GENERAL MONITORS

Protection for life.

MODEL MD002

Zero Two Series
Monitored Driver Module

INSTRUCTION MANUAL 05/96

Part No. MANMD002
Revision A/05-96

A/05-96

Warranty Statement

General Monitors warrants the Model MD002 to be free from defects in workmanship or material under normal use and service within two (2) years from the date of shipment. General Monitors will repair or replace without charge any equipment found to be defective during the warranty period. Full determination of the nature of, and responsibility for, defective or damaged equipment will be made by General Monitors' personnel. Defective or damaged equipment must be shipped prepaid to General Monitors' plant or the representative from which shipment was made. In all cases this warranty is limited to the cost of the equipment supplied by General Monitors. The customer will assume all liability for the misuse of this equipment by its employees or other personnel. All warranties are contingent upon proper use in the application for which the product was intended and do not cover products which have been modified or repaired without General Monitors' approval or which have been subjected to neglect, accident, improper installation or application, or on which the original identification marks have been removed or altered. Except for the express warranty stated above, General Monitors disclaims all warranties with regard to the products sold, including all implied warranties of merchantability and fitness and the express warranties stated herein are in lieu of all obligations or liabilities on the part of General Monitors for damages including, but not limited to consequential damages arising out of/or in connection with the use or performance of the product.

Warnings

- All Zero Two Series Modules contain components which can be damaged by static electricity. Special care must be taken when wiring the system to ensure that only the connection points are touched.

- **SAFETY WARNING: Installation and maintenance must be carried out by suitably skilled and competent personnel only.**

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List of Illustrations

The Introduction provides a brief description of the Model MD002, its features & benefits and a partial list of applications. More detailed information on the features & benefits listed in section 1.2 will be presented in later chapters.

1.1 General Description

The General Monitors Model MD002 (see figure 1) features four outputs to drive DC solenoids connected to fire extinguishant, horns or bells (or any other such device). This card monitors the output circuitry so that short circuits and open circuits in the field wiring will be detected as faults. The MD002 provides many options that satisfy a wide variety of applications.

The Model MD002 is electrically and physically compatible with the other modules in the Zero Two Series.

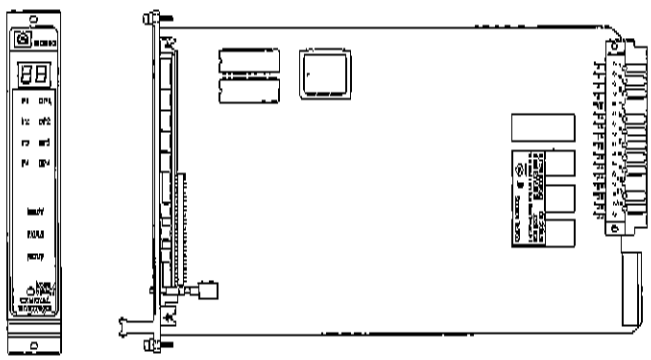

Figure 1

The Model MD002 is designed for use in non-hazardous (safe) environments.

1.2 Features & Benefits

Microprocessor Based Electronics: monitors the field device for open or short circuits and generates output signals in the form of front panel LEDs and current sourcing 1.2 A @ 24 Vdc monitored driver outputs.

Four Monitored Driver Outputs: drive DC solenoids connected to fire extinguishant or other compatible device.

LED Test: tests each front panel LED in the system by pressing the Master Reset button on the Facilities Module (Model FM002A).

Card Test: tests the functionality of the card by simulating an alarm condition. The alarm outputs may be enabled or disabled (programmable) for a card test.

Low Supply Power Indication: Fault LED will illuminate and Fault Code will be displayed when the input voltage drops below 18Vdc.

Live Insertion/Removal: allows the user to insert or remove a module while power is applied to the system without damage to any of the components in the system.

Modes of Operation: include Inhibit Mode, Fault Mode, Setup and Setup Check Mode.

Executive Outputs: the outputs can be active/inactive during a Card Test and the driver outputs can be latching/non-latching.

Executive Inputs: the Alarm inputs can be active low/high. Manual Abort & Release inputs are available for each channel.

Activation Time Delay: Alarm outputs can be delayed from 0 to 60 seconds.

Reverse Monitoring: outputs are monitored for open or short circuits. Reverse monitoring is used in fire alarm bell and siren systems utilizing a blocking diode.

1.3 Applications

The General Monitors Model MD002 is designed to supplement fire and gas detection systems and to provide increased flexibility by providing outputs to a variety of field devices. The list below is a partial representation of suitable applications:

- Refineries
- Drilling platforms & rigs
- Gas & oil production platforms
- Gas collection facilities
- Oil well logging operations
- LPG/LNG processing & storage
- Gas compressor stations
- Sewage & wastewater treatment facilities
- Chemical & petrochemical plants
- Mud logging operations
- Sulfur recovery plants
- Desulfurization facilities
- Aircraft hangars & military installations

This chapter provides detailed specifications for the Model MD002 Four Channel Monitored Driver Module. The system, mechanical, electrical and environmental specifications present the Model MD002 in technical terms. The engineering specification provides a description that can be inserted into written specifications.

2.1 System Specifications

Application:
Four channel DC output driver for fire extinguishant solenoids, beacons, horns or other applicable devices.

Approvals:
CSA & CE Mark pending. Conforms to NFPA 72A-72E Guidelines.

Warranty:
Two years

2.2 Mechanical Specifications

Height	6.8 in.	173 mm
Width	1.0 in.	25 mm
Length	9.9 in.	251 mm
Weight	11.2 oz.	318 grams

2.3 Electrical Specifications

Input Voltage:
20.0 to 35.0 Vdc (range)
24.0 Vdc (nominal)
18.0 Vdc (low voltage threshold)

Driver Inputs:
2 mA max @ 35 Vdc, sinking

Output Ratings:
1.2A max., 24Vdc max.

Open Collector Ratings:
100 mA @ 30 Vdc max
Fault, Fault-Unaccept & Inhibit

Electrical Classification:
The Model MD002 is designed for use in non-hazardous or safe environments for general purpose applications.

RFI Susceptibility:
The Model MD002 complies with BS 6667 Part 3/IEC 801-3, severity level 3.

