



MC<sup>3</sup> 90.10.EX  
MasterSet Controller  
Operation and Maintenance Manual  
Version B

Merrick Industries, Inc  
10 Arthur Drive  
Lynn Haven, FL 32444  
Ph. +1 850.265.3611  
Fax +1 850.265.9768  
Web <http://www.merrick-inc.com>



## Revisions

| Version | Date         | Description |
|---------|--------------|-------------|
| Z       | 02/06/03/ldd | New         |
|         |              |             |
|         |              |             |

All trademarks referenced are the property of their respective owners.

### PROPRIETARY NOTE

The information in this manual, including technical data and copies of drawings, embodies information proprietary to Merrick Industries, Incorporated. This manual is provided to the user of equipment purchased from Merrick Industries, Inc. for use only in operation or maintenance of such equipment. Such information in this manual is not to be used, disclosed, copied, or reproduced in whole or part for any use other than that indicated above, or for any other purpose detrimental to the interests of Merrick Industries, Inc. Patents owned by Merrick Industries, Inc. have been issued or are pending on at least some of the information in this manual, and unauthorized use of this subject matter of such patents is a violation of such patents and is prohibited.



## TABLE OF CONTENTS

|   |           |
|---|-----------|
| <b>INTRODUCTION .....</b>                       | <b>2</b>  |
| MANUAL CONVENTIONS .....                        | 2         |
| Important points .....                          | 2         |
| Buttons .....                                   | 2         |
| Screens .....                                   | 2         |
| SAFETY .....                                    | 2         |
| In General .....                                | 2         |
| Electrical Precautions .....                    | 2         |
| Solving Problems .....                          | 2         |
| Technical Support .....                         | 3         |
| <b>SYSTEM CONCEPTS .....</b>                    | <b>4</b>  |
| HARDWARE OVERVIEW .....                         | 4         |
| Installation .....                              | 4         |
| Enclosures .....                                | 5         |
| Electronic Cards .....                          | 6         |
| SOFTWARE OVERVIEW .....                         | 8         |
| Application Software .....                      | 8         |
| BIOS .....                                      | 8         |
| Register Database .....                         | 8         |
| Digital I/O Mapping .....                       | 8         |
| <b>RUNNING &amp; CONTROLS .....</b>             | <b>9</b>  |
| INITIAL SETUP .....                             | 9         |
| MAIN DISPLAY .....                              | 9         |
| MASTER SETPOINT .....                           | 10        |
| Local .....                                     | 10        |
| Analog .....                                    | 11        |
| Ratio .....                                     | 11        |
| Serial .....                                    | 11        |
| FAULTS .....                                    | 12        |
| WARNINGS .....                                  | 12        |
| GRAPH SCREEN .....                              | 13        |
| ACTION MENU .....                               | 13        |
| Recipe Select .....                             | 13        |
| Start/Stop Feeders .....                        | 13        |
| Reset Sub-Total .....                           | 14        |
| Reset Master Total .....                        | 14        |
| Diagnostic Display .....                        | 14        |
| Settings .....                                  | 14        |
| RECIPE MENU .....                               | 14        |
| Feeder Amount .....                             | 15        |
| Recipe String .....                             | 15        |
| FEEDER DISPLAY .....                            | 15        |
| FEEDER SETTINGS .....                           | 16        |
| Feeder Numeric .....                            | 17        |
| Feeder Strings .....                            | 18        |
| PRINTER MENU .....                              | 19        |
| Print Line Editing and Printout Selection ..... | 19        |
| <b>SETTINGS MENU .....</b>                      | <b>21</b> |

|   |           |
|---|-----------|
| ENTERING NEW VALUES .....               | 21        |
| Units Select .....                      | 21        |
| Design Capacities .....                 | 22        |
| Decimal Points.....                     | 22        |
| Comm Parameters .....                   | 22        |
| Comm 1 Numeric .....                    | 23        |
| Comm 2 Numeric .....                    | 24        |
| Limit Switches .....                    | 24        |
| Panel Meter.....                        | 25        |
| Display Parameters .....                | 25        |
| EMT Parameters .....                    | 25        |
| Date/Time .....                         | 26        |
| Analog Input .....                      | 26        |
| Analog Input Source Settings .....      | 26        |
| Analog Input Numeric.....               | 26        |
| Analog Input Cal .....                  | 27        |
| Analog Outputs.....                     | 28        |
| Analog Output Cal.....                  | 28        |
| DIGITAL IO .....                        | 29        |
| Digital Inputs.....                     | 29        |
| Digital Outputs .....                   | 31        |
| <b>DIAGNOSING PROBLEMS .....</b>        | <b>34</b> |
| DIAGNOSTIC DISPLAY.....                 | 34        |
| Feeder Diagnostics.....                 | 34        |
| Analog I/O Diagnostics.....             | 34        |
| Communication Diagnostics.....          | 34        |
| DF1 and Modbus Diagnostics .....        | 35        |
| Digital I/O Diagnostics.....            | 35        |
| Register Monitor .....                  | 36        |
| Misc. Data.....                         | 36        |
| Faults.....                             | 36        |
| Warnings .....                          | 36        |
| DIAGNOSTIC SETTINGS .....               | 37        |
| Password Settings .....                 | 37        |
| Quick Setup.....                        | 37        |
| Register Editor .....                   | 37        |
| <b>SOLVING PROBLEMS .....</b>           | <b>38</b> |
| SYMPTOMS.....                           | 38        |
| Unit does not power up.....             | 38        |
| Controller Fails to Boot Up. ....       | 38        |
| LCD Display too dark or too light ..... | 38        |
| No analog Input .....                   | 38        |
| External Totalizer problems .....       | 38        |
| No Serial Communications .....          | 38        |
| Hang Message Appears .....              | 39        |
| HARDWARE CALIBRATION AND TESTING .....  | 39        |
| Analog Outputs.....                     | 39        |
| Analog Inputs .....                     | 39        |
| <b>CONTROLLER HARDWARE.....</b>         | <b>40</b> |
| LTI BOARD .....                         | 40        |
| EMT.....                                | 40        |
| Encoder .....                           | 40        |
| Serial Communications .....             | 40        |
| PCIO BOARD .....                        | 41        |

|   |           |
|---|-----------|
| Digital Inputs.....                     | 41        |
| Digital Outputs .....                   | 41        |
| Analog Inputs .....                     | 41        |
| Analog Outputs.....                     | 42        |
| LCD Board .....                         | 42        |
| CPU BOARD .....                         | 42        |
| Communication Ports .....               | 42        |
| Printer Operation .....                 | 44        |
| BACKPLANE BOARD .....                   | 44        |
| DC Style Backplane Board .....          | 45        |
| AC Style Backplane Board.....           | 45        |
| <b>STORAGE.....</b>                     | <b>47</b> |
| STORAGE ON RECEIPT FROM FACTORY .....   | 47        |
| Storage Longer than 6 Months .....      | 47        |
| Storage up to 6 Months .....            | 47        |
| STORAGE FOLLOWING USE .....             | 47        |
| OPERATION AFTER STORAGE .....           | 47        |
| <b>SPARE PART LIST .....</b>            | <b>48</b> |
| SPARE PARTS LIST .....                  | 48        |
| ACCESSORIES .....                       | 48        |
| I/O System .....                        | 48        |
| Spare I/O Plugs and Miscellaneous ..... | 48        |
| <b>APPENDIX A .....</b>                 | <b>49</b> |
| PANEL MOUNT - DIMENSIONS .....          | 49        |
| WALL MOUNT – MOUNTING DIMENSIONS .....  | 50        |
| DOOR MOUNT - DIMENSIONS .....           | 51        |
| <b>INDEX .....</b>                      | <b>52</b> |



# INTRODUCTION

## **Manual Conventions**

### **Important points**

**NOTE:** Any additional information that may be useful follows the note marker.

**CAUTION:** *Be careful, certain settings may cause problems.*

**WARNING:** *Follow the directions prescribed in the warning. Serious problems can occur if the recommendations are not followed.*

### **Buttons**

Button graphics will be shown to the right of the corresponding information regarding the function for the button.

### **Screens**

A graphic of this size and type will show the functions and/or information available in many of the different screens.

## **Safety**

The Merrick MC<sup>3</sup> Controller is used for the control of process weighing equipment. As such, it is normally responsible for the control of a process and is not intended as a motor control device. To insure personnel safety please read the following instructions and precautions carefully.

### **In General**

Observe all standard precautions that pertain to moving machinery.

Observe all standard precautions that pertain to electrical drives and electrical controls.

Pay particular attentions to special notes and precautions that appear throughout this manual.

Please read and become familiar with this entire manual before attempting service or repair of the Merrick MC<sup>3</sup> Controller. If you have any questions or problems, please call the Merrick Customer Support Department for assistance.

All trademarks referenced are the property of their respective owners.

### **Electrical Precautions**

Before undertaking work on the electrical system, the drives, or the Controller, from the main-disconnect switches and lock boxes insure power is disconnected. Work should never be performed on the Controller with power on the unit. It is recommended to disconnect the power from the controller before attempting any service procedure.

Verify that all grounds called for on the wiring diagrams are in place and are securely connected. Proper grounding not only helps insure your personal safety, but is also necessary for the proper operation of the controller.

If it is necessary to work in or near areas of live high voltage, always keep one hand clear of the machine, the cabinet, or any other conductors to avoid the possibility of electrical shock traveling across your chest. NEVER undertake any electrical work in areas with wet or flooded standing areas.

**WARNING:** *NEVER impair or disable the function of a fuse or a circuit breaker.*

**CAUTION:** *IF IN DOUBT ABOUT ANY PROCEDURE CONTACT THE MERRICK CUSTOMER SUPPORT DEPARTMENT.*

### **Solving Problems**

Included in this manual is a troubleshooting section to assist in solving technical problems (section Diagnosing Problems on page 34 or section SOLVING PROBLEMS on page 38).

### **Technical Support**

Merrick provides customer technical and spare part support 24 hours a day, seven days a week. Our normal business hours are Monday through Friday 7:30 AM until 4:30 PM Central Standard Time. During normal hours call 1-888 MERRICK (637-7425) and ask for service. The call will be routed to the next available phone support technician.

After normal hours and on holidays and weekends, technical assistance is available by calling 1-888 MERRICK extension 7878. Follow the instructions and be sure to enter the area code and the phone extension where you can be reached. Someone will return your call as soon as possible.

When you call Merrick for Technical Support, please have your machine serial number or a controller serial number. This information will better help us to serve you.

## SYSTEM CONCEPTS

The MC<sup>3</sup> 90.10.EX MasterSet Controller was designed to connect multiple MC<sup>3</sup> Feeder Controllers together to provide a central point for control and data collection in a total feeding system. A MasterSet System contains an MC<sup>3</sup> MasterSet Controller with a FastComm 422 Serial Port Card installed, one or more MC<sup>3</sup> Feeder Controllers capable of communicating using Modbus RTU protocol, and the associated communications hardware needed to provide an interconnecting serial communications loop with multi-drop capability.

Features:

The MasterSet Controller provides the following features:

1. Display of combined system Feedrate and Total
2. Reset-able Recipe, Sub-Total and Master Total
3. MasterSetpoint Control through blending recipes
4. MasterSetpoint methods of Local, Analog, Ratio and Serial
5. Storage of 100 recipes for up to 32 Remote Controllers
6. Configurable alarming system for the entire MasterSet System
7. Display of Individual Feedrate, Speed, Load, Total, Sub-Total and other data
8. Digital and Analog Outputs representing MasterSet System variables and states
9. Ability to print information on a printer

### ***Hardware Overview***

The MC<sup>3</sup> Controller has been designed to control many different types of feeding, weighing and metering equipment. This allows for easier maintenance and simplified training.

The Standard Merrick MC<sup>3</sup> 90.10.EX Controller consists of an Enclosure, an LCD Display, Card Stack and a Power Supply.

### **Installation**

Carefully unpack the controller and inspect it for obvious damage because of shipping or handling. If the unit appears to be damaged in any way, contact the Merrick Service Department for assistance.

Insure that the power is disconnected from the power supply. Make the wiring connections to the controller, following the instructions on the electrical connection diagram. In order to maintain the weatherproof integrity: of the Wall Mount enclosure, liquid-tight conduit and conduit connectors must be used when running the wires. It is recommended to penetrate the enclosure from the bottom.

Verify all wiring connections before applying power to the controller.

**NOTE:** Before any deviation from the supplied wiring diagrams, Merrick must first be consulted to insure safe and proper operation of the controller. See Technical Support on page 3 for contacting the Merrick Customer Support Department.

**Enclosures**  
**Panel Mount**



The Merrick MC<sup>3</sup> Panel Mount Controller is designed for mounting in a control panel. It is suitable for use in environments that are generally clean, and within the temperature range of 32° to 122° F (0° to 40° C). It must be protected from water or significant dirt or dust.

The panel mount enclosure consists of a rectangular box with a hinged door on the rear covering the I/O connections, a removable top cover, a system-grounding bar and a sliding tray. The slide tray allows the Card Stack Assembly to be slid out of the back of the enclosure for easier maintenance while the controller is mounted into a panel. The Display assembly is mounted on the front bezel. The top cover may be removed for easier access to the boards. Access to the terminal blocks for interconnection with other equipment is obtained by unscrewing the rear cover.

**Installation**

Cut panel to dimensions provided in Panel Mount - Dimensions on page 49. Care must be used when cutting due to tight tolerances for the panel mount bezel. Also, insure there is adequate clearance around the controller for maintenance and ventilation. Install the controller into panel using the mounting brackets provided.

**Wall Mount**



The Merrick MC<sup>3</sup> Wall Mount Controller is designed to be weatherproof, and can generally be mounted anywhere where the temperature range is within 14° to 104° F (10° to 40° C). Merrick

recommends that the controller should be located out of direct sunlight and away from dripping water and must be protected from heavy rain.

The wall mount enclosure is available in NEMA-4 or NEMA-12 boxes. NEMA-4 box includes gaskets and a window kit over the touch screen to provide extra protection.

### **Installation**

Mount the controller on a vertical surface, Use dimensions provided in Wall Mount – Mounting Dimensions on page 50 for placement of hardware used to secure enclosure to surface. Make sure there is adequate clearance around the unit for swinging open the door and for maintenance.

### **Door Mount**

A door mount enclosure is available that separates the power-supply and Backplane boards from the controller. This style includes a window for protection from the elements. It also adds two fans to the cover of the enclosure to improve air circulation for better cooling.



The Merrick MC<sup>3</sup> Door Mount Controller is designed for mounting in a control panel. It is suitable for use in environments that are generally clean, and within the temperature range of 32° to 122° F (0° to 50° C). It must be protected from all but incidental water or significant dirt or dust.

### **Installation**

Mount the controller in the panel. Cut panel to dimensions provided in Door Mount - Dimensions on page 51. Insure there is adequate clearance around the controller for maintenance and ventilation. Install the controller into panel using the mounting brackets provided.

### **Electronic Cards**

#### **Backplane Board**

Most of the Digital I/O connections to the MC<sup>3</sup> will be made through the Back plane Board. The Back plane mounts vertically in the rear access cover on the Panel mount type enclosure. On the Wall mount enclosure, the boards are mounted directly below the Card stack assembly. When the Door Mount controller is used, the boards are normally placed on a panel inside the cabinet.

There are two types of Back plane cards available, a dry contact enclosure input card (BPLN) and an AC input card (BPAC). The BPLN card has four dry contact inputs and 7 relay (N/O) outputs.

The BPAC card has four AC inputs and 8 Relay outputs. The relays 1-7 are N/O types with relay 8 having the capability of being selected to N/O or N/C.

Up to four Back plane boards may be connected to the MC<sup>3</sup> Controller when two (2) PCIO boards are in the card stack assembly.

### **Card Stack Assembly**

The Card Stack assembly consists of one (1) CPU Board, one (1) FastComm 422/4-104 Communication Board, one (1) or two (2) PCIO boards and one (1) LTI board. The Card Stack Assembly in the panel mount enclosure is mounted to the slide tray. The slide tray is kept in place by a pair of guides that are mounted on the enclosure and with catch screws on the back of the enclosure. In the wall mount enclosure, the Card Stack Assembly is securely attached to the mounting plate. All boards are connected electronically by way of an industry standard PC-104 interface bus.

### **Fastcom 422/4-104**

The Fastcom 422/4-104 is a 4-port RS-422 serial communication board. All feeders to be controlled by the 90.10.EX software must be attached to one of ports on this board.

### **CPU Board**

The CPU Board contains the Intel 386EX Microprocessor and associated support circuitry for a bus interface, serial interface and memory support. The newest CPU module includes both available communication ports providing RS-232 and RS422/485 from both ports. The CPU board is the bottom board of the card stack.

The RS-485 Serial Communications port is a feature that provides the circuitry necessary for the MC<sup>3</sup> Controller to communicate with other serial devices such as a SuperBridge or Personal Computer. For more information regarding MC<sup>3</sup>, Serial Communications see the Merrick Communications Specification Manual. This specification lists some hardware options and interconnection examples and describes the Merrick Communications Protocol in detail.

### **PCIO Board**

The PCIO Board provides the circuitry for two (2) isolated analog outputs; one (1) isolated analog input, sixteen (16) digital outputs and eight (8) digital inputs. An additional PCIO Board is available as an option giving the controller a capability of having four (4) isolated Analog Outputs, two (2) isolated Analog Inputs, thirty-two (32) Digital outputs and sixteen (16) Digital inputs. Two (2) racks of digital inputs and outputs can be connected to the PCIO board.

