MC³ Controller

Hardware Manual
Version 1

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Revisions

0	06/08/04	Initial
1	06/30/04	RGB

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Table of Contents

INTRODUCTION

Merrick MC³ controllers are used in industrial weighing applications, typically handling a material feeder, conveyor belt scale or flow meter. This manual describes the MC³ hardware. It is a microprocessor based system, with support for

- Isolated Analog I/O, 4..20 ma or 0..10V,
- Digital I/O, dry contacts or 110V AC,
- Special Isolated Load Cell inputs,
- Special inputs for Qadrature Encoders,
- Special outputs for External Totalizers.

The MC³ hardware is a platform for different Firmware Applications, which can be changed and upgraded in the field.

The major components in the MC³ are

- Mechanical enclosure. There are three different versions, Panel, Wall and Door mount.
- Card Stack. Printed circuits boards in a standard PC/104 configuration.
- Graphical Display and Touch Screen.
- Power Supply, providing +5, +12 and -12V DC to components, inputs and outputs.
- I/O racks for digital I/O

The controller is scalable and configurable by means of cards in the card stack and I/O racks.

CONTROLLER ENCLOSURES

PANEL MOUNT

The Merrick MC³ Panel Mount Controller is designed for mounting in a control cabinet. It is suitable for use in environments that are generally clean, and within the temperature range of 32° to 104° F (0° to 40° C). It must be protected from water or significant dirt or dust. See the drawings provided in Appendix A (page 36) for exact specifications on the controller enclosure.

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.

WALL MOUNT

The Merrick MC³ Wall Mount Controller is designed to be weatherproof, and can be mounted most anywhere. The temperature range of this controller is within 14° to 122^oF $(-10^o$ to $50^oC)$. Merrick recommends that the controller should be located out of direct sunlight and away from dripping water and must be protected from heavy rain. Refer to the drawing in Appendix A on page 38 for detailed specifications of the controller enclosure.

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

DOOR MOUNT

The Merrick MC³ Door Mount Controller is designed for mounting on the door of a control cabinet. It is suitable for use in environments that are generally clean, and within the temperature range of 32° to 122° F $(0^o$ to 50° C). It must be protected from all but incidental water or significant dirt or dust. See the drawings provided in Appendix A (page 40) for exact specifications on the controller enclosure.

The door mount enclosure is mounted separately from the power supply and Backplane boards of 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 for use in warm environments.

MC³ BOARDS

BACKPLANE BOARDS
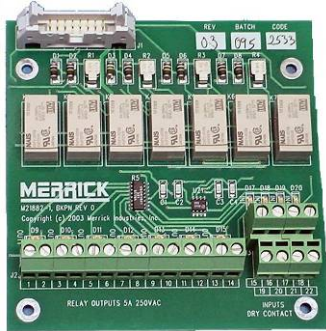
Most of the Digital I/O connections to the MC³ will be made through the Backplane Board. The Backplane Board mounts vertically in the rear access cover on the Panel mount type enclosure. On the Wall mount enclosure, the boards are mounted directly below the Card stack assembly. For the door mount, the boards are mounted on the panel in the cabinet.

There are two types of Back plane cards available, a dry contact closure input card (BKPN) and an AC input card (BPAC). The BKPN card has four dry contact inputs and 7 relay (N/O) outputs. The BPAC card has four AC inputs and 8 Relay outputs. Relays 1-7 are normally open types. Relay 8 can be jumpered for normally open or normally closed operation.

Up to four Backplane boards may be connected to the MC³ Controller when two (2) PCIO boards are present in the card stack assembly.

CARD STACK ASSEMBLY

The Card Stack is a grouping label for the primary boards of the controller which consists of one (1) CPU Board, one (1) or two (2) HPAD boards, 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 and door mount enclosures; 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.

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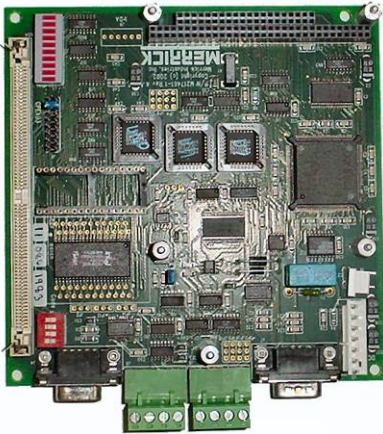
The CPU Board contains the Intel 386EX Embedded Microprocessor and associated support circuitry for a bus interface, serial interface and memory support. The newest CPU board includes two serial ports providing RS-232 and RS422/485 for both ports. The CPU board is the bottom board of the card stack.

The RS-485 Serial Communications port is a feature that provides the circuitry necessary for the MC³ Controller to communicate with other serial devices such as DF-1 and Modbus, and adapters for DeviceNet, EtherNet/IP and Profbus. For more information on MC³ connectivity, see http://www.merrick-inc.com/mct

HPAD BOARD

The High Performance Transducer A/D Board (HPAD) contains the circuitry needed to convert the analog input (mV) signal from the load cells into digital data. The Analog to Digital Converter (A/D) used on the HPAD Board is a 20-bit converter, with a resolution of about 1,000,000 counts. As an option, the MC³ Controller has the ability to utilize two (2) HPAD boards.

There are no switches on the HPAD Board for setting parameters such as Gain, Zero Offset or Electronic Calibration. The HPAD Board contains specialized circuitry for dynamically adjusting these parameters through software. There is one (1) set of jumpers to select Zener Barrier Protection and Normal Operation of the HPAD.

PCIO BOARD
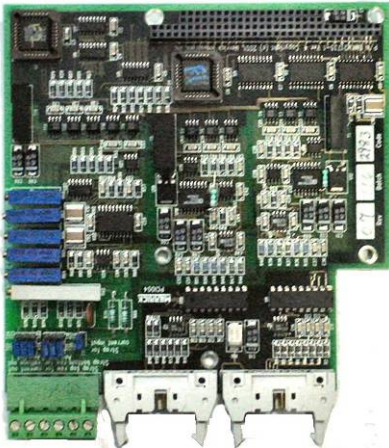
The PCIO Board provides the circuitry for two (2) isolated analog outputs; one (1) isolated analog input, sixteen (16) digital outputs and eight (8) digital inputs. An additional PCIO Board is available as an option giving the controller a capability of having four (4) isolated Analog Outputs, two (2) 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 one (1) PCIO board or four (4) can be connected if there are two (2) PCIO Boards. Located on the left side of the board, as pictured to the left, are 6 potentiometers, used to adjust zero and span. There are also jumpers to switch between current and voltage.

LTI BOARD

The LTI Board contains the circuitry required to process up to two (single or dual channel) speed encoders, outputs for an AC and DC Electromechanical Totalizer (EMT), an RS-485 Serial Port (legacy connector for older CPU boards) and an interface to the Display assembly. Supply voltages of +5V and +12V are located on the terminal block for the speed encoders.
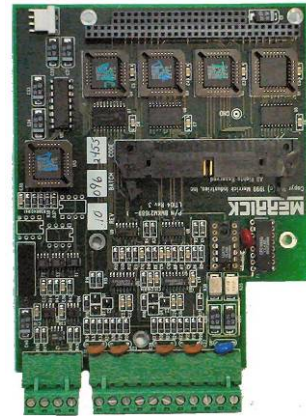
POWER SUPPLY ASSEMBLIES
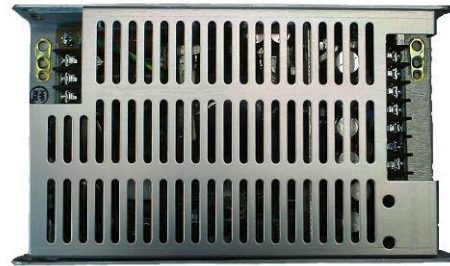
The MC3 Power Supply is a switching power supply that converts the 90/240 AC voltage input to DC voltages, without the use of any jumpers. The power supply is mounted on the front of the slide tray on the Panel Mount enclosure. On the Wall Mount enclosure, the power supply is mounted under a protective metal panel. With the Door Mount unit, the power supply is normally attached to the cabinet away from the controller. Both types of power supplies have built in Power Fail Detect circuits that send a warning to the processor when the input voltage begins to fail, so that parameters can be saved before the power is lost. The MC3 Power Supply has no user serviceable parts, such as fuses. In the Panel and Wall Mount controllers, the fuse is located in the switch assembly. For the Door Mount controller, see the wiring diagram for fuse located in the panel.

Power Receptacle and Switch

The Power Receptacle and switch assembly is the same on both the Panel Mount and Wall Mount enclosures. On the top above the switch, is the fuse holder. Push up on the small catch to release this holder from assembly. The fuse is a 1A 250V 5X20mm fuse.

DISPLAY ASSEMBLY
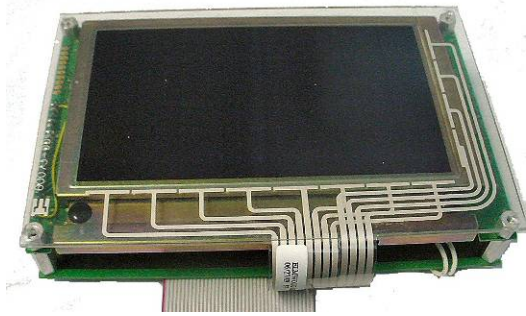
The Display Assembly consists of a Touch Keypad, LCD Board and LCD Display (Shown here with out bezel or enclosure). With the Panel Mount and the Wall Mount, the display assembly is sealed against dust with silicone around the touch screen to the bezel or enclosure. The Door Mount uses gaskets for sealing.

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 located on the top right corner. In addition, on there is a Brightness Adjust potentiometer on the left top corner of the board. An alignment tool is needed to make adjustments.
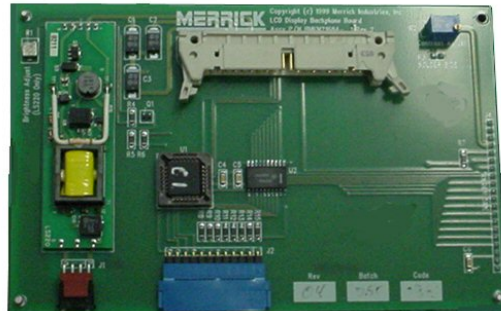
LCD Display

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 MC³ Panel Mount and Wall Mount enclosure. 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. In some controllers, a different display is used that has a touch screen attached to the display. The board also has a different LCD Board, but has the same functionality.
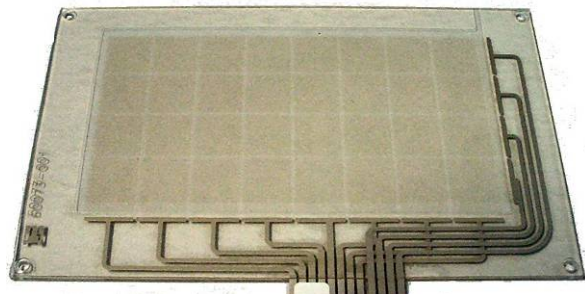
INSTALLATION

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. This will insure a watertight environment for the electronics. 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 cover page for contact information regarding the Merrick Support.

CONTROLLER PHYSICAL INSTALLATION

Panel Mount

Cut panel to dimensions provided in **APPENDIX A** (**Panel Mount – Dimensions**) on page 36. 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.

There are two screws on each side of the top cover. Remove them before putting the controller in the panel if you will not be able to get to them because of space restrictions.

Wall Mount

Mount the controller on a vertical surface, Use dimensions provided in **APPENDIX A** (**Wall Mount – Mounting Dimensions**) on page 38 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

Cut cabinet door to dimensions provided in **APPENDIX A** (**Door Mount - Dimensions**) on page 40.   Insure there is adequate clearance around the controller for maintenance and ventilation. Install the controller into cabinet door using the mounting brackets provided. The Power Supply should be mounted on the Cabinet panel in the cabinet. Make sure the cable supplied is long enough to reach the intended mounting location. Mount any Backplanes on the cabinet panel, using standoffs, to keep the back of the board from shorting against plate. Again, make sure the ribbon cables are long enough to go from the controller to the boards. Route the ribbon cables away from any power cables or switching circuits, which could induce a signal into the ribbon cables.

MC3 FLASHLOADER PROGRAMMING

This instruction details the procedure to use when loading (new or revised) application firmware into the Flash EPROM of an MC³ Controller. Use a straight serial DB9-P to DB9-S cable between the serial port on the PC and COM 2 serial port on the MC³ Controller. See Figure 1 on next page.

FLASHLDR.EXE is a DOS application, running on your PC, used to load the MC³ application (HEX file) into the MC³ Flash EPROM. It must be started from the directory that contains the HEX file you want to load. FLASHLDR.EXE cannot be used from a network drive.

The PC serial port must be native to the PC. USB serial adapters will not work.

The usable baudrate depends on the CPU speed and operating system. For DOS, Windows 95, 98 and ME, use 38400 or 57600 baud. For Windows 2000 and XP, you may have to go as low as 4800 baud.

A 1 to 16 Mbyte 72 pin SIMM must be connected into the SIMM socket on the CPU board before installation of application software. After programming the MC³ controller the SIMM memory must be removed.

NOTE: There are 2 procedures; choose the procedure that matches your CPU Board revision.

NOTE: Do not erase other programs in flash memory unless specified to do so by the factory.

CAUTION: It is recommended to turn off power and remove the power cord from the controller before setting or removing the JP1 jumper, changing position of SW1 and inserting and extracting the SIMM.

PROCEDURE FOR REV 10 OR EARLIER CPU BOARDS
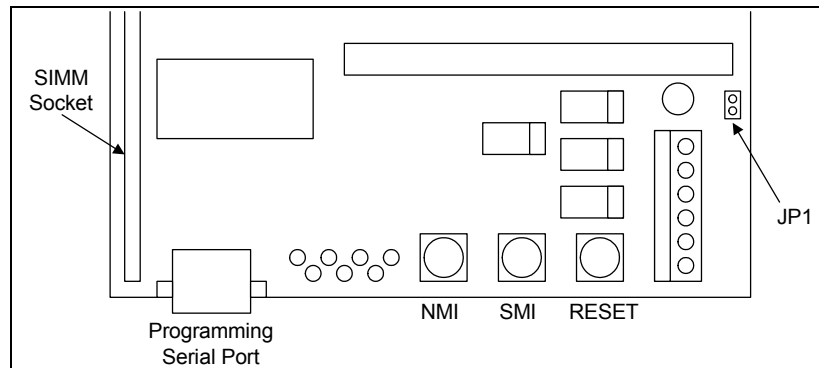
Insure that the power cord is disconnected from the controller (for safety).

Insert SIMM memory into SIMM socket and make sure it is seated properly.

Jumper JP1 on the CPU card. JP1 is located near the power supply connector. You may need long needle nose pliers to get to this.

Plug in your power cord and turn on power. The LCD screen should be blank (no display), if not, the controller may not see the SIMM or the jumper, so recheck those items and try again.

Connect the serial cable to the controller and to the PC com port to be used. Make sure you know which com port you are using on the computer.

Find the correct directory on the computer where flashldr.exe and the hex file are located. If they are on a floppy disk, copy them to a directory on the computer hard disk.

Start Flashldr
C:\3000software> type: `flashldr(.exe not needed)`

Set the baud rate for communications.
FLASH CMD: type: `baud=57600(or lower baud based on UART)`

Initialize communication on the serial port.
FLASH CMD: type: `init com2 (or the correct port on computer)`

Get a listing on what is currently in the flash memory.
FLASH CMD: type: `dir(take not of the app name)`

Delete the current application
FLASH CMD: type: `del 3000exr(or whatever the app name is)`

Program the new application version.
FLASH CMD: type: `pr r3000c(or whatever the new file is)`

After the application has been loaded, tell flash to boot from application.
FLASH CMD: type: `sb`

Quit Flashldr. This will update the flash tables appropriately.
FLASH CMD: type: `q`

Wait for FLASHLDR to update the flash tables and shut down. Turn off power to the controller. Remove power cord. Remove JP1 jumper. Remove SIMM memory.

Reinstall power cord. Turn on power. Watch screen for normal MC³ countdown.

Touch the upper left and right corners of the screen to perform a ram reset if required.

PROCEDURE FOR REV 11 OR LATER CPU BOARDS
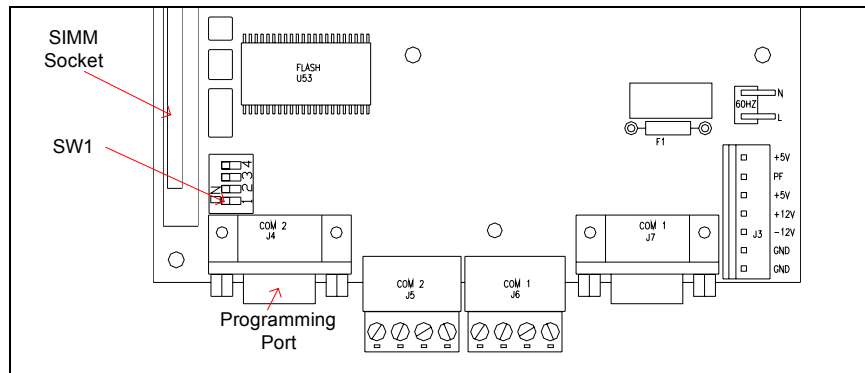
Insure that the power cord is disconnected from the controller (for safety).

Move SW1 to the OFF position (away from simm).

Insert SIMM memory into SIMM socket and make sure it is seated properly.

Plug in your power cord and turn on power. The LCD screen should be blank (no display), if not, the controller may not see the screen or the jumper, so recheck those items and try again.

Connect the serial cable to the controller and to the computer com port to be used. Make sure you know which com port you are using on the computer.

Find the correct directory on the computer where flashldr.exe and the hex file are located. If they are on a floppy disk, copy them to a directory on the computer hard disk.

Start Flashldr
C:\3000software> type: `flashldr(.exe not needed)`

Set the baud rate for communications.
FLASH CMD: type: `baud=57600  (or lower baud based on UART)`

Initialize communication on the serial port.
FLASH CMD: type: `init com2 (or the correct port on computer)`

Get a listing on what is currently in the flash memory.
FLASH CMD: type: `dir(take not of the app name)`

Delete the current application
FLASH CMD: type: `del 3000exr(or whatever the app name is)`

Program the new application version.
FLASH CMD: type: `pr r3000c(or whatever the new file is)`

After the application has been loaded, tell flash to boot from application.
FLASH CMD: type: `sb`

Quit Flashldr. This will update the flash tables appropriately.
FLASH CMD: type: `q`

Wait for FLASHLDR to update the flash tables and shut down. Turn off power to the controller. Remove power cord. Return SW1 to On Position. Remove SIMM memory.

Reinstall power cord. Turn on power. Watch screen for normal MC³ countdown.

Touch the upper left and right corners of the screen to perform a ram reset if required.

Sample Session

```
C:\MC3\APPS\2496EN\V003C>flashldr
*****  CQi Flash Loader - V2.0, 24 FEB 95  *****
Copyright (c) 1994,95 Intel Corporation
Copyright (c) 1994,95 Cyber Quest, Inc.

FLASH CMD: baud=38400
Baud rate set to 38.4K

FLASH CMD: init com2
Port set to COM2
VT Port set to COM2
Establish link to target system on COM2 at 38.4K baud ...
Target system on-line (board = 00010102, prog = 1, ver = 2.00)
Flash tables OK
Initialization complete

FLASH CMD: dir
Flash directory of I386EX-EVAL board (TARGET system):
                               File/Program    Strt/End  Log/Phy
Name        Group       Ver    Date/Time       Address     Size  Flg  Checksum
--------    ----------  -----  --------------  --------  -------  ---  --------
2496EXR                        07/16/96 16:41  00080000   253952  B1-  0167458B
                               07/16/96 16:44  000BDFFF   253952

FLASH CMD: del 2496exr
Program name set to 2496EXR
Program 2496EXR deleted

FLASH CMD: pr 2496exr
Program file set to .\2496EXR.HEX
Program name set to 2496EXR
File format set to HEX
Start flash programming ...
Process hex file .\2496EXR.HEX ...
Read ...       Addr: 00080000 - 000BDFFF   Size: 253952   Total: 253952
Hex file OK
Process flash blocks ...
Download ...  Addr: 0009FC00 - 0009FFFF   Size: 1024     Total: 131072
Program 28F400BX-T flash block #1 ...
Download ...  Addr: 000BDC00 - 000BDFFF   Size: 1024     Total: 253952
Program 28F400BX-T flash block #2 ...
Flash blocks OK
Flash programming complete

FLASH CMD: sb 2496exr
Program name set to 2496EXR
Boot program set to 2496EXR (start vector = 8000:0000)

FLASH CMD: q
Start shutdown ...
Update flash tables ...
Flash tables OK
Shutdown complete
C:\MC3\APPS\2496EN\V003C>
```

MC³ CONNECTIONS

The MC³ 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 which are plugged into the PCIO boards at the connectors labeled "Racks". The diagram below shows the card stack as seen from the back, with additional optional boards. If an older revision CPU is present, then the diagram on the following page should be used.

CARD STACK WITH REVISION 11 OR NEWER CPU BOARD
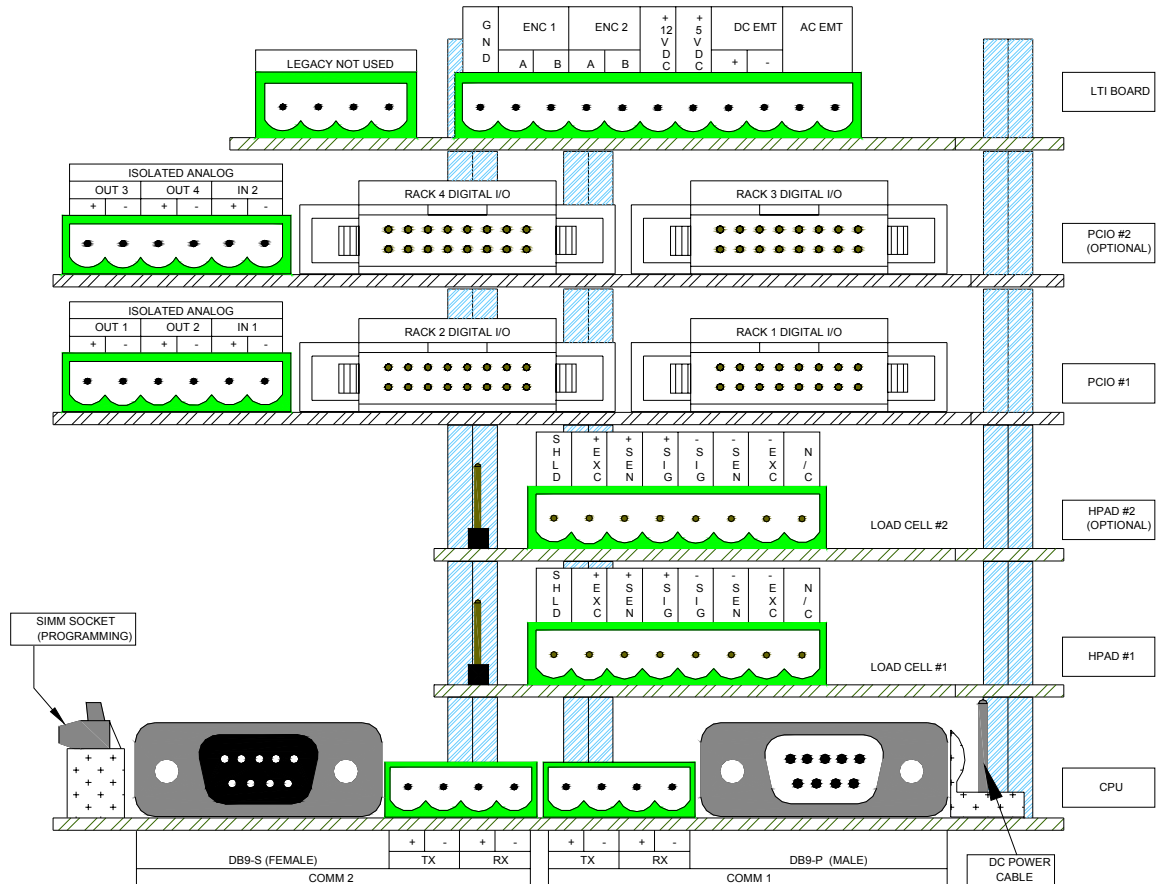
Back Panel Rear View

CARD STACK WITH REVISION 10 OR OLDER CPU BOARD
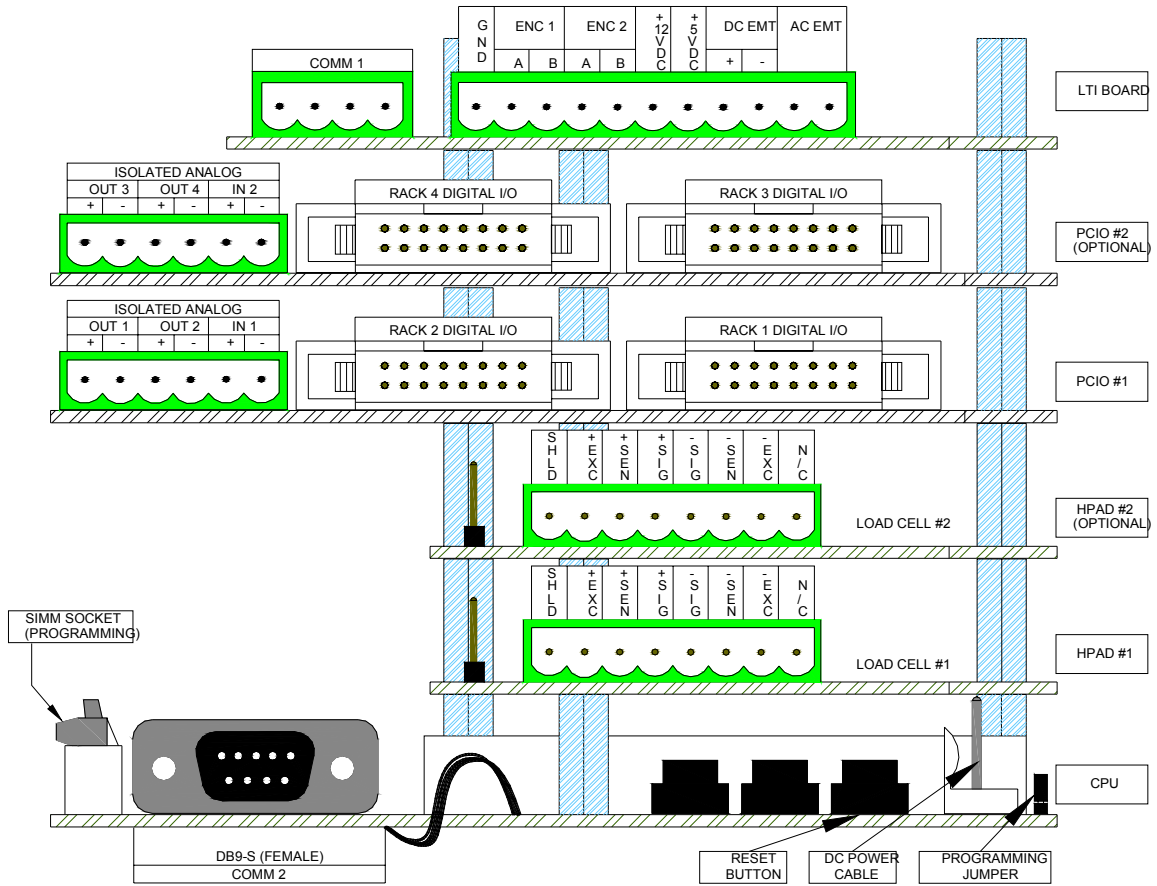
Back Panel Rear View

LTI BOARD

There are 3 types of connections available on the LTI Board: Communication, Encoder and Totalizer connections. There is +5VDC, +12VDC and Ground available for the encoders. These signals are detailed on the next page.

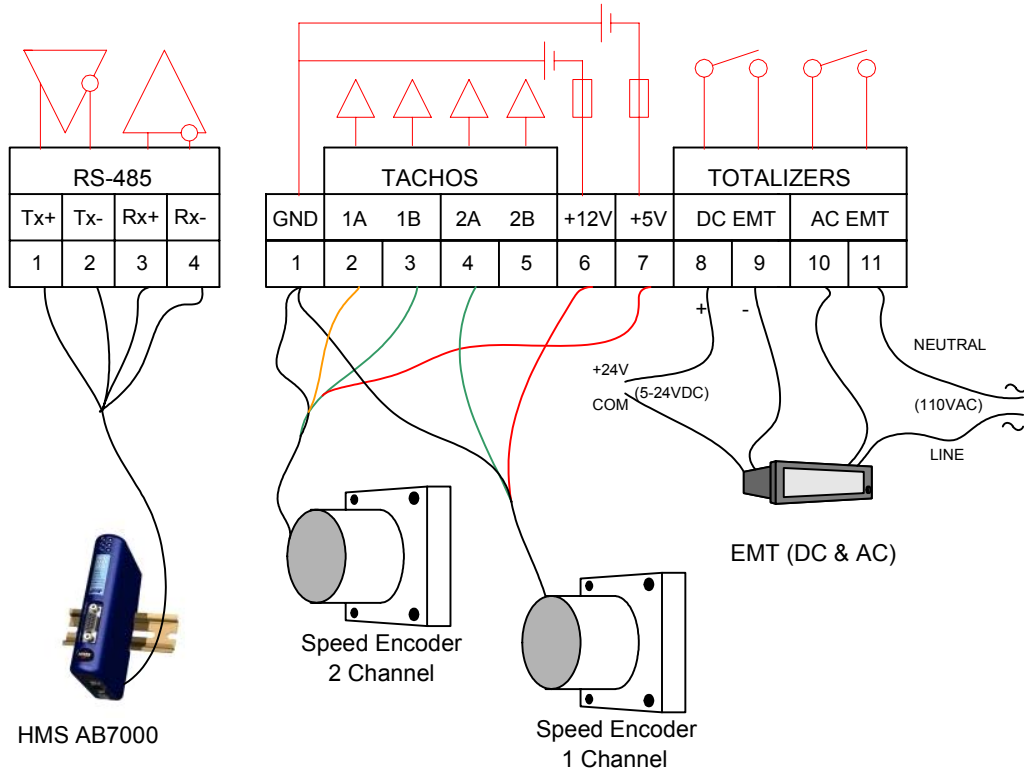| RS-485				TACHOS							TOTALIZERS			
Tx+	Tx-	Rx+	Rx-	GND	1A	1B	2A	2B	+12V	+5V	DC EMT		AC EMT	
1	2	3	4	1	2	3	4	5	6	7	8	9	10	11

HMS AB7000

Speed Encoder 2 Channel

Speed Encoder 1 Channel

EMT (DC & AC)

NEUTRAL

(110VAC)

LINE

+24V

COM (5-24VDC)

Serial Communications (for Older CPU Boards)

Serial Channel COMM #1 is a four wire RS-485 port. The baud rate, parity, stop bit settings and protocols 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 found in the Software Manual.. For users of the updated CPU board, this communication port has been moved to the CPU, this port is no longer used. For more information regarding communications, refer to the website www.merrick-inc.com/mct.
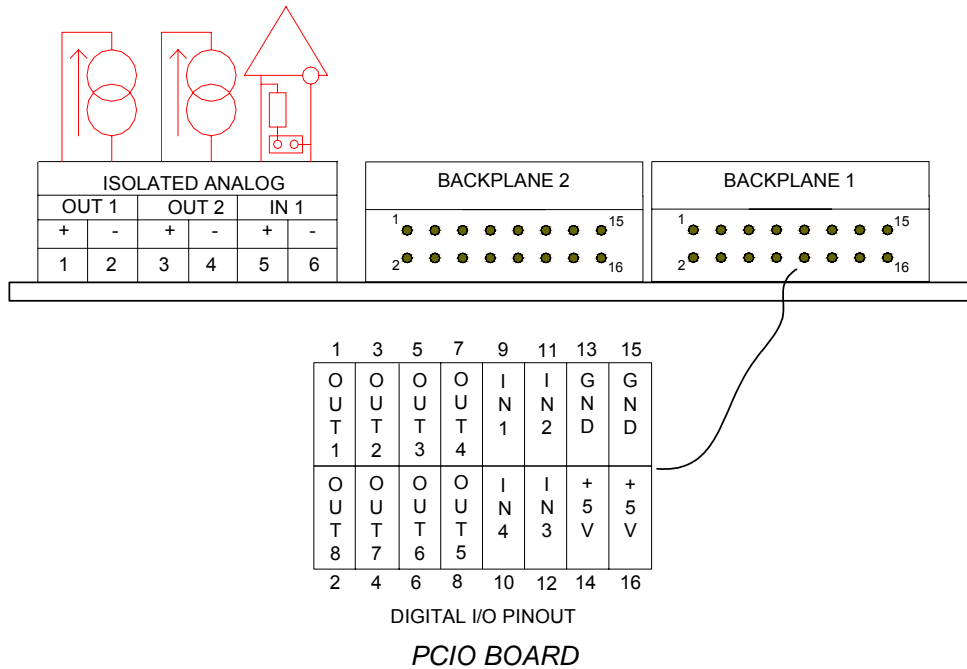
Encoder

If only one (1) encoder input channel is to be used it must be in the "A" position; ex. 1A. The mode should be No - Direction. The second encoder connects to would connect to 2A and 2B for 2 channels or 2A for single..

EMT

The EMT outputs are provided to you for connection to a remote totalizer. Both AC and DC pulses are available. The outputs are dry contact relay outputs.

PCIO BOARD

ISOLATED ANALOG					
OUT 1		OUT 2		IN 1	
+	-	+	-	+	-
1	2	3	4	5	6

BACKPLANE 2

BACKPLANE 1

| 1	3	5	7	9	11	13	15
OUT 1	OUT 2	OUT 3	OUT 4	IN 1	IN 2	GND	GND
OUT 8	OUT 7	OUT 6	OUT 5	IN 4	IN 3	+5V	+5V
2	4	6	8	10	12	14	16

DIGITAL I/O PINOUT

PCIO BOARD

Backplane Connections

The backplane connections on the PCIO Board, provide the customer with logical on/off signals to the MC³ Controller. The first backplane board plugs into Backplane 1 on the right. They also provide digital outputs for controls and status indicators.

Analog I/O Current/Voltage Strapping

On the PCIO board are jumpers, to change the analog signals from current to voltage. The default is current out (straps in top row) and current in (strap in place at T15).
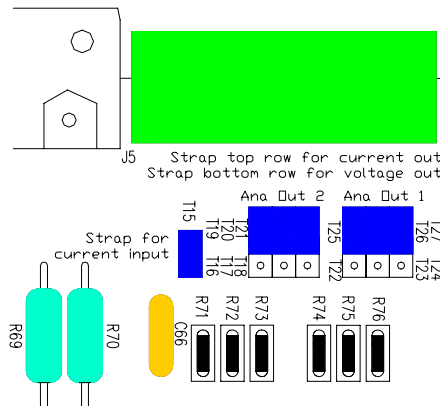
This example is set for Current input and output.

Analog Input

There is one isolated analog input. If the T15 is jumper installed (current input) the typical input impedance is 50Ω, and the range is 0..20 mA. If jumper is removed (voltage input) they typical impedance is 200kΩ, and the range is adjustable 0..1V to 0..10V.

Analog Outputs

There are two isolated analog outputs. The maximum load resistance is 750Ω in current output mode. The range is 0..20 mA. In voltage output mode, the minimum load resistance is 5KΩ, and the range is 0..10V.
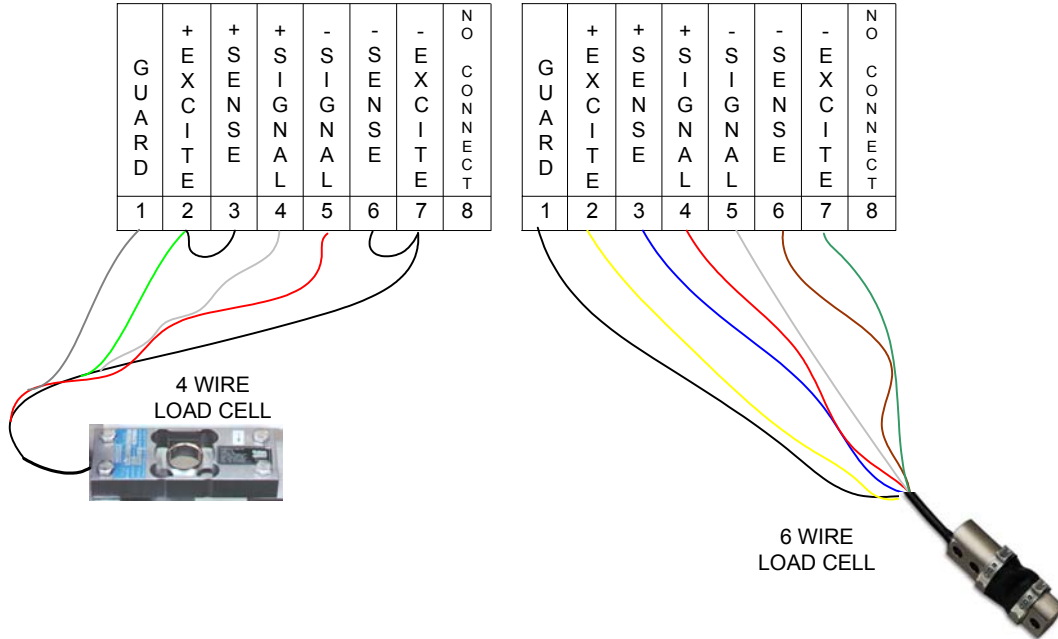
TOUCH SCREEN LOCATION CODES

The touch screen has 32 pressure sensitive pads. They can be used as physical inputs for testing and demonstration purposes. This table shows the names of the physical inputs.

| 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

HPAD BOARD

The transducer (load cell) connections are on the HPAD Board. There is a strap on this board to switch between normal operation (jumpered) and Zener Barrier operation (unjumpered).

GUARD	+ EXCITE	+ SENSE	+ SIGNAL	- SIGNAL	- SENSE	- EXCITE	NO CONNECT
1	2	3	4	5	6	7	8

4 WIRE
LOAD CELL

GUARD	+ EXCITE	+ SENSE	+ SIGNAL	- SIGNAL	- SENSE	- EXCITE	NO CONNECT
1	2	3	4	5	6	7	8

6 WIRE
LOAD CELL

Connection points and signals of the HPAD Board

All load cell connections, including the Guard terminal, are isolated from the rest of the MC³ circuitry. Connect the load cell cable shield to the guard terminal, not to the ground strip. The load cell cable shield should be grounded at one point, as close to the load cell as possible.

NEW CPU BOARD (REV 11 OR NEWER)
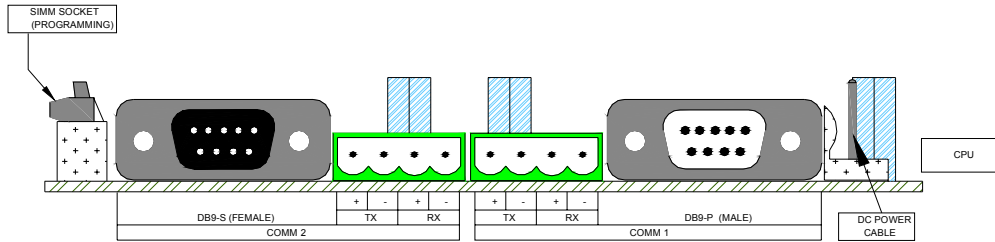
Communcation Ports

COM 1 RS-232 J7

Pin	Signal
2	Rx
3	Tx
4	DTR (+5VDC) Not Fused
5	Com (DC GND)
7	RTS
8	CTS

The RS-232 serial port is not isolated.

COM 1 RS-485 4 WIRE J6

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

The 4 wire RS-485 serial port is not isolated, but may float ± 50 V with respect to MC³ ground.

COM 2 RS-232 J4

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

The RS-232 serial port is not isolated.

COM 2 RS-485 4 WIRE J5

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

The 4 wire RS-485 serial port is not isolated, but may float ± 50 V with respect to MC³ ground.

Board Features
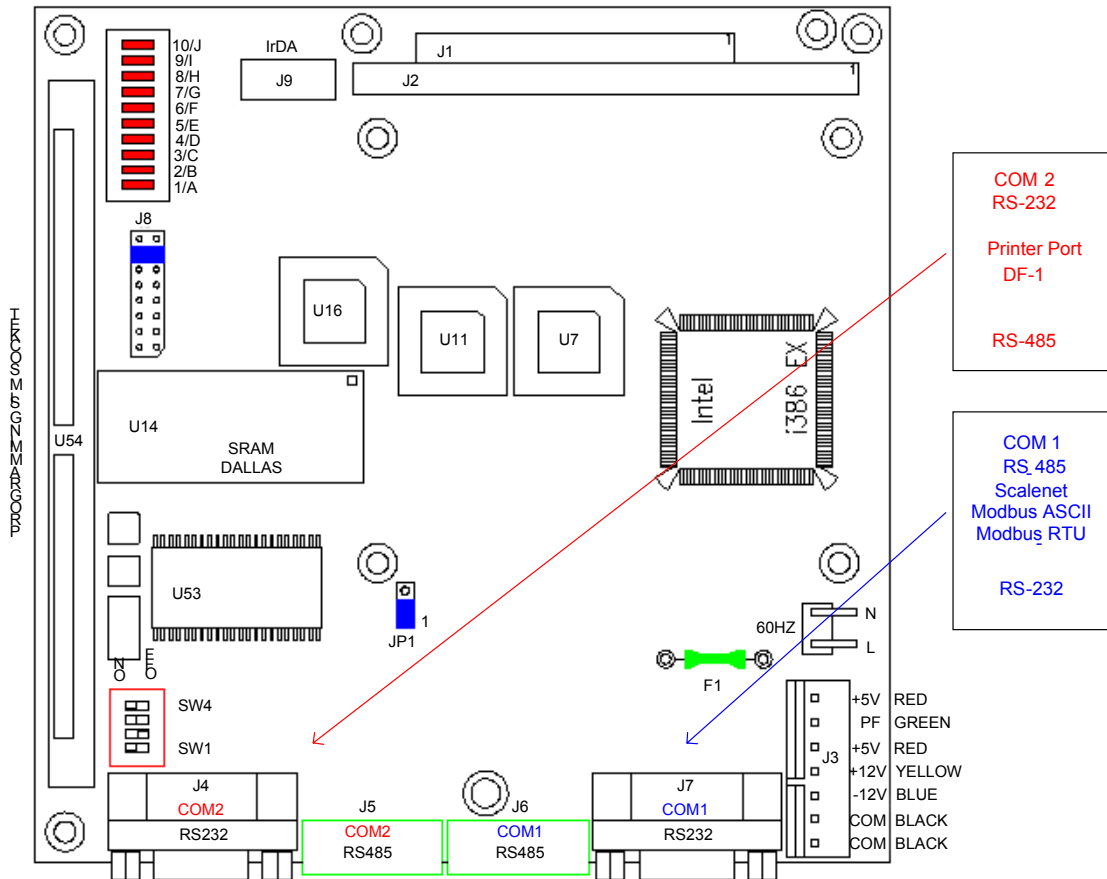
Option Switch Settings

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

LED Display

LED #	Description
1/A	Com 2 Receive
2/B	Com 2 Transmit
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

8/H, Test pin 4 has a status blink pattern with most firmware applications.

- Two blinks start the sequence (normal)
- A third blink indicate an application fault condition
- A fourth blink indicates a problems with the LCD display.

9/I The Power Fail indicator Blinks once momentarily when the MC³ is powered off. If it is on during normal operation, this is an indication that the DC power fail cable between the Power Supply and the CPU board is not connected, or that SW2 is in incorrect position.

JTAG/Service Port (J8)

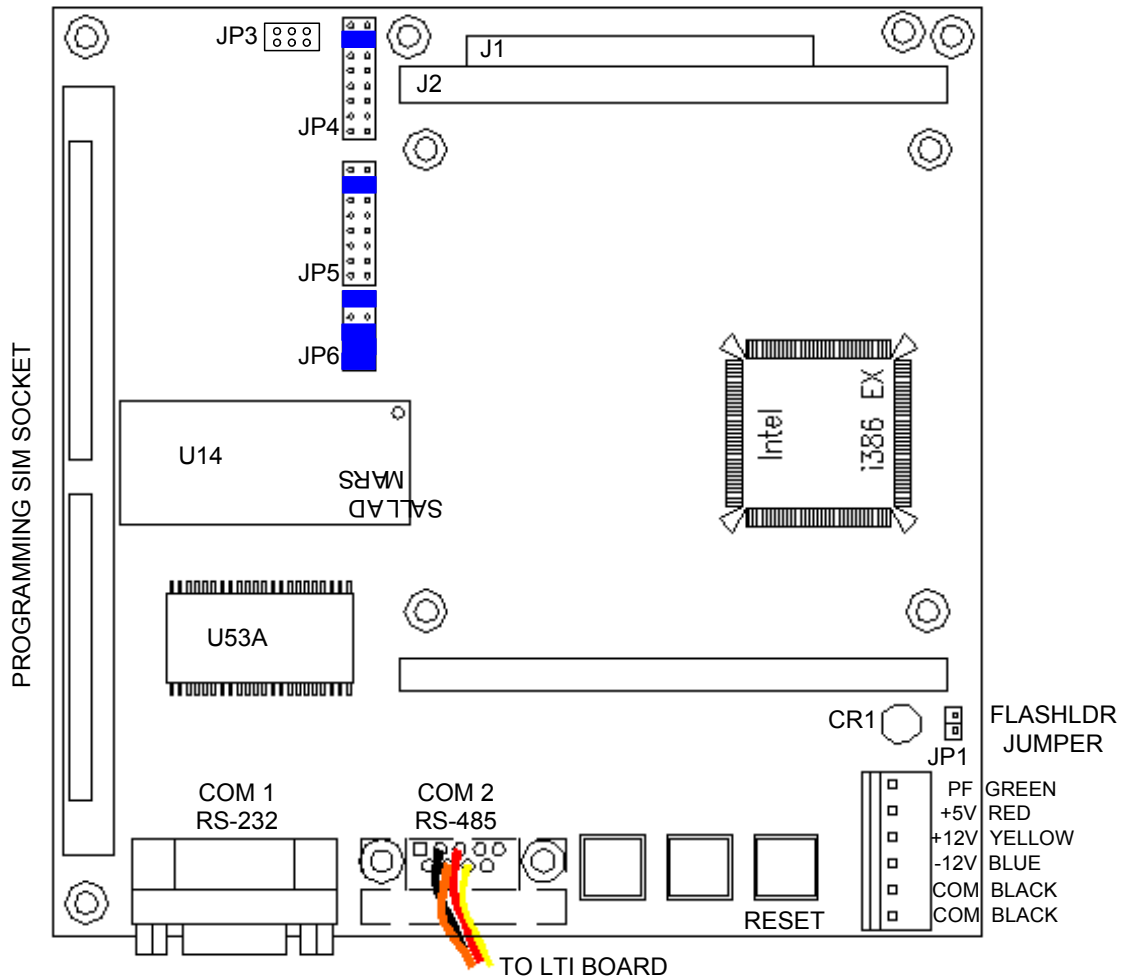| Pin	Description
1	+5VDC
2	Test Pin 1/LED 5/E
3	GND
4	Test Pin 2/LED 6/F
5	TCK
6	Test Pin 3/LED 7/G
7	TDO
8	Test Pin 4/LED 8/H
9	TDI
10	NMI (/Debug Break)
11	TMS
12	CPU Reset
13	TRST# (Normal operation 13/14 are jumpered)
14	PWRGD (Normal operation 13/14 are jumpered)
15	No Connection
16	Flash Lockout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

OLD CPU BOARD (REV 10 OR OLDER)
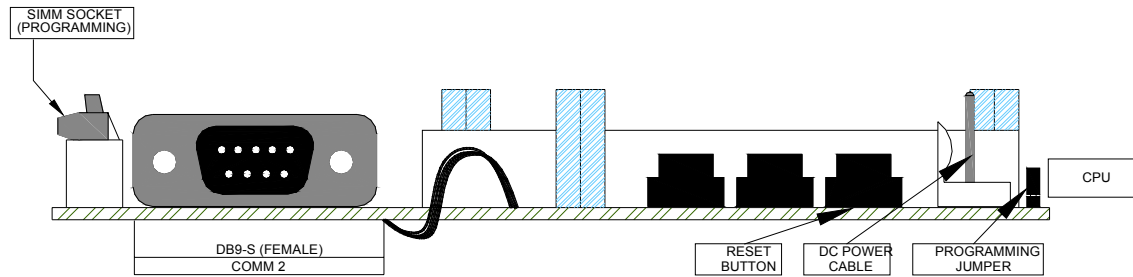
Communication ports

Comm 2 (RS-232)

Pin #	Description
1	N/C
2	TX Data
3	RX Data
4	N/C
5	Ground
6	N/C
7	Clear to send
8	N/C
9	N/C

The RS-232 serial port is not isolated. There is no RS485 port for Comm 2.

The Comm 1 serial interface has a 4 wire RS485 port located on the PCIO Board. See page 15. This port is isolated from the rest of the MC³ circuits. There is no RS-232 port for Comm 1.

Board Features

Jumper Settings

| Jumper	Description
JP1	FLASH PROGRAMMING
	Strap to program
	Un-strap for Normal operation
JP4	Memory Size
	Strap 1 & 2 for 1 to 2 Meg Sim
	Strap 3 & 4 for 4 to 8Meg Sim
	Strap 5 & 6 for 16+ Meg Sim (may not recognize larger)
JP6	NMI INPUT
	Older power supplies connect power fail to pins 3 & 4

Printer Operation (Old CPU Only)

MC³ CPU board must be specifically configured for Printer operation. Call Merrick for details to verify your CPU board configuration.
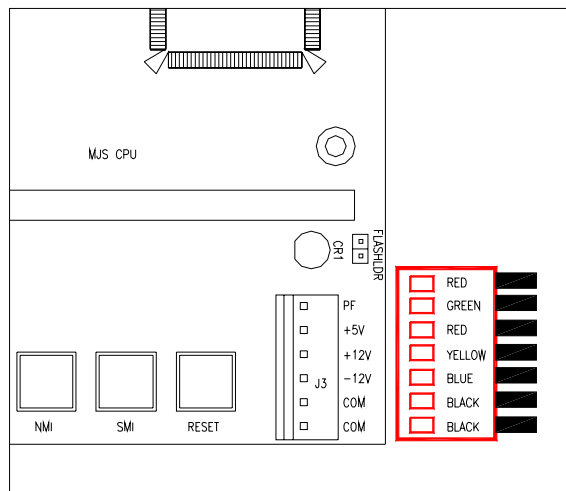
MC³ DC POWER CABLES

There have been numerous revisions to the DC Power Cable, and some of these are based on MC³ CPU Revisions. Below is a drawing that details how the different Cable revisions affect the connecting to the CPU Revisions. The older cables (REV 8 or older) used with Rev 10 or older CPU boards had 6 wires and a 6 position connector. The newer cables (Rev 9 or later) used with Rev 11 or newer CPUs have 7 wires with a 7 position connector. The additional wire is an additional +5V signal, added to improve the +5V supply to the CPU Board. If at older cable is used with this new CPU board, there will be an open pin near the F1 fuse on the board when mating the connector to the board as shown below. Likewise, if the newer cable is plugged into the older CPU board, the additional socket of the connector will hang over the header next to the LED on the CPU board. **WARNING: Connecting these incorrectly will damage the CPU board and other boards in the card stack.**
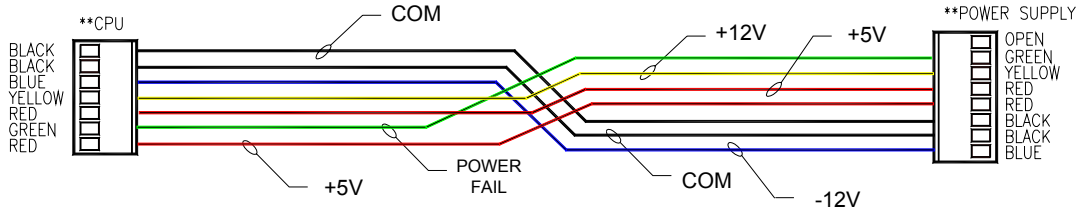

REV 11 CPU WITH REV 8 OR EARLIER CABLE
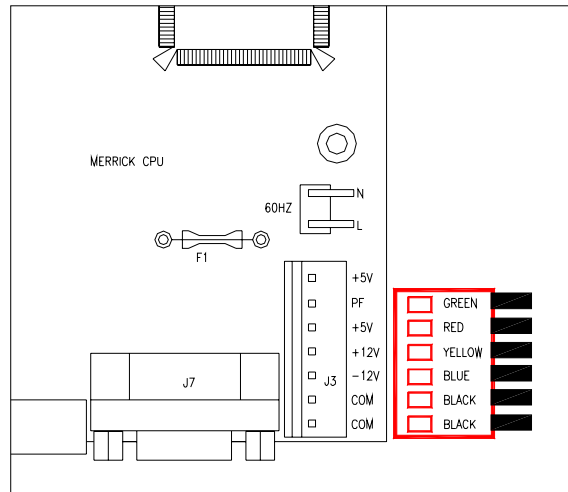
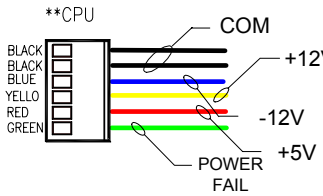REV 10 OR OLDER CPU WITH REV 9 OR NEWER CABLE
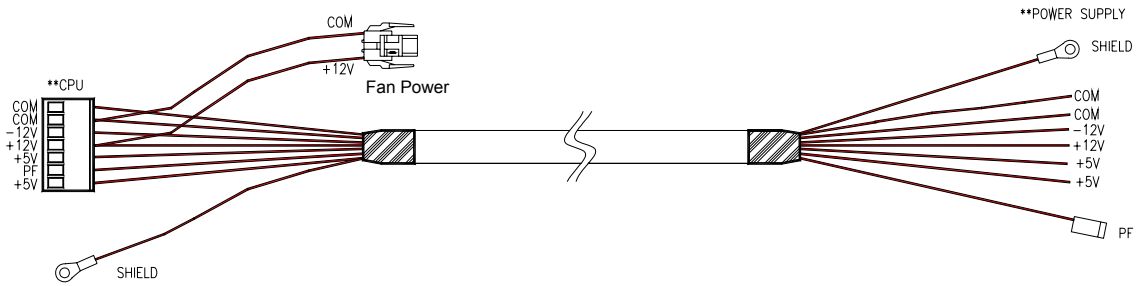
MC³ DC POWER CABLE DETAILS

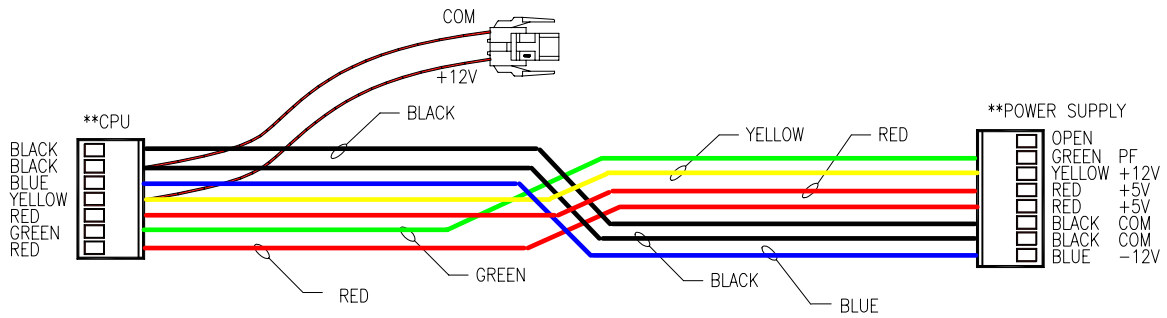### Panel Mnt and Wall Mnt DC Power Cable (REV 9)

Panel Mnt and Wall Mnt DC Power Cable (Previous Revision)

Door Mnt DC Power Cable


Door Mnt DC Power Cable For VL30

BACKPLANE BOARD

Each Back plane board is termed a Rack in the MC³ controller. A standard controller consists of one PCIO and one Backplane board. Up to four Backplane 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.

Terminals 19..22 are all connected to the MC³ digital ground. All outputs (terminals 1..14) are floating.


Ribbon Cable to PCIO Board

Digital Outputs   Digital Inputs
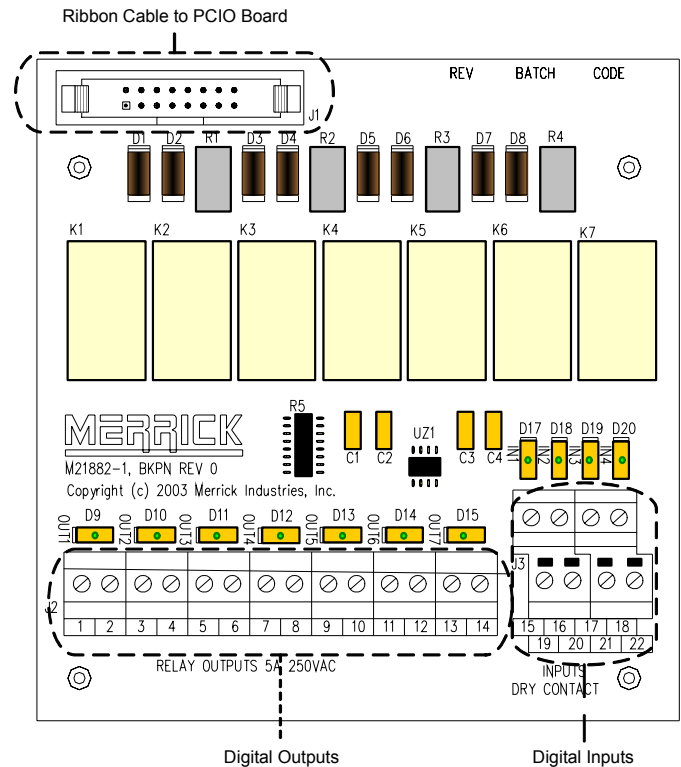
Inputs	Terminals	Outputs	Terminals
1	15/19	1	1,2
2	16/20	2	3,4
3	17/21	3	5,6
4	18/22	4	7,8
		5	9,10
		6	11,12
		7	13,14

AC Style Backplane Board

Each AC Style Back plane board consists of four (4) inputs and eight (8) outputs. The inputs are to be designed for 110VAC. 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.

All inputs and outputs are floating with respect to MC³ ground.
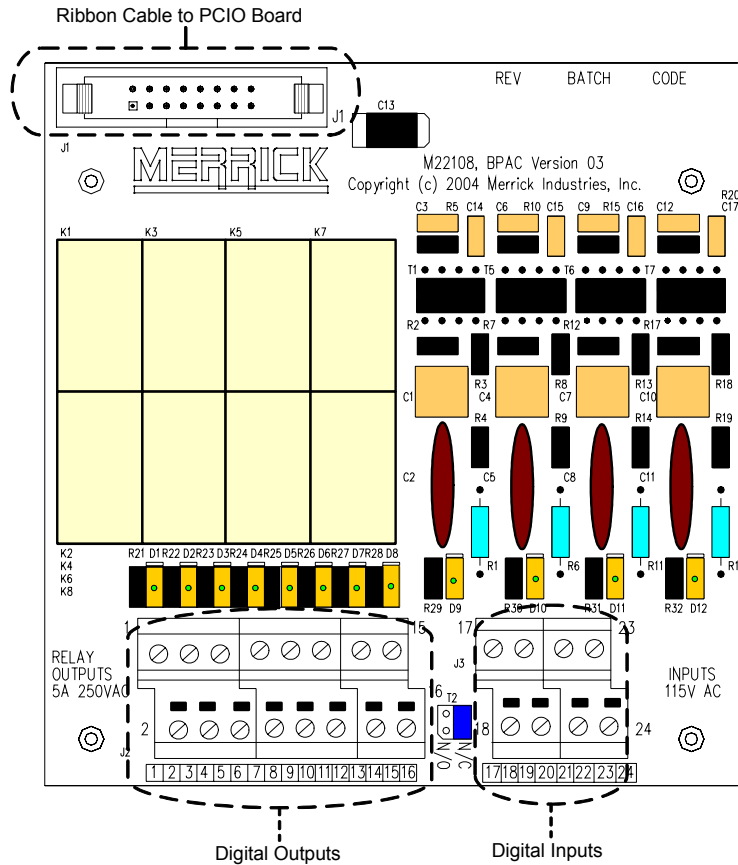
| Inputs	Terminals	Outputs	Terminals
1	17,18	1	1,2
2	19,20	2	3,4
3	21,22	3	5,6
4	23,24	4	7,8
		5	9,10
		6	11,12
		7	13,14
		8	15,16

MC³ ADJUSTMENTS

PCIO BOARD

Analog Outputs

The trimmers associated with the analog outputs (AOXXX) have been set at Merrick as a part of the shipment checkout using calibration grade instruments. There is very little trim space available. If you feel that you must, you can adjust them. The suggested procedure goes like this:

- Map the analog output you want to adjust to something you can control yourself, i.e. setpoint.
- Set the output type to 0..20 mA/0..10 V.
- Set the setpoint to Zero.
- Adjust AOXZ (Zero) for zero output {X = 1..2}.
- Set the setpoint to full scale, usually design feedrate
- Adjust AOXS (Span) for 20mA or 10V output.
- Restore the original mapping for the analog output.

AO1Z AO1S AO2Z AO2S AIZ AIS CURR\VOLT SELECTOR
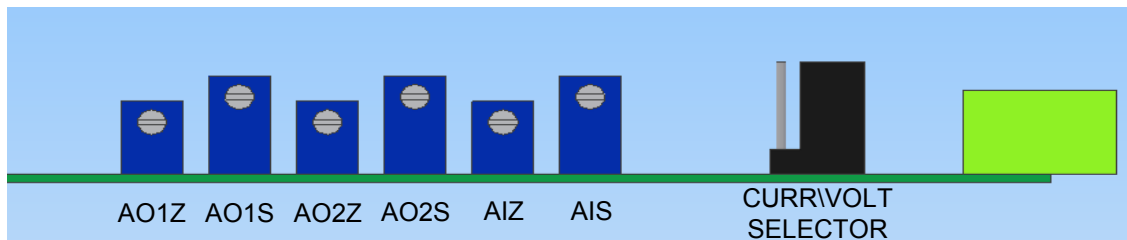
Analog Input

The input trimmers may have to be adjusted if you change between Voltage and Current. The factory adjustment is 0 – 1,000,000 A/D counts for 0..1 V. With the standard 50Ω shunt resistance, this will give you 0 – 1,000,000 A/D counts for 0..20 mA.

To trim the analog input, use the analog diagnostic screen.

- Short the input terminals.
- Adjust AIZ for slightly above Zero reading. The input is unipolar, so any negative value will be displayed as Zero
- Remove the short and supply your full scale signal
- Adjust AIZ for 1,000,000 counts reading.

DISPLAY BOARD

Brightness and Contrast Adjustments

Brightness Adjust
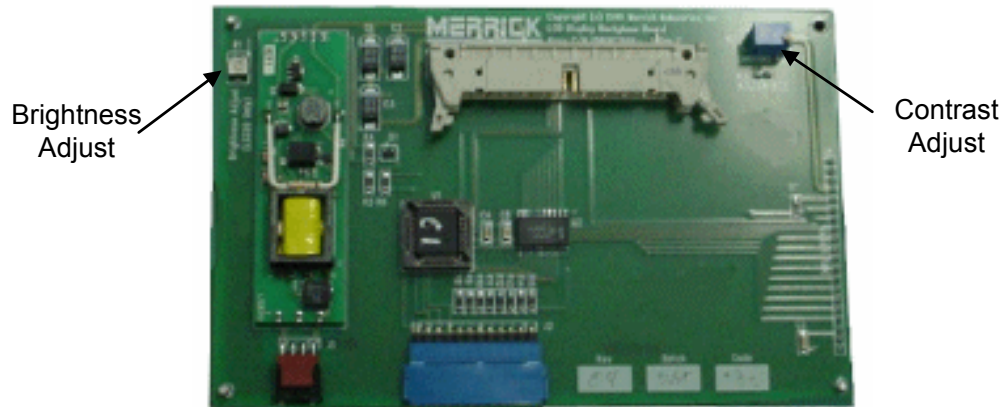
Contrast Adjust

Most of the adjustments will be made with the contrast pot. If the brightness needs to be adjusted, avoid contact with the inverter boards next to the pot. It is a high voltage, low current circuit and could produce a shock or burn if contact with a non-insulated adjustment tool is made.

Replacing Backlight Assembly

Removal of LCD Board (shown on top below) is the first step in replacing the Backlight. Next remove the LCD Display Board. Take care in handling the LCD Display board to avoid damaging the screen. Remove the plastic pins that secure the metal plate over the backlight diffuser panel. Next remove the plastic sockets that hold the pins and then slide out the old diffuser panel. Reassemble in reverse order.
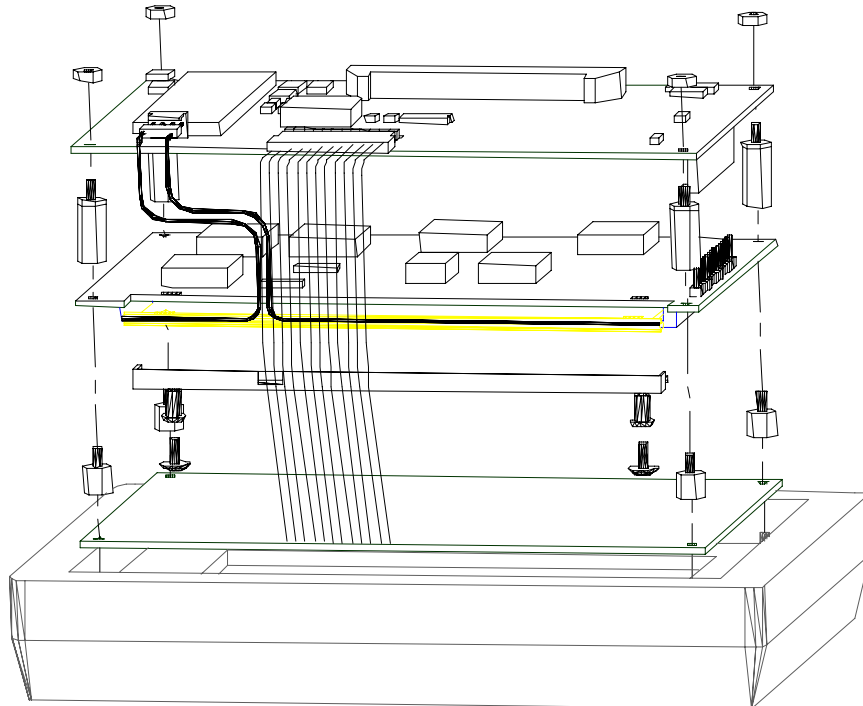
MC³ ANALOG UPGRADE

Adding an additional PCIO board to a MC³ controller

(Refer to drawing for card stack details on pages 8 & 9)

Make sure that the board you are adding has 2nd marked on the board or the socketed PLCC marked U4. If it is not, contact Merrick for the correct part. This part is not field programmable. The first and second board have different U4.

Controller Disassembly

- Remove the top enclosure or door for access to the Card Stack.
- Remove the ribbon cable going to the Display, and the and standoffs from the top board (LTI).
- Remove the top board (LTI) from the card stack gently, taking care not to bend the pins.

Controller Reassembly

- Insert the new board (PCIO #2) on top of the existing PCIO board, make sure the pins all line up and the standoffs are lined up with the holes.
- Add the 5 additional standoffs to secure the board.
- Replace the LTI board and the 5 small standoffs. Again make sure the pins and the holes line up properly.
- Replace the ribbon cable and cover.
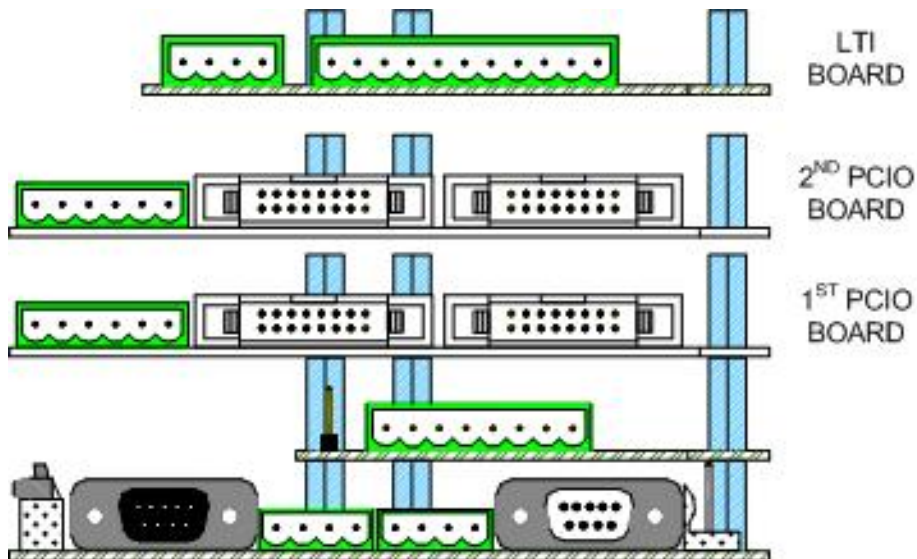
MC³ TROUBLESHOOTING

UNIT DOES NOT POWER UP –

- Check the supply power to the unit: is there supply power; are all cables connected? If no supply, check fuses in cabinet or breakers.
- If supply voltages are good, check the fuse on the power receptacle (wall mount and panel mount only). If the fuse is good, check the DC voltages as marked on the drawing below.
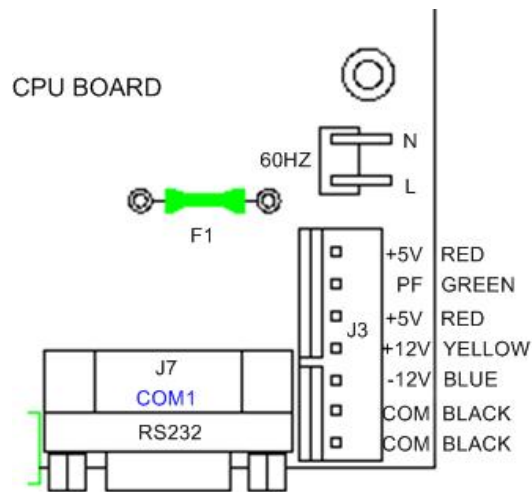
- If the DC voltages are not present, then the power supply or cable is defective.
  - o Without +12VDC the display will not light up
  - o Without +5VDC, the controller will not boot at all
- If all voltages are present, are there any lights on the CPU board? If not, the CPU board may be defective.
  - o If there are lights on the CPU board (l1), do they blink? LED Test indicator 8/H (see CPU Layout):
  - o If None of the LEDs blink or are all on, then the CPU has a problem.
    - oIf LED blinks 2 times, then processing is okay.
    - oIf LED blinks 3 times, then there are LCD Board problems.
    - oIf the LED blinks 2 times then 1 time, there is a fault in the controller.
  - o Check the display board or display assembly.
    - oThe backlight may be out on the controller and the screen maybe only partially visible.
    - oThe cable may have gotten damaged from heat or excessive stress.
  - o If the display is okay and the CPU seems to be processing data, one of the boards could be defective, such as the LTI boards. Consult Merrick for more information.

LCD TOO DARK/LIGHT OR OUT –

- First, touch the screen to make sure that the screen saver is not engaged and causing the blank or dark screen. The screen saver function turns off the backlight to increase its life span.

- If the screen is only a little light or dark, it may be the result of changing temperatures and can therefore be adjusted by the contrast pot R3 on the LCD Board.

- If there is no light at all or is not adjustable, the back light may need to be replaced A replacement kit can be purchased from Merrick.

NO BELT LOAD OR WEIGHT

- Go to the HPAD Diag Screen and check for A/D counts, if present - was an incorrect calibration performed. If no counts are present go to the next point.

- If no counts, measure the voltage being applied to the load cell, excitation voltage. It should be +10VDC, measured from terminal 2 and 7 of the PCAD board, the first terminal is shield or make the measurements at the Feeder Connection Board, if easier. Remember to validate connection from FCB to controller.

    o If no excitation voltage or it is low, the HPAD board may be bad. Disconnect the load cell from the board and re-measure, to make sure the load cell was not pulling the excitation voltage down.

    o If the excitation voltage is good, go to the next step.

- Next check the output signal from the load cell, it should be a 0 .. 30 mV signal and be close to the values indicated on the specification sheet for that machine.

    o If the signal from the load cell is a voltage (not millivolt) or negative millivolt, is it wired correctly? If the load cell was wired so that one of the excitation wires and signal wires were swapped, this could produce a large signal or even a negative signal.

    o If the signal is too large or too small, the HPAD board may be loading down the signal, so it may be necessary to disconnect the signal output from the load cell to the HPAD to isolate the signal from the controller. The controller must be rebooted, if the connections are disconnected.

- If the signal is greater than 30 mV or less than 0 mV, the load cell is wired in backwards or damaged.

NO SPEED DETECTED

- Check and see if the belt is moving. If so check the Tacho Setup and change it to 'No Direction' detected. This will let you receive pulses if only one channel is out, or if the wiring has been changed.

- If there is still no speed detected, check the supply voltage at the FCB board or pins 1 and 7 of the LTI board. There should be +5VDC. If the voltage isn't present, try removing the wire and see if the voltage comes back. The encoder could be loading the signal. It the +5VDC signal still isn't present, changed the LTI board. If voltage is present, check the signals coming into the LTI board to see that they measure around 2.5VDC RM.S. When the belt is moving. If the belt is not moving, you should see either 0V or 5V If not the encoder or cabling is the problem. It is also important to make sure that the encoder is still coupled to the shaft by way of the setscrew.

ANALOG OUTPUT PROBLEM

Go to the Analog Diagnostic screen.

- If the output is low or high it can be adjusted at the PCIO board at the appropriate pot. A01 Z & A02 Z is the zero or minimum setting pot. Adjust here if the 0% output is too high. A01 S & A02 S is the span or maximum setting pot. Adjust here if the 100% output is too high.

- If there is no output present, check to see that it is mapped correctly under the analog output settings. If it is correctly mapped, try changing the output to SCR and see if you can generate the output. If not, the PCIO board my need replaced. Try connecting a milliamp meter to it, without the device being driven. The device may be loading down the output.

- If the output is not proportional to the rate or condition, make sure the design capacities are correct. If the design rate does not equal the speed * the load, then the rate output will not be correct.

ANALOG INPUTS

Go to the Analog Diagnostic screen.

- If the setpoint indicated on the screen does not equal the desired setpoint being sent by an analog signal, the input may not have been calibrated properly. Also check the scaling units in the analog input settings. You can quickly verify this in the analog diagnostic screen.

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

1. Clean all equipment and enclosures thoroughly inside and out.
2. Remove rust as necessary. Touch up painted surfaces as necessary to protect bare metal surfaces. Protect electrical and electronic components from painting operations.
3. Place desiccant or evaporative corrosion inhibitors inside control enclosures.
4. 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 MC³ 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, contact the Merrick Spare Parts Department.

MC³ CONTROLLER SPARE PARTS LIST

Name	Part Number
Power Supply Assembly	M21912-1A
Fuse 1A 5X20MM	Q-73
CPU Board	M21746-1A
HPAD Board #1	M21701-1A
HPAD Board #2	M21701-2A
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
Touchpad Keypad	M21733-1
Map80 Power Supply	19-102-32402A
VL30 Power Asy Door Mt	A36539-1,2,3

ACCESSORIES

I/O System

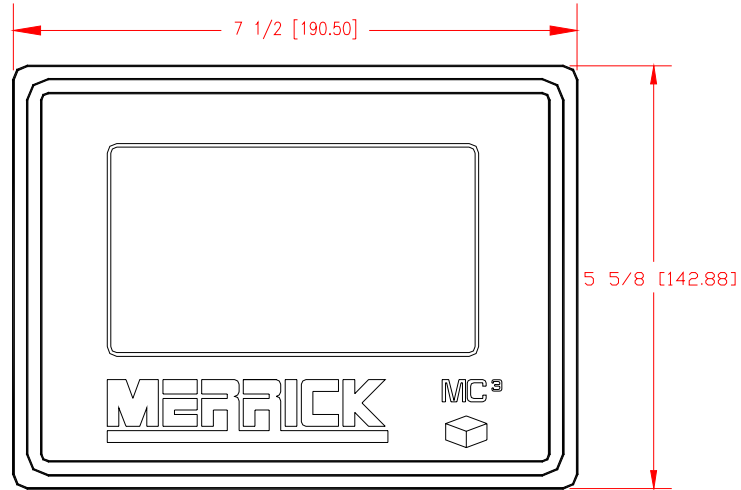| Name	Part Number
Backplane Board	M21882-1A
Backplane Board (AC)	M22108-1A
Cable - 9 inch	M20184-6
Cable 12 inch	M20184-5
Cable 18 inch	M20184-3
Cable 22 inch	M20184-4
Cable 48 inch (door mount)	09-600-20001
Watchdog Timer Board	N41215-1A

Spare I/O Plugs and Miscellaneous

Name	Part Number
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
AC Cable (panel mount)	M21731-1
AC Cable (wall mount)	M21731-2
DC Cable	M21732-2
Door Mount DC Cable	09-600-06001

Feeder Connection Board (FCB)

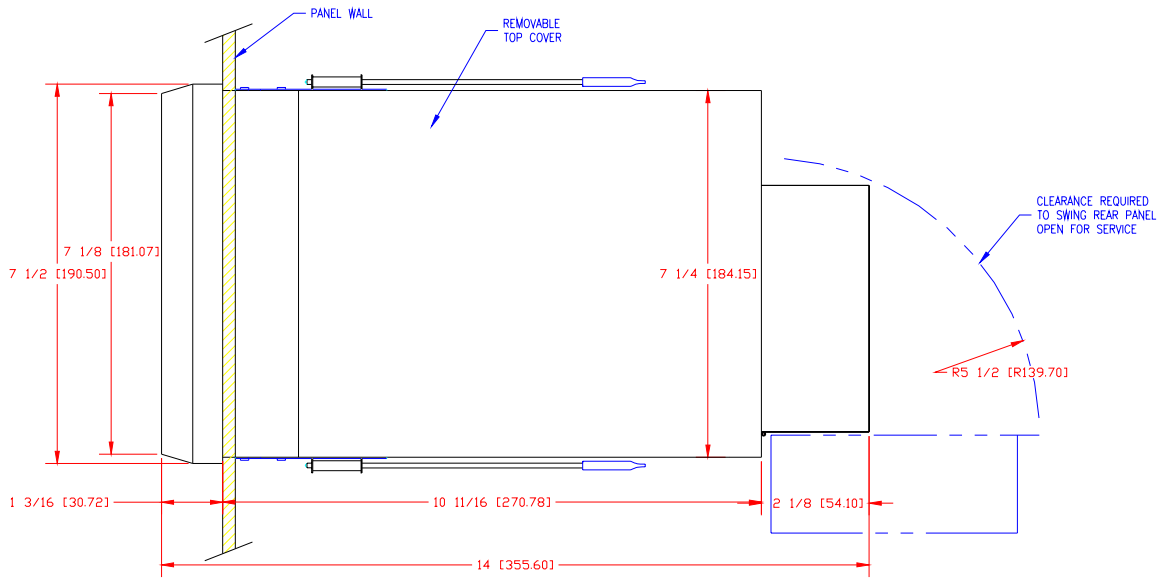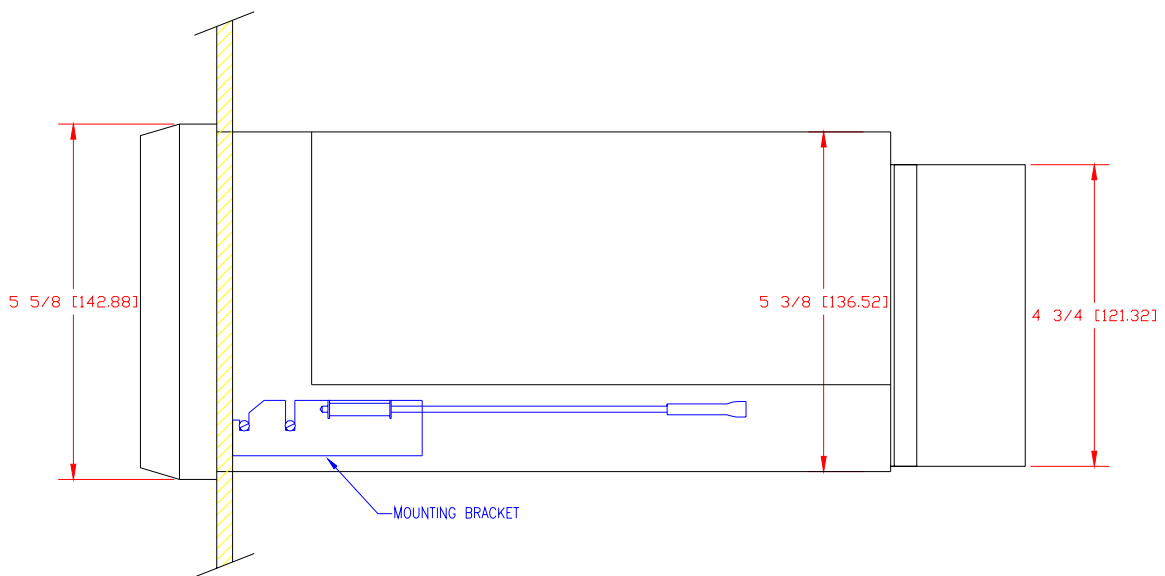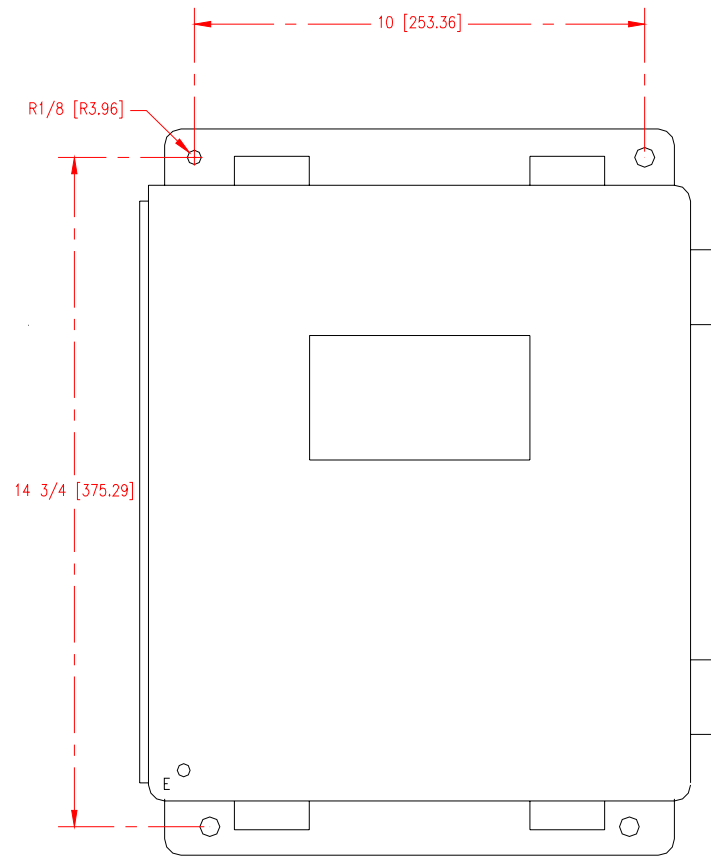| Name	Part Number	Description
Feeder Connection Board Only	M21911-1	1 Load Cell
Feeder Connection Board Only	M21911-4	4 Load Cells
FCB Assembly	A31196-1	NEMA 4 SS Enclosure 1 Load Cell
FCB Assembly	A31196-2	NEMA 4 SS Enclosure 4 Load Cell
FCB Assembly	A31196-3	NEMA 4 Std Enclosure 1 Load Cell
FCB Assembly	A31196-4	NEMA 4 Std Enclosure 4 Load Cell

APPENDIX A

PANEL MOUNT – DIMENSIONS

7 1/2 [190.50]

5 5/8 [142.88]

BEZEL FRONT

7 3/8 [187.33]

5 1/2 [139.70]

PANEL CUTOUT

PANEL CUTOUT

PANEL WALL

REMOVABLE
TOP COVER

CLEARANCE REQUIRED
TO SWING REAR PANEL
OPEN FOR SERVICE

7 1/8 [181.07]

7 1/2 [190.50]

7 1/4 [184.15]

R5 1/2 [R139.70]

1 3/16 [30.72]

10 11/16 [270.78]

2 1/8 [54.10]

14 [355.60]

TOP VIEW

5 5/8 [142.88]

5 3/8 [136.52]

4 3/4 [121.32]

MOUNTING BRACKET
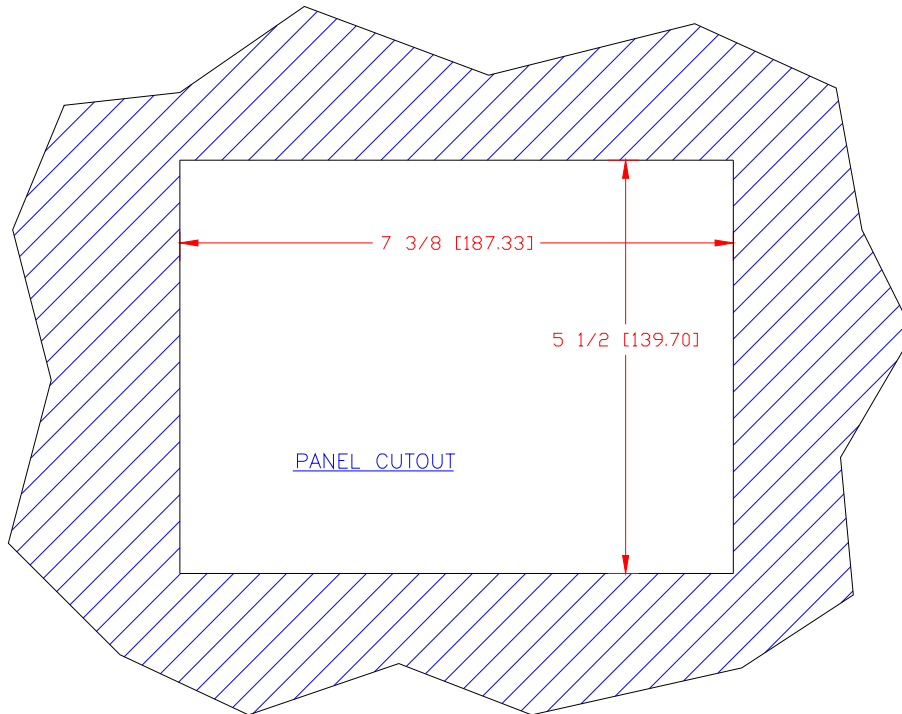
SIDE VIEW

WALL MOUNT – MOUNTING DIMENSIONS

FRONT VIEW

WALL MOUNT – MOUNTING DIMENSIONS CONT

7 9/16 [192.33]

6 3/16 [157.05]

15 1/2 [393.70]
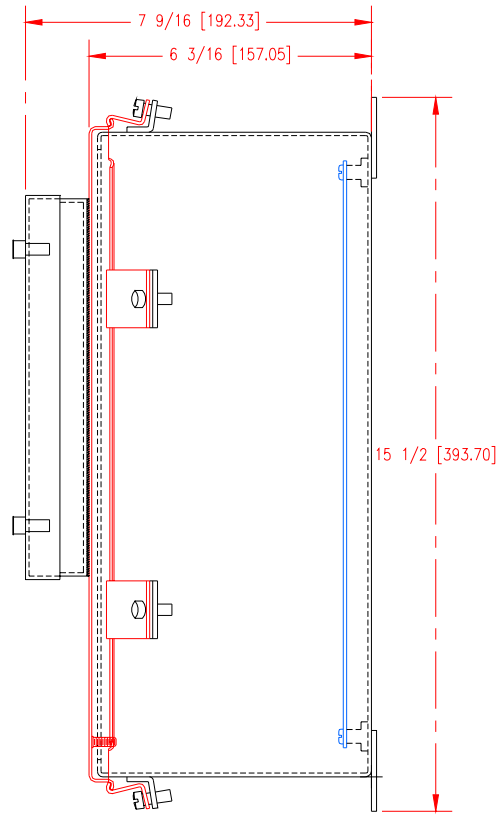
SIDE VIEW

DOOR MOUNT - DIMENSIONS

9 3/4 [247.65]

13 3/4 [349.25]

~

FRONT VIEW

4 1/2 [114.30]
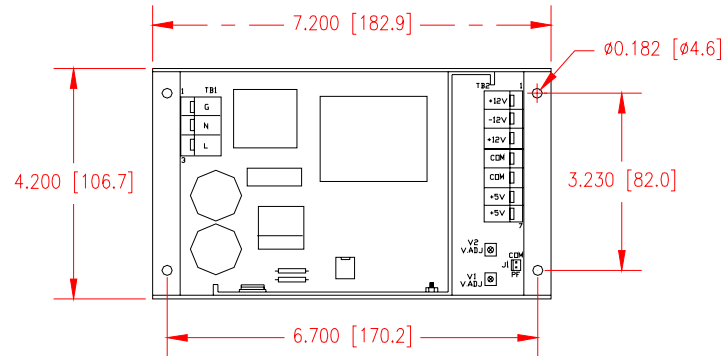
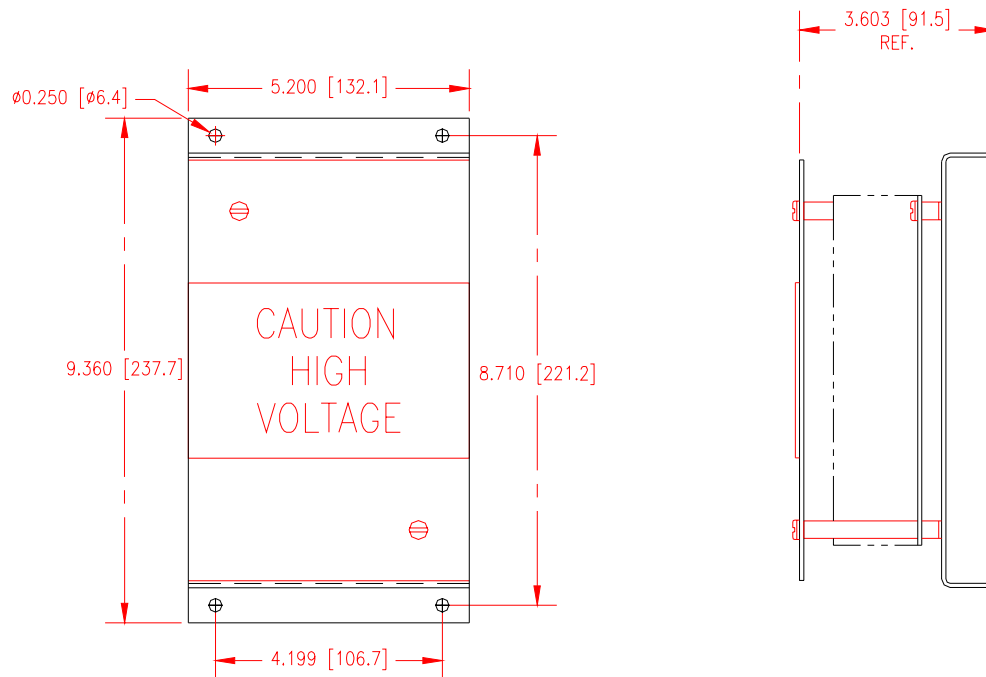12 1/4 [311.15]
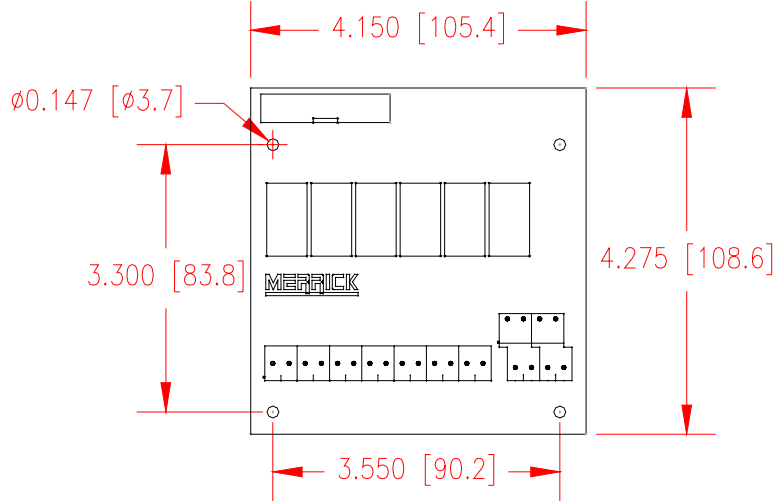
8 1/4 [209.55]
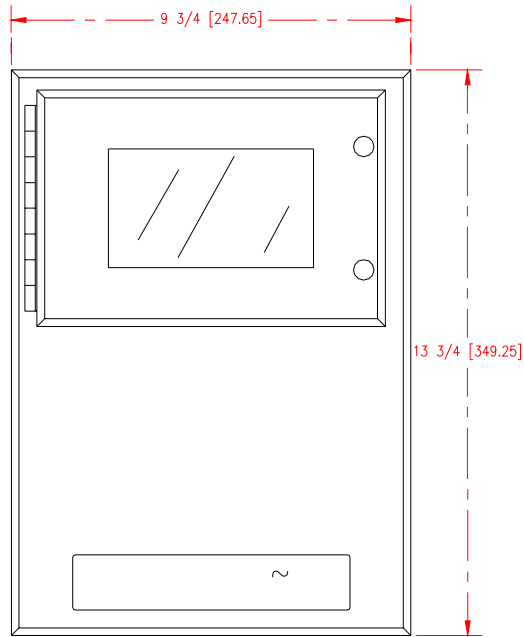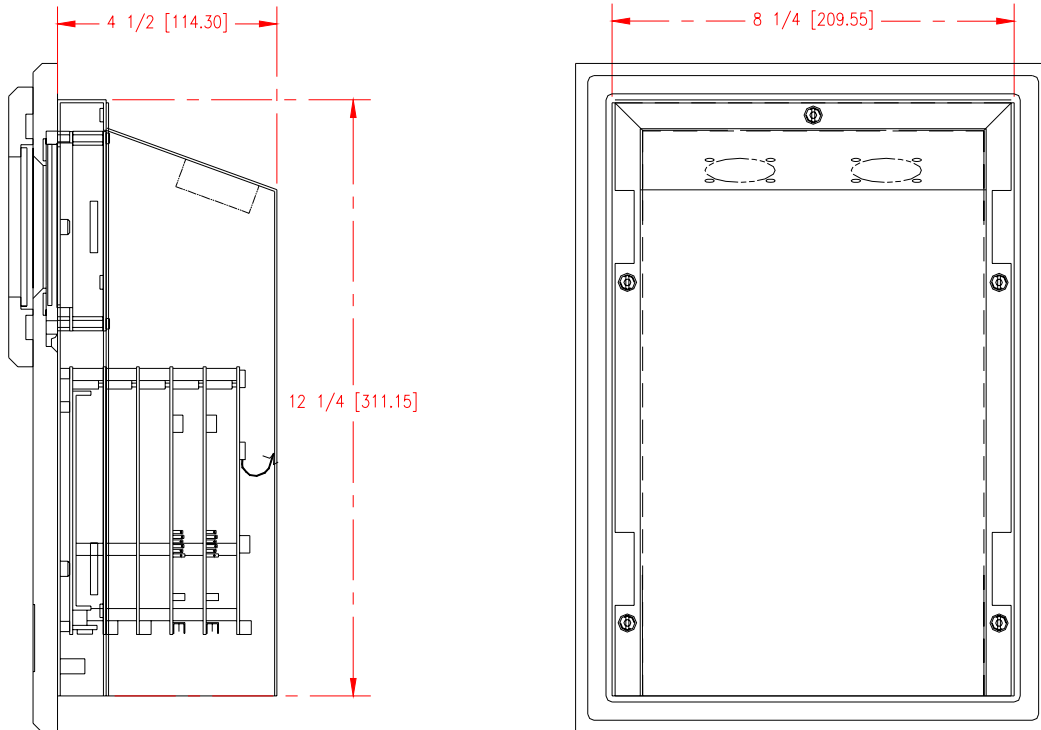
SIDE VIEW BACK VIEW

Door Mount Power Supply Mounting Dimensions

Door Mount Power Supply (VL30) Mounting Dimensions

BACKPLANE MOUNTING DIMENSIONS

WATCHDOG TIMER BOARD MOUNTING DIMENSIONS