2.4 Environmental Specifications

Operating Temperature Range:
0°F to +150°F (-18°C to +66°C)

Storage Temperature Range:
-40°F to +150°F (-40°C to +66°C)

Operating Humidity Range:
5 to 100% maximum relative humidity, (non-condensing)

2.5 Engineering Specifications

Zero Two System - Each system shall utilize modules capable of monitoring gas sensing elements or a 0 to 21.7mA analog signal from gas or flame detection transmitters. The system chassis shall be available in 4, 8 and 16 channels. Each chassis shall contain a bus for the following independent signals: A1 Alarm, A2 Alarm, Fault, Master Reset, Master Accept, Unaccept, CAL, +24Vdc and System Common. Module signals shall be capable of being bussed from one chassis to another so that up to 100 modules can comprise a single system. The gas and flame detection modules shall be electrically and physically compatible and capable of being used in the same chassis to form combined fire and gas detection systems. The system shall consist of Zero Two Series component modules as manufactured by General Monitors in Lake Forest, California, U.S.A. or General Monitors, Galway, Ireland.

Monitored Driver Output Module - The Monitored Driver Output Module shall conform to CSA, FM and ISA performance standards and be designed to NFPA guidelines 72A-72E where applicable. The module shall provide four driver outputs intended to drive DC solenoids or other applicable devices. All outputs shall be software selectable. A functional card test and front panel LED test shall be capable without interrupting normal on-line service. The module shall be capable of insertion and removal during power ON condition without damage to any component or module in the system. The Monitored Driver Output Module shall be capable of monitoring DC outputs connected to fire extinguishant, fire alarm systems or any other applicable devices.

The unit shall have a variety of ordering options that consist of:

Number of active channels (1 to 4).

Pre-discharge time delay (0 to 60 seconds, in one second increments).

Manual Abort Enable (1 to 4).

Latched/Non-Latched Ouputs (1 to 4).

Alarm Inputs Active Low/High (1 to 4).

Fault Outputs Active/Not Active dduring Inhibit Mode.

Outputs Active/Not Active during Card Test.

This chapter discusses what to do when the Model MD002 is received, how to install the module, what the terminal connections and their functions are and making the initial application of power.

3.1 Upon Receipt of Equipment

All equipment shipped by General Monitors is packaged in shock absorbing containers which provide considerable protection against physical damage. The contents should be carefully removed and checked against the packing slip. If any damage has occurred or if there is any discrepancy in the order, notify General Monitors as soon as possible. All subsequent correspondence with General Monitors must specify the equipment part and serial numbers.

Each Model MD002 is completely checked at the factory, however, a complete check-out is necessary upon initial installation and start up to ensure system integrity.

3.2 Module Installation

A rack or panel mounted chassis will be required when installing any Zero Two Series Module. These chassis should be mounted in a non-hazardous, weather protected location and should be subjected to minimal shock and vibration. The rack and panel mounted chassis are available in 4, 8 and 16 channel sizes. Multiple 16 channel chassis may be connected to each other to form larger systems.

In installations where two or more module types are to be mixed in the same chassis, ensure that the individual coding strips match the channel application. The coding strips are pre-configured at the factory and the male portion is already on each module.

The female portion, if unmounted, must be fastened into position on the mounting strip of the desired chassis channel so as to mate with its counterpart on the module (see figure 2 below).

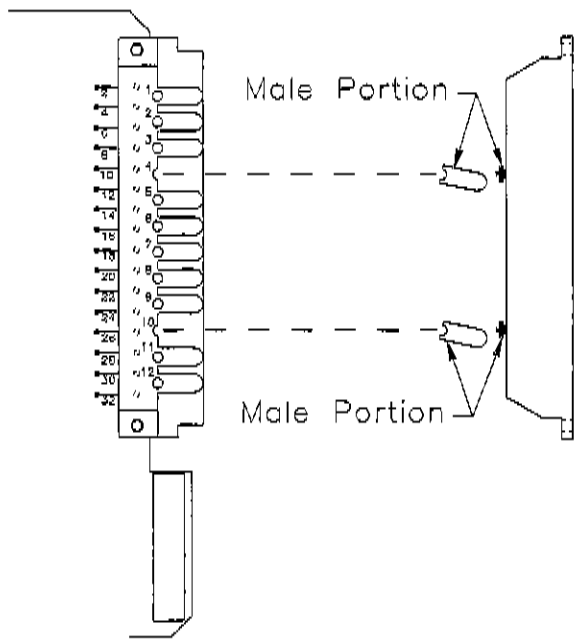

Figure 2

Zero Two Series modules require air circulation to avoid excessive heat build-up. If chassis are stacked vertically within an enclosure, forced air circulation may be required. The control modules are, to a great extent, immune to electromagnetic interference (EMI) and comply with the EMC Directive for application of CE Marking. However, they should not be mounted in close proximity to radio transmitters or similar equipment.

3.3 Rear Terminal Connections

All wire connections to the Model MD002 are made to the terminal block located at the rear of the chassis. The terminal block accepts 16 AWG to 20 AWG, stranded or solid core wire (14 AWG wire may be used if it is properly stripped as shown in figure 3).

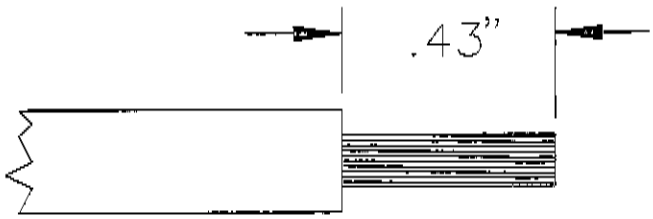

Figure 3

Contact with PC Board components should be avoided in order to prevent damage by ***static electricity***. To connect wires to the terminal block on the Model MD002, loosen the desired screw, insert the stripped end of the wire and tighten.

For the rear terminal designations refer to figure 4 below:

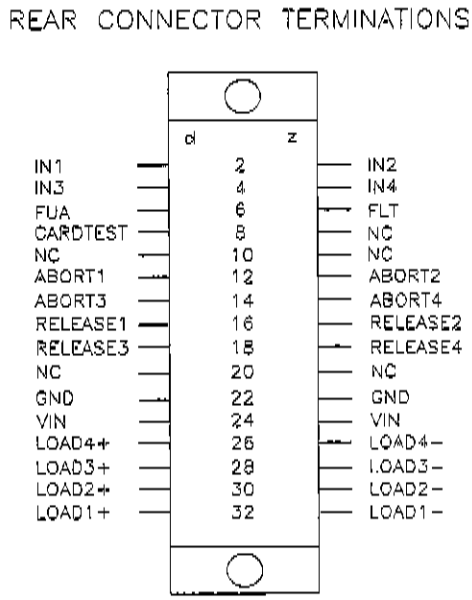

Figure 4

<u>Output Drivers</u> (field device)

Each channel provides two wire outputs to a DC solenoid or DC device. The terminal designations for these outputs are:

Designation	Term	Description
Load1 Out(+)	32d	Signal Output Chan 1
Load1 RTN(-)	32z	Signal Return Chan 1
Load2 Out(+)	30d	Signal Output Chan 2
Load2 RTN(-)	30z	Signal Return Chan 2
Load3 Out(+)	28d	Signal Output Chan 3
Load3 RTN(-)	28z	Signal Return Chan 3
Load4 Out(+)	26d	Signal Output Chan 4
Load4 RTN(-)	26z	Signal Return Chan 4

Figure 5 is a block diagram of DC solenoid or device connections to channel 1 of the MD002.

