

ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Visit our website - *Click HERE*

AutoMate®
DCS 5000/AutoMax®
Digital I/O Rails
and Modules

(M/N 45C1A)
(M/N 45C3)
(M/N 45C4)
(M/N 45C5)
(M/N 45C7)
(M/N 45C40)
(M/N 45C42)
(M/N 45C43)
(M/N 45C44)
(M/N 45C46)
(M/N 45C60)
(M/N 45C62)
(M/N 45C63)
(M/N 45C65)
(M/N 45C66A)
(M/N 45C67)
(M/N 45C68)
(M/N 45C69)
(M/N 45C166A)

Industrial
CONTROLS

Instruction Manual J-3012-3

RELIANCE ELECTRIC

The information in this user's manual is subject to change without notice.

DANGER

ONLY QUALIFIED ELECTRICAL PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND THE HAZARDS INVOLVED SHOULD INSTALL, ADJUST, OPERATE, OR SERVICE THIS EQUIPMENT. READ AND UNDERSTAND THIS MANUAL IN ITS ENTIRETY BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

DANGER

THE USER IS RESPONSIBLE FOR CONFORMING TO THE NATIONAL ELECTRIC CODE AND ALL OTHER APPLICABLE LOCAL CODES WITH RESPECT TO WIRING, GROUNDING, DISCONNECTS, AND OVERCURRENT PROTECTION. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

WARNING

A HARDWIRED EMERGENCY STOP CIRCUIT OUTSIDE OF THE PROGRAMMABLE CONTROLLER CIRCUITRY MUST BE PROVIDED. USE AN EXTERNAL STOP CIRCUIT AND THE "READY CONTACT" IN THE PROCESSOR TO STOP THE PROCESS SAFELY IN THE EVENT OF EQUIPMENT FAILURE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY AND/OR DAMAGE TO THE EQUIPMENT.

DANGER

CHECK FOR THE PRESENCE OF VOLTAGE BEFORE YOU PERFORM ANY INSTALLATION OR MAINTENANCE OPERATIONS. THE I/O DEVICES CONNECTED TO THE FIELD WIRING MAY BE POWERED FROM AN EXTERNAL POWER SOURCE. DO NOT ASSUME THAT IT IS SAFE TO WORK ON THE MODULES AND WIRING WHEN JUST THE MAIN SOURCE OF POWER IS DISCONNECTED. DISCONNECT ALL SOURCES OF POWER BEFORE SERVICING THE EQUIPMENT. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

AutoMax®, AutoMate® and Reliance® are registered trademarks of Reliance Electric Company or its subsidiaries.
Buss® is a registered trademark of Bussman, Cooper Industries.

Table of Contents

1.0 Overview **1-1**
1.1 Introduction 1-1
1.2 This Manual 1-1
1.3 Related Publications 1-1

2.0 I/O Rail **2-1**
2.1 Introduction 2-1
2.2 General Description 2-1
2.2.1 Rail Chassis 2-1
2.2.2 Rail Terminal Strip 2-3
2.2.3 Rail Motherboard 2-6
2.3 Rail Installation and Mounting 2-7
2.3.1 Grounding 2-11
2.3.2 Rail Cabling Channel Kit 2-12
2.3.3 Horizontal I/O Cable Channel Kit 2-12
2.3.4 Rail Jumper Bar Kit 2-15
2.4 I/O Wiring 2-16

3.0 Digital I/O Modules **3-1**
3.1 Introduction 3-1
3.2 Dual A-C/D-C Input Module 3-1
3.3 Dual Electronic Input Module 3-5
3.4 Voltage Comparator Module 3-10
3.5 Dual A-C Output Module 3-14
3.6 Dual D-C Output Module 3-18
3.7 Dual Contact Output Module - Normally Open Contacts 3-22
3.8 Dual Contact Output Module - Normally Closed Contacts 3-26
3.9 Dual Dry Contact Output Module 3-30

4.0 Diagnostics and Troubleshooting **4-1**
4.1 Introduction 4-1
4.2 Locating an I/O Rail Fault 4-1
4.2.1 AutoMate 15 4-1
4.2.2 AutoMate 20/20E 4-6
4.2.3 AutoMate 30/30E 4-14
4.2.4 AutoMate 40/40E 4-26
4.2.5 DCS 5000/AutoMax 4-34
4.3 Testing an AutoMate Input Circuit 4-41
4.4 Testing an AutoMate Output Circuit 4-42
4.5 Testing a DCS 5000/AutoMax Rail-Mounted Input Circuit 4-44
4.6 Testing a DCS 5000/AutoMax Rail-Mounted Output Circuit 4-46

Appendices

Appendix A
I/O Rail Mounting Dimensions A-1

List of Figures

Figure 2.1 - I/O Rail (Front View) 2-2
Figure 2.2 - I/O Rail (Top View) 2-3
Figure 2.3 - Rail Terminal Strip 2-4
Figure 2.4 - Terminal Strip Assembly 2-5
Figure 2.5 - Rail Motherboard 2-6
Figure 2.6 - Rail Mounting Dimensions 2-8
Figure 2.7 - Rail Mounting Examples 2-9
Figure 2.8 - Typical Rail Installations 2-10
Figure 2.9 - Grounding 2-11
Figure 2.10 - Rail Cabling Channel 2-12
Figure 2.11 - Horizontal Channel Dimensions 2-13
Figure 2.12 - Typical Horizontal Channel Applications 2-14
Figure 2.13 - Jumper Bar 2-15
Figure 2.14 - Jumper Bar Installation 2-15
Figure 2.15 - Field Wiring Example 2-17

Figure 3.1 - Dual A-C/D-C Input Module 3-2
Figure 3.2 - Dual A-C/D-C Input Module Channel Schematic 3-2
Figure 3.3 - Dual A-C/D-C Input Module Field Wiring Example 3-3
Figure 3.4 - Dual Electronic Input Module 3-6
Figure 3.5 - Schematic of a Dual Electronic Input Module 3-7
Figure 3.6 - Dual Electronic Input Module Field Wiring Example 3-7
Figure 3.7 - Dual Electronic Input Module Timing Diagram 3-8
Figure 3.8 - Voltage Comparator Module 3-11
Figure 3.9 - Voltage Comparator Schematic 3-11
Figure 3.10 - Voltage Comparator Module Field Wiring Example 3-12
Figure 3.11 - Deadband Adjustment 3-12
Figure 3.12 - Dual A-C Output Module 3-15
Figure 3.13 - A-C Output Channel Schematic 3-15
Figure 3.14 (A) - Dual A-C Output Module Field Wiring Example 3-16
Figure 3.14 (B) - RC Suppression Network for Inductive Loads 3-16
Figure 3.15 - Dual D-C Output Module 3-19
Figure 3.16 - Dual D-C Output Module Channel Schematic 3-20
Figure 3.17 - Dual D-C Output Module Field Wiring Example 3-20
Figure 3.18 - Dual Contact Output Module (N.O.) 3-23
Figure 3.19 - Schematic of a Dual Contact Output Module (N.O.) Channel 3-23
Figure 3.20 - Dual Contact Output Module (N.O) Field Wiring Example .. 3-24
Figure 3.21 - Dual Contact Output Module (N.C.) 3-27
Figure 3.22 - Schematic of a Dual Contact Output Module (N.C.) Channel 3-27
Figure 3.23 - Dual Contact Output Module (N.C.) Field Wiring Example .. 3-28
Figure 3.24 - Dual Dry Contact Output Module 3-30
Figure 3.25 - Schematic of a Low Power Output Channel 3-31
Figure 3.26 - Low Power Circuit Example 3-31
Figure 3.27 - Dual Dry Contact Output Module Field Wiring Example 3-32

Figure 4.1 - AutoMate 15 Rail Fault Troubleshooting Flowchart 4-2
Figure 4.2 - Motherboard Retaining Screws 4-5
Figure 4.3 - AutoMate 20/20E Rail Fault Troubleshooting Flowchart 4-6
Figure 4.4 - AutoMate 30/30E and 40/40E Rail Fault Troubleshooting Flowchart 4-15
Figure 4.5 - DCS 5000/AutoMax Rail Fault Troubleshooting Flowchart .. 4-35

List of Tables

Table 3.1 - Dual A-C/D-C Input Module Technical Specifications 3-4
Table 3.2 - Dual Electronic Input Module Technical Specifications 3-9
Table 3.3 - Dual Electronic Input Module Current and Voltage Specifications 3-9
Table 3.4 - Voltage Comparator Module Technical Specifications 3-13
Table 3.5 - Dual A-C Output Module Technical Specifications 3-17
Table 3.6 - Dual A-C Output Module Electrical Specifications 3-17
Table 3.7 - Dual D-C Output Module Technical Specifications 3-21
Table 3.8 - Dual Contact Output Module (N.O.) Technical Specifications 3-25
Table 3.9 - Dual Contact Output Module (N.C.) Technical Specifications . 3-29
Table 3.10 - Dual Dry Contact Output Module Technical Specifications ... 3-33

Table 4.1 - AutoMate 15 Rail Fault LED Error Codes 4-3
Table 4.2 - AutoMate 20/20E Rail Fault LED Error Codes 4-10
Table 4.3 - AutoMate 20/20E Rail Fault Register 2750 4-11
Table 4.4 - AutoMate 30/30E Rail Fault Registers 3750/3751 4-21
Table 4.5 - Remote I/O Head Rail Fault LED Error Codes 4-24
Table 4.6 - AutoMate 40 Rail Fault Registers 17600-17607 4-28
Table 4.7 - AutoMate 40E Rail Fault Registers 17600-17637 4-29
Table 4.8 - DCS 5000/AutoMax Rail Fault LED Error Codes 4-38

1.0 OVERVIEW

1.1 Introduction

This chapter tells you what is in this manual and lists related publications for additional information you may find helpful.

1.2 This Manual

This manual provides information on the AutoMate® I/O Rail, Digital I/O Modules, and accessories. These components can be used with an AutoMate 15, AutoMate 20/20E, AutoMate 30/30E, AutoMate 40/40E or a DCS 5000/AutoMax® programmable controller. The manual is divided into four chapters:

- Chapter 1 - Overview

  Summarizes the manual's contents and related publications.

- Chapter 2 - I/O Rail

  Describes the rail, its mounting instructions, and I/O wiring.

- Chapter 3 - Digital I/O Modules

  Provides information on the plug-in digital I/O modules. Includes background information, specifications, and example wiring diagrams.

- Chapter 4 - Diagnostics and Troubleshooting

  Describes how to locate I/O rail faults and how to isolate non-working I/O circuits.

1.3 Related Publications

For additional information, read the following publications and any others that apply to your system:

- J-3016 AutoMate 15 User's Manual
- J-3120 AutoMate 20 User's Manual
- J-3150 AutoMate 30/40 Software Reference Manual
- J-3039 AutoMate Racks
- J-3047 AutoMate Power Supply
- J-3040 AutoMate Fan Kit
- J-3031 AutoMate 30 Processor Hardware
- J-3140 AutoMate 40 Logic Processor
- J-3141 AutoMate 40 Control Processor
- J-3088 AutoMate 40 Memory Expansion
- J-3671 AutoMate Local Head

Related publications continued:

- J-3037 AutoMate Remote Head
- J-3033 AutoMate Local I/O Processor
- J-3654 AutoMate TWS Interface Module
- J-3655 AutoMate LED Interface Module
- J-3050 AutoMate Register Input Module
- J-3051 AutoMate Register Output Module
- J-3048 AutoMate Analog Input Module
- J-3046 AutoMate Analog Output Module
- J-3672 Analog Rail 0-10V In/Out
- J-3673 Analog Rail 4-20 ma In/Out
- J-3034 AutoMate Remote I/O Processor
- J-3161 AutoMate Accumulator Module
- J-3067 Mini Programmer Power Supply
- J-3094 Mini Programmer
- J-3063 ReSource AutoMate Programming Executive
- J-3634 AutoMate Software Loading Instructions
- J-3674 ReSource AutoMate Documentation Executive
- J-3075 AutoMate R-Net Applications
- J-3038 AutoMate Redundancy Processor
- J-3630 DCS 5000/AutoMax Programming Executive
- J-3606 Remote I/O Communications
- S-3006 D-C Drive Configuration and Programming
- S-3008 Power Module Interface Rack
- RE-181P DCS 5000/AutoMax AutoMate Remote I/O Head Reference Manual

2.0 I/O RAIL

2.1 Introduction

This chapter describes the I/O rail, its mounting instructions, and I/O wiring.

2.2 General Description

The I/O rail (M/N 45C1) can accommodate eight plug-in digital I/O modules, for a total of 16 I/O channels. When used with an AutoMate system the eight modules may be any combination of input or output modules. When used with a DCS 5000/AutoMax system a rail can hold either all input modules or all output modules, but not both. When used with a Distributed Power DCS 5000/AutoMax system a rail can hold any combination of input or output modules. Each I/O rail is made up of:

- a rail (or chassis)
- a terminal strip
- a motherboard

2.2.1 Rail Chassis

The rail is made of aluminum and measures 9 inches (22.9 cm) (H) x 5.5 inches (14.0 cm) (W) x 7.5 inches (19.1 cm) (D). The terminal strip and I/O motherboard mount on the chassis as shown in figures 2.1 and 2.2. The chassis also serves as a heat sink for the I/O modules.

The rail has a threaded groove on one of the cooling fins. You use this threaded groove to attach a wire channel or tray to the side of the rail, if needed. You can use number 10-32 screws which are 3/8 of an inch long to fasten the wire channel to the rail at any point along the cooling fin as shown in figure 2.10. There are four holes in the rail's backplate for mounting it in an enclosure or cabinet. See section 2.3 for installation instructions.

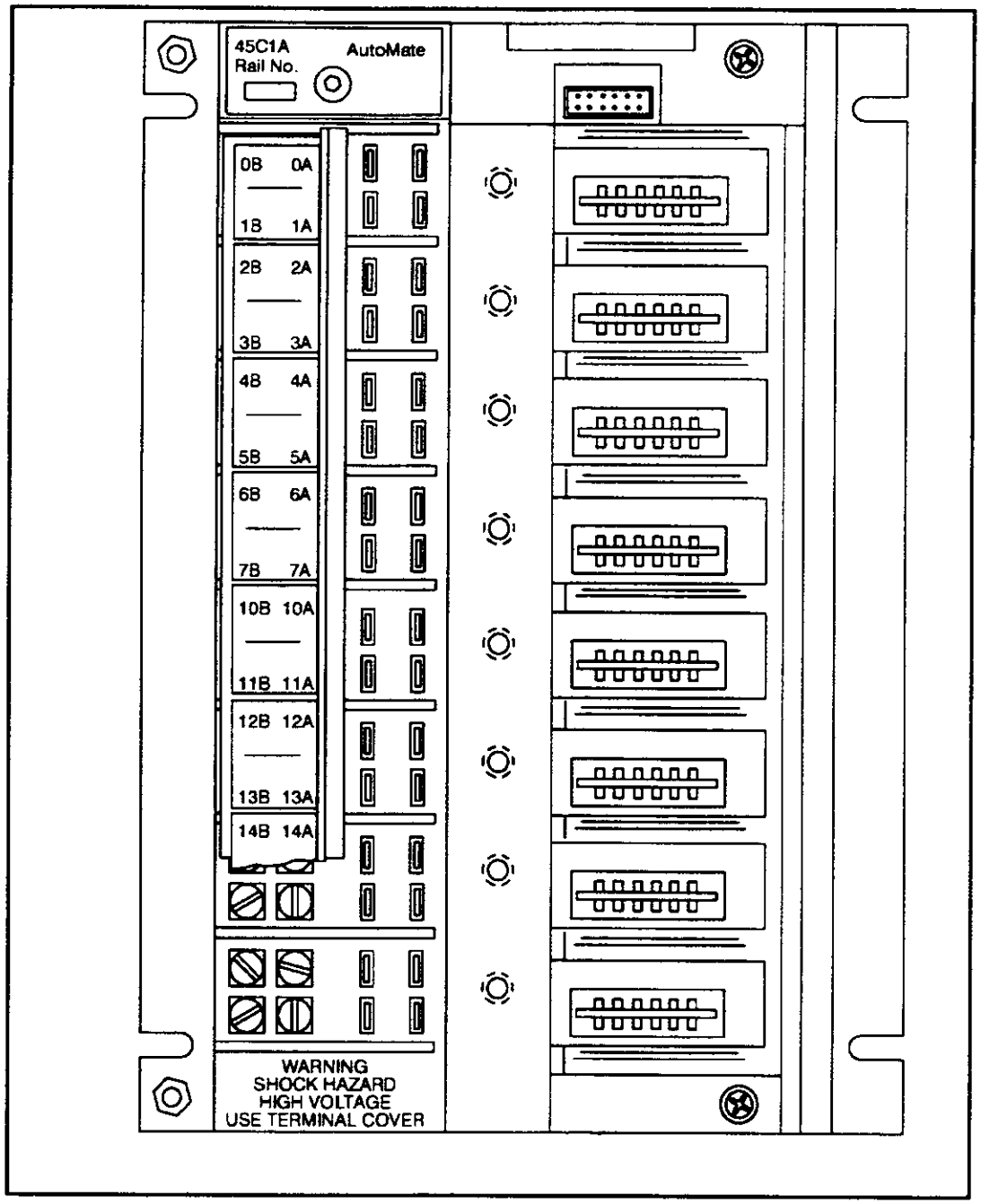


Figure 2.1 - I/O Rail (Front View)

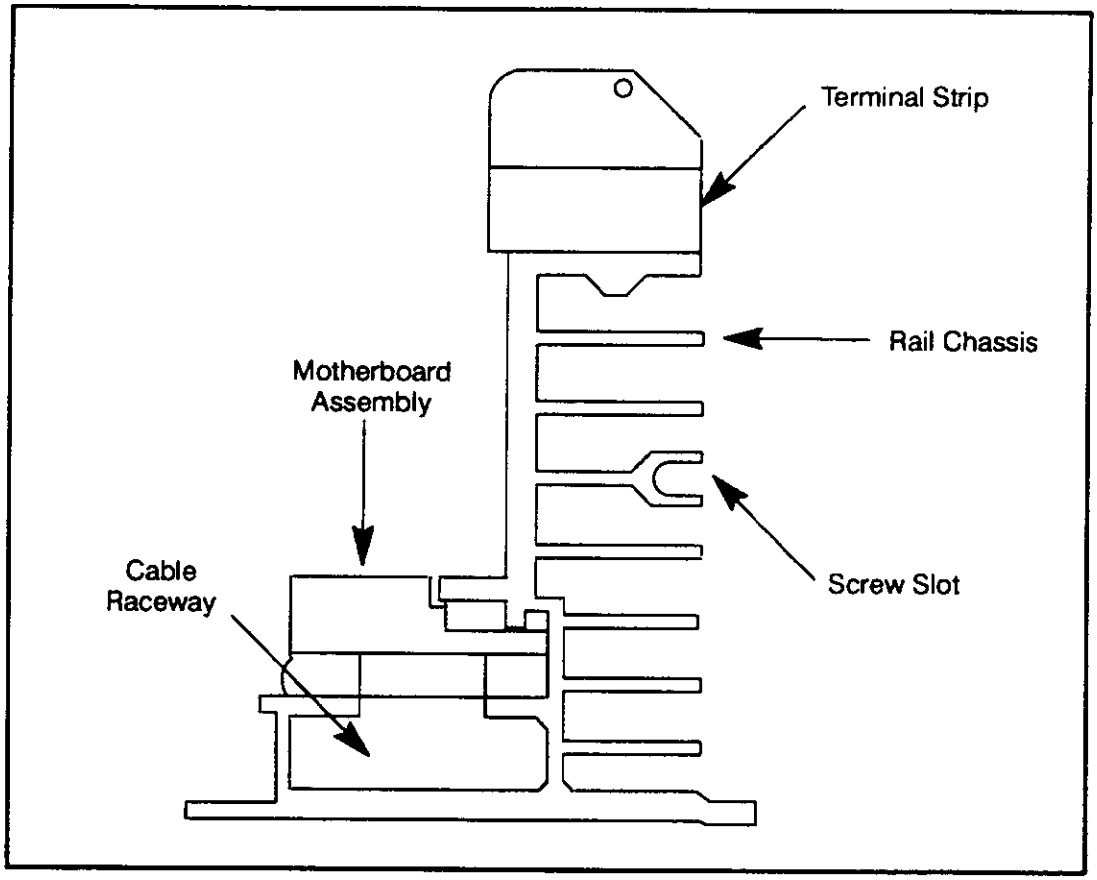


Figure 2.2 - I/O Rail (Top View)

2.2.2 Rail Terminal Strip

The rail's terminal strip provides:

- a termination for field wiring
- mounting slots for plug-in I/O modules
- a place for labeling your wiring
- an insulated safety cover over the terminals.

Field wiring connects directly to the rail's terminal strip. The terminals are arranged in two tiers as shown in figure 2.3. Each terminal is capable of holding two number 12 AWG (3.30 mm^2) wires. The smallest recommended wire size is number 22 AWG (0.32 mm^2).

There are two terminals (A, B) per I/O channel. Terminal A is the upper terminal and terminal B is the lower terminal. The type of I/O you use will determine which terminal is common or power.

The I/O modules plug into the terminal strip, which connects them to the field wiring. You can install or replace the modules without having to remove the field wiring.

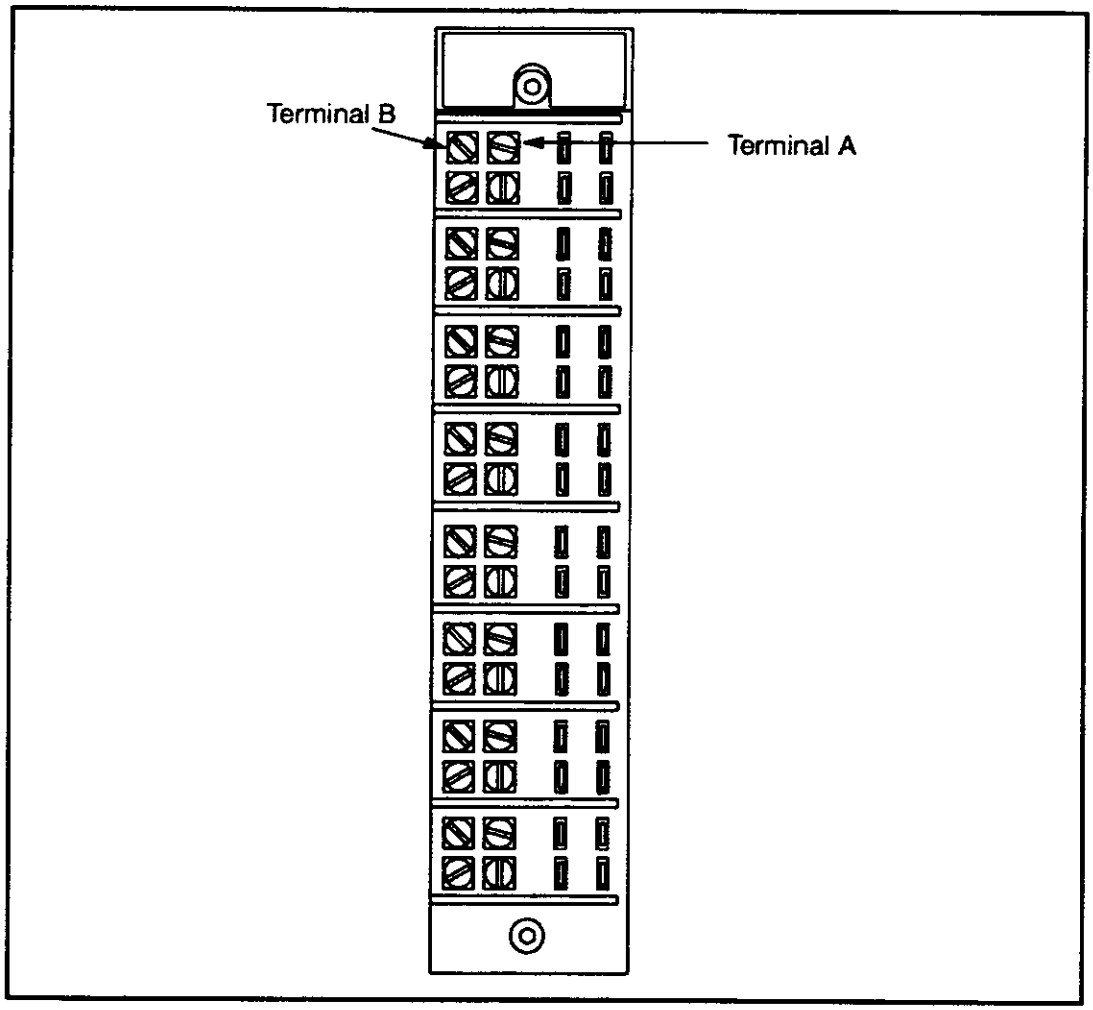


Figure 2.3 - Rail Terminal Strip

Identification labeling is provided on the terminal strip. The cover (P/N 802802-2B) over the terminals, shown in figure 2.4A, is pre-labeled (on both sides) with the I/O addresses of the 16 I/O points per rail. The 16 AutoMate I/O points are numbered in octal from 0-17. When a rail is used with a DCS 5000/AutoMax system, the I/O label addresses are in decimal (0-15). A separate label with the decimal addresses is included with the rail. On the back side of the cover plate, a labeling area is provided to allow you to identify the wire number of each connected device.

The AutoMate terminal strip label part number is 707207-4A. The DCS 5000/AutoMax terminal strip label part number is 707207-4E.

On the top front of the terminal strip, a label is provided for you to list the rail's number as shown in figure 2.4B. A stick-on label that identifies the type of I/O module is provided with each module. There is an area on the side of the terminal strip next to each of the eight module positions for you to place this label. See figure 2.4C.

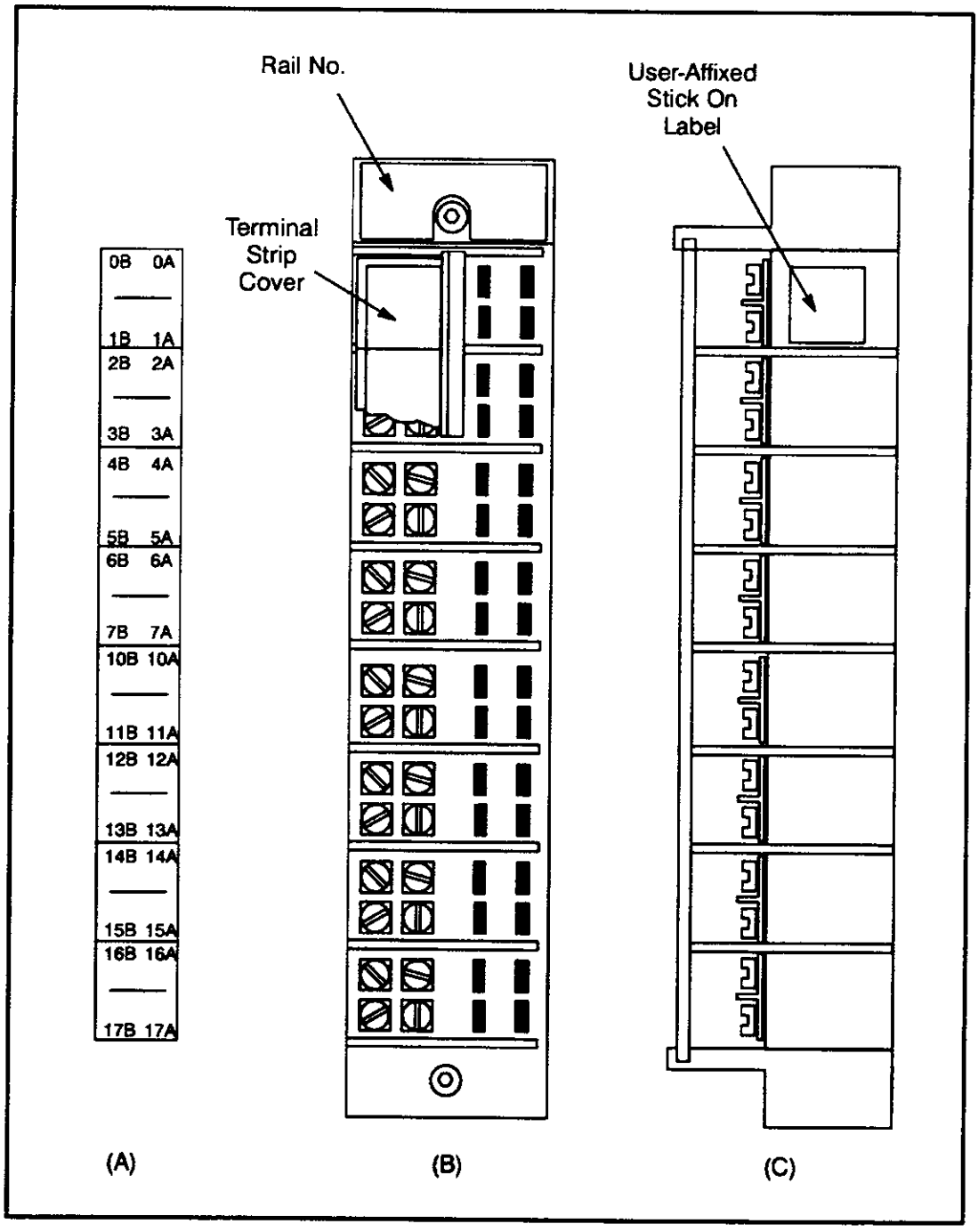


Figure 2.4 - Terminal Strip Assembly

2.2.3 Rail Motherboard

The rail motherboard (M/N 45C2A) is enclosed in a plastic housing and functions as the interface between the digital I/O and the AutoMate or DCS 5000/AutoMax processor. See figure 2.5. The motherboard is mounted on the back of the rail chassis and is held in place by two screws.

In operation, the motherboard:

- automatically detects the type of I/O module, either input or output
- decodes the I/O address of each I/O point in the rail
- communicates with the processor by sending and receiving the I/O status of the 16 points on the rail.

The rail is connected via an I/O Rail Interconnect Cable (M/N 45C5) to the I/O port of one of the following, depending on the equipment selected: an AutoMate processor, a Local I/O Head, a Remote I/O Head, a Local I/O Processor, a Distributed Power PMI Processor, or a DCS 5000/AutoMax Remote I/O Head. This cable provides power to the rail and the logic side of the modules. It also provides communication to and from the processor. The length of the cable is 48 inches (1.2 m). It has a female connector on each end.

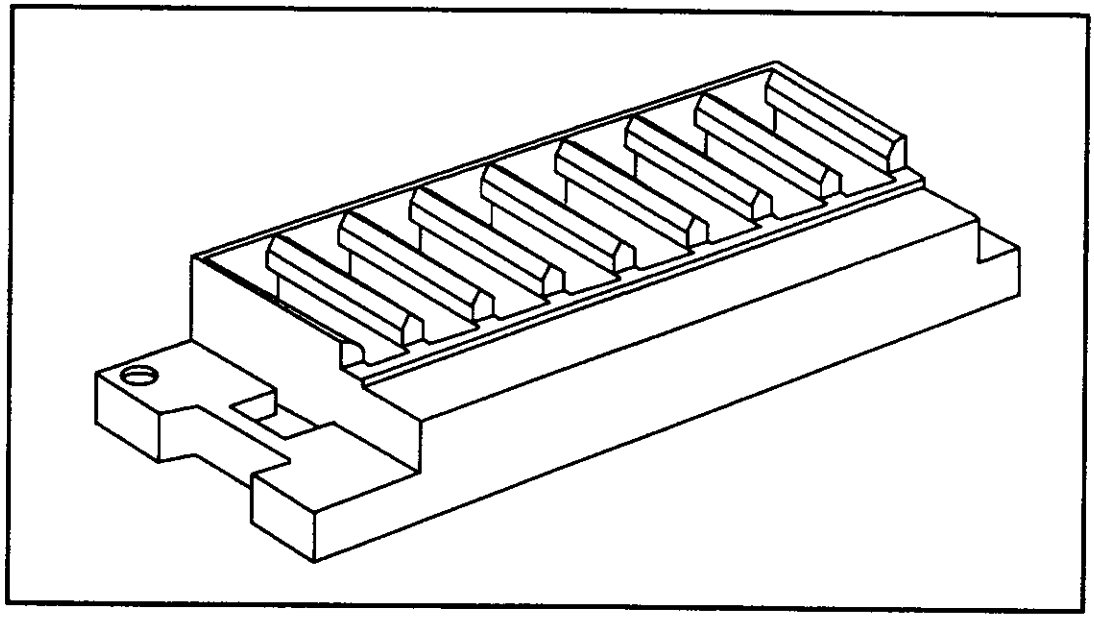


Figure 2.5 - Rail Motherboard

2.3 Rail Installation and Mounting

DANGER

ONLY QUALIFIED ELECTRICAL PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND THE HAZARDS INVOLVED SHOULD INSTALL, ADJUST, OPERATE, OR SERVICE THIS EQUIPMENT. READ AND UNDERSTAND THIS MANUAL IN ITS ENTIRETY BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

DANGER

THE USER IS RESPONSIBLE FOR CONFORMING TO THE NATIONAL ELECTRIC CODE AND ALL OTHER APPLICABLE LOCAL CODES WITH RESPECT TO WIRING, GROUNDING, DISCONNECTS, AND OVERCURRENT PROTECTION. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

Use the following procedure to install a rail:

Step 1. Attach the rail to a flat mounting surface. Figure 2.6 and Appendix A show the mounting dimensions. Figure 2.7 shows two examples of how to attach a rail to its mounting surface. A rail without modules weighs 3 pounds, 15 ounces (1.8 kg).

The rails are designed to be mounted vertically using #10 bolts or studs in an area which allows air flow for cooling.

Step 2. Connect the I/O Rail Interconnect Cable between the rail and the AutoMate processor, Local I/O Head, Remote I/O Head, Local I/O Processor, a Distributed Power PMI Processor, or DCS 5000/AutoMax Remote I/O Head. The cable is 48 inches (1.2 m) long. Be sure the cable will reach the rail as you design your installation. Place the cable in the rail's cable raceway. See figure 2.2.

Figure 2.8 shows some typical rail installations.

Step 3. Ground the rail as explained in section 2.3.1.

Step 4. If your installation requires them, attach the wire channels as described in sections 2.3.2 and 2.3.3.

Step 5. If your installation requires them, connect the rail jumper bars as described in section 2.3.4.

Step 6. Connect the I/O wiring as described in section 2.4.

Step 7. Place the modules' identification stickers on the side of the terminal strip. Insert the modules into the rail's terminal strip and the motherboard. Tighten the screw on the front of the module to securely hold it to the rail.

