LMC-00001 Controller

User's Guide

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WARNING!

This equipment must be operated by trained personnel. ALL safety related functions are the responsibility of the user. This equipment is NOT intended to replace personal responsibility for any safety related function.

1 Introduction

The Load Monitor and Controller (LMC) is the next generation of the intelligent DAQs used in the McCoy Global Product Portfolio. The LMC provides a cost effective solution for standard bridge crane systems. The LMC can support main and aux applications with up to 4 load devices per hoist. In addition, the LMC supports alarm outputs such as high and low alarms and inputs such as Tare and Main Aux select. This manual will include information including startup, system operation, calibration and system configuration.

2 Definitions & Acronyms

- MGNet – Is a proprietary protocol on a CAN bus message that allow for simple communications between devices on a network.
- DAQ – Data Acquisition System
- LMC – Load Monitor and Control
- A2C – Analog to CAN Converter

3 LMC Overview

The LMC is a single device bridge crane controller that can provide a high level of functionality in a small package. With built in IO and expansion options this controller

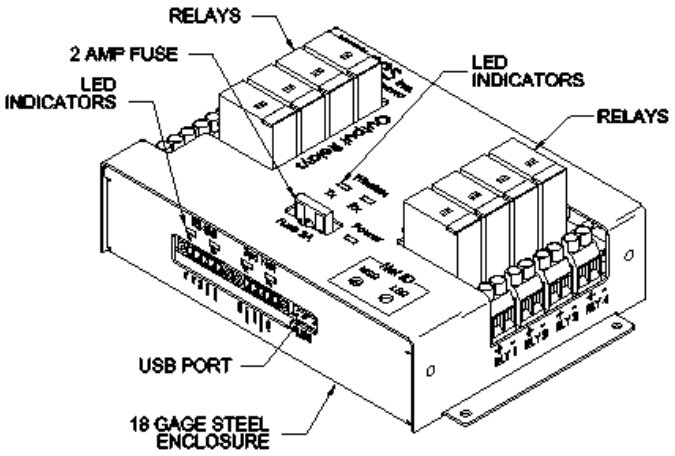


Figure 1 LMC

Hardware Features:

- Carbon Steel Enclosure with no aluminum components
- Wide operating range 8-30 VDC
- 4 Relay Outputs with expansion options for up to 8 more
- 4 Input relays for remote operation
- RS485 communications for scoreboard and ASCII Output interface
- 2 Analog Inputs
- 1 Analog Output
- 1 MGNet Port
- Onboard remote Antenna
- USB Port for Configuration

Product Features:

- Supports 2 hoists and can provide the total of the hoists
- Up to 4 inputs per hoist
- Up to 8 point calibration per hoist
- Rounding
- Unit less system allowing the user to define the output

4 Mechanical Description

The LMC is a single board Bridge crane platform in a small package.

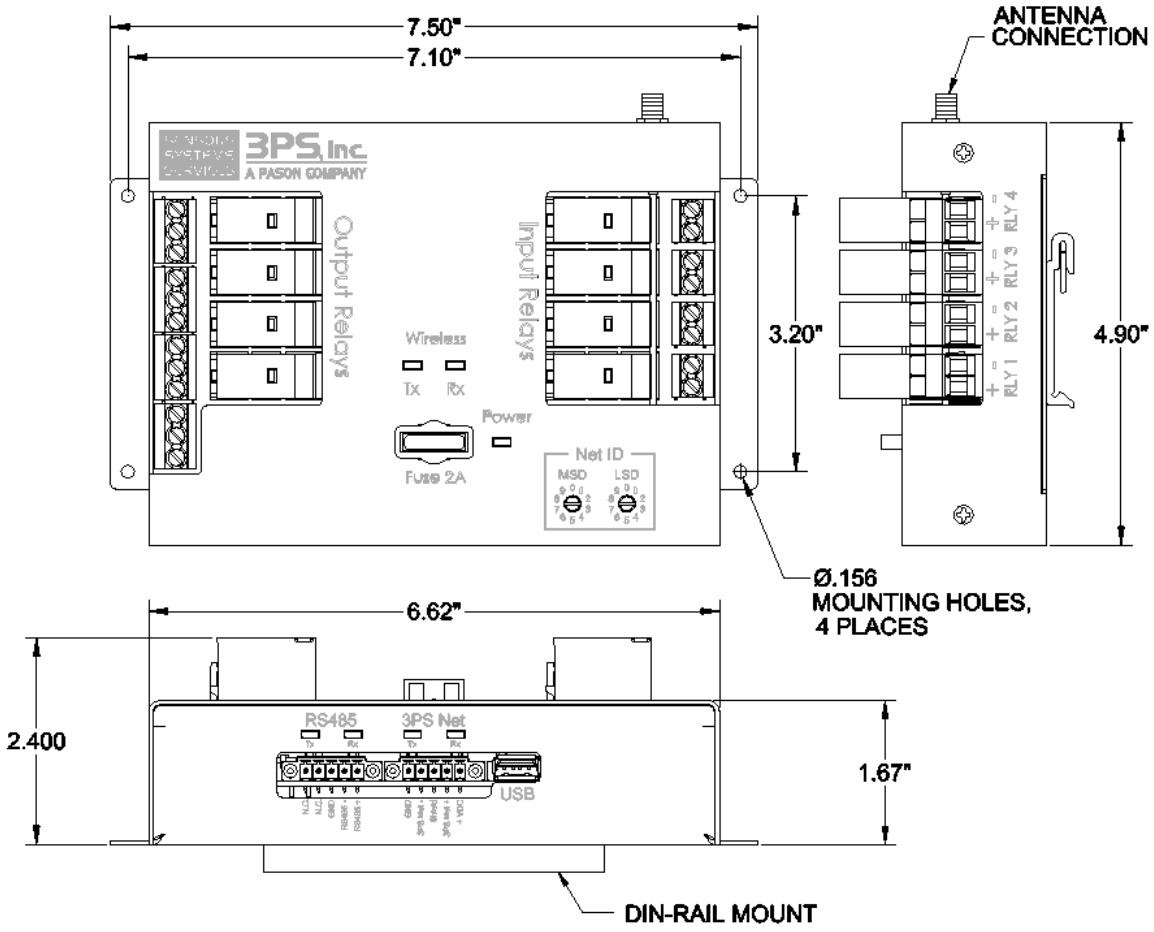


Figure 2 LMC Mechanical Overview

5 Quick Start Guide

The LMC arrives from the factory with the customer application preconfigured per application requested or easily configured by the user. This quick start guide serves as a general startup procedure.

Prior to beginning installation remove all system components from its shipping container(s) and review components to ensure that all are undamaged and correct according to the order placed.

5.1 System Installation

The system will arrive in one or more packages. Remove all the contents and lay the system out per the system requirements. All cable connections with the exception of the bare wire terminations are installed by hand with no tools needed. Once the system layout is complete mount all modules in applicable locations being sure to adequately protect the devices from any environmental conditions that may cause the device to fail. The individual section for each module will provide additional information needed for installation.

Note: device installation locations may be critical for proper functionality for noise avoidance.

5.2 System Startup

Prior to installing the system it is recommended that the unit be assembled and tested to insure proper operation. The process for this system startup is the same as the startup procedure for the final installation. Once all the components are interconnected with the correct cables, apply power to the power supply and to the scoreboard if used; they are powered separately. After power is applied, if the score board is powered before or at the same time as the DAQ controller, the scoreboard will show an initialization sequence. After powering up, the scoreboard display will begin displaying data and the system IO can be verified as well.