### **LTI Board**

The LTI Board contains the circuitry required to process incoming synchronization pulses, outputs for an AC and DC Electromechanical Totalizer (EMT) and an interface to the Display assembly.

### **Power Supply Assembly**

The power supply is mounted on the front of the slide tray on the panel mount enclosure. On the wall mount enclosure, the power supply is mounted under a protective metal panel. The power supply for the door mount is normally attached to the cabinet away from the controller.

### **Display Assembly**

The Display Assembly consists of a Touch Keypad, LCD Board and LCD Display.

#### **LCD Board**

This board is used to interface the LCD Display and the Touch Keypad to the LTI Board and provides the proper voltage for the backlight of the LCD Display. There is a potentiometer for adjusting the contrast of the LCD Display. In addition, on specific LCD Boards containing an LS220 type inverter there is a Brightness Adjust potentiometer.

#### **LCD Display**

The LCD Display is a 240 horizontal by 128 vertical pixel resolution monochrome graphical display. The display works in conjunction with the Touch Screen to provide a Graphical User Interface (GUI).

### **Touch Keypad**

The Touch Keypad is mounted directly to the bezel of the MC<sup>3</sup> Panel Mount Controller. It consists of a four by eight touch cell array. The Touch Keypad works with the LCD Display to provide a way for you to interface with the controller.

### **Software Overview**

The MC<sup>3</sup> software consists of three (3) primary parts consisting of the BIOS (Basic Input / Output System) a register database and the actual application software. The software has been designed to utilize the hardware fully without requiring a large amount of training to operate. The user interface has been designed to provide you with maximum flexibility with minimum input.

### **Application Software**

Application Software is written for each specific type of "job" that the controller is to perform. This software will allow you to turn on and off different modes of operation, which allows you to configure the software for your specific process

### **BIOS**

The BIOS is the portion of the software that directly manipulates the hardware. It is the interface between the application and the hardware.

### **Register Database**

The Register Database is a set of variables used in the software application. It is provided to allow structured access through Serial Communications to variables used in the MC<sup>3</sup>. A numeric listing of registers for each application is available from Merrick. Procedures for using Serial Communications to access the register list are also provided in the Merrick Serial Protocol Specification.

### **Digital I/O Mapping**

The MC<sup>3</sup> allows configuration of the digital inputs and outputs to the system's requirements. By allowing mapping of the I/O, the MC<sup>3</sup> gives a great degree of flexibility in design of the system.

**CAUTION:** *This feature is a very powerful tool that should be used with extreme care. For most installations, the default settings should be used.*

## Running & Controls

### Initial Setup

1. Slaves must be set to use Modbus/RTU. This usually is accomplished by setting the Comm Protocol Value to 2 then cycling power to use the protocol. Default Line Parameters - Baud Rate 9600, 8 Data Bits, 1 Stop Bit, Even Parity.
2. One digital input in the slave must be properly configured.

| Input            | Setting        |
|------------------|----------------|
| External Input 1 | Run Permission |

3. Five digital outputs must be mapped in the slave.

| Output            | Setting       |
|-------------------|---------------|
| External Output 1 | Fault         |
| External Output 2 | Warning       |
| External Output 3 | Ready         |
| External Output 4 | Running       |
| External Output 5 | Good Feedrate |

4. The total number of recipes used must be entered into the design parameters.
5. The total number of feeders (slaves) must be entered into the design parameters.
6. There are several parameters from the feeders (slaves) that need to be entered into the MC<sup>3</sup> 90.10.EX.

| Parameter  |
|--|
| Port # that the slave feeder is attached to                    |
| Controller number for the slave feeder                         |
| Type of feeder (Belt feeder, Loss-In-Weight Feeder, Flowmeter) |
| Unit settings for each feeder.                                 |
| Design Feedrate  |
| Design Weight/Load   |
| Design Speed (if not used use default of 100%)                 |

### Main Display

|                            |             |              |          |
|----------------------------|-------------|--------------|----------|
| <b>MERRICK</b>             |             | <b>F</b>     | <b>⚠</b> |
| Recipe 1: C-121 Red Velour |             |              |          |
| Feedrate:                  | 0.0 lb/min  | Stopped      |          |
| SetPoint:                  | 0.0 lb/min  | Local        |          |
| RecipeTotal:               | 0 lb        |              |          |
| SubTotal:                  | 0 lb        |              |          |
| MasterTotal:               | 0 lb        |              |          |
| Setpoint                   | Action Menu | Graph Screen |          |

The main screen displays the following parameters:

- The current selected recipe

- The current feedrate of all feeders that are a part of the current recipe

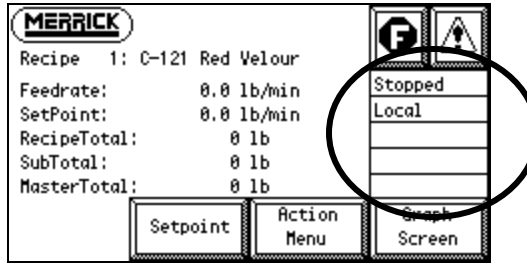
- The current setpoint (The method, ex. Local, is displayed within an indicator box.)

- The total of the current selected recipe

- A Sub-Total of all recipes

The Master Total of all recipes.

Below the Fault and Warning buttons there are several text indicators that provide additional information regarding the state of the controller.



The first line displays whether the process is running or stopped.

The second line displays the current setpoint method.



The third line displays whether there is a Blocking condition (Feeder Block logical input is enabled) or if the Run Permission logical input is enabled. If neither condition is detected the line is cleared.

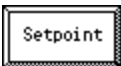
The fourth line Displays the running condition of the controller.

- Ready – All feeders associated with the current recipe are online AND There are no fatal communication errors AND All feeders are ready (The associated Ready output for each feeder is enabled.) AND The Feeder Block logical input is disabled AND there are no FAULTS.

In Control – The Ready (same as above) logical output is enabled AND Run Permission logical input is enabled.

- Good Feed – All feeders associated with the current running recipe are feeding good. (The associated output for Feed Good is enabled in each running feeder.) AND The In Control logical output is enabled (same as above). AND The feedrate is within the feedrate and deviation limits set in the Limit Switch Menu. AND The recipe is running (the Running logical output is enabled). AND there are no Warnings or Faults.

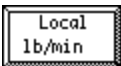
If none of these conditions are present the line will be cleared.



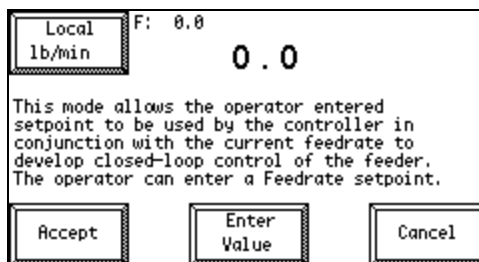
### Master Setpoint

Touching this button provides access to the Setpoint Screen. A Setpoint Password may be saved to restrict access to this screen. See the section Password Settings on Page 37 for setting and modifying password.

On the Setpoint Screen, the Setpoint Mode Button at the top left will indicate the Setpoint Mode. Touching the Setpoint Mode Button will change the Setpoint Mode to the next mode in the order of the list:



### Local



When this mode is selected, direct entry of the Feedrate setpoint is available. This setpoint is in engineering units for feedrate.

Analog  
lb/min

### Analog

Analog F: 0.0  
lb/min 0.0

This Setpoint mode allows the setpoint value to be input through the Analog Input in relation to the Maximum Feedrate Capacity value entered in Design Capacities.

Accept Cancel

This Setpoint mode allows the setpoint value to be input through the Analog Input in relation to the Maximum Feedrate. For example, if a 50% input signal (12mA when the input is 4-20mA) is being read from the Analog Input, and the Maximum Feedrate Capacity is 40.00 lb/min, then the Setpoint will be 20.00 lb/min.

RemRatio  
%

### Ratio

RemRatio F: 0.0 S: 0.0  
% 0.00%

This mode scales the setpoint as a % of the incoming analog input signal. This allows multiple feeders to be connected to a single signal with each feeder assigned a particular percentage of the signal as a setpoint.

Accept Enter Value Cancel

This method scales the External Feedrate setpoint as a percentage of the incoming analog input signal. Scaling is the same as Remote Analog. This allows multiple systems to be connected to a single signal with each system assigned a particular percentage of the signal as a setpoint.

For example, three systems are to be used configured to provide material to a process using one analog input for control. System number one provides 25%, system number 2 provides 35% and system number 3 will provide 40% of the material needed for the total process. When the setpoint changes for the process all three systems will properly scale for the new setpoint.

Serial  
lb/min

### Serial

Serial F: 0.0 S: 0.0  
lb/min 0.0

This setpoint mode receives the setpoint from a remote device through the serial port. This method can be locked to the current setting by enabling the Lock Set Point Mode logical input.

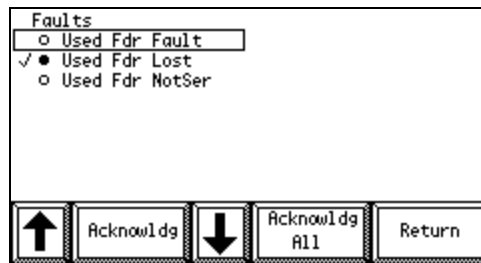
Accept Cancel

This setpoint mode allows the MC<sup>3</sup> Controller to receive a setpoint from a remote device through the serial port such as a computer or a PLC/SuperBridge Controller. This method requires that the remote device be connected to the controller via a serial port.

**NOTE:** When the controller is to be used in SuperBridge or any other system, which transmits setpoint information using Serial Communications, the Remote Serial mode must be selected. The rules and format of the data exchange is described in a separate publication, Merrick Serial Protocol Specification.




## Faults





The Fault button is used to indicate an error has occurred. A Fault condition will stop all feeders. The system will not restart until the Fault condition has been cleared. A Fault will also prevent the system from starting. Up to 16 Logical Inputs and Outputs may be selected to give you a Fault indication.

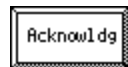
This button will remain displayed until the conditions that caused the Fault have been removed

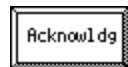
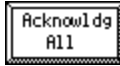


and the Fault acknowledged. To view the Fault screen, touch . There is an active indicator to the left of the text (■ = ON □ = OFF). Any Fault that occurs will be saved until acknowledged by you and will be displayed with a ✓ to the left of the active indicator. If there are no Faults, this button will be hidden from the main screens. You may still access this screen from the action menu.



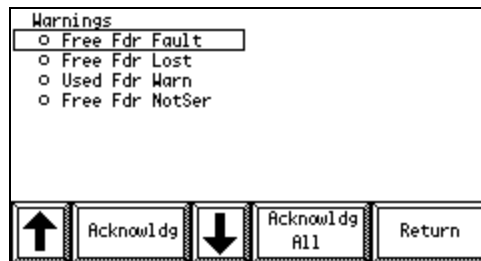
Use  and  to move the selection box to the Fault you want to acknowledge.



 is used to acknowledge a Fault selected by the selection box.  is used to acknowledge all Faults. If the error that caused an indication has not been corrected the Fault button will continue to be displayed on the main screens and the Fault will continue to be indicated on this screen.




## Warnings





The Warning button is used to indicate a problem has occurred. Up to 16 Logical Inputs and Outputs may be selected to give you a warning indication. A Warning condition will not stop the system.

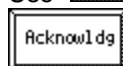
This button will remain displayed until the conditions that caused the Warning have been

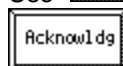
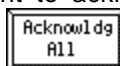


removed and the Warning acknowledged. To view the Warning screen, touch . There is an active indicator to the left of the text (■ = ON □ = OFF). Any Warning that occurs will be saved until acknowledged by you and will be displayed with a ✓ to the left of the active indicator. If there are no Warnings, this button will be hidden from the main screens. You may still access this screen from the action menu.



Use  and  to move the selection box to the Warning you want to acknowledge.



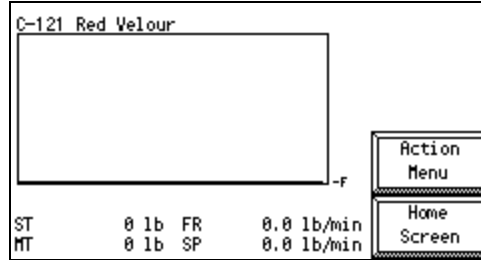
 is used to acknowledge a Warning selected by the selection box.  is used to acknowledge all Warnings. If the problem that caused an indication has not been corrected the

Warning button will continue to be displayed on the main screens and the Warning will continue to be indicated on this screen.

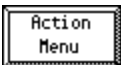


### **Graph Screen**

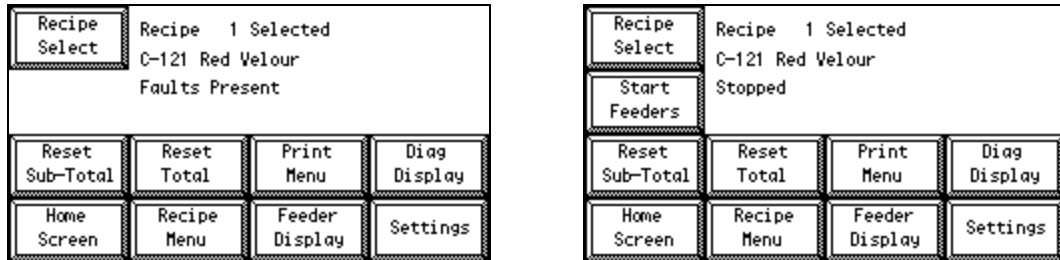
This button displays a trend screen that graphically compares the current feedrate to the setpoint.



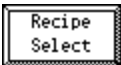
Also displayed on this screen is the Sub-Total (ST), Master Total (MT), Feedrate (FR), and Setpoint (SP).



### **Action Menu**

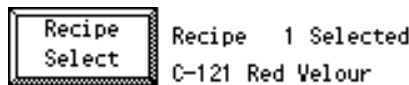


This menu allows you to change the current recipe, start and stop the feeders, reset the Sub-Total or Master Total, access to the Settings Menu, Diagnostic Menu, Recipe Menu and the Feeder Display menus.

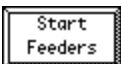


### **Recipe Select**

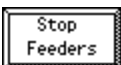
This button allows selection of the recipe to be used. Immediately to the right of the Recipe Select button the controller displays the currently selected recipe number and the name (string) associated with the recipe number directly below.



If a recipe is currently running the button will not be displayed. To change the selected recipe the system must be stopped either by removing Run Permission or touching the Stop Feeders button.



### **Start/Stop Feeders**



These buttons are used to start and stop the Feeders that are attached to this controller when the logical input Run Permission is enabled. A status message associated is displayed directly to the right of these buttons.

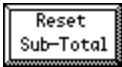
If a Fault occurs, this controller will stop all feeders and the text message **“Faults Present”** will be displayed. The Start/Stop feeder buttons will be hidden until the Fault has been cleared.

If the logical input Feeder Block is enabled, this controller will stop all feeders and the text **“Controller Blocked”** will be displayed. The Start/Stop Feeder buttons will be hidden until the input is turned off.

If Run Permission is turned off, this controller will stop all feeders and the text message **“No Run Permission”** will be displayed. The Start/Stop Feeder buttons will be hidden until the input is turned on.

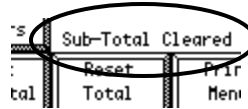
Once Run Permission is turned on the controller will display **“Running”** until the controller is stopped. While running the Stop button is displayed.

If the controller is stopped by touching the Stop Feeder buttons or the Stop Feeder logical input, the text message **“Stopped”** will be displayed. The button will change to Start Feeders.



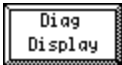
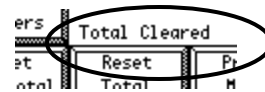
### Reset Sub-Total

When this button is touched you will clear the system Sub-Total. Feedback is provided just above the Reset Total button.



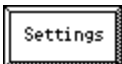
### Reset Master Total

When this button is selected you will be asked to enter the calibration password to confirm that you actually want to clear the Grand Total. Enter the password to clear the Total or touch the ESC button in the password screen to escape to the action screen without clearing the Master Total. Feedback is provided just above this button.



### Diagnostic Display

This selection takes you to the Diagnostic Display Menu. See Diagnostic Display (page 34) for more information. This menu is not password protected.



### Settings

This button displays the feeder settings menu where the feeder design parameters may be entered. See Settings Menu on page 21 for more information.



### Recipe Menu




|                         |         |
|-------------------------|---------|
| R 60 C-814 Cashmere     |         |
| F31 Feeder31            | 0.00%   |
| F32 Feeder32            | 0.00%   |
| F 1 Sand Bin 1 F1       | 7.41%   |
| F 2 Sand Bin 1 F2       | 0.00%   |
| F 3 Lime Bin 2 F3       | 0.00%   |
| Total                   | 100.00% |
| Total Amount of Recipe: | 0 lb    |

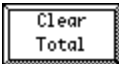

Example A

|                            |         |
|----------------------------|---------|
| R 60 C-814 Cashmere        |         |
| F11 Shale Coarse Bin 7 F11 | 77.78%  |
| F12 Shale Coarse Bin 7 F12 | 0.00%   |
| F13 FC Fine Bin 8 F13      | 14.81%  |
| F14 FC Fine Bin 8 F14      | 0.00%   |
| F15 FC Coarse Bin 9 F15    | 0.00%   |
| Total                      | 100.00% |
| Total Amount of Recipe:    | 0 lb    |

Example B

This menu allows entry and changes made to the recipes. Only the number of recipes and feeders that are entered into Design Capacities (found on page 22) will be displayed.