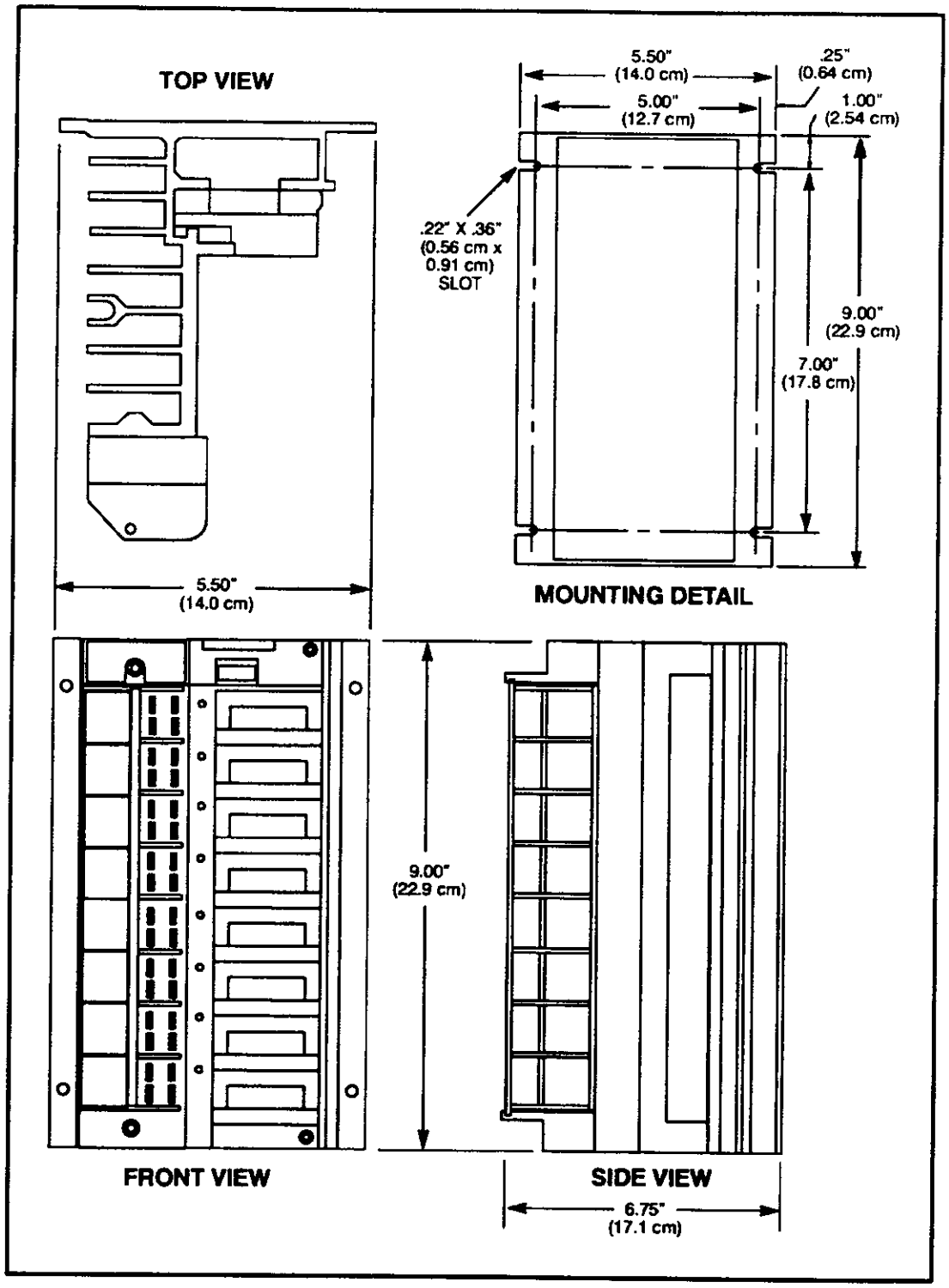


Figure 2.6 - Rail Mounting Dimensions

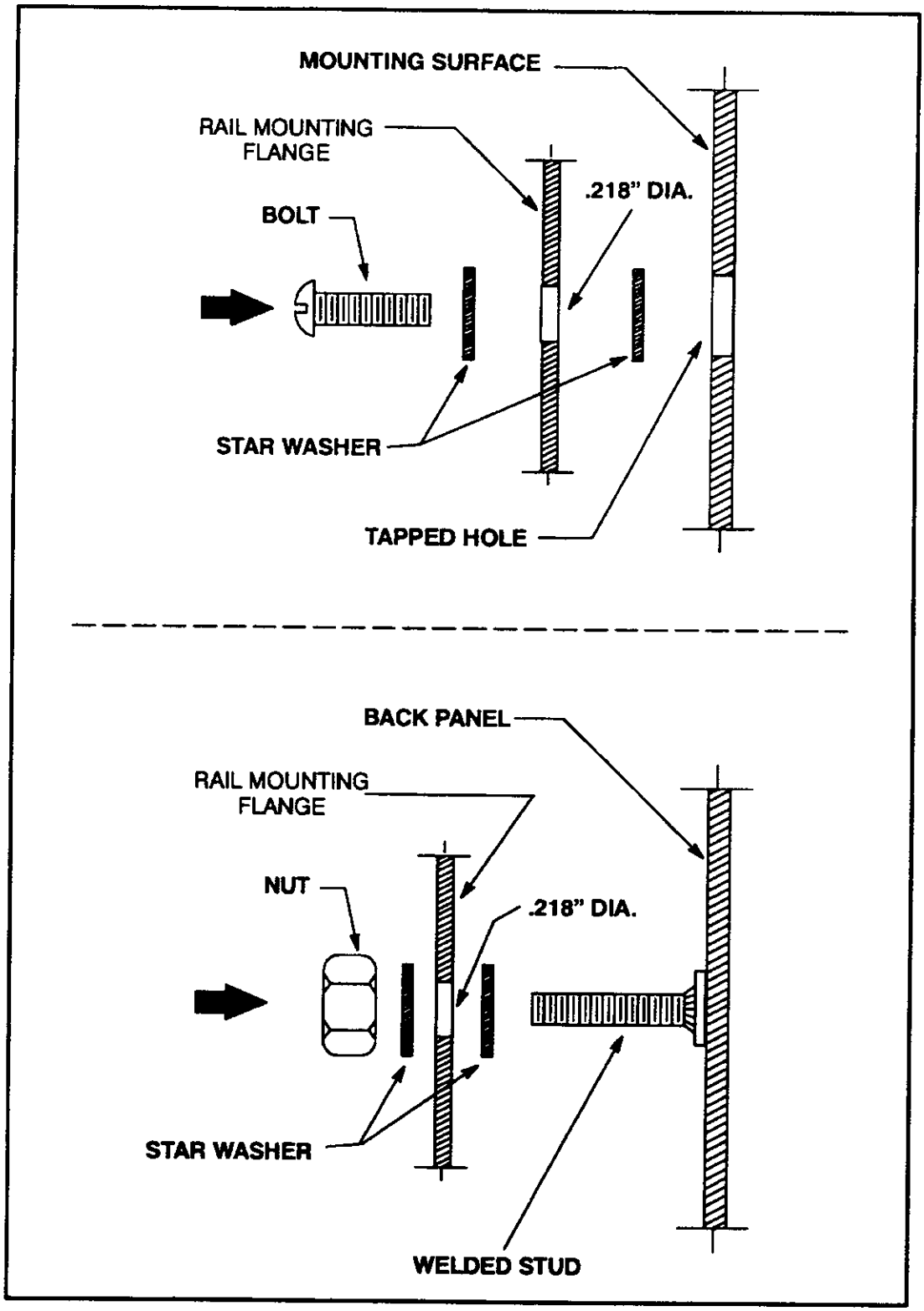


Figure 2.7 - Rail Mounting Examples

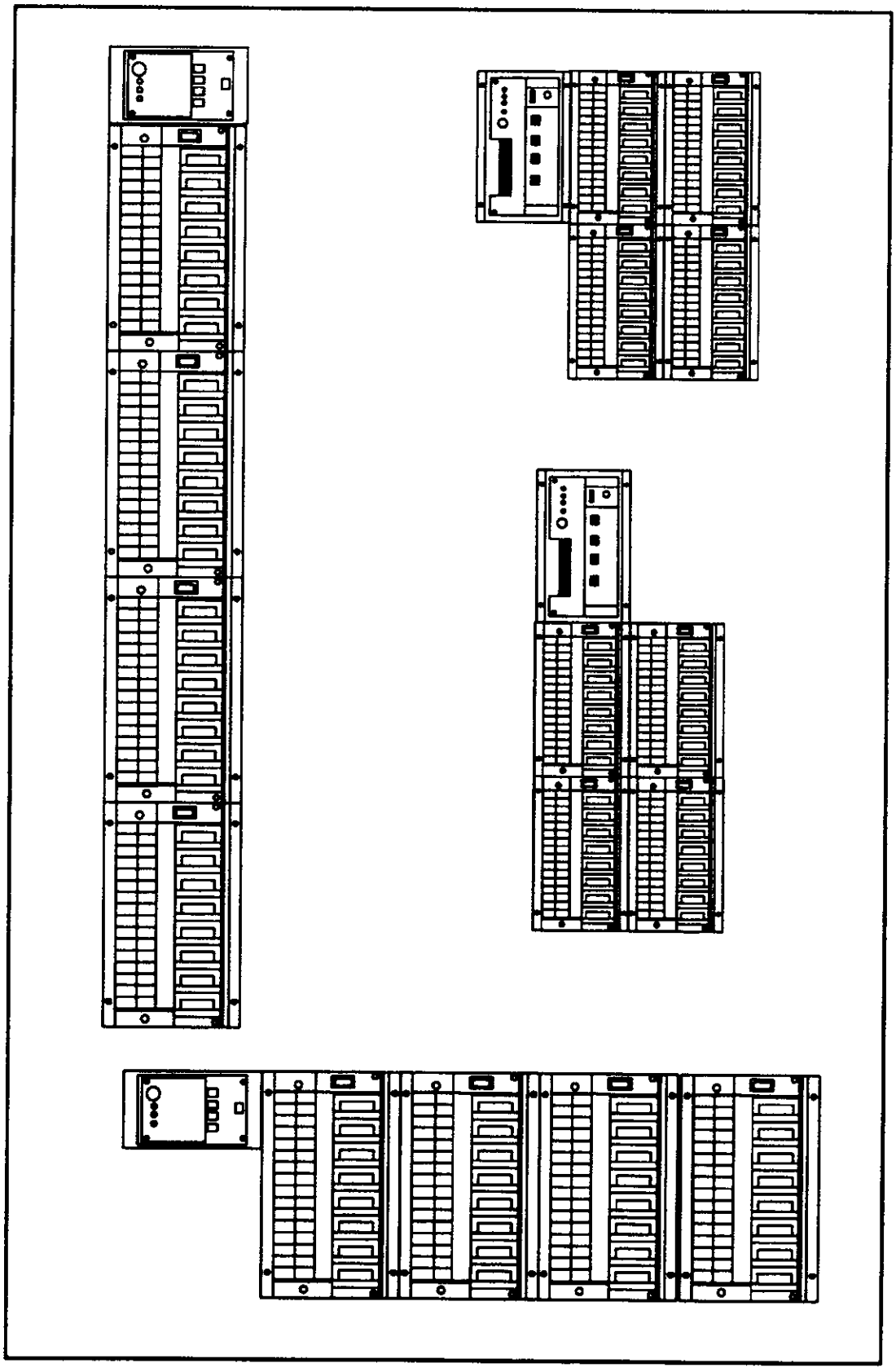


Figure 2.8 - Typical Rail Installations

2.3.1 Grounding

DANGER

THE USER IS RESPONSIBLE FOR CONFORMING TO THE NATIONAL ELECTRIC CODE AND ALL OTHER APPLICABLE LOCAL CODES WITH RESPECT TO WIRING, GROUNDING, DISCONNECTS, AND OVERCURRENT PROTECTION. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

Rails must be grounded for proper operation. Grounding is important in that it not only reduces the risk of electrical shock but it also helps to eliminate electrical noise. The path to ground (using a 1KVA transformer) should have less than 10 milli-ohms of resistance. On each rail there are two #10 studs for grounding purposes. See figure 2.9.

The ground wire must be at least 14 AWG (2.1 mm^2) with green insulation. Use a lug for a secure connection. Place a toothed lock washer under the lug to ensure a good ground.

If the rail is to be mounted on a properly grounded sub-panel, you can ground it through the sub-panel. You ground the rail through the sub-panel by removing the paint from the area where the AutoMate component will be mounted. Place a toothed lock washer between the sub-panel and the rail to ensure a good ground.

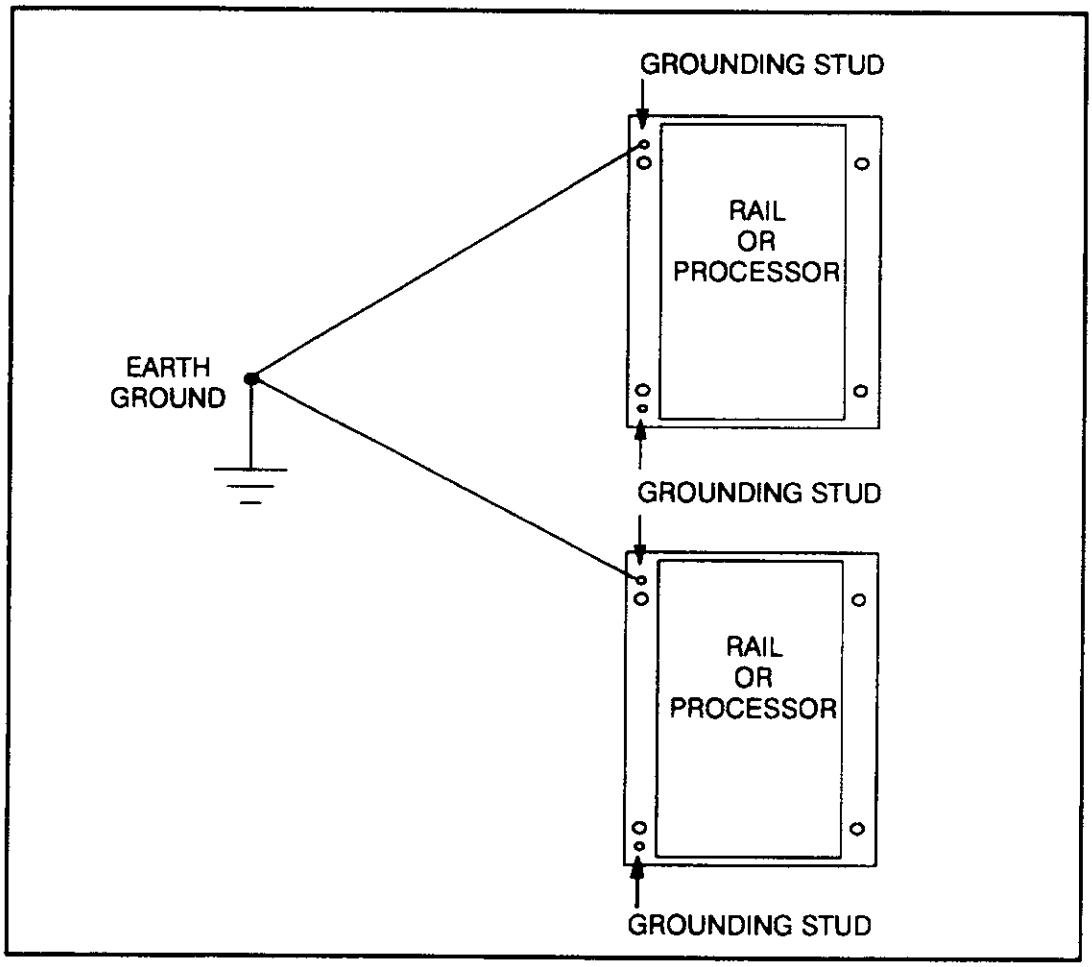


Figure 2.9 - Grounding

2.3.2 Rail Cabling Channel Kit

The I/O Rail Cabling Kit (M/N 45C4) consists of four sections of wire channel that can be mounted to the heat sink on the chassis of four rails.

This channel provides a housing for the field wiring connected to the rail's terminal strip. Figure 2.10 shows the wire channel fastened to the rail. The rail has a threaded groove on one of the cooling fins which accepts 10-32 screws that are 3/8 of an inch long. Screws are provided with each kit to mount the four channel sections. The wire channel measures 9.0 inches (22.9 cm) (H) x 4.0 inches (10.2 cm) (W) x 1.5 inches (3.8 cm) (D).

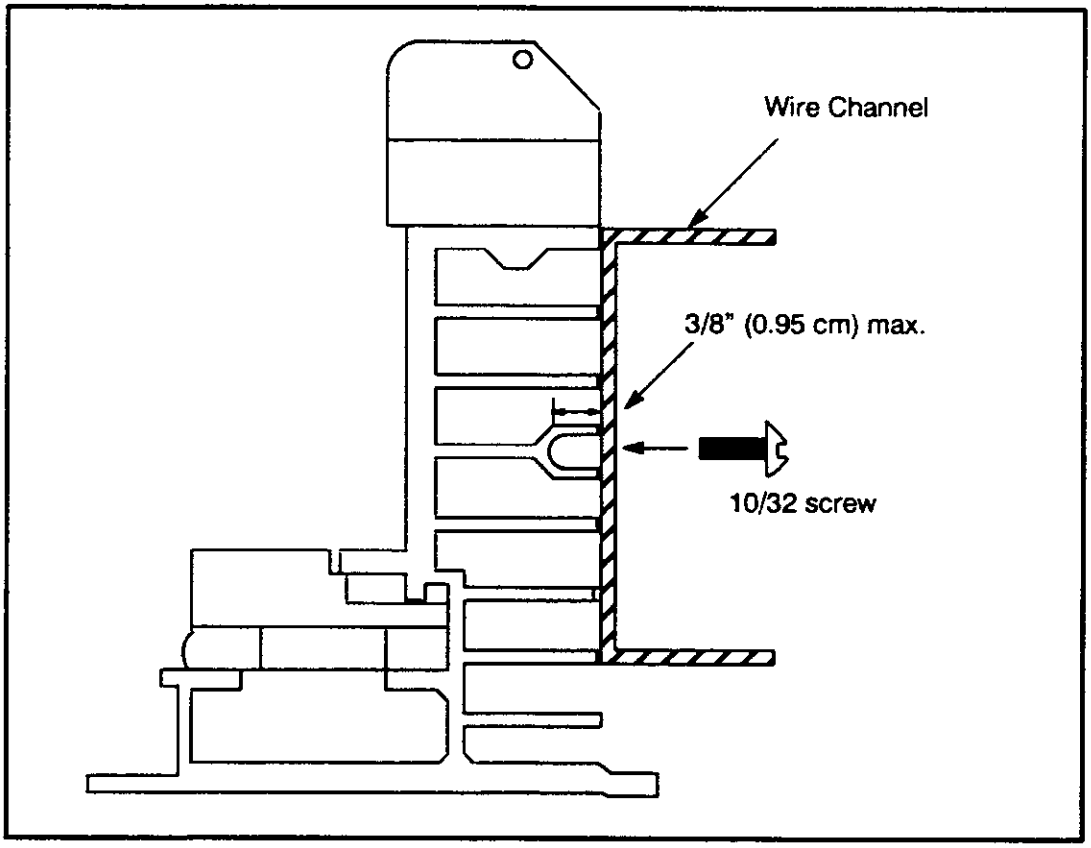


Figure 2.10 - Rail Cabling Channel

2.3.3 Horizontal I/O Cable Channel Kit

The Horizontal I/O Cable Channel Kit (M/N 45C7) is used to route the I/O Rail Cable when the cable cannot be run within the rail cable raceway.

Figure 2.11 shows the horizontal channel's dimensions. Figure 2.12 shows the typical rail layouts where the horizontal channel is used. Each kit contains five sections of the channel.

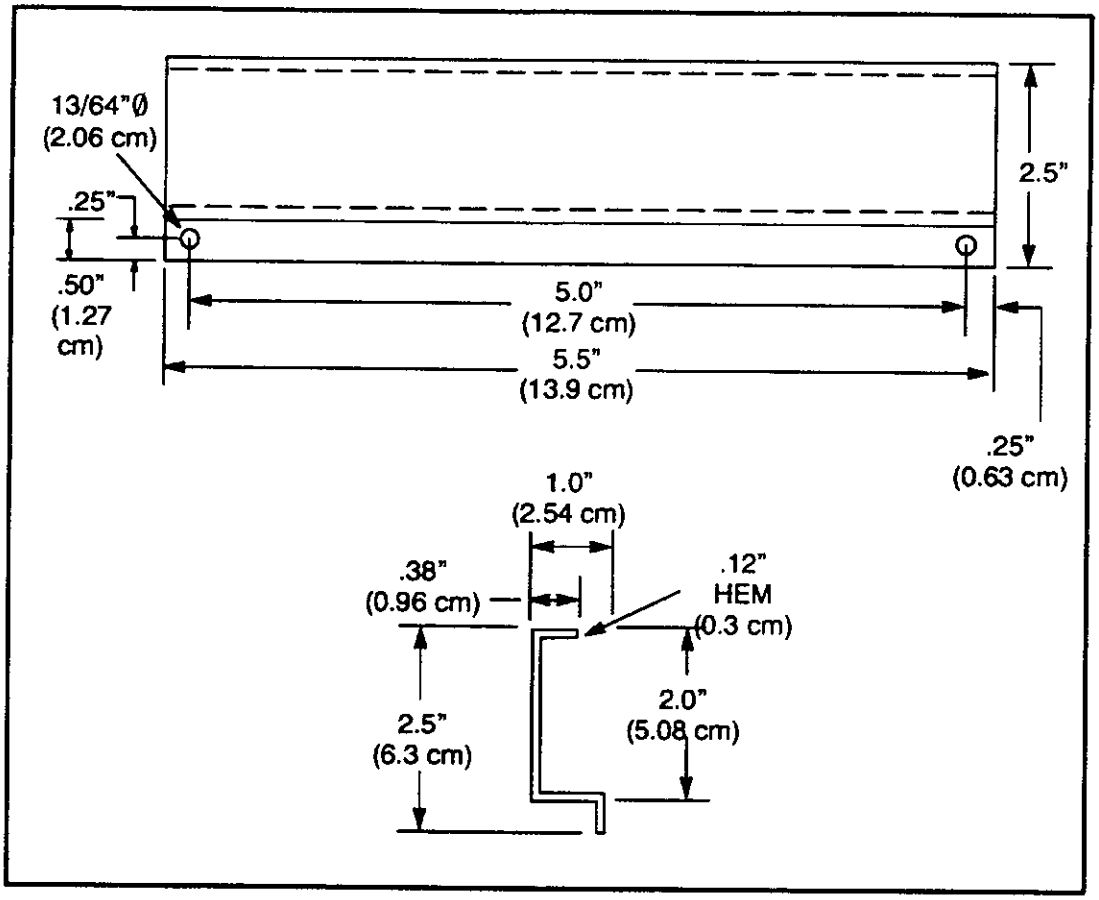


Figure 2.11 - Horizontal Channel Dimensions

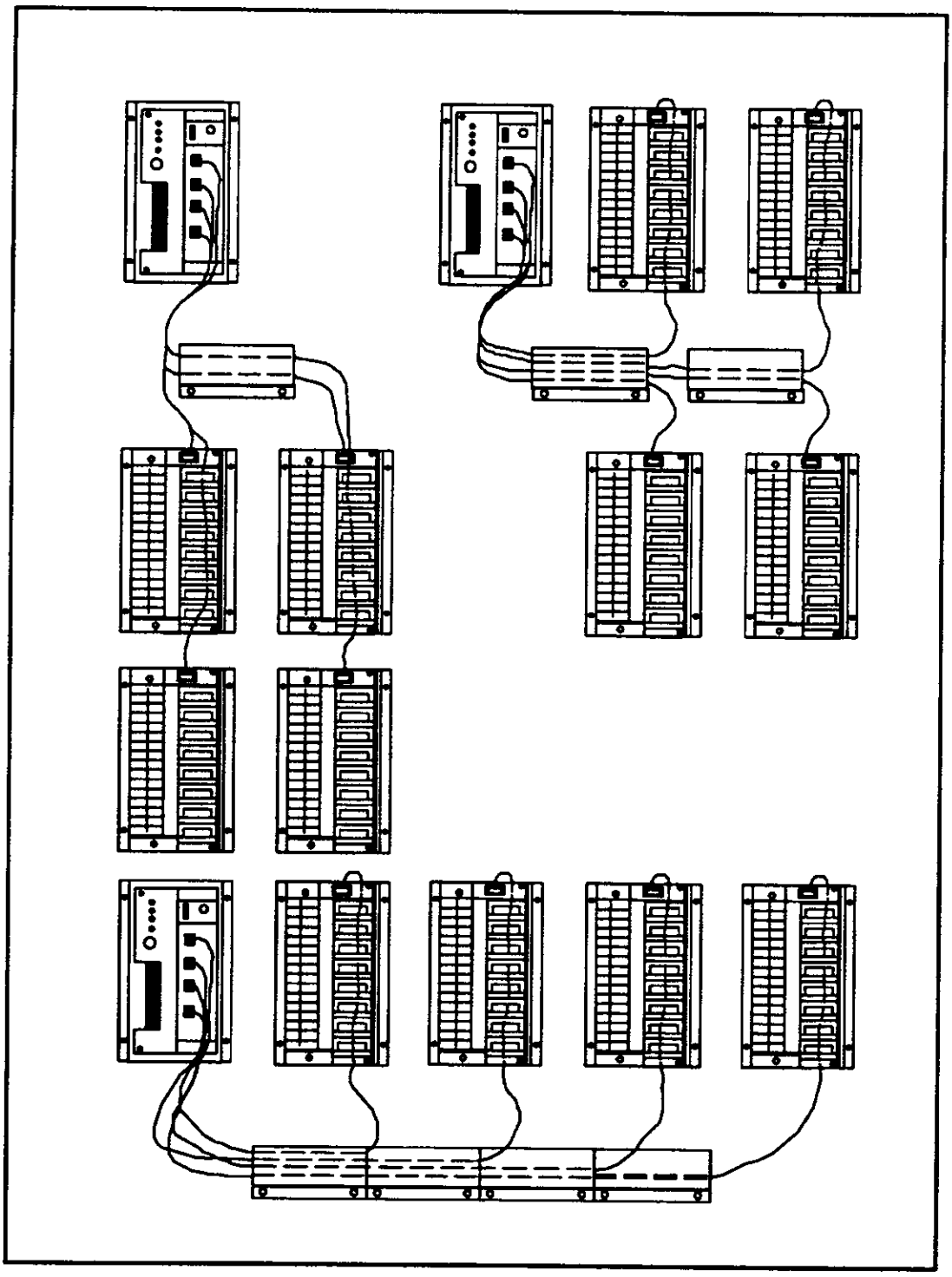


Figure 2.12 - Typical Horizontal Channel Applications

2.3.4 Rail Jumper Bar Kit

A Rail Jumper Bar (M/N 45C3) is used to tie two or more terminals together on the terminal strip. See figure 2.13. You can cut the jumper bar to any length you need for a particular installation.

Note that the jumper bar must be installed on the B terminals of the terminal strip. The jumper bar will not fit on the A terminals properly.

Figure 2.14 shows two jumper bars installed on the terminal strip. For clarity, the terminal strip cover is not shown in the figure.

When using a jumper to tie terminals together for inputs, the jumper is tying together the commons. When being used with outputs, a jumper is tying the power sides together.

DANGER

WHEN A JUMPER BAR IS INSTALLED YOU MAY BE EXPOSED TO HIGH VOLTAGE ON THE TERMINALS EVEN THOUGH THE TERMINAL STRIP COVER IS IN PLACE. DO NOT TOUCH THE TERMINAL STRIP WHEN POWER IS APPLIED. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

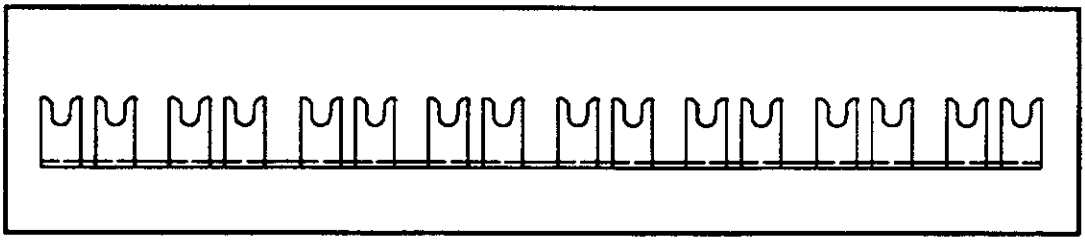


Figure 2.13 - Jumper Bar

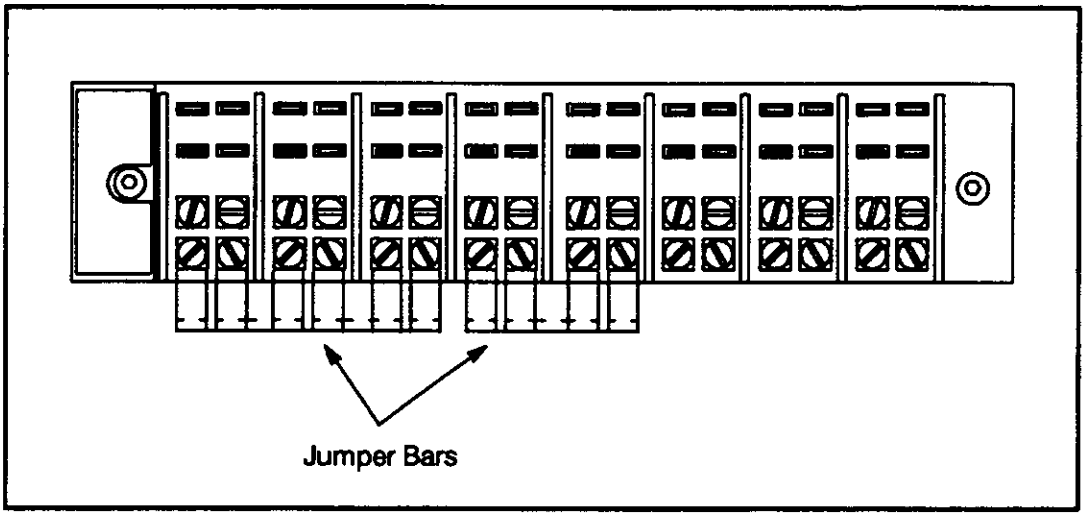


Figure 2.14 - Jumper Bar Installation

2.4 I/O Wiring

I/O wire identification labeling is provided on the terminal strip as described in section 2.2.2. Note that the I/O wiring cannot be larger than 12 AWG (3.30 mm^2) or smaller than 22 AWG (0.32 mm^2). Do not connect more than two wires per terminal. Even-number terminals connect to the modules' even-number channels (00, 02, 04, etc). Odd-number terminals connect to the modules' odd-number channels (01, 03, 05, etc).

Jumper connections can be made with either Jumper Bars (M/N 45C3) or 12 AWG insulated wire. On D-C output modules the internal fuse is located on the B terminal, which should be wired as the hot side. On A-C output modules, the internal fuse is located on the A terminal which should be wired as the hot side.

Figure 2.15 shows an example of the flexibility of the connections between the rail and field devices. Inputs are addresses 00 to 11. Outputs are addresses 12 to 17. The first seven inputs (00-06) have their commons connected together. The next three inputs have separate commons. Loads connected to outputs 12 through 15 are shown paralled. The last two outputs are shown individually isolated.

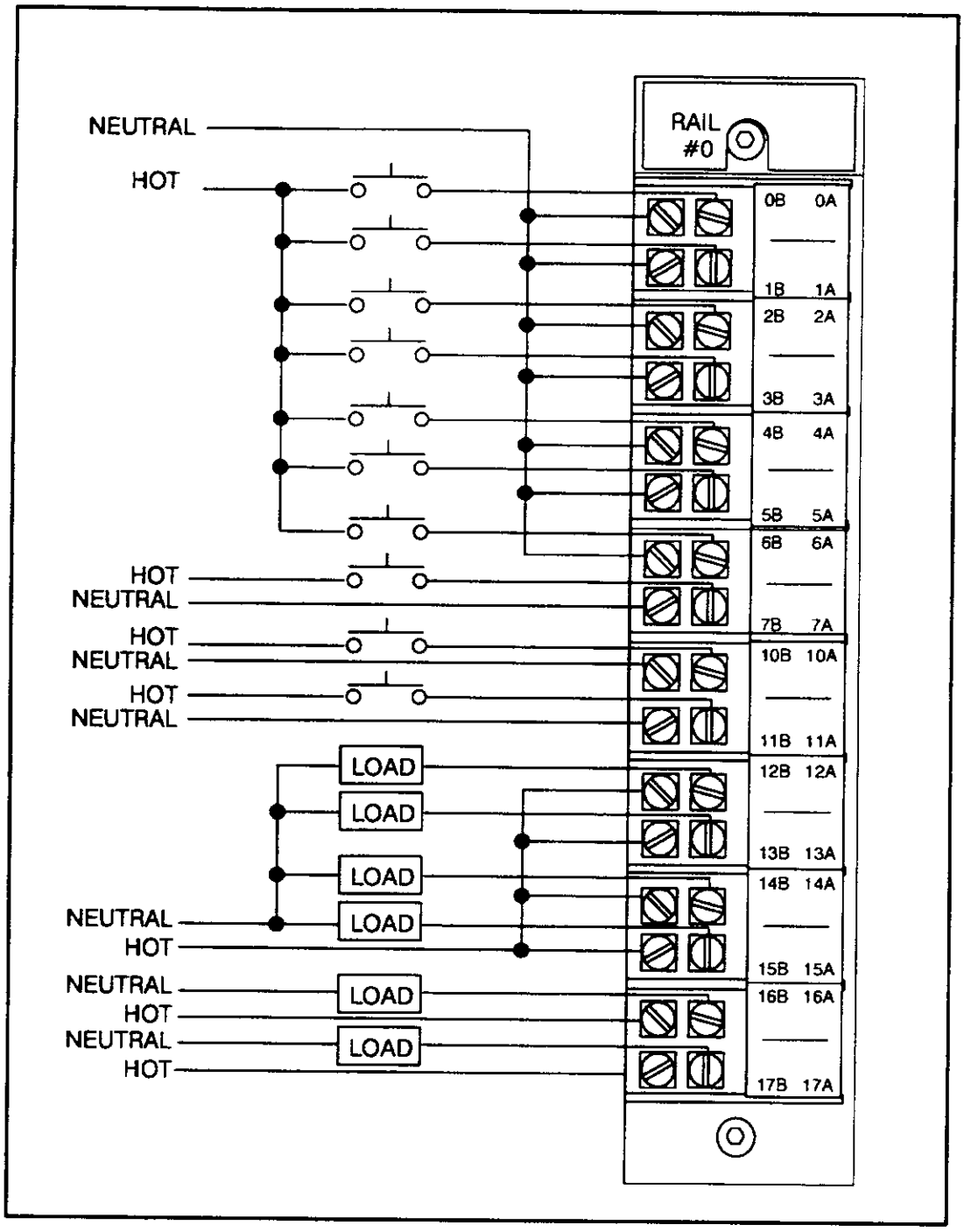


Figure 2.15 - Field Wiring Example

Use the following procedure to connect the I/O wiring:

DANGER

THE EQUIPMENT IS AT LINE VOLTAGE WHEN POWER IS CONNECTED. BE SURE TO DISCONNECT ALL POWER SOURCES BEFORE CONNECTING THE I/O WIRES TO THE RAIL. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

DANGER

THIS EQUIPMENT MAY BE FED FROM MORE THAN ONE POWER SOURCE. DO NOT ASSUME THAT IT IS SAFE TO WORK ON WHEN ONLY THE MAIN POWER SOURCE IS DISCONNECTED. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

Step 1. Plan your wiring and jumper connections.

Step 2. Loosen the terminal screws to which the field wiring will be connected.

Step 3. Locate the wire that is to be fastened to terminal 17B of the rail.

Step 4. Bend the wire to create a neat wire bundle. If a wire tray is used, be sure the wire bundle is in the tray.

Step 5. Cut the wire. The wire should be 5/16 of an inch (8 mm) longer than is needed.

Step 6. Strip 5/16 of an inch of insulation from the end of the wire.

Step 7. Insert the wire under the terminal's pressure plate.

Step 8. Insert the jumper bar or wire, if used.