Note: Ensure that power is removed from the system before disconnecting cables.

5.3 Configuration

If purchased as a system, the LMC will arrive from the factory preconfigured to function per the system drawing notes and application information provided. In the event that the system needs to be configured, the system can be connected to a PC and configured with the application supplied with the hardware. Once connected, the configuration can be modified using the McCoy Global Configuration Manager application. The figure below illustrates the configuration manager tool that is shipped with the product or supplied by McCoy Global.

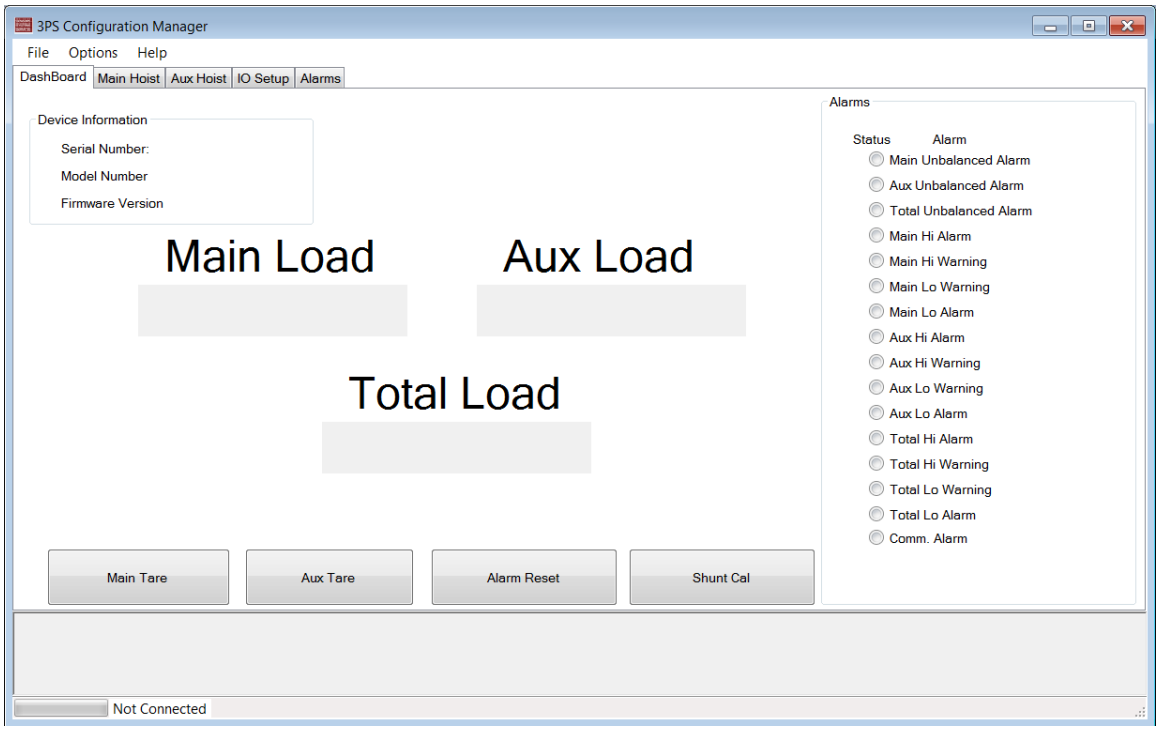


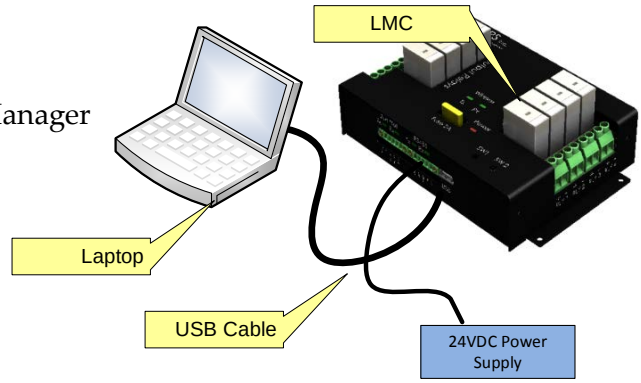
Figure 3 Configuration Management Tool

5.3.1 Connecting to the System

This quick start section shows how to quickly get the Configuration Manager tool up and running to quickly configure the system.

Requirements:

- Laptop with the LMC Configuration Manager installed
- LMC
- USB Cable



Installing Software

Installing the LMC Configuration Manager is done in two parts. The first is to install the driver on your PC and then to run the configuration manager tool.

Note: to install the driver you must have administrative privileges on your computer.

Prior to running the software download and install the driver from the following link.

http://www.ftdichip.com/Drivers/CDM/CDM21224_Setup.zip

Then download and extract the configuration manager software from the McCoy Global website from the following locations.

Quick Start Steps

1. Connect the USB cable to the LMC's USB Port.

2. Go to the device manager in your PC to verify that the serial port was properly detected.
3. Ensure that the LMC's switch settings are set to 00.
4. Connect the USB cable to the laptop.
5. Apply power to the LMC
6. Launch the McCoy Global Configuration Manager tool.
7. Set serial port parameters as below.

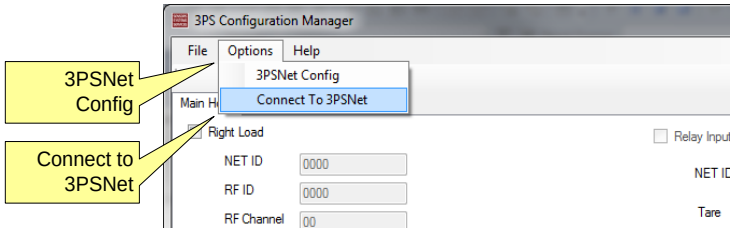


Figure 4 Connecting to a network

Feature	Description
MGNet Config	The MGNet Config menu item launches the Communications Port Settings Pop Up
Connect to MGNet	After port settings have been entered, the Connect to MGNet menu Item establishes communications with the MGNet to USB Gateway. If the proper serial port is selected both USB LEDs on the LMC will blink. If this does not happen the serial port is most likely not set correctly or the driver did not properly install.

The Communication Port Pop Up is used to configure the configuration manager to communicate to the MGNet to USB gateway.

Note: Baud Rate and MGNet ID should be set to 115200 and 1 respectively.

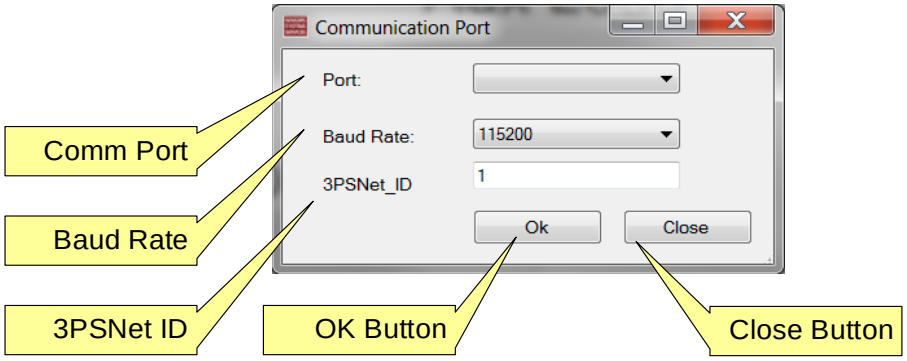


Figure 5 Communication Port Settings

5.3.2 Calibration

The LMC offers up to an 8 point system calibration for each hoist. The user can utilize to adjust to display and alarm an accurate load for the Main and Aux Hoist. For more information on calibration reference the section on calibration.

