



SYS-1

(Version 00.15)

Motion / Zero Speed Monitoring System



Manual and Installation Guide

**READ THIS ENTIRE GUIDE BEFORE
PROCEEDING WITH THE INSTALLATION**

Boone Cable Works & Electronics
1773 – 219th Lane - Boone, IA 52623
800-265-2010 ♦ 515-432-2010 ♦ 515-432-5262 (Fax)
www.rolfesatboone.com ♦ Revision IV, Spring 2017
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1.0 Introduction

Thank you for purchasing the Rolfes@Boone's SYS-1 Motion / Zero Speed Monitoring System. This manual is presented as a reference for the installation and operation of this system.

Rolfes@Boone offers a comprehensive line of motion monitoring equipment. The complete product range and extensive systems experience allows us to offer effective solutions to a wide spectrum of your practical requirements. Our extensive background in motion monitoring along with a constant program of innovation and technological development, allows us to offer cost-effective and user-orientated solutions.

Please read all instructions for this and any other system prior to installation to better understand its operation.

☞ NOTE: Rolfes@Boone will not be responsible for damages caused by any hardware or equipment which has not been supplied by Rolfes@Boone.

If you need assistance with any item in this manual, please call or write:

Rolfes@Boone
 A division of
 Boone Cable Works & Electronics
 1773 – 219th Lane
 P.O. Box 429
 Boone, IA 50036
www.rolfesatboone.com

800-265-2010	Toll Free
515-432-2010	
515-432-5262	FAX

2.0 Overview

The SYS-1 Motion Monitor measures *boot or tail* shaft RPM to detect belt slip or slowdown in bulk handling equipment. The system has been designed to work in a variety of equipment configurations.

The system has a number of features that make it an attractive choice for monitoring equipment RPM. Operation of the SYS-1 is simple. Once it has been setup and tested, it will generally not need to be changed again. Should any equipment parameters change, the system should be checked to ensure its operation is compatible with the equipment changes.

The SYS-1 monitor provides:

Alarms: Low speed and high-speed alarms can be set at a percentage of a nominal drive speed or it can be set to a specific RPM. Should the system drive get outside of the nominal speed range, the internal alarm will sound indicating a warning condition. The alarm can be enabled or disabled during configuration.

Shutdown: Low speed and high speed shutdown points can be set at which point the SYS-1 shutdown relay will interrupt power to the drive, shutting it down safely. Shutdown speeds can be set as a percentage of the nominal speed or set to a specific speed. Usually, the shutdown speeds are set outside the alarm range. This provides a system operator time to handle the warning condition before a shutdown occurs.

Monitoring Modes: There are three monitoring modes that are available. In POWER-UP monitoring mode, the SYS-1 is connected to the same power source as the drive motors. When the drives start, the SYS-1 starts operation as well. In RUN SIGNAL monitoring mode, the SYS-1 monitors the power to the equipment drive and only monitors the RPM when the drive is running. In PLC monitoring mode a remote PLC can signal to the SYS-1 when to monitor the equipment drive. These modes provide significant flexibility for integrating the SYS-1 into your equipment.

Startup Delay: A delay can be specified before equipment monitoring begins. This delay allows the drive to reach its nominal speed. Monitoring the speed before it reaches normal conditions could cause premature alarms or system shutdowns.

Network Support: If the SYS-1 is connected to a network, it can be integrated to a PLC using MODBUS support. A PLC using MODBUS can examine system parameters such as alarms, shutdowns, and system RPM. Furthermore, the PLC can issue alarms and shutdowns. The SYS-1 also serves a webpage showing the system status. This is useful for remotely monitoring equipment operation.

Testing Capability: The SYS-1 can be tested with an external speed test pendant or from configuration menus. Both are described below. The speed pendant is the best choice for testing since it is an external test system that simulates the pulses that would be coming from the shaft sensor. You are encouraged to have a pendant for testing during installation.

3.1 Theory of Operation

The SYS-1 is designed to monitor equipment that must operate at a constant speed. A shaft encoder connected to the equipment provides a fixed number of pulses per revolution. These pulses are counted by the SYS-1 and converted to a speed in revolutions / second (RPM). The SYS-1 checks the speed of the equipment every half second.

Alarm and shutdown parameters can be provided to the SYS-1 during configuration. These are continuously compared to the current speed of the equipment. If the speed gets above or below the thresholds set for the alarm condition, a warning alarm is sounded to inform the operator of the speed condition. Should the speed of the equipment get above or below the thresholds set for the shutdown condition, the system will shut down the equipment.

The system operates in the following manner:

Power Up: On power up, the system initializes itself. The alarm relay is shut off and the shutdown relay is engaged, allowing the equipment to start up. This initialization takes less than 3 seconds.

Run Wait: After initialization, the system waits for a run condition. Depending on the mode that the system is running in determines when a run condition occurs. Following are descriptions of each of the modes.

- **POWER-UP Mode:** In this mode, the simple fact that the SYS-1 has power is the indication that the system is running and should be monitored. The power for the SYS-1 is connected to the power for the equipment drive. Whenever the SYS-1 is on, it will be in a run condition.
- **POWERED Mode:** This mode has the SYS-1 powered independently from the equipment drive. For the SYS-1 to know that the drive shaft is running, a signal is provided whenever the drive is running. The SYS-1 will monitor the signal waiting for the drive to start. Also called LOCAL RUN ENABLE mode.
- **PLC RUN Mode:** As with RUN INPUT Mode, the SYS-1 is powered independently of the equipment drive. In this case however, the SYS-1 is notified of the equipment running from a PLC that sets the run bit in the SYS-1 PLC register space. The SYS-1 will wait for a PLC to set this bit.

The SYS-1 will simply wait until a run condition is detected. If a run condition is not present, the LCD will display "OFF".

The SYS-1 can also be placed in a "Disabled" mode. In this mode, it will not monitor the speed and compare it to the alarm and shutdown thresholds. It will allow the equipment to run.

Monitor Delay: Once a run condition is detected, the SYS-1 begins a waiting period while the equipment drive comes up to its nominal operating speed. During this time, the SYS-1 will delay issuing any alarms or shutdown conditions. It does not start monitoring the speed until the delay period is complete.

Speed Monitoring: After the monitor delay, the SYS-1 assumes that the equipment has reached its operating speed and it begins to monitor the speed and compare it to the alarm and shutdown speeds specified. It will stay in this mode as long as the run condition is present. If the run condition goes away, the SYS-1 will return to the **Run Wait** mode waiting for the run condition again.

Alarm Activation: If the speed reaches either the low or high alarm threshold, the SYS-1 will activate the alarm. The internal alarm in the SYS-1 will be on. Any external alarms that are wired into the SYS-1 will also be activated. The system continues to monitor the speed. When the SYS-1 returns to a normal operating speed, the alarm condition is removed. The alarm has a 3 second delay before it shuts off. During an alarm condition, the RPM display will flash.

System Shutdown: Should the equipment speed reach the low or high shutdown threshold, it will shut off the equipment by interrupting the power in the starter circuit. This is effectively what the equipment stop button would do for a shutdown. The SYS-1 will keep the shutdown condition until the run condition goes away. At that time, the operator may restart the system. The SYS-1 returns to waiting for a run condition once the previous run condition has gone away. During a shutdown condition, the display on the SYS-1 will show "OFF".

4.0 SYS-1 Components



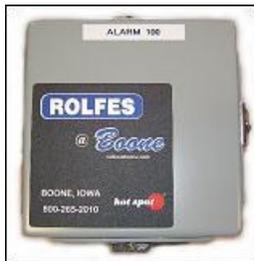
SYS-1

The SYS-1 is the main instrument in the Motion Monitoring System. This instrument has a large LCD display for viewing shaft RPM's and will send the alarm / shutdown commands when necessary.

The MS-200 Motion Sensor inputs the shaft RPM's to the SYS-1. This is mounted on the tail or boot shaft of the equipment being monitored.



MS-200



ALARM-100

ALRM-100: Receives the alarm command from the SYS-1 to alert operators of a slowdown condition, this unit powers the siren.

The Dual-Tone Siren has a weather-proof case and has alerting capabilities for multiple systems.



DUAL TONE SIREN



SPEED PENDANT

The Speed Pendant is a testing device intended to simulate RPM's for the SYS-1 instrument for alarm and shutdown of equipment.

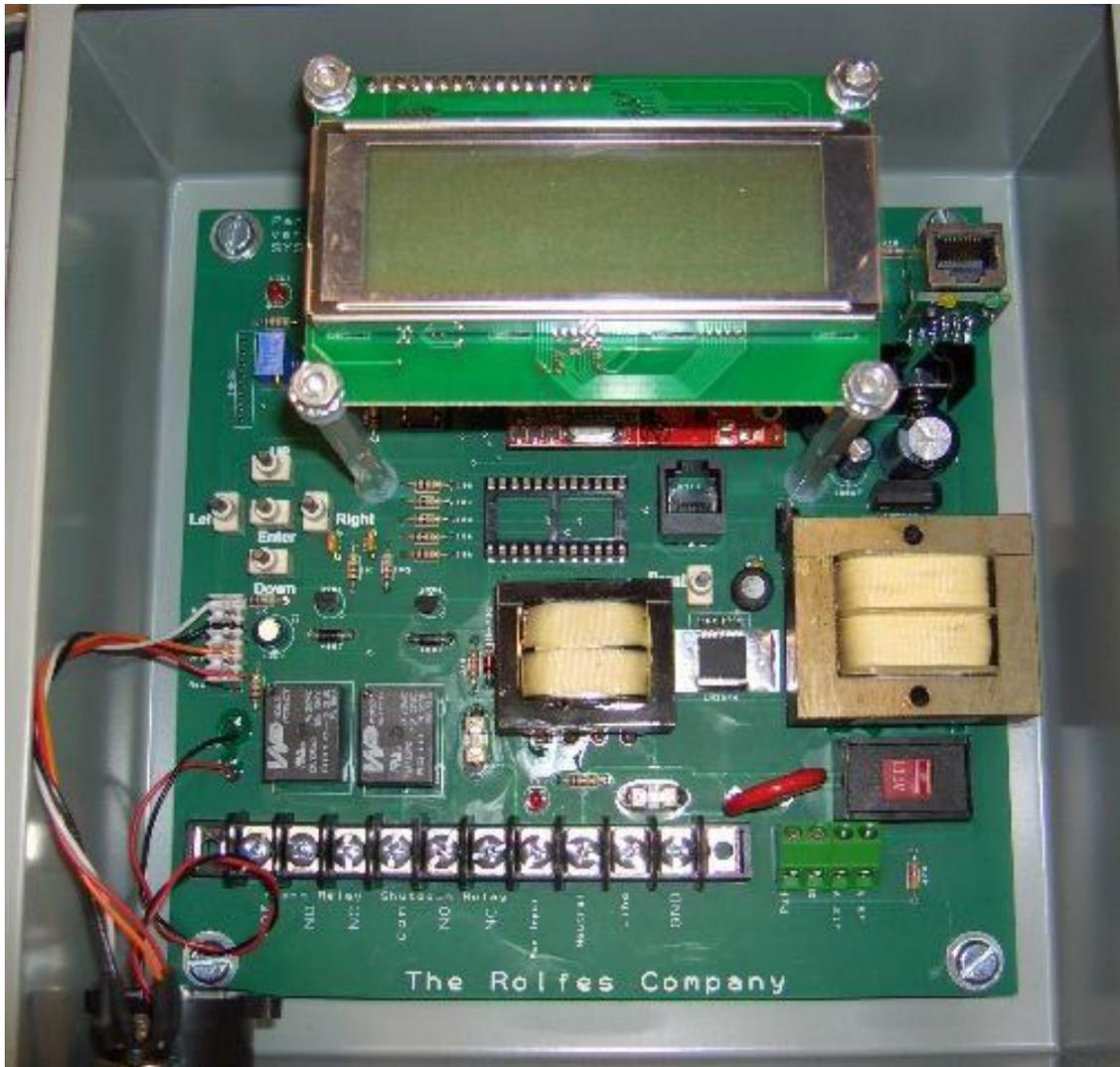
SPL-10 crimps are provided to aid in making splices or connections.



