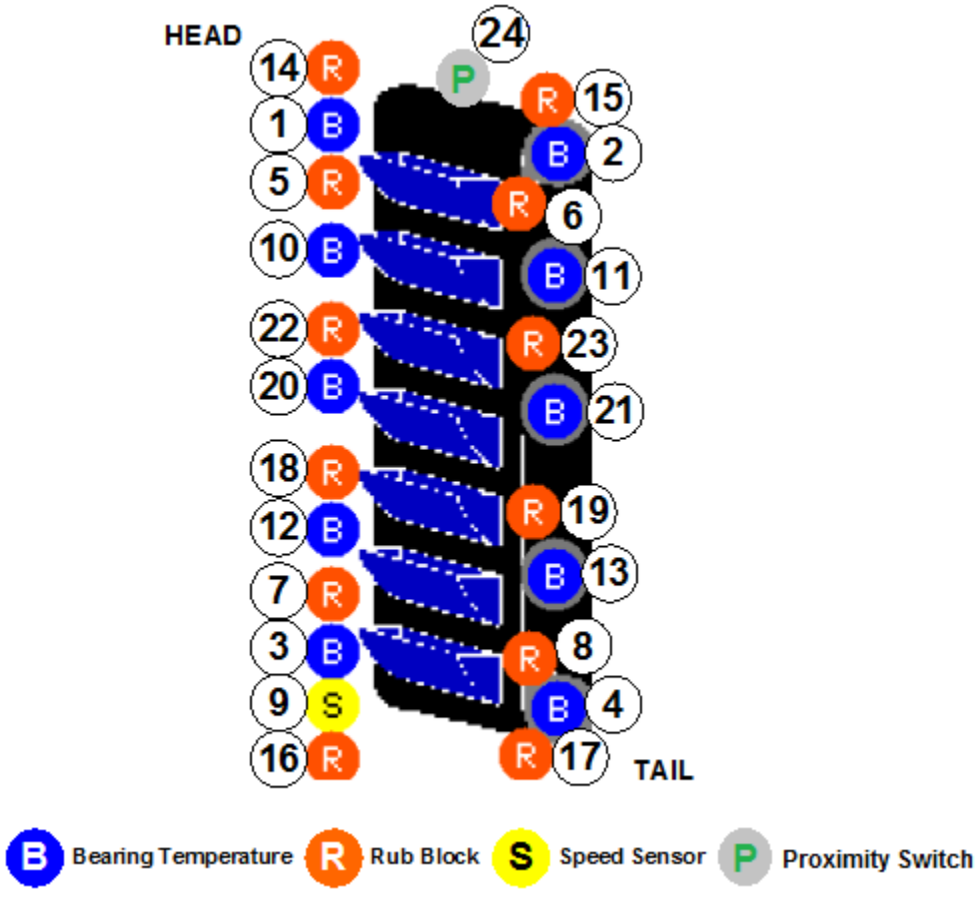
The EZSentinel 128 supports up to 15 machines on 15 custom definable screens. Screens are available for:

- Conveyors
- Legs / Bucket Elevators
- Drags
- Motor Drives
- Fans
- Gravity Take Up Conveyors
- Trippers
- Conveyor 2 (regular conveyor with different sensor layout)

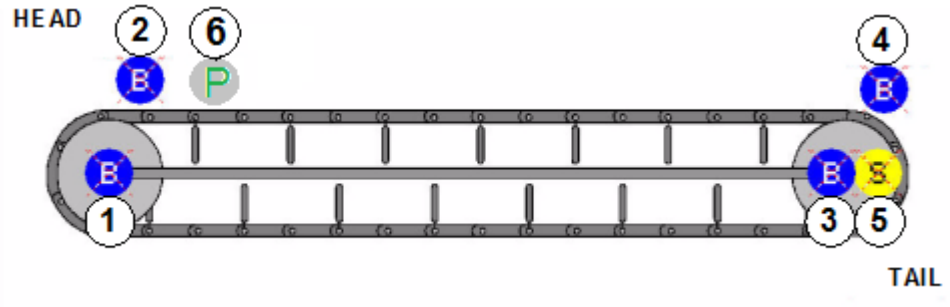
Each screen can have up to 25 sensors mapped to the screen sensor locations. Not all screens have 25 sensors. The following illustrations show the individual screens and the sensor display locations. Not all sensor display location will be visible, depending on the setup of the custom screen.