5.4 Scoreboard

The LMC can communicate with up to 3 robust scoreboard displays. The 6 character display is designed for both indoor and outdoor use and is preconfigured for an automatic brightness control.

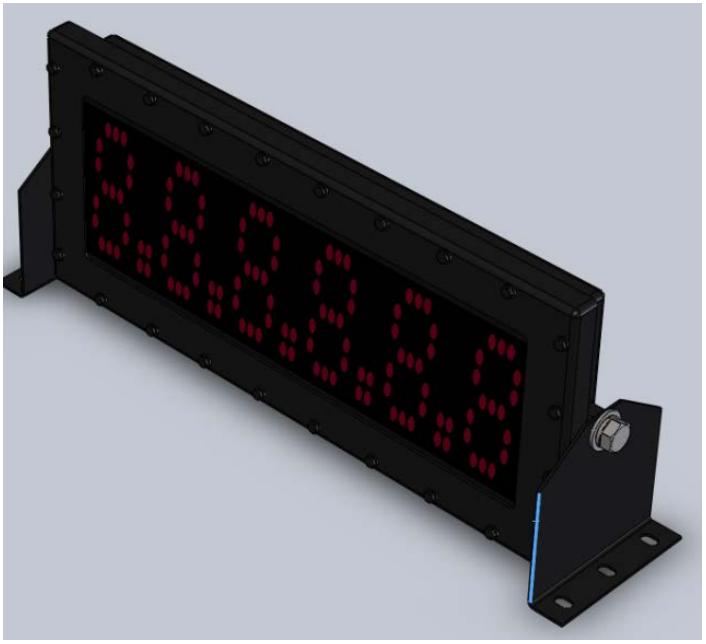


Figure 6 System Scoreboard

5.4.1 Features

- Numeric Display: 6 Digit, 7 Segment, 5.5 inch characters (RED)
- User Adjustable LED Backlight
- Character Viewing Distance: 125 feet normal light, 75 feet sunlight
- Power: 120VAC
- RS485 input (addressable)
- Baud rate: 9600
- Housing Material: Powder Coated steel with Lexan faceplate (standard), 316 Stainless available as special order
- Operating Temperature: -20°C to +60°C
- Sealing: IP66
- Weight: 32 pounds

5.4.2 Scoreboard Values

The Scoreboard is an alpha numeric display and as such can display minimal error messaging along with the weight to aid in trouble shooting. The table below illustrates what may be seen on the screen.

Feature	Description
-----	All dashes indicate that the LMC is not receiving information from one or more sensor. Check connectivity and batteries.
over	Indicates that the system has exceeded the Hi Alarm Setting

5.4.3 Power Connection

The power connector is a 3 Pin McCoy Global Turk style connector represented as part number CBL7009-M35-01-05. The pinout for the connector is shown in the table below. The incoming power is 120 volts AC.

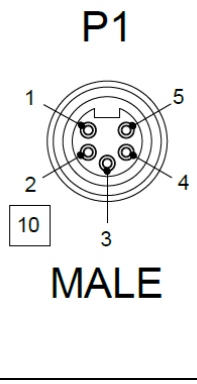
Table 1 Power Connector

Pin	Signal	Wire Color
1	Line	Black
2	Neutral	White
3	Chassis Ground	Green

5.4.4 RS485 Connection

The RS485 connector is a 5 Pin McCoy Global Turk style connector. The part number for the connector on the SD50 is CBL7009-M55-22-05. The pinout for the connector is shown in the table below.

Table 2 MGNet Connector

Pin	Signal	Location
1	Not Connected internally	
2	Not Connected internally	
3	RS485 +	
4	RS485-	
5	Not Connected internally	

5.4.5 Scoreboard Configuration

There are two elements to configure the scoreboard to communicate to the LMC. The first is LMC configuration and the second is the scoreboard setup.

The LMC supports up the 3 scoreboards. The Main Hoist (H1) is configured to communicate to address 1. The Aux Hoist (H2) is configured to communicate to address 2. The third scoreboard is a total of H1 and H2 and it is configured to communicate to address 3. The LMC has and Enable for Each Scoreboard under "IO Setup". Additional information for scoreboard configuration can be found in section 8.3.6.1.

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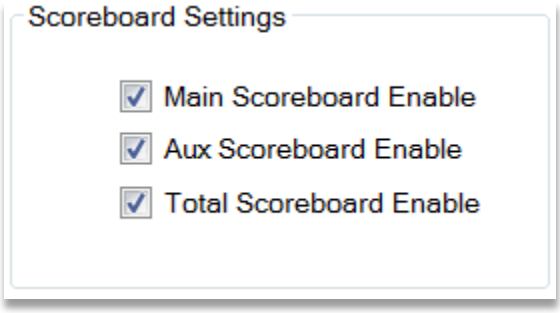


Figure 7 Scoreboard Control

6 LMC Hardware Description

This LMC Module acts as the main controller for the system. The DAQ module reads the information from the load cells and provides the output for the scoreboard. Additional inputs and outputs may be connected to the DAQ module for expanded functionality.

The LMC is designed using modular blocks to enable a scalable system that can be designed and installed with simplicity. The following sections describe many of the available blocks.

6.1 Relay Inputs

The LMC has 4 relay inputs built in that can be configured to provide different input functions. The relay coils provided can be rated for 12 VDC, 24 VDC, or 120 VAC. The following table describes the inputs.

Note: The 12 VDC and 24 VDC Relay inputs include built in kickback protection diodes. The 120 VAC does not.

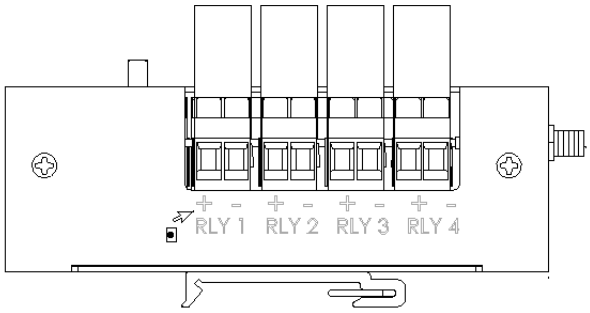


Figure 8 Relay Input Connections

6.2 Relay Outputs

The LMC has 4 relay outputs built in that can be configured to different alarm functions. The relay coils provided can be rated for 12 VDC or 24 VDC depending on the model selected to power the LMC. The outputs of the relays are rated for 120VAC / 30 VDC @ 10 amps.