SPL-10

5.0 Instrumentation & Controls

The SYS-1 uses a bold face Liquid Crystal Display (LCD). This is for the ease in reading the shaft RPM's on the equipment it's monitoring.



The controls for the SYS-1 are on the inside of the unit. Once the SYS-1 is setup for operation, the door is secured and no other adjustment should be needed. In other words; once set - forget about it, the system will tell you of any problems and take the appropriate action to prevent any hazard.

5.1 Sensor LED

The Sensor LED is in the upper left corner of the SYS-1 Control Board. When this LED is illuminated (on), it shows that the motion sensor is operating.

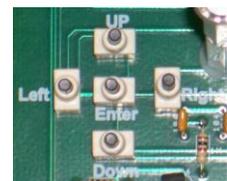


5.2 Run LED

The Run LED is located in the lower middle of the board. It will be illuminated when the 110 VAC RUN signal is on. This indicates to the SYS-1 that the drive system on the equipment to be monitored is active.

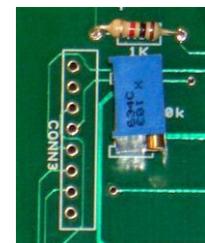
5.3 Configuration Buttons

The SYS-1 contains 5 buttons. These buttons are used for setting the configuration options on the SYS-1. The buttons are labeled UP, DOWN, LEFT, RIGHT and ENTER.



5.4 Display Contrast

The potentiometer on the upper left of the SYS-1 control board allows for adjustment of the LCD display contrast. Once the system is powered up, adjust this so that the display can be seen from a normal viewing position.



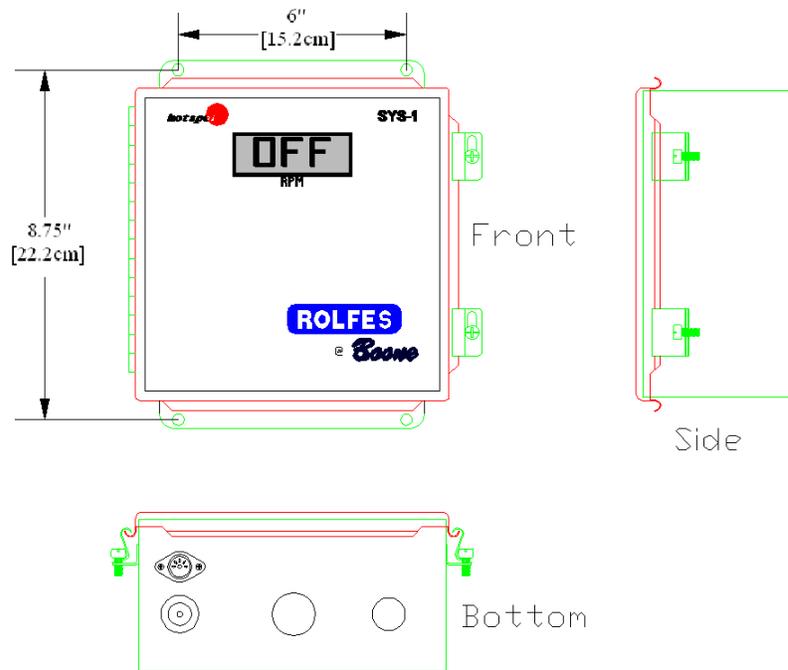
6.0 Installation

The SYS-1 instrument is a vital piece of equipment for the safety and smooth operation of your facility. Please use good judgment when choosing an installer.

The SYS-1 shall only be installed or used in **non-hazardous** locations. Hazardous locations are defined by the National Electrical Code in Article 500, under special occupancies.

6.1 Mounting the SYS-1 Instrument.

The SYS-1 instrument should be mounted near the equipment's start / stop station. Mount the instrument securely and in accordance with any local or regional codes. Use the diagram below as a reference for mounting dimensions.



NOTE: Use of conduit is highly recommended, but not required for proper function of the instrument. **HOWEVER**, with that in mind, make all cabling (CCL-318 & CAT-5) runs well clear of other power lines to prevent signal interference. **DO NOT** run SYS-1 cabling in power trays for this will interfere with the input signal generated from the MS-200 and could interfere with the network operation. **DO NOT** run SYS-1 cabling in conduit with any other lines either power or signal.

With the use of dedicated conduit, all cabling is protected against damage and improper equipment shutdown.

Conduit and cable runs should be made from the MS-200 (mounted on the boot or tail shaft) and from the start/stop station to the SYS-1. Follow any local or regional electrical codes.

6.2 Electrical Connections

The SYS-1 has been set to your voltage specification at the factory, either 120 VAC or 240 VAC. Please contact your representative if this is incorrect. Rolfes@Boone is not responsible for installing the wrong voltage to the SYS-1.

The SYS-1 can be wired for two different modes of operation; POWER-UP mode or POWERED mode. Which mode will be used determines how the system will be wired to the equipment it will be monitoring.

POWER-UP MODE: In this mode, the SYS-1 is wired so that it is powered up at the same time as the drive system on the equipment being monitored. When the drive is activated, the SYS-1 is powered up. A preset delay will determine when monitoring of the speed actually begins.

POWERED MODE: This mode leaves the SYS-1 powered independently of the equipment's drive motors. In this case, the SYS-1 needs to know when the drive is running. A run input is provided for this purpose. Alternatively, a PLC connected via MODBUS can signal the SYS-1 when to start and stop monitoring.

This section provides instructions for wiring the system for each of the modes.

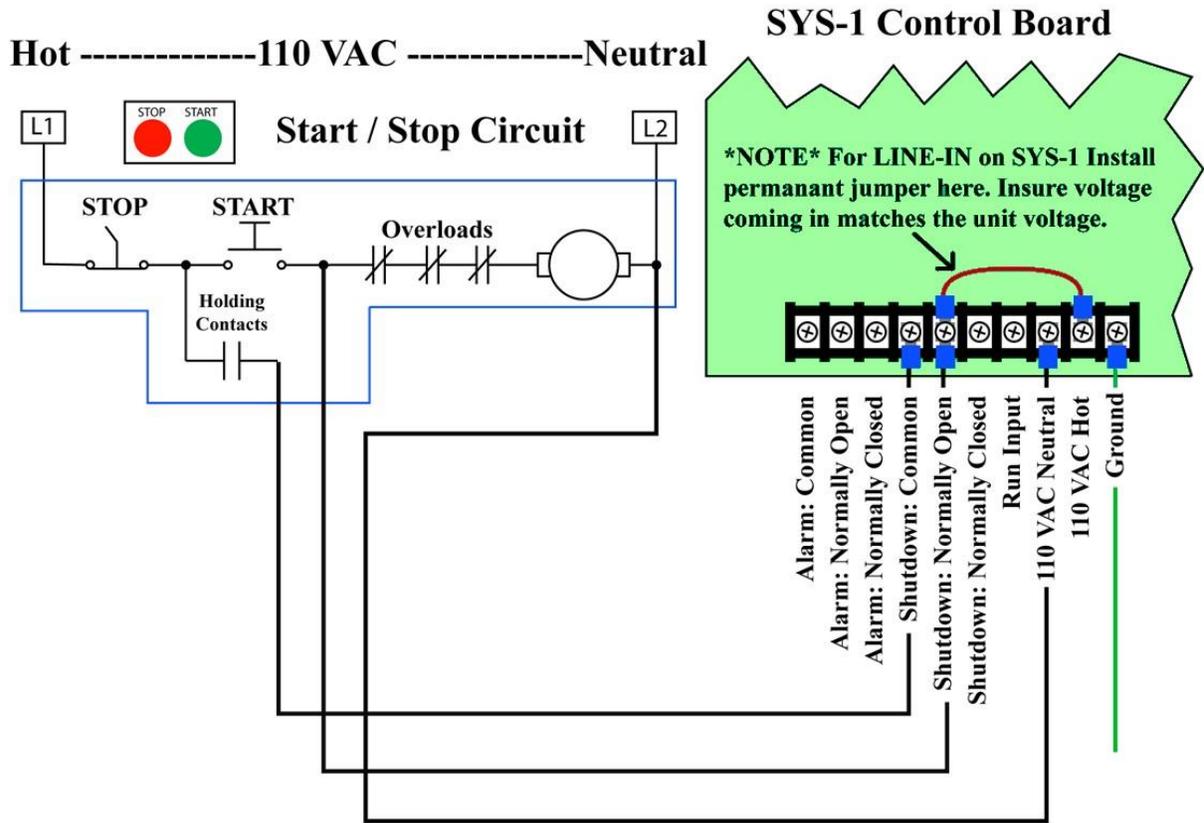
6.3 POWER-UP Mode Electrical Connections

In POWER-UP mode, the SYS-1 draws its power from the same circuit as the equipment drive. On start-up of the drive, the SYS-1 gets powered. When a shutdown condition is detected, the SYS-1 interrupts power to the drive, shutting down the drive AND the SYS-1.

The holding contacts should hold the power to the drive for 3 seconds to ensure that the SYS-1 engages the shutdown circuit.

6.3.1 120/240 VAC Connections

View the drawing below as a reference for your facility's voltage layout. Please observe the voltage specified on your SYS-1 prior to installing electric service to the SYS-1.



NOTE: All electrical connections are to be made by a licensed electrician and in accordance with any local or regional electrical codes.

6.3.2 Line-In Jumper

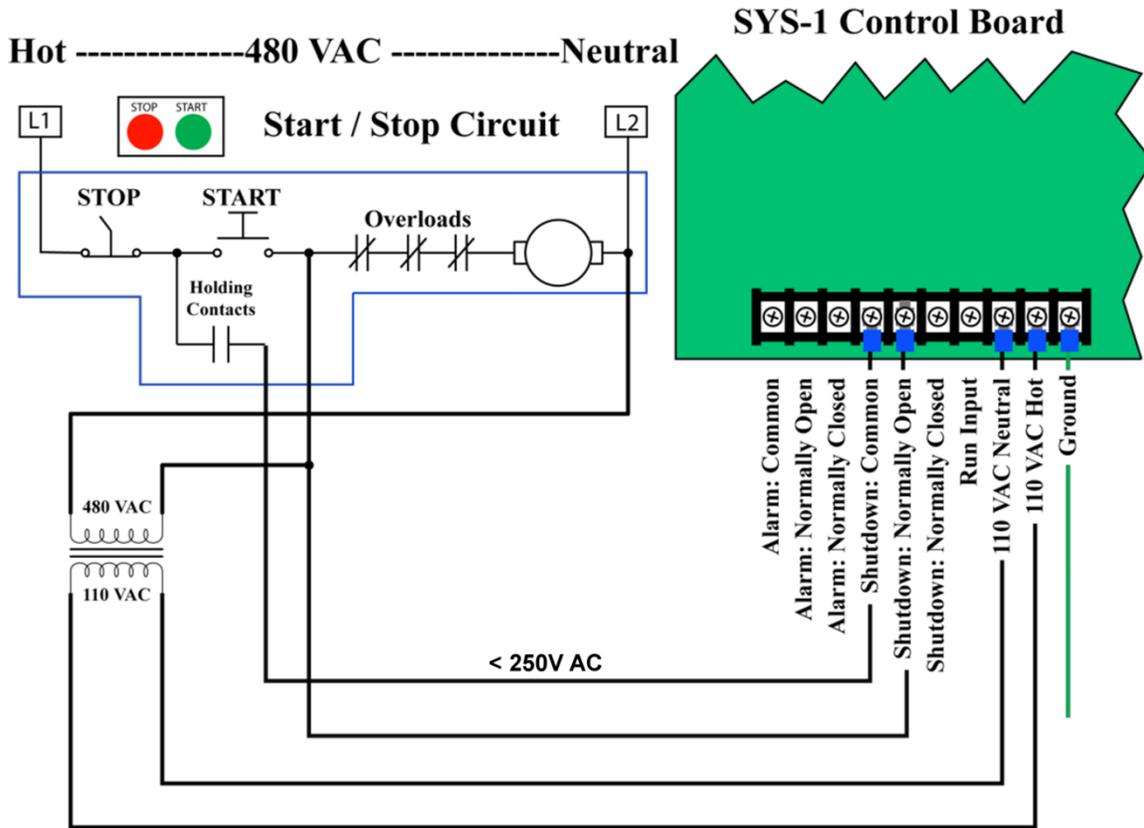
To power the SYS-1, install a jumper (not included) between the normally open contact and the line-in positions on the terminal strip. This will allow the SYS-1 to power-up when the equipment is energized and to power-down when that piece of equipment is shutdown.