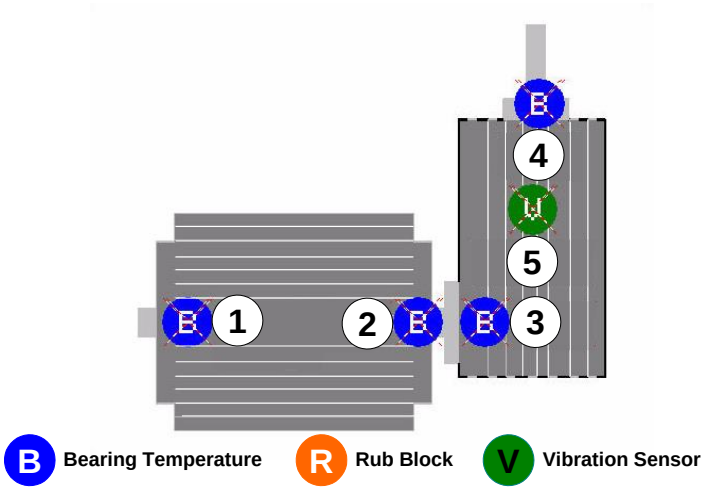
Standard Conveyor



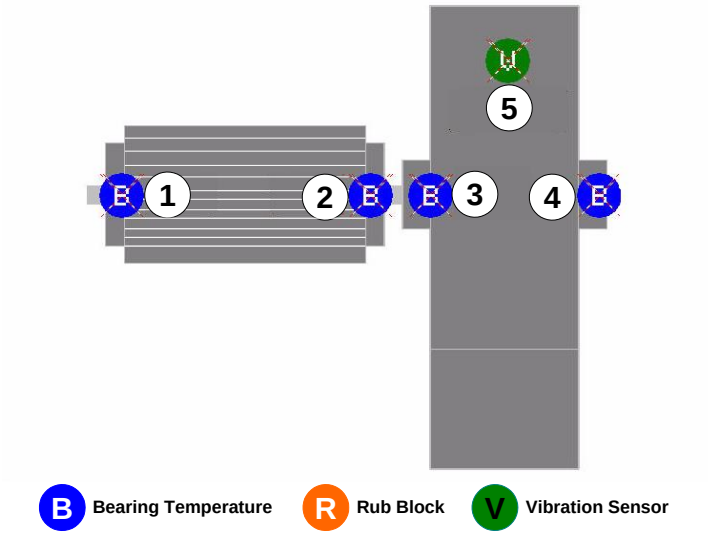
Leg / Bucket Elevator



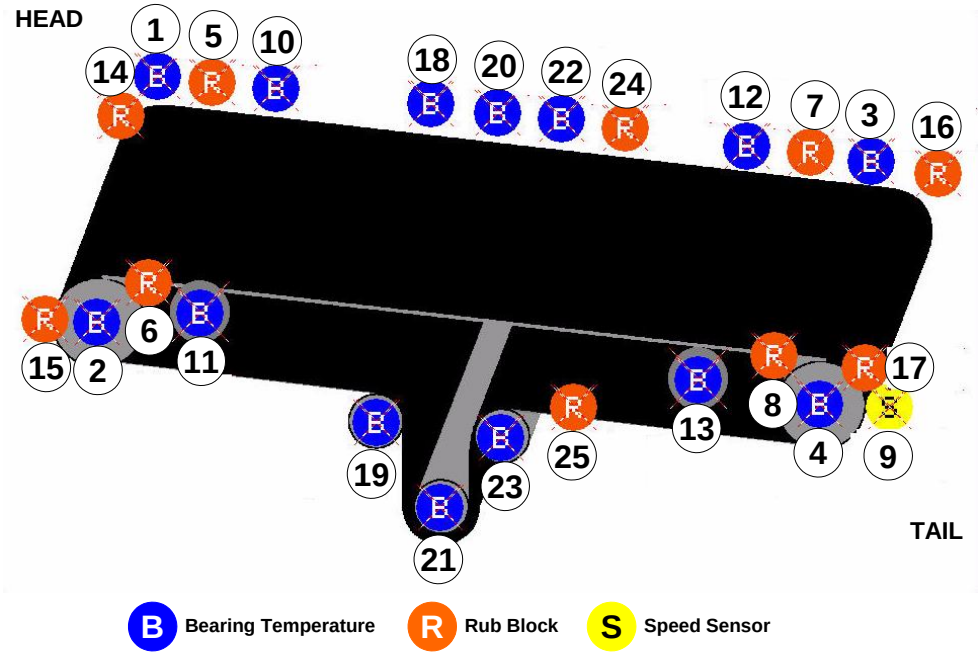
Drag



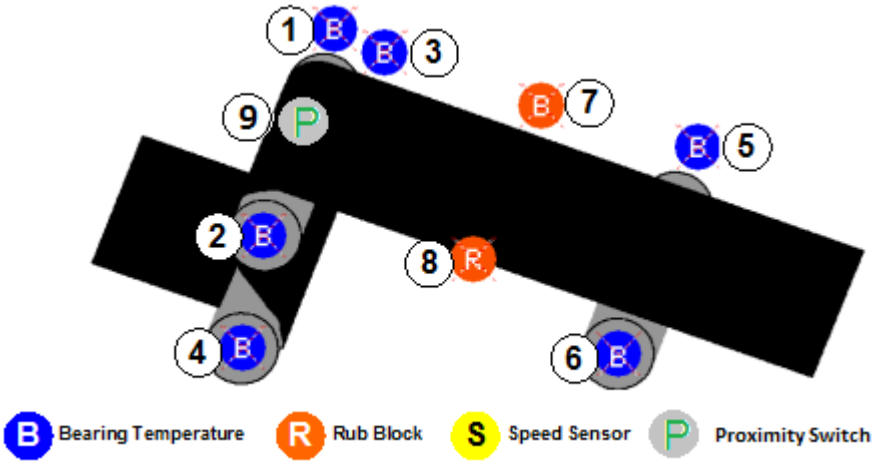
Motor Drive



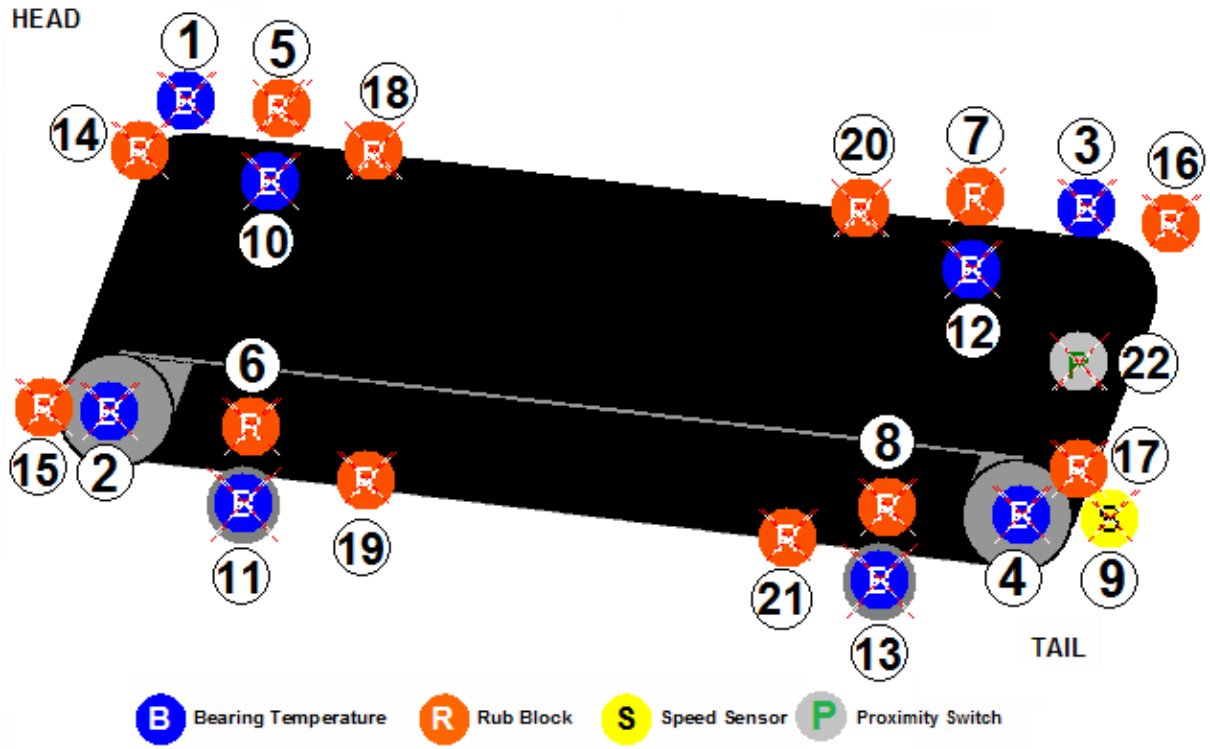
Fan



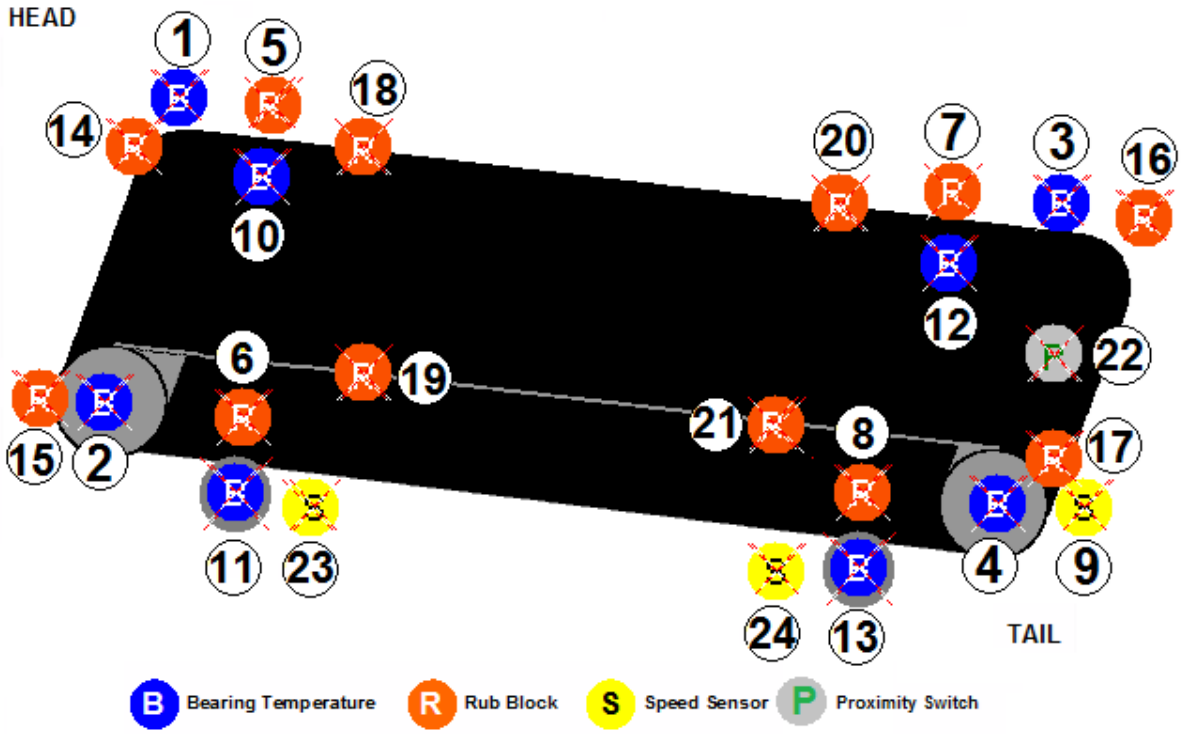
Gravity Conveyor



Tripper



Conveyor 2



Conveyor 3

A set of worksheets is provided in the Appendix of this manual to assist in collecting the information for setting the screens. A copy of the worksheets in Excel format is available from our website. The worksheets should be completed as follows:

1. Enter the machine name, and sensor descriptions before beginning installation;
2. Enter the serial numbers as the sensors are being installed;
3. Enter the bus converter numbers as the field sensor networks are completed;
4. Enter the sensor numbers and short names as the EZSentinel 128 Sensor Setup is completed.

There are 4 sections to setup for each custom screen. The custom screen number currently being edited is displayed under the screens title bar. Select the custom screen to be configured by using the ***Previous*** and ***Next*** keys.

The name of the custom screen is entered by touching the Screen name box on the screen. Screen names can be up to 10 characters in length.

The type of screen is selected by touching the Screen type box. The equipment type is selected using the up and down keys.

The sensors are assigned to screen locations using the 25 entry boxes that correspond to the screen display positions. If the sensor number for a screen location is 0, that item will not be visible on the custom screen.

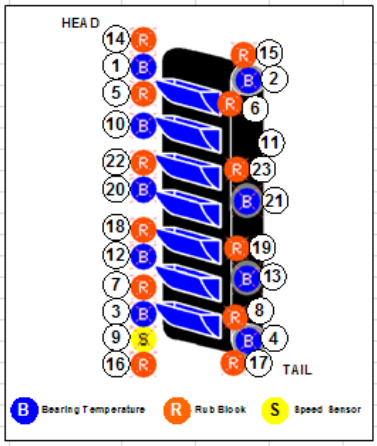
Enter the sensor number corresponding to the sensor on the machine for each screen location. The sensor numbers used to complete this table are obtained from your worksheets and the ***Sensor Setup*** screen.

The following is a sample machine worksheet for a bucket elevator:

EZSentinel128
Bucket Elevator Worksheet

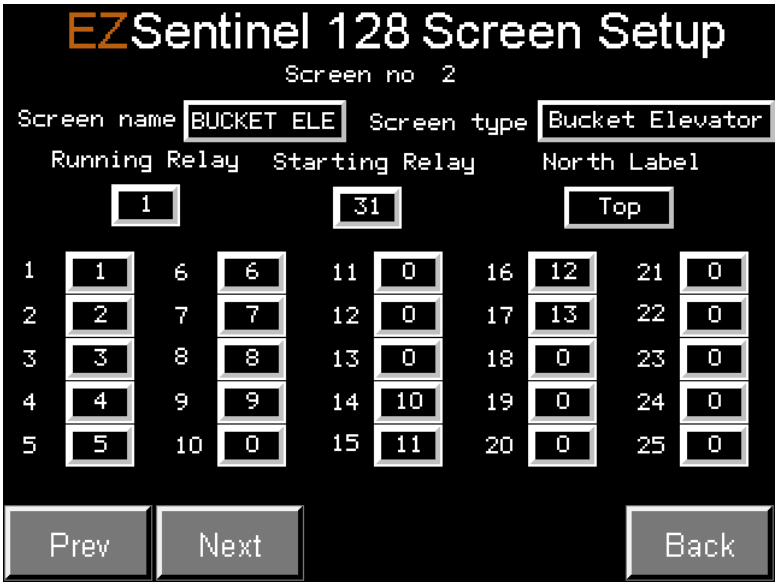
Machine Short Name (max 10 characters)