Step 9. Tighten the screw securely.

Step 10. Locate the wire that is to be fastened to terminal 17A of the rail.

Step 11. Bend the wire to create a neat wire bundle.

Step 12. Cut the wire 5/16 of an inch longer than is needed.

Step 13. Strip 5/16 of an inch of insulation from the end of the wire.

Step 14. Insert the wire under the terminal's pressure plate.

Step 15. Insert the jumper bar or wire, if used.

Step 16. Tighten the screw securely.

Repeat steps 2 through 16 until all of the wires are attached.

Step 17. Check your wiring and ground connections.

Step 18. Mark the terminal strip cover label with the proper wire numbers.

Step 19. Close the terminal strip cover over the terminals.

DANGER

IF THE TERMINAL STRIP COVER IS NOT IN PLACE, YOU MAY BE EXPOSED TO HIGH VOLTAGE ON THE TERMINALS. BE SURE THE TERMINAL COVER IS IN PLACE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

Step 20. Attach the module identification stickers to the side of the terminal strip next to the modules.

Step 21. Plug in the I/O modules by carefully pushing them into the rail's motherboard and terminal strip connectors. Secure the modules to the rail by tightening the screw on the front of each module.

Step 22. Restore power and test the system for proper operation.

3.0 DIGITAL I/O MODULES

3.1 Introduction

This chapter describes the various modules which plug into the I/O rails (M/N 45C1). Specifications and wiring examples for each are provided.

3.2 Dual A-C/D-C Input Module

The Dual A-C/D-C Input Module provides the needed interface circuitry between the on/off devices (pushbuttons, selector switches, limit switches) and the logic levels required by the programmable controller. See figure 3.1. There are three versions of the module:

- 120 VAC/DC (M/N 45C40)
- 240 VAC/DC (M/N 45C43)
- 24 VAC/DC (M/N 45C44)

The module provides two individually isolated input channels. Each channel will accept an A-C signal (48 to 63 Hz) or D-C signal of the specified voltage. The logic will be turned on when the input signal reaches the predetermined threshold. Photo-couplers electrically isolate the input signal from the logic signal.

There are two LED indicators for each input channel. The green POWER indicator is illuminated when power is applied to the input terminals by the input device. The yellow LOGIC indicator is illuminated when the logic signal has been optically isolated from the input signal and has been recognized by the module.

A minimum-current resistor at each input insures that sufficient current is drawn through the input device to inhibit contact-film build up.

Filtering is provided to attenuate noise which might affect module operation. Refer to figure 3.2 for a simplified schematic of an input channel.

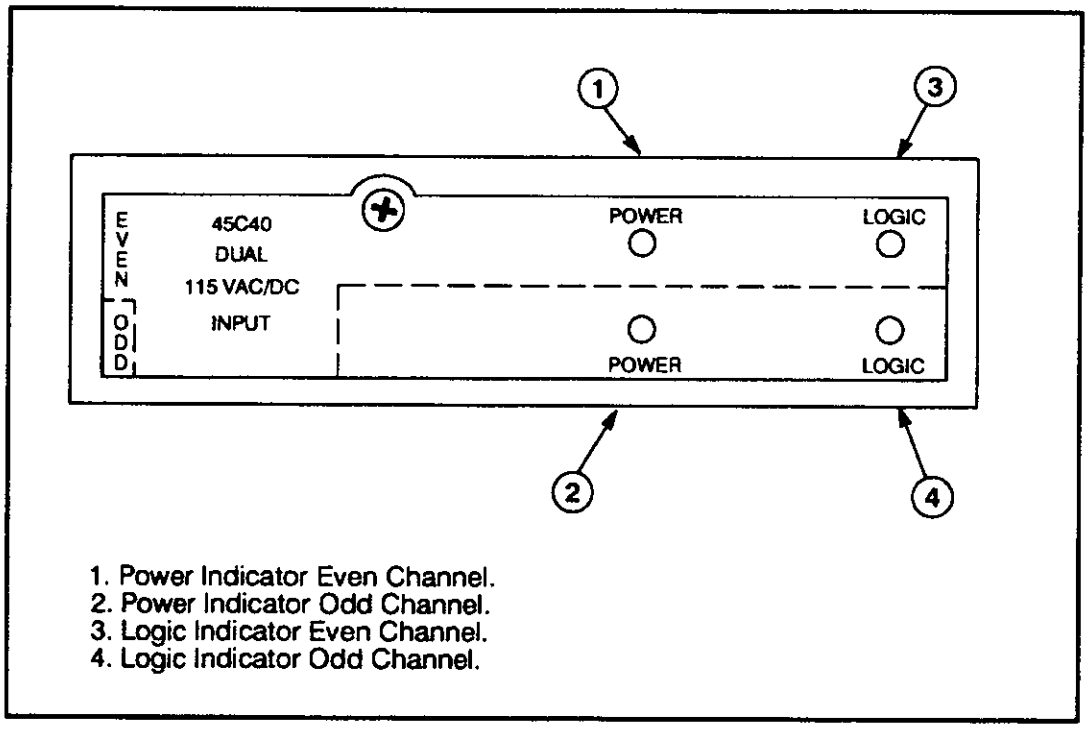
The input field wiring connects to the terminal strip on the rail. See figure 3.3 for a field wiring example.

A stick-on label is provided which identifies the type of module you have. Place this label on the right-hand side of the terminal strip. When the label is installed and the module is removed, the label will be visible and will identify the type module that needs to be replaced.

Module specifications are in Table 3.1.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.



1. Power Indicator Even Channel.
2. Power Indicator Odd Channel.
3. Logic Indicator Even Channel.
4. Logic Indicator Odd Channel.

Figure 3.1 - Dual A-C/D-C Input Module

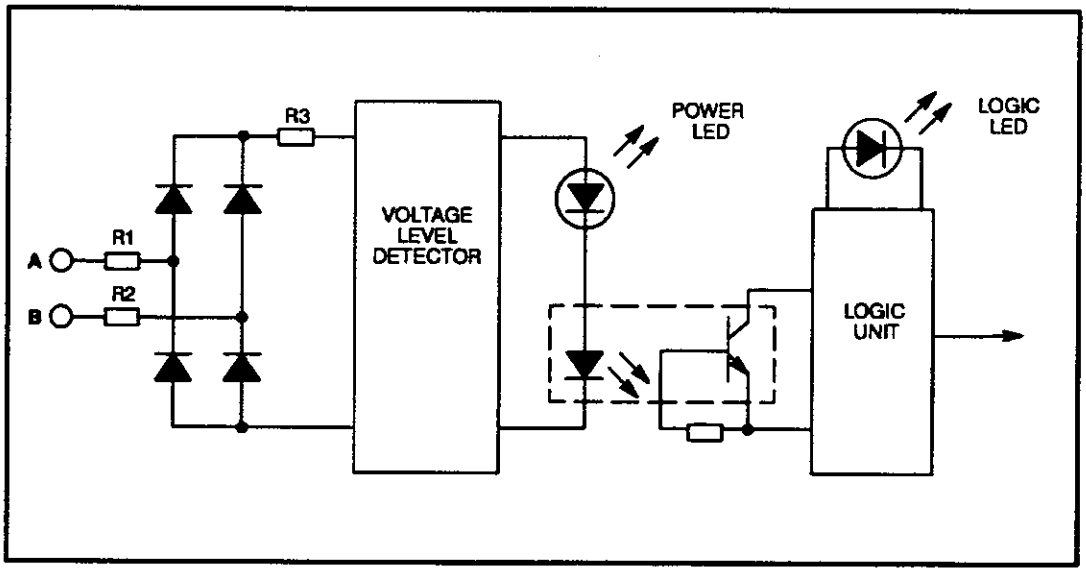


Figure 3.2 - Dual A-C/D-C Input Module Channel Schematic

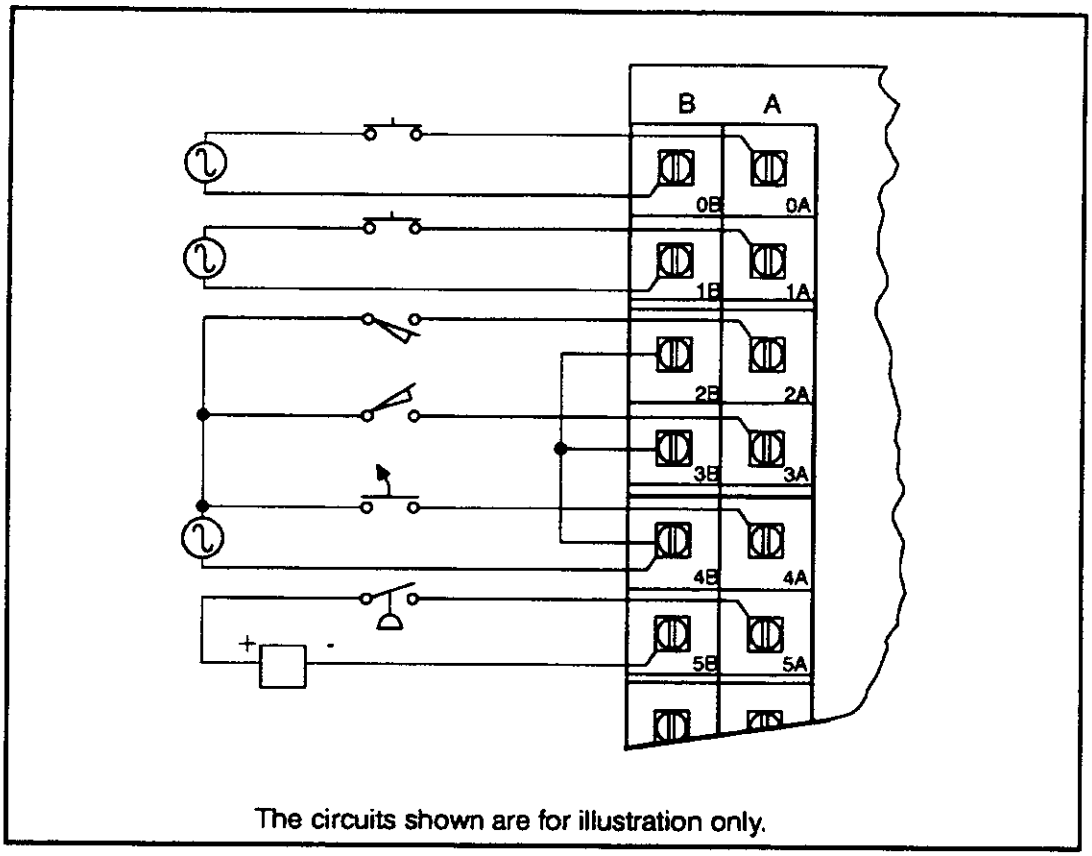


Figure 3.3 - Dual A-C/D-C Input Module Field Wiring Example

Table 3.1 - Dual A-C/D-C Input Module Technical Specifications

Module Location

- Plugged Into an I/O Rail (M/N 45C1)

Ambient Conditions

- Operating Temperature (at the module): 32 to 140°F (0 to 60°C)
- Storage Temperature: -4 to 185°F (-20 to 85°C)
- Humidity: 5 to 90% (Non-Condensing)

Module Dimensions

- Height: $^{13}/_{16}$ inches (2.1 cm)
- Width: 3 inches (7.6 cm)
- Depth: $6^{1}/_{16}$ inches (15.5 cm)
- Weight: 5 ounces (140 grams)

Input Circuit

- Number of Inputs: 2 Channels
- Response Time: 9.5ms at 60 HZ
- Turn-On Time: 2.0ms after threshold is exceeded
- Turn-Off Time: 19.0ms after threshold is removed
- Electrical Isolation: (1) 2500 V (RMS) isolation between the input circuit and the logic circuit.
  (2) 1000 V (RMS) channel to channel isolation
- Frequency: D-C or 48/63 Hz
- Maximum Short Circuit Power Source: 10KVA

	M/N 45C40	M/N 45C43	M/N 45C44
Nominal A-C/D-C Voltages	115V	230V	24V-28V
On Threshold A-C Voltages	80V	150V	16.5V
On Threshold D-C Voltages	108V	203V	20V
Off Threshold A-C Voltages	60V	120V	10.5V
Off Threshold D-C Voltages	83V	165V	14.5V
Maximum Input Voltage	130V	255V	40V
Impedance at Nominal Voltage	18.1K Ohms	52.8K Ohms	3.6K Ohms
Power Dissipation at Nominal Voltage (Watts per Input)	0.73W	1.0W	0.16W-0.22W
Input Current at Nominal Voltage	6.3 mA	4.4 mA	6.6 mA-7.8 mA
Maximum Off-State Current	3 mA	2 mA	1 mA
Maximum Wire Length	1000 Ft	500 Ft	1000 Ft

3.3 Dual Electronic Input Module

The Dual Electronic Input Module (M/N 45C42) provides the interface circuitry between the logic-level signals from the high speed electronic switches and photo cells and the logic level required by the programmable controller. See figure 3.4.

This input module provides two individually-isolated inputs. Photo-couplers electrically isolate the input signal from the logic signal. See figure 3.5 for a simplified input schematic.

There are two LEDs for each input channel. The green POWER indicator is illuminated when power is applied to the input terminals by the input device. The yellow LOGIC indicator is illuminated when the logic signal has been optically-isolated from the input signal and has been recognized by the input module.

The input field wiring connects to the terminal strip on the rail. See figure 3.6 for a field wiring example.

Note that this module must only be used in local I/O configurations. Therefore, it must be installed in an I/O Rail which is connected either directly to an AutoMate Processor I/O port or to a Local I/O Head which is in turn connected directly to an AutoMate Processor I/O port. This module may not function properly in remote I/O configurations.

Also note that when an I/O Rail containing a Dual Electronic Input Module (M/N 45C42) is to be connected to a Local I/O Head (M/N 45C22, 61C22, 61C22A), the I/O Rail must be connected to Local I/O Head ports 1, 2, or 3. If the I/O Rail is connected to port 0, the Local I/O Head may fail to detect all valid input signals from the I/O Rail.

Figure 3.7 shows a timing diagram of input signals received by this module and the output signals sent to the processor in relation to the end-of-scan signal.

Input signals must be a minimum of 3.5 volts D-C to a maximum peak of 21 volts with a minimum pulse width of 500 microseconds.

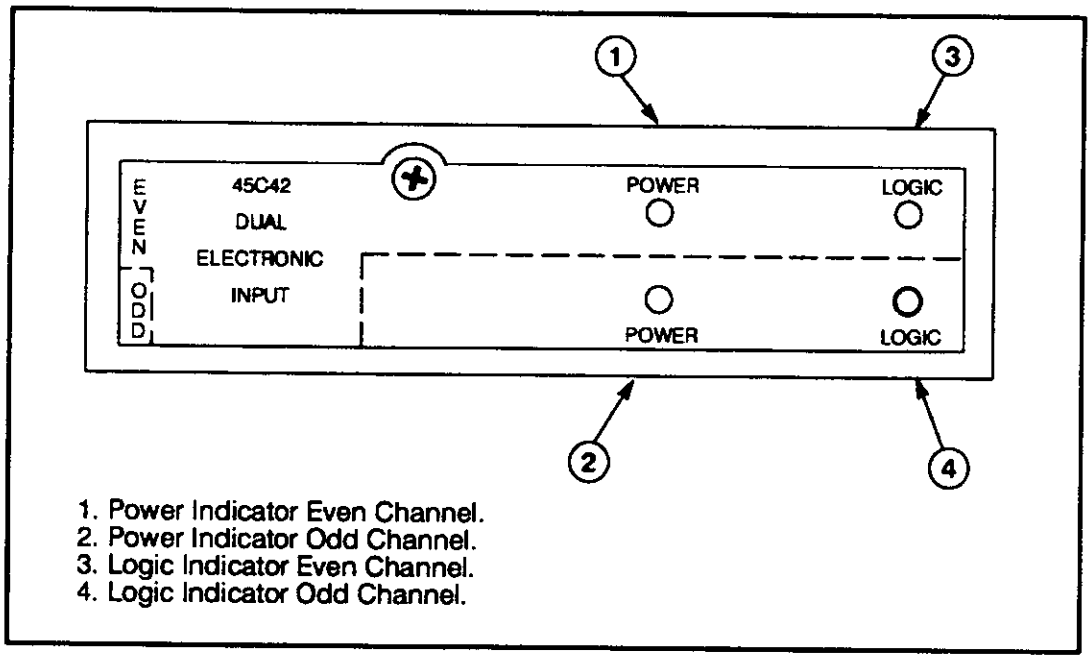
The module stretches received pulses that are greater than 500 microseconds but are less than one scan period. The stretched time will be one scan period as shown by T1. An input signal will appear as a typical input if it is greater than the threshold voltage and is longer than one scan period as shown by T2. This module will also detect a level change from high to low as long as the low level is maintained for 500 microseconds as shown by T3. If multiple pulses are received within a scan period, only the first pulse will be detected and the remaining pulses will be ignored as shown by T4 and T5. The system can only count pulses or level changes at less than one half the scan frequency as shown by T6. If pulses are fed every scan as shown by T7, the result is an output every other scan.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

A stick-on label is provided which identifies the type of module you have. Place this label on the right-hand side of the terminal strip. When the label is installed and the module is removed, the label will be visible and will identify the type module that needs to be replaced.

Module specifications are in Tables 3.2 and 3.3.



1. Power Indicator Even Channel.
2. Power Indicator Odd Channel.
3. Logic Indicator Even Channel.
4. Logic Indicator Odd Channel.

Figure 3.4 - Dual Electronic Input Module

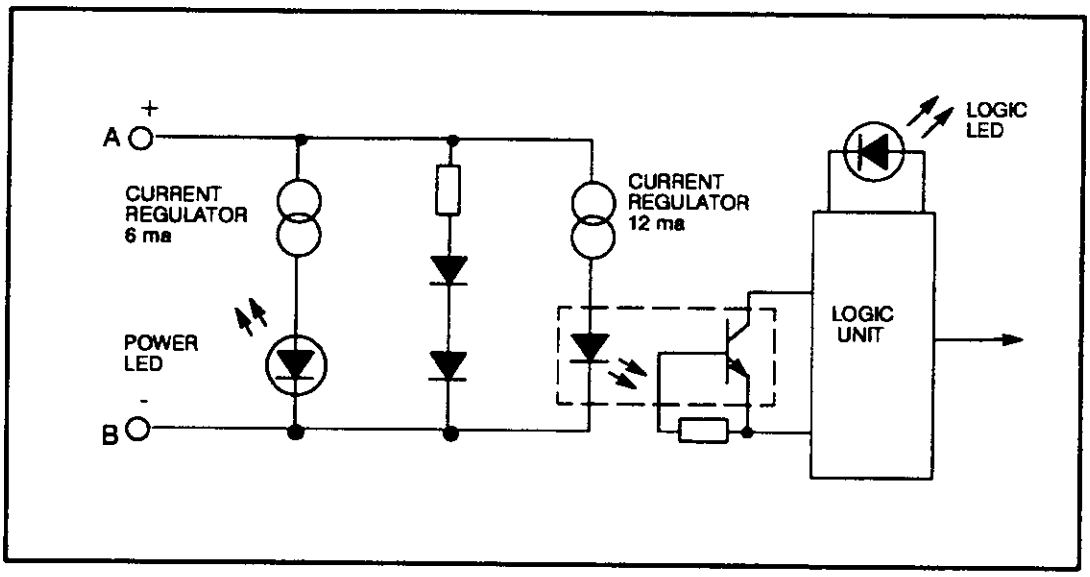


Figure 3.5 - Schematic of a Dual Electronic Input Module

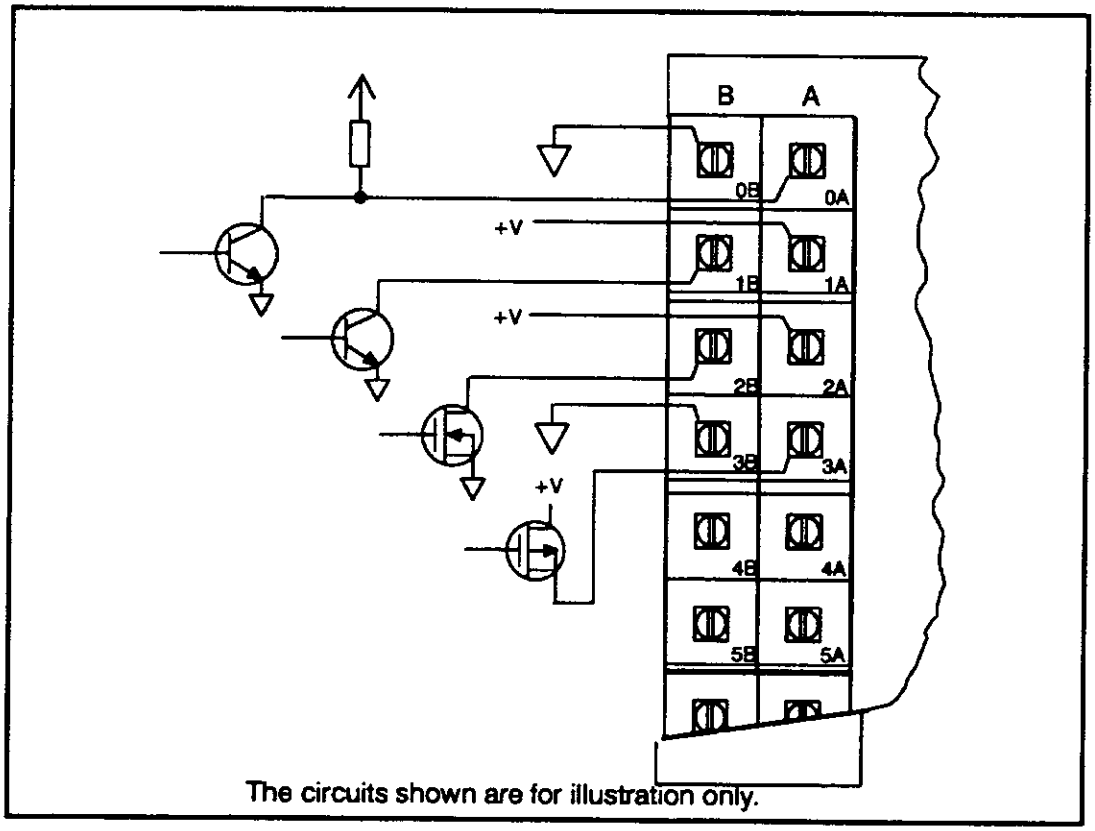


Figure 3.6 - Dual Electronic Input Module Field Wiring Example

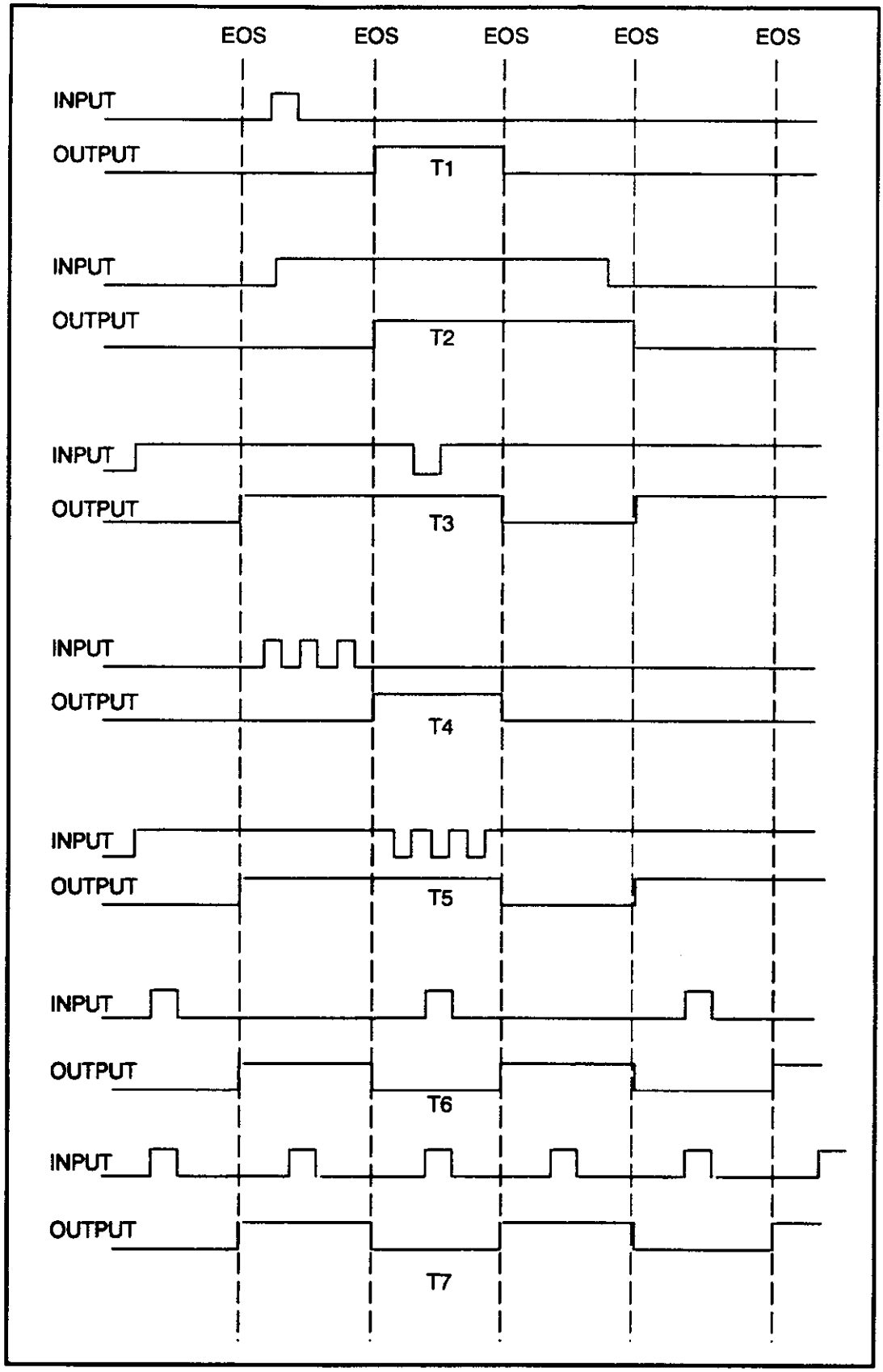


Figure 3.7 - Dual Electronic Input Module Timing Diagram

Table 3.2 - Dual Electronic Input Module Technical Specifications

Module Location

- Plugged into an I/O Rail (M/N 45C1). The I/O Rail must be connected either directly to an AutoMate Processor I/O port or to a Local I/O Head which is in turn connected directly to an AutoMate Processor I/O port.

  Note that when an I/O Rail containing a Dual Electronic Input Module (M/N 45C42) is to be connected to a Local I/O Head (M/N 45C22, 61C22, 61C22A), the I/O Rail must be connected to Local I/O Head ports 1, 2, or 3. If the I/O Rail is connected to port 0, the Local I/O Head may fail to detect all valid input signals from the I/O Rail.

Ambient Conditions

- Operating Temperature (at the module): 32 to 140°F (0 to 60°C)
- Storage Temperature: -4 to 185°F (-20 to 85°C)
- Humidity: 5 to 90% (Non-Condensing)

Module Dimensions

- Height: $^{13}/_{16}$ inches (2.1 cm)
- Width: 3 inches (7.6 cm)
- Depth: $6^{1}/_{16}$ inches (15.5 cm)
- Weight: 5 ounces (140 grams)

Input Circuit

- Number of Inputs: 2 Channels
- Minimum Working Voltage: 3.5 VDC
- Maximum Working Voltage: 15V RMS (21.1V peak) or Class II power source limited to 24VDC
- On-Voltage: 3.5 VDC or greater
- Off-Voltage: 1.0V or less
- Power Dissipation: 0.76W (Maximum) at 24 VDC per input channel
- Minimum Pulse Width: 500 Microseconds
- Electrical Isolation: (1) 2500 V (RMS) isolation between the input circuit and the logic circuit.
  (2) Each input is electrically isolated from the other.

Table 3.3 - Dual Electronic Input Module Current and Voltage Specifications

	Input Current		
	Minimum	Typical	Maximum
Input Voltage = 3.5V	15.5 ma	19.4 ma	23.3 ma
Input Voltage = 5V	15.9 ma	19.9 ma	23.9 ma
Input Voltage = 10V	17.2 ma	21.5 ma	25.8 ma
Input Voltage = 15V	18.6 ma	23.2 ma	27.8 ma
Input Voltage = 20V	19.8 ma	24.8 ma	29.8 ma
Input Voltage = 24V	21.1 ma	26.4 ma	31.7 ma

3.4 Voltage Comparator Module

The Voltage Comparator Module (M/N 45C46) determines if the level of an analog voltage (A) is greater than or less than that of a reference voltage (B). The module's even channel is energized (equal to 1) when A is greater than B. The module's odd channel is energized (equal to 1) when A is less than B. The LED indicators on the front of the module indicate which comparison is true. See figure 3.8. Refer to figure 3.9 for a simplified voltage comparator schematic.

Connect the analog voltage (A) to the even channel terminals. Terminal A is the plus (+) terminal and terminal B is the signal common. The reference voltage (B) may either be an external voltage signal or the adjustable power supply in the comparator module.

The voltage comparator field wiring connects to the terminal strip on the rail. See figure 3.10 for a field wiring example.

If an external voltage is used for the reference voltage (B), its positive line (+) is connected to terminal A of the odd channel and its common is connected to the even channel's B terminal.

Note that the module's internal reference voltage cannot be used as an external voltage source for other equipment.

If the internally-generated voltage is used for the reference voltage (B), you need to insert a jumper from the odd channel's A terminal to the B terminal. You set the internally-generated voltage by adjusting a 20-turn potentiometer through the access hole on the left-hand side of the module's front cover. You can connect a voltmeter between the odd and even channels' B terminals to accurately set the internal reference voltage.

The module has an adjustable deadband between the A and B voltages. The deadband setting is symmetrical for both input channels. A 20-turn potentiometer is accessible on the right hand side of the module's front cover which allows you to adjust the deadband width from 0 volts to 3 volts.

Note that when the deadband adjustment potentiometer is fully clockwise, the deadband width is at maximum. When fully counter-clockwise, the deadband width is at minimum. See figure 3.11.

A stick-on label is provided which identifies the type of module you have. Place this label on the right-hand side of the terminal strip. When the label is installed and the module is removed, the label will be visible and will identify the type module that needs to be replaced.