The  and  buttons cycle through the recipes the feeders inside the selected recipe. The  button is used to toggle between the Recipes (Example A above) and the Feeder percentage (Example B above).

If the Recipe is selected as in Example A the  button is displayed that will allow clearing of the Total for the selected Recipe. The  button is displayed if the Feeder is selected.

Feeder Amount

### Feeder Amount

|       |   |                           |   |   |        |                 |
|-------|---|---------------------------|---|---|--------|-----------------|
| ↑     | ↓ | R: 60 C-814 Cashmere Edit |   |   |        |                 |
| Clear |   | Sand Bin 1 F1             |   |   |        |                 |
|       |   | Feeder 1                  |   |   | 7.41 % |                 |
|       |   |                           |   |   |        | Total = 100.00% |
| 1     | 2 | 3                         | 4 | 5 | Enter  |                 |
| 6     | 7 | 8                         | 9 | 0 | .      | Escape          |

This menu allows direct entry of the percentage for the specific feeder of the selected recipe.



Once in this menu, the and buttons cycles through the available feeders.

**NOTE:** A setting of 0.00% indicates that the feeder is not used in this recipe.

Rcp Str

### Recipe String

|                                    |                 |                 |               |
|------------------------------------|-----------------|-----------------|---------------|
| v C-814 Cashmere*****              |                 |                 |               |
| Char # 0 ASCII 67                  |                 |                 |               |
| Last Character MUST be a NULL (0). |                 |                 |               |
|                                    |                 | Null            | SpC           |
| Toggle Capitals                    | Increment Alpha | Misc Char       | Extended Char |
| Char <                             | Char >          | Decrement Alpha | Numeric Char  |
|                                    |                 | Escape          |               |

This menu allows entry or changing of the Recipe name. For a more detailed explanation on using this menu see Feeder Strings on page 18.

Feeder Display

### Feeder Display

|               |      |                 |                 |
|---------------|------|-----------------|-----------------|
| Sand Bin 1 F1 |      |                 |                 |
| Feedrate      | 0.00 |                 |                 |
| Setpoint      | 0.00 |                 |                 |
| Weight/Load   | 0.00 |                 |                 |
| Speed         | 0.00 |                 |                 |
| SubTotal      | 0.00 | Total           | 0.00 HR 0       |
| ↑             | ↓    | Reset Sub-Total | Feeder Settings |
|               |      | Action Menu     |                 |

The Feeder Display menu displays the most commonly used information from each feeder that is

attached to the system. The and buttons cycles through each of the available feeders. The information displayed is:

**Feedrate** – This is the feedrate from the controller.

**Setpoint** - This is the setpoint that is being sent to the controller based on the selected recipe and the MasterSetpoint.


**Weight/Load** – This is the current weight if a LIW unit or the Load if a BELT type unit.


**Speed** – This is the current speed of the selected feeder. If the unit is BELT, the display will be belt speed. If the type of unit is the LIW unit, this will be the speed of the discharge device (normally from 0 – 100%).


**Sub-Total** – This is the Sub-Total from the currently selected feeder. Use the button to clear the value on the selected feeder. The string "**Clear Pending**" will be displayed informing that the request has been sent to the controller. Upon

acknowledgement that the value has been cleared the string **"SubTotal Cleared"** will be displayed.

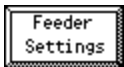
**Total** – This is the Master Total for the feeder. This value cannot be cleared from this controller. It must be cleared at the specific feeder.

If there are Warnings on the selected feeder, the  button will be displayed. The feeder

Warnings may be cleared by touching the  button. The string **"Clear Pending"** will be displayed informing that the request is pending. When confirmation that the Warnings have been cleared returns, the string "Warnings Cleared" will be displayed.





If there are Faults on the selected feeder, the  will be displayed. Any Faults must be cleared at the specific feeder. If this button is pressed the string **"THE FAULTS CAN ONLY BE CLEARED AT THE FEEDER!!"** will be displayed.

The bar graphs under each of the numeric displays are scaled to the respective Maximum values. Feedrate and Setpoint are scaled to the Max Feedrate value (page 17). Weight/Load is scaled to the Max Wt/Load value (page 17). The speed value is scaled to the Max Speed value (page 17).



## Feeder Settings

|                         |         |          |         |         |
|-------------------------|---------|----------|---------|---------|
| Feeder 1 Sand Bin 1 F1  |         |          |         |         |
| Address: Port 0, Unit 1 |         |          |         |         |
| Weight                  | Load    | Feedrate | Speed   | Total   |
| lb                      | lb/ft   | TN/h     | ft/min  | TN      |
| Unit Sel                | 4       |          |         | HRo     |
| Max FR                  | 100.000 |          |         |         |
| Max W/L                 | 33.000  |          |         |         |
| Max Spd                 | 100.000 |          |         |         |
|                         |         | Go       | Feeder  |         |
|                         |         | Offline  | Strings |         |
|                         |         | BELT     | Feeder  | Feeder  |
|                         |         | Units    | Numeric | Display |

The  and  buttons cycle through each of the available feeders. The HRo (heart rate) indicator is used to confirm that communications is taking place and will toggle between  and . If one of the indicators stays on for an inordinate amount of time, communications may have been lost.

The first line displays the current feeder number and the associated string. In the example below, it is Feeder 1 and the assigned name is Sand Bin 1 F1.

Feeder 1 Sand Bin 1 F1

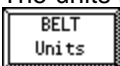
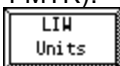
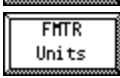
The second line displays the communication connection for the feeder. This feeder is attached to Port 0, with a unit address of 1. These values are set in the numeric entry menu.

Address: Port 0, Unit 1

The next set of data is the units data used by the selected feeder. This controller uses the setting to determine which conversion factors to use. This set of strings should be the same as on the selected feeder. If unsure contact Merrick Industries to properly set this value.

|          |      |          |       |       |
|----------|------|----------|-------|-------|
| Weight   | Load | Feedrate | Speed | Total |
| lb       |      | TN/h     | %     | TN    |
| Unit Sel | 4    |          |       |       |

The units button select the type of feeder that is connected (BELT, LIW or FMTR). The

 button is used for Belt Feeder Controllers (ex. 20.10.EX). The  button is used for Loss-In-Weight Controllers (ex. 30.00.EX or 30.10.EX). And the  for

Flowmeter Controllers (40.10.EX). Then the Units Select (page 17) numeric parameter sets the unit strings.

**Warning:** *The setting of this value incorrectly can cause erroneous calculations to be made and may affect the operation of the system.*

The next set of data that is displayed are the Max settings for each feeder. These values are used to scale the setpoint sent to the feeder and the bar graphs on the Feeder Display screen.

|         |         |
|---------|---------|
| Max FR  | 100.000 |
| Max W/L | 33.000  |
| Max Spd | 100.000 |

Feeder  
Numeric

### Feeder Numeric

|       |   |                   |         |      |    |        |
|-------|---|-------------------|---------|------|----|--------|
| ↑     | ↓ | Enter Feeder Data |         |      |    |        |
| Clear |   | Max Speed         | 100.000 |      |    |        |
|       |   | Unit Address      | 1       |      |    |        |
|       |   | Port Number       | 0       |      |    |        |
|       |   | Min:              | 1       | Max: | 64 |        |
| 1     | 2 | 3                 | 4       | 5    | +  | Enter  |
| 6     | 7 | 8                 | 9       | 0    | .  | Return |

#### Unit Address

This number is used to identify the numeric address of the selected controller on a multi-drop line. Controllers connected to the same communication port cannot have the same controller number. Limits are minimum of 1 and a maximum of 64.

#### Port Number

This is the communications port that the selected feeder is attached to (0-3).

**NOTE:** Two feeders may not have the same Port and Unit Address.

#### Units Select

This parameter is the index into the unit string array for the selected feeder. The 90.10.EX uses this number to select the correct conversion factor for use when determine the setpoint.

**CAUTION:** *It is very important that this parameter be set to the correct value since the calculation of the setpoint is directly affected.*

#### Max Feedrate

This value is the Design Feedrate of the attached controller. This parameter is used to scale the setpoint that is being sent back to the selected feeder. It is also used to scale the feedrate and setpoint bar graphs.

**CAUTION:** *It is very important that this parameter be set to the correct value since the scaling of the setpoint is directly affected.*

#### Max Wt/Load

This parameter represents the maximum belt load or maximum hopper weight of the feeder during normal operation. This number is used to scale the bar graph on the Feeder Display screen.

#### Max Speed

This value represents the maximum speed of the belt when the unit type is set to 



. If the unit type is set to 



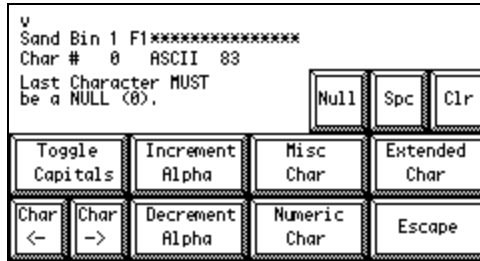
 or 



, this value should be set to 100 to scale the bar graph to the SCR output value of the selected feeder.

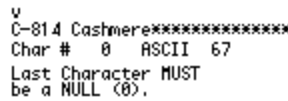
**Feeder Strings**

**Feeder Strings**

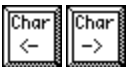


This menu allows entry and changing of the Feeder name string. The Recipe menu uses a similar display as this one.

At the top of the display is a 'v' that points to the character that is under edit. The index of the character in the string is directly below and noted with "Char #". The ASCII value is displayed to the right of the character number.



**NOTE:** Only 24 characters may be used for the name. The last character must be set to a NULL or ASCII value of 0 to denote the end of the string.



**Character Scrolling**

This button scrolls through the selected print string. The Char # displays the current character in the line.

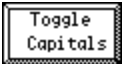


**Alpha Increment Decrement**

Increments or decrements Alpha Characters.

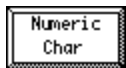


A B C D E F G H I J K L M N O P Q R S T U Y V W X Y Z



**Toggle Caps**

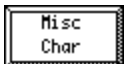
Toggles the current character between small and caps. If not a alpha character no changes will take place.



**Numeric Character**

Cycles through the numeric characters.

0 1 2 3 4 5 6 7 8 9



**Miscellaneous Character**

Cycles through the following characters.

Space " # \$ % & ' ( ) \* + , - . / : ; < = > ? @ [ \ ] ^ \_ ` { | } ~



**Space Button**

This button inserts a space at the place where the character pointer is aimed at.



**Clear Button**

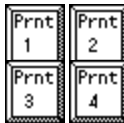
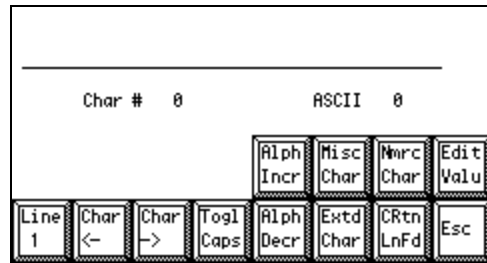
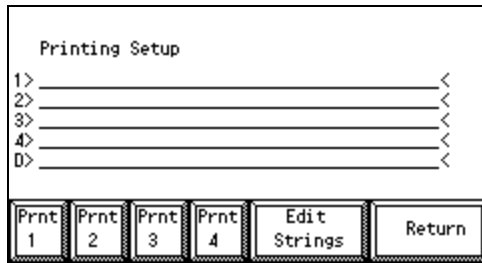
This button clears the current string.



**NULL Button**

Inserts a NULL at the place where the character pointer is aimed at. This informs the controller to display every character up to this point and ignore the rest.

## Printer Menu

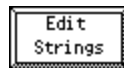


### Print Line Editing and Printout Selection

This menu allows editing or printing one of the four available print strings and the Feeder Screen Display String. The print strings (1[\_], 2[\_], 3[\_], and 4[\_]) are lines of characters that convey information to a printer for permanent record. The Feeder Screen Display (D[\_]) string allows placing custom text on the main screen for easier controller identification.

Touching one of these buttons will send the selected print string to the printer. The last selected line will be the line that is printed. For example, touching the button for line 1 for a test print, line 1 is the line printed when the external print command is triggered. This will be the string printed when an external print command is given. The <P at the end of line denotes the current selection.

One or more strings can be embedded into the printed line. For example, you have just edited line 1 and have embedded line 2 and 3 into line 1. When you send an external print command for line 1, lines 2 and 3 will be printed would be printed also. If the last line tested printed was line 3 then only line 3 would be printed.



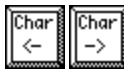
### Edit Strings

This selection allows editing of the strings. The string to edit is selected in the function.



### Line 1 – 4 / D

This button cycles through the print line to Edit. This button toggles through the four available print strings and the Main Screen Text display.



### Character Scrolling

This button scrolls through the selected print string. The Char # displays the current character in the line.



### Toggle Caps

Toggles the current character between small and caps. If not a alpha character no changes will take place.



### Alpha Increment Decrement

Increments or decrements Alpha Characters.

A B C D E F G H I J K L M N O P Q R S T U Y V W X Y Z



### Miscellaneous Character

Cycles through the following characters.

Space " # \$ % & " ( ) \* + , - . / : ; < = > ? @ [ \ ] ^ \_ ` { | } ~



### Numeric Character

Cycles through the numeric characters.

0 1 2 3 4 5 6 7 8 9



### Carriage Return Line Feed

This button cycles between inserting a Carriage Return (13) or a Line Feed into the print string.



### **Edit Value**

Opens a numeric entry screen to allow direct entry of numeric value into the print string. This allows entry of specific ASCII values that are not supported with a button. In addition, this menu allows:

1. Entry of a value for the print counter and the counter increment value.
2. Entry of a value for print lines to be printed at specific intervals (setting the timed print value to zero (0) turns off the timed print function).



### **Extended Character**

Cycles through the following the Extended Character set. Contact Merrick for more information regarding the Extended Character set of functions.

## Settings Menu



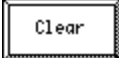
|                |                   |                |                 |
|----------------|-------------------|----------------|-----------------|
| Units Select   | Design Capacities | Analog Inputs  | Analog Outputs  |
| Decimal Points | Comm Params       | Digital Inputs | Digital Outputs |
| Limit Switches | Display Params    | EHT Params     | Set Date/Time   |
|                |                   | Action         | Main            |

## Entering New Values

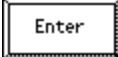
|       |   |                   |                   |   |   |   |        |
|-------|---|-------------------|-------------------|---|---|---|--------|
| ↑     | ↓ | Design Capacities |                   |   |   |   |        |
| Clear |   | # of Recipes      | 100               |   |   |   |        |
|       |   | Feedrate          | 100.0 lb/min      |   |   |   |        |
|       |   | # of Ports        | 4                 |   |   |   |        |
|       |   | Min:              | 0.0 Max: 100000.0 |   |   |   |        |
| 1     | 2 | 3                 | 4                 | 5 | + | - | Enter  |
| 6     | 7 | 8                 | 9                 | 0 | . |   | Return |

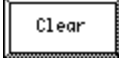
*Numeric Screen Example*

Most values are entered into the Controller via a numeric entry screen (see the above example). This screen shows the name of the parameter, the current value, units and the minimum and maximum allowed values for the parameter. If there are three or more related parameters, the controller displays three at a time otherwise the controller will only show one parameter. The active parameter is enclosed in a rectangle. This is the value that any button entry will act upon.

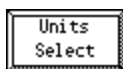
First find the parameter to be changed by using  or  buttons to scroll. Then press the  button to clear the current value for a new entry.

Enter the new value for the selected parameter using the numeric buttons. The display will show the value area as they are entered.

If the value is correct press the  button to save this value. The controller tests the number to insure that it is a valid entry. If the number is within the minimum and maximum values a message will appear under the parameter list:

If the value is incorrect, press the  button and re-enter the value. If the value is not within accepted limits, the following message will appear:

**NOTE:** The current engineering units will be shown for the parameter being displayed.



### **Units Select**

Use the Up or Down arrow buttons to scroll through the list of units until the combination appears in the center box that is correct for your application.

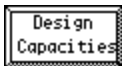
**NOTE:** When weight is displayed in the menu system, the units will follow the setting for load.

| Total | Feedrate |
|-------|----------|
| Lb    | lb/min   |
| Lb    | lb/h     |
| TN    | lb/min   |
| TN    | lb/h     |

| Total | Feedrate |
|-------|----------|
| TN    | TN/h     |
| Kg    | g/s      |
| Kg    | g/min    |
| Kg    | kg/min   |
| Kg    | kg/h     |
| T     | kg/min   |
| T     | kg/h     |
| T     | t/h      |

List of Unit Combinations

**NOTE:** It may be necessary, after selecting the units, to update the decimal point selection values. Even if no changes to the decimal points are necessary, you should at least look at each decimal point option to insure the proper display of values.



### **Design Capacities**

These parameters are used to set several internal scaling values in the controller.