Leg

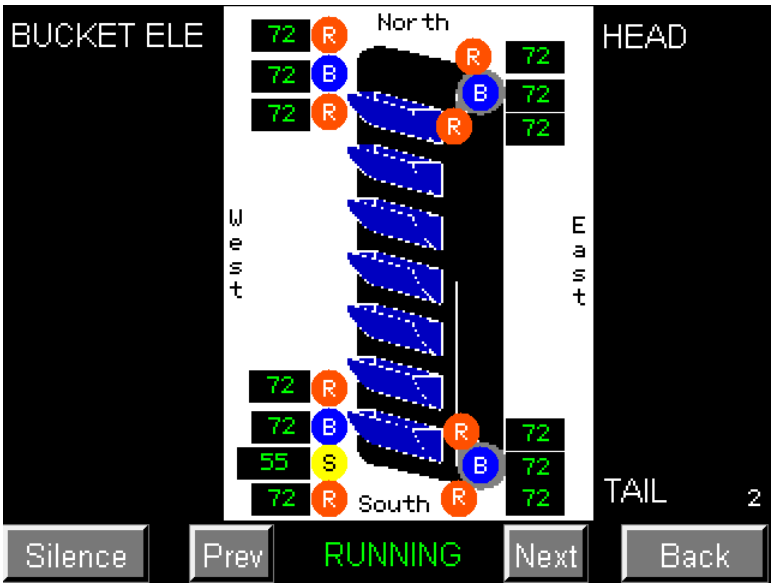


Position	Description	Short Name	Bus Converter	SN 1	SN 2	SN 3	SN 4	SN 5	SN 6	SN 7	SN 8	Sensor no
1	Leg head east bearing	LEG HEB	1	40	0	0	1	149	216	227	197	2
2	Leg head west bearing	LEG HWB	1	40	0	0	1	124	227	37	198	1
3	Leg tail east bearing	LEG TEB	1	40	0	0	1	149	201	65	70	8
4	Leg tail west bearing	LEG TWB	1	40	0	0	1	149	235	17	19	7
5	Leg head north east rub	LEG HNER	1	40	0	0	1	149	202	110	154	4
6	Leg head north west rub	LEG HNWR	1	40	0	0	1	149	234	15	150	3
7	Leg tail north east rub	LEG TNER	1	40	0	0	1	149	203	229	69	10
8	Leg tail north west rub	LEG TNWR	1	40	0	0	1	149	199	85	99	9
9	Leg speed	LEG SD	1	160	0	0	16	0	88	23	71	13
10												0
11												0
12												0
13												0
14	Leg head south east rub	LEG HSER	1	40	0	0	1	149	220	62	84	6
15	Leg head south west rub	LEG HSWR	1	40	0	0	1	149	246	157	57	5
16	Leg tail south east rub	LEG TSER	1	40	0	0	1	149	197	88	170	12
17	Leg tail south west rub	LEG TSWR	1	40	0	0	1	149	214	119	10	11

The screen display below configures a custom screen to display this bucket elevator:



This is how the bucket elevator will be displayed to the operator:



The following three features are only available on software version 2.0 and later.

The ***Running Relay*** entry is the input relay from RL1 - RL15 used to indicate that the machine is running. This entry is required for the “RUNNING” annunciator to be visible and also for the ***IN*** selection in section ***3.2.1.8 Out Setup*** to operate.

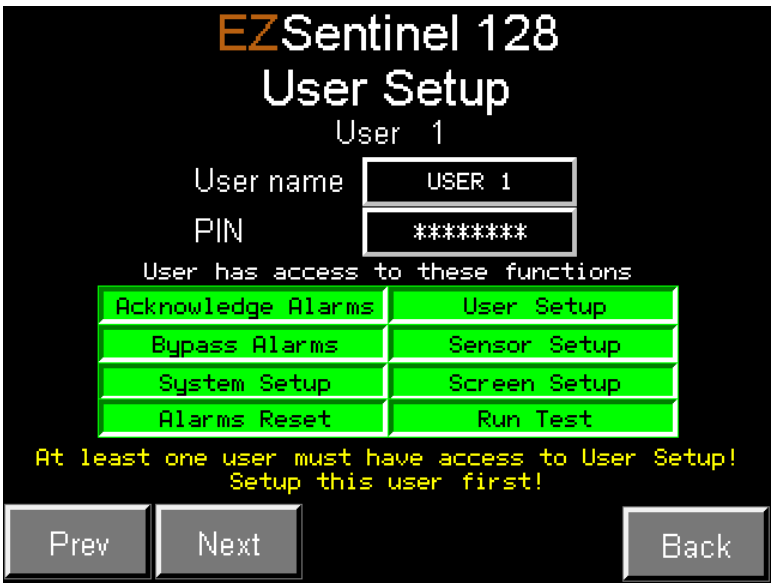
The ***Start Relay*** is the optional input that is used for a remote start pushbutton. When the remote start pushbutton input is energized it energizes the output relay for 2 seconds. The running relay must be engaged by the 2 second timeout to latch the motor control circuit. This field accepts entries from 1 – 32 with 1 – 16 corresponding to RL 1 – RL16 and 17 – 32 corresponding to optional input enclosure relays marked RL33 – RL48. See section **2.3 Machinery Control** for information on wiring and utilizing the remote start pushbutton function.

The ***North Label*** field controls the position of the North, West, South and East labels on the screen. The labels can be oriented as required by selecting the direction to be at the top of the display.

The number in the bottom right hand corner of the screen display is the custom screen number. This identifier helps in troubleshooting the system.

Prev and ***Next*** buttons have also been added to the custom screen displays to assist in navigation.

3.2.4 Users



The EZSentinel 128 has a comprehensive security system. The security system restricts access to up to 8 distinct program sections. In addition to restricting access the security system makes entries in the alarm log when user access is granted. Up to 10 users can be created.

****

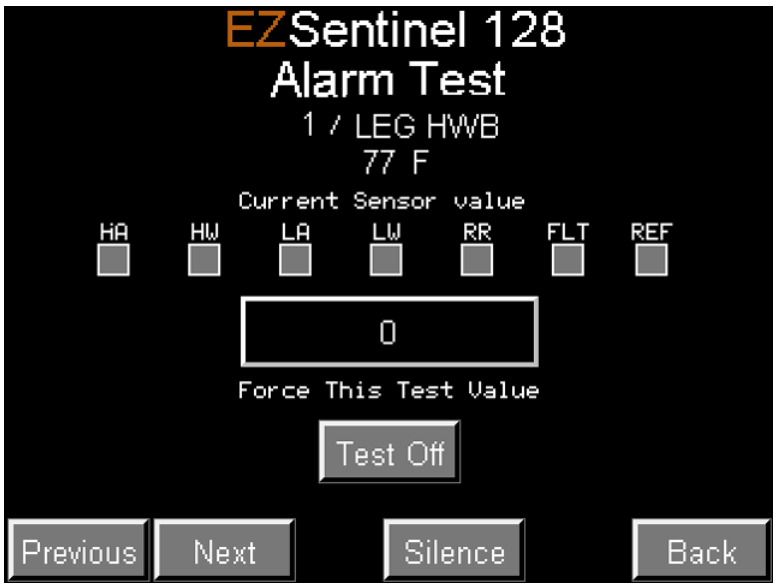
Caution

Before enabling security in the ***Setup -> System*** screen be sure to have set up a t least one user with a known PIN that can access both the ***System*** and ***Users*** screens. Failure to have at least one valid user will permanently lock out the ability to access the security system.

****

Select which user to set using the ***Previous*** and ***Next*** keys. The user number is displayed below the title bar. Enter the user name by touching the name box. User names can be up to 10 characters in length. Enter the users PIN by touching the PIN box. PIN number can be any number from 1 to 2,147,483,647. PIN numbers can not 0. Select which areas of the system the user has access to using the 8 pushbuttons. A green pushbutton means the user has access to that function.

3.2.5 Alarm Test



The alarm test function allows the operator or installer to confirm the operation of high alarm, high warning, low warning, low alarm and rate of rise alarms. Test the alarms for each sensor by:

1. Select the sensor using the ***Previous*** and ***Next*** keys. The sensor number and name will be displayed under the title bar.
2. Entering the value required to trigger the alarm in the ***Test Value*** box by touching the box.
3. Press the ***Test*** key to force the test value. The key will be green when the test value is forced. Press the ***Test*** key again to turn of the test value. The screen will display the current value of the sensor.
4. The alarm status is displayed by the alarm annunciators. Use the ***Silence*** key to turn off the alarm horn.

The test system is automatically disabled when you leave the Alarm Test screen.

****

Caution

If machinery is operating while the tests are performed, the machinery will stop if a machinery control alarm is triggered. Damage to property, personal injury or loss of life could occur.

****

3.2.6 Control Bypass

This function allows an alarm to be bypassed so it does not sound the horn or stop the machine. Alarms bypassed using this function will still be visible on all of the display screens and will still be recorded in the alarm event log. This system is typically used to bypass a damaged or faulted sensor. To bypass an alarm:

1. Select the sensor using the ***Previous*** and ***Next*** keys. The sensor number and name will be displayed under the title bar.
2. Press the button for the alarm to be bypassed. When the button is green, the alarm is bypassed.
3. To remove the bypass, press the button again.

Alarms bypassed using this function remains bypassed until this screen is re-entered and the bypass is removed. All bypasses present on the system can be cleared simultaneously using the ***Clear All*** button.

****

Caution

Machinery control and operator alerting is disabled for the alarms bypassed using this function. Should an alarm condition occur and the machinery not be stopped, damage to property, personal injury or loss of life may occur.

****

The system can be configured to automatically clear all bypasses at midnight. See section ***3.2.1.4 Auto Bypass*** Clear for details.

4. Commissioning

A detailed commissioning checklist is provided in the Appendix of this manual. This checklist should be completed by the installer and facility operator and be maintained as a permanent record of the commissioning of the system.

The following steps should be followed:

1. Complete the 1-Wire® network wiring and bus converter RS-485 network before beginning the commissioning process. Leave all of the branch disconnect switches OFF and do not connect any sensors in the field interconnect boxes.
2. Set the address switches on the bus converters before applying power. Bus converter address changes are only recognized during the power up sequence. Bus converters must have unique addresses starting at 1. The EZSentinel128 can support up to four bus converters using addresses 1 through 4.
3. Make sure the RS-485 network is terminated at each end. Termination is set to “ON” at the physical ends of the RS-485 bus. All devices in the middle of the network will have termination turned “OFF”. Only two devices on the network, at the physical ends of the cable will have termination “ON”. Termination switches on the bus converter are switches 1 & 2. Switch 1 terminates the EZSentienl128. Switches are turned on to terminate.
4. Apply power to the EZSentinel128 and observe the indicator lights in the first bus converter. There are two lights. The red LED indicates the bus converter status and the green LED communications with the EZSentinel128 . Both the red and green LEDs should be flashing if the bus converter is powered and communicating. Make sure the configuration is set for the correct number of bus converters installed in the system. If the configuration is incorrect, the green light may not flash on the higher address bus converters.
5. With no sensors connected in the field interconnects, the red LED will be flashing a code of 2 short blinks followed by a pause. See the mBC081 Technical Manual for flash codes if your bus converters status LED is flashing at a different rate.

********** **Warning** **********

Do not make connections or changes to the RS-485 network with power applied.

****

If no lights are flashing the RS-485 wiring is not correct. Verify the wiring and try again. Note that the RS-485 wiring could be miss-wired past the first bus converter and still affect the entire network. If you are unable to get the network started, disconnect the remaining network at the first bus converter and try again. Add bus converters until the wiring error is located.

6. Once the bus converters are all operating properly, test the remaining network components.
7. Starting at the first field interconnect on the first bus converter. Connect any sensors located in that field interconnect. The red and green LEDs should remain on.