Module specifications are in Table 3.4.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

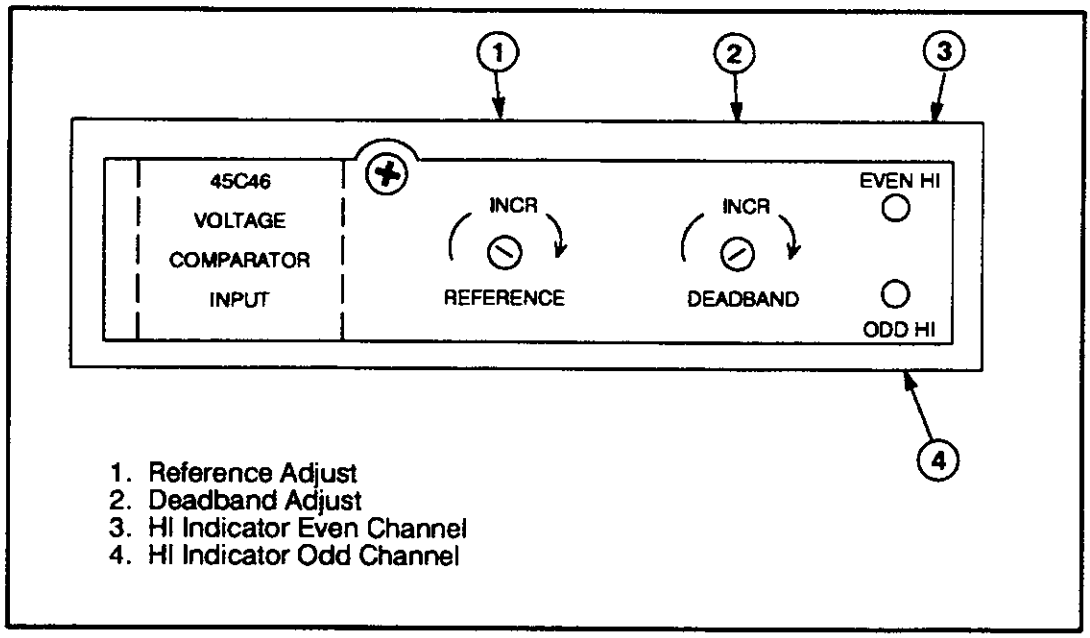


Figure 3.8 - Voltage Comparator Module

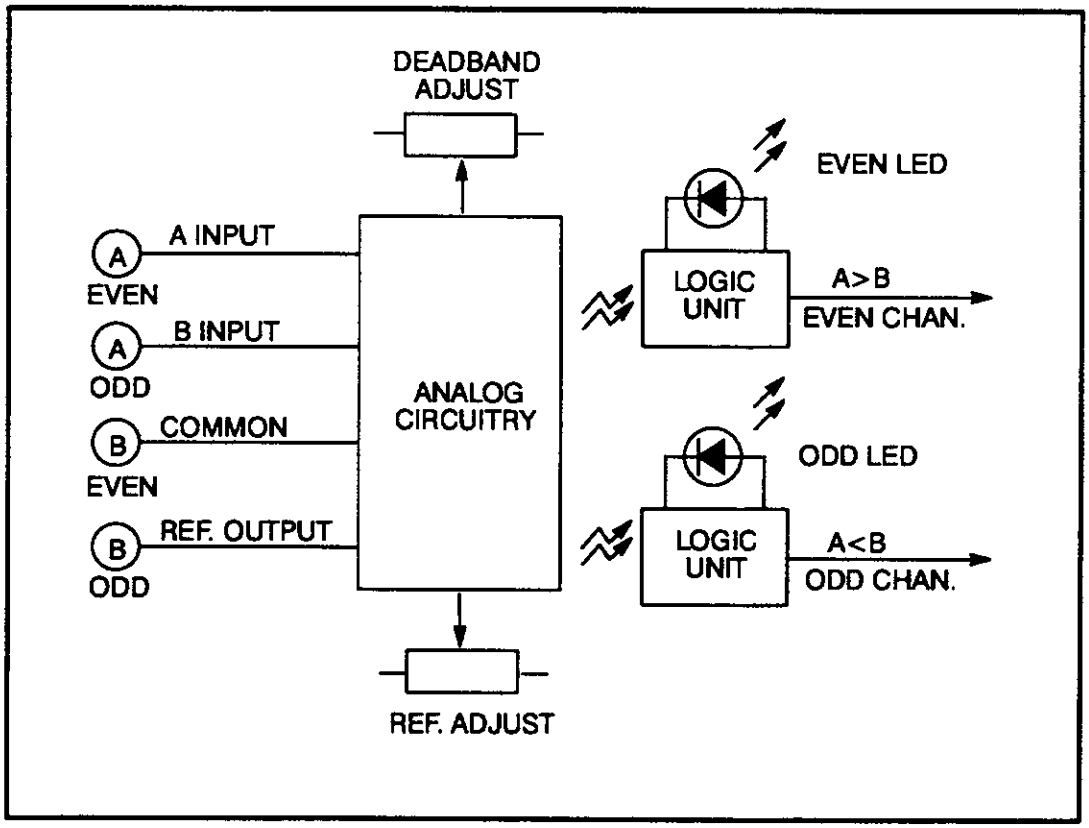


Figure 3.9 - Voltage Comparator Schematic

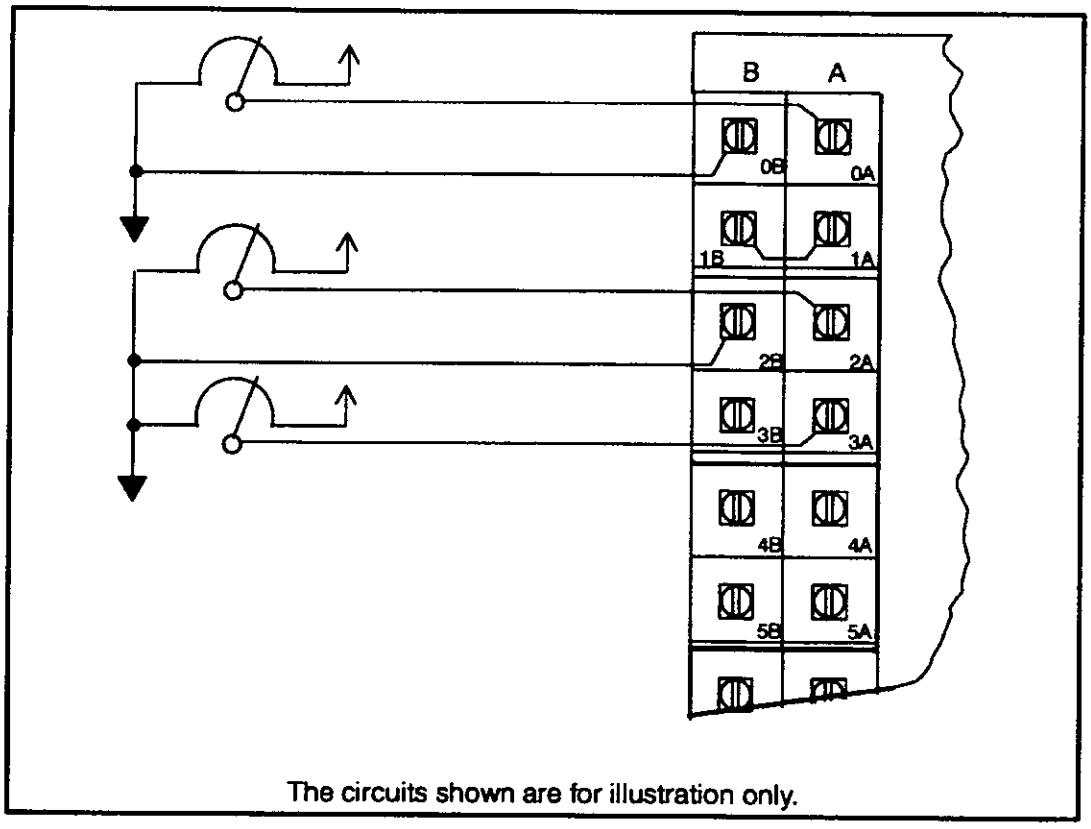


Figure 3.10 - Voltage Comparator Module Field Wiring Example

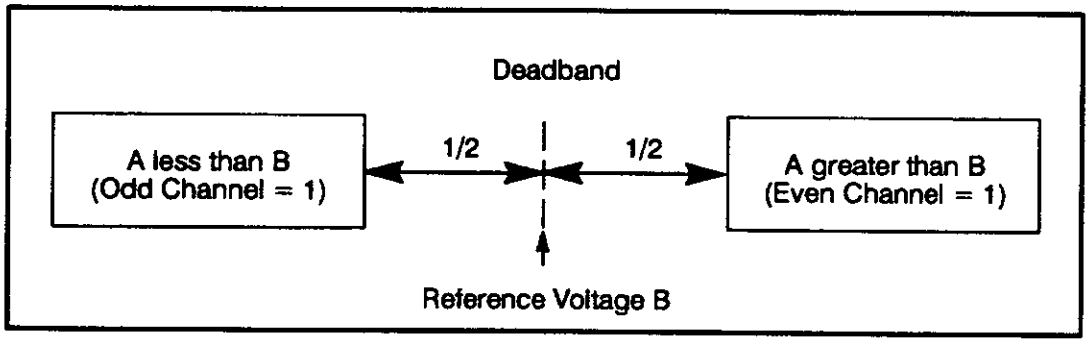


Figure 3.11 - Deadband Adjustment

Table 3.4 - Voltage Comparator Module Technical Specifications

Module Location

- Plugged into an I/O Rail (M/N 45C1)

Ambient Conditions

- Operating Temperature (at the module): 32 to 140°F (0 to 60°C)
- Storage Temperature: -4 to 185°F (-20 to 85°C)
- Humidity: 5 to 90% (Non-Condensing)

Module Dimensions

- Height: $^{13}/_{16}$ inches (2.1 cm)
- Width: 3 inches (7.6 cm)
- Depth: $6^{1}/_{16}$ inches (15.5 cm)
- Weight: 5 ounces (140 grams)

Input Circuit

- Channels: User-supplied input voltage (Vin).
  User-supplied reference voltage (Vext).
  Internally-generated adjustable reference voltage (Vint.)
- Vin Voltage Range: 0.02 VDC to 10 VDC
- Vin and Vext Input Impedance: 100K Ohms
- Vint Voltage Range: 0 VDC to 10 VDC (adjustable from module faceplate)
- Vint Stability: +/- 20mV
- Vint Minimum Load Resistance: 1000 Ohms
- Deadband Voltage Range: 0 VDC to 3 VDC (adjustable from module faceplate)
- EVEN LED lights if: Vin > Vint or Vext plus deadband voltage
- ODD LED lights if: Vin < Vint or Vext minus deadband voltage
- Power Dissipation: 0.2W per module
- Electrical Isolation: (1) 1600V (RMS) isolation between the input circuit and the logic circuit.
  (2) Each input is electrically isolated from the other.

3.5 Dual A-C Output Module

The Dual A-C Output Module provides two individually-isolated outputs for switching A-C loads, such as: motor starters, solenoids, or other control devices. Each output is rated at 2 Amps continuous. See figure 3.12. There are three versions of the module:

- 115 VAC (M/N 45C60)
- 230 VAC (M/N 45C62)
- 24 VAC (M/N 45C67)

The module contains a triac switch which, when used with an external power source, is capable of powering output devices such as an A-C motor starter or solenoid. Refer to figure 3.13 for a simplified schematic of an A-C output channel.

The two outputs can be supplied from separate power sources. A fuse is provided in each output for overload protection. Photo-couplers electrically isolate the switched output and the logic signal. Filtering is provided at the output switch to attenuate noise which might affect module operation.

There are two LED indicators for each output channel. The yellow LOGIC indicator is illuminated when the processor issues a command to turn the output on. The red FUSE indicator is illuminated when the fuse is blown and the output is commanded to be on.

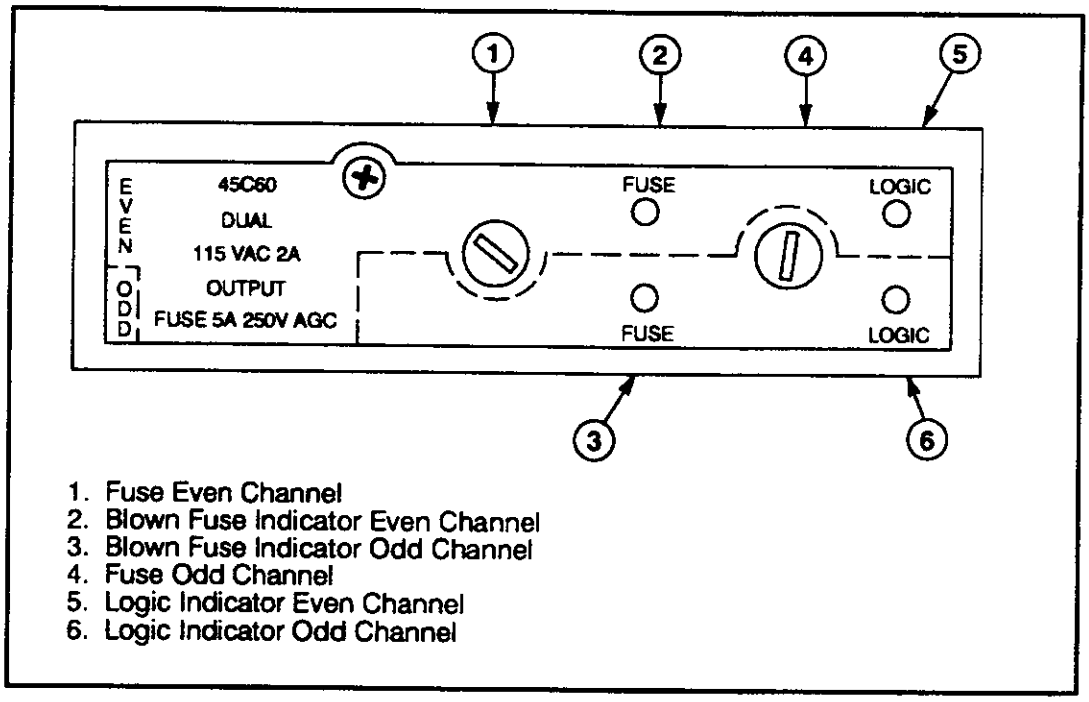
The output field wiring connects to the terminal strip on the rail. See figure 3.14 (A) for a field wiring example. If the device to which you are connecting this output module contains an inductive load, install an RC suppression network across the load terminals of the device. See figure 3.14 (B). If this is not done, the output module may not always function correctly.

A stick-on label is provided which identifies the type of module you have. Place this label on the right-hand side of the terminal strip. When the label is installed and the module is removed, the label will be visible and will identify the type module that needs to be replaced.

Module specifications are in Tables 3.5 and 3.6.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.



1. Fuse Even Channel
2. Blown Fuse Indicator Even Channel
3. Blown Fuse Indicator Odd Channel
4. Fuse Odd Channel
5. Logic Indicator Even Channel
6. Logic Indicator Odd Channel

Figure 3.12 - Dual A-C Output Module

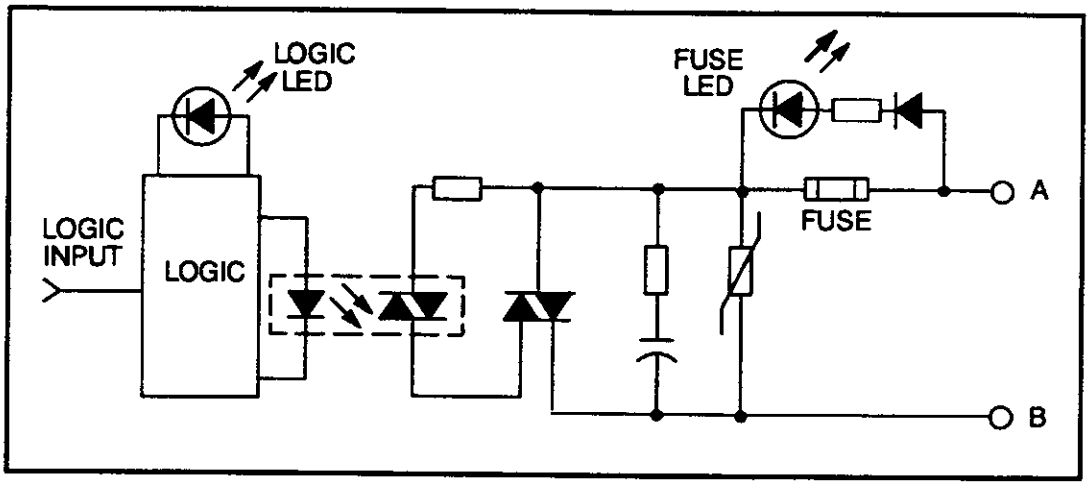


Figure 3.13 - A-C Output Channel Schematic

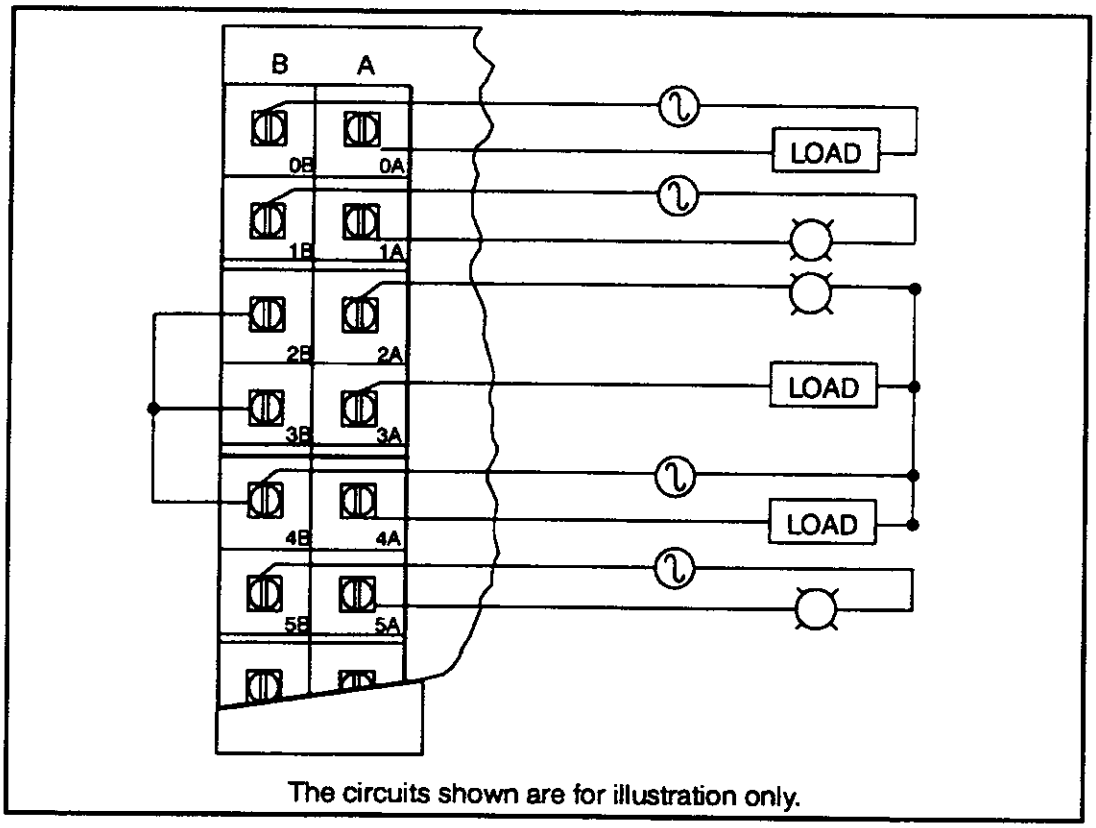


Figure 3.14 (A) - Dual A-C Output Module Field Wiring Example

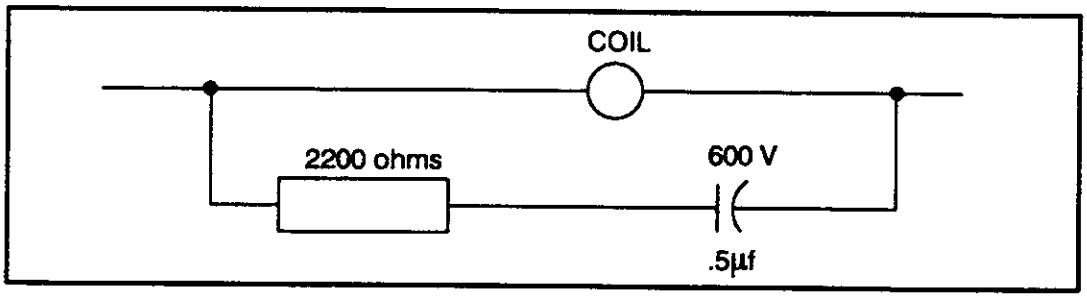


Figure 3.14 (B) - RC Suppression Network for Inductive Loads

Table 3.5 - Dual A-C Output Module Technical Specifications

Module Location

- Plugged Into an I/O Rail (M/N 45C1)

Ambient Conditions

- Operating Temperature (at the module): 32 to 140°F (0 to 60°C)
- Storage Temperature: -4 to 185°F (-20 to 85°C)
- Humidity: 5 to 90% (Non-Condensing)

Module Dimensions

- Height: $^{13}/_{16}$ inches (2.1 cm)
- Width: 3 inches (7.6 cm)
- Depth: $6^{1}/_{16}$ inches (15.5 cm)
- Weight: 5 ounces (140 grams)

Output Circuit

- Number of Outputs: 2 Channels
- Output Current: 2A (Maximum) Continuous per Output
- Power Dissipation: 2.6W (Maximum) per Output
- On-State Voltage Drop: 1.3V at Maximum Load Current
- Off to On Response Time: 10 Milliseconds (Maximum)
- On to Off Response Time: 9 Milliseconds (Maximum)
- Electrical Isolation: (1) 5000V (RMS) isolation between the output circuit and the logic circuit.
  (2) 1000 V (RMS) channel to channel isolation.
- Fuse Type: Buss 5 Amp, 250V, AGC, or Equivalent
- Maximum Short Circuit Power Source: 10KVA

Table 3.6 - Dual A-C Output Module Electrical Specifications

	M/N 45C60	M/N 45C62	M/N 45C67
Nominal A-C Voltage	120V	240V	24V
Working Voltage (RMS)	80 to 132V	200 to 270V	10 to 35V
Allowable 0.1 Second Surge Current	20A	20A	29A
Allowable 0.5 Second Surge Current	10A	10A	10A
Off-State Leakage Current At Rated Voltage (Maximum RMS 60 Hz)	5.9 ma	8.1 ma	1.2 ma
Minimum Holding Current	70 ma	70 ma	70 ma

3.6 Dual D-C Output Module

The Dual D-C Output Module provides two individually-isolated outputs for motor starters, solenoids, logic devices, or other control devices. The module uses low-level logic signals to switch power circuits by driving a FET to switch a load. See figure 3.15. There are three versions of the module:

- 24 VDC (M/N 45C63)
- 115 VDC (M/N 45C65)
- 250 VDC (M/N 45C68)

The two switched outputs can be fed from separate power sources. Each output is overload protected by a fuse. An isolation transformer electrically isolates the output signal from the logic signal. Filtering is provided to attenuate noise which might affect module operation. See figure 3.16 for a simplified schematic of an output channel.

There are two LED indicators for each output channel. The yellow LOGIC indicator is illuminated when the processor issues a command to turn the output on. The red FUSE indicator is illuminated when the fuse is blown and the output is commanded to be on.

The output field wiring connects to the terminal strip on the rail. See figure 3.17 for a field wiring example. Note that the B terminal is positive and the A terminal is negative.

Note that if the working voltage is less than 83V (M/N 45C65), 18V (M/N 45C63), or 140V (M/N 45C68), the fuse indicator will not illuminate when the fuse is blown.

A stick-on label is provided which identifies the type of module you have. Place this label on the right-hand side of the terminal strip. When the label is installed and the module is removed, the label will be visible and will identify the type module that needs to be replaced.

Module specifications are in Table 3.7.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

The module's D-C switch will sink either 2A or 0.5A. You need to consider the maximum load, energy, and duty cycle of the system. For proper operation, the following conditions should be met:

- Maximum Current = 2A (M/N 45C63 and 45C65) or 0.5A (M/N 45C68)
- Maximum Energy = 1/2 L(I*I) = less than X Joules
- Maximum Power = F*E = F 1/2 L(I*I) = less than .25 Watts
  Where = L is the load inductance in Henrys
  I is the current in Amperes
  F is the switching rate in Hertz
  E is D-C voltage
  X is maximum inductive load energy in Joules from Table 3.7

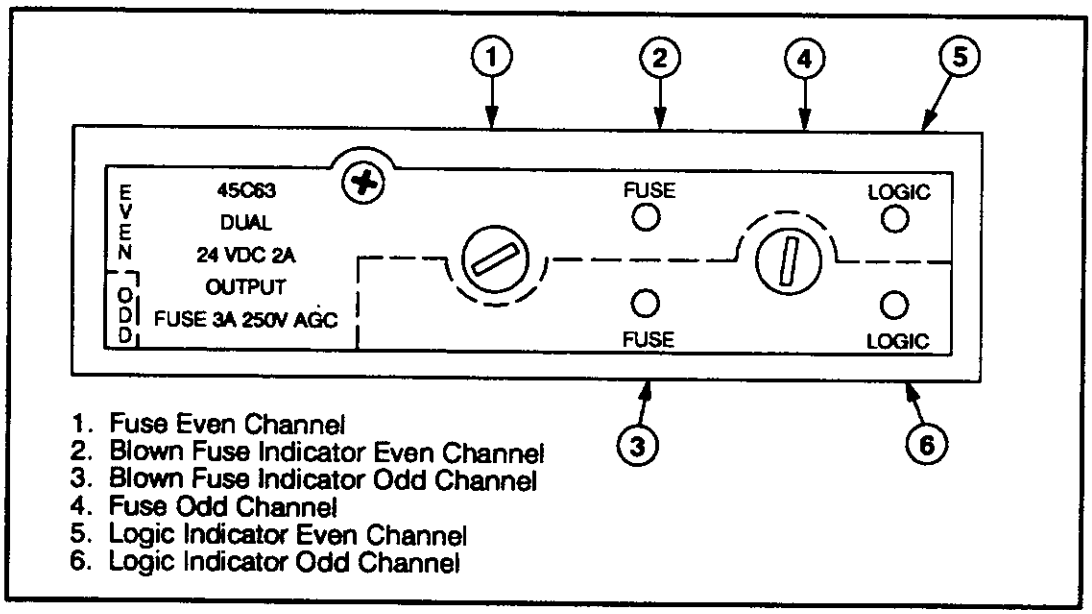


Figure 3.15 - Dual D-C Output Module

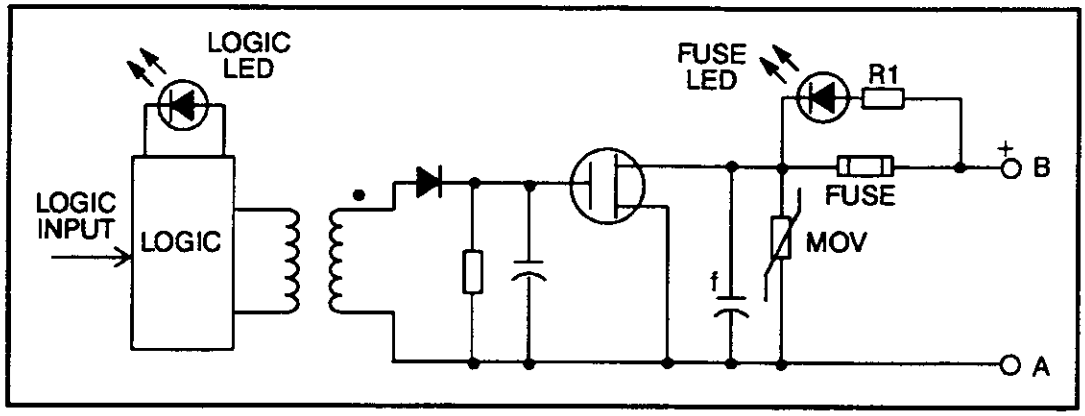
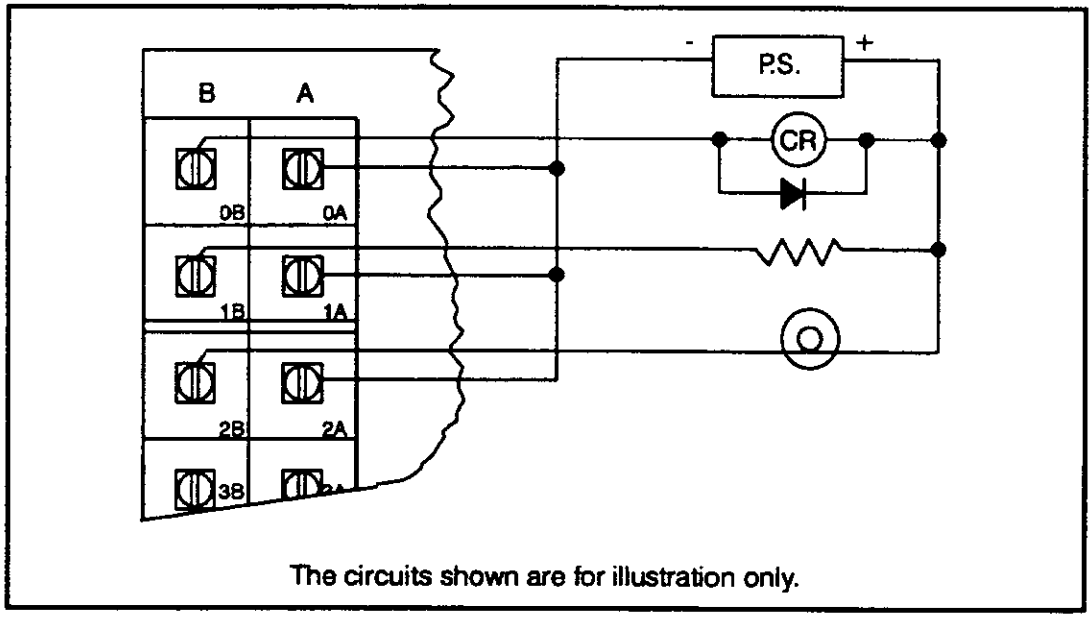


Figure 3.16 - Dual D-C Output Module Channel Schematic



The circuits shown are for illustration only.

Figure 3.17 - Dual D-C Output Module Field Wiring Example

Table 3.7 - Dual D-C Output Module Technical Specifications

Module Location

- Plugged Into an I/O Rail (M/N 45C1)

Ambient Conditions

- Operating Temperature (at the module): 32 to 140°F (0 to 60°C)
- Storage Temperature: -4 to 185°F (-20 to 85°C)
- Humidity: 5-90% (Non-Condensing)

Module Dimensions

- Height: $^{13}/_{16}$ inches (2.1 cm)
- Width: 3 inches (7.6 cm)
- Depth: $6^{1}/_{16}$ inches (15.5 cm)
- Weight: 5 ounces (140 grams)

Output Circuit

- Number of Outputs: 2 Channels
- Minimum Load Current: 1 ma
- Output Type: FET, open drain
- Maximum Inductive Power at 140°F (60°C): 0.25W
- Electrical Isolation: (1) 2500V (RMS) isolation between the output circuit and the logic circuit.
  (2) 1000 V (RMS) channel to channel isolation.
  (3) 1000 V (RMS) isolation across open contacts.
- Off to On Response Time: 0.45 Milliseconds
- On to Off Response Time: 0.2 Milliseconds
- Fuse Type M/N 45C63 and M/N 45C65: Buss 3 Amp, 250V, AGC, or Equivalent
- Fuse Type M/N 45C68: Buss 1 Amp, 250V, AGC, or Equivalent
- Maximum Short Circuit Power Source: 10KVA

	M/N 45C63	M/N 45C65	M/N 45C68
Nominal D-C Voltage	24V	120V	250V
Working D-C Voltages	15-40V	83-140V	140-275V
Allowable Peak Voltage Due to Overshoot	100V	300V	600V
Maximum Continuous Output Current	2A	2A	0.5A
Power Dissipation at Maximum Temperature and Current	2.6W	4.0W	1.8W
Maximum On-State Voltages	0.8V	1.1V	2V
Maximum Off-State Leakage Current at Peak Voltage	1 ma	1 ma	4 ma
Allowable 0.1 Second Surge Current	8A	8A	1.5A
Allowable 0.5 Second Surge Current	4A	4A	1A
Maximum Inductive Load Energy	6.5J	11J	26J

3.7 Dual Contact Output Module - Normally Open Contacts

The Dual Contact Output Module (Normally Open Contacts) (M/N 45C66A) provides two form A isolated-relay outputs. The module contains two output channels that have normally open contacts. Each output is rated 3 Amps continuous at 250 VAC RMS. See figure 3.18. The two switched-contact outputs can be supplied from separate power sources.

This output module converts low-level logic signals into contact outputs for connection to field devices. Each output channel is isolated and is complete with fuse, snubber network, and transient suppressor circuit. Refer to figure 3.19 for a simplified schematic of a normally open contact output channel.

There are two LED indicators for each output channel. The yellow LOGIC indicator is illuminated when the processor issues a command to turn the output on. The red FUSE indicator is illuminated when the fuse is blown and the output is commanded to be on.

The output field wiring connects to the terminal strip on the rail. See figure 3.20 for a field wiring example.

Note that if the working voltage being switched is less than 102 volts, the fuse LED will not illuminate when the fuse blows.

A stick-on label is provided which identifies the type of module you have. Place this label on the right-hand side of the terminal strip. When the label is installed and the module is removed, the label will be visible and will identify the type module that needs to be replaced.

Module specifications are in Table 3.8.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

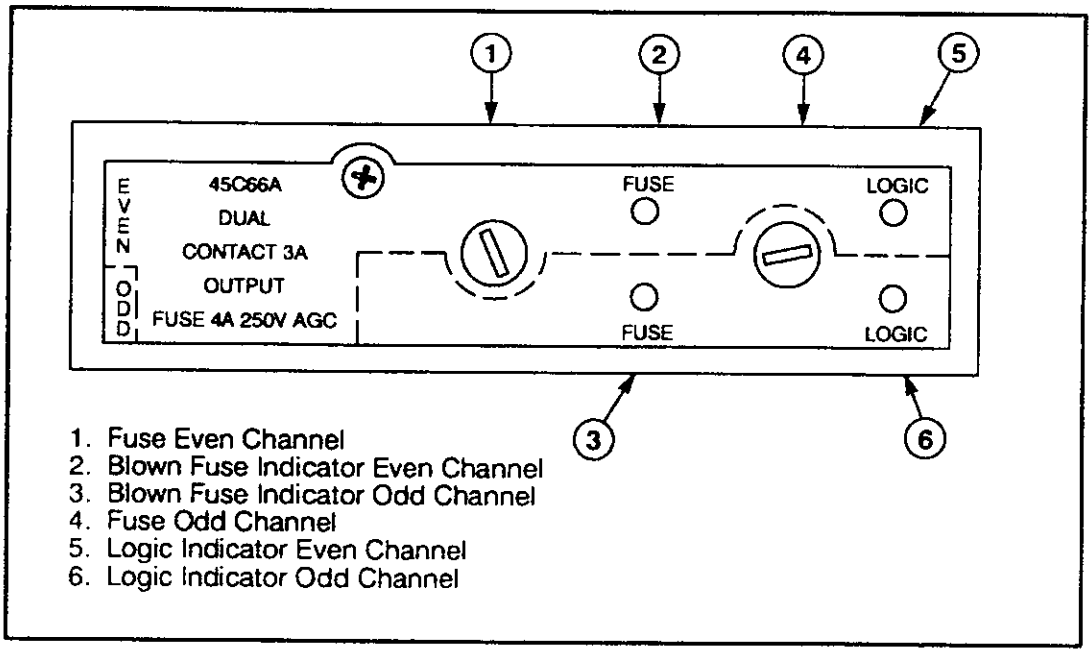


Figure 3.18 - Dual Contact Output Module (N.O.)

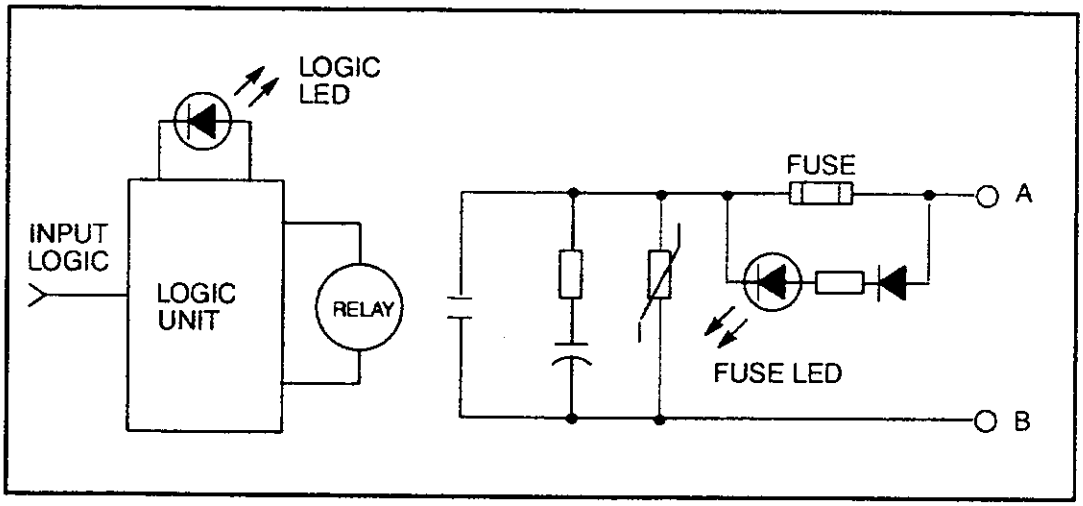


Figure 3.19 - Schematic of a Dual Contact Output Module (N.O.) Channel

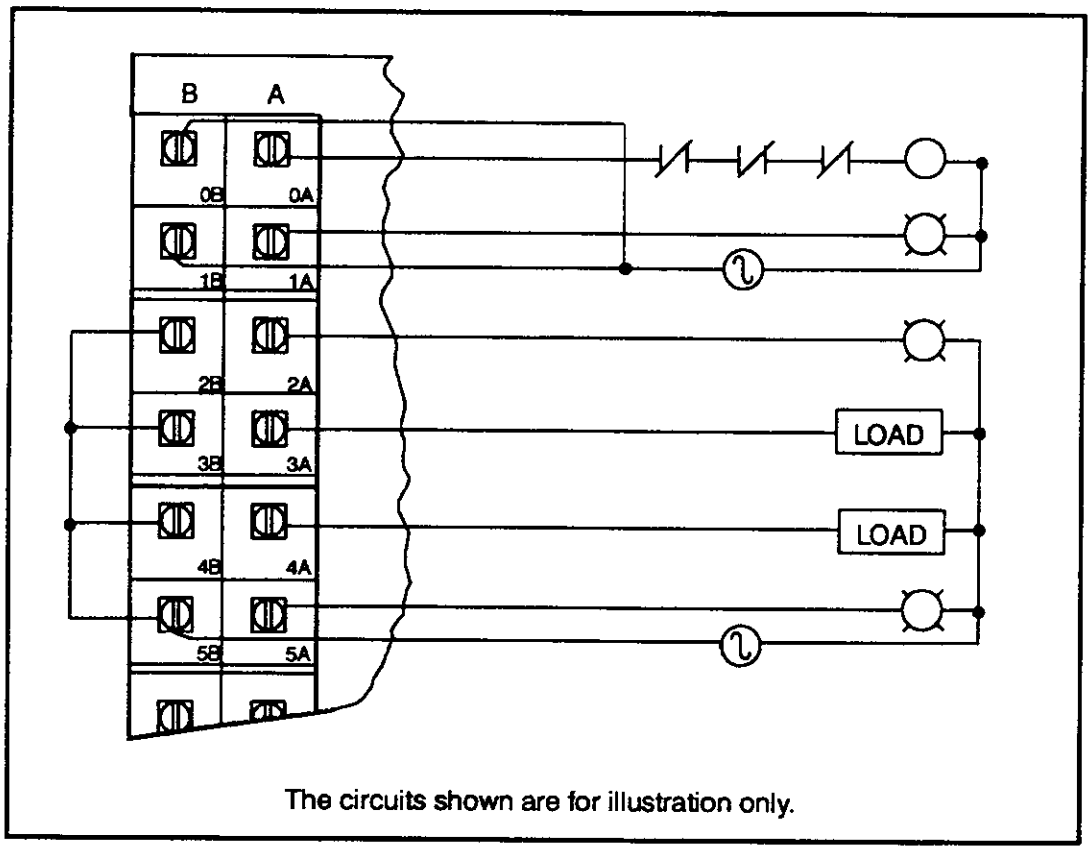


Figure 3.20 - Dual Contact Output Module (N.O) Field Wiring Example

Table 3.8 - Dual Contact Output Module (N.O.) Technical Specifications

Module Location

- Plugged Into an I/O Rail (M/N 45C1)

Ambient Conditions

- Operating Temperature (at the module): 32 to 140°F (0 to 60°C)
- Storage Temperature: -4 to 185°F (-20 to 85°C)
- Humidity: 5 to 90% (Non-Condensing)

Module Dimensions

- Height: $^{13}/_{16}$ inches (2.1 cm)
- Width: 3 inches (7.6 cm)
- Depth: $6^{1}/_{16}$ inches (15.5 cm)
- Weight: 5 ounces (140 grams)

Output Circuit

- Number of Outputs: 2 Channels
- Contact Voltage Ratings: 1 to 250 VAC (RMS)
  1 to 30 VDC
- Power Dissipation: 0.6W Maximum per Output Channel
- Off-State Leakage Current: 4.6 ma at 125V RMS 60 Hz
  9.2 ma at 250V RMS 60 Hz
- Contact Resistance: 0.2 ohms (includes rail's resistance)
- Contact Current Rating: 3A, 1/10 HP, 120 VAC, 250 VAC
  5A, 30 VDC
  0.6A, 110 VDC
- Electrical Isolation: (1) 2000V (RMS) isolation between the output circuit and the logic circuit.
  (2) 1000 V (RMS) channel to channel isolation.
  (3) 1000 V (RMS) isolation across open contacts
- Fuse Type: Buss 4 Amp, 250V, AGC, or Equivalent
- Electrical Life Expectancy: $2x10^5$ operations at 3A, 250 VAC/30 VDC
- Maximum Operating Speed: 20 Cycles per Second
- Maximum Operating Time: 15 Milliseconds
- Maximum Release Time: 3 Milliseconds
- Initial Insulation Resistance: 100M Ohms at 500 VDC
- Allowable 10 Microsecond Surge Voltage Between Open Contacts: 1500V
- Allowable 40 Microsecond Surge Voltage Between Coil and Contact: 5000V
- Adjacent Channel to Channel Voltages (In Accordance with U.L. 508):

Short Circuit Power	Peak Working Voltage*
More Than 10KVA	225V
500V to 10KVA	450V
Less Than 500VA	900V

* includes transient voltages. (All transient voltages must be known and controlled.)