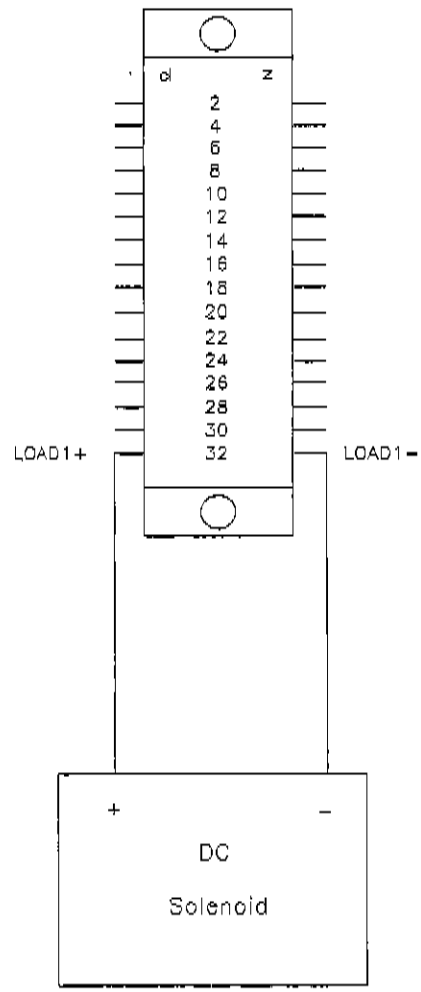

Figure 5

Rear Terminal Connections (*continued*)

Manual Abort Connections

Each channel provides a manual abort terminal for aborting a pending activation during the pre-discharge time-out or to deactivate a currently activated driver. The terminal designations for the manual abort contacts are:

Designation	Term	Description
Abort1	12d	Channel 1 Abort
Abort2	12z	Channel 2 Abort
Abort3	14d	Channel 3 Abort
Abort4	14z	Channel 4 Abort

Manual Release Connections

Each channel provides a manual release terminal for overriding a previously aborted activation. If still within the pre-discharge time-out, the time-out will continue. If the time-out has expired, it will immediately activate the driver. The terminal designations for the manual release contacts are:

Designation	Term	Description
Release1	16d	Channel 1 Release
Release2	16z	Channel 2 Release
Release3	18d	Channel 3 Release
Release4	18z	Channel 4 Release

Open Collector Inputs

The Model MD002 accepts four separate open collector inputs. These inputs are referenced to system common, and will activate the output drivers either in the programmed active low or active high state. The terminal designations for the open collector inputs are:

Designation	Term	Description
IN1	2d	Channel 1 Input
IN2	2z	Channel 2 Input
IN3	4d	Channel 3 Input
IN4	4z	Channel 4 Input

Fault Outputs

There are two fault open collector outputs. The first (FLT) is dedicated to new alarm conditions and the second (FUA) is dedicated to new fault conditions. The terminal designations for these outputs are:

Designation	Term	Description
FLT	6z	Fault OC
FUA	6d	Fault Unaccept OC

All of the open collector outputs on the Model MD002 have an electrical rating of 100mA @ 35Vdc. Figure 6 illustrates some typical open collector external circuits.

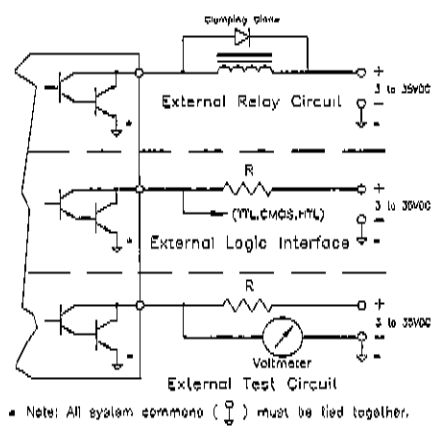

Figure 6

Rear Terminal Connections (*continued*)

Card Test Input

There is an input that is dedicated to the Card Test. The terminal designation for this input is:

Designation	Term	Description
CARDTEST	8d	Card Test Connection

Figure 7 is a block diagram of the Card Test connection.

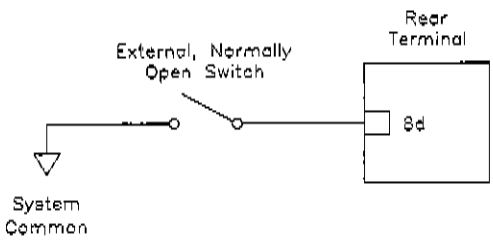

Figure 7

Other Designations

There are several terminations that fall under the No Connection designation. These contacts are:

Designation	Term	Description
NC	8z	No Connection
NC	10d	No Connection
NC	10z	No Connection
NC	20d	No Connection
NC	20z	No Connection

3.4 Applying Power

Zero Two Series Modules do not have an ON/OFF power switch. Each module in the Zero Two Series operates from 24Vdc. Current requirements vary according to the number and type of modules in the system, as well as the number and type of field devices. Figure 8 indicates where the power connections for the chassis are made.

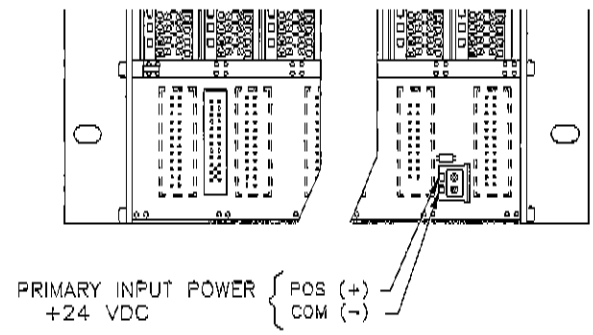

Figure 8

This chapter discusses general maintenance, refers to the electrical inputs, describes the electrical outputs, setup options and fault diagnostics.