8. Turning on the branch disconnect switches. Start by enabling branch A, then branch B. If the red and green LEDs in the field interconnect remain on, move to the next field interconnect on that branch. If the red or green LED goes out when you add a branch, there is a wiring problem with that branch. Turn the switch off and verify the wiring for that branch. Repeat step 7 and 8 until all field interconnects have been energized and all sensors connected. Wiring changes on the 1-Wire® network can be made with power on.
9. Repeat the procedure for all of the bus converters on the system.
10. At this point all of the bus converters should have their red LED flashing at a one second rate and their green LED flashing indicating communications. All of the field interconnect boxes should have their red LED on steady and green LED indicator flashing. All field sensors should be connected.
11. Enter or acquire the sensor serial numbers as described in this manual.
12. Configure the “System”, “Sensor”, “Output Control”, “Screens, “Inputs”, ”Remote Inputs” and “Users” sections of the EZSentinel128 configuration.
13. Verify each temperature sensors location and value on the display graphics by cooling the sensor with cold spray.
14. Verify the speed sensors using a handheld RPM meter and by starting and stopping the machine.
15. Verify the “Alarm” functions using the “Alarm Test” function. The machine should be running during this test to verify the machinery interlock is correctly configured.
16. Complete the “**Hazards Monitoring System Commissioning Checklist**” located in the Appendix of this manual.

5. Appendix A – Machine Worksheets

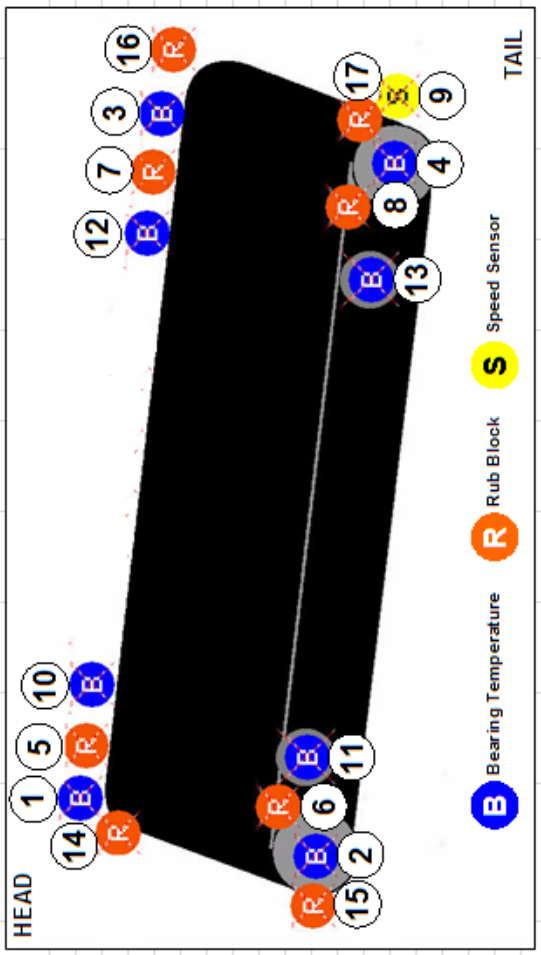
Worksheets are available for:

- Conveyors
- Legs / Bucket Elevators
- Drags
- Motor Drives
- Fans
- Gravity Take Up Conveyors
- Trippers

The worksheets should be completed in the following order:

1. Enter the machine name, and sensor descriptions before beginning installation;
2. Enter the serial numbers as the sensors are being installed;
3. Enter the bus converter numbers as the field sensor networks are completed;
4. Enter the sensor numbers as the EZSentinel 128 Sensor Setup is completed.

EZSentinel128
Conveyor Worksheet

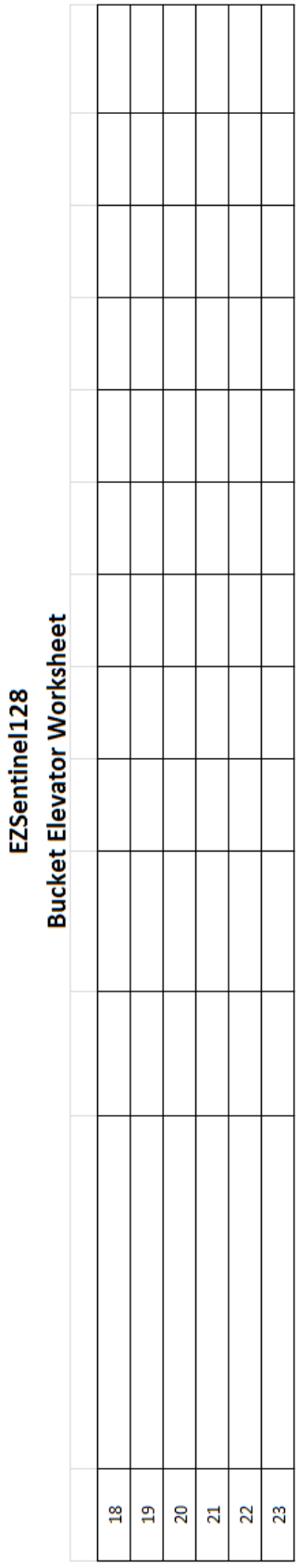


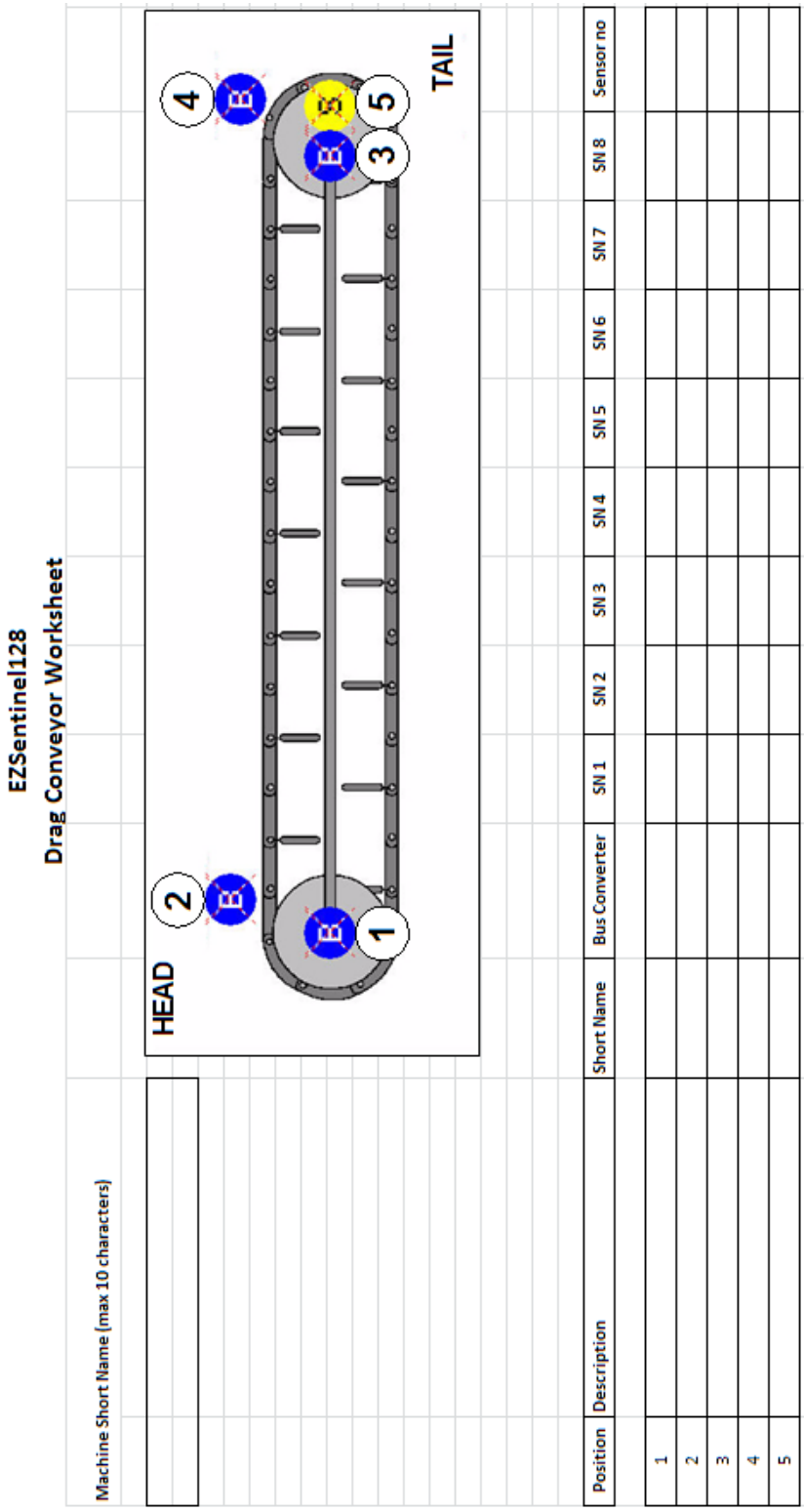
Machine Short Name (max 10 characters)