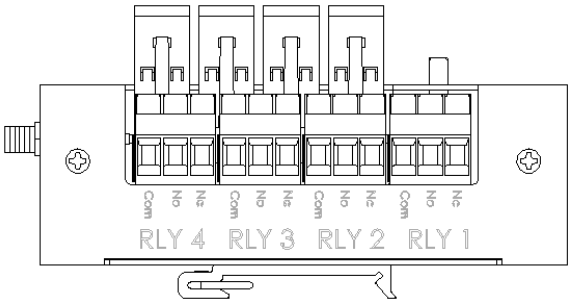


Figure 9 Relay Output Connections

6.3 Analog I/O

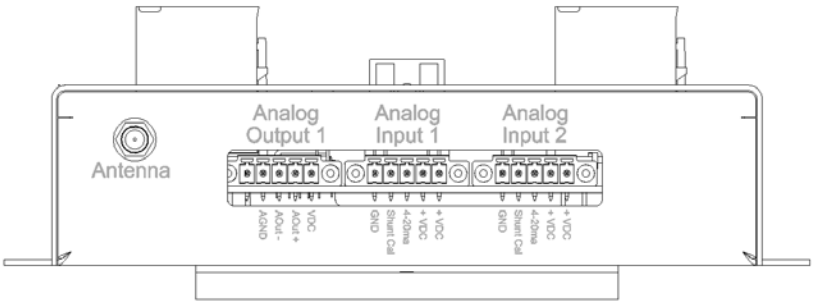


Figure 10 Analog Inputs Connections

6.1 Mode Switches

The LMC has two rotary switches that are used to set the Mode and the address of the device. The system does not require a power cycle to change the Mode switches.

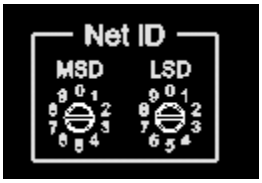


Figure 11 Mode Switches

00	Switch setting enables the LMC to communicate with the Configuration Management tool.
01	Switch settings is used for normal operation.
02 – 98	Switch settings are used for IO Mode
99	Switch setting enable the diagnostics Net Inspector tool

6.2 MGNet / RS485 Connection

The 3PSNet connector is a 5 Pin Phoenix style connector. The pinout for the connector is shown in the table below.

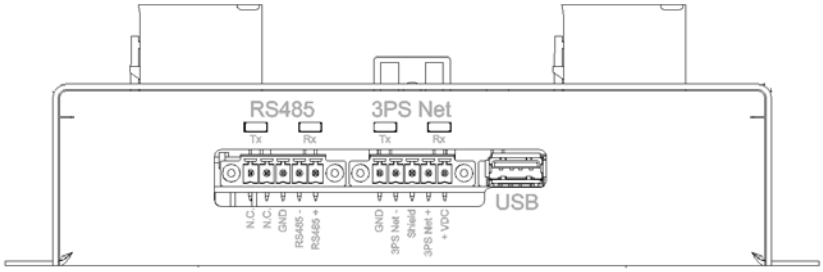
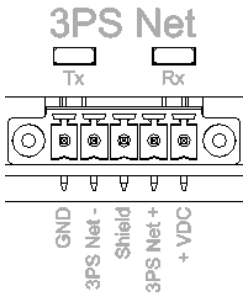


Figure 12 Network Connections

6.2.1 MGNet Interface

The MGNet Interface provides a simple and robust connection for external load devices. The connections can be 3PSNet based sensors, external A2C's or external remote antennas. The LMC Has built in selectable termination that is by default enabled.

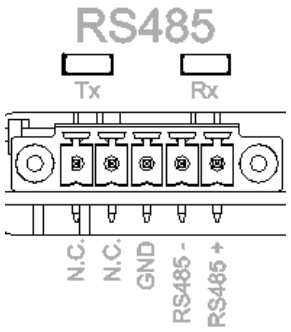
Table 3 MGNet Connector

Pin	Signal	Location
1	+24VDC	
2	MGNet+	
3	Shield	
4	MGNet-	
5	GND	

6.2.2 RS485 Interface

The RS485 connector is a 5 Pin McCoy Global Phoenix style connector. The pinout for the connector is shown in the table below.

Table 4 MGNet Connector

Pin	Signal	Location
1	RS485 +	
2	RS485-	
3	Sheild	
4	No Connected	
5	No Connected	

6.3 RF Antenna

The built in RF Interface supports a point to point connection with a load sensor. The Antenna can be remote located with additional hardware not included with this LMC. All wireless antennas should have line of site with each other.

7 LMC Operational Description

The LMC may act as a standard bridge crane controller for a 2 hoist system. The operation mode of the LMC is controlled via the rotary switch on the unit. The four supported modes are Controller Mode, Configuration Mode, IO Mode, and Diagnostics Mode.

7.1 Controller Mode (Switches set to 01)

Controller Mode is the stand alone controller mode for the LMC. This mode is enabled when the switch settings are in the 01 position. In this mode the LMC acts as a 2 hoist controller for a bridge crane. The functionality of the controller is based on the configuration of the unit. For bridge crane applications this mode should be set for normal applications.

7.2 Configuration mode (Switches set to 00)

Configuration Mode is used when connecting the LMC to the Configuration Management Tool. When the Mode Switches are set to 00 the USB port is enabled and the LMC is ready to be configured. In configuration mode the scoreboards are disabled.

7.3 IO Mode (Switches set to greater than 10)

IO Mode configures the LMC to be used as general purpose IO for MGNet. This can be used in conjunction with other controllers to expand the system capability. Calculating the NetID is based on the switch setting plus and offset value described below.

IO Type	**Network Address Offset**
AIN 0	Net ID Switch +1
AIN 1	Net ID Switch + 2
A out	Net ID Switch + 3
Relay In	Net ID Switch +4
Relay Output	Net ID Switch + 5
RF Antenna	Net ID Switch +6

7.4 Diagnostic Mode (Switch set to 99)

Diagnostic Mode provides information about the onboard and external MGNet devices. When the mode switches are set to 99 the device enters Diagnostic Mode. In this mode all bridge crane functions are disabled. Diagnostic Mode is used with the Network Inspector Tool.

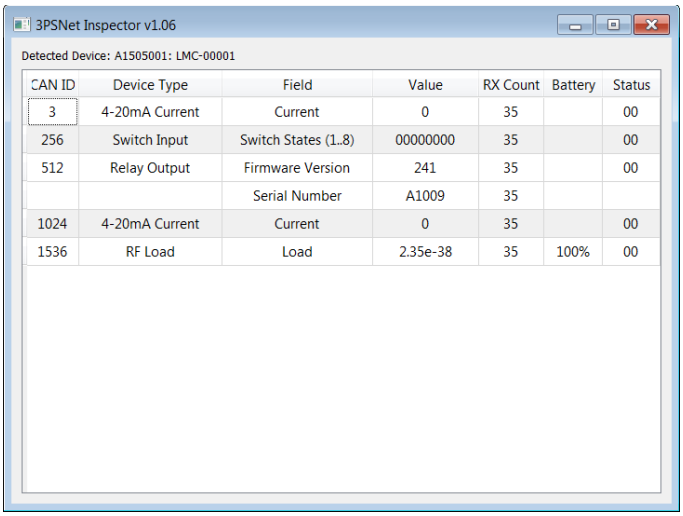


Figure 13 MGNet Inspector Tool

7.1 USB Connection

This LMC has a built in USB port that is used for configuration. The USB connection is a standard Type A and is provided with the LMC.

8 LMC Configuration

The LMC is configured using a PC and the supplied cable. The LMC switches must be set to Configuration Mode to connect to the software that is provided with the tool. The software is also available through McCoy Global Technical Support.