WARNING: ASSURE the voltage coming in from the NORMALLY OPEN contact is the same, as the SYS-1 requires. E.G. If the voltage required for SYS-1 to operate is 240VAC the incoming voltage is required to be 240VAC.

6.3.3 480 VAC Connections

For facilities with 480 VAC that wish to install the SYS-1, to accommodate this please use the following drawing as a reference.

NOTE: All electrical connections are to be made by a licensed electrician and in accordance with any local or regional electrical codes.



NOTE: Transformer and any hardware not included; supplied by the customer or installer.

WARNING: ASSURE the voltage coming in FROM the Transformer is the same as the SYS-1 requires. E.G. If the voltage required for the SYS-1 is 120VAC, you will need a transformer that is rated at 120VAC.

6.4 POWERED Mode Electrical Connections

In POWERED mode (or LOCAL RUN ENABLE mode), the SYS-1 is powered independently of the equipment drive. When a shutdown condition is detected, the SYS-1 interrupts power to the drive, shutting it down.

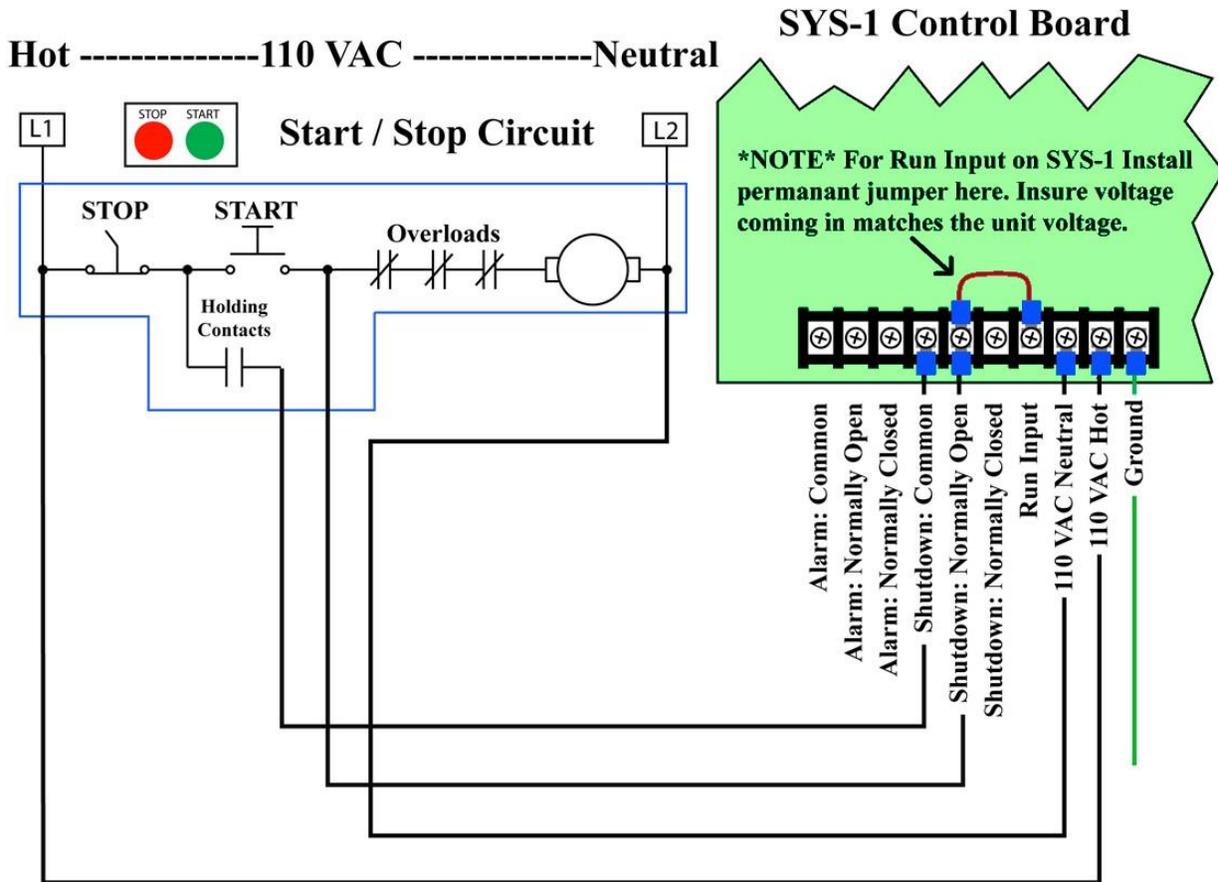
6.4.1 RUN Signal

When running in POWERED mode, the SYS-1 needs an additional signal that indicates when the equipment drive is running. This is a 110 VAC input that connects to the RUN terminal of the SYS-1. It is shown in the following diagrams.

The RUN Input signal is not necessary if drive status is sent to the SYS-1 over the MODBUS network.

6.4.2 120/240 VAC Connections

View the drawing below as a reference for your facility's voltage layout. Please observe the voltage specified on your SYS-1 prior to installing electric service to the SYS-1.



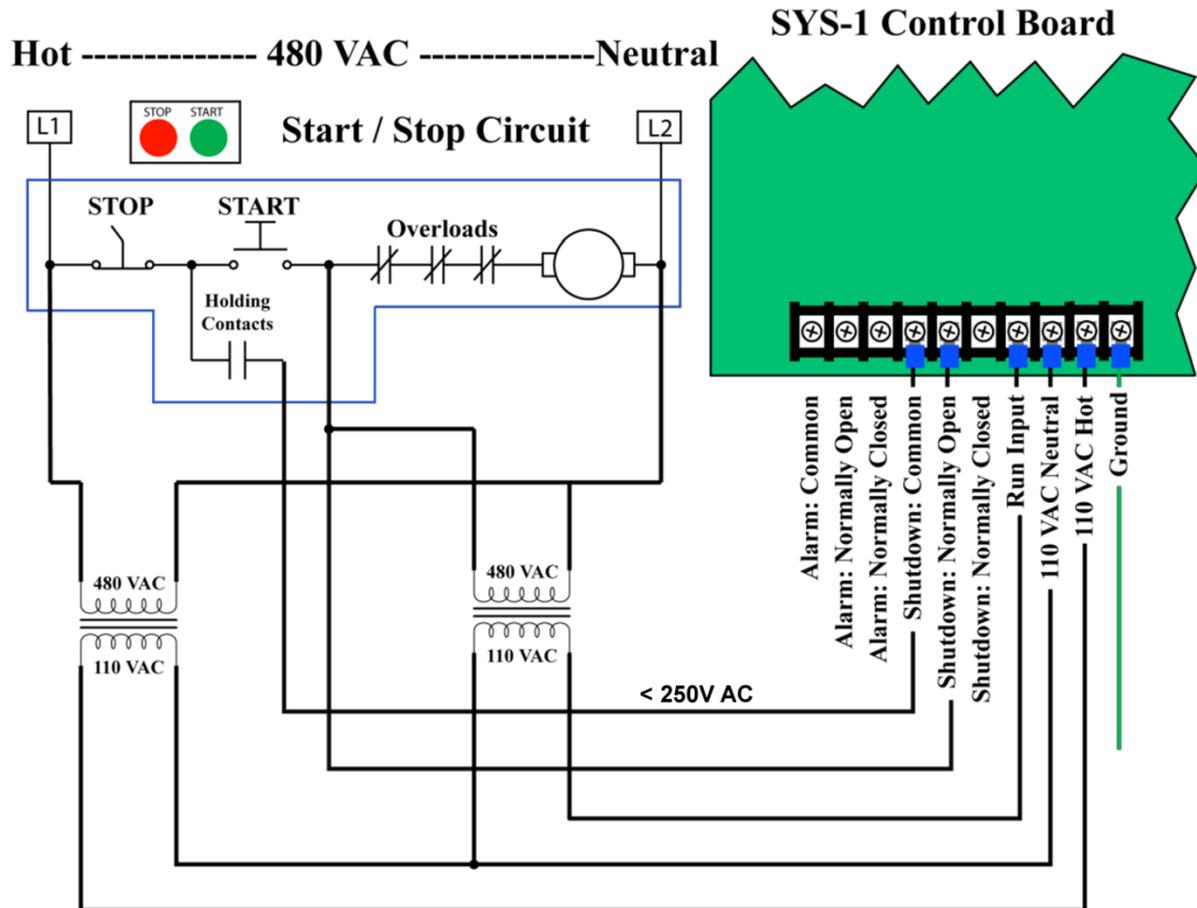
NOTE: All electrical connections are to be made by a licensed electrician and in accordance with any local or regional electrical codes.

WARNING: ASSURE the voltage coming in from the NORMALLY OPEN contact is the same as the SYS-1 requires. E.G. If the voltage required for SYS-1 to operate is 240VAC the incoming voltage is required to be 240VAC.

6.4.3 480 VAC Connections

For facilities with 480 VAC that wish to install the SYS-1, to accommodate this please use the following drawing as a reference.

NOTE: All electrical connections are to be made by a licensed electrician and in accordance with any local or regional electrical codes.



 **NOTE:** Transformer and any hardware not included; supplied by the customer or installer.

 **WARNING:** ASSURE the voltage coming in FROM the Transformers is the same. as the SYS-1 requires. E.G. If the voltage required for the SYS-1 is 120VAC, you will need transformers that are rated at 120VAC.

7.0 Alarm & Siren

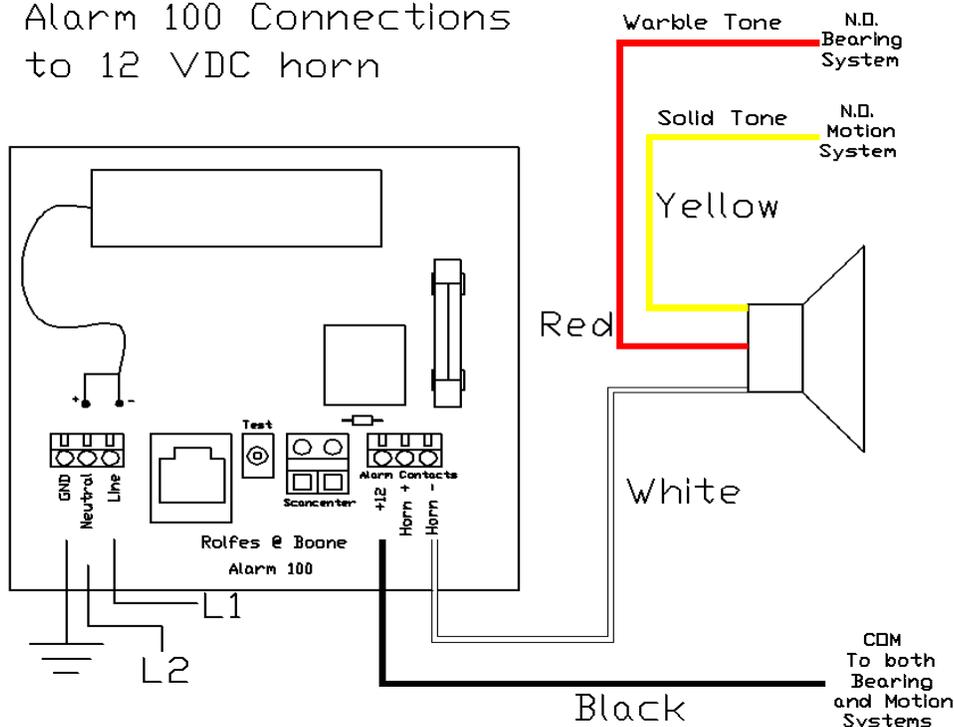
The recommended alarm for the SYS-1 system is the ALARM-100. This ALARM-100 is easily installed and should be mounted near the SYS-1 with the SIREN mounted where it will be noticed or heard clearly by any operators.

Use good judgment when locating an area for the SIREN; you don't want it to be too close to your operators, OR too far away from your operators to hear it over the noise of the equipment.



DUAL TONE SIREN

Alarm 100 Connections
to 12 VDC horn



The diagram above shows two different monitoring systems and one ALARM-100 controller using the dual tone capability of the siren (i.e. Motion system & Bearing system).

NOTE: If your facility has only one monitoring system, OMIT one of the System leads in the diagram above.

USE DRY CONTACTS ONLY (no voltage on lines going to or from these systems).

Siren Tones	
Yellow	Solid
Red	Wave
White	Common



WARNING: The ALRM-100 is rated at 120VAC ONLY. If your facility requires 240VAC, install a 240VAC to 120VAC transformer / converter. Contact your sales representative if you require a transformer / converter.

8.0 MS-200 Sensor Installation

The SYS-1 system monitors the status of your bulk handling equipment directly from the shaft speed. The main sensor that achieves this is the MS-200-60 Motion Sensor.

The MS-200 is a self-contained unit that mounts directly on the shaft to be monitored, simplifying installation. The standard MS-200 motion sensor generates 60 digital pulses @ 1.6 volts output per shaft revolution and operates from 5VDC power. Detection speeds of up to 500 RPM's are possible.

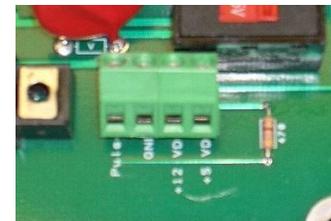
The MS-200 is designed for extreme conditions and rigorous applications and has an operating temperature of -50°F to 150°F. All electronics are enclosed in a corrosion-resistant machined aluminum housing that is dustproof and water resistant.

Sensor can be located up to 500 feet from the SYS-1 with simple 4 wire connections (ground included) and requires no routine maintenance.



The MS-200-60 wires connect to the green 4-point terminal strip at the bottom right of the SYS-1 board.

- | | |
|--------------------|----------------------|
| White - Pulse | Red - +5 VDC |
| Black - Ground | Green - Earth Ground |
| Not Used - +12 VDC | |

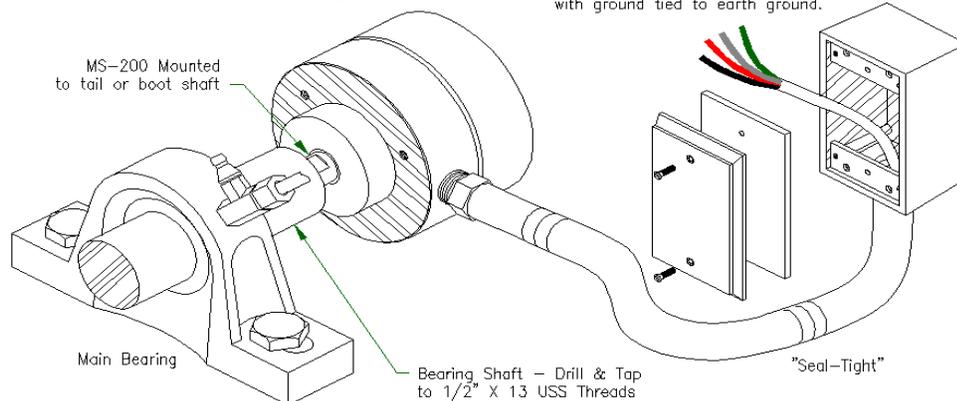


8.1 Sensor Mounting

To mount the MS-200;

1. Drill and tap the center of the *BOOT / TAIL* shaft to 1/2" x 13 threads x 1 1/2" deep.
2. Mount the MS-200 and tighten the locking nut to secure the unit.
3. Use "Seal-Tight" from the sensor to the junction box for the control lines.
4. Make terminations and secure junction box.

Make all connections in junction box, with ground tied to earth ground.



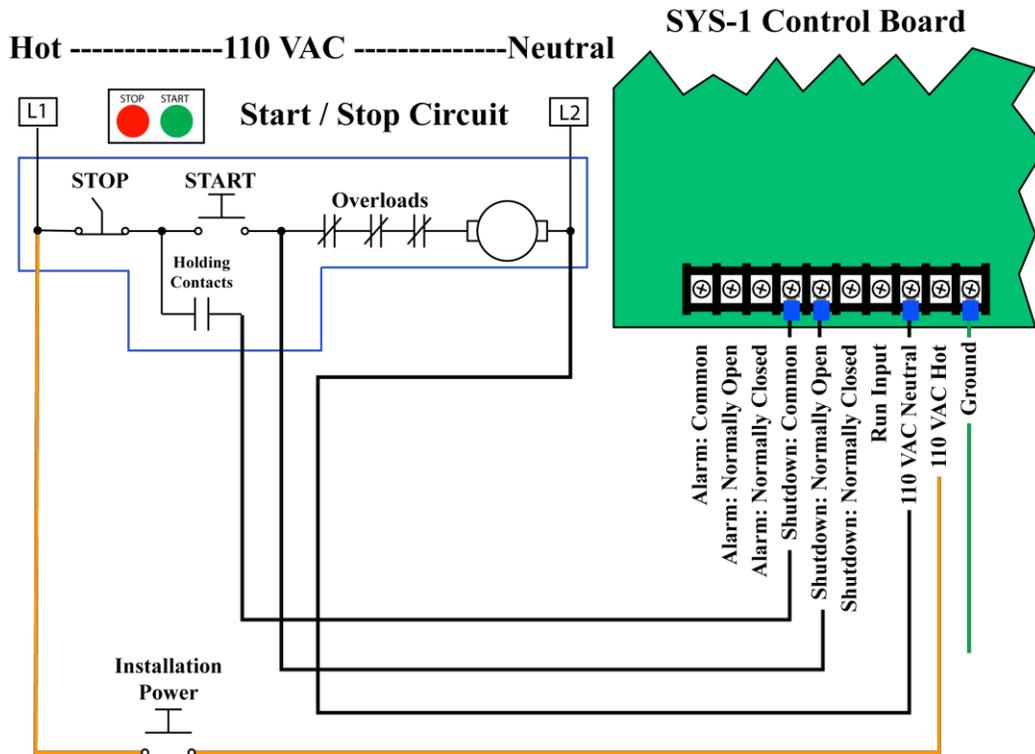
9.0 Configuring the System

The SYS-1 can be fully configured to meet the needs of the equipment to be monitored. There are two methods for configuring the system. The first is only available if your system is operating in the “POWER-UP Mode”. It’s a quick way to set the parameters and is also compatible with earlier versions of the SYS-1. The second method provides more flexibility and is recommended for new installations.

9.1 POWER-UP Mode Configuration

9.1.1 Powering Up the System

Before configuring the system make sure that all wiring has been completed and checked. This mode requires some special wiring only for configuring the system. Once the system has been installed, the wiring should be done as shown in the electrical diagrams earlier. The following diagram shows wiring necessary for installation when running in this mode.



The orange wire on the diagram shows a temporary wire to supply power to the SYS-1 without needing to power up the equipment drive. NOTE: The jumper for normal installation must also be removed!

9.1.2 Pulse Input Setting:

The SYS-1 has the capability of using several different impulse settings in this quick setup mode. Setting can be 1, 60 or 256 (pulses per second). Factory setting for the SYS-1 is 60. If a sensor is being used that requires a different number of pulses per second use the full configuration method detailed later.

To cycle impulse settings:

1. Press and hold the **ENTER** button.
2. Power-OFF the SYS-1.
3. Release the **ENTER** button and Power-ON the SYS-1.
4. When power is reapplied to the SYS-1 the display will flash its current setting. (i.e. 60)
5. Repeat this procedure to cycle through the settings (1, 60 or 256 pulses per second).

9.1.3 Startup Delay Setting

When power is applied to the equipment being monitored, the SYS-1 is also powered up and is monitoring the shaft RPM's. The *startup delay time* keeps the SYS-1 in stand-by mode and allows the equipment being monitored to reach normal operating speed.

Without calibrating the *startup delay time*, incorporated into it, the SYS-1 would alarm and shutdown the equipment you are trying to monitor. This is to protect against false warnings and equipment shutdown before the leg reaches operational speed.

Calibrating the startup delay time will equal the amount of time the *set button* is held and is required to be set only once.

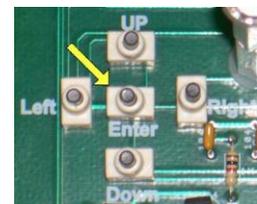
The following procedure will set the startup delay time for your equipment. Have a timer available to measure and set the delay.

EXAMPLE:

Press & Hold Set Button	Start-up Delay
15 Seconds	15 Seconds
30 Seconds	30 Seconds

1. Power-up the equipment to be monitored and achieve normal operating speed. Time how long it takes to reach its normal RPM.
2. Power-OFF the SYS-1 (via the momentary switch).
3. Press and hold the **ENTER** button.

*NOTE: The amount of time that you hold the **ENTER** button down AFTER the instrument is powered back on will establish the **STARTUP DELAY**. This delay should slightly exceed the amount of time that the leg takes to reach normal operating speed.*



4. Power on the SYS-1 (**ENTER** button still pressed).

5. When the desired amount of “*Startup*” time has elapsed release the **ENTER** button. You will hear two beeps to notify you that the *STARTUP DELAY* has now been set.
6. Wait for the unit to sound three more beeps (approx. 10 seconds). This signals that the unit has finished programming itself, and is ready for use.

The monitor startup delay and normal operating RPM may be reset at any time. Just follow the preceding programming instructions to reset the startup delay and normal operating RPM.

9.1.4 Normal Operating RPM

In setting the startup delay you have already set the normal operating RPM. When you release the ENTER button after setting the startup delay, the monitor will sound two beeps. During the next 10 seconds, the SYS-1 is counting the shaft RPM's.

The alarm will then sound three beeps to indicate when the monitor has completed counting. This establishes the normal operating RPM of the shaft. The monitor then saves and uses this information as the normal operating RPM as a standard to calculate the percentage of belt slip and slowdown.

 *NOTE: When setting the standard operating RPM it is suggested to have the leg operating at capacity.*

9.1.5 Alarm and Shutdown Speeds

The alarm and shutdown speeds are set to +/-10% and +/-20% respectively. Should other alarm and shutdown parameters need to be used, they may be set using the configuration methods detailed later.

9.1.6 System Testing

The system may be tested using a speed pendant as shown in section 10.0 Testing. This is highly recommended to insure that the system is operating correctly and that alarms and shutdown will occur as expected.

Change the system wiring back to the standard wiring for normal operating conditions. Make sure that the system powers up properly and begins monitoring the RPM of the equipment.

9.2 Standard System Configuration

These procedures are recommended for configuring the SYS-1. Prior to performing the configuration you should have the following information available:

- Nominal Speed of the Equipment in RPM's
- Alarm Low and Alarm High Speeds
- Shutdown Low and Shutdown High Speeds

- Mode Of Operation

If you are going to be using the network capabilities of the SYS-1 such as access to the Web Page or MODBUS capabilities, you will need the following information as well:

- TCP/IP Network Address
- TCP/IP Network Mask
- MODBUS License Key
- MODBUS Port Number

This information is described in more detail later.

If the SYS-1 is wired for POWER-UP mode you may want to temporarily wire it as described in section 8.1.1.

Appendix A contains a reference chart showing the menus used to set the various system parameters. Refer to this chart along with the following procedures for performing the configuration.

9.2.1 Factory Default Settings

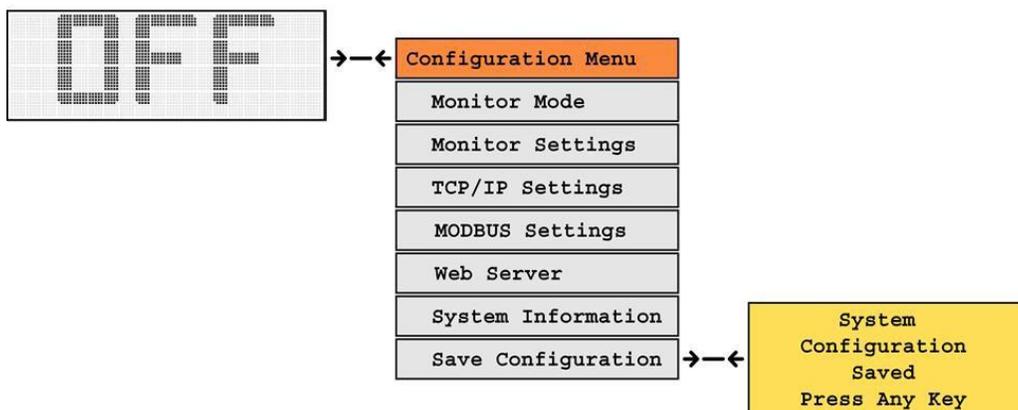
While the SYS-1 is delivered with factory defaults, these should be changed to the specific settings needed for your system. If you need to return to factory defaults, this can be accomplished using the following procedure:

1. Press and hold the **UP**, **DOWN**, **LEFT** and **RIGHT** buttons.
2. Power up the **SYS-1**.

The SYS-1 will now be set with the factory default settings.

9.2.2 Saving System Configuration

Once you have configured the system as described in the following procedures, you will need to save these settings to flash memory. This should be done **AFTER** you have followed the procedures below to set the parameters. Once they are stored, you will not need to enter them again.

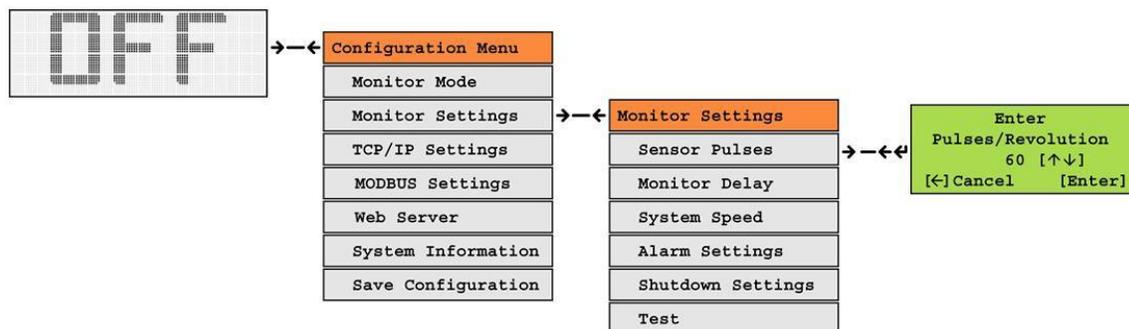


To save the configuration settings:

1. From the RPM display, press the **RIGHT** button. The configuration menu should now be visible.
2. Press the **DOWN** button until the cursor ">" is at the start of the line that says "Save Configuration".
3. Press **ENTER** to save the current settings. The display will confirm that the settings have been saved.
4. Press **ANY KEY** to return to the configuration menu.
5. Press **LEFT** to return to the RPM display.

9.2.3 Setting Pulses per Revolution

In order for the system to report the correct RPM in the display, the number of pulses per revolution from the sensor must be entered. If you are using the MS-200, this number is 60 and it is the factory default.

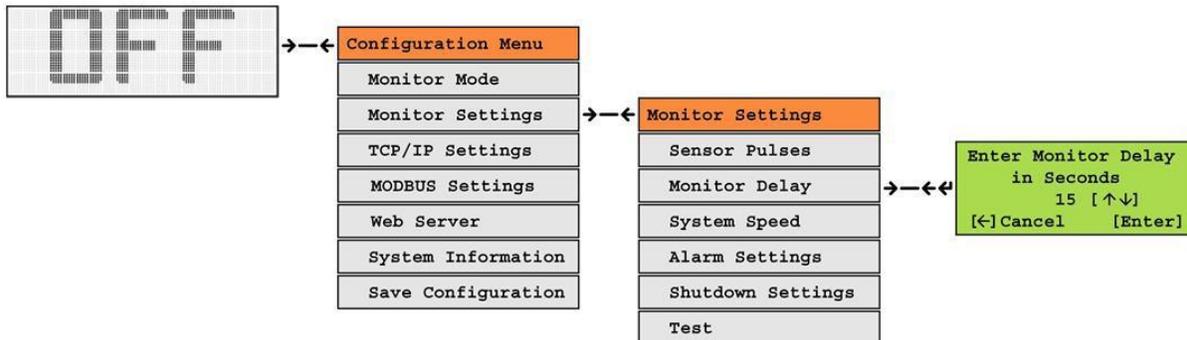


To verify or change this number, do the following:

1. From the RPM display, press the **RIGHT** button. The configuration menu will be visible.
2. Press the **DOWN** button until the cursor ">" is at the start of the line that says "Monitor Settings".
3. Press the **RIGHT** button to get to the "Monitor Settings" menu.
4. On the "Monitor Settings" menu, press the **DOWN** button until the cursor is at the "Sensor Pulses" entry.
5. Press the **RIGHT** to get to the screen for setting the number of pulses per revolution from the sensor.
6. Using the **UP** and **DOWN** buttons adjust the pulses per revolution number for the sensor being used.
7. Press the **ENTER** button to set the pulses per revolution.
8. Press the **LEFT** key repeatedly to return to the RPM screen.

9.2.4 Setting Monitor Delay

For most installations, the run signal to the SYS-1 will be at the moment that the drive starts. The equipment requires a period of time before the nominal speed is reached. This time must be entered into the SYS-1. Each time the system starts, the SYS-1 will not issue a warning or perform a shutdown until the specified delay time in seconds has elapsed. You will need to measure this time for the equipment being monitored. Add some extra time to ensure that the system will always be up to speed. Note that it may take longer for a fully loaded system to get up to speed than a lightly loaded system.

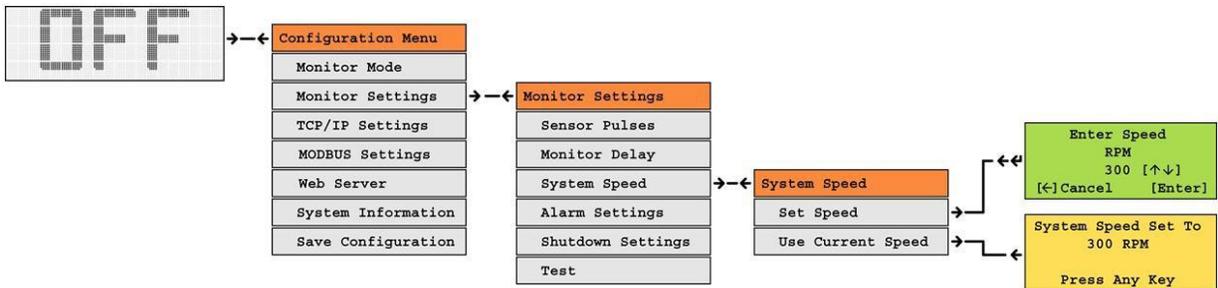


Set the delay using the following procedure:

1. From the RPM display, press the **RIGHT** button. The configuration menu will be visible.
2. Press the **DOWN** button until the cursor ">" is at the start of the line that says "Monitor Settings".
3. Press the **RIGHT** button to get to the "Monitor Settings" menu.
4. On the "Monitor Settings" menu, press the **DOWN** button until the cursor is at the "Monitor Delay" entry.
5. Press the **RIGHT** to get to the screen for setting the monitor delay.
6. Using the **UP** and **DOWN** buttons adjust the monitor delay to the appropriate number of seconds.
7. Press the **ENTER** button to set the number of seconds to delay.
8. Press the **LEFT** key repeatedly to return to the RPM screen.

9.2.5 Setting Nominal System Speed

The nominal speed of the system is necessary when the alarm and shutdown settings are specified as a percent of the normal running speed. The nominal speed can be set in one of two ways.



The following procedure sets the nominal speed:

1. From the RPM display, press the **RIGHT** button. The configuration menu will be visible.
2. Press the **DOWN** button until the cursor “>” is at the start of the line that says “Monitor Settings”.
3. Press the **RIGHT** button to get to the “Monitor Settings” menu.
4. On the “Monitor Settings” menu, press the **DOWN** button until the cursor is at the “System Speed” entry.
5. Press the **RIGHT** button to get to the “System Speed” menu.

To set the nominal speed to the current speed of the equipment, continue with these steps:

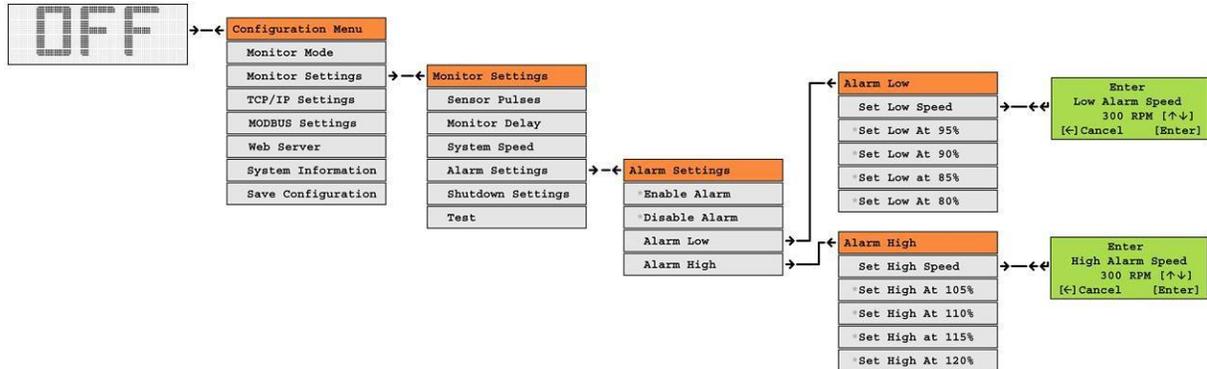
1. Press the **DOWN** button until the cursor is on the “User Current Speed” menu entry.
2. Press the **ENTER** button to set the RPM to the current system speed. A confirmation menu showing the speed will be displayed.
3. Press the **LEFT** key repeatedly to return to the RPM screen.

To set the nominal speed to a specific RPM, perform the following steps:

1. Press the **DOWN** button until the cursor is on the “Set Speed” menu entry.
2. Press the **ENTER** button to display the screen for entering the system speed.
3. Using the **UP** and **DOWN** buttons adjust the nominal system speed to the appropriate RPM.
4. Press the **ENTER** button to set the RPM's.
5. Press the **LEFT** key repeatedly to return to the RPM screen.

9.2.6 Setting Alarm Parameters

The SYS-1 tracks the current speed of the equipment and will issue an alarm, warning the operator that the equipment is either above or below the RPM limits set for the alarm condition. The alarm can be enabled or disabled.