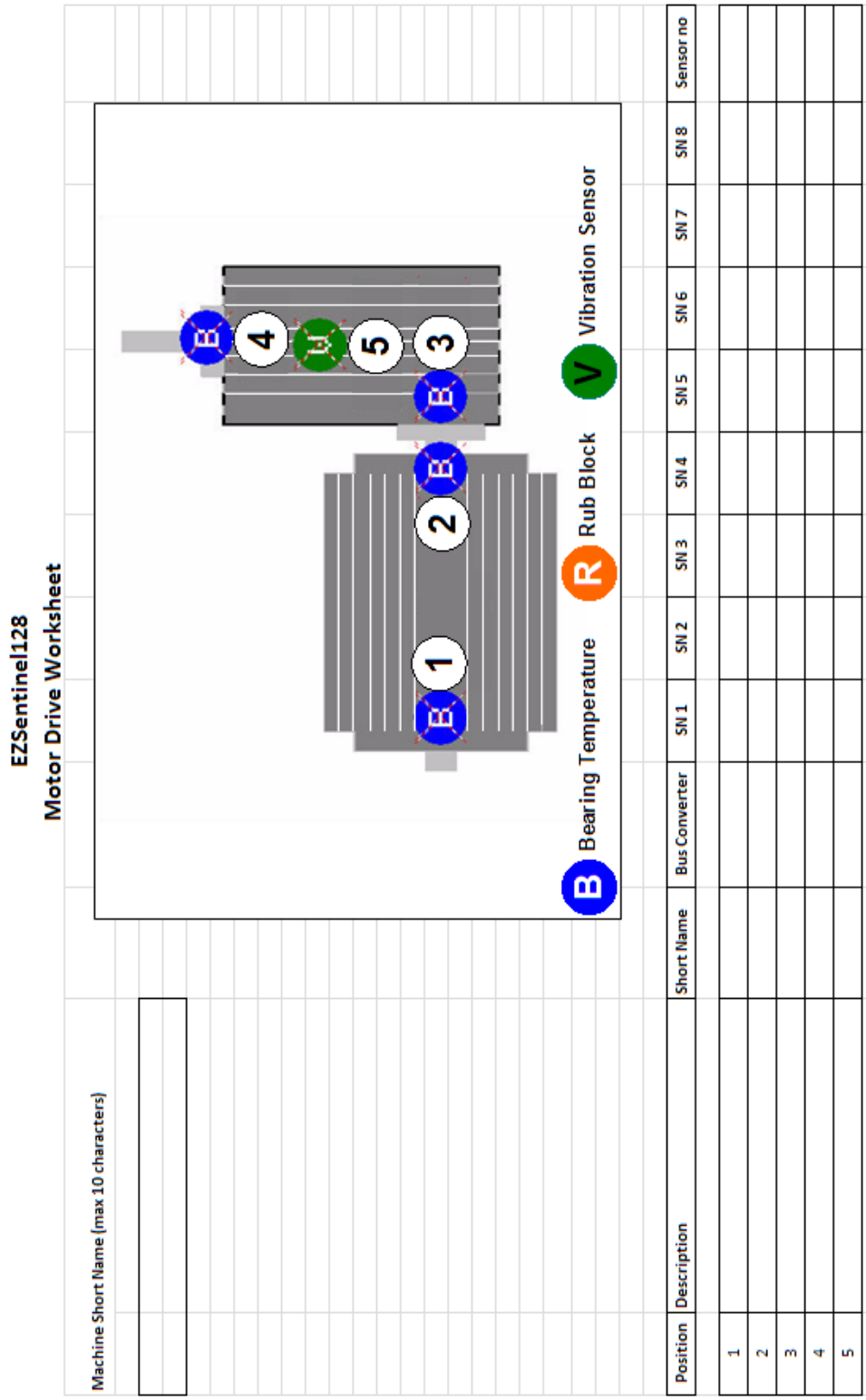
Position	Description	Short Name	Bus Converter	SN 1	SN 2	SN 3	SN 4	SN 5	SN 6	SN 7	SN 8	Sensor no
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												

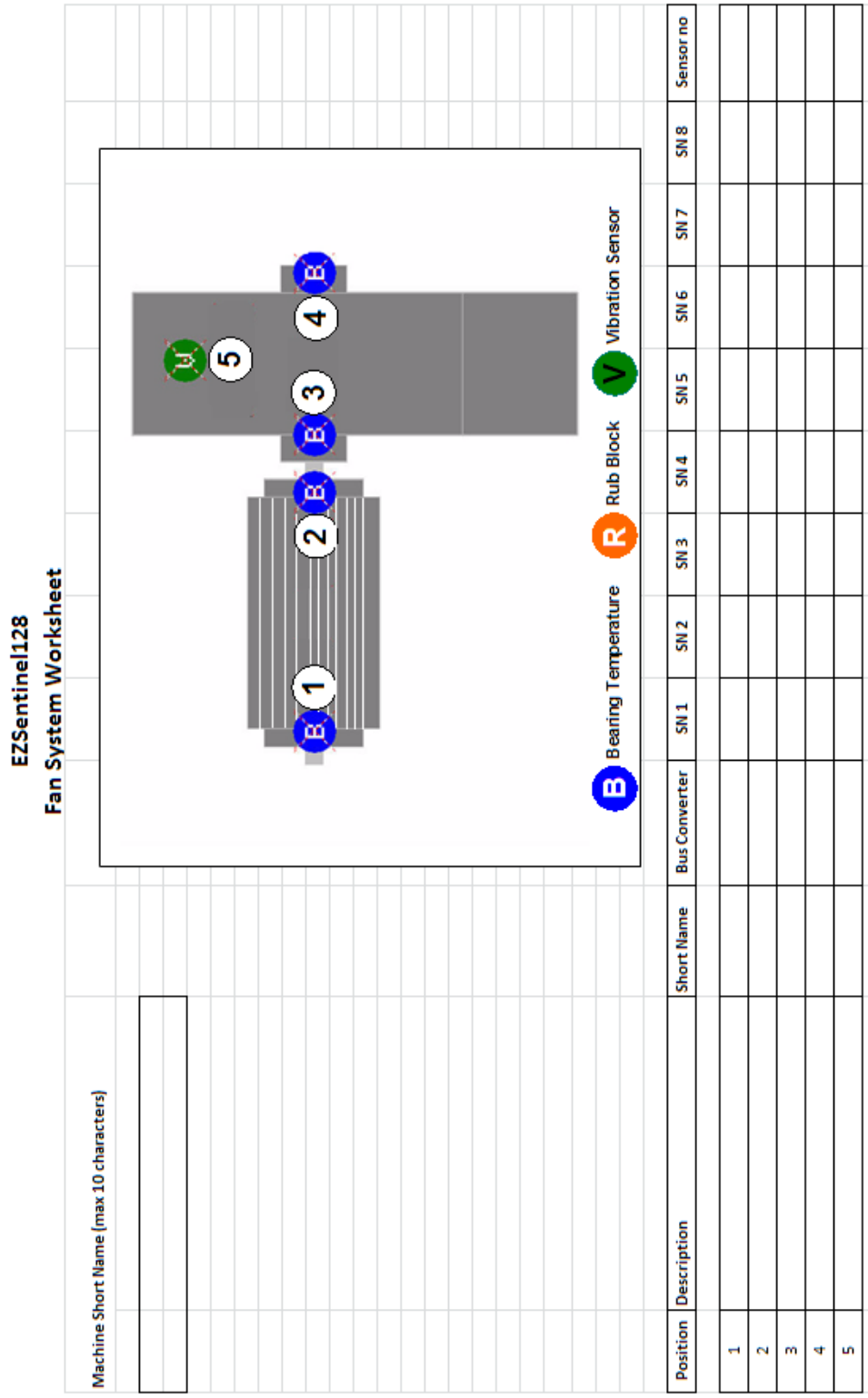
Machine Short Name (max 10 characters)

Position	Description	Short Name	Bus Converter	SN 1	SN 2	SN 3	SN 4	SN 5	SN 6	SN 7	SN 8	Sensor no
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												


EZSentinel128
Bucket Elevator Worksheet
18
19
20
21
22
23

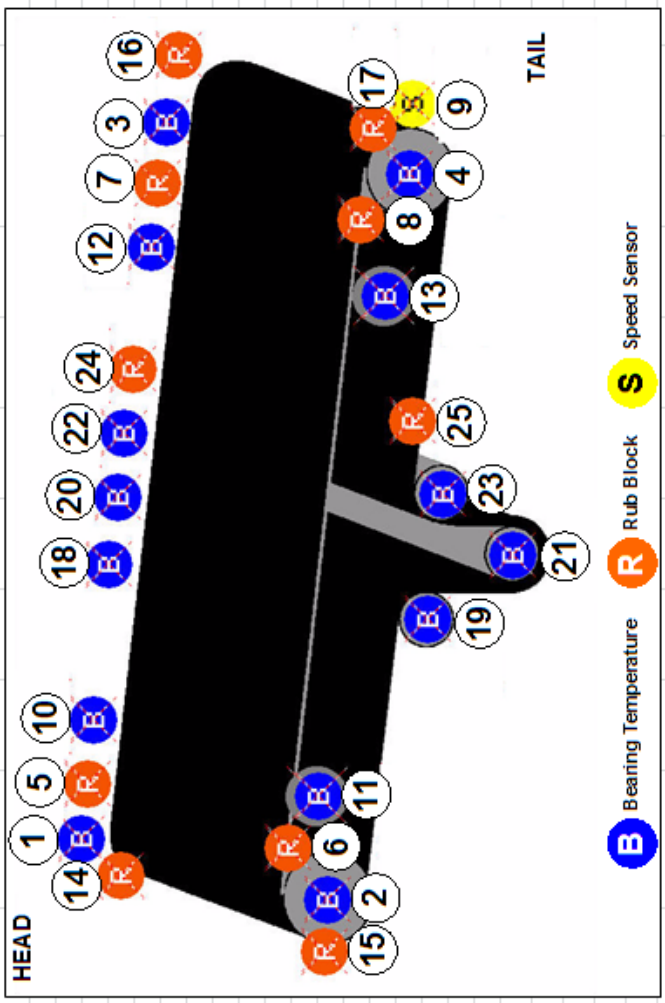

EZSentinel128
Drag Conveyor Worksheet
Machine Short Name (max 10 characters)
HEAD
TAIL
1
2
3
4
5
Position
Description
Short Name
Bus Converter
SN 1
SN 2
SN 3
SN 4
SN 5
SN 6
SN 7
SN 8
Sensor no


EZSentinel128
Motor Drive Worksheet
Machine Short Name (max 10 characters)
B Bearing Temperature
R Rub Block
V Vibration Sensor
B 1
B 2
B 3
B 4
5
Position
Description
Short Name
Bus Converter
SN 1
SN 2
SN 3
SN 4
SN 5
SN 6
SN 7
SN 8
Sensor no
1
2
3
4
5


EZSentinel128
Fan System Worksheet
Machine Short Name (max 10 characters)
B Bearing Temperature
R Rub Block
V Vibration Sensor
1
2
3
4
5
Position
Description
Short Name
Bus Converter
SN 1
SN 2
SN 3
SN 4
SN 5
SN 6
SN 7
SN 8
Sensor no