#### **Feedrate**

This parameter normally represents the highest feedrate that can be obtained by all of the feeders attached to the system.

#### **# of Ports**

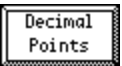
This parameter is the number of Fastcom 422/4-104 communication ports that have slave feeders attached.

#### **# of controllers**

This parameter is the number of MC<sup>3</sup> feeders attached to the system. This is used by the menu system to reduce the amount of button pushes required to reach a specific controller.

#### **# of Recipes**

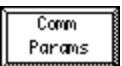
This parameter is the total number of recipes used. If only 25 recipes are used this limits the cycling time when choosing a recipe by eliminating the 75 that are not used when selecting recipes.



### **Decimal Points**

Internally the MC<sup>3</sup> Controller uses floating-point numbers. Any changes to the decimal point setting affects only the display of the values, which will be rounded appropriately.

**NOTE:** Note that the maximum number of decimal places is four and is used for display purposes only.



### **Comm Parameters**

Serial Communications provides the means to exchange information between the MC<sup>3</sup> Controller and another device. For example, data in the MC<sup>3</sup> Controller can be exchanged with devices such as SuperBridge, for PLC connectivity. The rules and format of the data exchange is described in a separate publication, Merrick Serial Protocol Specification.

Please refer to Merrick's web site at [www.merrick-inc.com/mct/](http://www.merrick-inc.com/mct/) for information concerning the Modbus ASCII Communications Specifications.

**CAUTION:** Failure to program communications correctly can result in the operational failure of serial communications.

For Baud Rate, Data Bits, Stop bits and Parity parameters, simply touching the button for the corresponding parameter will toggle through the list of available settings.

#### **Baud**

The Baud Rate is the speed at which data is transmitted across the serial communications lines. Available baud rates are:

|     |     |      |      |      |      |       |       |
|-----|-----|------|------|------|------|-------|-------|
| 300 | 600 | 1200 | 2400 | 4800 | 9600 | 19200 | 38400 |
|-----|-----|------|------|------|------|-------|-------|

### Data Bits

The number of data bits value indicates how many bits represent each character transmitted or received on the serial communications lines. The options available are 5, 6, 7 or 8. The recommended value is eight (8).

### Stop Bits

This value is used to number of stop bits added to the end of a character transmission unit and may be set to 1 or 2. The recommended value is one (1).

### Parity

Parity is a method of error checking during serial communications. Available selections:

|      |     |      |      |       |
|------|-----|------|------|-------|
| NONE | ODD | EVEN | MARK | SPACE |
|------|-----|------|------|-------|

### Comm 1 Numeric

An ASCII Begin Code and End Code must be designated for each message sent to and from the serial port on the MC<sup>3</sup> Controller. Since not all computers and protocols have the same Begin and End Codes, an operator may wish to change them in order to attempt to communicate with non-Merrick equipment. A specific controller number is used to identify each controller on the network.

**NOTE:** Power must be cycled to this controller for changes to communication parameters to take effect.

**NOTE:** It is very important: Two (2) controllers on the same serial line do not have the same controller address! This would result in both responding to a message at the same time. The results would usually be unusable data.

### Comp Start Code

This value is always sent at the beginning of a communications message. This default value is 10, for an ASCII representation of a Line Feed. To enter new values for this variable, use the arrow keys to select your choice. Limits are minimum of 1 and a maximum of 127.

### Comp End Code

This value is always sent at the end of a communications message. This default value is 13, for an ASCII representation of a Carriage Return. Limits are minimum of 1 and a maximum of 127.

### Controller Number

This number is used to identify the numeric address of the controller when utilizing serial communications on a multi-drop line. Controllers connected to the same communication line should not have the same controller number. Limits are minimum of 1 and a maximum of 64.

### Com Protocol

This parameter selects the communications protocol used on Comm Port 2.

|   |              |
|---|--------------|
| 0 | Scalenet     |
| 1 | Modbus ASCII |
| 2 | Modbus RTU   |

### Communication Time-out

This parameter is the allowed limit of no communications activity on the serial port. If this value is exceeded, the logical output Comm Timeout will turn on.

### Write Enable

The controller will not write a value to a register until the bit for the register in this word is set. See the Modbus protocol manual for the correct bit order.

### Byte (Word) Order

The Byte (Word) order bit reverses the order of the two (2) words that contain the value information. This may be needed to allow the device requesting the data to receive the value in the format it needs to correctly process the data.

### **Int/Frac FP**

The Integer/Fraction bits are used when the device using the data does not support floating-point numbers. The first word will carry the integer part and the second word carrying the fractional part, multiplied by 10000 (giving 4 implied decimal places). Setting this value to 0 uses IEEE floating point format (default).

### **Tag Reg 1-5**

These values are the registers to be monitored by the Modbus ASCII communications.

### **Comm 2 Numeric**

This button allows the operator access to the DF-1/DNI Menu containing the parameters required for correct DF-1 Communications. DF-1 Is an Allen-Bradley industrial communications protocol, which is supported by the MC3 Controller.

### **DF1 Time-out**

This is the delay that will set the DF1 Timeout logical output when DF1 communications have not been detected.

### **DF1 Uses BCC (error detection)**

This sets the type of error correction for the DF1 protocol. Setting this to 0 will cause the controller to use the CRC error correction. Setting this to 1 will set the error correction to BCC.

### **Prtr/0 DF1/1**

This selects between using a serial printer attached to Comm Port 1 or using DF1 protocol on the comm. Port.

### **RW Protect**

The write protection property should be set when a MC<sup>3</sup> register is tagged for monitoring only. When the device writes to words which are write protected, the corresponding Tag n W value changes accordingly, but the corresponding MC<sup>3</sup> register (Tag n R Value) is unaffected.

### **Byte (Word) Order**

The Byte (Word) Order Bit, when set, reverses the order of the two words that contains value information.

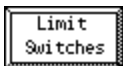
### **Int/Frac FP**

The Integer/Fraction bits are used when the device using the data does not support floating-point numbers. The first word will carry the Integer part, and the second the fractional part, multiplied with 10000. (4 implied decimal places).

### **Tag Reg 1- 5**

These are the registers to be monitored by DF1 communications.

**NOTE:** Please consult Merrick's Customer Service Department for any questions or comments regarding the available communication protocols.



### **Limit Switches**

There are several programmable limit indicators available in this controller. They may be changed during the normal operation of the feeder as required. The Limit Switch Logical outputs will turn on after the associated delay time. For example, if the High Feedrate limit is set to 50 lb/min and the actual feedrate is 55 lb/min, the output will turn on when the High Feedrate delay time has expired.

### **Feedrate**

This button allows you to set the upper and lower limits for the feedrate and feedrate deviations.

### **Setpoint**

This button allows you to set the upper and lower limits for the setpoint.

**NOTE:** When the logical input **Limit Setpoint** is enabled the setpoint will not be allowed to exceed the limits.

## Panel Meter

This button sets the upper and lower limits for the Panel Meter monitor. This is an analog input that is available for monitoring another device such as the current used by a VFD.

### Output (NOT USED)

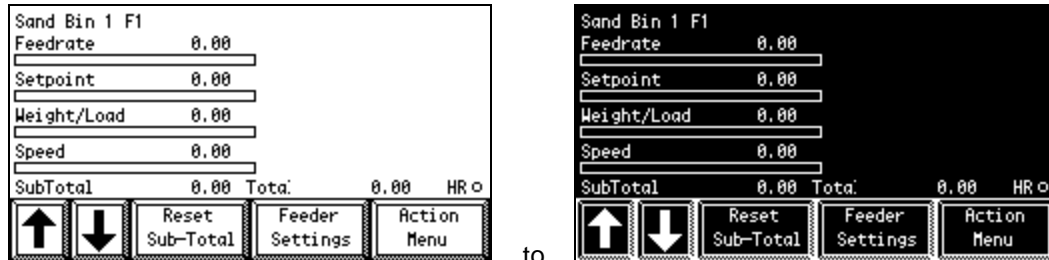


## Display Parameters

This menu allows you to customize the display settings.

### Invert Display

This button allows you to invert the pixel color of the display. An example is shown below.



### Display Numeric

These parameters are used to dampen the values for the feedrate and Setpoint. Increasing the value will cause more dampening.

#### Feedrate Dampening

The Feedrate dampening factor controls a feedrate low pass filter for the displayed feedrate and, if used, the corresponding analog output. It does not affect the internal feedrate value used by the PID controller. The purpose of this factor is to achieve a smooth and readable feedrate value.

#### Setpoint Dampening

The speed-dampening factor controls a sliding average filter that affects the internal and displayed setpoint. Use this filter to eliminate noise on a remote analog setpoint (4..20 mA input).

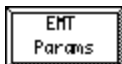
#### Backlight Off Time

The backlight off time is used to turn off the backlight after a period of when no key press is detected. A value of 0 will turn off this feature.

**NOTE:** This feature requires the proper hardware upgrade to the controller. LTI and LCD boards must be of the appropriate type for this feature to work.

#### Graph Time

This parameter is the update time of the Graph Main Screen. With the default of 1 second per sample the controller can display approximately 2 1/2 minutes of data. By changing the sample rate to 5 seconds, the controller can display approximately 12.5 minutes of data with a decrease of resolution.



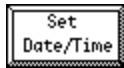
## EMT Parameters

### Weight Per Pulse

This is the value used to scale the EMT (External Mechanical Totalizer) output. If the Weight per Pulse is set to 1 then there is a pulse for every pound or kilogram that is totalized. If Weight per Pulse Value is set to 100.0, there must be 100.0 pounds or kilograms totalized before a pulse is sent to the external totalizer. Limits are minimum 1.0 and a maximum of 100,000.0.

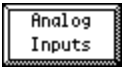
### Pulse Length

This value is the length in seconds for the pulse that is sent to the EMT. A mechanical totalizer will require a longer pulse than a electronic totalizer or pulses may be missed. The pulse output from the controller is buffered, in order to allow slow EMT's to "catch up" and be accurate. The recommended value for a mechanical totalizer is 0.10, and 0.01 for an electronic totalizer. Limits are minimum of 0.01 and a maximum of 5.0. The duty cycle is 50% at the full pulse rate.

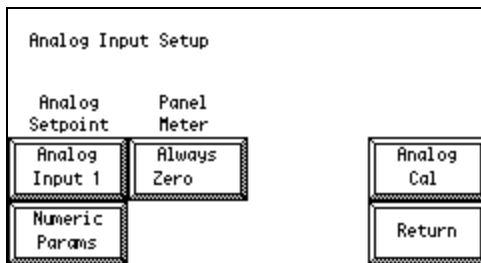


### **Date/Time**

For setting the date and time parameters, follow the direction given the Entering New Values section found on page 21.



### **Analog Input**



The analog inputs can be mapped to Analog Setpoint or Panel Meter functions. Two analog inputs are available when there are two PCIO boards installed into the controller. Once the inputs are mapped, you should adjust the high, low and scaling values. The Analog I/O Diagnostics (page 34) displays the active counts for the analog inputs and can be used to determine the high and low values.

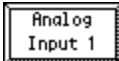
### **Analog Setpoint**

When you intend to use an analog signal for the setpoint, an Analog Input Source must be set for this input. The analog input selected is used for the setpoint when the Setpoint method is Remote Analog Input.

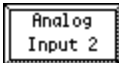
### **Panel Meter**

This selection is used to display a value of an analog input to be used for display purposes only. The value is scaled to a user-defined value. The value can be set in the numeric parameter selection (see below).

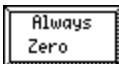
### **Analog Input Source Settings**



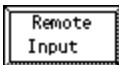
The source used is analog input number 1 on PCIO board number 1.



The source used is analog input number 2, which is located on the PCIO board number 2.



The value that is used for the function selected is always 0.



The value used is controlled through a register using the serial port.

### **Analog Input Numeric**

#### **Low Values**

This value is the counts representing the zero level of the incoming signal. When the input signal is set to 4-20mA (2-10V) input then this value should be 200,000 counts. If the input is set to 0-20mA (0-10V) then the zero level should be close to 0 counts. Limits are minimum of 0 and a maximum of 1,040,000.

#### **High Values**

This value is the representation of the 100% value of the incoming signal. Normally this value will be 1,000,000 counts representing 100% (20mA or 10V) of the incoming signal. Limits are minimum of 1 and a maximum of 1,040,000.

#### **Maximum Scale Values**

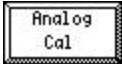
This is the value representing the full-scale value used for scaling the input. This value should be associated with the analog input counts it is to represent

### Minimum Scale Values

This is the value representing the zero value used for scaling the inputs.

### Panel Meter Units

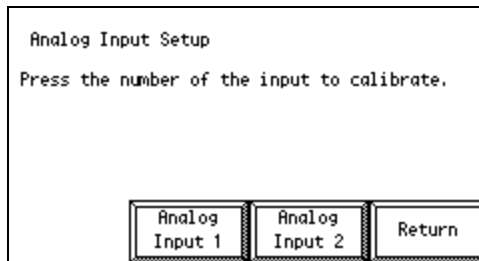
|   |          |
|---|----------|
| 0 | Amps     |
| 1 | Volts    |
| 2 | Torque % |
| 3 | Temp °F  |
| 4 | Temp °C  |
| 5 | Incl °   |



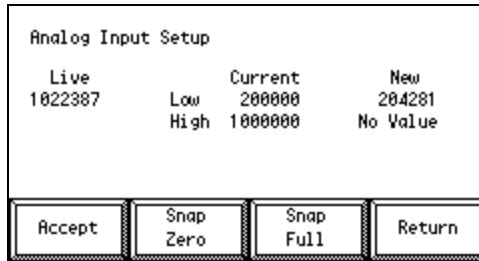
### Analog Input Cal

This procedure allows you to setup your analog inputs.

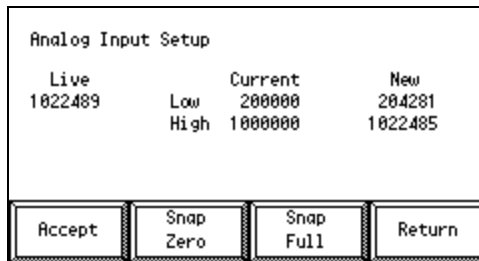
Touch the number of the analog input to calibrate to edit the analog input alarm values.



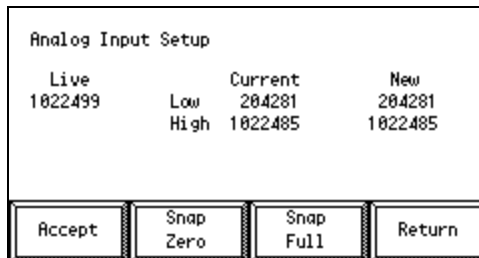
Adjust the input for a zero level. The live counts will vary accordingly. When zero is reached touch the snap zero button. The live value will snap to the new value column.



Adjust the input for full-scale level. The live counts should follow the input. When the full level has been reached touch the Snap full button. The live value will snap to the new Hi column.



If the values you selected are correct for your application, touch the accept button. The controller will move the values from the New column to the Current column and start using the new values.



When done, touch return. If return is touched without touching accept the new values will not be placed into memory.

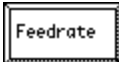
**Analog Outputs**

**Analog Outputs**

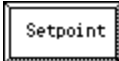
| Analog Output Settings |                   |                   |                   |
|------------------------|-------------------|-------------------|-------------------|
| Output 1               | Output 2          | Output 3          | Output 4          |
| Feedrate               | Setpoint          | Available         | Feedrate          |
| 4-20 mA<br>2-10 V      | 4-20 mA<br>2-10 V | 4-20 mA<br>2-10 V | 4-20 mA<br>2-10 V |
| Numeric<br>Params      |                   | Analog<br>Cal     | Escape            |

The purpose of this section is to configure the Analog Outputs. Each analog output may be 0-20mA (0-10V) or 4-20mA (2-10V). The type of output may be for Feedrate, the current setpoint or available for use by communications. To change the settings for any of the outputs, just press on the button to cycle through the choices for type and output rating. The percentage will be scaled to the design feedrate.

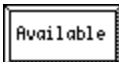
**Mode**



The output is scaled to the design feedrate.

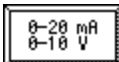


The output is the current setpoint scaled to the design feedrate.

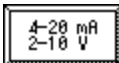


This mode makes the output available for use by an external source via the communications port.

**Type**



The mode selected is scaled between 0 and 20 mA (0 and 10V).



The mode selected is scaled between 4 and 20 mA (2 and 10V).

**Numeric Parameters**

Zero Values – The zero values are used to scale the zero point for each of the analog outputs. This allows you to scale the zero value to the desired mA or V required for your system.

Full Values – This allows you to adjust the scaling of the output to fit you system.

**Analog Cal**

**Analog Output Cal**

|                           |   |      |      |      |      |        |
|---------------------------|---|------|------|------|------|--------|
| Adjust to 100% or 20 ma   |   |      |      |      |      |        |
| Curr AOUT 1 30% or 6 ma   |   |      |      |      |      |        |
| Curr AOUT 2 65% or 13 ma  |   |      |      |      |      |        |
| Curr AOUT 3 75% or 15 ma  |   |      |      |      |      |        |
| Curr AOUT 4 100% or 20 ma |   |      |      |      |      |        |
| ↑                         | ↓ | Out1 | Out2 | Out3 | Out4 | Escape |

This menu allows direct access to the analog outputs. This allow verification analog lines going to external equipment.