3.8 Dual Contact Output Module - Normally Closed Contacts

The Dual Contact Output Module (Normally Closed Contacts) (M/N 45C166A) provides two form B isolated-relay outputs with normally closed contacts. Each output is rated 3 Amps continuous at 250 VAC RMS. See figure 3.21. The two switched-contact outputs can be supplied from separate power sources.

The module converts low-level logic signals into contact outputs for connection to field devices. Each output channel is isolated and is complete with fuse, snubber network and transient suppressor circuit. Refer to figure 3.22 for a simplified schematic of a normally closed contact output channel.

There are two LED indicators for each output channel. The yellow LOGIC indicator is illuminated when the processor issues a command to open the contacts. When the output is de-energized, the output contacts are closed. This will turn the load on. The red FUSE indicator is illuminated when the fuse is blown and the output is commanded to be on.

The output field wiring connects to the terminal strip on the rail. See figure 3.23 for a field wiring example.

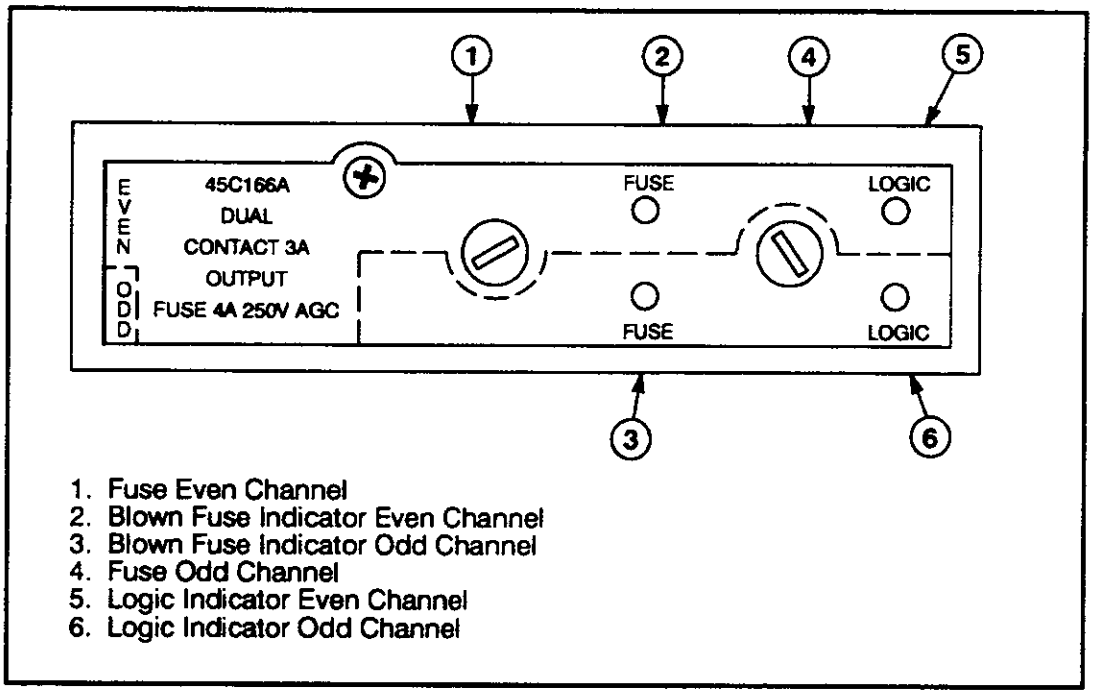
Note that if the working voltage being switched is less than 102 volts, the fuse LED will not illuminate when the fuse blows.

A stick-on label is provided which identifies the type of module you have. Place this label on the right-hand side of the terminal strip. When the label is installed and the module is removed, the label will be visible and will identify the type module that needs to be replaced.

Module specifications are in Table 3.9.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.



1. Fuse Even Channel
2. Blown Fuse Indicator Even Channel
3. Blown Fuse Indicator Odd Channel
4. Fuse Odd Channel
5. Logic Indicator Even Channel
6. Logic Indicator Odd Channel

Figure 3.21 - Dual Contact Output Module (N.C.)

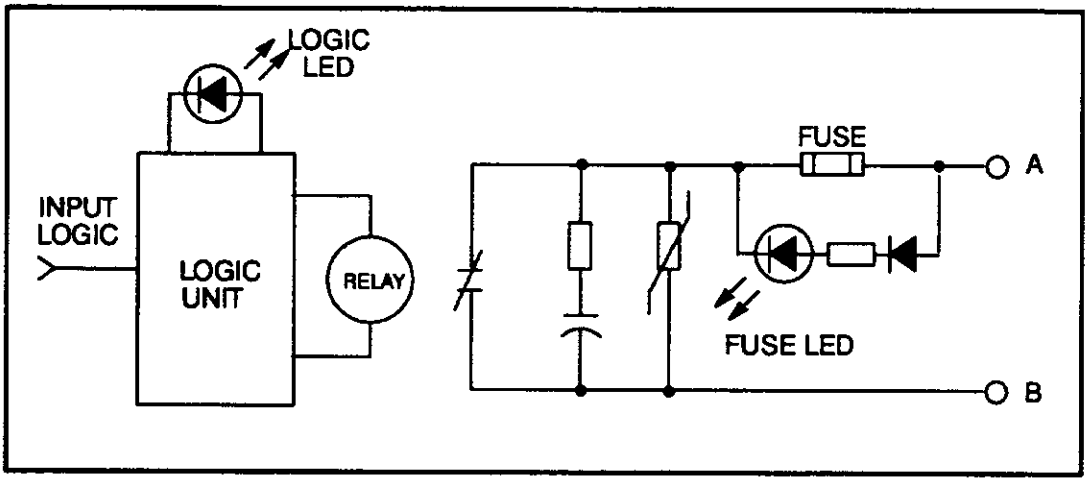


Figure 3.22 - Schematic of a Dual Contact Output Module (N.C.) Channel

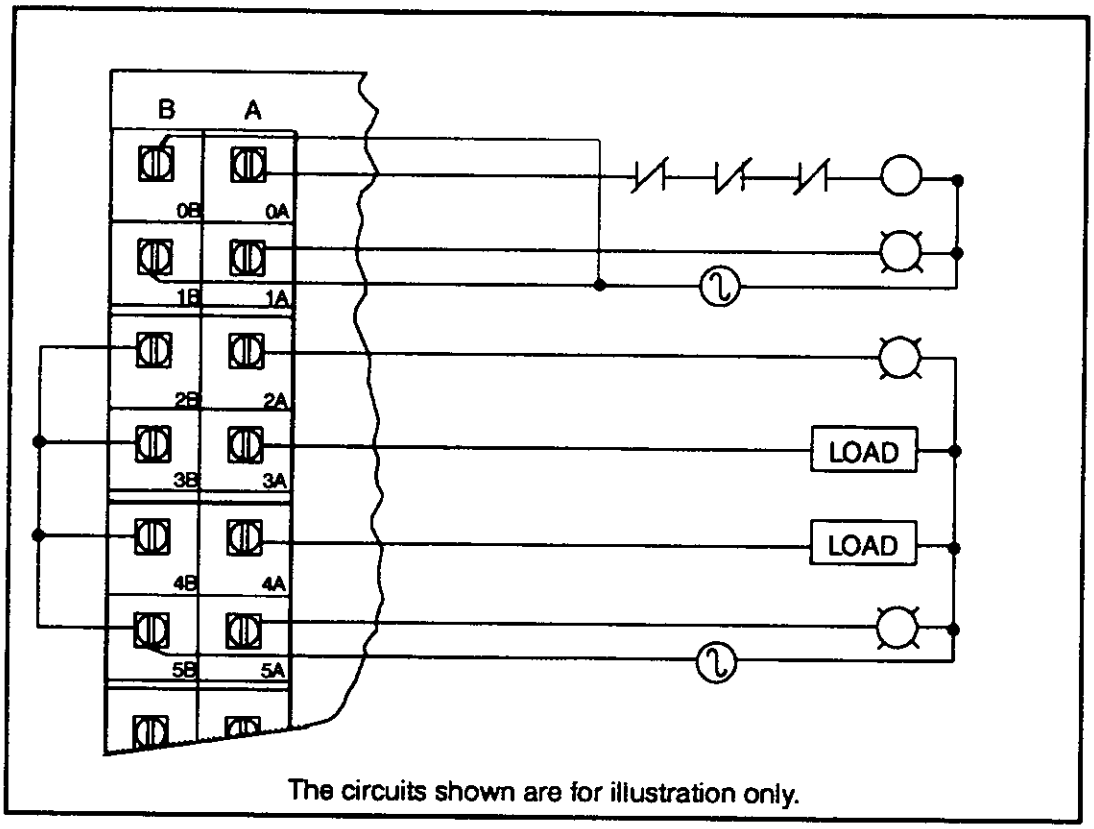


Figure 3.23 - Dual Contact Output Module (N.C.) Field Wiring Example

Table 3.9 - Dual Contact Output Module (N.C.) Technical Specifications

Module Location

- Plugged into an I/O Rail (M/N 45C1)

Ambient Conditions

- Operating Temperature (at the module): 32 to 140°F (0 to 60°C)
- Storage Temperature: -4 to 185°F (-20 to 85°C)
- Humidity: 5 to 90% (Non-Condensing)

Module Dimensions

- Height: $^{13}/_{16}$ inches (2.1 cm)
- Width: 3 inches (7.6 cm)
- Depth: $6^{1}/_{16}$ inches (15.5 cm)
- Weight: 5 ounces (140 grams)

Output Circuit

- Number of Outputs: 2 Channels
- Contact Voltage Ratings: 1 to 250 VAC (RMS)
  1 to 30 VDC
- Power Dissipation: 0.6W Maximum per Output Channel
- Off-State Leakage Current: 4.6 ma at 125V (RMS) 60 Hz
  9.2 ma at 250V (RMS) 60 Hz
- Contact Resistance: 0.2 ohms (includes rail resistance)
- Contact Current Rating: 3A, 1/10 HP, 120 VAC, 250 VAC
  5A, 30 VDC
  0.6A, 110 VDC
- Electrical Isolation: (1) 2000V (RMS) isolation between the output circuit and the logic circuit.
  (2) 1000 V (RMS) channel to channel isolation.
  (3) 1000 V (RMS) isolation across open contacts
- Fuse Type: Buss 4 Amp, 250V, AGC, or Equivalent
- Electrical Life Expectancy: $2x10^5$ operations at 3A, 250 VAC/30 VDC
- Maximum Operating Speed: 20 Cycles per Second
- Maximum Operating Time: 15 Milliseconds
- Maximum Release Time: 3 Milliseconds
- Initial Insulation Resistance: 100M Ohms at 500 VDC
- Allowable 10 Microsecond Surge Voltage Between Open Contacts: 1500V
- Allowable 40 Microsecond Surge Voltage Between Coil and Contact: 5000V
- Adjacent Channel to Channel Voltages (In Accordance with U.L. 508):

Short Circuit Power	Peak Working Voltage*
More Than 10KVA	225V
500V to 10KVA	450V
Less Than 500VA	900V

* Includes transient voltages. (All transient voltages must be known and controlled.)

3.9 Dual Dry Contact Output Module

The Dual Contact Output Module (Low Power) (M/N 45C69) provides two form A isolated-relay outputs. Each output is rated at 1A at 30 VDC or 0.30A at 115 VAC. See figure 3.24.

The module converts low level logic signals into contact outputs for connection to field devices. The outputs are isolated dry gold-plated contacts. Refer to figure 3.25 for a simplified schematic of a low power output channel. See figure 3.26 for a low power output circuit.

Each output channel has a yellow LOGIC indicator that illuminates when the processor issues a command to turn the output on.

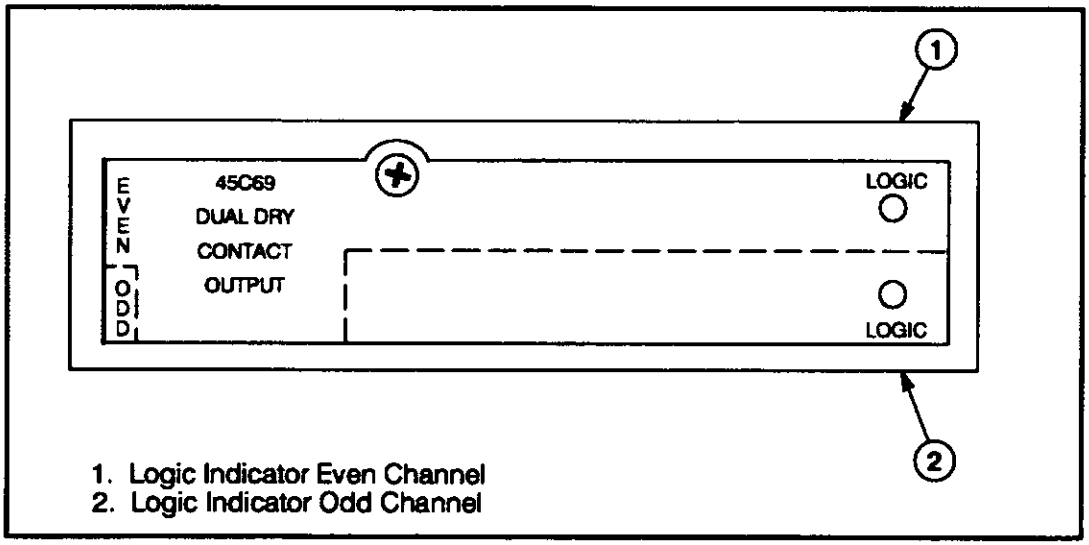
The output field wiring connects to the terminal strip on the rail. Refer to figure 3.27 for a field wiring example. This module is intended for use with resistive loads only.

A stick-on label is provided which identifies the type of module you have. Place this label on the right-hand side of the terminal strip. When the label is installed and the module is removed, the label will be visible and will identify the type module that needs to be replaced.

Module specifications are in Table 3.10.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.



1. Logic Indicator Even Channel
2. Logic Indicator Odd Channel

Figure 3.24 - Dual Dry Contact Output Module

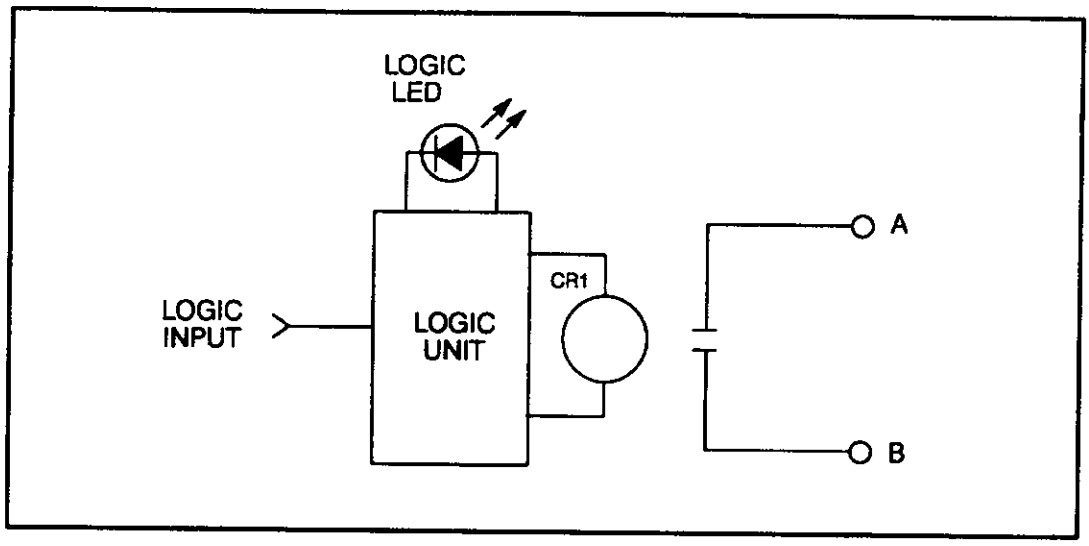


Figure 3.25 - Schematic of a Low Power Output Channel

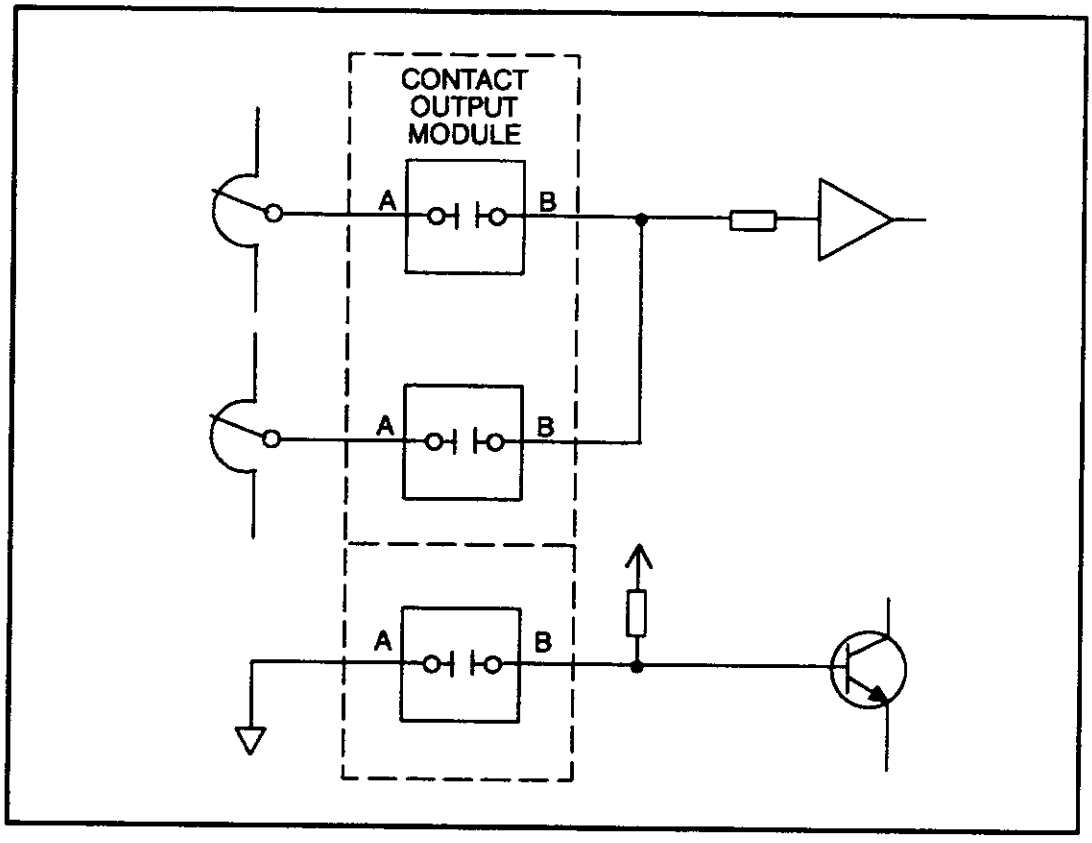


Figure 3.26 - Low Power Circuit Example

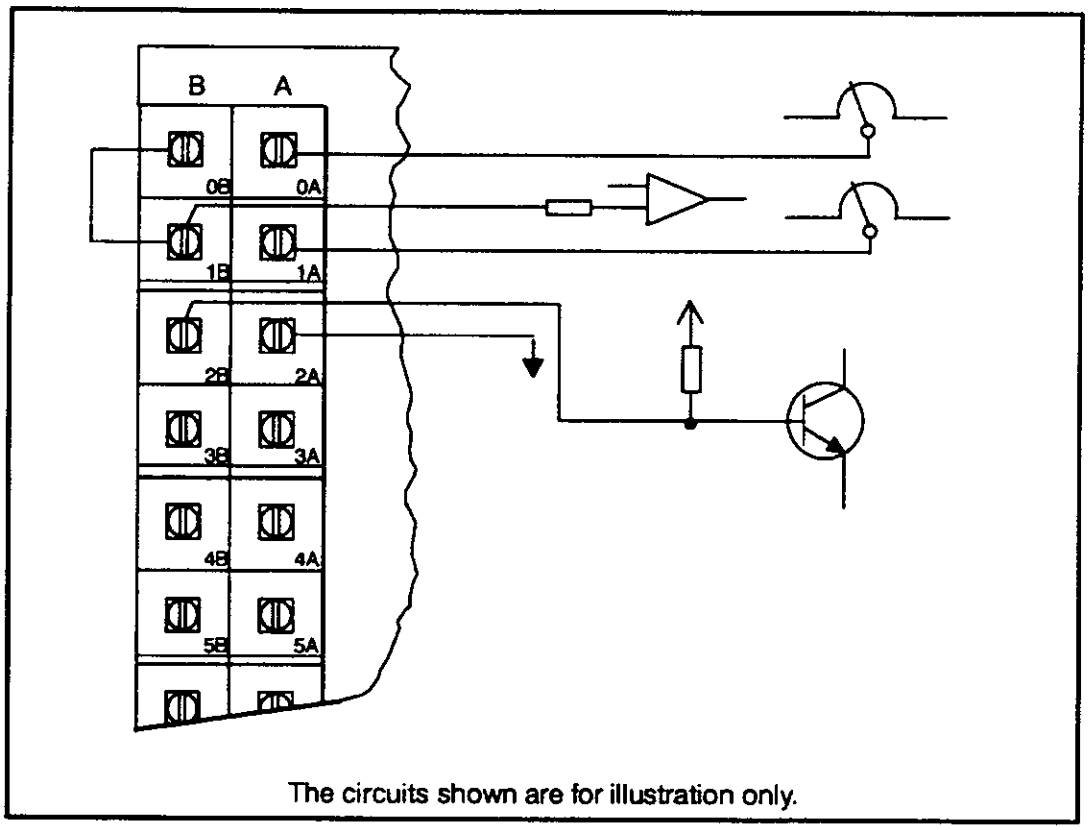


Figure 3.27 - Dual Dry Contact Output Module Field Wiring Example

Table 3.10 - Dual Dry Contact Output Module Technical Specifications

Module Location

- Plugged Into an I/O Rail (M/N 45C1)

Ambient Conditions

- Operating Temperature (at the module): 32 to 140°F (0 to 60°C)
- Storage Temperature: -4 to 158°F (-20 to 70°C)
- Humidity: 5 to 90% (Non-Condensing)

Module Dimensions

- Height: $^{13}/_{16}$ inches (2.1 cm)
- Width: 3 inches (7.6 cm)
- Depth: $6^{1}/_{16}$ inches (15.5 cm)
- Weight: 5 ounces (140 grams)

Output Circuit

- Number of Outputs: 2 Channels
- Output Voltage: 0.10 to 125 VAC
  0.10 to 30 VDC
- Resistive Output Current : 0.01 ma to 0.4A at 125 VAC
  (PF=1) 0.01 ma to 1A at 30 VDC
- Maximum Resistive Switching Capacity: 50VA, 60W
- Power Dissipation: 0.2W Maximum per Output Channel
- Contact Resistance: 0.2 Ohms (includes rail resistance)
- Contact to Contact Electrostatic Capacitance: 4pF
- Electrical Isolation: (1) 1500V (RMS) isolation between the output circuit and the logic circuit.
  (2) 1000 V (RMS) channel to channel isolation.
  (3) 1000 V (RMS) isolation across open contacts.
- Surge Current for 0.1 Seconds: 5A D-C
- Maximum Operating Speed: 60 Cycles per Second
- Mechanical Life Expectancy: 1×10^9 operations
- Electrical Life Expectancy: 15×10^3 operations at 30 VDC at 1A (Rated)
  40×10^3 operations at 30 VDC at 0.5A (Rated)
  200×10^3 operations at 30 VDC at 0.2A (Rated)
- Maximum Contact Bounce: 3 Milliseconds
- Maximum Operating Time: 5 Milliseconds
- Maximum Release Time: 5 Milliseconds

4.0 DIAGNOSTICS AND TROUBLESHOOTING

4.1 Introduction

This chapter describes how to locate rail faults and input/output malfunctions.

DANGER

ONLY QUALIFIED ELECTRICAL PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND THE HAZARDS INVOLVED SHOULD INSTALL, ADJUST, OPERATE, OR SERVICE THIS EQUIPMENT. READ AND UNDERSTAND THIS MATERIAL IN ITS ENTIRETY BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

DANGER

CHECK FOR THE PRESENCE OF VOLTAGE BEFORE YOU PERFORM ANY INSTALLATION OR MAINTENANCE OPERATIONS. THE I/O DEVICES CONNECTED TO THE FIELD WIRING MAY BE POWERED FROM AN EXTERNAL POWER SOURCE. DO NOT ASSUME THAT IT IS SAFE TO WORK ON THE MODULES AND WIRING WHEN JUST THE MAIN SOURCE OF POWER IS DISCONNECTED. DISCONNECT ALL SOURCES OF POWER BEFORE SERVICING THE EQUIPMENT. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

4.2 Locating an I/O Rail Fault

An I/O Rail Fault indicates that a communication problem exists between the rail and AutoMate processor, Local I/O Head, Remote I/O Head, Local I/O Processor, or DCS 5000/AutoMax Remote I/O Head. The type of processor determines how the faulted rail is identified.

4.2.1 AutoMate 15

An AutoMate 15 rail fault will light the RAIL FAULT LED on the front of the processor. The Rail Fault Bit (12.17) will also be set to one. The COM DATA and FORCING LEDs on the front of the processor will display a binary code indicating which rail has had an interruption in communication. An AutoMate 15 rail fault troubleshooting flowchart is shown in figure 4.1.

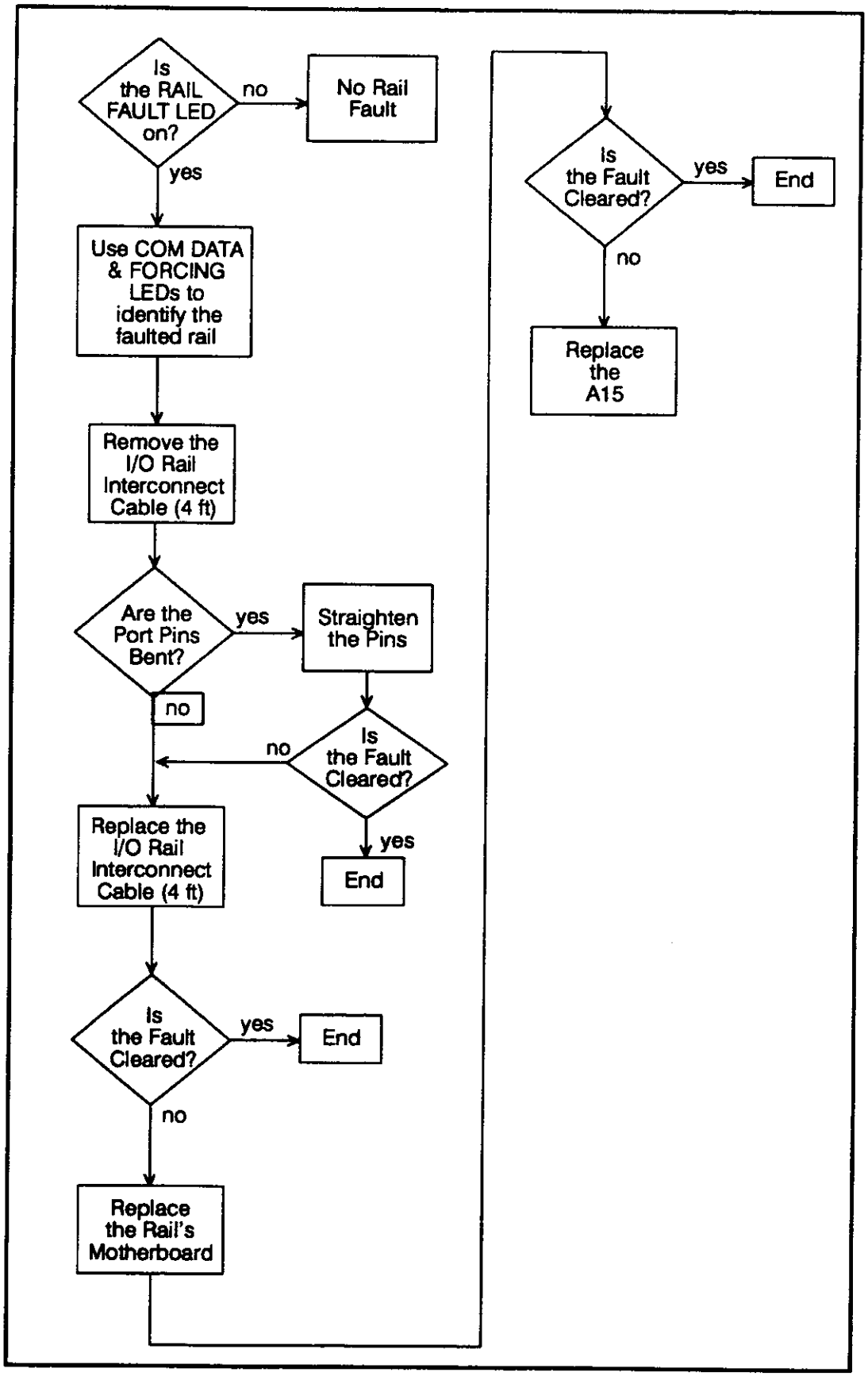


Figure 4.1 - AutoMate 15 Rail Fault Troubleshooting Flowchart

AutoMate 15 rail faults may be caused by a malfunctioning:

- I/O Rail Interconnect Cable
- rail motherboard
- AutoMate 15

WARNING

THE RAIL FAULT ERROR COIL MUST BE USED TO SET THE PROGRAMMABLE FAULT COIL IN ORDER TO OPEN THE READY RELAY CONTACTS WHEN A RAIL FAULT IS DETECTED. THE READY RELAY CONTACTS MUST BE WIRED IN SERIES WITH CONTROL POWER SO THAT POWER WILL BE REMOVED FROM THE RAILS. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Use the following procedure to isolate and clear an AutoMate 15 rail fault. After each step, check the system for proper operation. If the problem remains, continue on with the next step.

Step 1. Look at the RAIL FAULT LED and the COM DATA/FORCING LEDs on the front of the processor to identify the rail that has had a communication problem. See Table 4.1.

Table 4.1 - AutoMate 15 Rail Fault LED Error Codes

The RAIL FAULT LED is ON.

COM DATA LED	=	OFF	ON	OFF	ON
FORCING LED	=	OFF	OFF	ON	ON
Rail That Has a Rail Fault	=	0	1	2	3

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Step 2. Remove power and disconnect the appropriate I/O Rail Interconnect Cable (M/N 45C5) and check the I/O ports for bent pins. Straighten any pins that are bent, carefully reconnect the cable, and then reapply power.

Step 3. Remove power and replace the I/O Rail Interconnect Cable with a replacement cable that is known to be good.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Step 4. Remove power from the AutoMate 15 and replace the rail's motherboard:

- Disconnect the I/O Rail Interconnect Cable.
- Remove the I/O modules.
- Remove the two screws that hold the motherboard to the rail's chassis. See figure 4.2.
- Slide the motherboard out from under the heat sink assembly.
- Install the replacement motherboard and fasten it to the chassis with the two retaining screws.
- Plug in the I/O modules and reconnect the I/O Rail Interconnect Cable.
- Reapply power to the AutoMate 15.

Step 5. Replace the AutoMate 15:

- Remove power from the AutoMate 15.
- Disconnect the input power connections from the terminal strip.
- Disconnect the cable from the peripheral communications connector, if attached.
- Disconnect the cable from the R-Net connector, if attached.
- Disconnect the I/O Rail Interconnect Cable(s).
- Disconnect the ground connections.
- Remove the four mounting bolts.
- Install the replacement processor by following the procedure in reverse order.
- Reapply power to the AutoMate 15.