EZSentinel128

Gravity Conveyor Worksheet



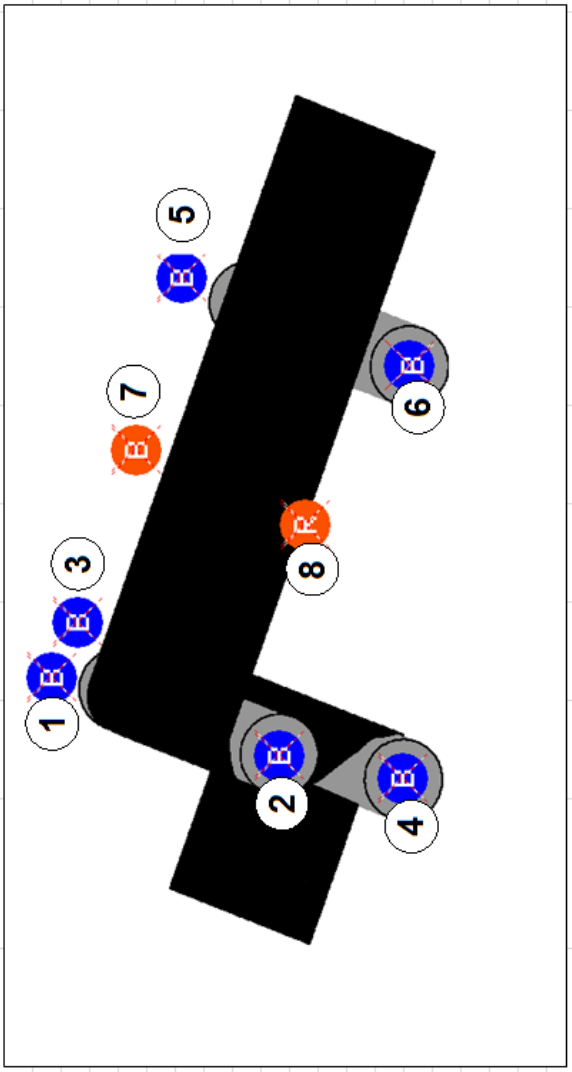
Machine Short Name (max 10 characters)

Position	Description	Short Name	Bus Converter	SN 1	SN 2	SN 3	SN 4	SN 5	SN 6	SN 7	SN 8	Sensor no
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												

EZSentinel128
Gravity Conveyor Worksheet

13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												

EZSentinel128
Tripper Worksheet



Machine Short Name (max 10 characters)

Position	Description	Short Name	Bus Converter	SN 1	SN 2	SN 3	SN 4	SN 5	SN 6	SN 7	SN 8	Sensor no
1												
2												
3												
4												
5												
6												
7												
8												

6. Appendix B – Program Upgrade

The software for the EZSentinel128 can be upgraded in the field. To upgrade the software, the new software file must first be copied to the micro SD Card in the controller. The software file will be formatted as: E128VXXX.PGM where the “XXX” is the software version number. Only SD Cards formatted using the EZSentinel128 controller can be read.

Before attempting a software upgrade, execute a “Save” operation on the EZSentinel128. The “Save” operation described in **Section 3.2.1.10 Save** copies the system configuration to the SD Card. Depending on the software version, additional setup steps may be required after the software upgrade has been completed.

To remove the SD Card, loosen the two thumbscrews that hold the inner door of the enclosure in place. Open the door and locate the SD Card. The card is on the side of the controller near the top as shown below:

Push on the edge of the card and then release it to remove the card. A new SD Card can then be installed in the controller. See **Section 3.3 Formatting the SD Card** for information on formatting a new SD Card in the controller. SD Cards cannot be formatted in a PC for use in the controller.

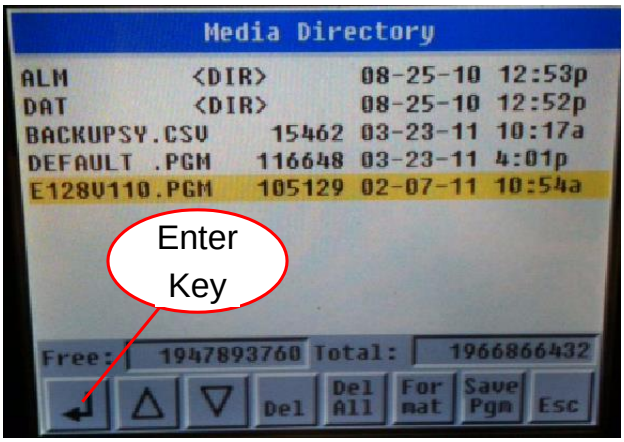
Use the supplied micro SD Card to SD Card adapter to install the SD Card in your computer using the existing SD Card slot or a USB connected SD Card reader. Copy the BACKUPSY.CSV file from the SD Card to your computer. Be sure to save this file with the date copied to provide a known state should you need to restore the controller. Copy the new program file from your computer to the SD Card.

Re-install the SD Card in the EZSentinel128.

Upgrade the program using the following steps:

1. Access the “System” screen from the “Setup” menu.
2. The “System Setup” screen must be displayed. Press the blue system button on the upper right bezel of the controller as shown below:

3. Touch the “Removable Media” entry on the screen and then press the “Enter Key” (bottom right hand key)in the menu bar.
4. Touch the .PGM file name in the menu list, and then press the “Enter Key” (bottom left hand key) in the menu bar.



5. Answer yes to the “Are You Sure” prompt. The controller will ask for a password to proceed. Enter “9999” for the password.
6. The program will load a series of files and objects. Once complete you will be prompted to “Place in Run Mode”. Press “OK”. The controller will restart.
7. Press the “status button from the main menu and confirm that the new program version has been installed. The program version number is displayed at the bottom of the Status screen.

The program has now been updated. The following matrix indicates if any further setup steps need to be taken as a result of the upgrade. Complete the steps in the order shown.

Old Version	New Version	Setup Steps
1.08	1.09	Create new backup **Section 3.2.1.10 Save**

1.09	1.10	Create new backup **Section 3.2.1.10 Save**
1.10 or earlier	1.20	Configure **Section 3.2.1.6 Out Setup** Configure **Section 3.2.1.7 Remote I/O** Create new backup **Section 3.2.1.10 Save**
1.21	1.23	Setup “Running Inputs” for mBC081 on the mBC Setup screen for bus converters that are mounted on trippers. Setting this input will suppress all fault0s from the mBC081 on the tripper when the belt is stopped. **Section 3.2.1.7 mBC’s Setup** Create new backup after configuration, **Section 3.2.1.10 Save**
1.23	1.26	A communications delay timer was added to the mBC081 setup screen to allow for delayed communications from trippers over the radio. **Section 3.2.1.7 mBC’s Setup** Create new backup after configuration, **Section 3.2.1.10 Save**
1.26	1.27	The low alarm system was modified to declare a low alarm if the belt is running and no “Running Input” signal is present. A field was added to the “Screen Setup” to indicate which “Running Input” is used for the machine on the screen. This input is used to change the color of the machine when the machine starts from blue to green on the main select screen. In addition a “Stopped/Running” annunciator has been added to each of the graphics screens. **Section 3.2.3 Screens** Create new backup after configuration, **Section 3.2.1.10 Save**
1.27	1.28	Changes to the special low speed alarm system to have different set points on time for movement starts and signal lost conditions
1.28	2.00	Major new release • Add input controls output system to force detection of machine running before control circuit will latch • Add start pushbutton inputs to prevent starts if machine is in alarm • Add provisions for optional input module with relays RL33 – RL48 covering inputs 17 – 32 • Update all I/O screens to reflect the new inputs • Add repeated start lock out detection system • Add Prev and Next buttons to machinery displays • Add screen number to machine screen displays • Add North / West / South / East identifiers to machinery displays • Add “Night Mode” to disable all machinery and alarm

horn during non-operation hours

- Add “Night Mode Active” message to main screen and status screen
- Add “Sensor Bypassed” messages to main screen and status screen
- Add “Clear All” button to machinery bypass screen
- Add automatic bypass clear function at midnight
- Update mBC setup screen to add warning messages to both the “Acquire” and “Clear” functions
- Update messages on the Alarms 2 screen

The following table illustrates the changes to the BACKUPSY.CSV file between software versions. Older versions of the BACKUPSYS.CSV file can be used to reload system parameters if the file is updated as shown below. Note that the steps shown in the above table will have to be configured if an older version of the backup configuration file is modified and used to restore for a new version of software.

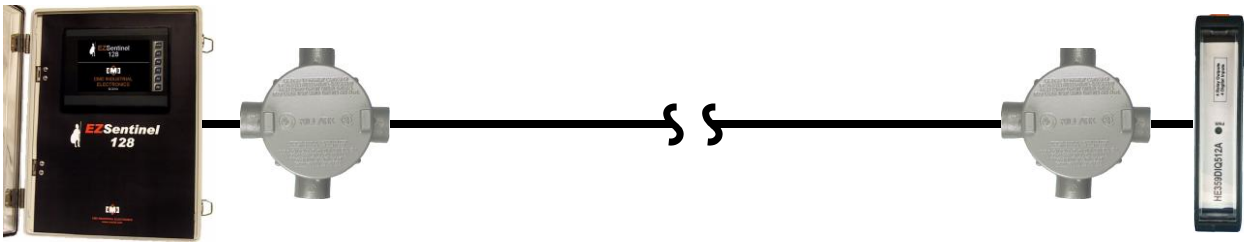
Old Version	New Version	Setup Steps
1.08	1.09	No change
1.09	1.10	Add “0”s to column AD from rows 1 - 154
1.10 or earlier	1.20	Add “0”s to column AD from rows 1 - 154 Add “MS002” to Column A, Row 155 Add “MS003” to Column A, Row 156 Add “MS004” to Column A, Row 157 Add “MS005” to Column A, Row 158 Add “MS006” to Column A, Row 159 Add “MS007” to Column A, Row 160 Add “MS008” to Column A, Row 161 Add “0”s to columns B – AD, rows 155 - 161
1.24	1.25	Add a 4 to Row 161, Column J
1.25	1.27	Add “Running Input Relay No.” to rows 129 – 143 in column D
1.27	2.00	Modify rows 129 – 143 columns D & E to add start input and north designators

Copies of all versions of the BACKUPSY.CSV file can be obtained by contacting Technical Support.