4.1 General Maintenance

Once a Zero Two Series System has been installed, very little maintenance is required other than periodic checks to verify the integrity of the system.

- A functional test of the system should be performed at least once each year. This test should include full operation of stand-by systems or back up power for the prescribed period.
- The power, input and output wiring should be checked for tightness, verifying that all of the components and devices are connected correctly.

4.2 Input/Output Connections

The Model MD002 has four driver inputs which are driven with an open collector input referenced to system common. Each optional driver is activated by an active low/high input. To activate an output, the appriopriate open collector compatible input must be driven to active low or active high state. The open collector input is rated to 35Vdc maximum.

The Model MD002 provides four driver outputs that drive DC solenoids connected to fire extinguishant (or other similar application). These outputs are monitored for short or open circuits of the DC solenoids. Any detected short or open circuits will activate the fault open collector output. The monitored outputs are capable of sourcing 1.2 A @ 24Vdc and are capable of driving devices with a coil resistance as low as 20 Ohms.

4.3 Card Test Input

The card test input is provided to allow the operator to perform a functional test of the circuitry.

Connect one end of a normally open SPST switch to the card test input on the terminal block at the rear of the chassis and the other end to ground or system common (see section 3.3). To activate the card test, close the switch for at least 3 seconds. The card test will be active for as long as there is a path from the card test input to ground or system common (i.e. as long as the switch is closed).

4.4 Setup Mode

The Model MD002 allows the user to change various card functions by entering the setup mode (see flow chart on page 11). This mode may be protected by a password if that option is desired.

To enter the setup mode, depress the *Mode/Select* switch for approximately five seconds. If the password is enabled, it must be entered at this point.

Upon entering the password correctly, or if the password option is not invoked, the card will display "**In**". If the user requires the cards' output drivers to be inhibited, press the *Mode/Select* switch and the "**In**" will begin to flash, the **READY** LED will illuminate and the inhibit open collector will activate to show that the outputs are now inhibited.

Setup Mode (cont)

The following options are chosen for each of the four output drivers independently. The appropriate (**OP1** through **OP4**) LED will be flashing to show which driver is being configured.

To change a particular option, press the *Mode/Select* switch repeatedly to cycle through the available options.

Output Driver Configuration

The configurable options are then displayed for each channel in the following order:

1. "**IU**" for output driver In Use or "**nU**" for output driver Not in Use. If Not in Use is selected, the card will skip steps 2 through 9 and change to the next Output Driver.

2. Wait five seconds.

3. "**00**" to "**60**" for driver output activation time delay (in 1 second increments).

4. Wait five seconds.

5. "**Ab**" for Manual Abort active or "**nA**" for Manual Abort Not Active.

6. Wait five seconds.

7. "**LA**" for Latched output or "**nL**" for Non-Latched output.

8. Wait five seconds.

9. "**AL**" for alarm input Active Low or "**AH**" for alarm input Active High.

10. Wait five seconds.

The card will now change to the next output driver and return to step one above.

Following configuration of output driver four, the card will cycle through three more options that affect all of the channels.

Fault During Inhibit Mode

The **FAULT** LED will flash, choose "**Ac**" if the fault outputs should be active during Inhibit Mode, or "**nA**" to deactivate the outputs during Inhibit Mode.

Card Test Output

The card will display "**ct**" for five seconds then display "**Ac**" if the output drivers should be active during the Card Test, or "**nA**" to deactivate the outputs during the Card Test.

Setting the Password

The last option is to enable and choose the password, or to disable the password. "**PE**" is displayed for password enabled and "**Pd**" for password disabled. If the password is enabled, the left digit will be displayed. To change the password, press the *Mode/Select* switch repeatedly until the desired digit is displayed and wait for five seconds. The right digit will now be displayed. Press the *Mode/Select* switch repeatedly until the desired digit is displayed and wait for five seconds. The password is now set.

The card now returns to normal operation.

4.5 Setup Mode Flowchart

Setup Mode

NOTE: Press Mode/Select switch repeatedly to change option.

Depress *Mode/Select* switch for five seconds.

Enter password (if required).
Press *Mode/Select* switch repeatedly until left digit is correct, wait five seconds.
Press *Mode/Select* switch repeatedly until right digit is correct, wait five seconds.

Inhibit Output Drivers.
Steady "**In**" equals Output Drivers not inhibited.
Flashing "**In**" equals Output Drivers are inhibited, wait five seconds.

Configure Output Drivers.
Loop for Drivers 1 through 4.
OP1(2,3 or 4) LED flashing.

"**IU**" equals current Output Driver in use.
"**nU**" equals current Output Driver not in use, wait five seconds.

"**00**" to "**60**" equals Output Driver time delay in seconds, wait five seconds.

"**Ab**" equals Manual Abort active.
"**nA**" equals Manual Abort not active, wait five seconds.

"**LA**" equals Latching Output Driver.
"**nL**" equals Non-Latching Output Driver, wait five seconds.

"**AL**" equals Active Low alarm input.
"**AH**" equals Active High alarm input, wait five seconds.

Go on to next Output Driver configuration.

Fault During Inhibit Mode.
FAULT LED flashes.
"**Ac**" equals Fault Outputs are active during Inhibit Mode.
"**nA**" equals Fault Outputs are not active during Inhibit Mode, wait five seconds.

Card Test Output.
"**ct**" displayed, wait five seconds.
"**Ac**" equals Output Drivers active during Card Test.
"**nA**" equals Output Drivers not active during Card Test, wait five seconds.

Password Option.
"**PE**" equals Password enabled.
"**Pd**" equals Password disabled, wait five seconds.

If password is enabled.
Enter password.
Press *Mode/Select* switch repeatedly until desired left digit is displayed, wait five seconds.
Press *Mode/Select* switch repeatedly until desired right digit is displayed, wait five seconds.

Card returns to normal operation.

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4.6 Manual Abort Input

Each channel has a Manual Abort connection so that an impending output activation can be averted. If the channel is in the pre-discharge time-delay or currently activated, grounding this terminal to system common will deactivate the output driver.

This option allows a control room operator to override the MD002's automatic discharge and hold the fire deluge system for Manual Release.

4.7 Manual Release Input

Each channel has a Manual Release connection so that the user can override a previously aborted output driver. If the channel is still in the pre-discharge time-delay, the time-out will continue. If the time-out has expired, grounding this terminal to system common will immediately activate the output driver.

This option, used in conjunction with the Manual Abort option, allows a control room operator to manually activate the fire deluge system after being Manually Aborted.

4.8 Fault Codes

The model MD002 displays fault codes on the digital display covering various malfunctions that may occur.