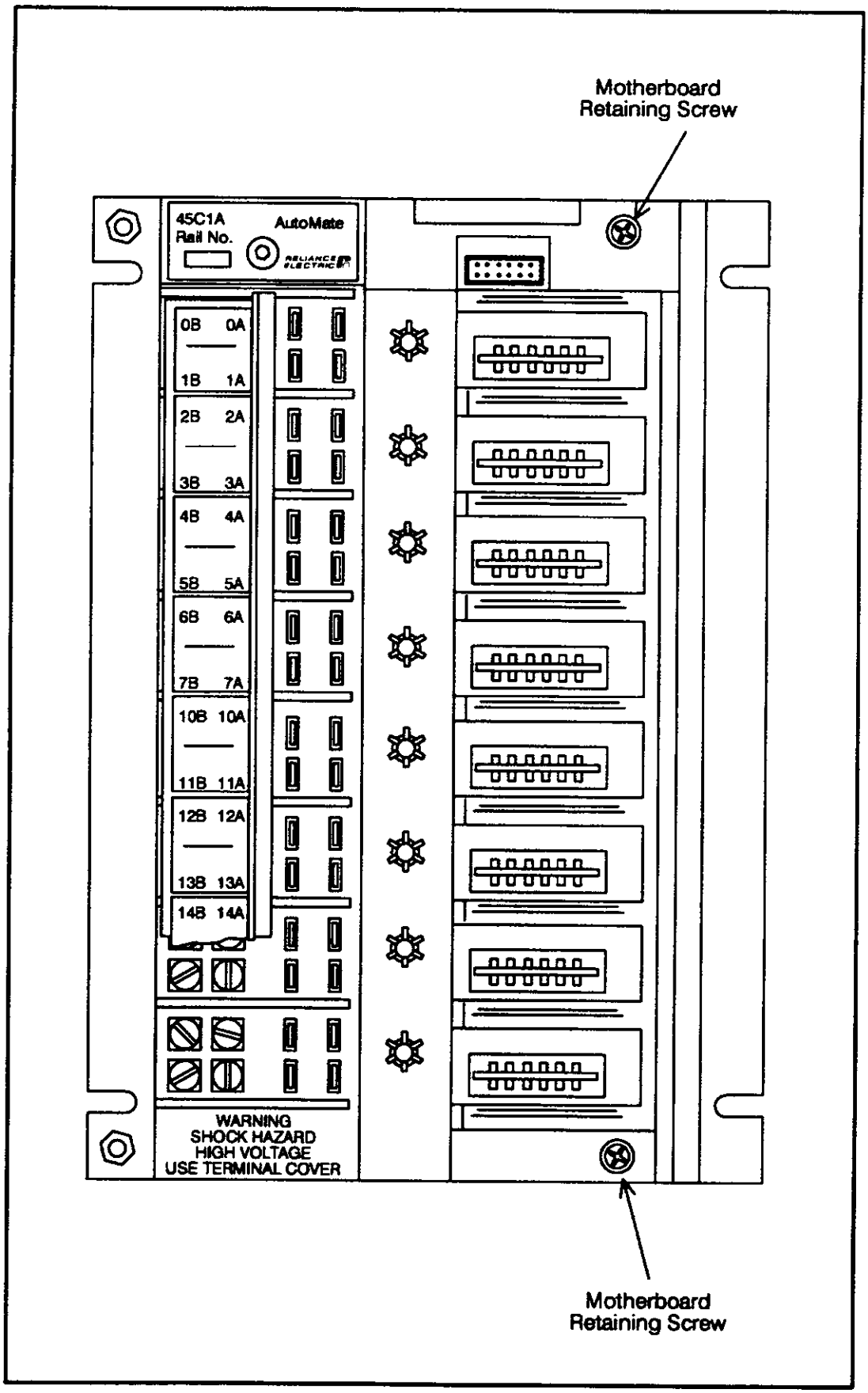


Figure 4.2 - Motherboard Retaining Screws

4.2.2 AutoMate 20/20E

A rail fault from a directly-connected rail will light the RAIL FAULT LED on the front of the AutoMate 20/20E Processor. The Rail Fault Bit (76.01) will also be set to one. The COM DATA and FORCING LEDs on the front of the processor will display a binary code indicating which port has had an interruption in communication.

An AutoMate 20/20E rail fault troubleshooting flowchart is shown in figure 4.3.

WARNING

THE RAIL FAULT ERROR COIL MUST BE USED TO SET THE PROGRAMMABLE FAULT COIL IN ORDER TO OPEN THE READY RELAY CONTACTS WHEN A RAIL FAULT IS DETECTED. THE READY RELAY CONTACTS MUST BE WIRED IN SERIES WITH CONTROL POWER SO THAT POWER WILL BE REMOVED FROM THE RAILS. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

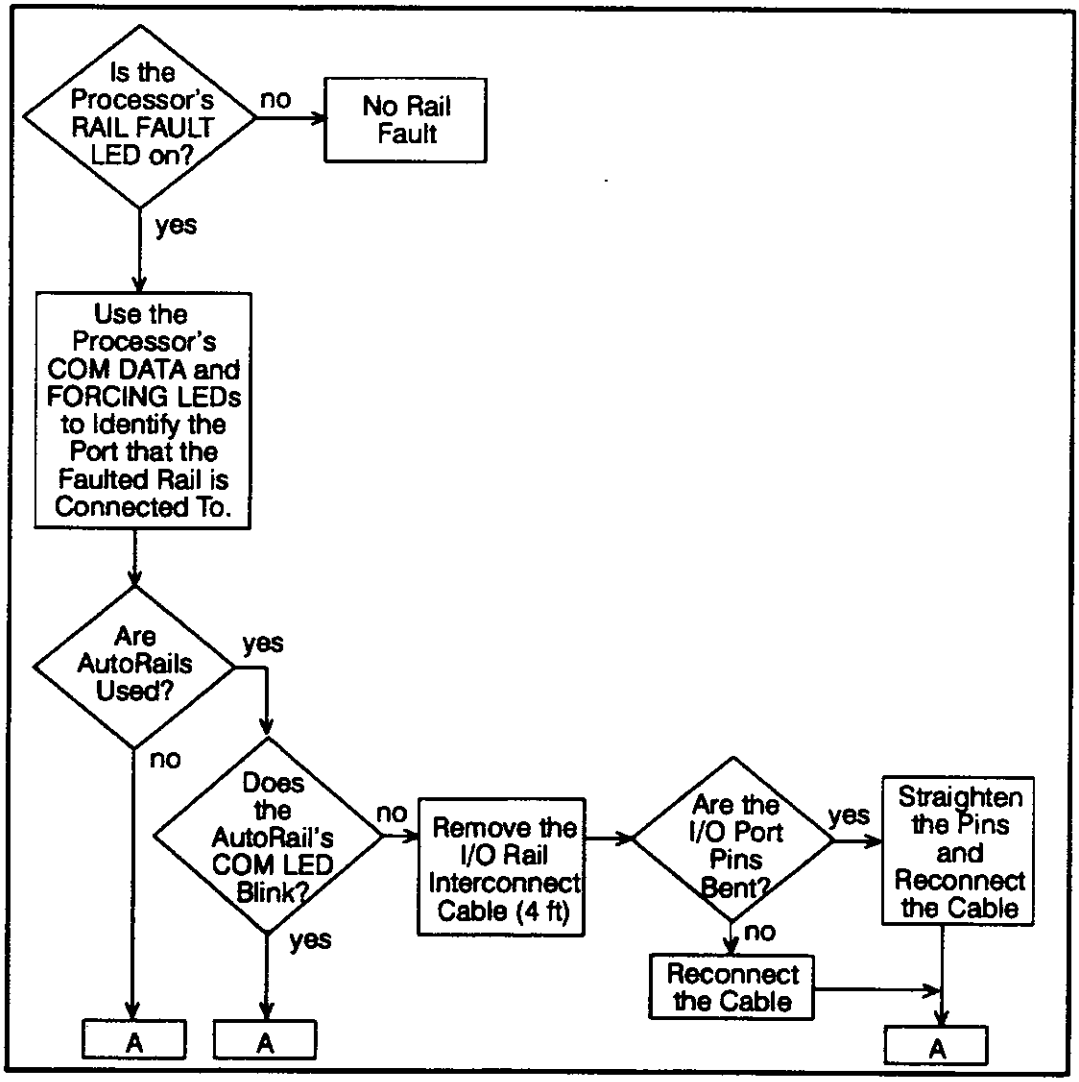


Figure 4.3 - AutoMate 20/20E Rail Fault Troubleshooting Flowchart

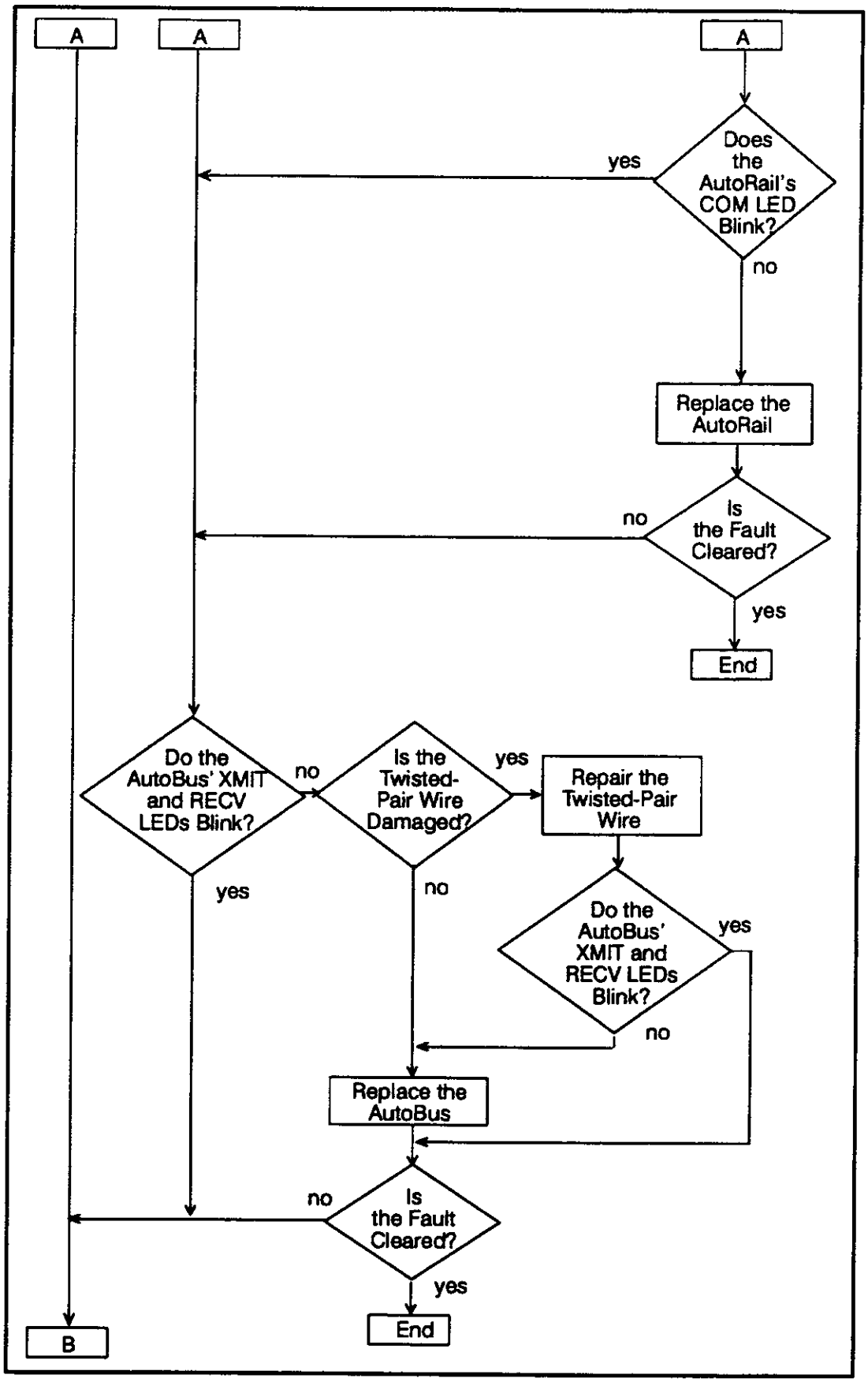


Figure 4.3 - AutoMate 20/20E Rail Fault Troubleshooting Flowchart (Continued)

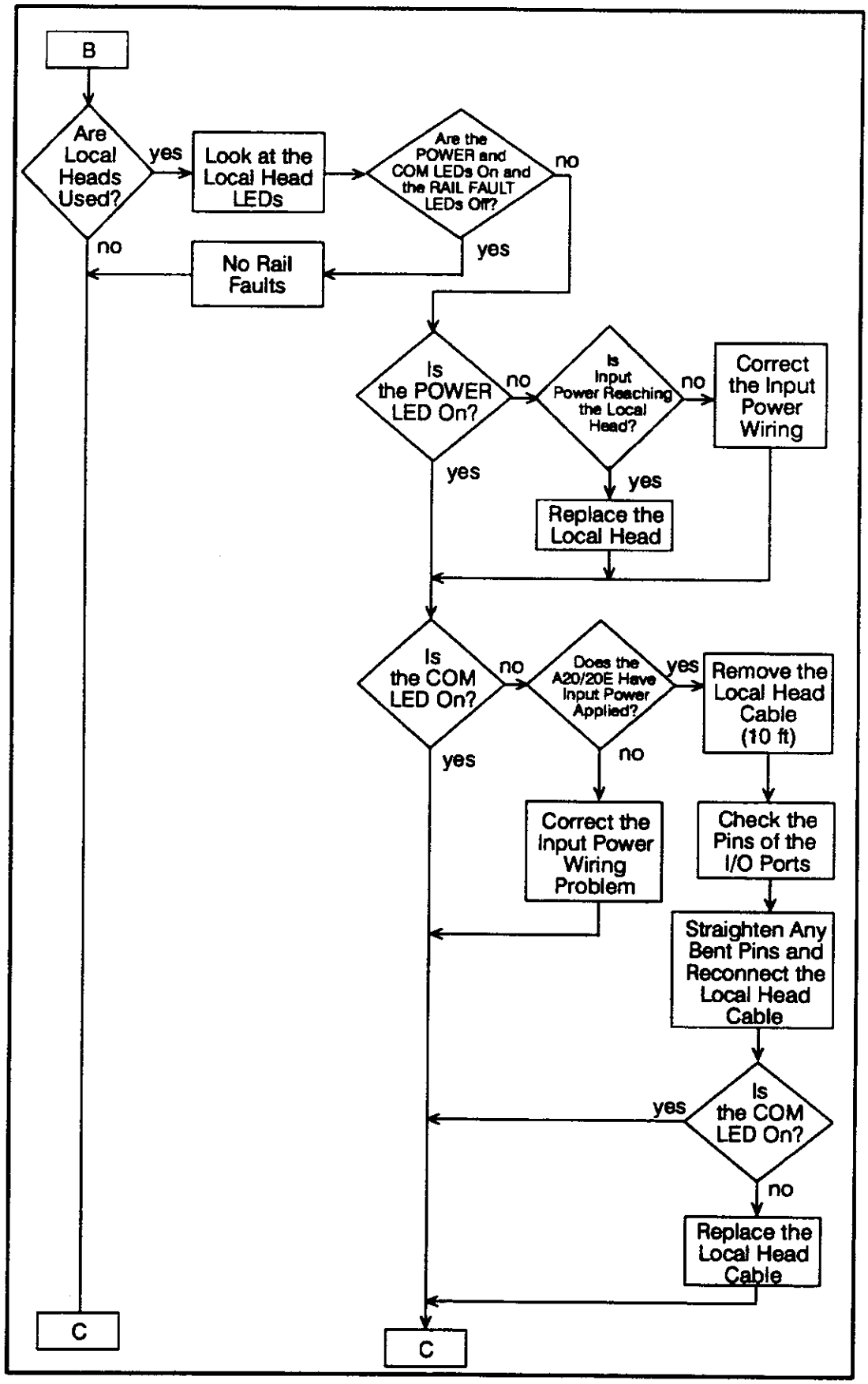


Figure 4.3 - AutoMate 20/20E Rail Fault Troubleshooting Flowchart (Continued)

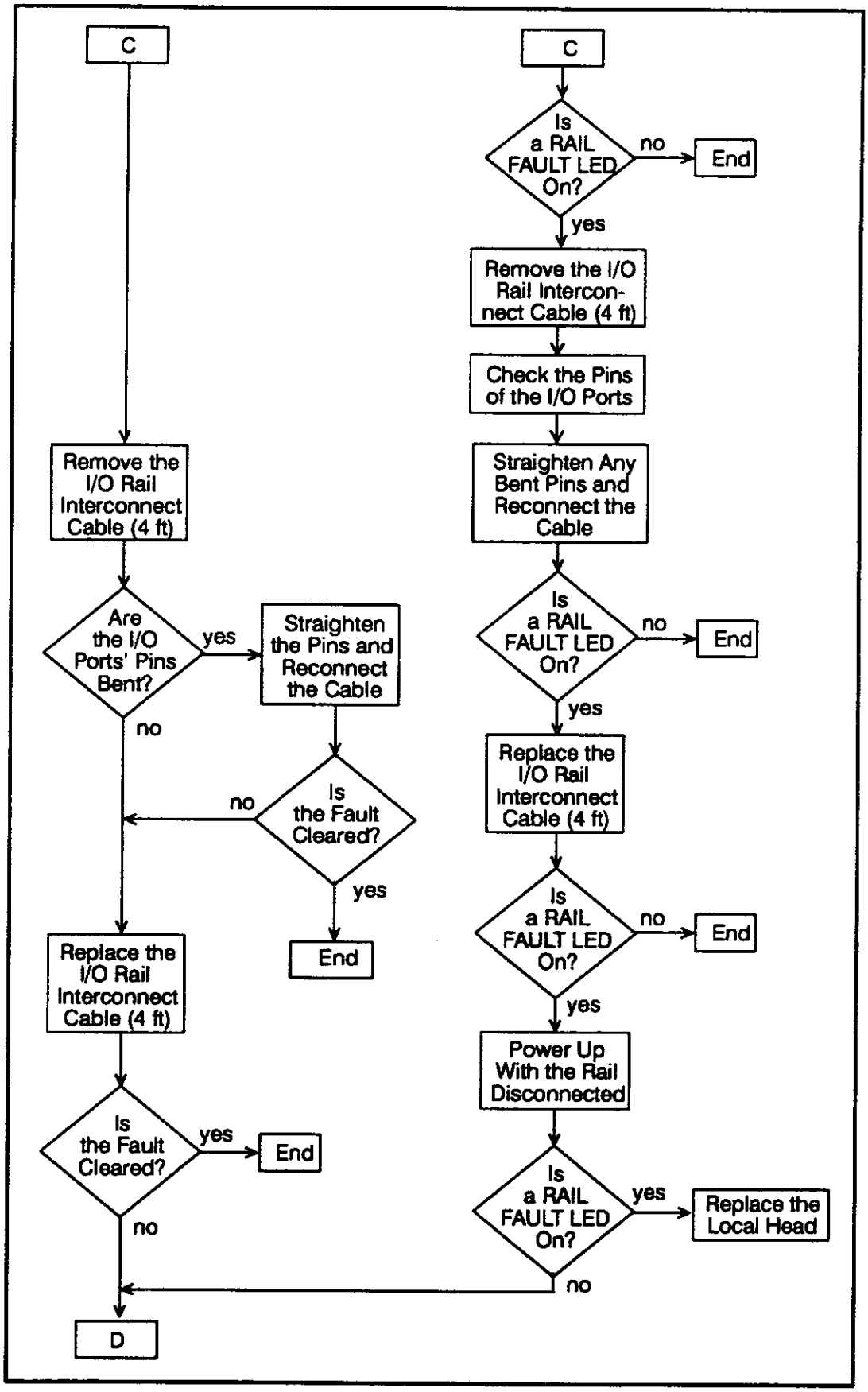


Figure 4.3 - AutoMate 20/20E Rail Fault Troubleshooting Flowchart (Continued)

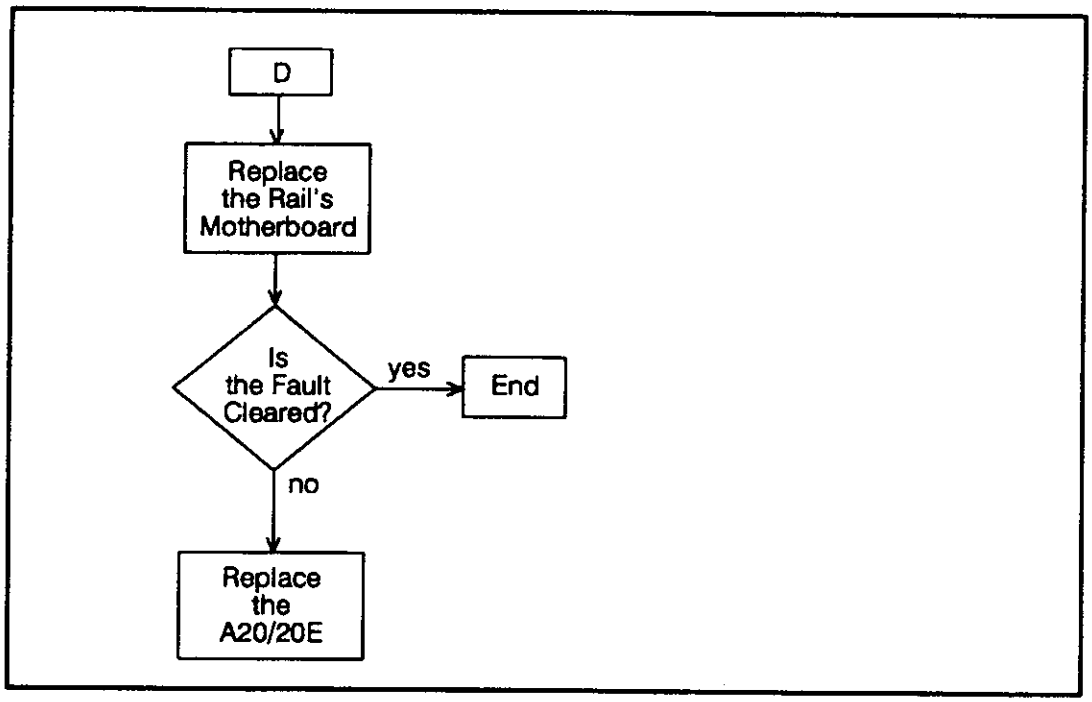


Figure 4.3 - AutoMate 20/20E Rail Fault Troubleshooting Flowchart (Continued)

AutoMate 20/20E rail faults may be caused by a malfunctioning:

- I/O Rail Interconnect Cable
- Local Head Interconnect Cable
- rail motherboard
- Local I/O Head
- AutoRail
- AutoBus
- AutoMate 20/20E

Use the following procedure to isolate and clear an AutoMate 20/20E rail fault. After each step, check the system for proper operation. If the problem remains, continue on with the next step.

Step 1. Look at the RAIL FAULT LED and COM DATA/FORCING LEDs on the front of the AutoMate 20/20E to identify the port that has had a communication problem (rail fault). See Table 4.2.

Table 4.2 - AutoMate 20/20E Rail Fault LED Error Codes

The RAIL FAULT LED is ON.

COM DATA LED	=	OFF	ON	OFF	ON
FORCING LED	=	OFF	OFF	ON	ON
Port That Has a Rail Fault	=	0	1	2	3

You can also use Rail Fault Register 2750 to determine which AutoMate 20/20E port the rail fault originated from.

Rail Fault Register 2750 (when displayed in binary) identifies the configured I/O register of the rail that has had an interruption in communication.

Each configured I/O register is assigned a bit location in register 2750. Each rail is represented by a corresponding I/O register. If a bit location in register 2750 equals one, a rail fault from that I/O register's corresponding rail has been detected. See Table 4.3.

Note that if a faulted rail is connected to the AutoMate 20/20E through a Local Head, all four bits that represent the Local Head's I/O registers will be equal to one.

Table 4.3 - AutoMate 20/20E Rail Fault Register 2750

Bit 0= I/O register 00	Bit 10 = I/O register 10
Bit 1= I/O register 01	Bit 11 = I/O register 11
Bit 2= I/O register 02	Bit 12 = I/O register 12
Bit 3= I/O register 03	Bit 13 = I/O register 13
Bit 4= I/O register 04	Bit 14 = I/O register 14
Bit 5= I/O register 05	Bit 15 = I/O register 15
Bit 6= I/O register 06	Bit 16 = I/O register 16
Bit 7= I/O register 07	Bit 17 = I/O register 17

If the rail associated with an I/O register is identified as having a rail fault, select the Point Monitor option in the ReSource AutoMate Programming Executive and locate the register number in the I/O Configuration Registers 2734-2737. These registers show which I/O registers are assigned to each port.

Step 2. If your system uses AutoRails, continue with Step 3. If your system does not use AutoRails go to Step 5.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Step 3. Look at the AutoRail's COM LED. If the LED is off, remove power and unplug the I/O Rail Interconnect Cable (M/N 45C5) between the AutoRail and AutoMate 20/20E. Check the port pins and straighten them if necessary. Reconnect the cable and reapply power. If the LED remains off, remove power and replace the cable. Reapply power. If the COM LED remains off, replace the AutoRail:

- Remove power from the AutoMate 20/20E.
- Unplug the I/O Rail Interconnect Cable from the AutoRail.
- Note the position of the twisted-pair wires and disconnect them.
- Remove the two mounting screws.

- Note the position of the AutoRail's internal jumpers. Be sure the replacement AutoRail's jumpers are positioned the same as the original's.
- Install the replacement AutoRail by following the procedure in reverse order.
- Reapply power to the AutoMate 20/20E.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Step 4. Look at the AutoBus' XMIT and RECV LEDs. If the LEDs are off, check the twisted-pair wires. If the wires are damaged, remove power and repair or replace them. Reapply power. If the two LEDs remain off, replace the AutoBus:

- Remove power from the AutoBus.
- Disconnect the input power connections from the terminal strip.
- Disconnect the I/O Rail Interconnect Cable(s).
- Note the position of the twisted-pair wires and disconnect them.
- Disconnect the ground connections.
- Remove the four mounting screws.
- Install the replacement AutoBus by following the procedure in reverse order.
- Reapply power to the AutoBus.

Step 5. If the rails in your installation are connected through Local Heads (M/N 61C22A, 61C22, or 45C22), continue with Step 6. If the Local Heads are not used, continue with Step 12.

Step 6. Look at the Local Head's LEDs.

When the Local Head is operating properly, the POWER and COM LEDs are on and the RAIL FAULT LEDs are off. This indicates that there are no rail faults associated with the rails connected to the Local Head.

Step 7. Look at the Local Head's POWER LED.

If the POWER LED is off, check to see if input power is reaching the Local Head. If power is reaching the Local Head and the POWER LED remains off, replace the Local Head (Step 11). If power is not reaching the Local Head, check the source of power and its associated wiring.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Step 8. Look at the Local Head's COM LED.

If the COM LED is off, verify that the A20/20E has input power applied. If the COM LED remains off with processor input power applied, remove power and disconnect the Local Head Interconnect Cable (M/N 45C8). Check the I/O ports for bent or broken pins. Straighten any pins that are bent. Securely reconnect the cable and reapply power.

Step 9. If the COM LED remains off, remove power and replace the Local Head Interconnect Cable with a replacement cable that is known to be good. Reapply power.

Step 10. Look at the Local Head's RAIL FAULT LEDs.

If your installation uses M/N 61C22A Local Heads, and a RAIL FAULT LED is on, check the I/O Rail Interconnect Cable (M/N 45C5) as described in Step 12. If the fault continues, replace the cable as described in Step 13. If the fault continues, power up the system with the rail cable disconnected. If the RAIL FAULT LED is on, replace the Local Head as described in Step 11. If the RAIL FAULT LED is off, replace the rail's motherboard as described in Step 14.

If your installation uses M/N 45C22 or M/N 61C22 Local Heads, and one or more of the rails connected to the Local Head has a rail fault, all four of the RAIL FAULT LEDs will be on. Isolate the malfunctioning rail or Local Head port by repeating the procedure in the previous paragraph for each of the rails.

Step 11. Replace the Local Head:

- Remove power from the Local Head.
- Disconnect the input power and ground connections.
- Disconnect the Local Head Interconnect Cable.
- Disconnect the I/O Rail Interconnect Cables.
- Remove the four mounting bolts.
- Install the replacement Local Head by following the procedure in reverse order.
- Reapply power to the Local Head.

Step 12. Remove power and remove the I/O Rail Interconnect Cable. Check the I/O ports for bent pins. Straighten any pins that are bent and carefully reconnect the cable. Reapply power.

Step 13. Remove power and replace the I/O Rail Interconnect Cable with a replacement cable that is known to be good. Reapply power.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Step 14. Replace the rail's motherboard:

- Remove power from the AutoMate 20/20E or Local Head.
- Disconnect the I/O Rail Interconnect Cable.
- Remove the I/O modules.
- Remove the two screws that hold the motherboard to the rail's chassis. See figure 4.2.
- Slide the motherboard out from under the heat sink assembly.
- Install the replacement motherboard and fasten it to the chassis with the two retaining screws.
- Plug in the I/O modules and reconnect the I/O Rail Interconnect Cable.
- Reapply power to the AutoMate 20/20E or Local Head.

Step 15. Replace the AutoMate 20/20E:

- Remove power from the AutoMate 20/20E.
- Disconnect the input power connections from the terminal strip.
- Disconnect the cable from the peripheral communications connector, if attached.
- Disconnect the cable from the R-Net connector, if attached.
- Disconnect the I/O Rail Interconnect Cables.
- Disconnect the ground connections.
- Remove the four mounting bolts.
- Install the replacement processor by following the procedure in reverse order.
- Reapply power to the AutoMate 20/20E.

4.2.3 AutoMate 30/30E

A rail fault from a directly-connected rail will light the RAIL FAULT LED on the front of the AutoMate 30/30E Processor or the Local I/O Processor. The Rail Fault Bit (76.01) will also be set to one.

You can use Rail Fault Registers 3750 and 3751 to determine which AutoMate 30/30E Processor or Local I/O Processor port the faulted rail is connected to.

An AutoMate 30/30E rail fault troubleshooting flowchart is shown in figure 4.4.

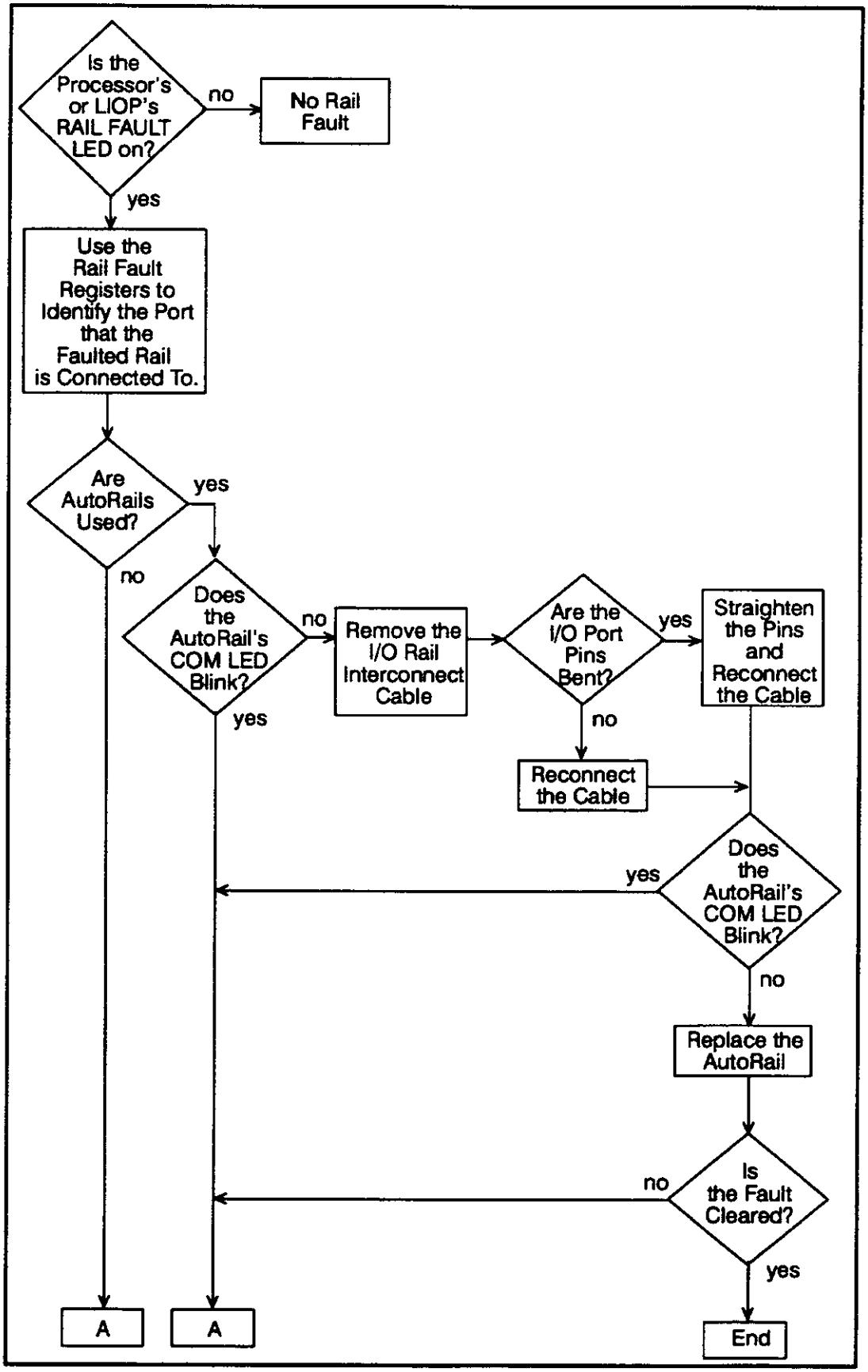


Figure 4.4 - AutoMate 30/30E and 40/40E Rail Fault Troubleshooting Flowchart

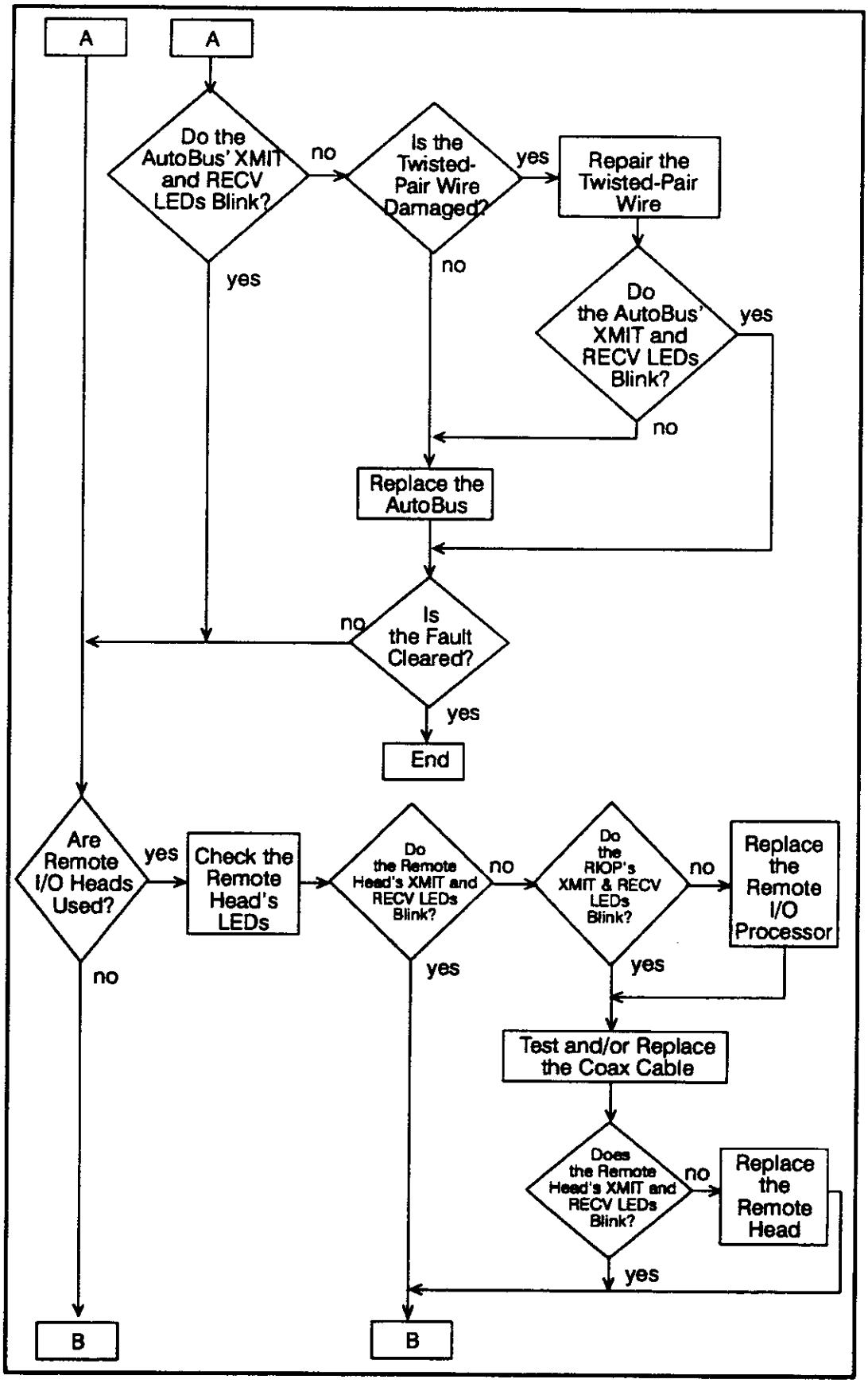


Figure 4.4 - AutoMate 30/30E and 40/40E Rail Fault Troubleshooting Flowchart (Continued)