7. Appendix C – Deploying Remote I/O

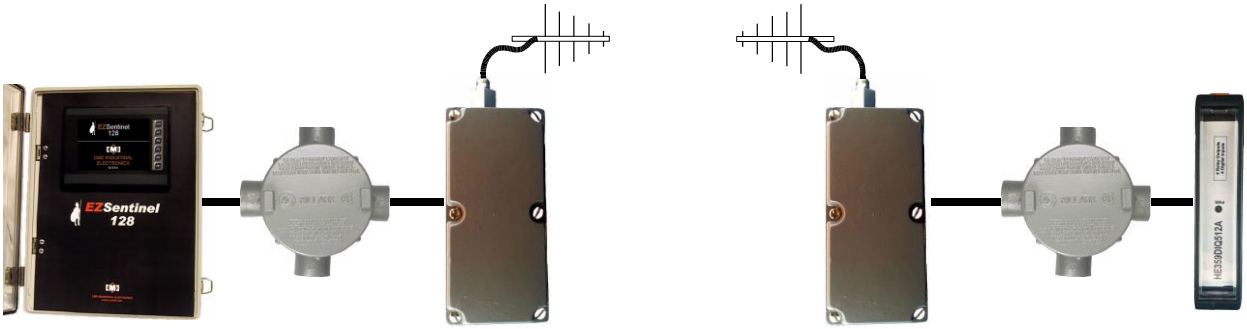
The EZSentinel128 can support up to 4 remote inputs and 4 remote outputs. The remote I/O module communicates with the EZSentine128 over the same Modbus RS485 network as the bus converters. The modules can communicate over a wired or wireless network. The remote I/O is provided as a module only with 24VDC inputs and outputs. It is recommended that interposing relays be used on both the inputs and outputs.

The following illustration details the possible methods of deploying the remote I/O:



Remote I/O Using Cabled Connection

The Modbus RS-485 cable can be up to 5000' feet in length. Use the mBC081 cable size calculator available at www.cmciel.com to determine the required cable gauge.

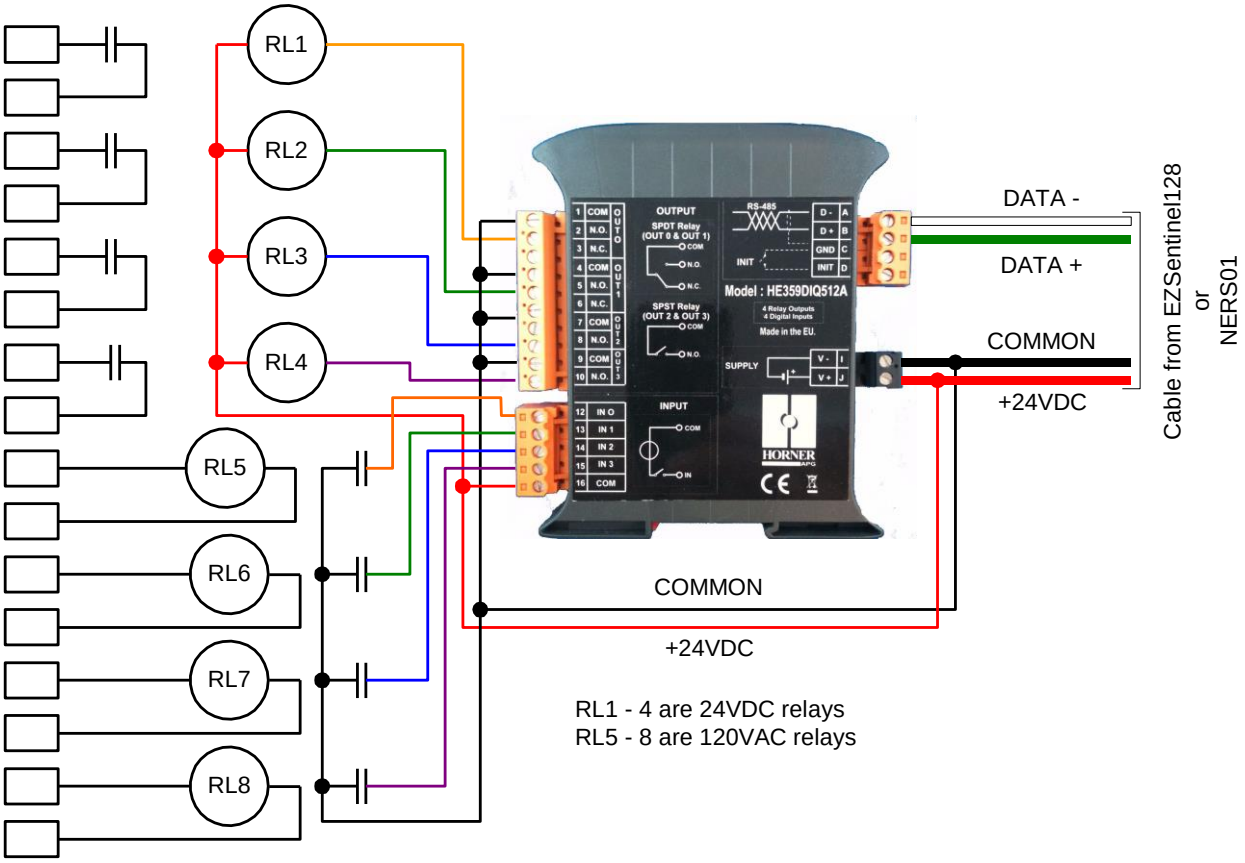


Remote I/O Using the NERS01 Radio

See the NERS001 Network Extender Radio System Technical Manual for information on the wireless link option.

7.1 Wiring the Remote I/O

The remote I/O module has 4 - 24VDC inputs and 4 dry contact relay outputs. It is recommended that the inputs and outputs be protected with interposing relays. The following diagram illustrates the connections:



Remote I/O Wiring Diagram

The remote I/O module and relays should be mounted in an enclosure suitable for the location.

If the system uses radios to communicate to the bus converters or remote I/O, the “Poll Delay” may have to be adjusted. The Poll Delay setting is on the Bus Converter Setup screen. The default setting is 4 for a 40 millisecond delay between polls. The default setting has been tested with CMC NERS01 radio systems. The range is 1 – 100 for 10 through 1000 milliseconds of delay. Increase the delay by 10 millisecond interval until reliable radio communications is achieved.

8. Appendix D – Configuring the Remote I/O Module

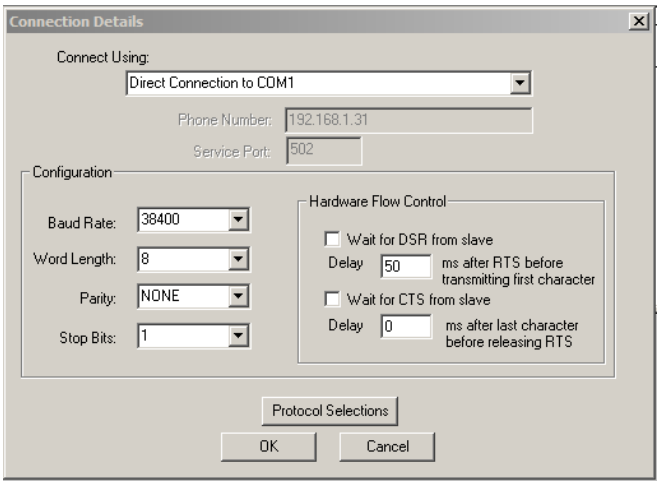
Modules purchased from CMC Industrial Electronics will be pre-configured and no further action is required. The module is a Horner Automation, www.heapg.com, HE359DIQ512A. The factory default configuration of the module must be configured before use with EZSentinel128.

To configure the module the following test equipment is required:

1. A PC based Modbus test tool such as Modscan. This tool is available from Win-Tech at: www.win-tech.com/html/**modscan32**.htm;
2. A USB to RS-485 or Serial to RS-485 converter;
3. A 24VDC power supply.

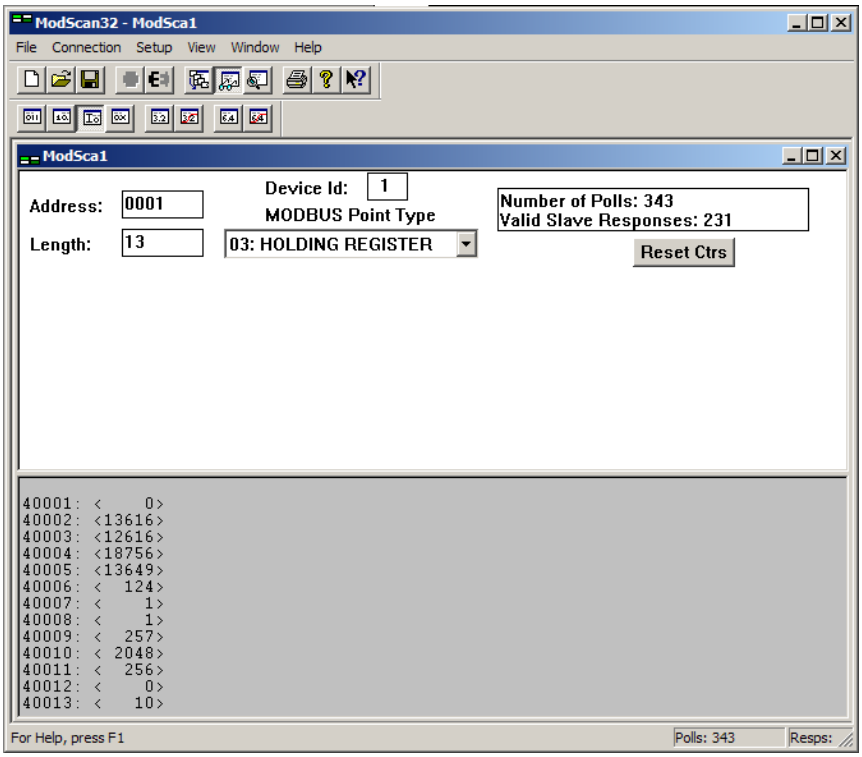
The following configurations steps are required:

1. Connect the module to the PC computer using the RS-485 converter;
2. Connect 24VDC to the module;
3. Open Modscan and select “Connection” from the menu bar. Setup communications as shown below. You must select the COM port in use on your computer, the example shows COM1:



If you have performed an “INIT” by jumpering the two terminals (C & D) on the communication block of the module, then powering up the module, the baud rate will be 9600, not 38,400. The baud rate of 38,400 is the factory default value when shipped from Horner Automation.