9.2.6.1 Setting Alarm Limits

A low limit and a high limit can be set for the SYS-1. Use the following procedure for both the low limit and the high limit. To set the high alarm speed, substitute the “Alarm Low” menu for the “Alarm High” menu.

1. From the RPM display, press the **RIGHT** button. The configuration menu will be visible.
2. Press the **DOWN** button until the cursor “>” is at the start of the line that says “Monitor Settings”.
3. Press the **RIGHT** button to get to the “Monitor Settings” menu.
4. On the “Monitor Settings” menu, press the **DOWN** button until the cursor is at the “Alarm Settings” entry.
5. Press the **RIGHT** button to get to the “Alarm Settings” menu.

To enable or disable the alarm continue with the following steps:

1. Press the **DOWN** button until the cursor is at the start of either the “Enable Alarm” or “Disable Alarm” menu item. The current selection will be shown with a “*” on the selected item.
2. Press **ENTER** to change the enable or disable setting.

To set the low alarm parameter continue with the following steps:

1. Press the **DOWN** button until the cursor is at the “Alarm Low” menu item.
2. Press the **RIGHT** button to the “Alarm Low” menu.

To set the low alarm to be a percentage of the nominal system speed, continue with the following steps:

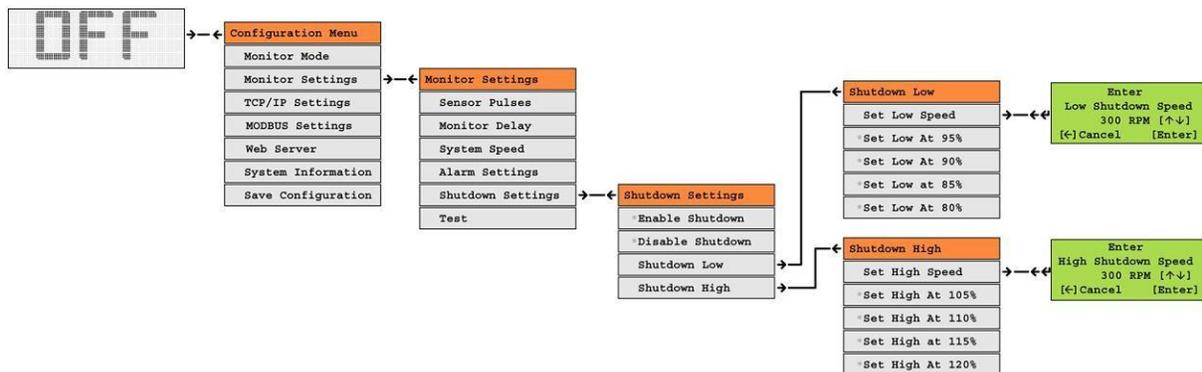
1. Press the **DOWN** button until the cursor is at one of the selected percentages (95%, 90%, 85% or 80%). If a percentage is currently selected, it will be shown with an “*” in front of it.
2. Press the **ENTER** button to select the new setting.

To set the low alarm to be a specific RPM setting, continue with the following steps:

1. Press the **UP** or **DOWN** buttons until the cursor is on the “Set Low Speed” menu entry.
2. Press the **ENTER** button to display the screen for entering the low alarm speed.
3. Using the **UP** and **DOWN** buttons adjust the low alarm speed to the appropriate RPM.
4. Press the **ENTER** button to set the RPM’s.
5. Press the **LEFT** key repeatedly to return to the RPM screen.

9.2.7 Setting Shutdown Parameters

The SYS-1 tracks the current speed of the equipment and will issue an alarm, warning the operator that the equipment is either above or below the RPM limits set for the alarm condition. The alarm can be enabled or disabled.



9.2.7.1 Setting Shutdown Limits

A low limit and a high limit can be set for the SYS-1. Use the following procedure for both the low limit and the high limit. To set the high shutdown speed, substitute the “Shutdown Low” menu for the “Shutdown High” menu.

1. From the RPM display, press the **RIGHT** button. The configuration menu will be visible.
2. Press the **DOWN** button until the cursor “>” is at the start of the line that says “Monitor Settings”.
3. Press the **RIGHT** button to get to the “Monitor Settings” menu.
4. On the “Monitor Settings” menu, press the **DOWN** button until the cursor is at the “Shutdown Settings” entry.
5. Press the **RIGHT** button to get to the “Shutdown Settings” menu.

To enable or disable the shutdown continue with the following steps:

1. Press the **DOWN** button until the cursor is at the start of either the “Enable Shutdown” or “Disable Shutdown” menu item. The current selection will be shown with a “*” on the selected item.
2. Press **ENTER** to change the enable or disable setting.

To set the low shutdown parameters continue with the following steps:

1. Press the **DOWN** button until the cursor is at the “Shutdown Low” menu item.
2. Press the **RIGHT** button to the “Shutdown Low” menu.

To set the low shutdown to be a percentage of the nominal system speed, continue with the following steps:

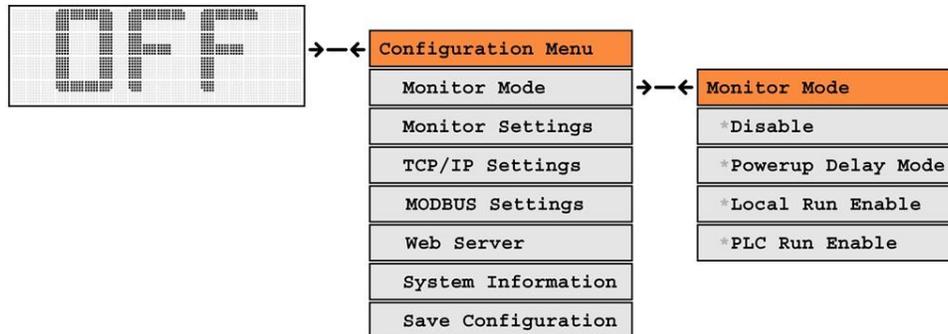
1. Press the **DOWN** button until the cursor is at one of the selected percentages (95%, 90%, 85% or 80%). If a percentage is currently selected, it will be shown with an “*” in front of it.
2. Press the **ENTER** button to select the new setting.

To set the low shutdown to be a specific RPM setting, continue with the following steps:

1. Press the **UP** or **DOWN** buttons until the cursor is on the “Set Low Speed” menu entry.
2. Press the **ENTER** button to display the screen for entering the low shutdown speed.
3. Using the **UP** and **DOWN** buttons adjust the low shutdown speed to the appropriate RPM.
4. Press the **ENTER** button to set the RPMs.
5. Press the **LEFT** key repeatedly to return to the RPM screen.

9.2.8 Setting Mode of Operation

After the above parameters have been set, the mode of operation can be selected. By default, the mode of operation is disabled. See the section on theory of operation to get a detailed description of each of the modes.

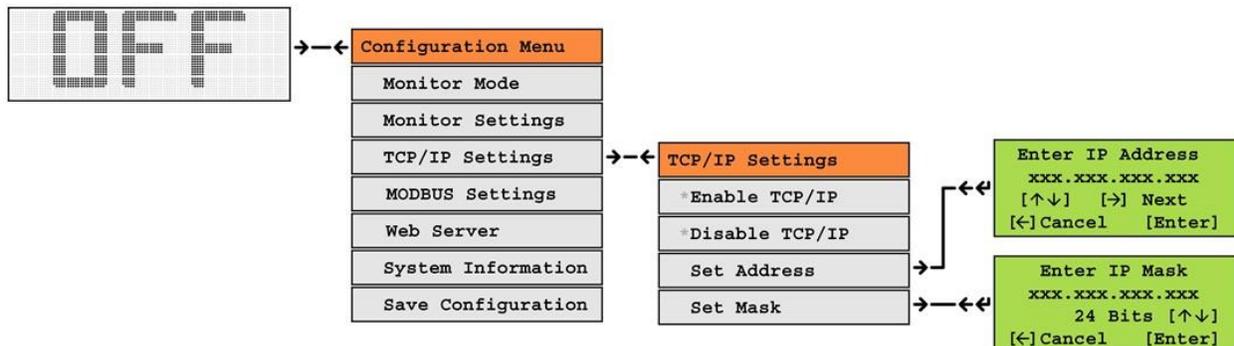


To set a mode, use the following procedure:

1. From the RPM display, press the **RIGHT** button. The configuration menu will be visible.
2. The cursor ">" will point to the menu item "Monitor Mode".
3. Press the **RIGHT** button to get to the "Monitor Mode" menu.
4. The "Monitor Menu" will show the selected mode with an "*" next to the currently selected mode.
5. Press the **DOWN** button until the cursor is on the line of the desired mode.
6. Press the **ENTER** button to select the new mode of operation.
7. Press the **LEFT** key repeatedly to return to the RPM screen.

9.2.9 Network Settings

The SYS-1 has the ability to connect to a network however this capability is optional. This is necessary if the MODBUS functionality or the Web Server is used. Before the network can operate, the network address and the network mask must be entered into the system. Your local network administrator can provide these. Use the following procedure to enter these numbers.



9.2.9.1 Setting Network Address

The network address consists of 4 sets of numbers. Each number can range from 0-255.

1. From the RPM display, press the **RIGHT** button. The configuration menu will be visible.
2. The cursor ">" will point to the menu item "TCP/IP Settings".
3. Press the **RIGHT** button to get to the "TCP/IP Settings" menu.
4. Press the **DOWN** button until the cursor is on the Set Address menu item.
5. Press the **RIGHT** button to display the screen for entering the TCP/IP address.
6. The current TCP/IP address is shown with the first number flashing.
7. Press the **UP** or **DOWN** buttons to change the number to the correct number.
8. Once the number is correct, press the **RIGHT** button to move to the next number.
9. Repeat steps 7 and 8 until all 4 of the TCP/IP address numbers are right.
10. Press **ENTER** to set the TCP/IP address.

9.2.9.2 Setting Network Mask

The network mask is a number from 0-32 that is used by the SYS-1 network software. Enter this number using the following procedure:

1. From the RPM display, press the **RIGHT** button. The configuration menu will be visible.
2. The cursor ">" will point to the menu item "TCP/IP Settings".
3. Press the **RIGHT** button to get to the "TCP/IP Settings" menu.
4. Press the **DOWN** button until the cursor is on the Set Mask menu item.
5. Press the **RIGHT** button to display the screen for entering the TCP/IP mask.
6. Press the **UP** or **DOWN** buttons to change the number to the correct number.
7. Press **ENTER** to set the TCP/IP address.

9.2.9.3 Enable and Disabling the Network

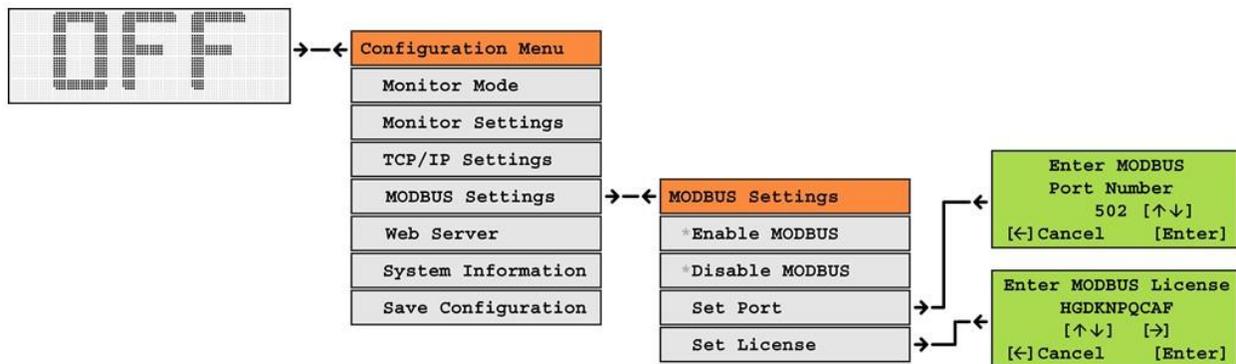
The TCP/IP network can be enabled or disabled. It must be enabled before the MODBUS or Web Server capabilities will work. Use the following procedure to enable or disable the network.