To use this menu, the and buttons adjust the selected output by 5% or 1 mA. The output buttons, , toggle between the adjusted value and 0 (or off).

| %   | 0-20mA | 4-20mA (adj. %) |
|-----|--------|-----------------|
| 0   | 0      | 0               |
| 20  | 4      | 4 (0%)          |
| 50  | 10     | 10              |
| 60  | 12     | 12 (50%)        |
| 100 | 20     | 20 (100%)       |

## Digital IO

I/O mapping requires a layered approach to the design process. In the MC<sup>3</sup>, there are two layers, one is a physical layer and the other is a logical layer. The physical layer is connected to the outside world, for example relays and switches. The MC<sup>3</sup> actually acts upon data in the logical layer, such as determining if a user should be allowed access to the custom setup menus.

The physical input layer is mapped to the logical input layer. This allows a (one) physical input to control several logical inputs. For example, a physical input can control both accesses to the custom setup menus and to the ability to accept calibration changes. The logical output layer is mapped to the physical output layer. This allows use of several physical outputs mapped to one (1) logical output to control different processes. For example, a process may need to occur due to a high feedrate and an indication that the feedrate went high in the control room is required. The MC<sup>3</sup> can map the High Feedrate logical output to two different physical outputs allowing the process to occur and giving an indication in the control room without using extra hardware.

The inverting function acts on the physical layer of the I/O. The MC<sup>3</sup> gives the system designer the ability to adjust the type of logic for his system. For example, one (1) logical output controlling two (2) physical outputs with one (1) positive logic and one (1) negative logic.

The MC<sup>3</sup> also allows forcing of the physical layer I/O ON or OFF. Forcing simulates the action of switches (inputs) or relays (outputs) for an easier way to troubleshoot the system. For example, by forcing on the weight simulators the entire process can be simulated for troubleshooting your system. Alternatively, if there is no longer an alarm indication on the system console, force the output on at the MC<sup>3</sup> and detect where the problem is occurring.

**CAUTION:** *This feature is a very powerful tool that should be used with extreme care. For most installations, the default settings should be used.*

### Select Column

This button switches between the Logical and Physical sections allowing re-mapping of I/O points to occur.

### Invert (button) / IV (display column)

This button inverts the Physical I/O points. For example, if the physical input mapped to the Feeder Block logical input is ON and the invert option is on then the Feeder Block logical input would be off.

### Forced (button) / FC (display column)

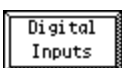
This button toggles the Physical I/O point through ON (1), OFF (0) or None (X, normal state). The force selected will stay on until changed by this button. An indication that forces are in place is indicated on the Main Feeder Screen.

### Alarming (button) / WF (display column)

This button cycles between Fault (F), Warning (W) and None (X). Faults will stop the feeder when in the AUTO state.

### Set F/W Button

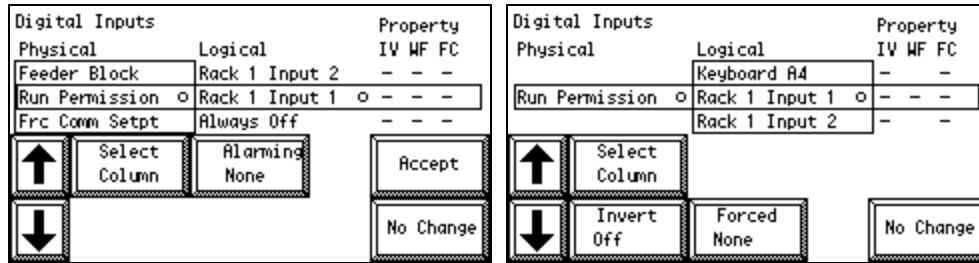
This button runs a menu that is used to adjust the Fault/Warning property of the Logical outputs more easily.



### Digital Inputs

This selection allows changing the mapping for the digital inputs. The Physical is mapped to the logical layer. This means that a (one) physical input may be mapped to several different logical

inputs. For example the Physical Input "Rack 2 Input 1" may be mapped to the Logical Inputs "Calibr. Access" and "Advanced Set". This will allow calibration acceptance and custom setup access only if the input Rack 2 Input 1 is set appropriately.



Digital input screens

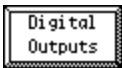
### List of Logical Inputs

| Name              | Description   |
|-------------------|---|
| Feeder Block      | This input is used to unconditionally stop the feeder.  |
| Run Permission    | This input is used to start and stop the all feeders associated with the selected recipe. The feeders will start when this input is on. The Start and Stop Feeders buttons will be enabled and can be used to start and stop all feeders. . |
| Frc Comm Setpt    | Force the controller to use the Serial feedrate setpoint when the controller is in communications with a serial device.   |
| Reset Faults      | Used to externally reset FAULTS.  |
| Reset Warnings    | Used to externally reset WARNINGS.  |
| Print             | Sends the selected print string to the printer serial port.   |
| EMT Enabled       | When off, the pulses going to External Electromechanical Totalizer (EMT) are disabled.  |
| Total Enabled     | Enables the main Totalizer. When Off, the main total does not increment.  |
| Sub-Total Enabl   | Enables Sub Totalizer. When Off, the sub total does not increment.  |
| Extended Access   | Allows access to calibration constants in the register editor and via communications.   |
| Register Access   | Input permitting the user to access to the Register Editor (page 37).   |
| Lck Setpnt Mode   | Locks Setpoint method to the current one selected. The buttons that change the setpoint method will disappear from the screen.  |
| Limit Setpoint    | Switch used to clamp the feedrate setpoint between the limits set in the (page 43) section of the Limit Switches menu.  |
| Start Feeders     | Input to start feeders remotely. Can only be used when Run Permission is enabled.   |
| Stop Feeders      | Input to stop feeders remotely. Can only be used when Run Permission is enabled.  |
| Available I/O 1/8 | I/O points that may be used by an external communication device for control.  |

### List of Physical Inputs

| Physical Inputs | Description                                |
|-----------------|--|
| Always Off      | The contact is always equal to 0 (open).   |
| Always On       | The contact is always equal to 1 (closed). |

| Physical Inputs                | Description   |
|--------------------------------|---|
| Keyboard A1 - H4               | Keyboard Location Codes   |
| Rack 1 INPUT 1 through 4       | PCIO #1 1st bank.   |
| Rack 2 INPUT 1 through 4       | PCIO #1 2nd bank.   |
| Rack 3 INPUT 1 through 4       | PCIO #2 1st bank. Requires use of a second PCIO board.  |
| Rack 4 INPUT 1 through 4       | PCIO #2 2nd bank. Requires use of a second PCIO board.  |
| Accessory Inputs 1-4           | PCIO #2 2nd bank. Requires use of a second PCIO board.  |
| External Inputs 1-16           | These represent “virtual” physical inputs. They are normally used by a communications device attached to a serial port to allow a logical input’s state to be changed.. |
| External Outputs 1-16          | A device attached to a communications channel to display the state of an input normally uses these.   |
| Stable Weight, Keyboard Locked | These inputs are used by the controller internally and should not be mapped..   |



### Digital Outputs

This selection allows changing the mapping for the digital outputs. The Logical is mapped to the Physical layer. This means one (1) logical output may be mapped to several different physical outputs. For example the Logical Output “General Alarm” may be mapped to Rack 1 Output 4, Rack 2 Output 6 and Rack 4 Output 2 allowing different external processes to know that a problem has occurred with the controller.

#### List of Logical Outputs

| Name           | Description   |
|----------------|---|
| Fault          | This output indicates that a condition occurred that is serious enough to stop feeding. This is the Logical “or” of all outputs and inputs qualified for FAULT.   |
| Warning        | A condition has occurred that needs attention but is not serious enough to stop the feeder. This is the Logical “or” of all outputs and inputs qualified for WARNING  |
| High Feedrate  | Output indicating that the feedrate has exceeded a set limit for a set time. The settings for this parameter is in the Limit Switches on page 24.   |
| Low Feedrate   | Output indicating that the feedrate has been below a set limit for a set time. The settings for this parameter is in the Limit Switches on page 24.   |
| High Deviation | Output indicating that the difference between the feedrate and the setpoint has lag set limits for a set time. The settings for this parameter is in the Limit Switches on page 24.   |
| Low Deviation  | Output indicating that the difference between the feedrate and the setpoint has lag set limits for a set time. The settings for this parameter is in the Limit Switches on page 24.   |
| High Setpoint  | Output indicating that the setpoint is above the High Feedrate Limit. The Setpoint will not be allowed to go above the High Setpoint Value and will be set to that value when the logical input Limit Setpoint is enabled. The settings for this parameter is in the Limit Switches on page 24. |
| Low Setpoint   | Output indicating that the setpoint is below the Low Setpoint limit. The setpoint will not be allowed to drop below the Low Setpoint Value and will be set to that value when the logical input Limit Setpoint is enabled. The settings for this parameter is in the Limit Switches on page 24. |

| Name             | Description   |
|------------------|---|
| High Panel Meter | Output Indicating that the Analog Input mapped to the Panel Meter function has exceeded the limit switch value High Panel Meter. The settings for this parameter is in the Limit Switches on page 24.   |
| Low Panel Meter  | Output Indicating that the Analog Input mapped to the Panel Meter function has dropped below the limit switch value Low Panel Meter. The settings for this parameter is in the Limit Switches on page 24.   |
| Ready            | All feeders associated with the current recipe are online <b>AND</b><br>There are no fatal communication errors <b>AND</b><br>All feeders are ready (The associated <b>Ready</b> output for each feeder is enabled.) <b>AND</b><br>The Feeder Block logical input is disabled <b>AND</b><br>There are no FAULTS.  |
| Running          | The control state of this controller is Running. Setpoint values and Run Permission bit should be present at all slaves associated with the selected recipe.  |
| In Control       | The <b>Ready</b> (same as above) logical output is enabled <b>AND</b><br><b>Run Permission</b> logical input is enabled.  |
| Good Feedrate    | All feeders associated with the current running recipe are feeding good. (The associated output for <b>Feed Good</b> is enabled in each running feeder.) <b>AND</b><br>The <b>In Control</b> logical output is enabled (same as above). <b>AND</b><br>The feedrate is within the feedrate and deviation limits set in the Limit Switch Menu. <b>AND</b><br>The recipe is running (the <b>Running</b> logical output is enabled). <b>AND</b><br>There are no Warnings or Faults. |
| In Menu System   | Output indicating that the user interface is not in one of its main screens   |
| In Calibration   | NOT USED  |
| Register Access  | Used by the controller to permit the user to enter the low level register editor.   |
| Screen Locked    | NOT USED  |
| Serial Setpoint  | The controller is using serial communications to derive the setpoint.   |
| Analog Setpoint  | The setpoint method is set to Analog or Ratio.  |
| COM1 Comm Lost   | Output indicating that Scalenet serial communication has been initiated, and later timed out.   |
| DF1 Comm Lost    | Output indicating that DF1 serial communication has timed out.  |
| Power Fail       | Power was removed from the controller. This output only turns on when the controller is initialized during a power up sequence.   |
| Used Fdr Fault   | One of the slave controllers used by the selected recipe has a Fault condition.   |
| Free Fdr Fault   | One of the slave controllers <i>not</i> used by the selected recipe has a Fault Condition.  |
| Used Fdr Lost    | One of the slave controllers used by the selected recipe is no longer communicating on the serial port or has been taken offline.   |
| Free Fdr Lost    | One of the slave controllers <i>not</i> used by the selected recipe is no longer communicating on the serial port or has been taken offline.  |
| Used Fdr Warn    | One of the slave controllers used by the selected recipe has a Warning condition.   |
| Free Fdr Warn    | One of the slave controllers <i>not</i> used by the selected recipe has a Warning Condition.  |

| <b>Name</b>      | <b>Description</b>  |
|------------------|---|
| Used Fdr NotSer  | One of the slave controllers used by the selected recipe is not in serial setpoint mode.  |
| Free Fdr NotSer  | One of the slave controllers <i>not</i> used by the selected recipe is not in serial setpoint mode.   |
| AuxIO Output 1-8 | Output associated with the Available I/O that has the capability to be delayed on or off. These outputs may be used as an auxiliary timed output. Contact Merrick for more details. |
| Always ON        | Output is always ON (closed).   |
| Always OFF       | Output is always turned OFF (open).   |

#### **List of Physical Outputs**

| <b>Physical Output</b> | <b>Description</b>  |
|------------------------|---|
| Rack 1 Output 1 - 8    | PCIO #1 1st bank.   |
| Rack 2 Output 1 - 8    | PCIO #1 2nd bank.   |
| Rack 3 Output 1 – 8    | PCIO #2 1st bank. Requires use of a second PCIO board.                                |
| Rack 4 Output 1 – 8    | PCIO #2 2nd bank. Requires use of a second PCIO board.                                |
| External Outputs       | These can be used by a serial communication device to show the mapped logical output. |
| Accessory Switches     | USED INTERNALLY ONLY  |

# Diagnosing Problems

## Diagnostic Display

|                 |                 |                 |                     |
|-----------------|-----------------|-----------------|---------------------|
| Feeder<br>Diag  | Analog<br>Diag  | Misc<br>Data    | Register<br>Monitor |
| Comm<br>Diag    | Digital<br>Diag | DFI/DNI<br>Diag | Modbus<br>Diag      |
| Clean<br>Screen | Warnings        | Faults          | Diag<br>Settings    |
| Main            |                 |                 | Action<br>Menu      |

The Diagnostic Menu for the MC<sup>3</sup> Controller is provided to allow access to additional displays and values. It is provided as a troubleshooting tool.

Feeder  
Diag

### Feeder Diagnostics

| Slave List | 0 | 1     | 2  | 3 | 4     | 5     | 6 | 7 |
|------------|---|-------|----|---|-------|-------|---|---|
| Slave ID#  | 0 | 1     | 2  | 3 | 4     | 5     | 6 | 7 |
| Used       | 1 | NxRTM | 50 |   | Used  | 1     |   |   |
| Port       | 0 | RTgms | 0  |   | ActSI | 0     |   |   |
| CMUM       | 1 | TTgms | 0  |   | State | 0     |   |   |
| OnI        | 0 | Errs  | 0  |   | CurSI | 0     |   |   |
| RTgms      | 0 | ParEr | 0  |   | CurTg | 0     |   |   |
| TTgms      | 0 | QueEr | 0  |   | TgTm  | 14318 |   |   |
| Errs       | 0 | FroEr | 0  |   | NUMSI | 8     |   |   |
| LErr       | 0 | BnkEr | 0  |   | rxchs | 0     |   |   |
| FoTE       | 0 | BorEr | 0  |   |       |       |   |   |
| LFoTE      | 0 | TIMEr | 0  |   |       |       |   |   |
| State      | 0 | CsuEr | 0  |   |       |       |   |   |
| RotTime    | 0 | NokEr | 0  |   |       |       |   |   |
| NxRotTM    | 0 | LngEr | 0  |   |       |       |   |   |
| FBTme      | 0 |       |    |   |       |       |   |   |
| NxFBTM     | 0 |       |    |   |       |       |   |   |

Status Screen

|                |               |          |               |           |   |
|----------------|---------------|----------|---------------|-----------|---|
| Sts/DNI        | 0000          | Ctl/DNI  | 0000          | Slave ID# | 0 |
| Ext Outs       | 0000          | Ext Ins  | 0000          |           |   |
| Warnings       | 0000          | Feed SP  | 0.000000e+000 |           |   |
| Faults         | 0000          | Sec SP   | 0.000000e+000 |           |   |
| Tog1 R U       | 0.000000e+000 | Tog1 W U | 0.000000e+000 |           |   |
| Tog2 R U       | 0.000000e+000 | Tog2 W U | 0.000000e+000 |           |   |
| Tog3 R U       | 0.000000e+000 | Tog3 W U | 0.000000e+000 |           |   |
| Tog4 R U       | 0.000000e+000 | Tog4 W U | 0.000000e+000 |           |   |
| Tog5 R U       | 0.000000e+000 | Tog5 W U | 0.000000e+000 |           |   |
| Feedrate       | 0.000000e+000 | NR Fern  | 0000          |           |   |
| Weight         | 0.000000e+000 | Word Ord | 0000          |           |   |
| Speed          | 0.000000e+000 | Int/Proc | 0000          |           |   |
| Subtotal       | 0.000000e+000 | Tog1 Rg  | 000           |           |   |
| Total          | 0.000000e+000 | Tog2 Rg  | 000           |           |   |
| App/Ver        | 0000          | Tog3 Rg  | 000           |           |   |
| Phys In        | 0000          | Tog4 Rg  | 000           |           |   |
| Phys L/H /0000 |               | Tog5 Rg  | 000           |           |   |

Data Screen

These screens give an overview of the port and slave communication status and the data exchanged by each slave feeder attached and this controller.

Dot

Sts

The **Dot** and **Sts** buttons toggle between the Status and Data screens. The **Clr** button clears the error and status counters on the Status Screen.