8.1 Main Dashboard

The Dashboard tab provides an overview of the LMC System. It provides Hoist values and alarm status as well as device specific information that is useful for debugging purposes.

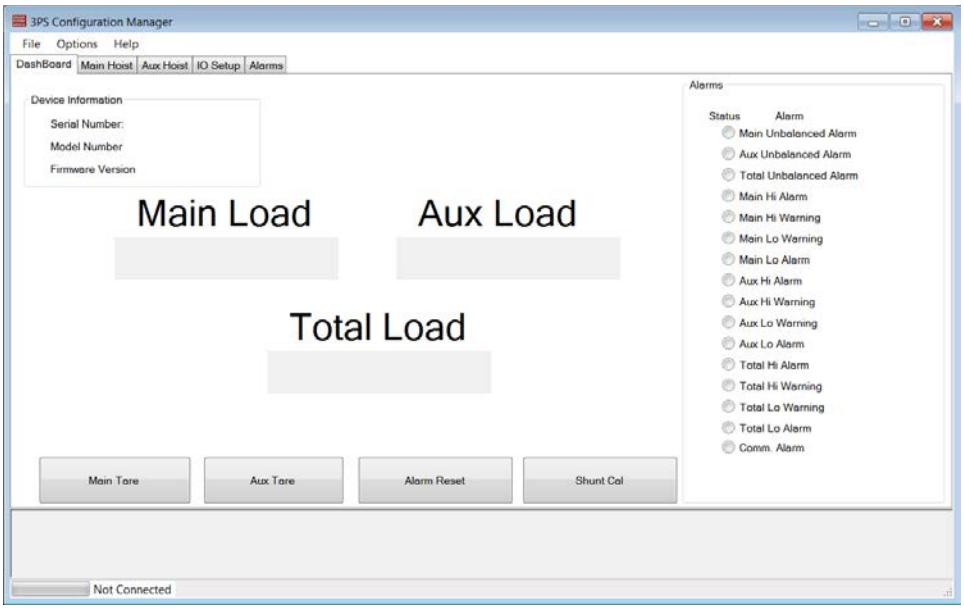


Figure 14 Configuration Tool Details

8.2 Main Hoist (H1) and Aux Hoist (H2) Configuration

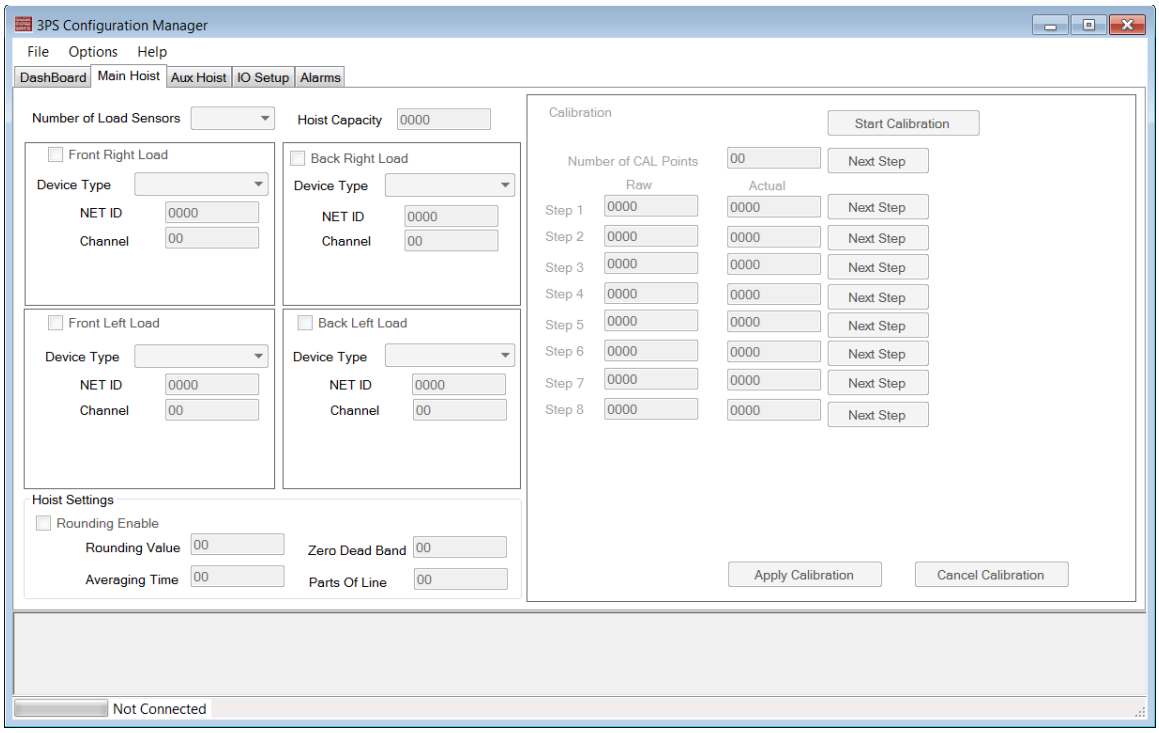


Figure 15 Hoist Setup

8.2.1 Sensor Setup

When setting up the Hoist, the configuration can include 1, 2 or 4 load devices. It can also be disabled. There are several device types that can be selected for each sensor. This include onboard RF, Onboard Analog, External RF, External MGNet, or External 4-20 ma converter. Additional Hoist settings include Rounding, filtering, and zero dead band.

8.2.2 Calibration

The LMC offers up to an 8 point system calibration for each hoist. The user can utilize to adjust to display and alarm an accurate load for the Main and Aux Hoist.

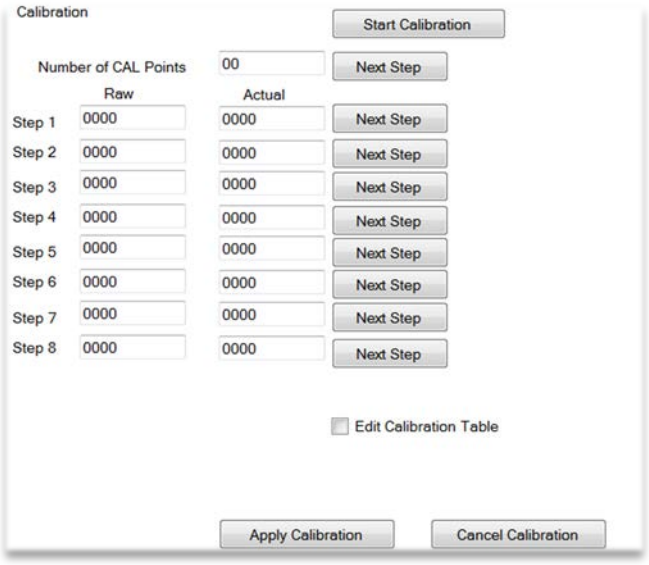


Figure 16 Calibration Details

Calibrating a hoist on the LMC is the same whether the Main or Aux Hoist is selected. The LMC if factory configured will have a factory calibration pre-installed. If the LMC is not factory configured it will not have a default calibration.

Note: If load pins are used with the LMC a customer site calibration is required.

The Process for calibration is as follows:

1. Connect to the LMC using the method explained.
2. By default the calibration is set to read only as in the figure below.