The Model MD002 fault codes are listed below for reference:

F1 - Unused

F2 - Vin Voltage Disconnected

F3 - EEPROM Checksum Error

F4 - Output Driver Open Circuited (Corresponding **F1** - **F4** LED will illuminate)

F5 - Output Driver Short Circuited (Corresponding **F1** - **F4** LED will illuminate)

F6 - Low Input Supply Voltage

F7 - EEPROM Verification Failure

F8 - Failure to Complete Setup

For **F4** and **F5** faults, check output wiring. For **F6** fault, check power supply voltage. For **F8** fault, card must go through the setup process again. For all other faults, return card to General Monitors for repair.

Glossary of Terms

Activated : An activated LED or output indicates that a state other than "normal" is present.

CH : Channel.

CSA : Canadian Standards Association.

De-Activated : A de-activated LED or output is the normal state, usually safe (see Activated).

De-Energized : A state where electrical voltage/current is not applied (see Energized).

EMI : Electromagnetic Interference.

Energized : A state where electrical voltage/current is applied (see De-Energized).

Fault : An error or malfunction.

FM : Factory Mutual Research Corporation.

FUA : Fault Unaccept.

INH : Inhibit.

Inhibit : To prevent from occurring.

Latching : An output that remains activated until manually Reset.

LED : Light Emitting Diode.

mA : Milliampere, 1/1000 of an Ampere.

mADC : Milliampere, Direct Current.

NC : No Connection.

Non-Latching : An output that does not require manual Resetting.

OC : Open Collector.

Open Collector : The output element of a transistor, when properly biased, collects charge carriers.

Reset : To return to the previous state.

SPST : Single Pole, Single Throw.

SW : Switch.

UA : Unaccept.

UL : Underwriters Laboratory.

Engineering Documentation

Reference Drawing # 11409-1 Schematic Diagram - Display Board

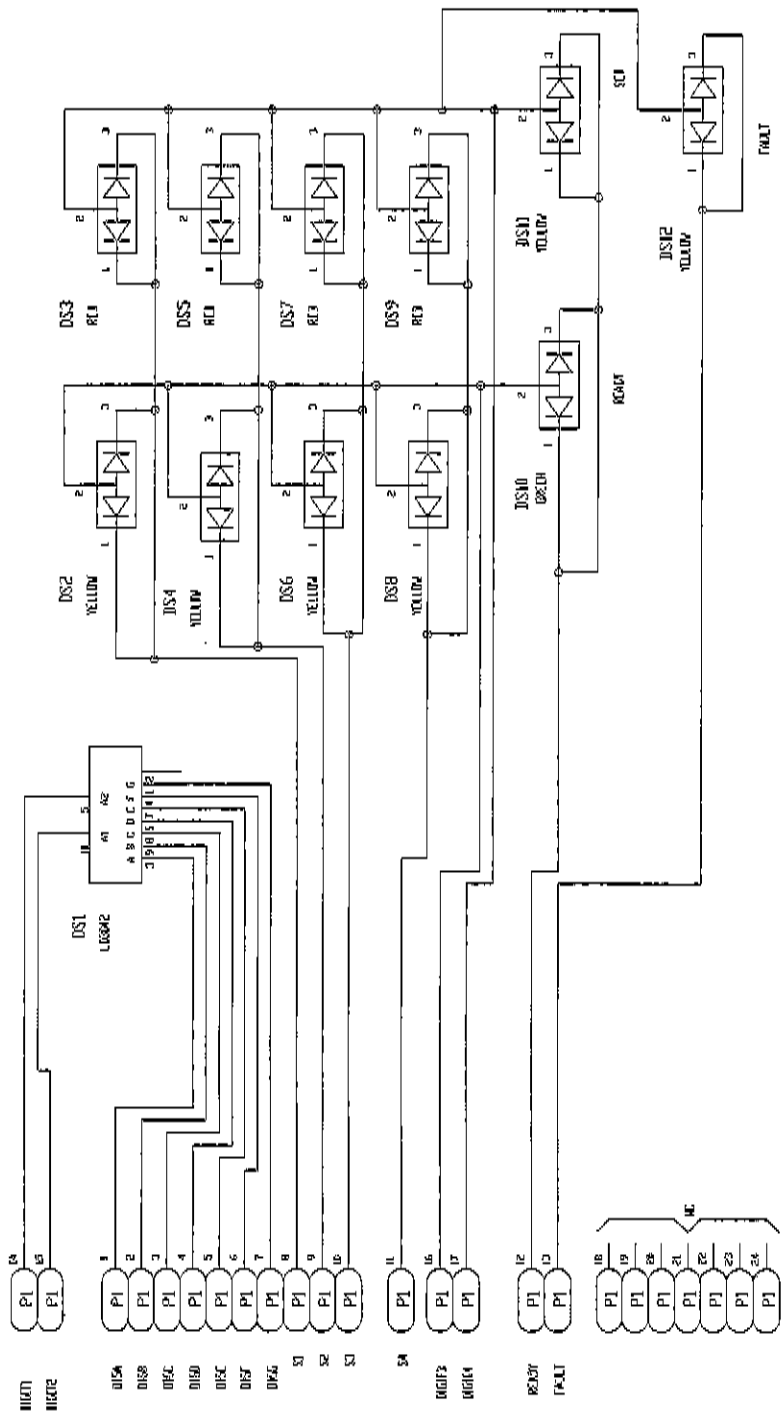

Figure 9

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Engineering Documentation (*continued*)