Clr

Analog  
Diag

### Analog I/O Diagnostics

| Analog I/O Diagnostics |                 |             |        |
|------------------------|-----------------|-------------|--------|
| Function               | Type            | Actual      | EST-mA |
| Out1 Available         | 4 mA/2V         | 0           | 0.00   |
| Out2 Feedrate          | 4 mA/2V         | 0.0 lb/min  | 4.00   |
| Out3 Feedrate          | 4 mA/2V         | 0.0 lb/min  | 4.00   |
| Out4 Feedrate          | 4 mA/2V         | 0.0 lb/min  | 4.00   |
| Counts                 |                 | %           | Value  |
| In1                    | 0               | -0.00 %     | -1.00  |
| In2                    | 154990081549.90 | 15499023.00 |        |

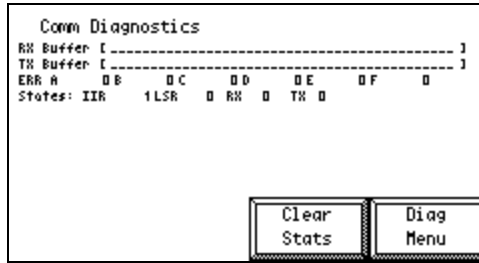
This diagnostic screen displays the current function and type for each of the Analog outputs. The "Actual" column in the output section displays the current value of function selected for the particular output. The "EST-mA" column displays the estimated milliamp value for the output.

In the Input section the current analog counts, the percentage of the allowed range and the value based on the full scale value for the particular input are displayed. See Analog Inputs (page 52) for more information.

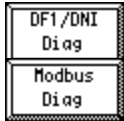
Comm  
Diag

### Communication Diagnostics

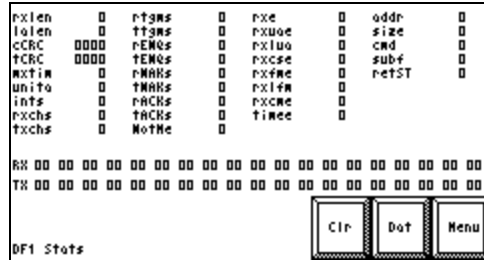
This display is useful when troubleshooting communications.



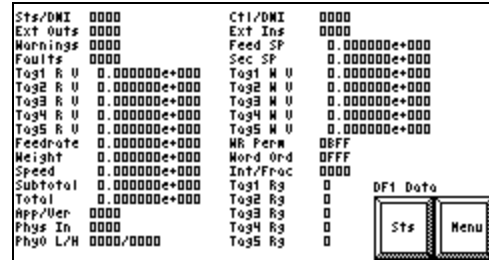
Consult Merrick for more information regarding this display.



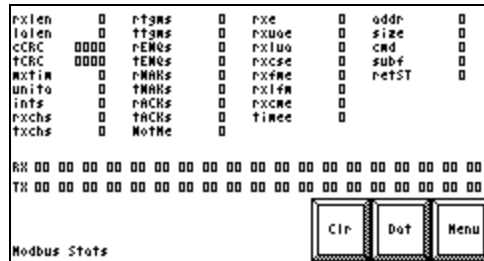
### DF1 and Modbus Diagnostics



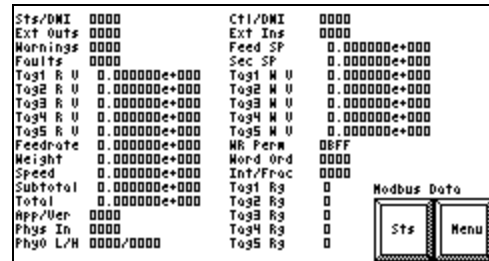
DF1/DNI Status



DF1/DNI Data



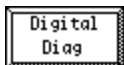
Modbus Status



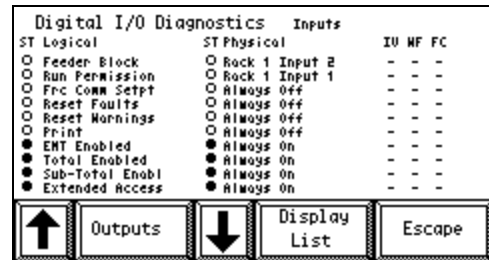
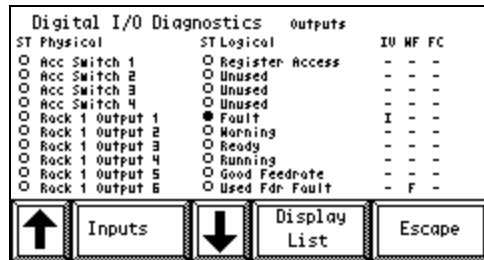
Modbus Data

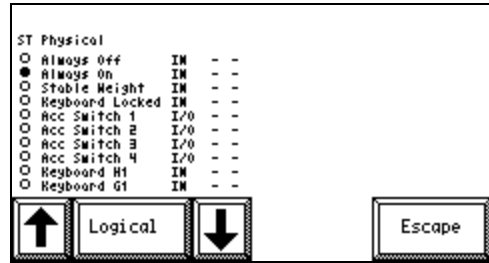
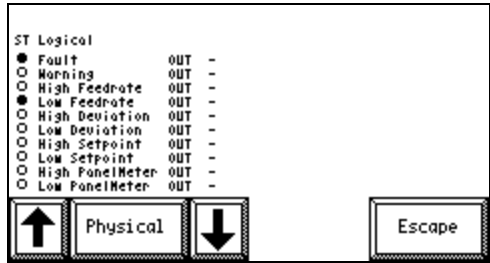
The data table exposed to communications can be inspected in the MC<sup>3</sup>. Note that the values are only updated on valid DF1 or Modbus telegrams. If no telegrams have been received, most values are zero. The layout follows the MC<sup>3</sup> data map exactly. The 'e' format of the floating points can help troubleshooting FP transfers. You are reading from the first six rows to the left, and writing to the first 3 rows on the right. If you succeed with the integrity bit, you should see the Sts/DNI and Ctl/DNI toggle between XX00 and XX80.

Consult Merrick for more information regarding this display.



### Digital I/O Diagnostics

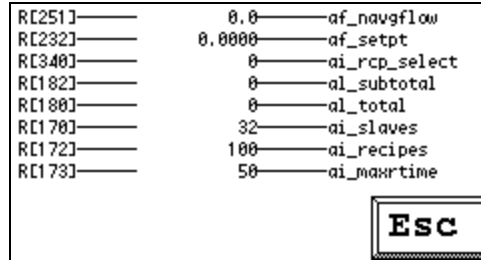




The button between the up and down arrows toggles between Digital Outputs and Inputs. The up and down arrow buttons are used to page the digital I/O points.

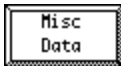


### Register Monitor

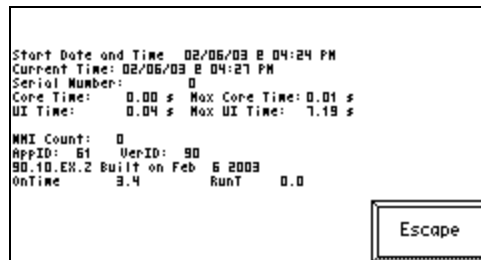


This screen is used to monitor the values of specific registers. The display includes the register number, the value and the register name.

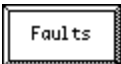
To setup the register pointers you must have access to the Register Editor and a register list. Determine the number of the register 'ai\_regptr0'. Enter this value into the register number field (R[ ]) in the register editor. Tab to the register value entry field. Clear and enter the number of the register you wish to view in the monitor. You may enter up to eight different registers for viewing with the register monitor. Changing the values for pointers 1 – 5 will directly affect the Modbus/DF1 mapping.



### Misc. Data

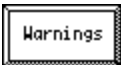


This screen displays various operating data including the start and current times the number of hours that the controller has been running, NMI Counts and other data.



### Faults

See Faults on page 12 for more information regarding Faults.

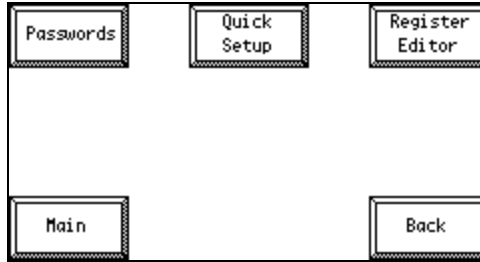


### Warnings

See Warnings on page 12 for more information regarding Warnings.



## Diagnostic Settings



The Diagnostic Setting Menu has its own password.



## Password Settings

This option is used to select the passwords that allow specific users access to the Calibration, Setup and Diagnostic screens. The password is a four digit numeric value.

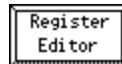
| Menu        | Default Password |
|-------------|------------------|
| Calibration | 1234             |
| Set-Up      | 5678             |
| Diagnostic  | 1030             |
| Setpoint    | 0                |

This software incorporates a failsafe method of gaining access to this menu in case of lost passwords. It is called the challenge response system. On the Diagnostic screen a string is displayed called challenge. Phone this number into Merrick service and a response will be given to allow entry to the diagnostic settings menu to observe or change the password.



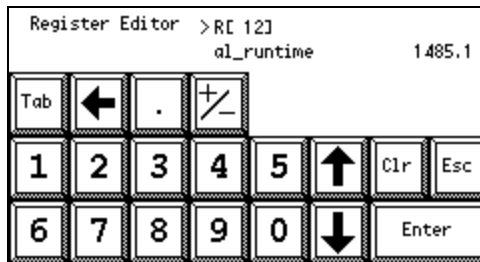
## Quick Setup

This button will setup reasonable values for the following parameters. It will appear when the Register Access logical input is enabled.




## Register Editor



Access to the Register Editor menu is only allowed if the logic input Register Access is enabled. If the logical input is off the button for the Register Editor button will not appear on the diagnostic screen.



Use of the register editor is simple. The '>' symbol is used to denote the active line. The top line displays the current register number. The second line displays the register name and the value

that the register contains. The  button is used to switch between the Register Number line

and the Register Name/Value line. The  is used as a backspace key in the register editor. The

 and  buttons are used to scroll up and down through the register list. This works when either the register number or register name is the current selection.

**NOTE:** Before entering new values into the controller, clear the previous value by touching this button.

## SOLVING PROBLEMS

If the following procedures do not assist in solving the problem, see Technical Support on page 2 on obtaining factory support for the controller.

### **Symptoms**

#### **Unit does not power up.**

**WARNING: Only qualified service technicians should work on the controller. When working with live voltages insure all safety precautions are taken.**

Check wiring harnesses, Power running to the controller.

Verify that the fuses are good. There are two (2) fuses in the controller. One (1) is in the power receptacle and one (1) is on the power supply board.

Using a voltmeter, verify that 110V is present at the power supply.

Verify that the +5 volt and  $\pm 12$  volts at the power supply are good.

#### **Controller Fails to Boot Up.**

If the message "Bad Register Checksum", touch OK to Continue" appears during boot-up, hit OK and the controller should continue to initialize. After the controller has initialized, check all settings carefully before operating the Feeder.

By touching the upper left and right corners of the touch screen simultaneously during initialization, a screen will be displayed requesting "Reset the Registers to Reasonable Values?" This will set the feeder to the factory defaults that will be different from the actual setup. Re-enter all of the operating parameters and re-calibrate the feeder before normal operation can resume.

**WARNING: Make sure that you check all settings carefully before starting the feeder. Otherwise, the feeder could operate in an unsafe mode.**

#### **LCD Display too dark or too light**

The contrast of the LCD display is affected by large temperature changes. It may need to adjust it. The contrast adjustment (R3) is located inside the controller on the backside of the display assembly in the upper right hand corner.

The LCD backlight may be burnt-out and need to be replaced. With power applied, there should be a light seen from the backlight coming from the bottom of the assembly.

#### **No analog Input**

Check all wiring; make sure that the polarity is correct.

If at all possible, place a current meter in series with the current loop and verify that current is present and the polarity is correct.

Check that a positive millivolt input between 0.01 an 1.0 mV exists on the terminals five (5) and six (6) on the HPAD Board. If it does not exist, the signal source may be damaged or incorrectly connected.

After correcting the problem, cycle the power to the controller.

#### **External Totalizer problems**

Check and verify all wiring and connections are correct.

If the system is using a DC EMT, check the polarity of the connection between the EMT and the controller are correct.

Check the EMT Parameters on page 25 and verify that the Divide Value and Pulse Length values are correct for the installation.

#### **No Serial Communications**

Check all cables and wire harness. Check the serial port settings in Comm Parameters on page 22.

### **Hang Message Appears**

The hang screen message will appear if an error occurs within the control software that could effect the safe operation of the system. If the hang screen appears, write down the exact error that is displayed on the screen and call customer support at Merrick Industries. Several types of errors may cause the controller to reset or reboot. If this occurs, verify all parameters.

### **HARDWARE CALIBRATION AND TESTING**

The MC<sup>3</sup> was calibrated and tested at the factory before it was shipped. The following procedures can affect the accuracy of the controller and should only be performed with extreme caution.

**WARNING: Always disconnect the MC<sup>3</sup> from the feeder before attempting to test or calibrate hardware. Failure to do so could damage the feeder or cause personal injury.**

### **Analog Outputs**

Attach a milliamp meter to the analog output to be adjusted.

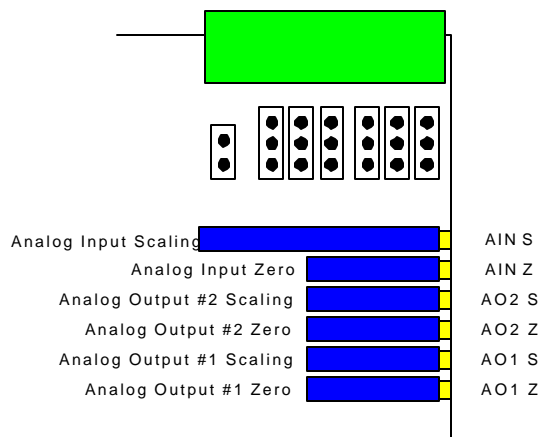
In the Analog Output setup menu, select Analog Cal and set the output to 0%.

If, calibrating analog output 1, adjust the 'A01 Z' pot (R68) until the meter reads 0.0 mA. If, calibrating analog output 2, adjust the 'A02 Z' pot (R66) until the meter read 0.0 mA.

Set the output to 100%.

If, calibrating analog output 1, adjust the 'A01 S' pot (R67) until the meter reads 20.0 mA. If, calibrating analog output 2, adjust the 'A02 S' pot (R65) until the meter read 20.0 mA.

Set the output to 50% and verify that 10 mA is read on the meter.



Potentiometers used for adjusting analog input and outputs

### **Analog Inputs**

Typically, a current source is not available, so the easiest way to adjust the analog input is to feed the analog outputs back into the analog input. This is accomplished by using jumpers from the analog output to the analog input. To calibrate the Analog Input using the 90.10.EX application, access to the register editor, is required.

Insert a jumper wire from analog output 1 to the analog input. Insure the polarity is correct (positive to positive, negative to negative).

In the Analog Output setup menu, select Analog Cal and set the output to 0%. Go to the register editor and select the al\_aninst1 register (this is register 385 for version 0.3A).

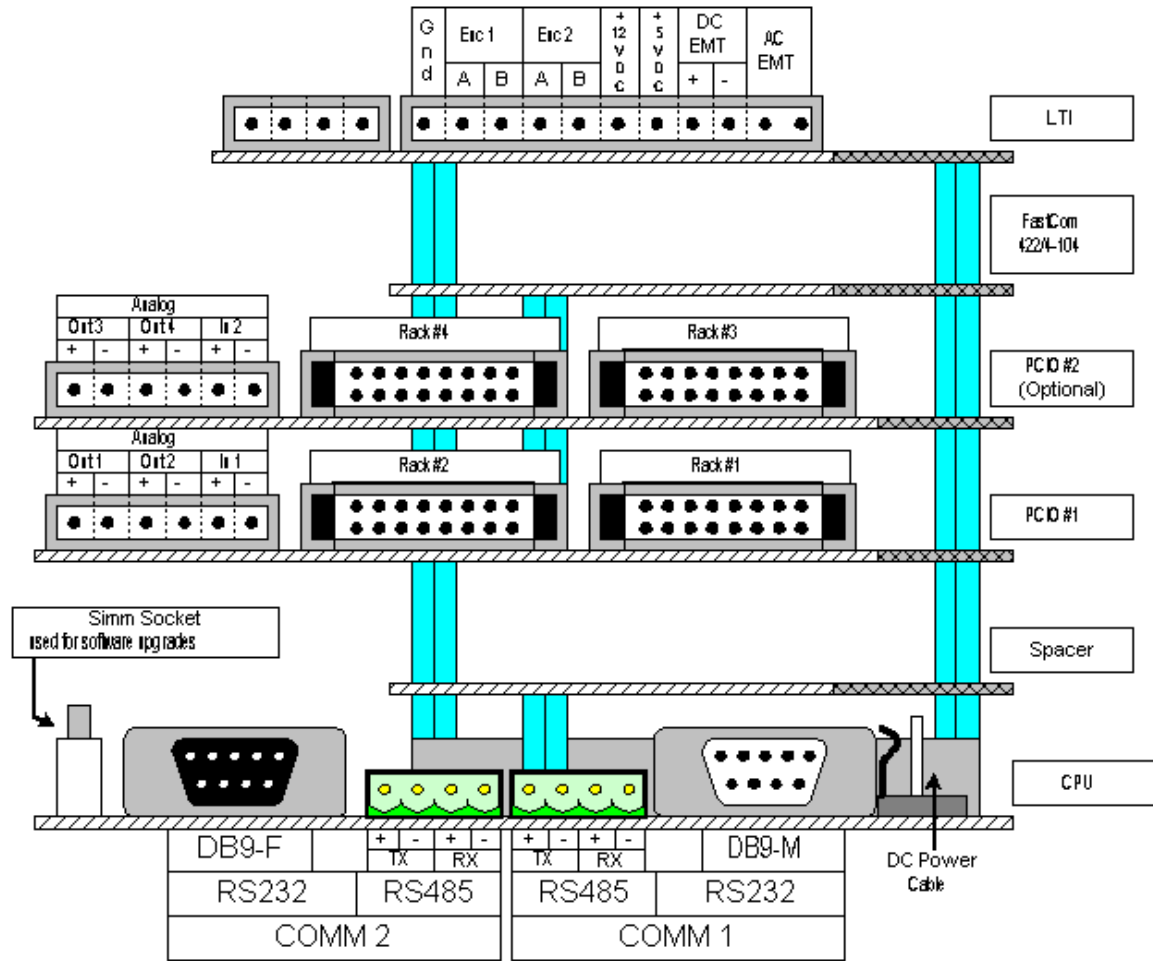
Adjust 'AIN Z' (R64) until the register just reads 0 (the best way to do this is approach zero from the positive side).