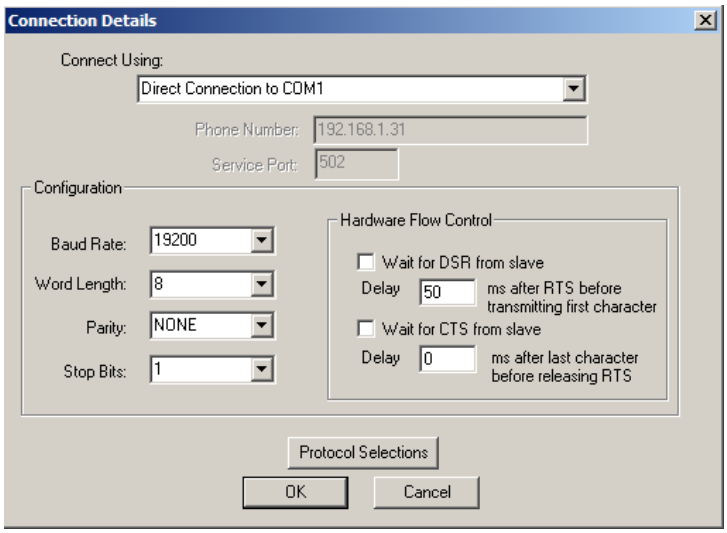
4. Set the Modscan main screen as follows, Device ID = 1, Address = 1, Length = 13, Modbus Point Type = 03: Holding Register. The screen is shown below:

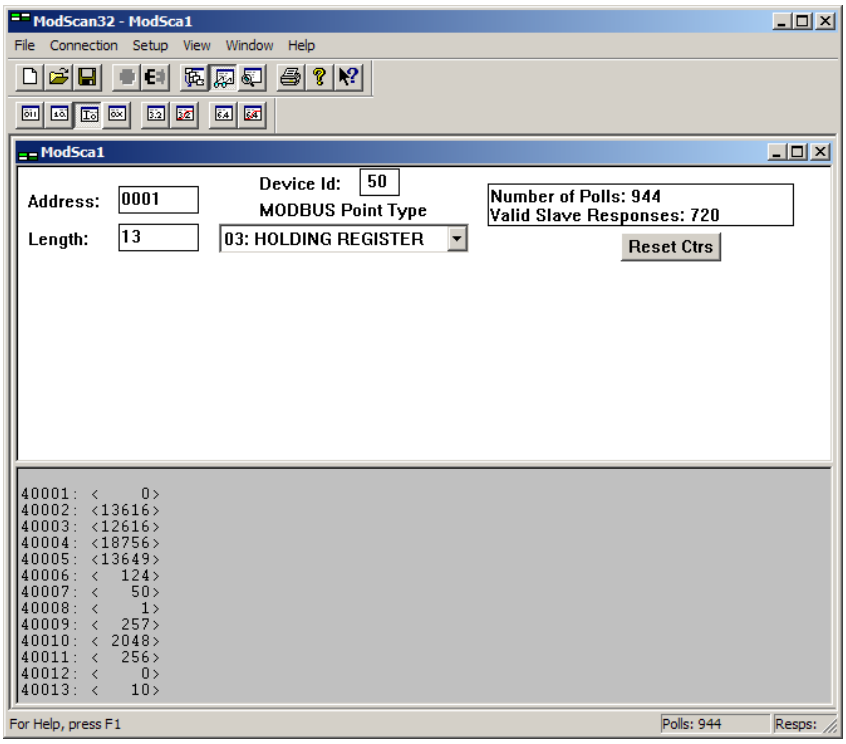


5. Once communication is established, the green light will flash on the top of the module, an error message in red text will appear above the register list if you are not communicating with the module.
6. Once communications is established, the following registers need to be set:

Register	Value	Notes
40006	124	Set the baud rate to 19,200 (Note the Modscan communications speed will have to be changed to 19,200 baud by “Disconnecting” and “Connecting” communications under the “Connection” tab.)
40007	50	Set the module Modbus address to 50 (Note the Device ID will have to be changed on the main Modscan screen to 50 after setting this register.)
40012	0	Turns all outputs off when communication fails or on power up.
40013	10	Sets the communications fault time to 5 seconds.

7. Once completed, the Modscan Connect and Main screens should indicate the following for registers 40006, 40007, 40012 and 40013:





The module is now ready for service.

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9. Appendix E – Commissioning Checklist

This checklist should be reviewed by the installer prior to commencing the project. Upon completion, the installer and facility owner should complete the checklist.

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Hazards Monitoring System Commissioning Checklist

To be completed before power is applied to the system

Sensor Wiring

- ☐ The field interconnect enclosures have been mounted in accessible locations and are securely affixed
- ☐ No holes have been drilled in the top of the field interconnect enclosures
- ☐ Only the sides of the field interconnect enclosure have been used for sensor connections
- ☐ Only the bottom of the field interconnect enclosure has been used for box to box connections
- ☐ The sensor network CAT5 cable is installed in conduit, or if direct burial cable is used, it is well strapped to prevent accidental damage during maintenance
- ☐ If metallic conduit is used for the box to box CAT5 cables and the metallic conduit system is directly attached to the field interconnect box, ensure the metal grounding plate has been installed in the bottom of the box
- ☐ The sensor network is fully divided from all other wiring and does not share any conduits or raceways with any other wiring such as the bus converter RS-485 wiring system
- ☐ If direct burial cable is used, verify the shields of the direct burial cable are clamped to the lugs provided in the field interconnect boxes
- ☐ All cable or conduit entries to the field interconnect box are tight and seal rings have been used on all connectors to prevent water ingress
- ☐ Sensor liquid tight conduit is strapped down to prevent accidental damage during maintenance
- ☐ Sensor conduit fittings are tight to prevent water leaks
- ☐ Bearing probes are adjusted 1/8” above the bearing race
- ☐ Rub block sensors are installed and have been inspected to ensure all possible off track belt and pulley events are sensed
- ☐ Rub block brackets are installed using wing nuts and locked screws to allow for inspections
- ☐ Speed sensors are mounted securely to the machine shaft and reasonably on center
- ☐ Speed sensor liquid tight conduit is fixed to the machine a minimum 2’ from the sensor to prevent damage during maintenance
- ☐ The punch down connections have been double checked for accuracy
- ☐ All branch disconnect switches in the field interconnect boxes are off
- ☐ All sensors are installed but not plugged into the field interconnect connectors
- ☐ The machinery commissioning sheets are complete and all serial numbers have been recorded

Bus Converter Wiring

- ☐ Bus converters have been mounted in accessible locations and are securely affixed
- ☐ All bus converter RS-485 network cabling is installed in a suitable raceway or conduit system for Class II, Group G, Division 1 or 2 as required for the facility

- ☐ The network is installed in its own raceway or conduit or if installed with other low voltage (24VDC or lower) cables those cables are verified not to cause interference with the RS-485 network
- ☐ The correct conduit entries are used for the RS-485 and sensor network cables as shown in the mBC081 Technical Manual
- ☐ All conduit connections are tight to prevent water ingress
- ☐ The bus converter connection to the field interconnect box use metallic conduit and connectors and that all connectors to the field interconnect enclosure have sealing rings
- ☐ The field interconnect box where the bus converter connects has the metal grounding plate installed in the bottom and the ground screw installed connecting the plate to the circuit board
- ☐ The RS-485 cable is correctly sized using the CMC cable sizing utility for the length of cable used
- ☐ The RS-485 wiring is installed as shown in the mBC081 Technical Manual and the connections double checked
- ☐ The RS-485 network is connected at the EZSentinel128 or WS1 Webserver, and that the connections are as described in the Installation and Technical Manuals
- ☐ The address and network termination switches for each bus converter and the HMI are set as shown in the mBC081 Technical Manual

To be completed after power is applied to the system

Bus Converter Network

- ☐ Configure the EZSentienl128 or WS1 as described in the Installation or Technical Manuals and ensure the correct number of bus converters has been selected if the EZSentiel128 is used
- ☐ Starting at the first bus converter on the network, verify that both the red and green LED are flashing on the bus converters
- ☐ If the red or green LED is not flashing, remove power and verify the wiring for the bus converter network and the address switch and termination settings on the HMI and bus converters

Sensor network

- ☐ Starting with the field interconnect box where the bus converter connects, verify that the red and green LED inside the field interconnect or are on
- ☐ If sensors are present in this box, connect the sensors one at a time and verify the LED’s remain on
- ☐ Turn on the Branch A disconnect and verify the red and green LED remain on
- ☐ If one or more of the LEDs go off, verify the wiring between the field interconnect boxes
- ☐ Move to the field interconnect on Branch A and repeat ensuring that the red and green LED remain on after each operation
- ☐ Repeat the procedure until all sensors have been connected and all branches in use are verified

To be completed after system configuration

Verifying sensor location on the HMI

Full details on the HMI configuration are provided in the Installation and Technical Manuals for the EZSentinel128 and the WS1. For each sensor the following minimum verification should be completed

- ☐ For temperature sensors locate the sensor value on the HMI display
- ☐ The sensor should be displaying ambient temperature
- ☐ Spray cold spray on the physical sensor and ensure the HMI value changes downward when the cold spray is deployed
- ☐ If the temperature value is displayed in multiple locations on the HMI ensure all of the locations are linked to the correct sensor
- ☐ For speed sensors use a handheld tachometer to verify the speed displayed on the HMI is the same as the shaft speed for the machine being monitored
- ☐ Stop and start the machine while observing the display to ensure the speed sensor is linked to the correct speed display
- ☐ Repeat the above test for all sensors on the system

Alarm Test

This section only applies to the EZSentinel128. For WS1 systems, the systems integrator will have designed a test procedure for the alarming system supplied. The integrators test procedure should provide at minimum the functionality described in this section. The machine under test must be running when these tests are performed if direct machinery control is configured on the EZSentinel128.

- ☐ For each sensor, using the “Alarm Test” function on the EZSentinel128, force a warning condition by setting the sensor value at or above the warning setpoint for temperature sensors or at or below the low speed warning setpoint for speed sensors
- ☐ The correct alarm annunciator should be indicated on the alarm test screen and the horn should sound
- ☐ For each sensor, using the “Alarm Test” function on the EZSentinel128, force an alarm condition by setting the sensor value at or above the alarm setpoint for temperature sensors or at or below the low speed alarm setpoint for speed sensors
- ☐ The correct alarm annunciator should be indicated on the alarm test screen (note the warning indicator will also be set) and the horn should sound
- ☐ In addition to the horn sounding, if configured, the machine and all machines interlocked to the primary machine controlled by the EZSentinel128 must stop
- ☐ This test is repeated for each sensor installed on the system

We the undersigned agree that the above basic commissioning requirements have been met. We also agree that the responsibility for safe operation of the facility rests solely with the facility operator. Monitoring systems require frequent inspection and verification. It is the facility operator's sole responsibility to ensure the monitoring system is fully operational and regularly inspected.

_____ _____

Installer Signature **Facility Operator Signature**

_____ _____

Print Installer Name **Print Facility Operator Name**

_____

Company

_____

Site name

_____

Address

_____

City

_____

State/Province, Postal code

_____

Date