Reference Drawing # 11405-1 Schematic Diagram - Control Board

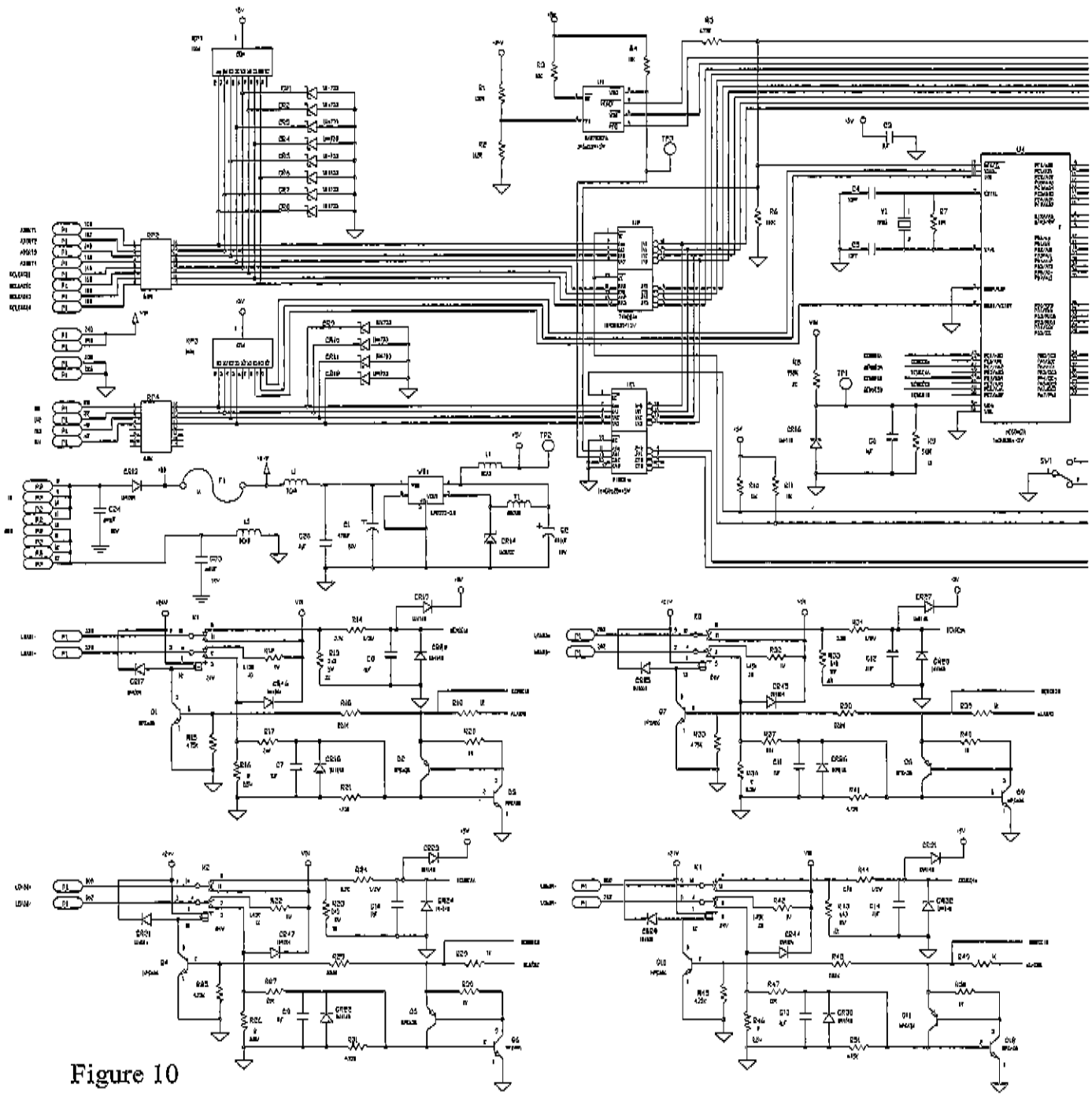

Figure 10

Left Side

Engineering Documentation (*continued*)

Reference Drawing # 11405-1 Schematic Diagram - Control Board

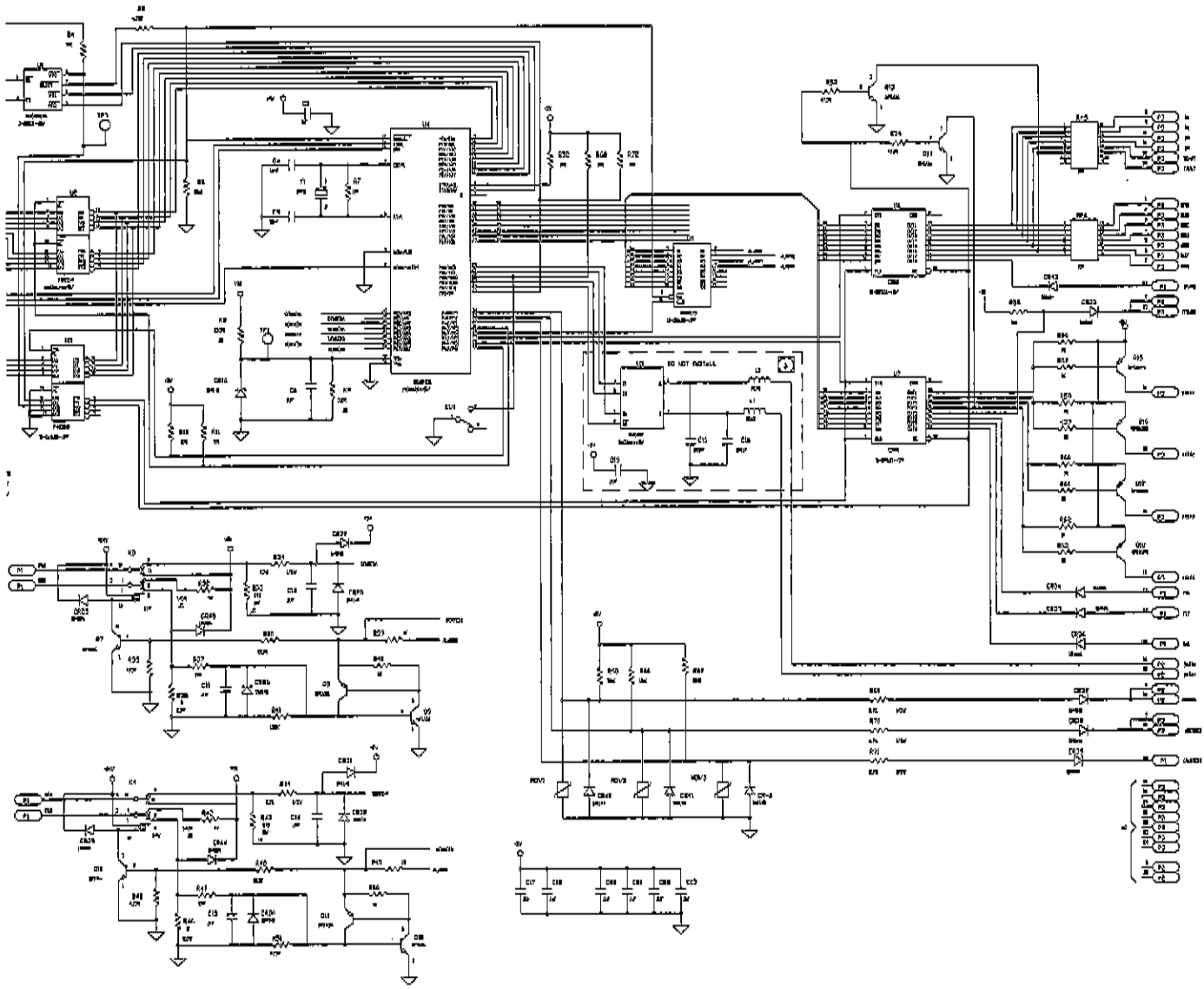

Figure 10
Right Side

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Engineering Documentation (*continued*)

Reference Drawing # 11410-1 Circuit Card Assembly - Display Board

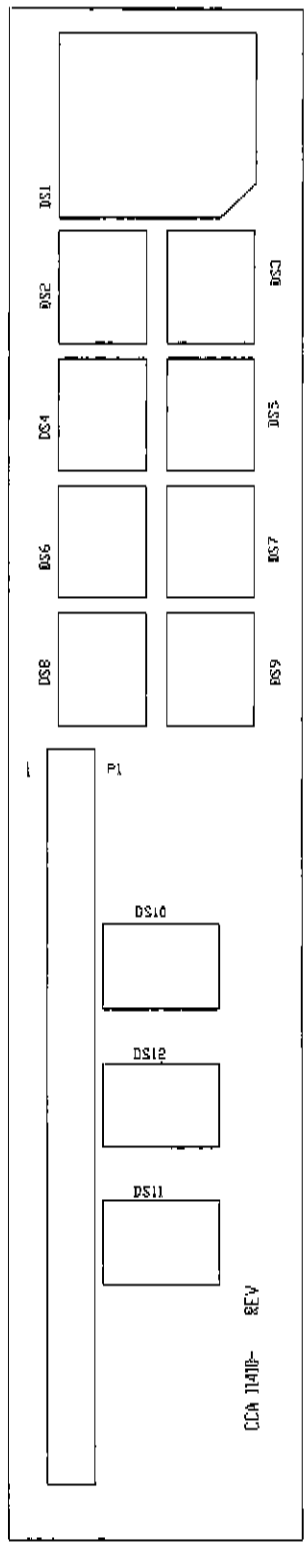

Figure 11

Engineering Documentation (*continued*)

Reference Drawing # 11406-1 Circuit Card Assembly - Control Board

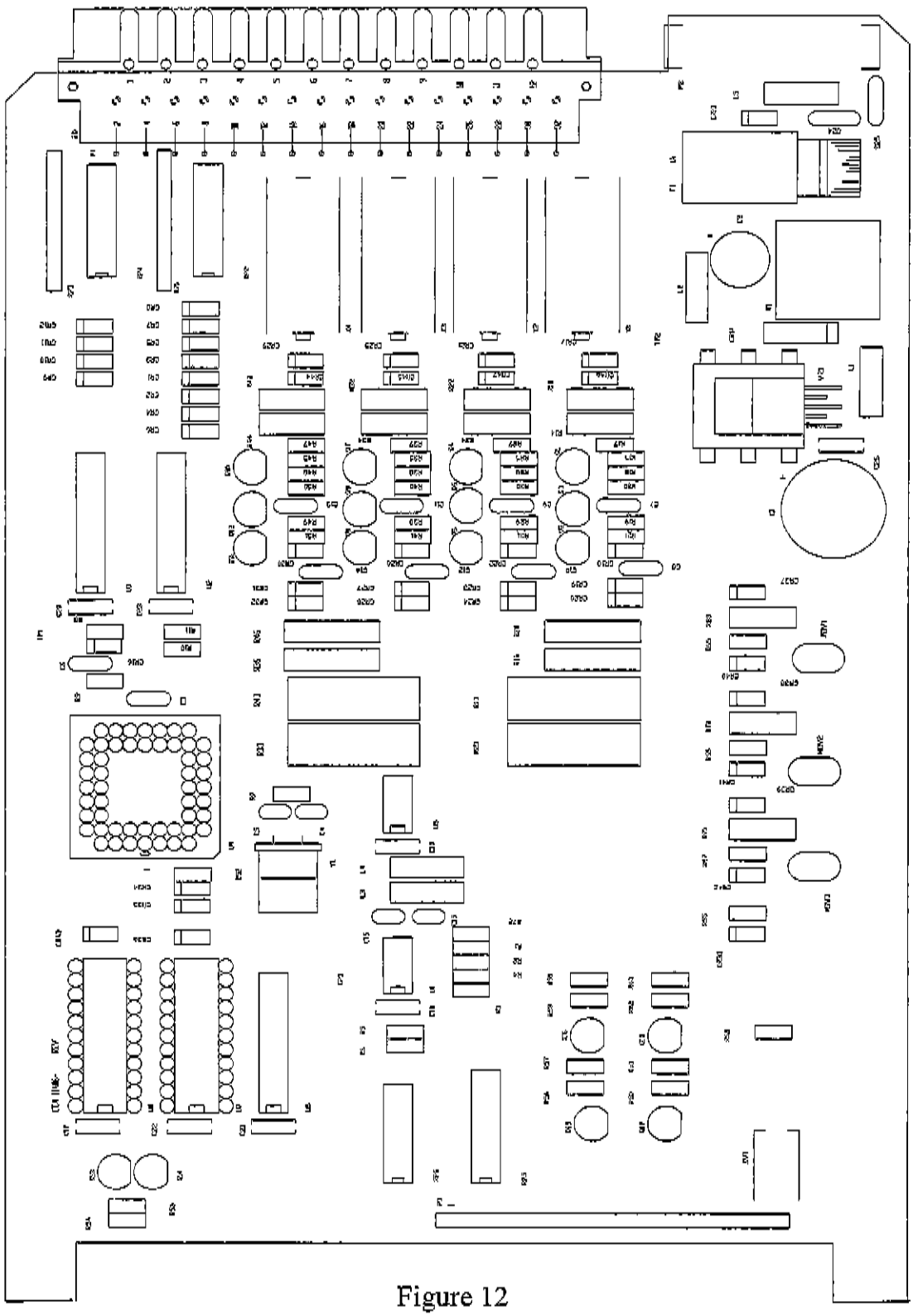

Figure 12

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Engineering Documentation (*continued*)