Set the output to 100%. Adjust 'AIN S' (R63) until the register reads 1,000,000 counts.

Set the output to 50%. Verify that the register reads 500,000 counts.

## Controller Hardware

The MC<sup>3</sup> is capable of processing many different types of inputs and outputs. Most of the connections necessary for the inputs and outputs are located on the Backplane Board.



*Back Panel Rear View*

### **LTI BOARD**

#### **EMT**

The EMT outputs are provided to you for connection to a remote totalizer. Both AC and DC pulse outputs are available. See "" on page 64 for more information.

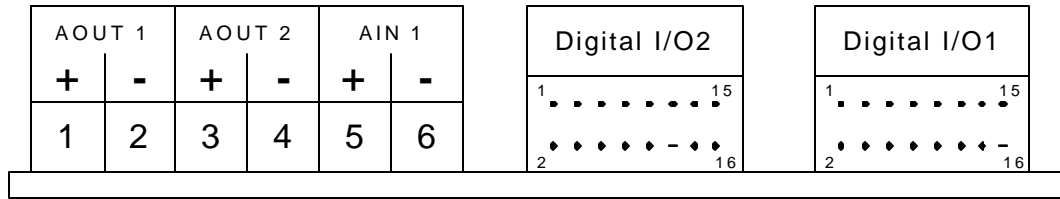
#### **Encoder**

If only one (1) encoder input is to be used it must be in the "A" position. The mode should be No - Direction.

#### **Serial Communications**

Serial Channel #1 is a four wire RS-485 port. The baud rate, parity, stop bit settings and protocol of the ports are setup in the software. For further information on configuring the Serial Communications Board and its interface to different types of serial equipment, see Communications on page 64. For users of the updated CPU board, this communication port has been moved to the CPU, this port is no longer supported.

## PCIO Board



|                  |                  |                  |                  |             |             |                       |                       |
|------------------|------------------|------------------|------------------|-------------|-------------|-----------------------|-----------------------|
| O<br>U<br>T<br>1 | O<br>U<br>T<br>2 | O<br>U<br>T<br>3 | O<br>U<br>T<br>4 | I<br>N<br>1 | I<br>N<br>2 | G<br>N<br>D           | G<br>N<br>D           |
| 1                | 3                | 5                | 7                | 9           | 11          | 13                    | 15                    |
| 2                | 4                | 6                | 8                | 10          | 12          | 14                    | 16                    |
| O<br>U<br>T<br>8 | O<br>U<br>T<br>7 | O<br>U<br>T<br>6 | O<br>U<br>T<br>5 | I<br>N<br>4 | I<br>N<br>3 | +<br>5<br>V<br>D<br>C | +<br>5<br>V<br>D<br>C |

Digital I/O Pin Layout

### PCIO BOARD

#### Digital Inputs

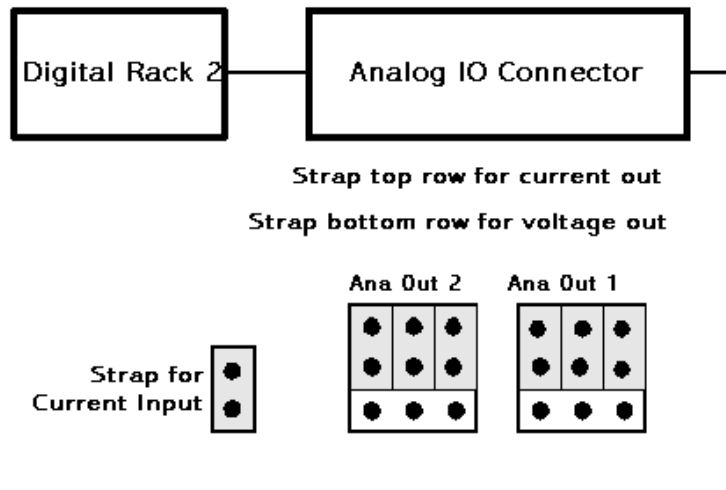
The digital inputs are provided so that the customer may provide logical on/off signals to the MC<sup>3</sup> Controller. The default digital input is:

#### Digital Outputs

The digital outputs are provided so that the customer may use these outputs as status indicators. The default digital output map is:

#### **Analog I/O Current/Voltage Strapping**

On the PCIO board are straps, to convert the analog signals from current to voltage.



*This example is set for Current input and output.*

#### Analog Inputs

One (1) analog input is available for changing the Setpoint.

NOTE: If the analog signal is a current input, a jumper must be installed. If the input is a voltage, a jumper must be removed for proper conversion.

**Analog Outputs**

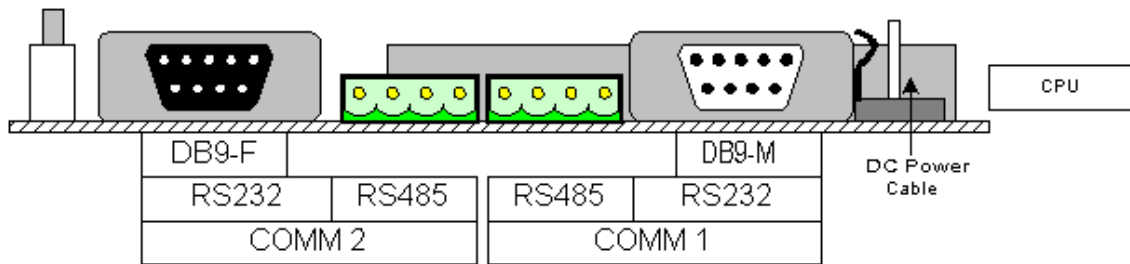
Isolated Analog Outputs are provided with the PCIO Board. There is a maximum of two outputs per board. Provided with two PCIO's, a maximum of four analog outputs can be used.

**LCD Board**

**KEYBOARD LOCATION CODES**

|    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|
| A1 | B1 | C1 | D1 | E1 | F1 | G1 | H1 |
| A2 | B2 | C2 | D2 | E2 | F2 | G2 | H2 |
| A3 | B3 | C3 | D3 | E3 | F3 | G3 | H3 |
| A4 | B4 | C4 | D4 | E4 | F4 | G4 | H4 |

**CPU Board**



**Communication Ports**

**Comm 1 RS-232 J7**

| Pin | Signal       |
|-----|--------------|
| 2   | Rx           |
| 3   | Tx           |
| 4   | DTR (+5VDC)  |
| 5   | Com (DC GND) |
| 7   | RTS          |
| 8   | CTS          |

**Comm 1 RS-485 J6**

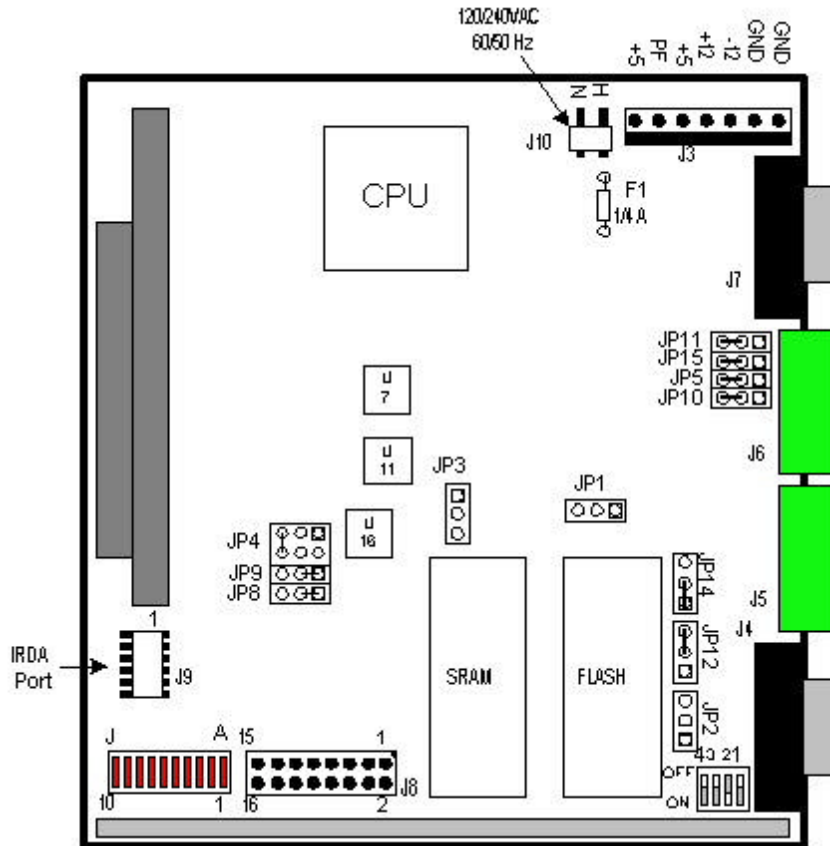
| Pin | Signal |
|-----|--------|
| 1   | TX +   |
| 2   | TX -   |
| 3   | RX +   |
| 4   | RX -   |

**Comm 2 RS-232 J4**

| Pin | Signal       |
|-----|--------------|
| 2   | Tx           |
| 3   | Rx           |
| 5   | Com (DC GND) |
| 6   | DSR (+5VDC)  |
| 7   | RTS          |
| 8   | CTS          |

**Comm 2 RS-485 J5**

| Pin | Signal |
|-----|--------|
| 1   | TX +   |
| 2   | TX -   |
| 3   | RX +   |
| 4   | RX -   |



**Option Switch Settings**

|     |  |
|-----|--|
| SW1 | Flash Programming Lockout<br>OFF - Program when SIMM installed<br>ON - Normal Operation  |
| SW2 | Power Fail Detection Level<br>OFF - High Level Detection (Old Style)<br>Modified Power Supplies<br>ON - Low Level Detection<br>Unmodified Power Supplies |
| SW3 | Test Pin 1 (Led 5/E) (Forced OFF)  |
| SW4 | Test Pin 2 (Led 6/F) (Forced OFF)  |
|     |  |

**LED Display**

| LED # | Desc           |
|-------|----------------|
| 1/A   | Com 2 Receive  |
| 2/B   | Com 2 Transmit |

| LED # | Desc           |
|-------|----------------|
| 3/C   | Com 1 Receive  |
| 4/D   | Com 1 Transmit |
| 5/E   | Test Pin 1     |
| 6/F   | Test Pin 2     |
| 7/G   | Test Pin 3     |
| 8/H   | Test Pin 4     |
| 9/I   | Power Fail     |
| 10/J  | Power ON       |

#### JTAG/SERVICE Port (J8)

| Pin | Desc                                       |
|-----|--|
| 1   | +5VDC                                      |
| 2   | Test Pin 1/LED 5/E                         |
| 3   | GND  |
| 4   | Test Pin 2/LED 6/F                         |
| 5   | TCK  |
| 6   | Test Pin 3/LED 7/G                         |
| 7   | TDO  |
| 8   | Test Pin 4/LED 8/H                         |
| 9   | TDI  |
| 10  | NMI (/Debug Break)                         |
| 11  | TMS  |
| 12  | CPU Reset                                  |
| 13  | TRST# (Nomal operation 13/14 are jumpered) |
| 14  | PWRGD (Nomal operation 13/14 are jumpered) |
| 15  | No Connection                              |
| 16  | Flash Lockout (see SW1)                    |

#### Option Jumper Settings

| Jumper | Desc   |
|--------|--|
| JP1    | FLASH PROGRAMMING VOLTAGES<br>Strap 1 to 2 for +12VDC Flash Programming Voltage<br>Strap 2 to 3 for +5VDC Flash Programming Voltage<br>Default 2-3 |
|        |  |

#### Printer Operation

MC<sup>3</sup> CPU board must be specifically configured for Printer operation. Call Merrick for details to verify your CPU board configuration.

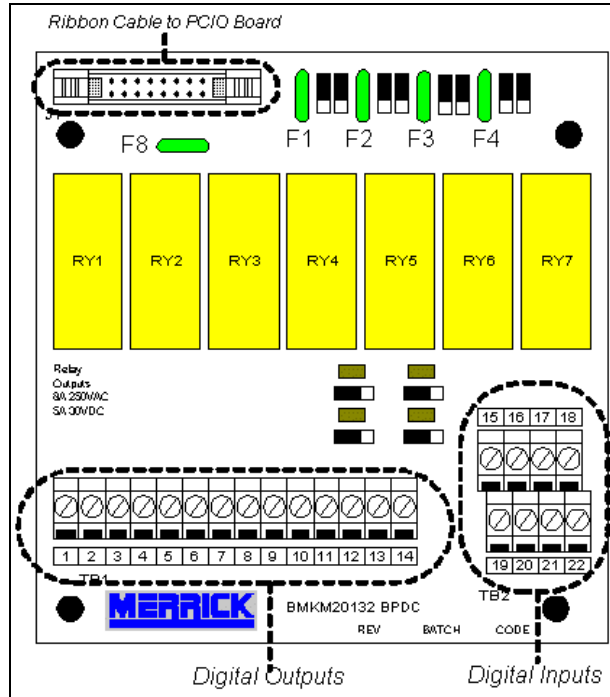
#### **Backplane Board**

Each Back plane board is termed a Rack in the MC<sup>3</sup> controller. A standard controller consists of one PCIO and one Back plane board. Up to four Back plane boards may be connected in a cabinet using two PCIO boards.

Two different Back plane boards are available for use with Feeder systems. One is DC dry contact input style with four inputs and seven outputs. The other is an AC input style with four inputs and eight outputs.

### DC Style Backplane Board

Each DC Style Back plane board consists of four (4) inputs and seven (7) outputs. The inputs are to be dry contact type. The outputs are N/O relay contacts with a rating of eight amps at 125 VAC or five amps at 30VDC. Care must be taken not to exceed these values. The inputs are fused with the fuses rated at 1/16 Amp (F8 is a spare fuse).

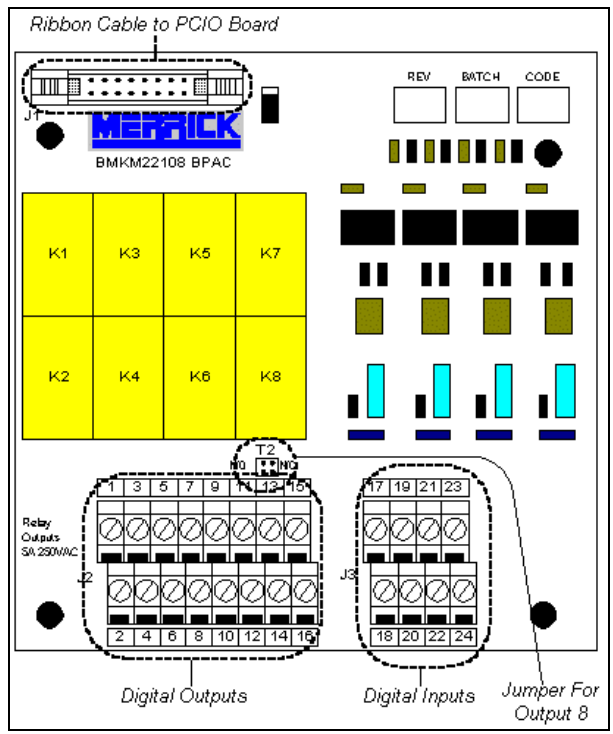


| Inputs | Terminals | Fuse |
|--------|-----------|------|
| 1      | 15/19     | 1    |
| 2      | 16/20     | 2    |
| 3      | 17/21     | 3    |
| 4      | 18/22     | 4    |

| Outputs | Terminals |
|---------|-----------|
| 1       | 1,2       |
| 2       | 3,4       |
| 3       | 5,6       |
| 4       | 7,8       |
| 5       | 9,10      |
| 6       | 11,12     |
| 7       | 13,14     |

### AC Style Backplane Board

Each AC Style Back plane board consists of four (4) inputs and eight (8) outputs. The inputs are to be 110VAC switched type. The outputs are N/O relay contacts with a rating of 5 amps at 250 VAC. Output 8 is jumper selectable between N/C and N/O, which causes the contact to be de-rated. Care must be taken not to exceed these values.



| Inputs | Terminals |
|--------|-----------|
| 1      | 17,18     |
| 2      | 19,20     |
| 3      | 21,22     |
| 4      | 23,24     |

| Outputs | Terminals |
|---------|-----------|
| 1       | 1,2       |
| 2       | 3,4       |
| 3       | 5,6       |
| 4       | 7,8       |
| 5       | 9,10      |
| 6       | 11,12     |
| 7       | 13,14     |
| 8       | 15,16     |

## **STORAGE**

### ***Storage On Receipt from Factory***

#### **Storage Longer than 6 Months**

Outside storage is NOT recommended. If possible, store electrical equipment in a heated warehouse, above freezing temperatures.