1. From the RPM display, press the **RIGHT** button. The configuration menu will be visible.
2. The cursor ">" will point to the menu item "TCP/IP Settings".
3. Press the **RIGHT** button to get to the "TCP/IP Settings" menu.
4. The current selection for enable and disable will be shown with an "*" next to the selected item.
5. To change the selection, press the **DOWN** button until the cursor is next to the desired selection.
6. Press the **ENTER** button to select the new setting.

9.2.10 MODBUS Settings

See the section on MODBUS for more information on how it can integrate with a PLC. The MODBUS is an optional feature. Make sure you save the 10 character key should you ever need to reenter it into the system.

The MODBUS also requires that the appropriate port number be entered.



9.2.10.1 Setting MODBUS License

The MODBUS license is a 10-character key that can be entered into the SYS-1 using the following procedure.

1. From the RPM display, press the **RIGHT** button. The configuration menu will be visible.
2. The cursor ">" will point to the menu item "MODBUS Settings".
3. Press the **RIGHT** button to get to the "MODBUS Settings" menu.
4. Press the **DOWN** button to get to the "Set License" menu item.
5. Press the **RIGHT** button to display the entry screen for the MODBUS license.
6. The screen will show the current license. This may be blank if you have not previously entered a license. The cursor will be under the first character.
7. Press the **UP** or **DOWN** buttons to change the selected character in the license.
8. Press the **RIGHT** button to move to the next character.
9. Repeat steps 7 and 8 until you have entered all 10 characters of the license.
10. Press the **ENTER** button to set the license.

9.2.10.2 Setting the MODBUS Port

The MODBUS port is a number from 0-65535 that is necessary for proper communication with the PLC. The PLC administrator will be able to tell you the appropriate number to use.

11. From the RPM display, press the **RIGHT** button. The configuration menu will be visible.
12. The cursor ">" will point to the menu item "MODBUS Settings".
13. Press the **RIGHT** button to get to the "MODBUS Settings" menu.
14. Press the **DOWN** button to get to the "Set Port" menu item.
15. Press the **RIGHT** button to display the entry screen for the MODBUS port.
16. The screen will show the current selection. Normally, this will be 502.
17. Press the **UP** or **DOWN** buttons to change the port to another number. Press the **ENTER** button to set the selected port number.

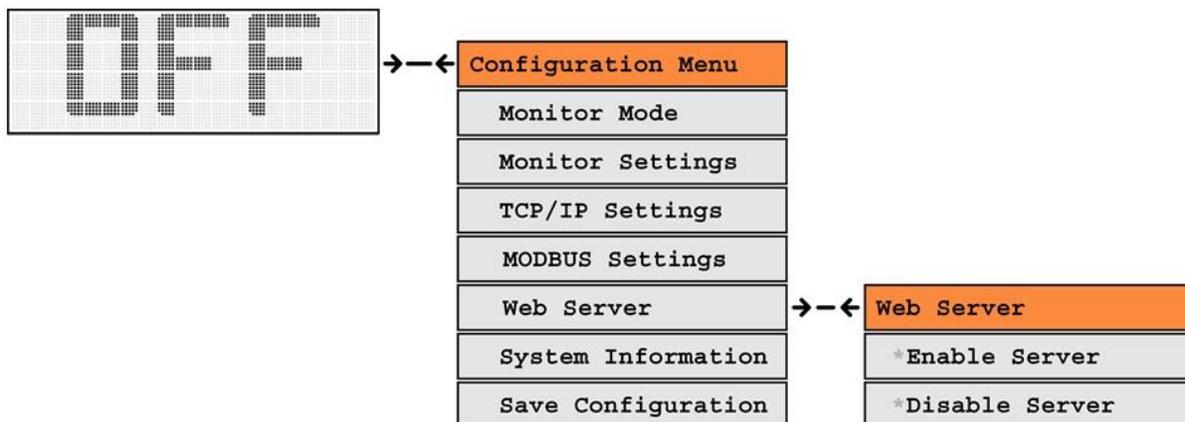
9.2.10.3 Enable and Disabling MODBUS

The MODBUS can be enabled or disabled. Use the following procedure to enable or disable the network.

1. From the RPM display, press the **RIGHT** button. The configuration menu will be visible.
2. The cursor ">" will point to the menu item "MODBUS Settings".
3. Press the **RIGHT** button to get to the "MODBUS Settings" menu.
4. The current selection for enable and disable will be shown with an "*" next to the selected item.
5. To change the selection, press the **DOWN** button until the cursor is next to the desired selection.
6. Press the **ENTER** button to select the new setting.

9.2.11 Web Page Settings

The SYS-1 can serve a web page if the web server has been enabled. See the section on the web server for more information on this capability.



The Web Server can be enabled or disabled. Use the following procedure:

7. From the RPM display, press the **RIGHT** button. The configuration menu will be visible.
8. The cursor ">" will point to the menu item "Web Server Settings".
9. Press the **RIGHT** button to get to the "Web Server Settings" menu.
10. The current selection for enable and disable will be shown with an "*" next to the selected item.
11. To change the selection, press the **DOWN** button until the cursor is next to the desired selection.
12. Press the **ENTER** button to select the new setting.

10.0 Network

The SYS-1 is capable of connecting to a network for providing MODBUS functionality and/or to provide access to a web page that is served by the SYS-1. Note that this functionality is optional and the SYS-1 will operate without a network connection.

10.1 Installation

The SYS-1 connects to a standard 10-baseT compatible Ethernet network. This requires a CAT-5 RJ-45 connection from the local area network. Network cabling should be installed according to local wiring codes. Network cabling should avoid runs with cabling that supplies power to the SYS-1 or other equipment.

10.2 Network Parameters

The SYS-1 requires two network parameters for its operation; IP address and network mask. The administrator of the local area network can provide these. The SYS-1 only works with static IP addresses since its address needs to remain constant for PLC systems or users to access it. Network administrators may want to assign a host name to the static IP address so that it can be addressed by name instead of IP address.

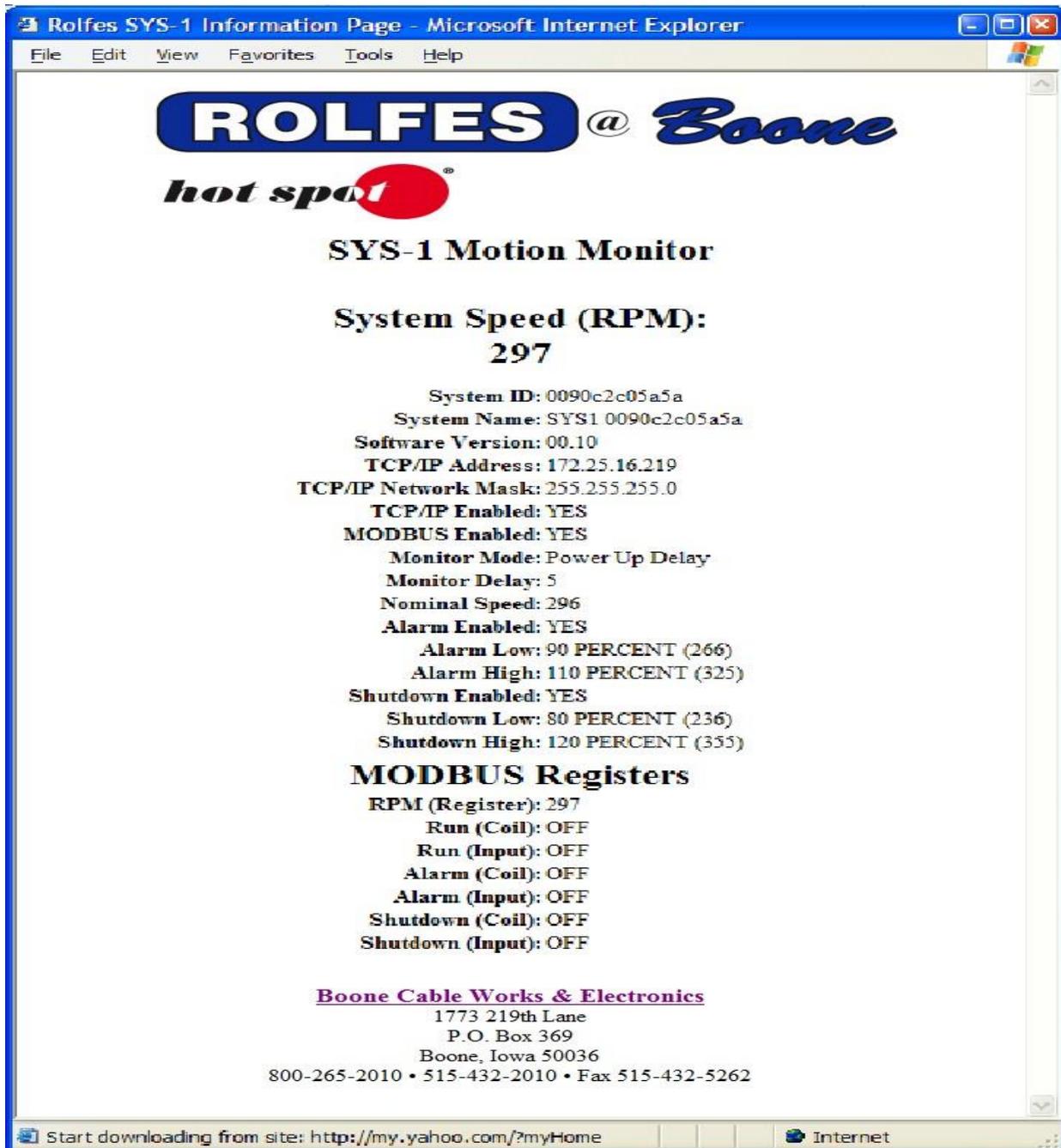
The SYS-1 does not require a gateway address or DNS entry for operation.

To test the network installation and the network parameters, enable the Web Server as described in the next section and try to access the server from a web browser.

11.0 Web Server

The SYS-1 can server a web page that provides information on the state of the system. The web server requires that the network is connected and that the network parameters have been set correctly. The web server needs to be enabled as described in the section on configuration.

The following screen shot shows the web page that is returned by the SYS-1.



ROLFES @ Boone
hot spot

SYS-1 Motion Monitor

System Speed (RPM):
297

System ID: 0090c2c05a5a
System Name: SYS1 0090c2c05a5a
Software Version: 00.10
TCP/IP Address: 172.25.16.219
TCP/IP Network Mask: 255.255.255.0
TCP/IP Enabled: YES
MODBUS Enabled: YES
Monitor Mode: Power Up Delay
Monitor Delay: 5
Nominal Speed: 296
Alarm Enabled: YES
Alarm Low: 90 PERCENT (266)
Alarm High: 110 PERCENT (325)
Shutdown Enabled: YES
Shutdown Low: 80 PERCENT (236)
Shutdown High: 120 PERCENT (355)

MODBUS Registers

RPM (Register): 297
Run (Coil): OFF
Run (Input): OFF
Alarm (Coil): OFF
Alarm (Input): OFF
Shutdown (Coil): OFF
Shutdown (Input): OFF

Boone Cable Works & Electronics
1773 219th Lane
P.O. Box 369
Boone, Iowa 50036
800-265-2010 • 515-432-2010 • Fax 515-432-5262

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12.0 MODBUS Capability

The SYS-1 has the ability to communicate with a PLC using MODBUS TCP/IP. This is an industry standard that defines how two PLC components can exchange control information and data. The SYS-1 defines a number of bits and a single input register. These are all defined below.