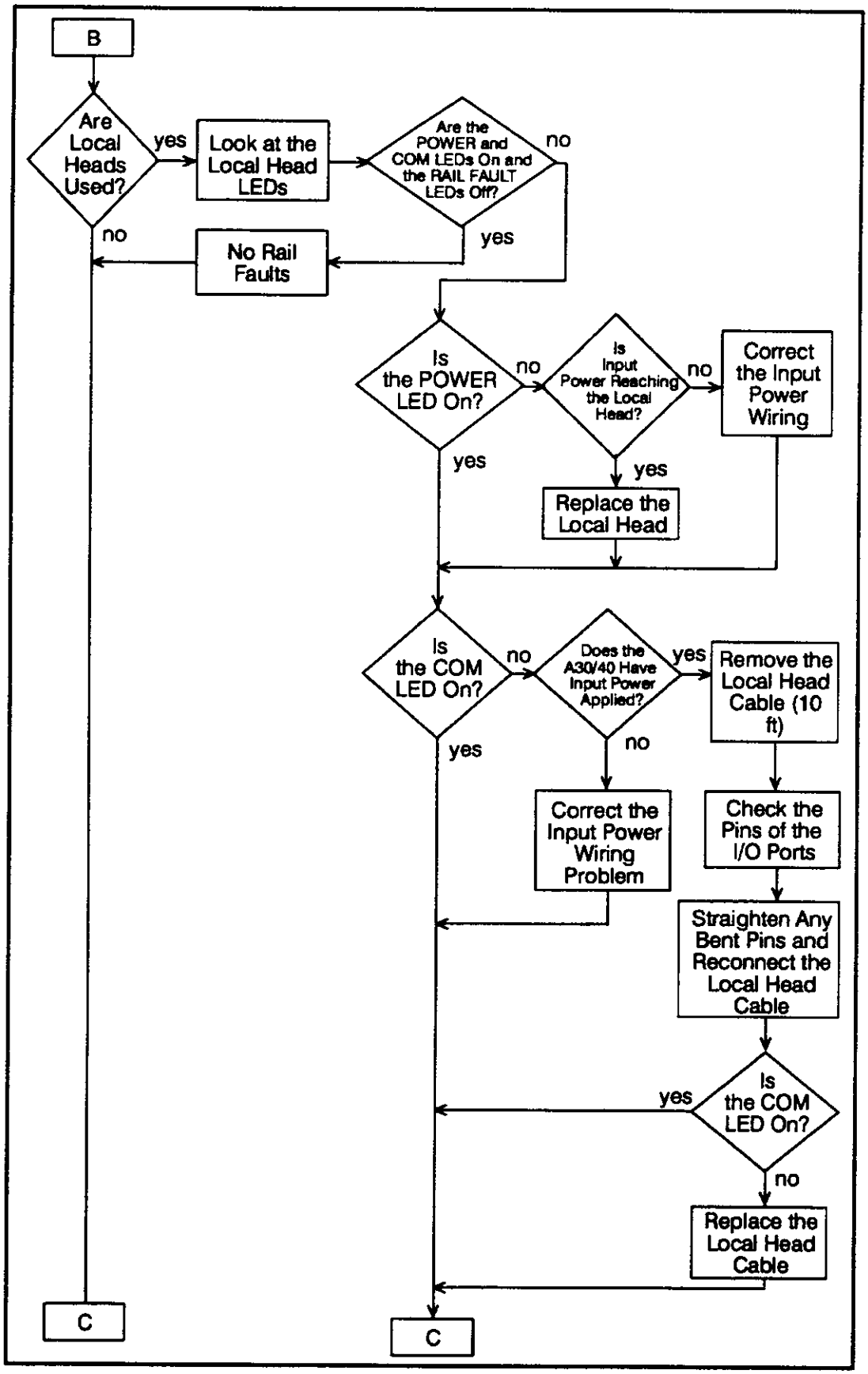


Figure 4.4 - AutoMate 30/30E and 40/40E Rail Fault Troubleshooting Flowchart (Continued)

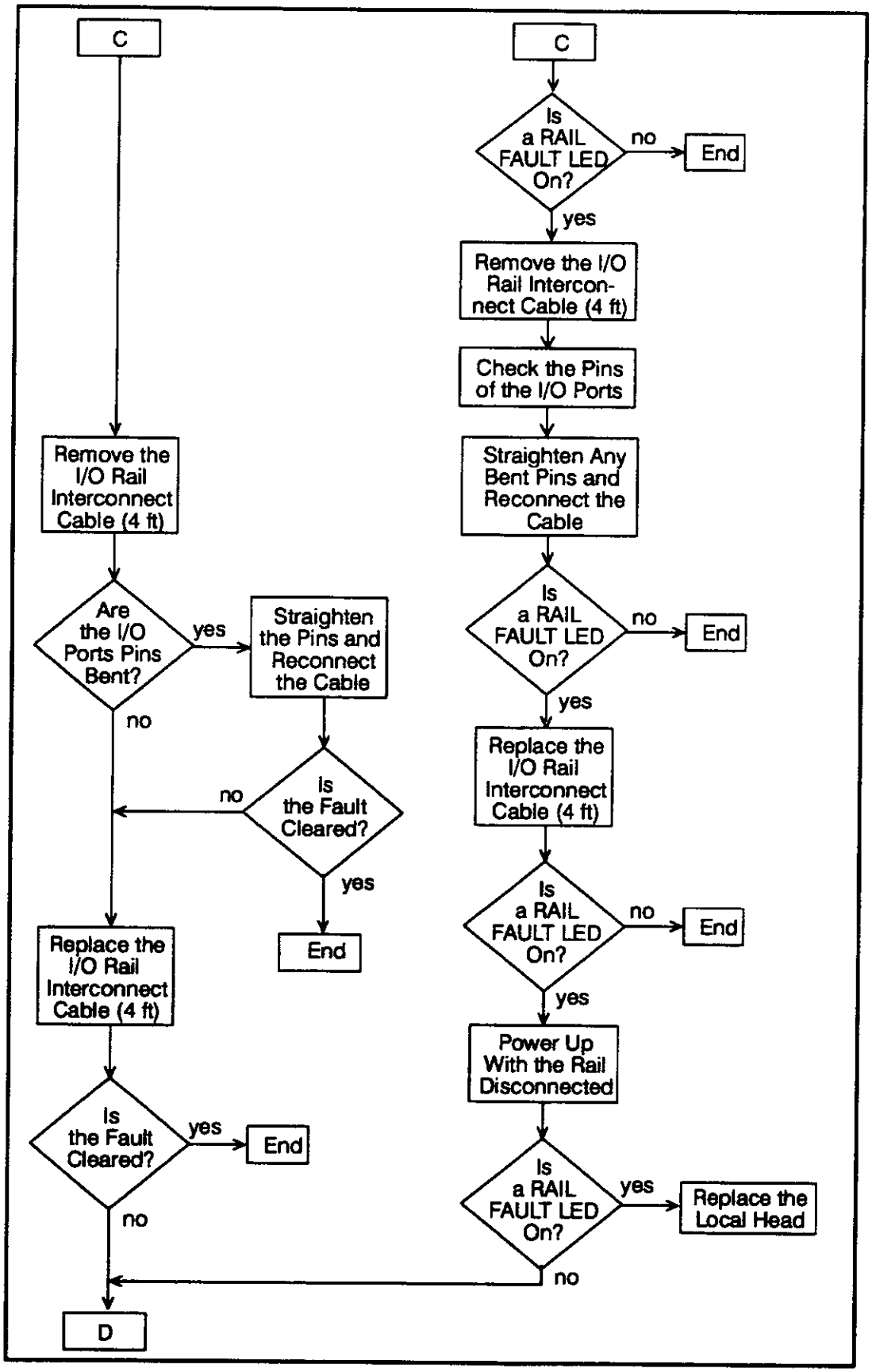


Figure 4.4 - AutoMate 30/30E and 40/40E Rail Fault Troubleshooting Flowchart (Continued)

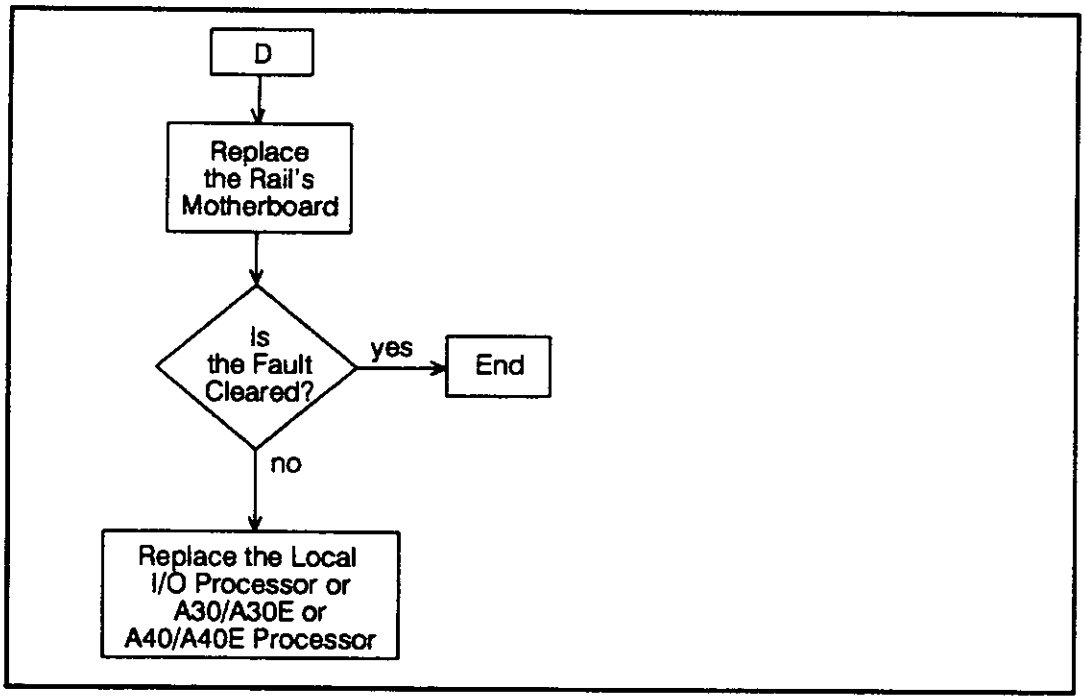


Figure 4.4 - AutoMate 30/30E and 40/40E Rail Fault Troubleshooting Flowchart (Continued)

AutoMate 30/30E rail faults may be caused by a malfunctioning:

- I/O Rail Interconnect Cable
- Local Head Interconnect Cable
- rail motherboard
- Local I/O Head
- AutoRail
- AutoBus
- Remote I/O Head
- Local I/O Processor
- AutoMate 30/30E

WARNING

THE RAIL FAULT ERROR COIL MUST BE USED TO SET THE PROGRAMMABLE FAULT COIL IN ORDER TO OPEN THE READY RELAY CONTACTS WHEN A RAIL FAULT IS DETECTED. THE READY RELAY CONTACTS MUST BE WIRED IN SERIES WITH CONTROL POWER SO THAT POWER WILL BE REMOVED FROM THE RAILS. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Use the following procedure to isolate and clear an AutoMate 30/30E rail fault. After each step, check the system for proper operation. If the problem remains, continue on with the next step.

Step 1. A rail fault from a directly-connected rail will cause the RAIL FAULT LED on the front of the A30/30E Processor (M/N 45C301A, 45C305A, 45C307A) or the Local I/O Processor to light. You can also use Rail Fault Registers 3750 and 3751 to locate the port that the faulted rail is connected to.

Rail Fault Registers 3750 and 3751 (when displayed in binary) identify the configured I/O register of the rail that has had an interruption in communication.

Each configured I/O register is assigned a bit location in either register 3750 or 3751. Each rail is represented by a corresponding I/O register. If a bit location in register 3750 or 3751 equals one, a rail fault from that I/O register's corresponding rail has been detected. Register 3750 indicates rail faults from I/O registers 00 to 17. Register 3751 indicates rail faults from I/O registers 20 to 37. See Table 4.4.

Note that if a faulted rail is connected to the AutoMate 30/30E system through a Local Head, all four bits that represent the Local Head's I/O registers will be equal to one.

If the rail associated with an I/O register is identified as having a rail fault, use the ReSource AutoMate Programming Executive Software and select the Configure System option and then the Digital I/O option to view the AutoMate 30/30E's current configuration. The configuration screen shows which I/O registers are assigned to each port.

Table 4.4 - AutoMate 30/30E Rail Fault Registers 3750/3751

Register 3750,	bit 0	=	I/O register 00
"	bit 1	=	I/O register 01
"	bit 2	=	I/O register 02
"	bit 3	=	I/O register 03
"	bit 4	=	I/O register 04
"	bit 5	=	I/O register 05
"	bit 6	=	I/O register 06
"	bit 7	=	I/O register 07
"	bit 10	=	I/O register 10
"	bit 11	=	I/O register 11
"	bit 12	=	I/O register 12
"	bit 13	=	I/O register 13
"	bit 14	=	I/O register 14
"	bit 15	=	I/O register 15
"	bit 16	=	I/O register 16
"	bit 17	=	I/O register 17
Register 3751,	bit 0	=	I/O register 20
"	bit 1	=	I/O register 21
"	bit 2	=	I/O register 22
"	bit 3	=	I/O register 23
"	bit 4	=	I/O register 24
"	bit 5	=	I/O register 25
"	bit 6	=	I/O register 26
"	bit 7	=	I/O register 27
"	bit 10	=	I/O register 30
"	bit 11	=	I/O register 31
"	bit 12	=	I/O register 32
"	bit 13	=	I/O register 33
"	bit 14	=	I/O register 34
"	bit 15	=	I/O register 35
"	bit 16	=	I/O register 36
"	bit 17	=	I/O register 37

Step 2. If your system uses AutoRails, continue with Step 3. If your system does not use AutoRails go to Step 5.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Step 3. Look at the AutoRail's COM LED. If the LED is off, remove power and unplug the I/O Rail Interconnect Cable (M/N 45C5) between the AutoRail and the AutoMate 30/30E Processor or Local I/O Processor. Check the port pins and straighten them if necessary. Reconnect the cable and reapply power. If the LED remains off, remove power and replace the cable. Reapply power and test the system.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

If the COM LED remains off, replace the AutoRail:

- Remove power from the rack containing the AutoMate 30/30E Processor or Local I/O Processor.
- Unplug the I/O Rail Interconnect Cable from the AutoRail.
- Note the position of the twisted-pair wires and disconnect them.
- Remove the two mounting screws.
- Note the position of the AutoRail's internal jumpers. Be sure the replacement AutoRail's jumpers are positioned the same as the original's.
- Install the replacement AutoRail by following the procedure in reverse order.
- Reapply power to the rack.

Step 4. Look at the AutoBus' XMIT and RECV LEDs. If the LEDs are off, check the twisted-pair wires. If the wires are damaged, remove power and repair or replace them. Reapply power. If the two LEDs remain off, replace the AutoBus:

- Remove power from the AutoBus.
- Disconnect the input power connections from the terminal strip.
- Disconnect the I/O Rail Interconnect Cable(s) (M/N 45C5).
- Note the position of the twisted-pair wires and disconnect them.
- Disconnect the ground connections.
- Remove the four mounting screws.
- Install the replacement AutoBus by following the procedure in reverse order.
- Reapply power to the AutoBus.

Step 5. If the rails are connected through Remote I/O Heads (M/N 45C37A, 45C38A), continue with Step 6. If Remote I/O Heads are not used, continue with Step 10.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Step 6. Look at the Remote Head's LEDs. If the XMIT and RECV LEDs are off, check the Remote I/O Processor's XMIT and RECV LEDs. If these two LEDs are also off, replace the Remote I/O Processor (M/N 45C201A):

- Remove power from the rack containing the Remote I/O Processor.
- Disconnect the BNC coax cable connector.
- Remove the Remote I/O Processor from the rack.
- Set the replacement processor's drop number and mode select switches to the same settings as the original processor's.
- Install the replacement processor in the rack and reconnect the coax connector.
- Reapply power to the rack.

Step 7. If the Remote Head's XMIT and RECV LEDs remain off, check the coax cable between the Remote Head and the Remote I/O Processor. If the coax cable is damaged, remove power and repair or replace the cable as necessary and then reapply power.

Step 8. Look at the Remote Head's XMIT and RECV LEDs. If they are off, replace the Remote Head:

- Remove power from the Remote Head.
- Disconnect the input power connections from the terminal strip.
- Disconnect the cable from the peripheral communications connector, if attached.
- Disconnect the cable from the BNC coax connector.
- Disconnect the I/O Rail Interconnect Cable(s).
- Disconnect the ground connections.
- Remove the four mounting bolts.
- Set the replacement Remote Head's drop number and mode selector switches to the same settings as the ones on the original Remote Head.
- Install the replacement Remote Head by following the procedure in reverse order.
- Reapply power to the Remote Head.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Step 9. When the Remote Head's RAIL FAULT LED is on, the XMIT and RECV LEDs display a binary code which identifies the port that has had an interruption in communication. See Table 4.5.

Table 4.5 - Remote I/O Head Rail Fault LED Error Codes

The RAIL FAULT LED is ON.

XMIT LED	=	OFF	ON	OFF	ON
RECV LED	=	OFF	OFF	ON	ON
Port That Has a Rail Fault	=	0	1	2	3

Step 10. If the rails in your installation are connected through Local Heads (M/N 61C22A, 61C22, or 45C22), continue with Step 11. If Local Heads are not used, continue with Step 17.

Step 11. Look at the Local Head's LEDs.

When the Local Head is operating properly, the POWER and COM LEDs are on and the RAIL FAULT LEDs are off. This indicates that there are no rail faults associated with the rails connected to the Local Head.

Step 12. Look at the Local Head's POWER LED.

If the POWER LED is off, check to see if input power is reaching the Local Head. If power is reaching the Local Head and the POWER LED remains off, replace the Local Head (Step 16). If power is not reaching the Local Head, check the source of power and its associated wiring.

Step 13. Look at the Local Head's COM LED.

If the COM LED is off, verify that the A30/30E Processor, Local I/O Processor, or Remote Head has input power applied. If the COM LED remains off with processor input power applied, remove power and disconnect the Local Head Interconnect Cable (M/N 45C8). Check the I/O ports for bent or broken pins. Straighten any pins that are bent. Securely reconnect the cable and reapply power.

Step 14. If the COM LED remains off, remove power and replace the Local Head Interconnect Cable with a replacement cable that is known to be good. Reapply power.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Step 15. Look at the Local Head's RAIL FAULT LEDs.

If your installation uses M/N 61C22A Local Heads, and a RAIL FAULT LED is on, check the I/O Rail Interconnect Cable (M/N 45C5) as described in Step 17. If the fault continues, replace the cable as described in Step 18. If the fault continues, power up the system with the rail cable disconnected. If the RAIL FAULT LED is on, replace the Local Head as described in Step 16. If the RAIL FAULT LED is off, replace the rail's motherboard as described in Step 19.

If your installation uses M/N 45C22 or M/N 61C22 Local Heads, and one or more of the rails connected to the Local Head has a rail fault, all four of the RAIL FAULT LEDs will be on. Isolate the malfunctioning rail or Local Head port by repeating the procedure in the previous paragraph for each of the rails.

Step 16. Replace the Local Head:

- Remove power from the Local Head.
- Disconnect the input power and ground connections.
- Disconnect the Local Head Interconnect Cable.
- Disconnect the I/O Rail Interconnect Cables.
- Remove the four mounting bolts.
- Install the replacement Local Head by following the procedure in reverse order.
- Reapply power to the Local Head.

Step 17. Remove power and disconnect the I/O Rail Interconnect Cable (M/N 45C5) from the faulted rail and check the I/O ports for bent pins. Straighten any pins that are bent. Carefully reconnect the cable and reapply power.

Step 18. Remove power and replace the I/O Rail Interconnect Cable with a replacement cable that is known to be good. Reapply power.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Step 19. Replace the rail's motherboard:

- Remove power from the rack containing the AutoMate A30/30E Processor, Local I/O Processor, or from the Local Head.
- Disconnect the I/O Rail Interconnect Cable.
- Remove the I/O modules.
- Remove the two screws that hold the motherboard to the rail's chassis. See figure 4.2.
- Slide the motherboard out from under the heat sink assembly.
- Install the replacement motherboard and fasten it to the chassis with the two retaining screws.
- Plug in the I/O modules and reconnect the I/O Rail Interconnect Cable.
- Reapply power to the AutoMate 30/30E Processor, Local I/O Processor, or Local Head.

Step 20. Replace the AutoMate 30/30E Processor or Local I/O Processor:

- Remove power from the rack containing the AutoMate 30/30E Processor or the Local I/O Processor.
- Disconnect the I/O Rail Interconnect Cables.
- Remove the AutoMate 30/30E Processor or Local I/O Processor from the rack.
- Install the replacement processor in the rack.
- Connect the I/O Rail Interconnect Cables.
- Reapply power to the rack containing the AutoMate 30/30E Processor or the Local I/O Processor.

4.2.4 AutoMate 40/40E

A rail fault from a directly-connected rail will light the RAIL FAULT LED on the front of the AutoMate 40/40E Logic Processor or the Local I/O Processor. The Rail Fault Bit (1776.01) will also be set to one.

In an AutoMate 40, you can use Rail Fault Registers 17600 through 17607 to locate the AutoMate 40 Processor or Local I/O Processor port that the faulted rail is connected to.

In an AutoMate 40E, you can use Rail Fault Registers 17600 through 17637 to locate the AutoMate 40E Processor or Local I/O Processor port that the faulted rail is connected to.

An AutoMate 40/40E rail fault troubleshooting flowchart is shown in figure 4.4.

AutoMate 40/40E rail faults may be caused by a malfunctioning:

- I/O Rail Interconnect Cable
- Local Head Interconnect Cable
- rail motherboard
- Local I/O Head
- AutoRail
- AutoBus
- Remote I/O Head
- Local I/O Processor
- AutoMate 40/40E

Use the following procedure to isolate and clear an AutoMate 40/40E rail fault. After each step, check the system for proper operation. If the problem remains, continue on with the next step.

Step 1. A rail fault from a directly-connected rail will cause the RAIL FAULT LED on the front of the A40 Logic Processor (M/N 45C400A) or the Local I/O Processor (M/N 45C200A) to light. You can use Rail Fault Registers 17600-17607 (A40) or 17600-17637 (A40E) to locate the port that the faulted rail is connected to.

Rail Fault Registers 17600-17607 (A40) or 17600-17637 (A40E) (when displayed in binary) identify the configured I/O register of the rail that has had an interruption in communication.

Each configured I/O register is assigned a bit location in either registers 17600 - 17607 or 17600 - 17637. Each rail is represented by a corresponding I/O register. If a bit location in the Rail Fault Registers equals one, a rail fault from that I/O register's corresponding rail has been detected.

In an AutoMate 40, register 17600 indicates rail faults from I/O Registers 00 to 17. Register 17601 indicates rail faults from I/O Registers 20 to 37. Registers 17602 through 17607 indicate rail faults from I/O Registers 40 to 177. See Table 4.6.

In an AutoMate 40E, register 17600 indicates rail faults from I/O Registers 00 to 17. Register 17601 indicates rail faults from I/O Registers 20 to 37. Registers 17602 through 17637 indicate rail faults from I/O Registers 40 to 777. See Table 4.7.

Note that if a faulted rail is connected to the AutoMate 40/40E system through a Local Head, all four bits that represent the Local Head's I/O registers will be equal to one.

If the rail associated with an I/O register is identified as having a rail fault, use the ReSource AutoMate Programming Executive Software and select the Configure System option and then the Digital I/O option to view the AutoMate 40/40E current configuration. The configuration screen shows which I/O registers are assigned to each port.

Table 4.6 - AutoMate 40 Rail Fault Registers 17600-17607

Register 17600,	bit 0	=	I/O Register 00
"	bit 1	=	I/O Register 01
"	bit 2	=	I/O Register 02
"	bit 3	=	I/O Register 03
"	bit 4	=	I/O Register 04
"	bit 5	=	I/O Register 05
"	bit 6	=	I/O Register 06
"	bit 7	=	I/O Register 07
"	bit 10	=	I/O Register 10
"	bit 11	=	I/O Register 11
"	bit 12	=	I/O Register 12
"	bit 13	=	I/O Register 13
"	bit 14	=	I/O Register 14
"	bit 15	=	I/O Register 15
"	bit 16	=	I/O Register 16
"	bit 17	=	I/O Register 17
Register 17601,	bit 0	=	I/O Register 20
"	bit 1	=	I/O Register 21
"	bit 2	=	I/O Register 22
"	bit 3	=	I/O Register 23
"	bit 4	=	I/O Register 24
"	bit 5	=	I/O Register 25
"	bit 6	=	I/O Register 26
"	bit 7	=	I/O Register 27
"	bit 10	=	I/O Register 30
"	bit 11	=	I/O Register 31
"	bit 12	=	I/O Register 32
"	bit 13	=	I/O Register 33
"	bit 14	=	I/O Register 34
"	bit 15	=	I/O Register 35
"	bit 16	=	I/O Register 36
"	bit 17	=	I/O Register 37

Register 17602:	Bit 17 = I/O Register 57,	Bit 0 = I/O Register 40
Register 17603:	Bit 17 = I/O Register 77,	Bit 0 = I/O Register 60
Register 17604:	Bit 17 = I/O Register 117,	Bit 0 = I/O Register 100
Register 17605:	Bit 17 = I/O Register 137,	Bit 0 = I/O Register 120
Register 17606:	Bit 17 = I/O Register 157,	Bit 0 = I/O Register 140
Register 17607:	Bit 17 = I/O Register 177,	Bit 0 = I/O Register 160

Table 4.7 - AutoMate 40E Rail Fault Registers 17600-17637

Register 17600,	bit 0	= I/O Register 00
"	bit 1	= I/O Register 01
"	bit 2	= I/O Register 02
"	bit 3	= I/O Register 03
"	bit 4	= I/O Register 04
"	bit 5	= I/O Register 05
"	bit 6	= I/O Register 06
"	bit 7	= I/O Register 07
"	bit 10	= I/O Register 10
"	bit 11	= I/O Register 11
"	bit 12	= I/O Register 12
"	bit 13	= I/O Register 13
"	bit 14	= I/O Register 14
"	bit 15	= I/O Register 15
"	bit 16	= I/O Register 16
"	bit 17	= I/O Register 17

Register 17601:	Bit 17 = I/O Register 37,	Bit 0 = I/O Register 20
Register 17602:	Bit 17 = I/O Register 57,	Bit 0 = I/O Register 40
Register 17603:	Bit 17 = I/O Register 77,	Bit 0 = I/O Register 60
Register 17604:	Bit 17 = I/O Register 117,	Bit 0 = I/O Register 100
Register 17605:	Bit 17 = I/O Register 137,	Bit 0 = I/O Register 120
Register 17606:	Bit 17 = I/O Register 157,	Bit 0 = I/O Register 140
Register 17607:	Bit 17 = I/O Register 177,	Bit 0 = I/O Register 160
Register 17610:	Bit 17 = I/O Register 217,	Bit 0 = I/O Register 200
Register 17611:	Bit 17 = I/O Register 237,	Bit 0 = I/O Register 220
Register 17612:	Bit 17 = I/O Register 257,	Bit 0 = I/O Register 240
Register 17613:	Bit 17 = I/O Register 277,	Bit 0 = I/O Register 260
Register 17614:	Bit 17 = I/O Register 317,	Bit 0 = I/O Register 300
Register 17615:	Bit 17 = I/O Register 337,	Bit 0 = I/O Register 320
Register 17616:	Bit 17 = I/O Register 357,	Bit 0 = I/O Register 340
Register 17617:	Bit 17 = I/O Register 377,	Bit 0 = I/O Register 360
Register 17620:	Bit 17 = I/O Register 417,	Bit 0 = I/O Register 400
Register 17621:	Bit 17 = I/O Register 437,	Bit 0 = I/O Register 420
Register 17622:	Bit 17 = I/O Register 457,	Bit 0 = I/O Register 440
Register 17623:	Bit 17 = I/O Register 477,	Bit 0 = I/O Register 460
Register 17624:	Bit 17 = I/O Register 517,	Bit 0 = I/O Register 500
Register 17625:	Bit 17 = I/O Register 537,	Bit 0 = I/O Register 520
Register 17626:	Bit 17 = I/O Register 557,	Bit 0 = I/O Register 540
Register 17627:	Bit 17 = I/O Register 577,	Bit 0 = I/O Register 560
Register 17630:	Bit 17 = I/O Register 617,	Bit 0 = I/O Register 600
Register 17631:	Bit 17 = I/O Register 637,	Bit 0 = I/O Register 620
Register 17632:	Bit 17 = I/O Register 657,	Bit 0 = I/O Register 640
Register 17633:	Bit 17 = I/O Register 677,	Bit 0 = I/O Register 660
Register 17634:	Bit 17 = I/O Register 717,	Bit 0 = I/O Register 700
Register 17635:	Bit 17 = I/O Register 737,	Bit 0 = I/O Register 720
Register 17636:	Bit 17 = I/O Register 757,	Bit 0 = I/O Register 740
Register 17637:	Bit 17 = I/O Register 777,	Bit 0 = I/O Register 760

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Step 2. If your system uses AutoRails, continue with Step 3. If your system does not use AutoRails go to Step 5.

Step 3. Look at the AutoRail's COM LED. If the LED is off, remove power and unplug the I/O Rail Interconnect Cable (M/N 45C5) between the AutoRail and the AutoMate 40/40E Logic Processor or Local I/O Processor. Check the port pins and straighten them if necessary. Reconnect the cable and reapply power. If the LED remains off, remove power and replace the cable. Reapply power. If the COM LED remains off, replace the AutoRail:

- Remove power from the rack containing the AutoMate 40/40E Logic Processor or Local I/O Processor.
- Unplug the I/O Rail Interconnect Cable from the AutoRail.
- Note the position of the twisted-pair wires and disconnect them.
- Remove the two mounting screws.
- Note the position of the AutoRail's internal jumpers. Be sure the replacement AutoRail's jumpers are positioned the same as the original's.
- Install the replacement AutoRail by following the procedure in reverse order.
- Reapply power to the rack.

Step 4. Look at the AutoBus' XMIT and RECV LEDs. If the LEDs are off, check the twisted-pair wires. If the wires are damaged, remove power and repair or replace them. Reapply power and test the system. If the two LEDs remain off, replace the AutoBus:

- Remove power from the AutoBus.
- Disconnect the input power connections from the terminal strip.
- Disconnect the I/O Rail Interconnect Cable(s) (M/N 45C5).
- Note the position of the twisted-pair wires and disconnect them.
- Disconnect the ground connections.
- Remove the four mounting screws.
- Install the replacement AutoBus by following the procedure in reverse order.
- Reapply power to the AutoBus.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Step 5. If the rails are connected through Remote I/O Heads (M/N 45C37A, 45C38A, 45C38B), continue with Step 6. If Remote I/O Heads are not used, continue with Step 10.

Step 6. Look at the Remote Head's LEDs. If the XMIT and RECV LEDs are off, check the Remote I/O Processor's XMIT and RECV LEDs. If these two LEDs are also off, replace the Remote I/O Processor (M/N 45C201A):

- Remove power from the rack containing the Remote I/O Processor.
- Disconnect the BNC coax cable connector.
- Remove the Remote I/O Processor from the rack.
- Set the replacement processor's drop number and mode select switches to the same settings as the original processor's.
- Install the replacement processor in the rack and reconnect the coax connector.
- Reapply power to the rack and test the system for proper operation.

Step 7. If the Remote Head's XMIT and RECV LEDs remain off, check the coax cable between the Remote Head and the Remote I/O Processor. If the coax cable is damaged, remove power and repair or replace the cable as necessary and then reapply power.

Step 8. Look at the Remote Head's XMIT and RECV LEDs. If they remain off, replace the Remote Head:

- Remove power from the Remote Head.
- Disconnect the input power connections from the terminal strip.
- Disconnect the cable from the peripheral communications connector, if attached.
- Disconnect the cable from the BNC coax connector.
- Disconnect the I/O Rail Interconnect Cable(s).
- Disconnect the ground connections.
- Remove the four mounting bolts.
- Set the replacement Remote Head's drop number and mode selector switches to the same settings as the ones on the original Remote Head.
- Install the replacement Remote Head by following the procedure in reverse order.
- Reapply power to the Remote Head.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Step 9. When the Remote Head's RAIL FAULT LED is on, the XMIT and RECV LEDs display a binary code which identifies the port that has had an interruption in communication. See Table 4.5.

Step 10. If the rails in your installation are connected through Local Heads (M/N 61C22A, 61C22, 61C23, or 45C22), continue with Step 11. If Local Heads are not used, continue with Step 17.

Step 11. Look at the Local Head's LEDs.

When the Local Head is operating properly, the POWER and COM LEDs are on and the RAIL FAULT LEDs are off. This indicates that there are no rail faults associated with the rails connected to the Local Head.

Step 12. Look at the Local Head's POWER LED.

If the POWER LED is off, check to see if input power is reaching the Local Head. If power is reaching the Local Head and the POWER LED remains off, replace the Local Head (Step 16). If power is not reaching the Local Head, check the source of power and its associated wiring.

Step 13. Look at the Local Head's COM LED.

If the COM LED is off, verify that the A40/40E Processor, Local I/O Processor, or Remote Head has input power applied. If the COM LED remains off with processor input power applied, remove power and disconnect the Local Head Interconnect Cable (M/N 45C8). Check the I/O ports for bent or broken pins. Straighten any pins that are bent. Securely reconnect the cable and reapply power.

Step 14. If the COM LED remains off, remove power and replace the Local Head Interconnect Cable with a replacement cable that is known to be good. Reapply power.

Step 15. Look at the Local Head's RAIL FAULT LEDs.

If your installation uses M/N 61C22A or 61C23 Local Heads, and a RAIL FAULT LED is on, check the I/O Rail Interconnect Cable (M/N 45C5) as described in Step 17. If the fault continues, replace the cable as described in Step 18. If the fault continues, power up the system with the rail cable disconnected. If the RAIL FAULT LED is on, replace the Local Head as described in Step 16. If the RAIL FAULT LED is off, replace the motherboard as described in Step 19.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

If your installation uses M/N 45C22 or M/N 61C22 Local Heads, and one or more of the rails connected to the Local Head has a rail fault, all four of the RAIL FAULT LEDs will be on. Isolate the malfunctioning rail or Local Head port by repeating the procedure in the previous paragraph for each of the rails.

Step 16. Replace the Local Head:

- Remove power from the Local Head.
- Disconnect the input power and ground connections.
- Disconnect the Local Head Interconnect Cable.
- Disconnect the I/O Rail Interconnect Cables.
- Remove the four mounting bolts.
- Install the replacement Local Head by following the procedure in reverse order.
- Reapply power to the Local Head.