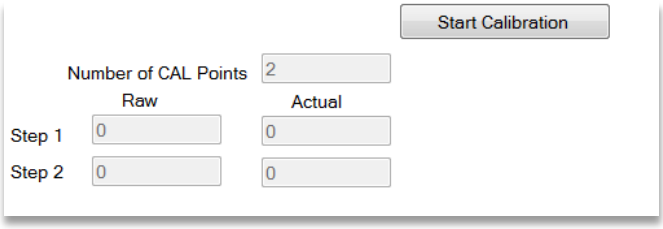


Figure 17 Start New Calibration

3. Begin a new calibration by selecting the "Start Calibration". This will begin a new calibration cycle.

   Note: Data taken during the calibration cycle is only stored in the application. No data is written to the LMC until the "Apply Calibration" button is selected.

   Note: During Calibrations it is always important to write down calibration information in the event that the information is lost. This will help ensure no loss of data or retesting required.

4. Once the "Start Calibration button is selected the first step is to enter the number of calibration points. You can select from 2-8 points. The first point should always be a zero point.

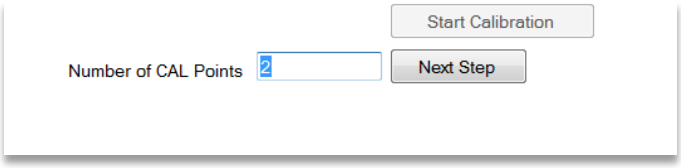


Figure 18 Number of Calibration Points

5. The next step is to start the calibration sequence. The raw value is automatically entered by the software unless the user chooses the "Edit Calibration Table" Checkbox.

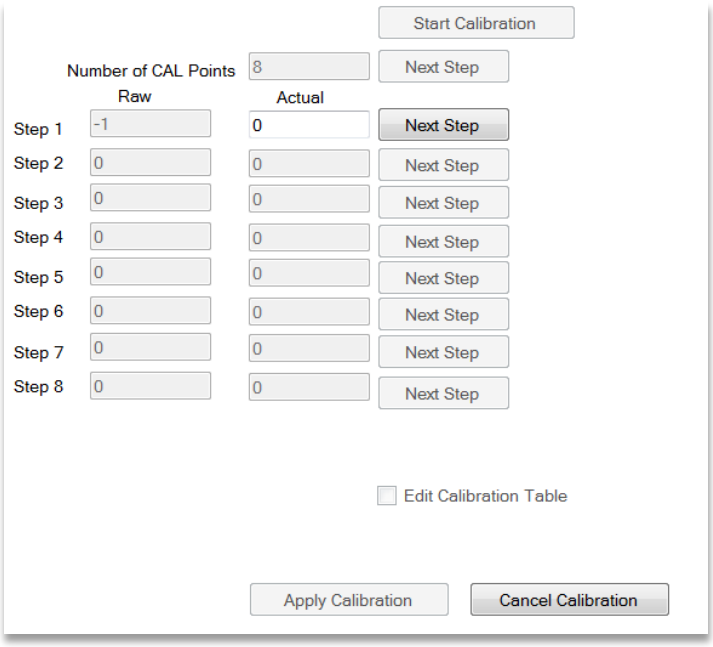


Figure 19 First Calibration Point

Note: Ensure that the Raw Value is stable and correct before selecting the next button.

6. After selecting next and capturing the zero point lift the load for the next calibration point.
7. Ensure that the load is stable, enter the Actual weight and select "Next Step".

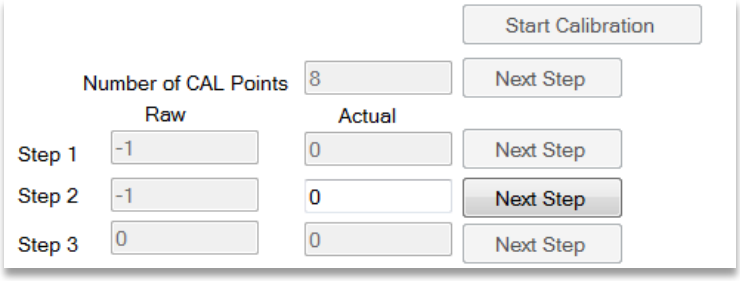


Figure 20 Next Step

8. After the final calibration step the "Apply Calibration" button will become active.
9. Verify the calibration is correct before selecting the "Apply Calibration" button.

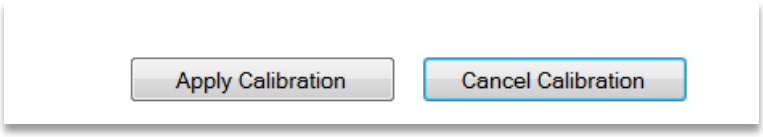


Figure 21 Complete Calibration

Note: The Cancel Calibration button is always available and can be used to stop the calibration

8.3 IO Setup

The IO Setup Page is used to configure the Onboard IO and other functionality of the LMC.

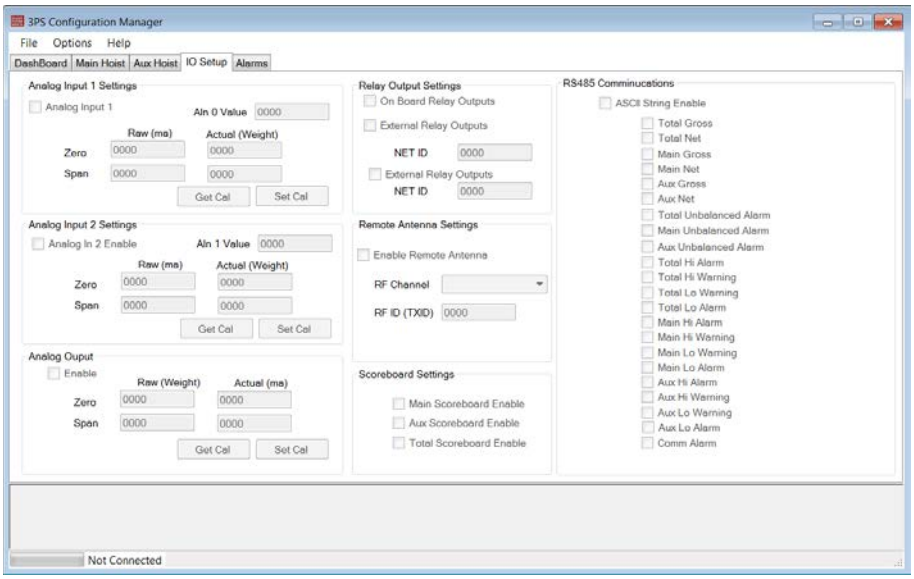


Figure 22 IO Setup Page

8.3.1 Relay Inputs

This LMC has 4 relay inputs built in that can be configured to provide different input functions. The relay coils provided can be rated for 12 VDC, 24 VDC, or 120 VAC. The following table describes the inputs. There is no software configuration for the input relays as the operation is predefined.

Relay Input	Description
1	Main Tare function used to zero the net wait for the main load. Selecting the Tare button will zero the scoreboard and display an "n" on the scoreboard. Selecting Tare again will return the gross weight to the scoreboard.
2	Aux Tare function used to zero the net wait for the Aux load. Selecting the Tare button will zero the scoreboard and display an "n" on the scoreboard. Selecting Tare again will return the gross weight to the scoreboard.
3	Reserved
4	Shunt Cal function holding the relay closed will turn on the Shunt CAL function. The relay must be held closed to maintain this function.