12.1 Setting up The MODBUS

MODBUS TCP/IP requires that a network connection be enabled and working. Make sure that the TCP/IP parameters have been set and that the network is working correction. One good way to check this is to make sure that you can access the SYS-1 from an Internet browser at the SYS-1's Internet address. A page with SYS-1 parameters should be returned to the Internet browser if the network connection is operating correctly.

To ensure reliable operation, there should not be any wireless network segments between the SYS-1 and the controlling PLC.

Enable or disable the MODBUS using the configuration menus.

All TCP/IP services, such as MODBUS, required a specific 'port' number for operation. The default MODBUS port number, specified in the MODBUS specification, is 502. Check with the PLC engineer to ensure that this is the correct port number for your installation. If necessary, you can change the port number in the configuration menus.

12.2 MODBUS Register Space

The following table describes all of the parameters that are available from the SYS-1. These may be accessed from a PLC controller allowing the SYS-1 to be integrated with the PLC system controlling the equipment.

Description	Type	Mode	Offset
RPM	Input Register	Read Only	0
Run Signal	Coil	Read/Write	0
Alarm	Coil	Read/Write	1
Shutdown	Coil	Read/Write	2
Run Input State	Input	Read Only	0
Alarm State	Input	Read Only	1
Shutdown State	Input	Read Only	2

Each of these is described in more detail below:

RPM: This is a 16-bit input register that holds the current speed of the equipment in revolutions / minute. It is a read only register. The speed is updated 2 times / second.

Run Signal: This is a bit in the MODBUS 'COIL' bank that can be set/reset or read. When the SYS-1 is running in PLC mode, this bit must be set by the PLC to indicate that the equipment drive has started. It should be reset when the drive is stopped. The SYS-1 monitors this bit and begins monitoring the speed when it is set and after the monitor delay has elapsed.

Alarm: This is a bit in the MODBUS 'COIL' bank that can be set/reset or read. When the PLC sets this bit, it activates the internal alarm of the SYS-1 and the external alarm relay contacts. The alarm stays active as long as the bit is set. Note, the alarm from the SYS-1 is a combination of this bit and any alarm condition that may be detected by the SYS-1. If the SYS-1 has set an alarm because of an alarm condition, the PLC cannot turn it off by resetting this bit.

Shutdown: This is a bit in the MODBUS 'COIL' bank that can be set/reset or read. When the PLC sets this bit, it activates the shutdown relay of the SYS-1. The shutdown stays active as long as the bit is set. Note, the shutdown from the SYS-1 is a combination of this bit and any shutdown condition that may be detected by the SYS-1. If the SYS-1 has set a shutdown because of a shutdown condition, the PLC cannot turn it off by resetting this bit.

Run Input State: This is a bit in the MODBUS 'INPUT' bank that can only be read. This input follows the state of the run input to the SYS-1. A 1 indicates that the run signal is active.

Alarm State: This is a bit in the MODBUS 'INPUT' bank that can only be read. This input is set whenever the SYS-1 has detected an alarm condition. This bit does not reflect the state of the Alarm coil that can be set by the PLC.

Shutdown State: This is a bit in the MODBUS 'INPUT' bank that can only be read. This input is set whenever the SYS-1 has shut down the equipment. This bit does not reflect the state of the Shutdown coil that can be set by the PLC.

13.0 Testing

Testing the instrument should be accomplished right after installation to ensure proper functioning of the SYS-1 Motion Monitor.

The SYS-1 Motion Monitoring unit has an optional speed pendant to test and verify proper alarm and shutdown conditions. The use of this instrument should be by authorized equipment managers and removed after testing.

WARNING: During this test, **DO NOT** have any product or material on the equipment being tested (i.e. transporting grain on a belt or leg.)

13.1 Speed Pendant Operation

1. Power-OFF the SYS-1.
2. Insert the pendant into the SYS-1 (lower receptacle).
3. Set pendant to approximately half-scale.
4. Power-ON the equipment to be monitored, this will power-up the SYS-1 and illuminate the sensor LED (D4, which verifies sensor input) on the inside of SYS-1.
5. Set the *speed pendant* to the normal RPM of the equipment you are monitoring. (i.e. your leg #1 runs at 96 RPM push up or down until 96 RPM is displayed on the front panel.)

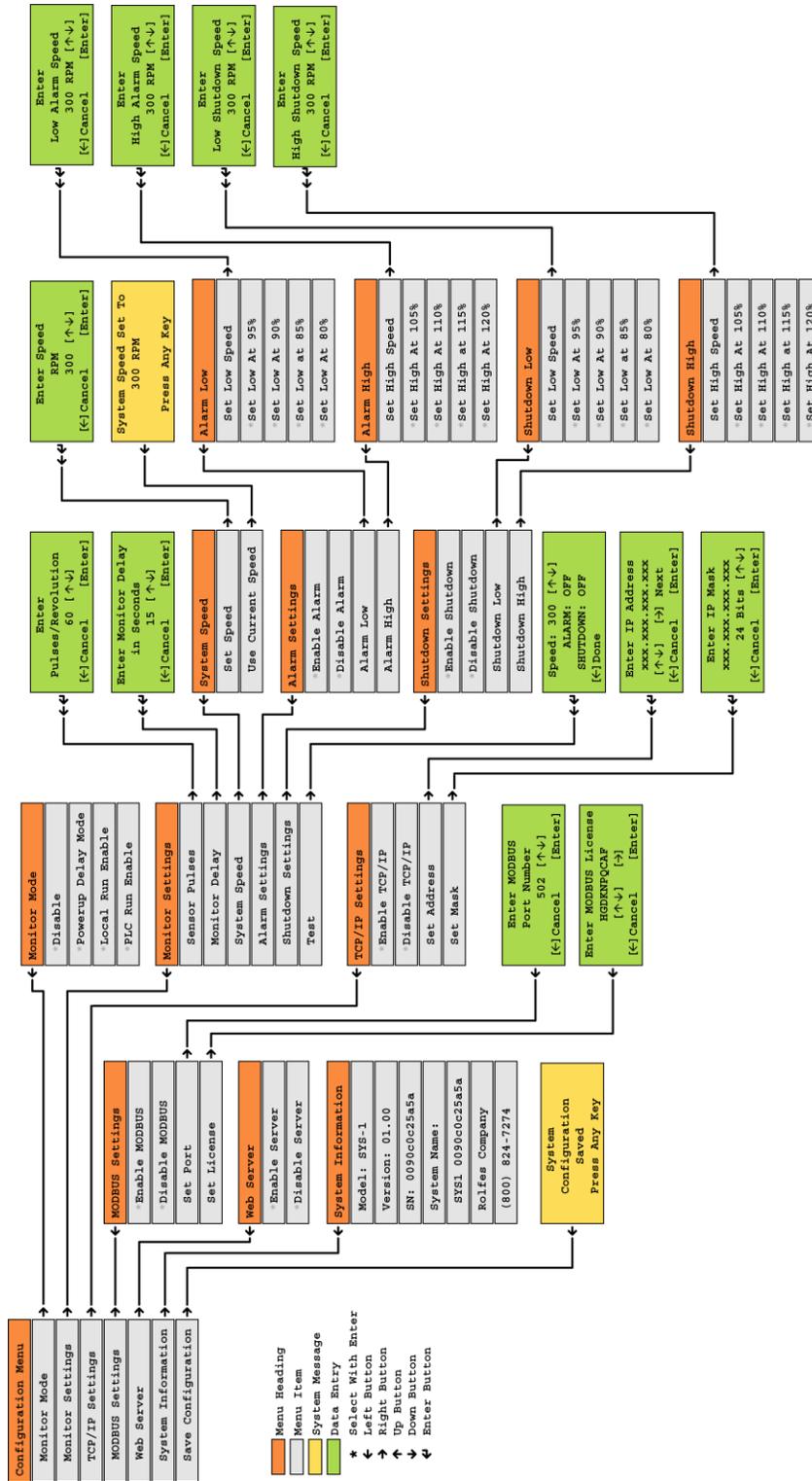


 *Hint: On an older style pendant with a knob, dial in the normal RPM and place a mark on the face of the pendant decal for future reference.*

6. *Slowly push down* the pendant to simulate a SLOW-DOWN condition 90% of normal RPMs; the SYS-1 will sound an alarm.
7. Continue to *slowly push down* to simulate a SHUTDOWN 80% of normal RPMs; the alarm state continues and then the SYS-1 will shut down the monitored equipment.
8. When finished testing *Power-OFF* the SYS-1, and remove pendant.

WARNING: REMOVE the Speed Pendant to monitor normal operations of your equipment.

Appendix A: Configuration Menu Chart



Limited Warranty

ROLFES@BOONE warrants that the products furnished to the PURCHASER will, at the time of shipment, be free from all defects in material and workmanship under normal use and service for a period of twelve (12) months from date of original shipment or, if installed by ROLFES@BOONE personnel, twelve (12) months from date of placing product into service. ROLFES@BOONE'S sole obligation hereunder shall be limited to, at ROLFES@BOONE option, either replacing or repairing any product for which (i) prompt notice has been given to ROLFES@BOONE within the warranty period of the product under question; and (ii) after ROLFES@BOONE'S authorization, is returned to ROLFES@BOONE factory of origin, freight prepaid; and (iii) after examination it is disclosed, to ROLFES@BOONE'S satisfaction, the product is defective.

If the product was originally installed by ROLFES@BOONE personnel within the continental United States, an on-site examination by ROLFES@BOONE can be performed in lieu of parts (ii) and (iii) above and if the product is found defective, it will be repaired or replaced under warranty if all other conditions of this warranty are met. If on-site examination is requested and no defects are found within the scope of this warranty, PURCHASER will be subject to payment to ROLFES@BOONE for the on-site examination at ROLFES@BOONE'S standard hourly and travel rates.

Any repair or replacement shall not extend the period with which this warranty can be asserted. All replaced equipment or parts will become the property of ROLFES@BOONE. This warranty shall not apply to products which ROLFES@BOONE has determined have, by PURCHASER or another, been altered or modified by anyone other than ROLFES@BOONE; or has been subjected to misuse, neglect, accident, damage in transit, abuse or unusual or natural hazard; or has been installed improperly or used in violation of ROLFES@BOONE 'S standards and specifications.

THIS WARRANTY MAY BE ASSERTED BY PURCHASER ONLY AND NOT BY PURCHASER'S CUSTOMER AND IS EXPRESSED IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY, AND ALL OTHER OBLIGATIONS OR LIABILITIES ON ROLFES@BOONE 'S PART. ROLFES@BOONE NEITHER ASSUMES NOR AUTHORIZES ANY OTHER PERSON TO ASSUME FOR ROLFES@BOONE ANY OTHER LIABILITIES IN CONNECTION WITH THE SALE OF SAID PRODUCTS. IN NO EVENT SHALL ROLFES@BOONE BE LIABLE FOR ANY SPECIAL, INCIDENTAL, INDIRECT OR CONSEQUENTIAL DAMAGES; LOSSES OR EXPENSES INCLUDING, BUT NOT LIMITED TO, LOSS OF USE, LOSS OF PROFITS OR LOSS OF DATA; OR FOR LOSS, DAMAGE, OR EXPENSE DIRECTLY OR INDIRECTLY ARISING FROM THE FAILURE OF THE PRODUCT TO OPERATE PROPERLY OR THE INABILITY OF THE PURCHASER, PURCHASER'S CUSTOMER, OR ANY END USER TO USE THE PRODUCT EITHER SEPARATELY OR IN COMBINATION WITH ANY OTHER EQUIPMENT. In no event shall ROLFES@BOONE 'S liability for failure to deliver or breach of any provision of this warranty, including, without limitation ROLFES@BOONE'S obligation with respect to non-conforming items, exceed, with respect to the product, the purchase price of the relevant product.

ROLFES@BOONE reserves the right to incorporate improvements without notice and is not obligated to incorporate the same improvements in products previously manufactured.