Reference Drawing # 11401-1 Outline & Terminal Connection Drawing

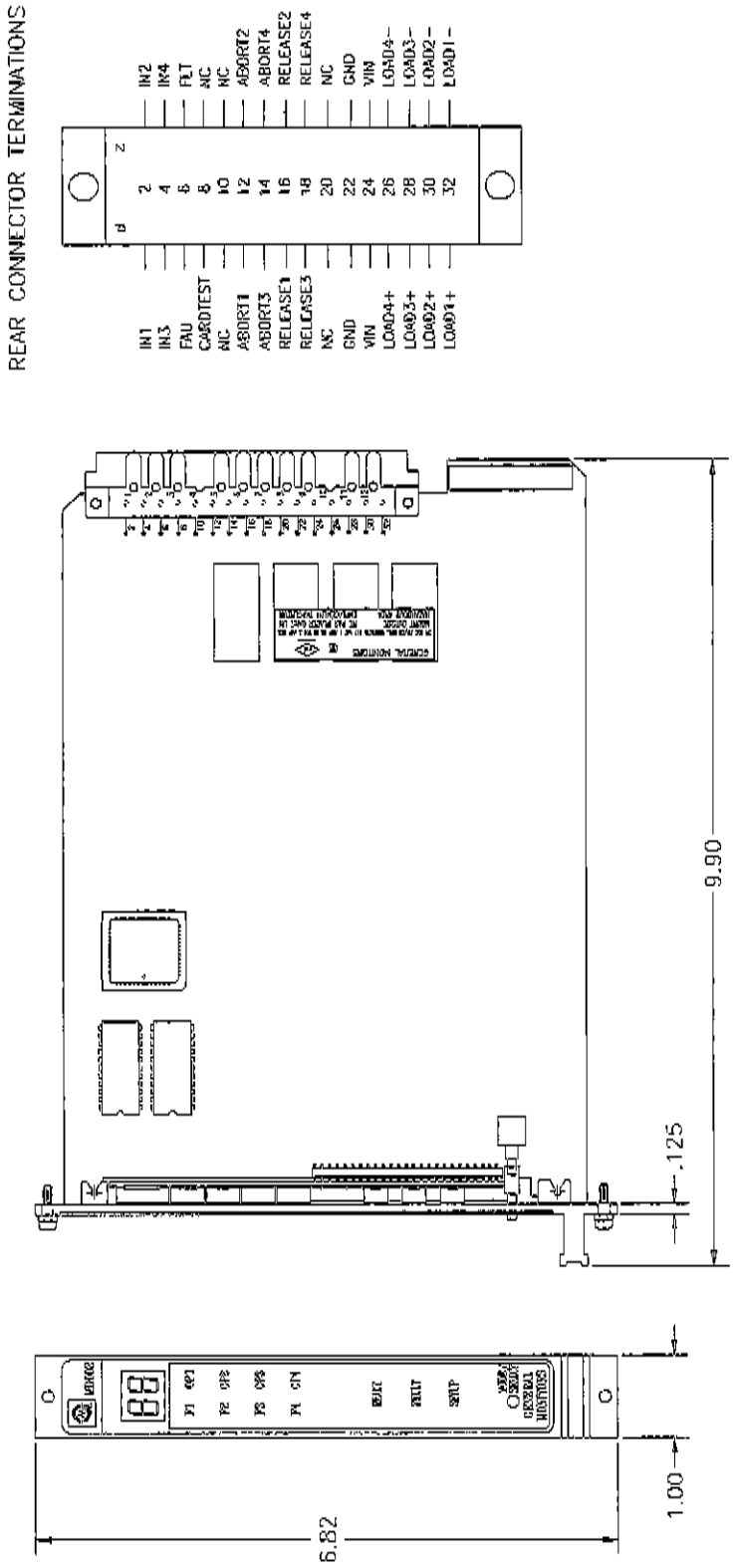
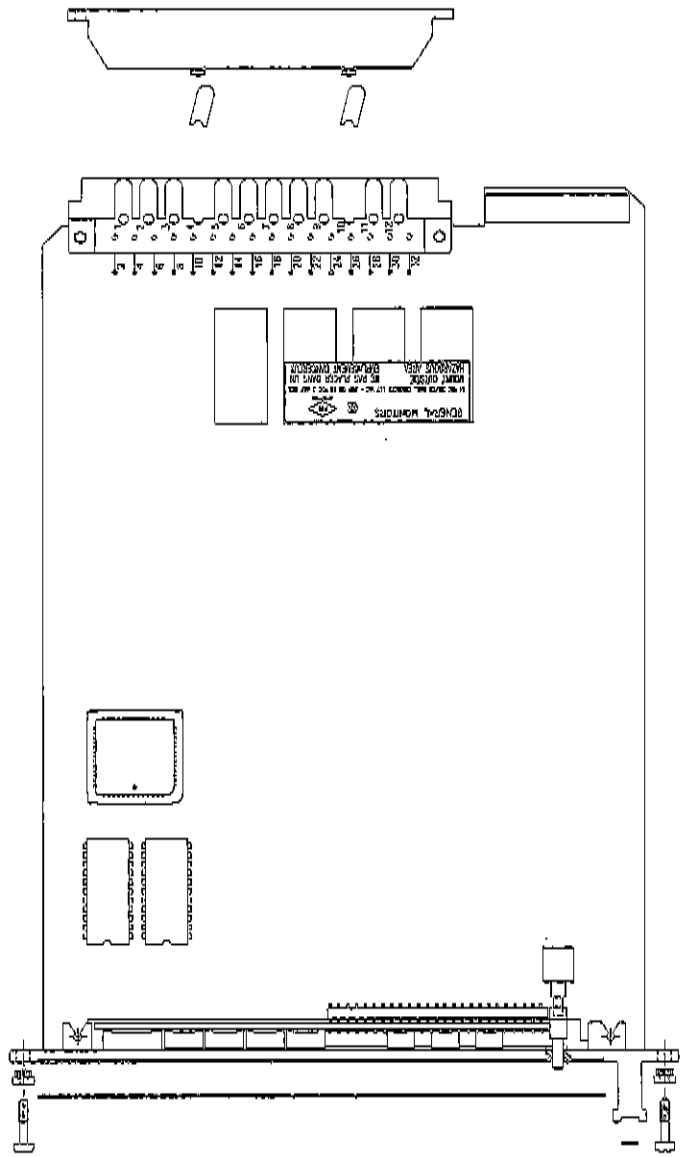


Figure 13

Engineering Documentation (*continued*)

Reference Drawing # 11400-1 Final Assembly Drawing



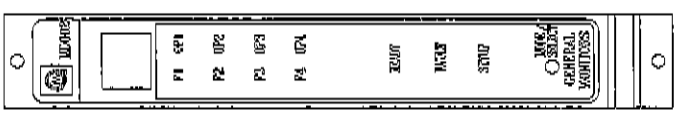


Figure 14