Note: The 12 VDC and 24 VDC Relay inputs include built in kickback protection diodes. The 120 VAC does not.

8.3.2 Relay Outputs

This LMC has 4 relay outputs built in that can be configured to different alarms functions. The relay coils provided can be rated for 12 VDC, 24 VDC depending on the model selected to power the LMC. The outputs of the relays are rated for 120VAC / 30 VDC @ 10 amps.

In addition, to the 4 on board relays and additional 8 relay via the MGNet port. All relay modules are enabled through the IO Setup page. If external relays are used the proper NetID must be entered. The figure below shows the relay option in the IO Setup page.

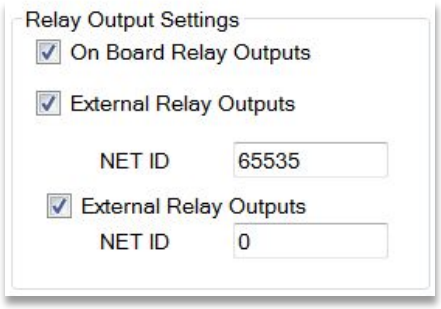


Figure 23 Relay Output Settings

8.3.3 Analog IO

Analog Setup for the LMC allows the user to configure the analog for the end application. There are 2 analog inputs and 1 analog output. The inputs are configured separately but the methods are the same. If not used the IO should be disabled in the IO Setup Menu.

8.3.4 Analog Inputs

The LMC supports two analog inputs. The options for configuration are the same. The check box is used to enable and disable the channel. The "Value" text box shows the calibrated output of the channel. The Zero and Span function allow the output to be scaled per the application.

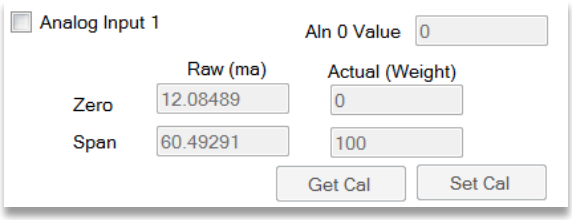


Figure 24 Analog Input Settings

Typical analog input wiring example is provide below:

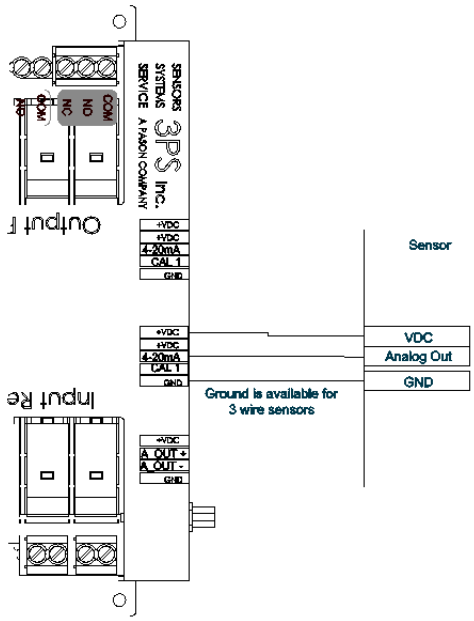


Figure 25 Analog Input Wiring Example

8.3.5 Analog Outputs

The LMC supports one analog Output. The check box is used to enable and disable the channel. The "Value" text box shows the calibrated output of the channel. The Zero and Span function allow the output to be scaled per the application.

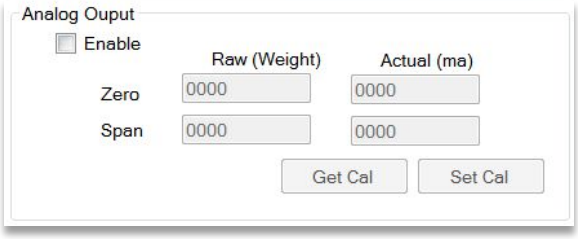


Figure 26 Analog Output

Typical analog output wiring example is provide below:

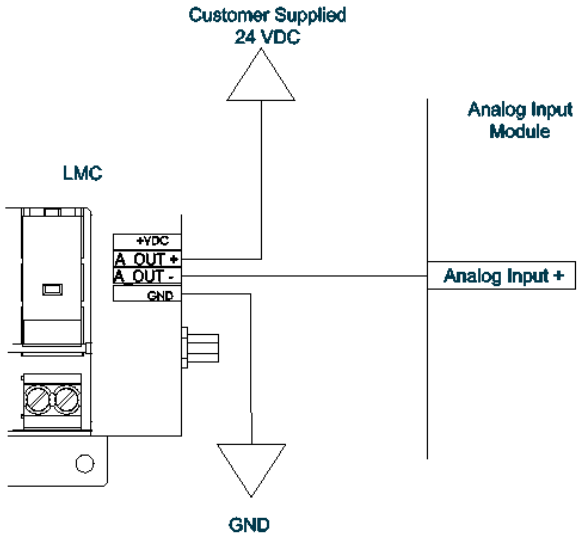


Figure 27 Analog Output Wiring Example

8.3.6 RS485 Communications

The RS485 communication support both scoreboard and ASCII output communications. The Port Settings are fixed to maintain simplicity and prevent setup issues. The table below are the port settings.

Setting	Description
Baud Rate	9600
Data bits	8
Stop bits	1
Parity	None

8.3.6.1 Scoreboard Communications

The LMC can communicate with up to three scoreboards. The scoreboards include the Main, Aux and the Total. Each scoreboard can be individually enabled through the IO Setup Screen on the configuration tool. If scoreboards are not used they should be disabled.

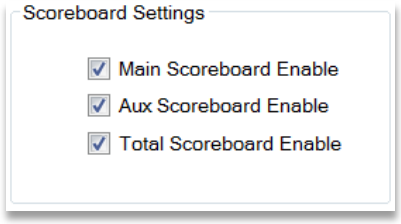


Figure 28 Scoreboard Control

The table below shows the settings that are not the default settings for the scoreboard.

Area 1	Value 1 to Accept Alpha Characters
Area 2	Value 3 Baud Rate 9600 (Default)
Area 3	Value 0 Auto Brightness (Default)
Area 4	Value 0 Mirror Mode Off (Default)
Area 5	Value 0 Zero Suppression (Default)
Area 6	Value 0 Colons Together (Default)
Area 7	Address 10's Location (See Table)
Area 8	Address 1's Location (See Table)
Area 9	Value 0 (Default)

The Table below is for setting the addresses for the scoreboard.

Scoreboard	Area 7 (MSD)	Area 8 (LSD)
Main	0	1
Aux	0	2
Total	0	3

8.3.6.2 ASCII Communications

The LMC supports a basic ASCII protocol to allow data to be shared with other controllers over RS485. The interface is basic using a start and stop delimiter that should be parsed by the user as scoreboard can share the same interface. The Start Delimiter is a '$' and the Stop Delimiter is a carriage return. Each data value is separated by a comma. The string is enabled in the IO Setup screen on the configuration software. Once enabled the output s values are sent out in the order on the IO Setup screen from top to bottom. If the ASCII string is not used it should be disabled.

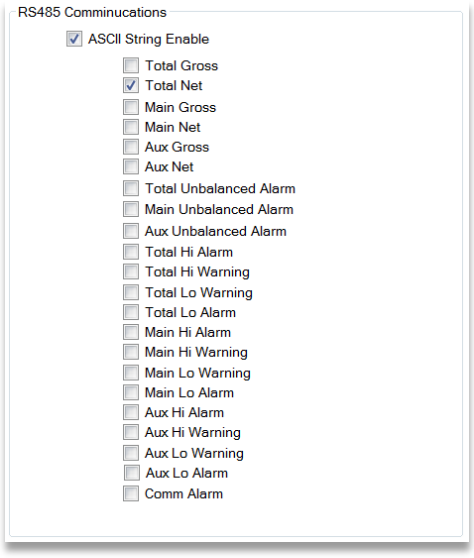


Figure 29 ASCII String Setup

8.3.7 Remote Antenna

The LMC has an on board RF Receiver. The antenna should be placed in direct line of sight with the transmitters for best results.

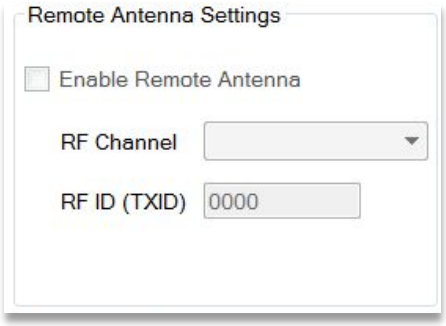


Figure 30 On Board Remote Antenna Settings.

8.4 Alarm Setup

The LMC supports several alarms that can be individually enabled and has configurable alarm values and relay Assignments. The Alarm Page in the configuration tool is used to setup the alarms.

Note: The only alarm that is enabled by default is the communications alarm. This alarm affects all relays.

Note: Relays operate in reverse logic for failsafe operation.

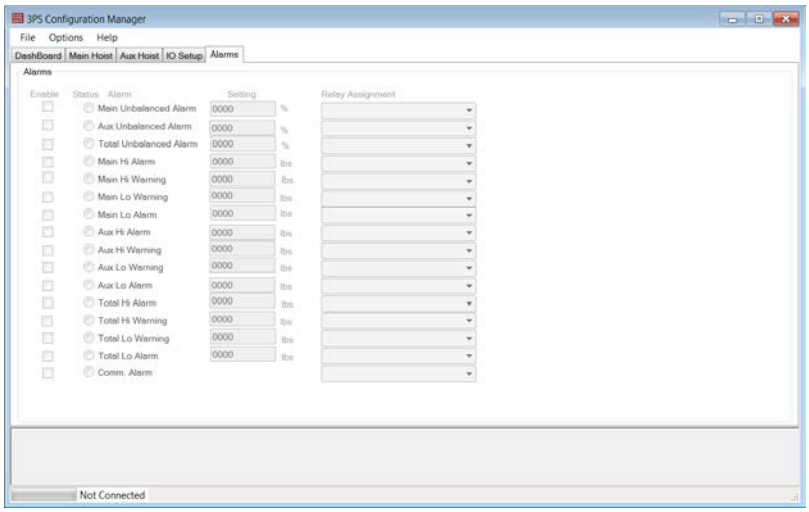


Figure 31 Alarm Setup

9 Specifications

Environmental:

Operation Temperature:	-20 to +70°C
Storage Temperature:	-30 to +85°C

Electrical:

Supply Voltage (See Note 1.)	8 – 30 VDC
Supply Current	1.2A max
Transient Voltage Protection	
Reverse Polarity Protection	
RFI Filtered	

Mechanical:

Enclosure dimensions	7.5″w x 6.7″h x 2.4″d
Materials	Steel
Weight	<2 lbs.

Reference A – Option Matrix

The part number matrix below outlines the part number configuration for the LMC. It has configurable options that can be selected at the time of ordering and will drive the build configuration.

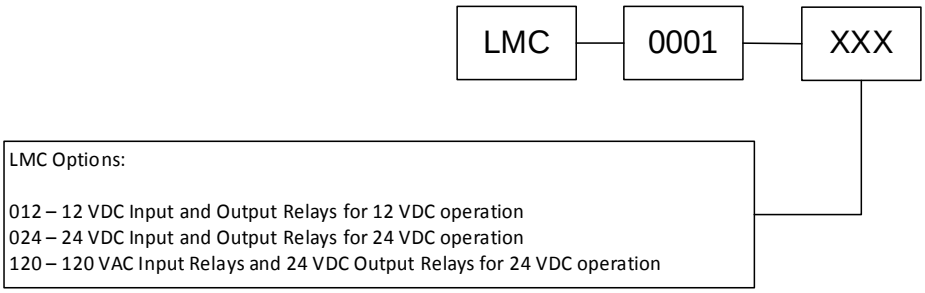


Figure 32 Configuration Options

Reference E – Warranty Requirements

McCoy Global (the "Company") warranties the products or parts it manufactures against defects in materials and workmanship as follows:

- For a period of 18 months from time of shipment, or 12 months from date of installation, whichever comes first and provided the products or parts have been paid for and stored, handled, installed and used under proper conditions.
- The Company's liability under this Warranty Policy shall extend to the repair or replacement of a defective product or part only, at the Company's option.
- All Warranty work is to be performed at the Company's facilities.
- Products or parts being returned under this Warranty Policy are to be returned freight prepaid to the Company, and the Company will return the product or part to the customer freight prepaid.
- No field service is included. Field service work can be performed at the rate published by the Company and in the Company's sole discretion.
- The Company reserves the right, in its sole discretion, to make all determinations as to whether or not work requested is covered by this Warranty Policy.
- The Company's liability will be no more than the amount the customer has paid for the product or part that is the subject of a claim. This is the maximum amount for which the Company is responsible.
- During the Warranty period, the Company will, at its sole discretion, repair or replace defective products or parts for the customer, or refund the amount paid for the product or part less depreciation, upon its return to the Company. The Company reserves the right to refund the purchase price as its exclusive Warranty remedy.
- The Company shall not be liable for and does not assume any responsibility for loss of business or any indirect, incidental, special or consequential damages suffered by the customer or any subsequent buyer.
- TO THE EXTENT PERMITTED BY LAW AND EXCEPT AS SET FORTH IN THIS WARRANTY POLICY, THE COMPANY DOES NOT MAKE, AND SHALL NOT BE DEEMED TO HAVE MADE, ANY OTHER REPRESENTATION OR WARRANTY, EXPRESS OR IMPLIED, TO THE CUSTOMER OR BUYER OR ANY OTHER PERSON OR ENTITY REGARDING THE PRODUCT, PARTS OR ANY OTHER MATTER. THE COMPANY HEREBY SPECIFICALLY DISCLAIMS ANY AND ALL IMPLIED REPRESENTATIONS AND WARRANTIES RELATING TO THE PRODUCT, PARTS OR ANY OTHER MATTER, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED REPRESENTATION OR WARRANTY AS TO THE QUALITY, MERCHANTABILITY, SUITABILITY OR FITNESS FOR A PARTICULAR USE OR PURPOSE, OR NON-INFRINGEMENT OF OR WITH RESPECT TO THE PRODUCT OR PARTS, WHETHER USED ALONE OR IN COMBINATION WITH OTHER MATERIALS, PRODUCTS OR SUBSTANCES.

- The Warranties provided herein are not transferable.