Operate all electrical and electronic equipment at least once (1) a year for a minimum of two hours, preferably during a low humidity season. Operate all switches at least ten (10) times and allow the equipment to obtain normal operating temperature before turning off. Allow units to cool before repackaging and returning to storage.

#### **Storage up to 6 Months**

Keep all equipment dry and well above the ground. If the equipment has been in transit for two months or longer, replace the factory supplied desiccant (if so equipped) before placing in storage. The use of evaporative corrosion inhibitors is recommended, but not mandatory.

### ***Storage Following Use***

Clean all equipment and enclosures thoroughly inside and out.

Remove rust as necessary. Touch up painted surfaces as necessary to protect bare metal surfaces. Protect electrical and electronic components from painting operations.

Place desiccant or evaporative corrosion inhibitors inside control enclosures.

Observe storage instructions as above for storage before use.

### ***Operation after Storage***

When electrical equipment has been stored at either high humidity or low temperature, do not apply power until the equipment has been allowed to stand at ambient conditions a minimum of three (3) hours.

Remove all packing and/or protective materials. Remove all desiccants.

## SPARE PART LIST

This section contains typical parts lists to assist in identifying necessary parts, should a problem develop with your MC<sup>3</sup> Controller unit or a part become lost or damaged. Depending on the options ordered with the unit, it is possible that not all parts shown will be present in this particular unit.

If you need further assistance, or would like to place a parts order, please contact the Merrick Spare Parts Department.

### *Spare Parts List*

| <b>Name</b>           | <b>Part Number</b> |
|-----------------------|--------------------|
| Power Supply Assembly | M21912-1A          |
| Fuse                  | Q-73               |
| CPU Board             | M21746-1A          |
| PCIO Board #1         | M21735-1A          |
| PCIO Board #2         | M21735-2A          |
| LTI Board             | M21689-1A          |
| Display Assembly      | M21729-2A          |
| LCD Board             | M21684-1A          |
| LCD Graphic Display   | 19-411-00002       |
| Backlight Assembly    | 13-903-79001       |
| Fastcom 422/4-104     | 25-001-00009       |
|                       |                    |
|                       |                    |

### **Accessories**

#### I/O System

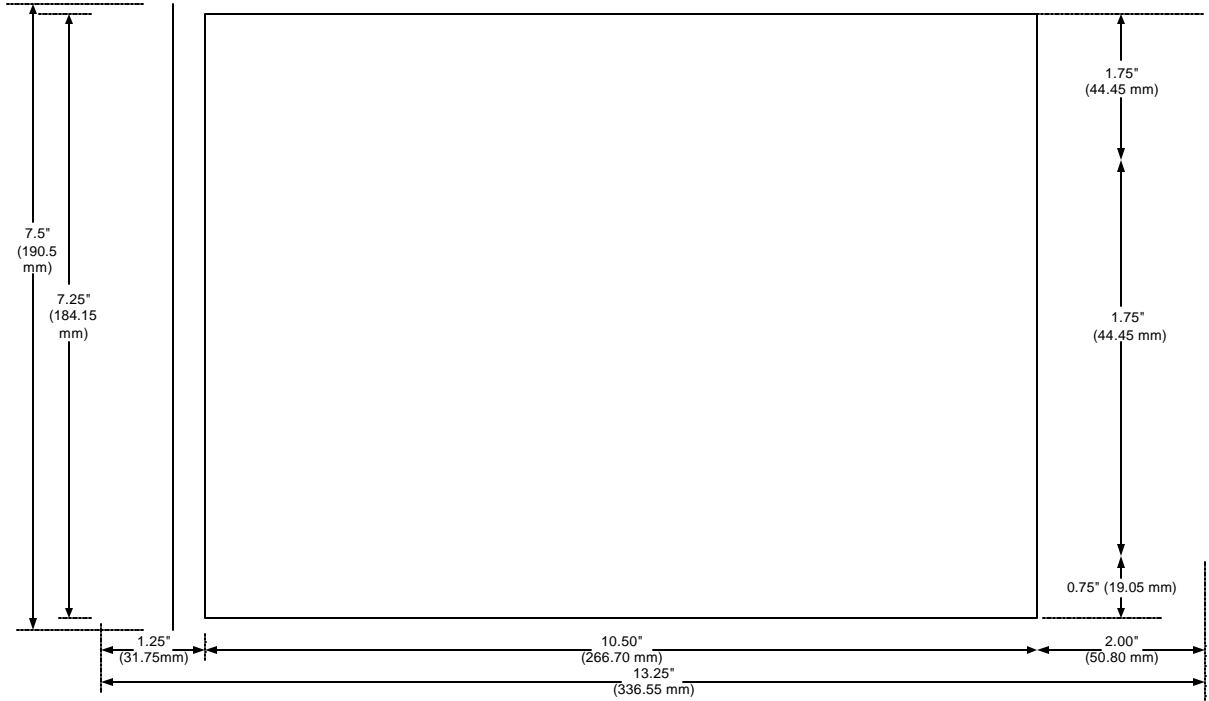
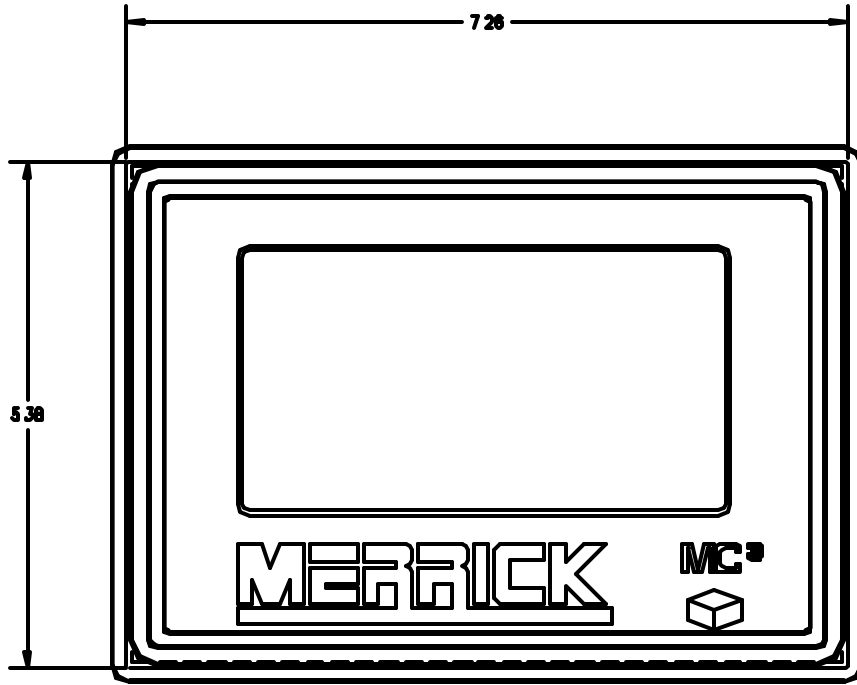
| <b>Name</b>          | <b>Part Number</b> |
|----------------------|--------------------|
| Backplane Board      | M21882-1           |
| Backplane Board (AC) | M22108-1A          |
| Cable - 9 inch       | M20184-6           |
| Cable 12 inch        | M20184-5           |
| Cable 18 inch        | M20184-3           |
| Cable 22 inch        | M20184-4           |

#### Spare I/O Plugs and Miscellaneous

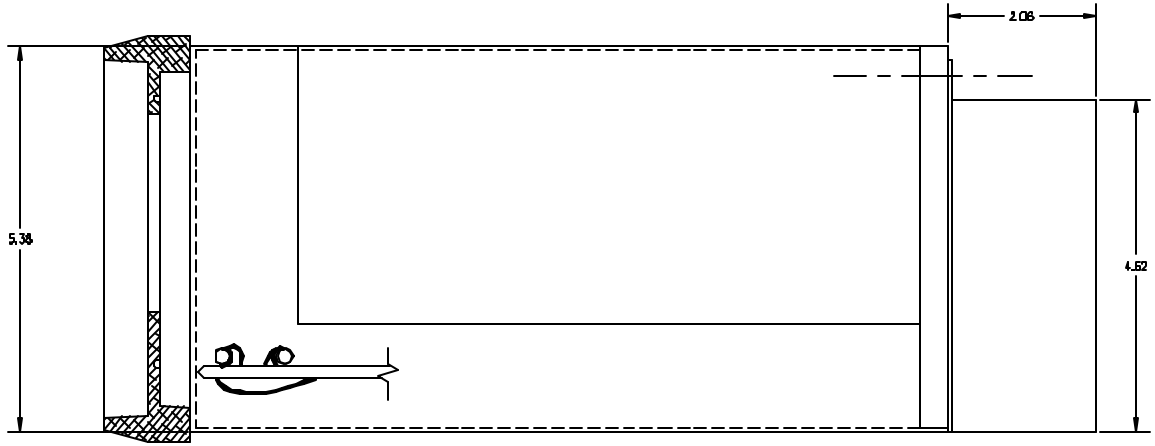
| <b>Name</b>   | <b>Part Number</b> |
|---------------|--------------------|
| 4 Pin         | 09-204-40401       |
| 6 Pin         | 09-204-40601       |
| 8 Pin         | 09-204-40801       |
| 11 Pin        | 09-204-41101       |
| Grounding Bar | FE11887            |
| Power Cord    | FE11270            |

# APPENDIX A

## Panel Mount - Dimensions

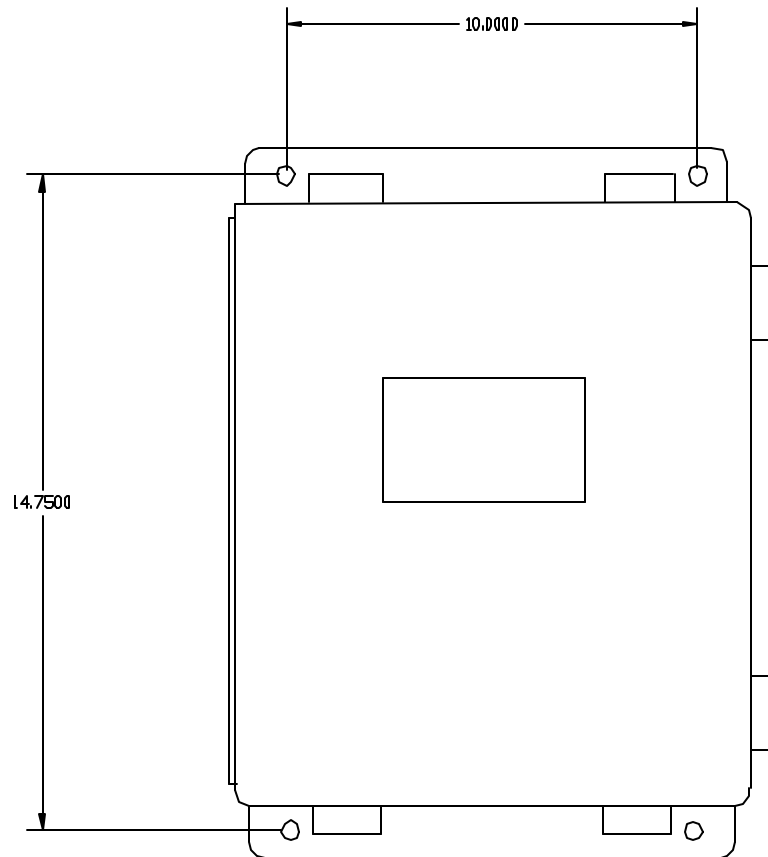


Top View

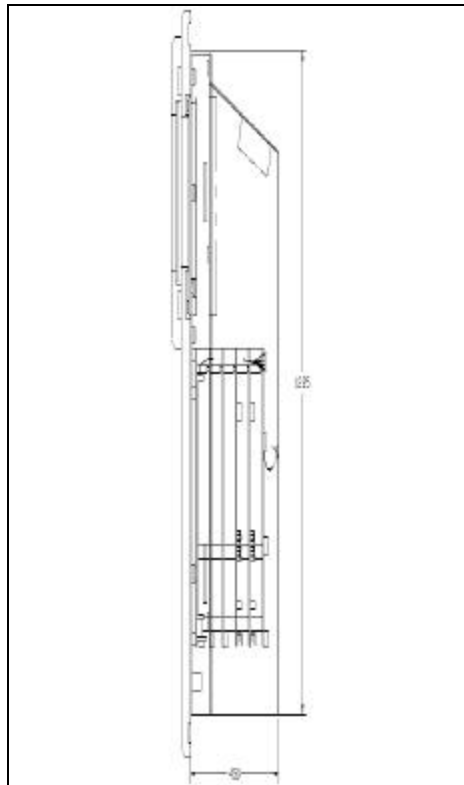
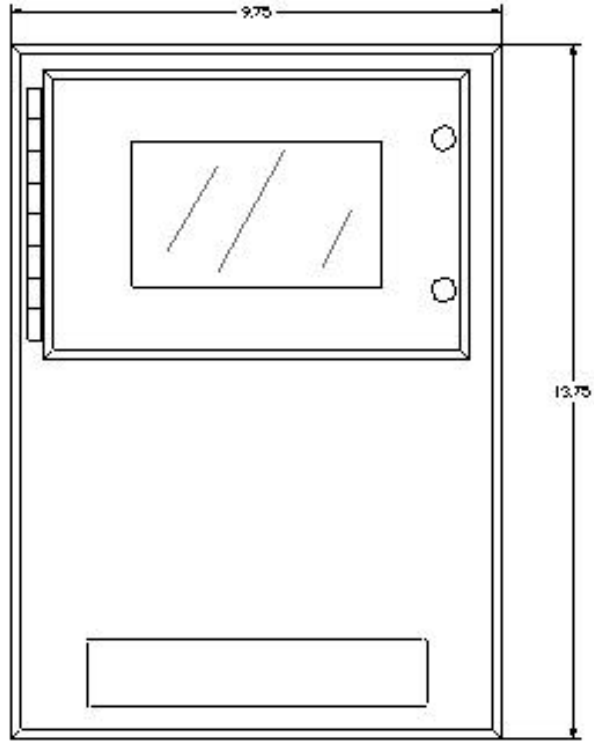


Side View

**Wall Mount – Mounting Dimensions**



**Door Mount - Dimensions**



## Index

|                                 |    |                               |    |
|---------------------------------|----|-------------------------------|----|
| AC Style Backplane .....        | 45 | Local Setpoint .....          | 10 |
| Action Menu .....               | 13 | Logical Inputs .....          | 30 |
| Analog I/O Diagnostics.....     | 34 | Logical Outputs .....         | 31 |
| Analog Input .....              | 26 | LTI BOARD .....               | 40 |
| Analog Outputs.....             | 28 | Main Display.....             | 9  |
| Analog Setpoint .....           | 11 | Misc. Data.....               | 36 |
| Backlight Off Time .....        | 25 | Modbus Diagnostics.....       | 35 |
| Comm 1 Numeric.....             | 23 | Panel Meter Limit Switch..... | 25 |
| Comm 2 Numeric.....             | 24 | Panel Mount .....             | 5  |
| Comm Parameters .....           | 22 | Password.....                 | 37 |
| Communication Diagnostics ..... | 34 | PCIO Board.....               | 41 |
| CPU Board .....                 | 42 | Physical Inputs .....         | 30 |
| DC Style Backplane.....         | 45 | Printer .....                 | 19 |
| Decimal Points .....            | 22 | Pulse Length .....            | 25 |
| Design Capacities .....         | 22 | Quick Setup .....             | 37 |
| DF1 Diagnostics .....           | 35 | Ratio Setpoint .....          | 11 |
| Diagnostic Display .....        | 34 | Recipe Menu.....              | 14 |
| Digital I/O Diagnostics.....    | 35 | Recipe Select .....           | 13 |
| Digital Inputs .....            | 29 | Register Editor.....          | 37 |
| Digital IO.....                 | 29 | Register Monitor .....        | 36 |
| Digital Outputs.....            | 31 | Reset Master Total .....      | 14 |
| Display Parameters.....         | 25 | Reset Sub-Total.....          | 14 |
| Door Mount .....                | 6  | Serial Setpoint .....         | 11 |
| EMT Parameters .....            | 25 | Setpoint .....                | 10 |
| Faults.....                     | 12 | Setpoint Dampening .....      | 25 |
| Feeder Diagnostics.....         | 34 | Setpoint Limit Switch.....    | 24 |
| Feeder Display .....            | 15 | Start/Stop Feeders .....      | 13 |
| Feeder Settings .....           | 16 | Technical Support .....       | 3  |
| Feedrate Dampening .....        | 25 | Units Select.....             | 21 |
| Feedrate Limit Switch.....      | 24 | Wall Mount .....              | 5  |
| Initial Setup .....             | 9  | Warnings.....                 | 12 |
| Installation.....               | 4  | Weight Per Pulse.....         | 25 |
| Limit Switches .....            | 24 |                               |    |
| List of Physical Outputs.....   | 33 |                               |    |