Step 17. Remove power and disconnect the I/O Rail Interconnect Cable (M/N 45C5) from the faulted rail and check the I/O ports for bent pins. Straighten any pins that are bent. Carefully reconnect the cable and reapply power.

Step 18. Remove power and replace the I/O Rail Interconnect Cable with a replacement cable that is known to be good. Reapply power.

Step 19. Replace the rail's motherboard:

- Remove power from the rack containing the AutoMate A40/40E Logic Processor, or Local I/O Procesor, or from the Local Head.
- Disconnect the I/O Rail Interconnect Cable.
- Remove the I/O modules.
- Remove the two screws that hold the motherboard to the rail's chassis. See figure 4.2.
- Slide the motherboard out from under the heat sink assembly.
- Install the replacement motherboard and fasten it to the chassis with the two retaining screws.
- Plug in the I/O modules and reconnect the I/O Rail Interconnect Cable.
- Reapply power to the AutoMate A40/40E Logic Processor, or Local I/O Procesor, or Local Head.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Step 20 Replace the AutoMate 40/40E Logic Processor or Local I/O Processor:

- Remove power from the rack containing the AutoMate 40 Logic Processor or the Local I/O Processor.
- Disconnect the I/O Rail Interconnect Cables.
- Remove the AutoMate 40/40E Processor or Local I/O Processor from the rack.
- Install the replacement processor in the rack.
- Connect the I/O Rail Interconnect Cables.
- Reapply power to the rack containing the AutoMate 40/40E Logic Processor or the Local I/O Processor.

4.2.5 DCS 5000/AutoMax

A rail fault will light the RAIL FAULT LED on the front of a DCS 5000/AutoMax Remote I/O Head (M/N 57C330). The FAULT MSB and FAULT LSB LEDs on the front of the Remote Head will display a binary code indicating which port has had an interruption in communication (rail fault).

A DCS 5000/AutoMax rail fault troubleshooting flowchart is shown in figure 4.5.

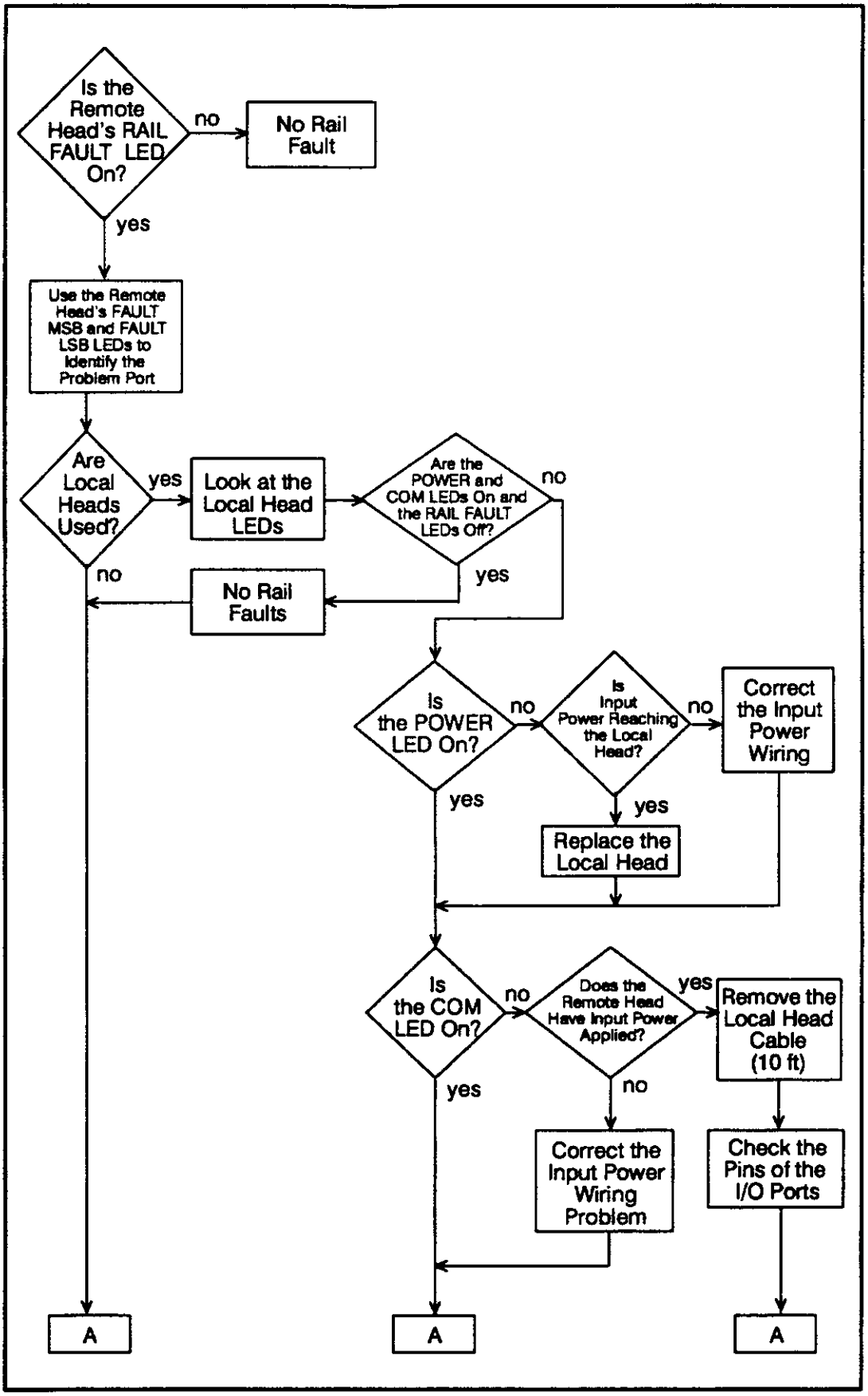


Figure 4.5 - DCS 5000/AutoMax Rail Fault Troubleshooting Flowchart

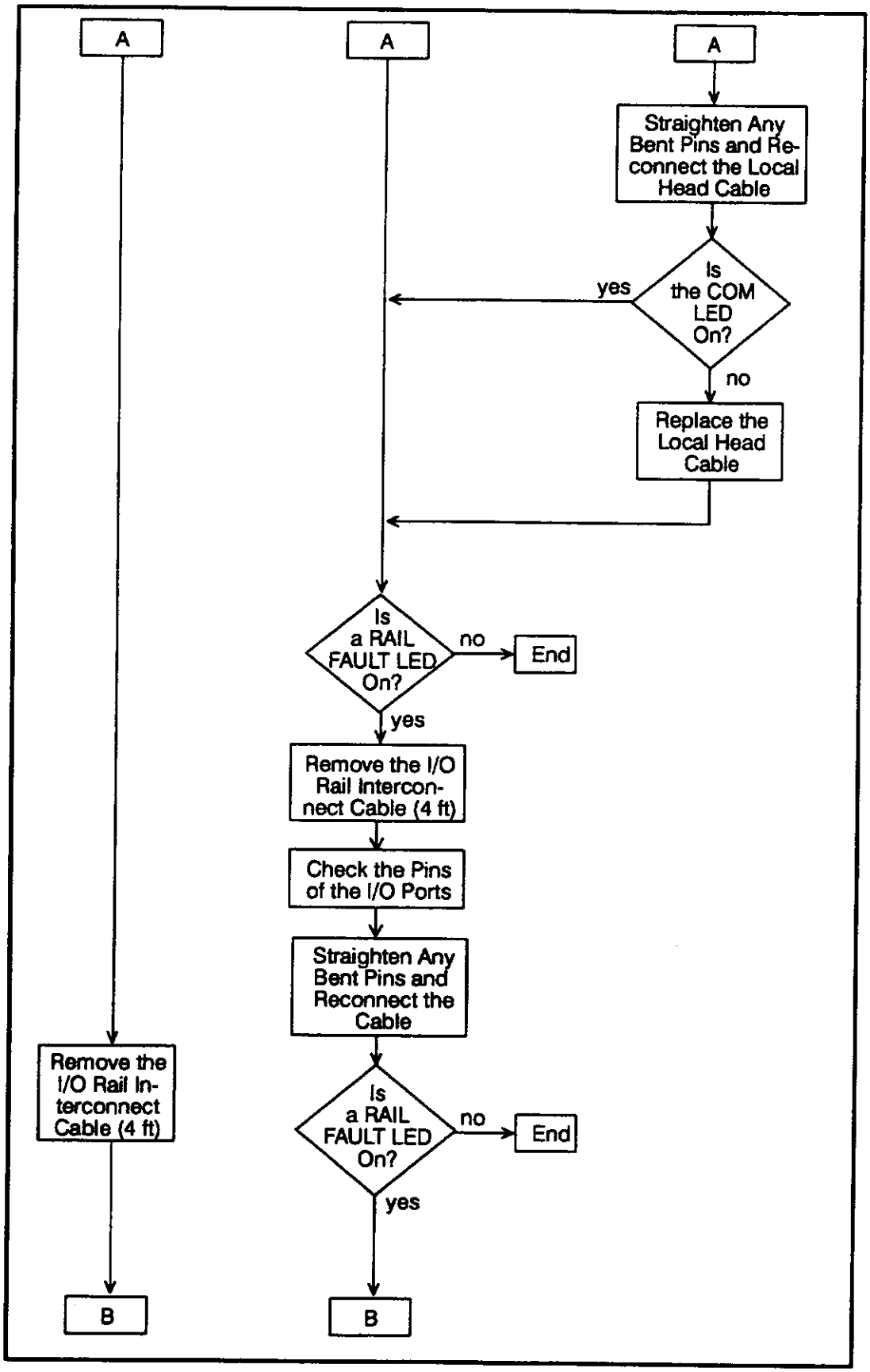


Figure 4.5 - DCS 5000/AutoMax Rail Fault Troubleshooting Flowchart (Continued)

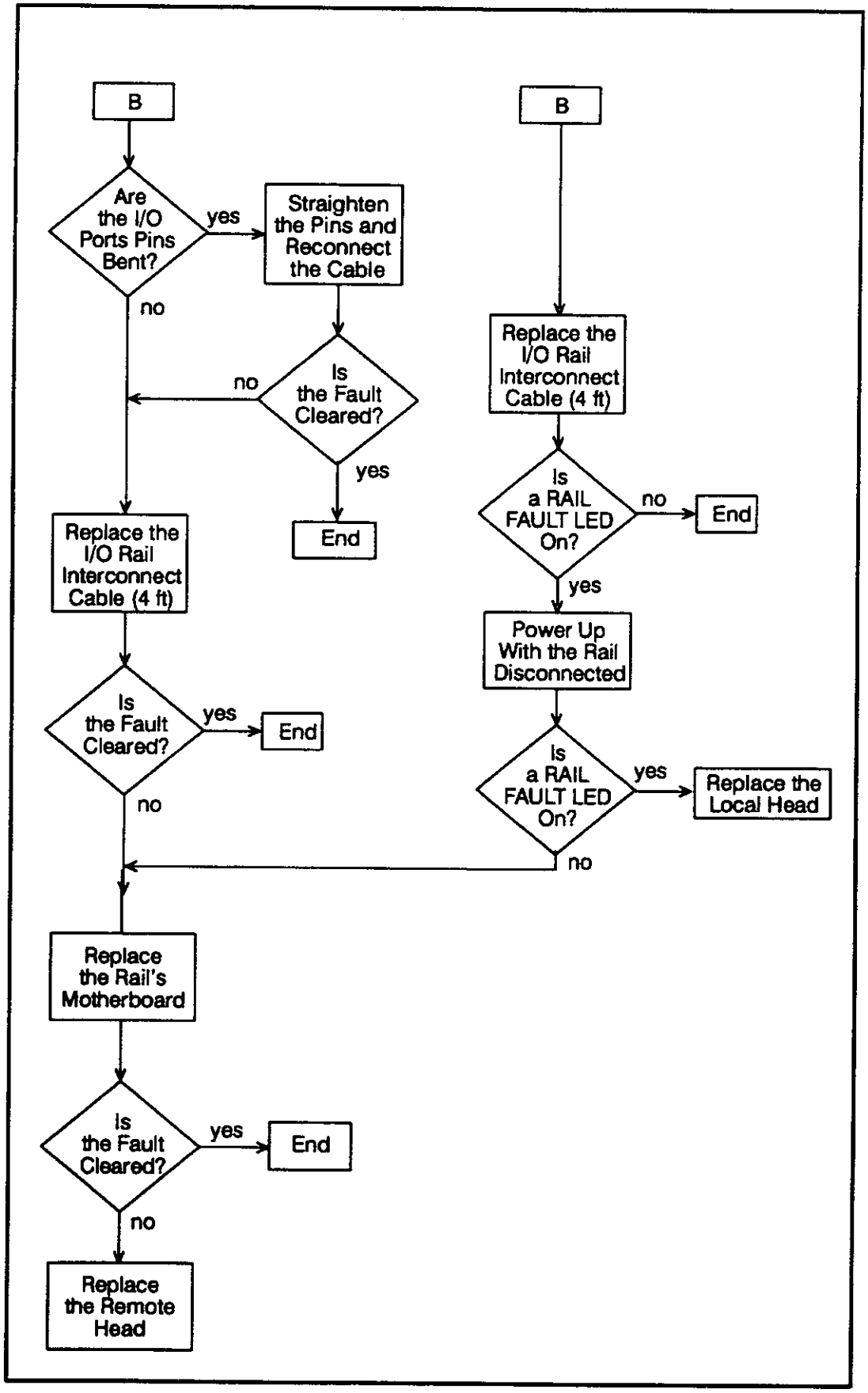


Figure 4.5 - DCS 5000/AutoMax Rail Fault Troubleshooting Flowchart (Continued)

DCS 5000/AutoMax rail faults may be caused by a malfunctioning:

- I/O Rail Interconnect Cable
- Local Head Interconnect Cable
- rail motherboard
- Local I/O Head
- DCS/AutoMax Remote I/O Head

Use the following procedure to isolate and clear a DCS 5000/ AutoMax rail fault. After each step, check the system for proper operation. If the problem remains, continue on with the next step.

Step 1. Look at the RAIL FAULT LED on the front of the DCS 5000/ AutoMax Remote I/O Head (M/N 57C330). A rail fault will cause this LED to light. Use the FAULT MSB and FAULT LSB LEDs to identify the port that has had a communication problem. Refer to Table 4.8.

Table 4.8 - DCS 5000/AutoMax Rail Fault LED Error Codes

The RAIL FAULT LED is ON.

FAULT MSB LED	=	OFF	OFF	ON	ON
FAULT LSB LED	=	OFF	ON	OFF	ON
Port That Has a Rail Fault	=	0	1	2	3

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Step 2. If the rails in your installation are connected through Local Heads (M/N 61C22A, 61C22, 61C23, or 45C22), continue with Step 3. If the Local Heads are not used, continue with Step 9.

Step 3. Look at the Local Head's LEDs.

When the Local Head is operating properly, the POWER and COM LEDs are on and the RAIL FAULT LEDs are off. This indicates that there are no rail faults associated with the rails connected to the Local Head.

Step 4. Look at the Local Head's POWER LED.

If the POWER LED is off, check to see if input power is reaching the Local Head. If power is reaching the Local Head and the POWER LED remains off, replace the Local Head (Step 8). If power is not reaching the Local Head, check the source of power and its associated wiring.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Step 5. Look at the Local Head's COM LED.

If the COM LED is off, verify that the Remote Head has input power applied. If the COM LED remains off with Remote Head input power applied, remove power and disconnect the Local Head Interconnect Cable (M/N 45C8). Check the I/O ports for bent or broken pins. Straighten any pins that are bent. Securely reconnect the cable and reapply power.

Step 6. If the COM LED remains off, remove power and replace the Local Head Interconnect Cable with a replacement cable that is known to be good. Reaaply power.

Step 7. Look at the Local Head's RAIL FAULT LEDs.

If your installation uses M/N 61C22A or 61C23 Local Heads, and a RAIL FAULT LED is on, check the I/O Rail Interconnect Cable (M/N 45C5) as described in Step 9. If the fault continues, replace the cable as described in Step 10. If the fault continues, power up the system with the rail cable disconnected. If the RAIL FAULT LED is on, replace the Local Head as described in Step 8. If the RAIL FAULT LED is off, replace the rail's motherboard as described in Step 11.

If your installation uses M/N 45C22 or M/N 61C22 Local Heads, and one or more of the rails connected to the Local Head has a rail fault, all four of the RAIL FAULT LEDs will be on. Isolate the malfunctioning rail or Local Head port by repeating the procedure in the previous paragraph for each of the rails.

Step 8. Replace the Local Head:

- Remove power from the Local Head.
- Disconnect the input power and ground connections.
- Disconnect the Local Head Interconnect Cable.
- Disconnect the I/O Rail Interconnect Cables.
- Remove the four mounting bolts.
- Install the replacement Local Head by following the procedure in reverse order.
- Reapply power to the Local Head.

Step 9. Remove power and disconnect the I/O Rail Interconnect Cable (M/N 45C5). Check the I/O ports for bent pins. Straighten any pins that are bent and carefully reconnect the cable. Reapply power.

Step 10. Remove power and replace the I/O Rail Interconnect Cable with a replacement cable that is known to be good. Reapply power.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Step 11. Replace the rail's motherboard:

- Remove power from the Remote Head.
- Disconnect the I/O Rail Interconnect Cable.
- Remove the I/O modules.
- Remove the two screws that hold the motherboard to the rail's chassis. See figure 4.2.
- Slide the motherboard out from under the heat sink assembly.
- Install the replacement motherboard and fasten it to the chassis with the two retaining screws.
- Plug in the I/O modules and reconnect the I/O Rail Interconnect Cable. Note that the modules in the rail must be either all input modules or all output modules.
- Reapply power to the Remote Head.

Step 12. Replace the Remote Head:

- Remove power from the Remote Head.
- Disconnect the input power connections from the terminal strip.
- Disconnect the cable from the peripheral communications connector, if attached.
- Disconnect the cable from the BNC coax connector.
- Disconnect the I/O Rail Interconnect Cable(s).
- Disconnect the ground connections.
- Remove the four mounting bolts.
- Set the replacement Remote Head's drop number and mode selector switches to the same settings as the ones on the original Remote Head.
- Install the replacement Remote Head by following the procedure in reverse order.
- Reapply power to the Remote Head.

4.3 Testing an AutoMate Input Circuit

Use the following procedure to isolate a possible input problem:

DANGER

UNEXPECTED MACHINE MOTION MAY RESULT FROM TURNING INPUTS ON AND OFF DURING TROUBLESHOOTING. BE SURE THE MACHINE OR PROCESS IS IN A SAFE STATE AND PERSONNEL ARE CLEAR OF THE AREA BEFORE TURNING INPUTS ON AND OFF. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

DANGER

HIGH VOLTAGES APPEAR ON THE TERMINAL STRIP. DISCONNECT THE POWER FROM THE INPUT FIELD DEVICES BEFORE CONNECTING THE I/O FIELD WIRING TO THE RAIL. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Step 1. Measure the voltage across terminals A and B and look at the module's POWER and LOGIC LEDs to determine if the proper voltage is being applied to the module from the input field device. The voltages are listed in the module's specifications. Note that the input field device must be on for voltage to appear across the A and B terminals.

If the LEDs are off with source voltage applied to the input field device, check the input device and the wiring that connects it to the rail's terminal strip.

If the LEDs are on and the proper voltage is coming from the input device, continue with Step 2.

Step 2. Using the ReSource AutoMate Programming Executive software, select Point Monitor and monitor the register and bit that is assigned to the module.

If a logic one (1) is present with voltage applied, the input and its associated wiring are operating properly. Examine the application program for a programming error.

If a logic zero (0) is present with voltage applied, go to Step 3.

To be sure the bit's status is not being forced through the application program during testing, save the program on disk and then remove the program from the AutoMate's memory. Configure the system and monitor the status of the bit.

Step 3. Monitor another input from the same rail. If a logic one (1) is present with voltage applied, replace the suspected module.

If a logic zero (0) is present with voltage applied, go to Step 4.

Step 4. Remove power from the AutoMate device to which the rail is connected. Replace the rail's I/O Interconnect Cable (M/N 45C5) with a replacement cable that is known to be good. Reapply power and test the system for proper operation. If the problem remains, continue with Step 5.

Step 5. Replace the rail's motherboard by using the following procedure:

- Remove power from the device to which the rail is connected: the AutoMate Processor, Local I/O Processor, Local Head, AutoBus, or Remote Head.
- Disconnect the I/O Rail Interconnect Cable.
- Remove the I/O modules.
- Remove the two screws that hold the motherboard to the rail's chassis. See figure 4.2.
- Slide the motherboard out from under the heat sink assembly.
- Install the replacement motherboard and fasten it to the chassis with the two retaining screws.
- Plug in the I/O modules and reconnect the I/O Rail Interconnect Cable.
- Reapply power and test the system for proper operation.

4.4 Testing an AutoMate Output Circuit

Use the following procedure to isolate a possible output problem:

DANGER

UNEXPECTED MACHINE MOTION MAY RESULT FROM TURNING OUTPUTS ON AND OFF DURING TROUBLESHOOTING. BE SURE THE MACHINE OR PROCESS IS IN A SAFE STATE AND PERSONNEL ARE CLEAR OF THE AREA BEFORE TURNING OUTPUTS ON AND OFF. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

DANGER

HIGH VOLTAGES APPEAR ON THE TERMINAL STRIP. DISCONNECT POWER FROM THE OUTPUT DEVICES BEFORE CONNECTING THE I/O FIELD WIRING TO THE RAIL. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Step 1. Measure the voltage from the output module's source terminal (B terminal) to common (12 or 24 VDC circuits) or neutral (115 or 230 VAC circuits). If the expected voltage is not present, check the external power source. If the proper voltage is present, go to step 2.

Step 2. Using the ReSource AutoMate Programming Executive software, set the output's logic to one (1) through Point Monitor. The module's LOGIC LED should light. Measure the voltage between the module's A and B terminals.

When the output logic is enabled (equal to one) and a load is connected, a negligible amount of voltage (less than 1.5V) should appear across the A and B terminals. If the output device's source voltage appears across the terminals, continue with Step 3.

Only when the output logic is disabled (equal to zero) and a load is connected, should the source voltage appear across the A and B terminals.

Step 3. Select another output from the same rail and set its logic to one. Measure the voltage across the A and B terminals with a load connected. A negligible amount of voltage (less than 1.5V) should appear across the terminals.

If the source voltage appears across the A and B terminals, continue with Step 4. If only a small voltage is present, indicating that this module is working properly, replace the previous suspected module.

Step 4. Remove power from the AutoMate device to which the rail is connected. Replace the rail's I/O Interconnect Cable (M/N 45C5) with a replacement cable that is known to be good. Reapply power and test the system for proper operation. If the problem continues, go to Step 5.

Step 5. Replace the rail's motherboard by using the following procedure:

- Remove power from the device to which the rail is connected: the AutoMate Processor, Local I/O Processor, Local Head, AutoBus, or Remote Head.
- Disconnect the I/O Rail Interconnect Cable.
- Remove the I/O modules.
- Remove the two screws that hold the motherboard to the rail's chassis. See figure 4.2.
- Slide the motherboard out from under the heat sink assembly.
- Install the replacement motherboard and fasten it to the chassis with the two retaining screws.

- Plug in the I/O modules and reconnect the I/O Rail Interconnect Cable.
- Reapply power and test the system for proper operation.

4.5 Testing a DCS 5000/AutoMax Rail-Mounted Input Circuit

Use the following procedure to isolate a possible input problem:

DANGER

UNEXPECTED MACHINE MOTION MAY RESULT FROM TURNING INPUTS ON AND OFF DURING TROUBLESHOOTING. BE SURE THE MACHINE OR PROCESS IS IN A SAFE STATE AND PERSONNEL ARE CLEAR OF THE AREA BEFORE TURNING INPUTS ON AND OFF. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

DANGER

HIGH VOLTAGES APPEAR ON THE TERMINAL STRIP. DISCONNECT POWER FROM THE INPUT FIELD DEVICES BEFORE CONNECTING THE I/O FIELD WIRING TO THE RAIL. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Step 1. Measure the voltage across terminals A and B and look at the module's POWER and LOGIC LEDs to determine if the proper voltage is being applied to the module from the input field device. The voltages are listed in the module's specifications. Note that the input field device must be on for voltage to appear across the A and B terminals.

If the LEDs are off with source voltage applied to the input field device, check the input device and the wiring that connects it to the rail's terminal strip.

If the LEDs are on and the proper voltage is coming from the input device, continue with Step 2.

Step 2. Disconnect the Remote I/O Communications Coaxial Cable from the Remote Head (M/N 57C330).

Step 3. Connect your IBM-compatible personal computer to the RS-232C port on the Remote Head.

Step 4. Using the AutoMax Programming Executive software, from the MAIN MENU, press the F6 key (COMMUNICATION INTERFACE) to select the Kermit communication software.

Step 5. At the ASD-KERMIT> prompt enter:

SET PORT COM1 [Return]
SET SPEED 1200 [Return]
CONNECT [Return]
R

Step 6. The Read Port Test is now active. This test displays the data from the selected Remote Head port. At the READ PORT: prompt, enter the number (0-3) of the port you want to test and press [Return]. The data is displayed in the following format: REGISTER I/O HEX DEC BIN.

Note that the data read in from the Remote Head is not continuously updated. It is just a snapshot of the I/O status at the time the Read Port Test is requested. Press the R key to again view the status of the I/O connected to the Remote Head.

Step 7. Check the status of the register and bit that is assigned to the module.

If a logic one (1) is present with voltage applied, the rail and its associated wiring are operating properly. Examine the application program for a possible programming error.

If a logic zero (0) is present with voltage applied, go to Step 8.

Step 8. Check the status of another input from the same rail. If a logic one (1) is present with voltage applied, replace the suspected module.

If a logic zero (0) is present with voltage applied, go to Step 9.

Step 9. Remove power from the Remote Head or Local Head (M/N 61C22A or 61C23). Replace the rail's I/O Interconnect Cable (M/N 45C5) with a replacement cable that is known to be good. Reapply power and test the system for proper operation. If the problem continues go to Step 10.

Step 10. Replace the rail's motherboard.

- Remove power from the Remote Head or Local Head.
- Disconnect the I/O Rail Interconnect Cable.
- Remove the I/O modules.
- Remove the two screws that hold the motherboard to the rail's chassis. See figure 4.2.
- Slide the motherboard out from under the heat sink assembly.
- Install the replacement motherboard and fasten it to the chassis with the two retaining screws.
- Plug in the I/O modules and reconnect the I/O Rail Interconnect Cable.
- Reapply power and test the system for proper operation.

4.6 Testing a DCS 5000/AutoMax Rail-Mounted Output Circuit

Use the following procedure to isolate a possible output problem:

DANGER

UNEXPECTED MACHINE MOTION MAY RESULT FROM TURNING OUTPUTS ON AND OFF DURING TROUBLESHOOTING. BE SURE THE MACHINE OR PROCESS IS IN A SAFE STATE AND PERSONNEL ARE CLEAR OF THE AREA BEFORE TURNING OUTPUTS ON AND OFF. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

DANGER

HIGH VOLTAGES APPEAR ON THE TERMINAL STRIP. DISCONNECT POWER FROM THE OUTPUT DEVICES BEFORE CONNECTING THE I/O FIELD WIRING TO THE RAIL. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

WARNING

REMOVING OR INSERTING A MODULE OR I/O INTERCONNECT CABLE WITH POWER APPLIED MAY RESULT IN UNEXPECTED MACHINE MOTION OR LOSS OF PROCESS CONTROL. STOP THE MACHINE OR PROCESS IN AN ORDERLY FASHION AND DISCONNECT THE POWER TO THE SYSTEM BEFORE YOU REMOVE OR INSERT A MODULE OR I/O INTERCONNECT CABLE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY INJURY.

Step 1 Measure the voltage from the output module's source terminal (B terminal) to common (12 or 24 VDC circuits) or neutral (115 or 230 VAC circuits). If the expected voltage is not present, check the external power source. If the proper voltage is present, go to step 2.

Step 2 Disconnect the Remote I/O Communications Coaxial Cable from the Remote Head (M/N 57C330).

Step 3 Connect your IBM-compatible personal computer to the RS-232C port on the Remote Head.

Step 4 Using the AutoMax Programming Executive software, from the MAIN MENU, press the F6 key (COMMUNICATION INTERFACE), to select the Kermit communication software.

Step 5 At the ASD-KERMIT> prompt enter:

SET PORT COM1 [Return]
SET SPEED 1200 [Return]
CONNECT [Return]
W

Step 6 The Write Port Test is now active. This test writes data to the selected Remote Head port. At the WRITE PORT: prompt, enter the number (0-3) of the port you want to write to and press [Return].

Step 7. At the REGISTER: prompt, enter the register number (0-3) and press [Return].

If the register has not yet been defined as an output, the screen will prompt with a message asking if the register should be defined as an output. Press the Y key and [Return].

Step 8. At the NEW DATA: prompt, enter the data to be written to the port and press [Return].

The data can be in binary, hexadecimal, or decimal. Binary values begin with a B. Hexadecimal values begin with a 0 (zero).

Step 9. Set the output's logic to one (1). The module's LOGIC LED should light. Measure the voltage from the output's load terminal to ground.

If the load voltage does not approximately equal the source voltage, go to Step 10.

Step 10. Select another output from the same rail and set its logic to one (1). Measure the voltage from the output's load terminal to ground.

If the load voltage equals the source voltage, replace the suspected output module.

If the load voltage does not approximately equal the source voltage, go to Step 11.

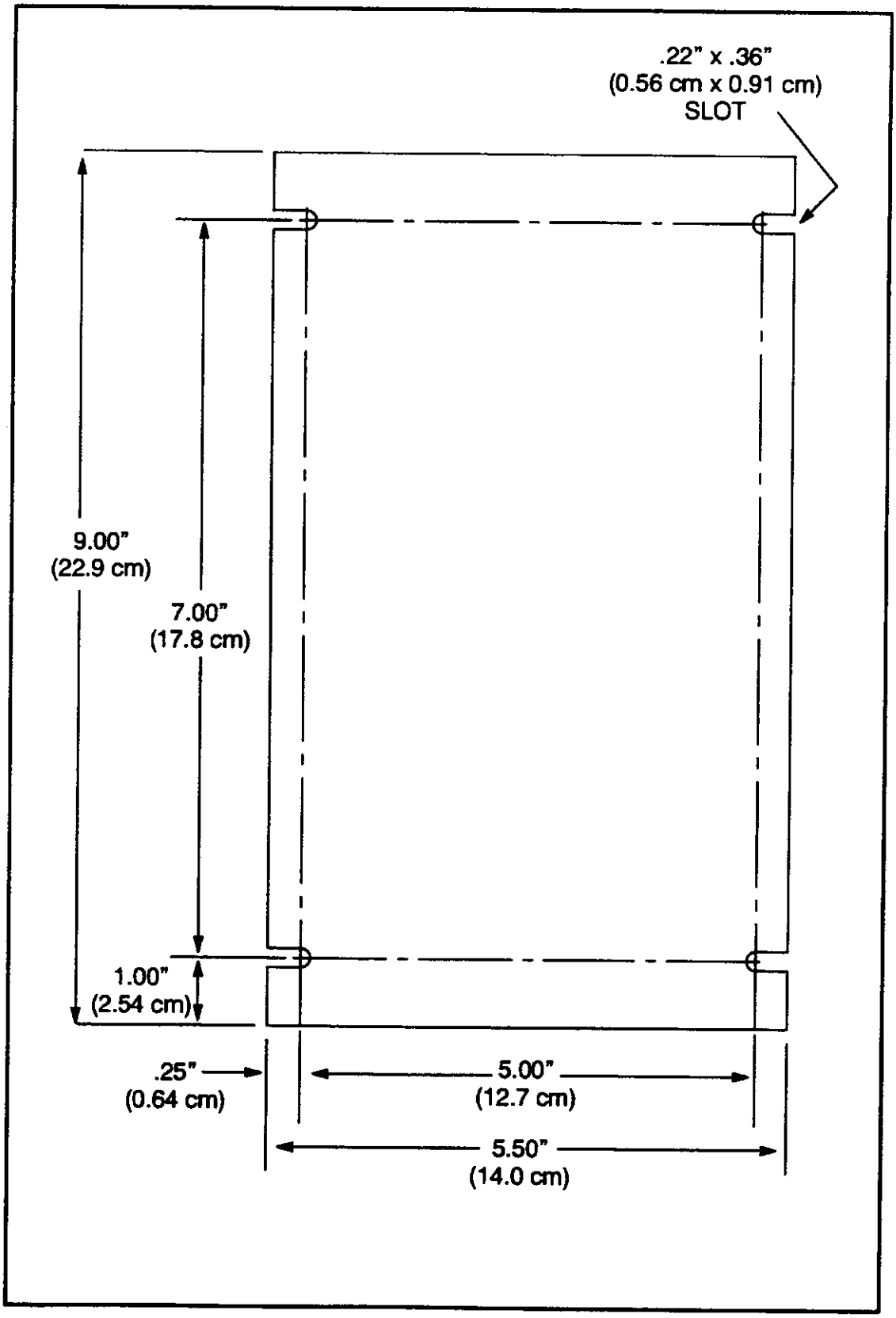
Step 11. Remove power from the Remote Head or Local Head (M/N 61C22A or 61C23) and replace the rail's I/O Interconnect Cable (M/N 45C5) with a replacement cable that is known to be good. Reapply power and test the system for proper operation. If the problem continues, go to Step 12.

Step 12. Replace the rail's motherboard by using the following procedure:

- Remove power from the Remote Head or Local Head.
- Disconnect the I/O Rail Interconnect Cable.
- Remove the I/O modules.
- Remove the two screws that hold the motherboard to the rail's chassis. See figure 4.2.
- Slide the motherboard out from under the heat sink assembly.
- Install the replacement motherboard and fasten it to the chassis with the two retaining screws.
- Plug in the I/O modules and reconnect the I/O Rail Interconnect Cable.
- Reapply power and test the system for proper operation.

Appendix A

I/O Rail Mounting Dimensions



For additional information

1 Allen-Bradley Drive
Mayfield Heights, Ohio 44124 USA
Tel: (800) 241-2886 or (440) 646-3599
http://www.reliance.com/automax

www.rockwellautomation.com

Corporate Headquarters
Rockwell Automation, 777 East Wisconsin Avenue, Suite 1400, Milwaukee, WI, 53202-5302 USA, Tel: (1) 414.212.5200, Fax: (1) 414.212.5201

Headquarters for Allen-Bradley Products, Rockwell Software Products and Global Manufacturing Solutions
Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation SA/NV, Vorstlaan/Boulevard du Souverain 36, 1170 Brussels, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, 27/F Citicorp Centre, 18 Whitfield Road, Causeway Bay, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Headquarters for Dodge and Reliance Electric Products
Americas: Rockwell Automation, 6040 Ponders Court, Greenville, SC 29615-4617 USA, Tel: (1) 864.297.4800, Fax: (1) 864.281.2433
Europe/Middle East/Africa: Rockwell Automation, Brühlstraße 22, D-74834 Elztal-Dallau, Germany, Tel: (49) 6261 9410, Fax: (49) 6261 17741
Asia Pacific: Rockwell Automation, 55 Newton Road, #11-01/02 Revenue House, Singapore 307987, Tel: (65) 6356-9077, Fax: (65) 6356-9011

Publication J-3012-3 - April 1993

Copyright © 2002 Rockwell Automation, Inc.. All rights reserved. Printed in U.S.A.

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP