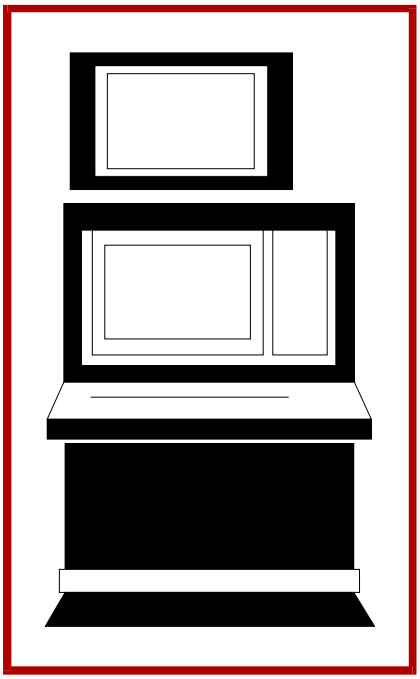
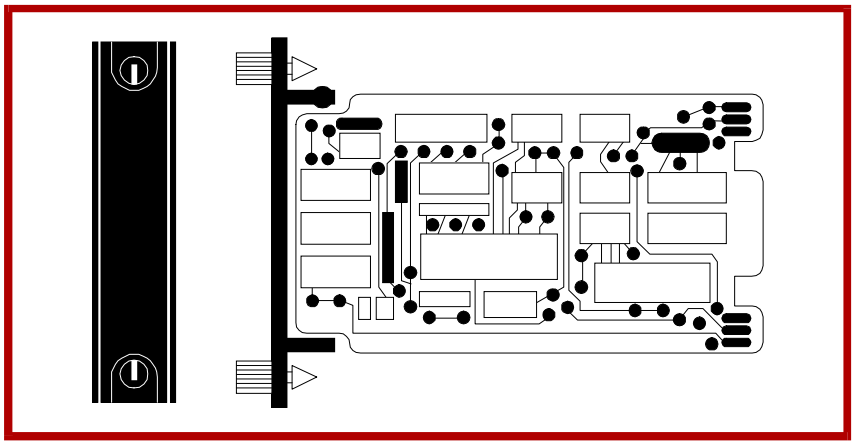
Bailey® infi 90®

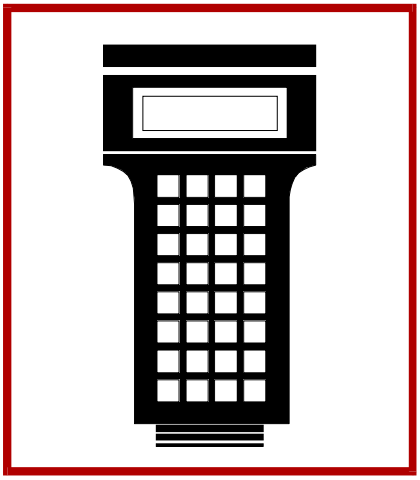
E96-506

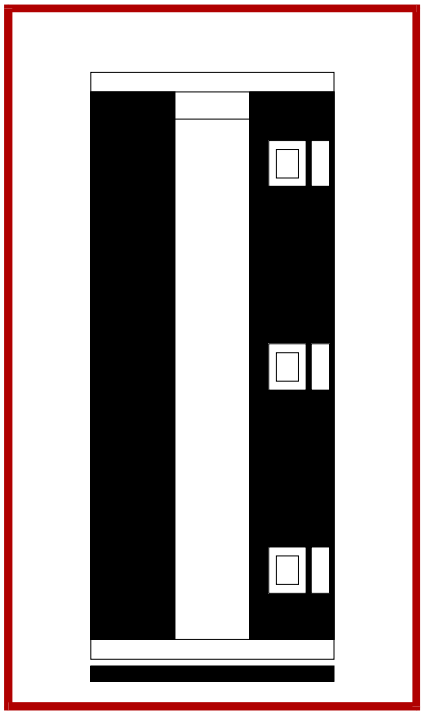
Instruction

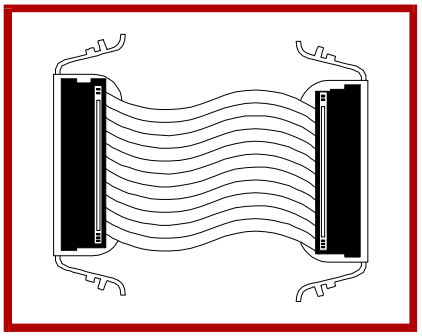
AC Modular Power System

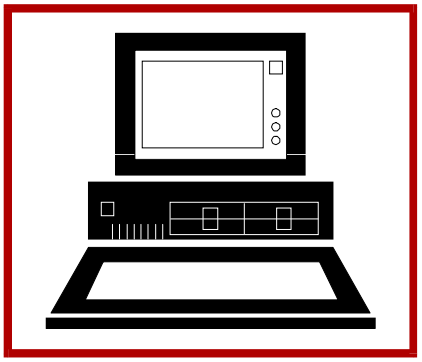












Bailey® Process Control and Automation Solutions from Elsag Bailey Group

WARNING notices as used in this instruction apply to hazards or unsafe practices that could result in personal injury or death.

CAUTION notices apply to hazards or unsafe practices that could result in property damage.

NOTES highlight procedures and contain information that assists the operator in understanding the information contained in this instruction.

WARNING

INSTRUCTION MANUALS

DO NOT INSTALL, MAINTAIN, OR OPERATE THIS EQUIPMENT WITHOUT READING, UNDERSTANDING, AND FOLLOWING THE PROPER **Elsag Bailey** INSTRUCTIONS AND MANUALS; OTHERWISE, INJURY OR DAMAGE MAY RESULT.

RADIO FREQUENCY INTERFERENCE

MOST ELECTRONIC EQUIPMENT IS INFLUENCED BY RADIO FREQUENCY INTERFERENCE (RFI). CAUTION SHOULD BE EXERCISED WITH REGARD TO THE USE OF PORTABLE COMMUNICATIONS EQUIPMENT IN THE AREA AROUND SUCH EQUIPMENT. PRUDENT PRACTICE DICTATES THAT SIGNS SHOULD BE POSTED IN THE VICINITY OF THE EQUIPMENT CAUTIONING AGAINST THE USE OF PORTABLE COMMUNICATIONS EQUIPMENT.

POSSIBLE PROCESS UPSETS

MAINTENANCE MUST BE PERFORMED ONLY BY QUALIFIED PERSONNEL AND ONLY AFTER SECURING EQUIPMENT CONTROLLED BY THIS PRODUCT. ADJUSTING OR REMOVING THIS PRODUCT WHILE IT IS IN THE SYSTEM MAY UPSET THE PROCESS BEING CONTROLLED. SOME PROCESS UPSETS MAY CAUSE INJURY OR DAMAGE.

AVERTISSEMENT

MANUELS D'OPÉRATION

NE PAS METTRE EN PLACE, RÉPARER OU FAIRE FONCTIONNER L'ÉQUIPEMENT SANS AVOIR LU, COMPRIS ET SUIVI LES INSTRUCTIONS RÉGLEMENTAIRES DE **Elsag Bailey**. TOUTE NÉGLIGENCE À CET ÉGARD POURRAIT ÊTRE UNE CAUSE D'ACCIDENT OU DE DÉFAILLANCE DU MATÉRIEL.

PERTURBATIONS PAR FRÉQUENCE RADIO

LA PLUPART DES ÉQUIPEMENTS ÉLECTRONIQUES SONT SENSIBLES AUX PERTURBATIONS PAR FRÉQUENCE RADIO. DES PRÉCAUTIONS DEVRONT ÊTRE PRISES LORS DE L'UTILISATION DU MATÉRIEL DE COMMUNICATION PORTATIF. LA PRUDENCE EXIGE QUE LES PRÉCAUTIONS À PRENDRE DANS CE CAS SOIENT SIGNALÉES AUX ENDROITS VOULUS DANS VOTRE USINE.

PERTURBATIONS DU PROCÉDÉ

L'ENTRETIEN DOIT ÊTRE ASSURÉ PAR UNE PERSONNE QUALIFIÉE EN CONSIDÉRANT L'ASPECT SÉCURITAIRE DES ÉQUIPEMENTS CONTRÔLÉS PAR CE PRODUIT. L'AJUSTEMENT ET/OU L'EXTRACTION DE CE PRODUIT PEUT OCCASIONNER DES À-COUPS AU PROCÉDÉ CONTRÔLE LORSQU'IL EST INSÉRÉ DANS UNE SYSTÈME ACTIF. CES À-COUPS PEUVENT ÉGALEMENT OCCASIONNER DES BLESSURES OU DES DOMMAGES MATÉREILS.

NOTICE

The information contained in this document is subject to change without notice.

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Preface

The AC Modular Power System supplies system and I/O power to the components within an INFI 90® system cabinet. This manual provides information on the IEPAS02 and IEPAF02 Power Modules and their related system hardware. Related hardware includes the IEPEP01, IEPEP02 and IEPEP03 Power Entry Panels, IEMMU01 and IEMMU02 Module Mounting Units, and IEPMU01 and IEPMU02 Power Mounting Units. The information in this manual includes a procedure for sizing the power system, installation instructions, operating procedures, troubleshooting, maintenance and repair/replacement procedures.

The IEPAS02 and IEPAF02 AC Power Modules supersede the IEPAS01 and IEPAF01 AC Power Modules and are compatible replacements. Refer to Appendix E for more information.

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List of Effective Pages

Total number of pages in this instruction is 95, consisting of the following:

Page No.	Change Date
Preface	Original
List of Effective Pages	Original
iii through ix	Original
1-1 through 1-7	Original
2-1 through 2-7	Original
3-1 through 3-17	Original
4-1 through 4-4	Original
5-1 through 5-7	Original
6-1 through 6-8	Original
7-1 through 7-6	Original
8-1	Original
A-1 through A-2	Original
B-1 through B-10	Original
C-1 through C-5	Original
D-1 through D-8	Original
D-1 through E-2	Original
Index-1 through Index-2	Original

When an update is received, insert the latest changed pages and dispose of the superseded pages.

NOTE: On an update page, the changed text or table is indicated by a vertical bar in the outer margin of the page adjacent to the changed area. A changed figure is indicated by a vertical bar in the outer margin next to the figure caption. The date the update was prepared will appear beside the page number.

Safety Summary

GENERAL WARNINGS

Equipment Environment
All components whether in transportation, operation, or storage must be in a noncorrosive environment.

Electrical Shock Hazard During Maintenance
Disconnect power or take precautions to ensure that contact with energized parts is avoided when servicing.

Special Handling
This module uses electrostatic sensitive devices.

SPECIFIC WARNINGS

Verify the main power and power entry panel circuit breakers are turned off before starting installation, retrofit, upgrade, or wiring procedures. Failure to do so could result in severe or fatal shock. Do not turn the power on until the installation, retrofit, upgrade, or wiring procedures are complete. (p. 3-2, 3-13, 7-6, D-1)

Do not remove the plastic covers on the module mounting unit backplane. These covers protect against accidental contact with AC voltage. Severe or fatal shock could result. (p. 3-9)

Allow five seconds for the line filter capacitors to discharge before handling the module after removal. Failure to do so could result in severe or fatal shock. (p. 3-11, 7-5)

Handle the module by surfaces other than the heat sink. The heat sink may be hot and may cause severe burns. (p. 3-12, 7-5)

There are exposed AC and DC connections inside the cabinet. These exposed electrical connections present a shock hazard that can cause injury or death. (p. 6-1)

Never clean electrical parts or components with the AC power on. Doing so exposes you to a fatal electrical shock hazard. (p. 6-1)

If input or output circuits are a shock hazard after disconnecting system power at the power entry panel, then the door of the cabinet containing these externally powered circuits must be marked with a warning stating that multiple power sources exist. (p. 6-1)

Wear eye protection whenever working with cleaning solvents. When removing solvents from printed circuit boards using compressed air, injury to the eyes could result from splashing solvent as it is blown off the printed circuit board. (p. 6-1)

Safety Summary (continued)

SPECIFIC CAUTIONS	Verify the line voltage select switch is properly configured before energizing the power entry panel. Failure to do so could permanently damage the PFI circuit board by exposing it to improper input voltage levels. (p. 3-12)

Sommaire de Sécurité

AVERTISSEMENT D'ORDRE GENERAL	**Environment de l'equipment** Ne pas soumettre les composants a une atmosphere corrosive lors du transport, de l'entreposage cu de l'utilisation. **Risques de chocs electriques lor de l'entretien** S'assurer de debrancher l'alimentation ou de prendre les precautions necessaires a eviter tout contact avec des composants sours tension lors de l'entretien. **Precautions de manutention** Ce module contient des composantes sensibles aux decharges electro-statiques.
AVERTISSEMENT D'ORDRE SPECIFIQUE	Assurez-vous que le disjoncteur d'alimentation principal et le disjoncteur de panneau d'entrée des alimentatoins sont éteints avant de procéder à l'installation, à la mise à jour, à l'extension ou au câblage, dans le but d'éviter les chocs sérieux et même mortels. Ne rétablissez pas l'alimentation tant que ces procédures ne sont pas terminées. (p. 3-2, 3-13, 7-6, D-1) Ne retirez pas les couvercles de plastique situés sur le panneau arrière du châssis de montage des modules. Ces couvercles constituent une protection contre les contacts accidentels avec la tension c.a., qui risquent de provoquer des chocs sérieux et même mortels. (p. 3-9) Après avoir retiré le module, laissez les condensateurs de filtres antiparasites se décharger pendant cinq secondes avant de manipuler celui-ci, afin d'éviter les chocs sérieux et même mortels. (p. 3-12, 7-5)

AVERTISSEMENT D'ORDRE SPECIFIQUE *(suite)*	Le module diot être manipulé à l'aide de surfaces autres que le dissipatour thermique. Ce dernier resque d'être chaud et de provoquer des brûlures sérieuses. (p. 3-12, 7-5) Cette armoire comporte des connexions c.a. et c.c. dénudées. Ces connexions électriques présentent un danger d'électrocution pouvant entraîner des blessures ou la mort. (p. 6-1) Il ne faut jamais nettoyer des pièces ou des composants électriques lorsqu'ils sont sous tension. Cedi présente un risque d'électrocution fatale. (p. 6-1) Si des circuits d'entrée ou de sortie sont alimentés à partir de sources externes, ils présentent un risque de choc électrique même lorsque l'alimentation du système est débranchée du panneau d'entrée l'alimentation. Le cas échéant, un avertissement signalant la présence de sources d'alimentation multiples doit être apposé sur la porte de l'armoire. (p. 6-1) Portez toujours des lunettes de protection lorsque vous utilisez des solvants de nettoyage. L'aircomprimé servant à enlever le solvant des cartes de circuits imprimés provoque des éclaboussures qui risquent d'atteindre les yeux. (p. 6-1)
ATTENTION D'ORDRE SPECIFIQUE	Assurez-vous que l'interrupteur de sélection de la tension de ligne est adéquatement configuré avant de mettre sous tension le panneau d'entrée des alimentations. Toute négligence à cet égard risque d'endommager de facon permanente la carte de détection des coupures d'alimentation (PFI) en l'exposant à des niveaux inadéquats de tension d'entrée. (p. 3-12)

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SECTION 1 - INTRODUCTION

OVERVIEW

The INFI 90 AC modular power system provides +5, +15, -15 and +24 VDC to power process control modules and field termination devices.

The system consists of the power entry panel, fan assembly, power modules and their mounting unit, bus bars and associated wiring. The power modules provide scalable power for logic and I/O functions. The user has the option of selecting N+1 power redundancy. In this type of redundancy, power modules equally share output. If any power module fails, the remaining power modules adjust their outputs to meet the total system load. Therefore, redundancy can be provided by one extra power module beyond the minimum number required to power the system.

HARDWARE DESCRIPTION

Power Entry Panel

The power entry panel supplies line power to the system cabinet. There are three versions: IEPEP01, IEPEP02 and IEPEP03 Power Entry Panel. The IEPEP01 panel is the basic version. It has surge protection and power fail interrupt detection; however, it does not have circuit breakers or DC voltage monitoring capabilities. The IEPEP02 panel has one circuit breaker and is identical to the IEPEP01 panel. The IEPEP03 panel has additional features.

The IEPEP03 panel transfers redundant power to the system cabinet and monitors system status. It contains the AC transfer module and the bus monitor module that perform these functions. The AC transfer module monitors line voltage inputs to the system cabinet, provides automatic AC line transfer (for redundant AC lines) and generates a power fail interrupt (PFI) signal. The bus monitor module monitors the power system and provides status and customer alarm outputs.

Fan Assembly

The IEFAN01 and IEFAN02 fan assemblies provide air flow cooling for the power modules and process control modules in the system cabinet.

Power Modules

There are two AC power modules: IEPAS02 System Power Module and IEPAF02 Field Power Module. The IEPAS02 module provides +5, +15, -15 and +24 DC voltages. The IEPAF02 module provides +24 VDC only for field powered devices.

The IEPAS02 and IEPAF02 modules replace the IEPAS01 and IEPAF01 modules. Both sets of modules can be used in the same cabinet. The IEPAS02 and IEPAF02 modules are compatible with the IEPAS01 and IEPAF01 modules.

Power Mounting Units

The IEPMU01 and IEPMU02 Power Mounting Units are designed to provide housing and power connections to the power modules. The power mounting units can service up to ten power modules.

Power mounting units segregrate power modules from process control modules and are built to handle heavier currents. The IEPMU01 Power Mounting Unit is a rear mounted unit. The IEPMU02 Power Mounting Unit is a front mounted unit.

Module Mounting Units

The IEMMU01 Module Mounting Unit provides the housing, power connections and signals for power supply and process control modules. The module mounting unit is an alternative to the power mounting unit.

The IEMMU02 unit has the same functionality as the IEMMU01 unit, but it is a front mounted unit. Its primary use is in smaller system cabinets like the MINI-90™ system.

USER QUALIFICATIONS

This manual is not a tutorial. Therefore, the user should have training as an electrical technician. That is, the user should know the basics of, and precautions for, working with AC/DC voltages, and how to use various measuring instruments such as digital voltmeters.

INSTRUCTION CONTENT

This manual provides introductory, installation, operation, troubleshooting and maintenance information. Read and

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understand this document before placing the power system into service. A summary of section content follows:

Introduction — Provides an overview of the system, description of hardware, glossary of unique terms, reference documentation, and physical and electrical specifications.

Description and Operation — Contains a block diagram to explain how key parts of the system operate.

Installation — Explains handling, inspection, location and safety considerations, setup (e.g., switch settings) and interfacing.

Operating Procedures — Covers start-up, how to use and individual controls.

Troubleshooting — Lists error indications, corrective actions, problem determination and verification.

Maintenance — Provides guidelines to assist in establishing a preventive maintenance program.

Repair/Replacement Procedures — Provides procedures for user repair and replacement.

Support Services — Explains services, training, replacement parts and warranty policy.

Appendices — Contain quick reference material, a modular power system sizing procedure, system wiring diagrams and a modular power system retrofitting procedure.

HOW TO USE THIS MANUAL

Read this manual in sequence. To get the best use of this manual, read it from cover to cover, then go back to specific sections.

1. Read and do the steps in Section 3.
2. Read Section 4 thoroughly before powering up the system.
3. Refer to Section 5 for what to do if a problem occurs.
4. Read Section 7 if system repairs are needed.
5. Section 8 lists ordering information, training and documentation.

REFERENCE DOCUMENTS

Table 1-1 lists reference documents.

Table 1-1. Reference Documents

Document Number	Title
I-E96-500	Site Planning and Preparation

NOMENCLATURE

Table 1-2 lists nomenclatures associated with the IEPAS02 and IEPAF02 Power Supply Modules. Refer to Table 7-1 for part numbers of related items such as cables and fuses.

Table 1-2. Nomenclature

Nomenclature	Description
IEFAN01	Fan assembly - 120 VAC
IEFAN02	Fan assembly - 240 VAC
IEFAS01	INFI 90 fastener kit
IEMMU01	Module mounting unit (rear mount)
IEMMU02	Module mounting unit (front mount)
IEPAF02	AC field power module
IEPAS02	AC system power module
IEPEP01	Power entry panel with single AC feed and no circuit breaker
IEPEP02	Power entry panel with single AC feed and circuit breaker
IEPEP03	Power entry panel with redundant AC feed and circuit breakers
IEPMU01	Power mounting unit (rear mount)
IEPMU02	Power mounting unit (front mount)

GLOSSARY OF TERMS AND ABBREVIATIONS

Table 1-3 is a glossary of terms and abbreviations used in this manual.

Table 1-3. Glossary of Terms and Abbreviations

Term	Definition
ATM	AC transfer module.
BMM	Bus monitor module.
Controlway	High speed, redundant, peer-to-peer communication link. Used to transfer information between intelligent modules within a process control unit.

Table 1-3. Glossary of Terms and Abbreviations (continued)

Term	Definition
Module Bus	Peer to peer communication link used to transfer information between intelligent modules within a process control unit.
MMU	Module mounting unit. A card cage that provides electrical and communication support for INFI 90/Network 90® modules.
PEP	Power entry panel.
PFI	Power fail interrupt. A signal generated by the power entry panel when there is a loss of AC or DC input power, or an out-of-tolerance bus voltage.
PMU	Power mounting unit.
I/O Expander Bus	Parallel communication bus between the control and I/O modules.
Termination Module	Provides input/output connection between plant equipment and the INFI 90/Network 90 modules.
Termination Unit	Provides input/output connection between plant equipment and the INFI 90/Network 90 modules.

SPECIFICATIONS

Table 1-4 lists the modular power system specifications.

Table 1-4. Specifications

<table>
<tr><th>Property</th><th>Characteristics</th></tr>
<tr><td>Power system input requirements:</td><td></td></tr>
<tr><td>Power requirements (jumper configurable)</td><td>
<table>
<tr><th colspan="3">Voltage (VRMS)</th></tr>
<tr><th>Nom</th><th>Min</th><th>Max</th></tr>
<tr><td>120
240</td><td>102
204</td><td>132
264</td></tr>
</table>
</td></tr>
<tr><td>Total harmonic distortion</td><td>5%</td></tr>
<tr><td>Frequency</td><td>47 to 63 Hz</td></tr>
<tr><td>IEPAS02 and IEPAF02 power module characteristics:</td><td></td></tr>
<tr><td>Input voltage/current</td><td>
<table>
<tr><th rowspan="2">Power Module</th><th colspan="3">Voltage (VRMS)</th><th colspan="2">Current (ARMS)</th></tr>
<tr><th>Nom</th><th>Min</th><th>Max</th><th>Typ</th><th>Max</th></tr>
<tr><td>IEPAS02</td><td>120
240</td><td>90
180</td><td>132
264</td><td>2.25
1.40</td><td>3.00
1.55</td></tr>
<tr><td>IEPAF02</td><td>120
240</td><td>90
180</td><td>132
264</td><td>1.75
1.00</td><td>2.25
1.25</td></tr>
</table>
</td></tr>
<tr><td>Inrush current</td><td><5 A peak per supply for 100 msecs</td></tr>
<tr><td>Crest factor</td><td>3 at 120 VAC
3 at 240 VAC</td></tr>
<tr><td>Power factor</td><td>0.7 typical</td></tr>
</table>

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Table 1-4. Specifications (continued)

<table>
<tr><th>Property</th><th>Characteristics</th></tr>
<tr><td>IEPAS02 and IEPAF02 power module characteristics:
(continued)</td><td></td></tr>
<tr><td>Output current/voltage/ regulation/power:

(Line regulation is less than 0.5% on all outputs.
All tolerances are maximum tolerances and cumulative.)</td><td>
<table>
<tr><th rowspan="2">Power Module</th><th rowspan="2">Current (A)</th><th colspan="2">Voltage</th><th rowspan="2">Load Regulation (%)</th><th rowspan="2">Max Power (W)</th></tr>
<tr><th>VDC</th><th>%</th></tr>
<tr><td>IEPAS02</td><td>4.0
13.0
0.8
0.8</td><td>25.8
5.225
+15.2
-15.2</td><td>±0.5
±0.5
±2.3
±2.3</td><td>1.5
4
3
3</td><td>130 (max output per power module)</td></tr>
<tr><td>IEPAF02</td><td>4.0</td><td>25.8</td><td>±0.5</td><td>1.5</td><td>102</td></tr>
</table>
</td></tr>
<tr><td>Minimum output hold up time</td><td>17 msecs, output fully loaded</td></tr>
<tr><td>Heat dissipation</td><td>30 W per module maximum</td></tr>
<tr><td>Mounting</td><td>Power supply modules mount in a single slot of the module mounting unit or power mounting unit.</td></tr>
<tr><td>IEPEP01/02/03 characteristics:</td><td></td></tr>
<tr><td>AC input monitoring and transfer low voltage detect</td><td>96 VRMS (±6 VRMS) for 120 VAC nominal input
192 VRMS (±12 VRMS) for 240 VAC nominal input</td></tr>
<tr><td>Line interrupt detect time</td><td>2.3 msecs to 3.2 msecs</td></tr>
<tr><td>Redundant AC transfer time</td><td>16 msecs maximum (IEPEP03 only)</td></tr>
<tr><td>Maximum current</td><td>20 A</td></tr>
<tr><td>IEPEP03 characteristics:</td><td></td></tr>
<tr><td>Monitor trip points</td><td>
<table>
<tr><th>Monitor</th><th>Voltage (VDC)</th><th>Low Voltage Trip Point (Typical)</th></tr>
<tr><td>DC power</td><td>5
15
-15
24</td><td>4.76
14.30
-14.30
24.50</td></tr>
<tr><td>Auxiliary voltage</td><td>24
48
125</td><td>21.8
43.7
114.0</td></tr>
</table>
</td></tr>
<tr><td>Status and alarm requirements:</td><td></td></tr>
<tr><td>Power system alarm output to system common</td><td>Open to alarm, 24 VDC maximum, 120 mA (inductive loads require diode suppression)</td></tr>
<tr><td>Bus voltage alarm output</td><td>Open to alarm, 24 VDC maximum, 120 mA (inductive loads require diode suppression)</td></tr>
<tr><td>Status signal inputs</td><td>Normally open (NO) or normally closed (NC) jumper selectable on BMM module. Low ≤ 0.8 VDC, High ≥ 3.1 VDC at bus monitor test points</td></tr>
<tr><td>IEFAN01/02 power requirements</td><td>
<table>
<tr><th rowspan="2">Fan Assembly</th><th colspan="2">Current (ARMS)</th></tr>
<tr><th>Operating</th><th>Inrush</th></tr>
<tr><td>IEFAN01 (120 VAC)</td><td>1.2</td><td>1.6</td></tr>
<tr><td>IEFAN02 (240 VAC)</td><td>0.6</td><td>0.9</td></tr>
</table>
</td></tr>
</table>

Table 1-4. Specifications (continued)

<table>
<tr><th>Property</th><th>Characteristics</th></tr>
<tr><td>General system specifications:

Module voltage requirements (at bus monitor test points)

Electromagnetic/radio frequency interference

Physical dimensions</td><td>
<table>
<tr><th colspan="3">Module Voltage (VDC)</th><th rowspan="2">Max Ripple (mV, p to p)</th></tr>
<tr><th>Nom</th><th>Min</th><th>Max</th></tr>
<tr><td>5</td><td>4.75</td><td>5.25</td><td>50</td></tr>
<tr><td>+15</td><td>+14.30</td><td>+15.75</td><td>100</td></tr>
<tr><td>-15</td><td>-14.30</td><td>-15.75</td><td>100</td></tr>
<tr><td>24</td><td>25.50</td><td>27.00</td><td>100</td></tr>
</table>

Values not available at this time. Keep cabinet doors closed. Do not use communication equipment any closer than 2 meters from the cabinet.

<table>
<tr><th rowspan="2">Component</th><th colspan="2">Height</th><th colspan="2">Width</th><th colspan="2">Depth</th></tr>
<tr><th>mm</th><th>in.</th><th>mm</th><th>in.</th><th>mm</th><th>in.</th></tr>
<tr><td>IEPEP01/02</td><td>132</td><td>5.2</td><td>428.6</td><td>19</td><td>114.3</td><td>4.5</td></tr>
<tr><td>IEPEP03</td><td>175.2</td><td>6.9</td><td>428.6</td><td>19</td><td>685.8</td><td>27</td></tr>
<tr><td>IEFAN01/02</td><td>44.4</td><td>1.75</td><td>428.6</td><td>19</td><td>33.0</td><td>13</td></tr>
<tr><td>IEPMU01/02</td><td>177.8</td><td>7.0</td><td>428.6</td><td>19</td><td>317.5</td><td>12.5</td></tr>
<tr><td>IEMMU01/02</td><td>177.8</td><td>7.0</td><td>428.6</td><td>19</td><td>317.5</td><td>12.5</td></tr>
</table>
</td></tr>
<tr><td>Environmental:

Room ambient temperature

Maximum module ambient temperature

Humidity

Cooling (fan)

Atmospheric pressure

Air quality</td><td>

0° to 55°C (32° to 131°F)

70°C (158°F)

5% to 90%, up to 55°C (131°F) noncondensing
0% to 45% at 70°C (158°F) noncondensing

180 cfm typical

Sea level to 3 km (1.86 mi)

Noncorrosive</td></tr>
<tr><td>Certification</td><td>Meets IEEE-472-1974 surge test requirements.

CSA certification as process control equipment in an ordinary (nonhazardous) environment.</td></tr>
</table>

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

SECTION 2 - DESCRIPTION AND OPERATION

INTRODUCTION

This section uses block diagrams and supportive text to explain how the main functional blocks of the power system operate. The first diagram, Figure 2-1, shows overall system architecture. Figure 2-2 shows power distribution to the IEPAS02 module. Figures 2-3 and 2-4 show circuit details for the system power module, and AC transfer and bus monitor module.

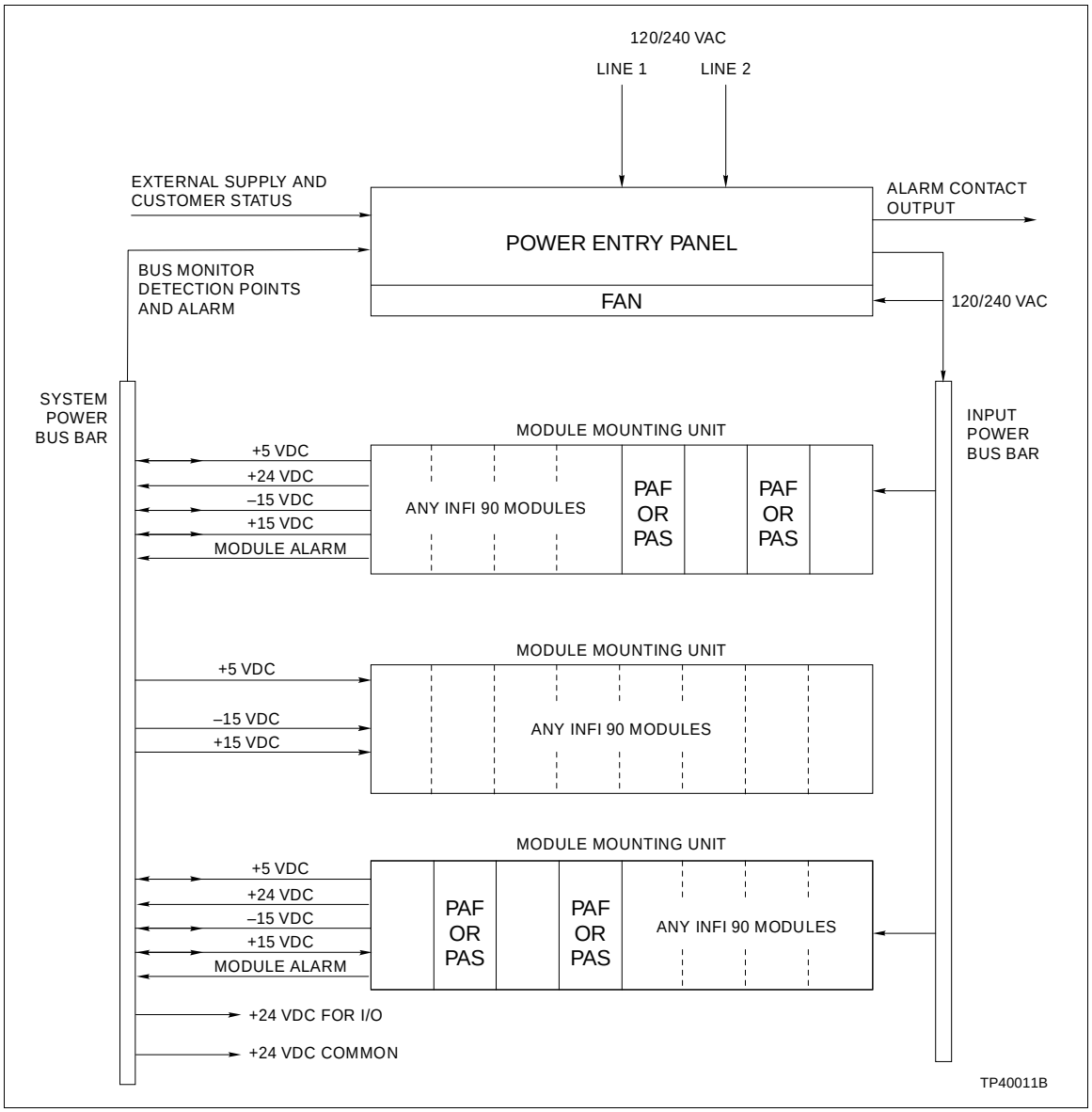

Figure 2-1. Modular Power System Architecture

POWER DISTRIBUTION

Bus bars distribute AC and DC power throughout the cabinet. The AC bus bar has three separate conductor layers. The DC bus bar has eight separate conductor layers. The use of bus bars reduces hand wiring and improves reliability.

The input power bus bar distributes AC power from the power entry panel to the module mounting unit (MMU) backplanes. The bus bar has quick connect tabs to connect cables from the panel to the mounting unit.

The eight layer system power bus bar distributes regulated DC voltages, power module status and power fail interrupt signals. This bus bar also has quick connect tabs. A cable from the power entry panel to the system power bus bar allows the system to monitor bus voltages and status signals. High current, multiconductor flat cables connect regulated voltage outputs and status signals from the MMU backplane to the bus bar. Extra tabs are available at the bottom of the system power bus bar. These tabs are for connecting +24 VDC I/O power to field termination units or to other cabinets. Tabs are also available to connect DC common and I/O common to the system common bus bar at the cabinet bottom.

POWER ENTRY PANEL

IEPEP01 and IEPEP02 Panels

The IEPEP01 and IEPEP02 Power Entry Panels connect a single 120/240 VAC (50/60 hertz) line power to an INFI 90 system cabinet and distribute power to the power modules and fan assembly. The IEPEP01 panel has no circuit breakers, but the IEPEP02 panel does.

There are two terminal blocks on each panel. One is for line input, the other for output to the input power bus bar for distribution to the power modules. The power entry panel has surge suppression and filtering to protect the power modules. An internal circuit board monitors input line voltage. It generates a power fail interrupt (PFI) signal for low AC line or a loss of voltage. The panel mounts in any standard 19-inch rack frame.

IEPEP03 Panel

The IEPEP03 Power Entry Panel connects single or redundant 120/240 VAC (50/60 hertz) line power to an INFI 90 system cabinet. It also distributes power to the power modules and fan assembly. This version has circuit breakers for each power line input. This panel also has surge suppression and filtering.

Two modules reside in the PEP panel. They are the AC transfer module and bus monitor module.

AC Transfer Module

The AC transfer module (ATM) monitors both the AC inputs and its own circuitry. If an AC input is lost or faulty, the module automatically transfers to the redundant input. The ATM module generates a power fail interrupt signal if both lines are lost or below the low voltage threshold. It sends this signal to the bus monitor module (BMM). The BMM module sends the PFI signal to the appropriate process control modules, thereby interrupting their operation.

Visible through the front panel are three LED indicators. The red/green LED at the top shows whether the module is operating normally (green) or not (red). The two other LEDs (LINE 1 and LINE 2) provide AC input status (green = good, red = bad).

Bus Monitor Module

The bus monitor module (BMM) monitors the regulated bus voltages (+5, +15, -15 and +24 VDC) and module status from the distribution bus bar. A cable connection between the bus bar and the J2 connector on the PEP panel provides the path. The BMM module can also monitor two additional external power supply voltages at the PEP terminal blocks. User configured jumpers allow the module to monitor either 24, 48 or 125 VDC for up to two auxiliary power supplies.

There are two contact inputs (NO or NC) for monitoring system status signals. Two red/green LEDs on the module faceplate provide status information. The top-most LED shows whether the module is operating properly (green) or not (red). The system status LED is red when voltages are low or other inputs are bad. The status signal goes to the communication system hardware, which is the bus interface module for Plant Loop systems, and the network interface module for INFI-NET® systems. Once on the communication loop, any INFI 90 operator interface can use the signal.

There are two alarms: PWR SYS ALARM and BUS VOLT ALARM. The PWR SYS ALARM becomes active when a power system problem occurs. The BUS VOLT ALARM becomes active when any bus voltage (+5, +15, -15 or +24 VDC) falls out of tolerance. The BMM module also generates a power fail interrupt (PFI) signal if it receives a PFI from the AC transfer module, or if the +5 VDC bus voltage is low. It distributes this signal to process control modules in the INFI 90 system cabinet.

> **NOTE:** The bus monitor module receives power from the AC transfer module. Therefore, the AC transfer module must be in place and operating properly before the bus monitor module will work.

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FAN ASSEMBLY

The IEFAN01 and IEFAN02 fan assemblies contain six fans that mount in one chassis. Their purpose is to keep the power and system modules cool. The fans draw cooling air up through the module mounting assemblies and force it through exhaust vents (when present) in the top of the cabinet door.

MODULE MOUNTING UNIT

The IEMMU01 and IEMMU02 Module Mounting Units provide mounting for the power modules and process control modules. Two five-conductor flat cables link the power fail interrupt and power module status signals, +5, +15, -15 and +24 VDC from the DC bus bar to the MMU card cage. A three-wire cable from the AC bus bar to the MMU backplane supplies the power modules with AC.

Cables connect the communication busses between multiple MMU card cages. The module bus uses a three-wire, twisted cable, while the I/O expander bus uses a flat, 40-conductor ribbon cable.

POWER MOUNTING UNITS

The IEPMU01 and IEPMU02 Power Mounting Units mount and segregate power modules from INFI 90 process modules. Each PMU card cage is open on the top and bottom for air flow. There are 12 pairs of guides for mounting power modules, two side plates and the backplane. The power mounting unit backplane uses bus bars rather than traces for heavier currents.

POWER MODULES

The IEPAS02 System Power Module converts the 120/240 VAC at the MMU backplane to a primary voltage of 325 VDC nominal. The DC-to-DC converters convert the primary voltage to secondary regulated voltages of +5, +15, -15 and +24 VDC. These voltages travel through the system power bus bar to other module mounting units for distribution to process control modules (see Figures 2-2 and 2-3). The power modules can be inserted or removed from their mounting unit while under power.

The IEPAF02 Field Power Module is functionally the same as the IEPAS02 module except that it provides only +24 VDC. The IEPAF02 provides power to field termination devices when using separate termination cabinets, or when it is desirable to separate the I/O power supplies from the system power supplies.

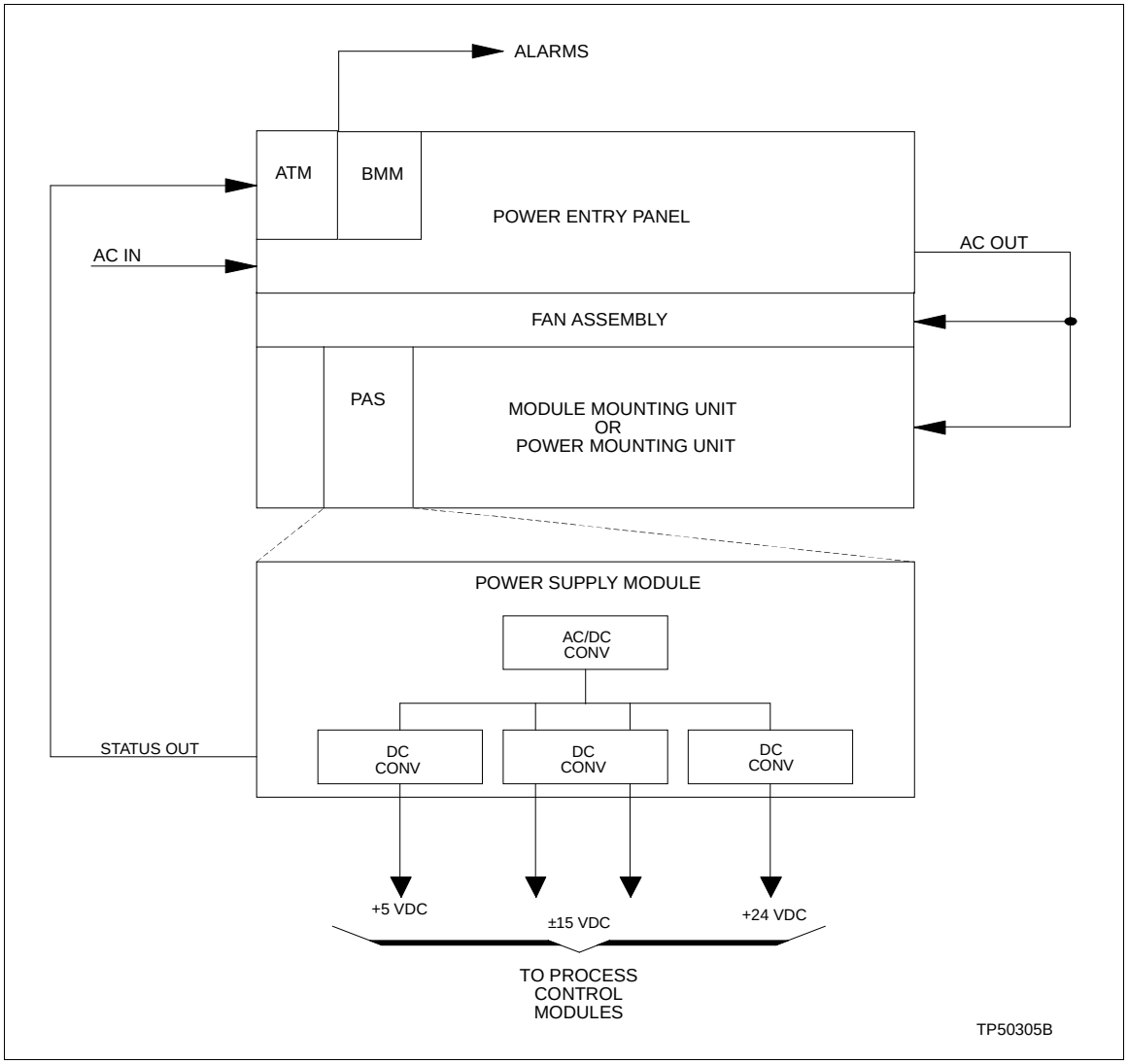

Figure 2-2. Power Distribution to the IEPAS02 System Power Module

STATUS SIGNALS

The block diagram in Figure 2-4 shows the flow of status signals through the system.

Power System Status

All status lines, AC line, bus voltages, external power inputs, external customer status inputs, and power module status are ANDed in the bus monitor module. Bus monitor circuitry determines if any status line is bad. If any status is bad, the bus monitor module generates a low-true output signal to the communication system hardware, which is the bus interface module for Plant Loop systems, and the network interface module for INFI-NET systems.

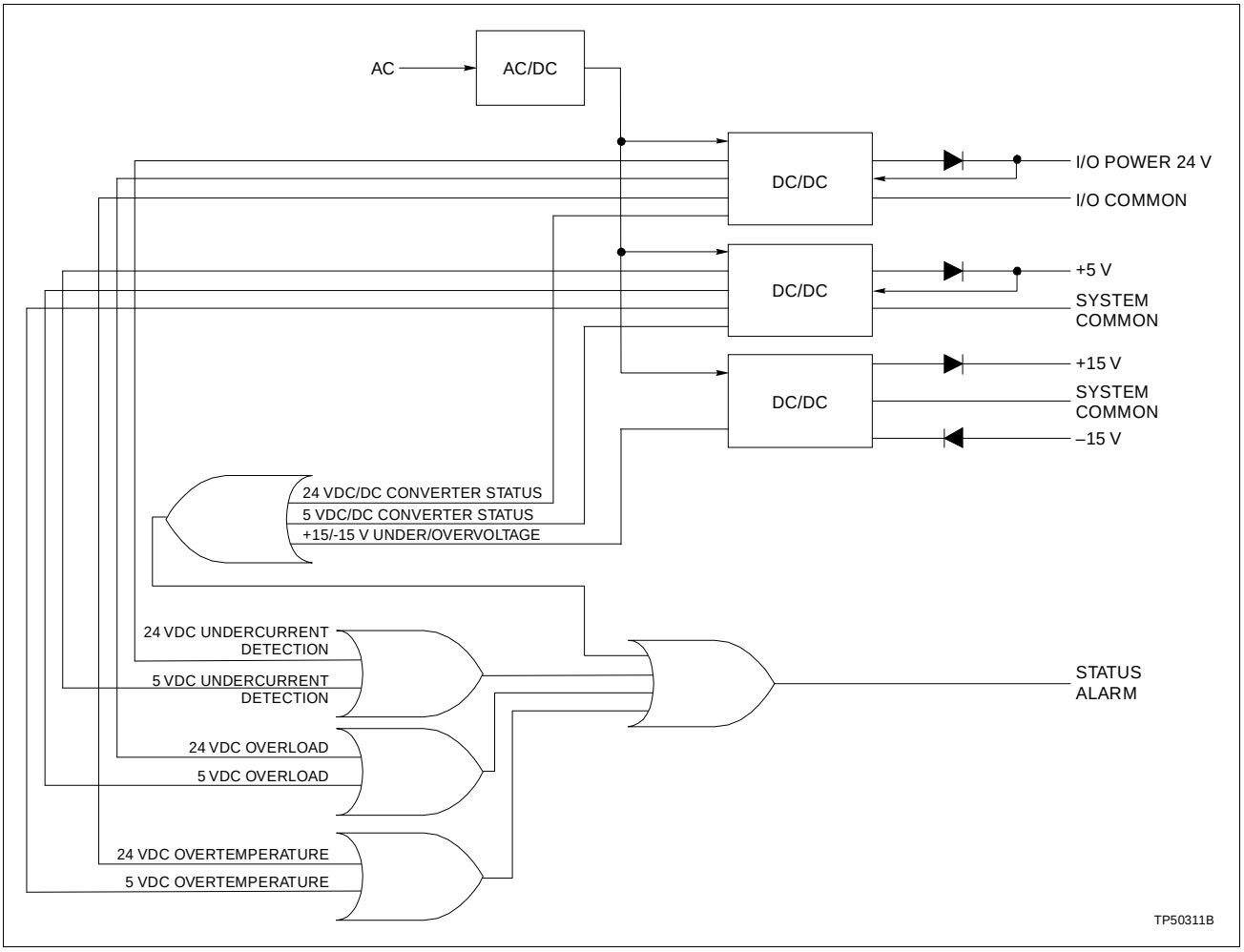

Figure 2-3. IEPAS02 Module Converter and Status Circuitry

Bus Voltage Status

The system power bus voltages are ANDed together in the BMM module and output to an isolated customer alarm output (refer to Table 1-4 for customer alarm output specifications). If any bus voltage signal falls out of specification, the BMM module generates a bus voltage alarm.

Power Module Status

The power modules generate their own status signals. These signals travel on the system power bus bar to the bus monitor module. The bus monitor module then ANDs this signal with the other status signals. If it or any other signal is bad, the BMM module generates a power system status alarm.

Customer Alarm Outputs

There are two customer alarm outputs (normally closed): bus voltage and power system status alarm. The bus voltage alarm activates (opens) if any bus voltage goes low or is lost. The power system status alarm activates (opens) for any bad status. These outputs are optically isolated and can drive relays or annunciator panels.

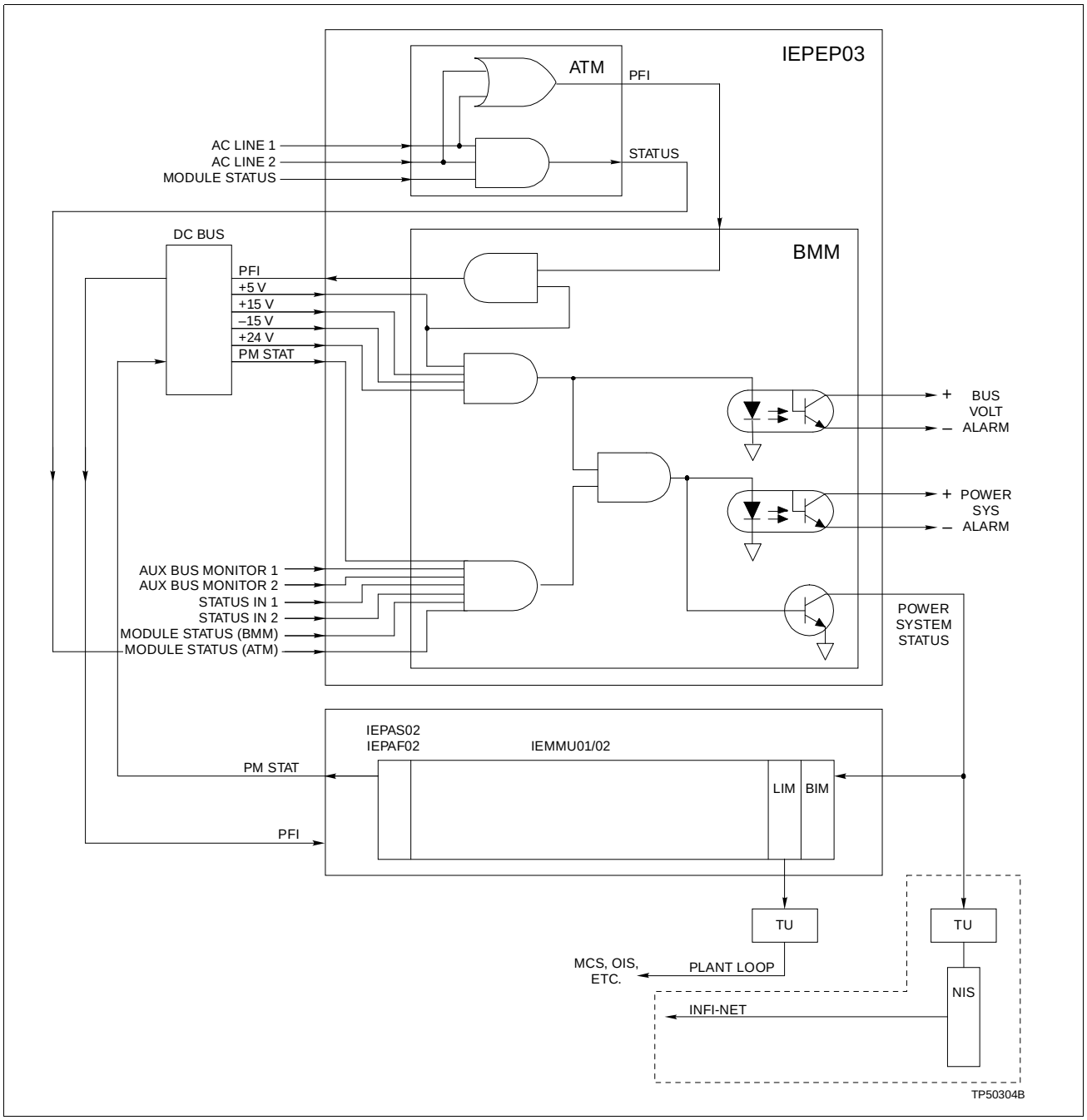

Figure 2-4. Status Signal Block Diagram

SECTION 3 - INSTALLATION

INTRODUCTION

Completely install and prepare the hardware before applying power (i.e., attach wiring to terminal blocks, etc.). This section explains hardware preparation in detail.

> **NOTE:** Normally, the cabinet is fully wired and ready to go upon receipt. The following information is provided in the event that you need to repair, replace, rewire or add to the modular power system.

UNPACKING AND INSPECTION

The power modules are in separate packages from the rest of the power system. Follow the guidelines in ***Special Handling*** when handling these modules.

Special Handling

Observe these steps when handling electronic circuitry:

> **NOTE:** Always use Bailey's field static kit (part number 1948385A1 - consisting of two wrist straps, ground cord assembly, alligator clip and static dissipative work surface) when working with the modules. The kit grounds a technician and the static dissipative work surface to the same ground point to prevent damage to the modules by electrostatic discharge.

1. ***Use Static Shielding Bag.*** Keep the modules in the static shielding bag until you are ready to install them in the system. Save the bag for future use.

2. ***Ground Bag Before Opening.*** Before opening a bag containing an assembly with semiconductors, touch it to the equipment housing or a ground to equalize charges.

3. ***Avoid Touching Circuitry.*** Handle assemblies by the edges; avoid touching the circuitry.

4. ***Avoid Partial Connection of Semiconductor.*** Verify that all devices connected to the modules are properly grounded before using them.

5. ***Ground Test Equipment.***

6. ***Use Antistatic Field Service Vacuum.*** Remove dust from the module if necessary.

7. ***Use a Grounded Wrist Strap.*** Connect the wrist strap to the appropriate grounding plug on the power entry panel. The

grounding plug on the power entry panel must be effectively connected to the earth grounding electrode system through the AC safety ground.

8. ***Do Not Use Lead Pencils to Set Dipswitches.*** To avoid contamination of switch contacts that can result in unnecessary circuit board malfunction, do not use a lead pencil to set a dipswitch.

General Handling

1. Examine the hardware immediately to verify that it has not been damaged in transit.

2. Notify the nearest Bailey Controls Company sales office of any such damage.

3. File a claim for any damage with the transportation company that handled the shipment.

4. Use the original packing material and container to store the hardware.

5. Store the hardware in an environment of good air quality, free from temperature and moisture extremes.

IEPEP03 POWER ENTRY PANEL WIRING

The appendices at the back of this manual show complete wiring diagrams of the modular power system. Figures C-1 and C-2 show the IEPEP03 system cabinet wiring diagram.

WARNING	**Verify the main power and power entry panel circuit breakers are turned off before starting installation, retrofit, upgrade, or wiring procedures. Failure to do so could result in severe or fatal shock. Do not turn the power on until the installation, retrofit, upgrade, or wiring procedures are complete.**
AVERTISSEMENT	**Assurez-vous que le disjoncteur d'alimentation principal et le disjoncteur de panneau d'entrée des alimentations sont éteints avant de procéder à l'installation, à la mise à jour, à l'extension ou au câblage, dans le but d'éviter les chocs sérieux et même mortels. Ne rétablissez pas l'alimentation tant que ces procédures ne sont pas terminées.**

NOTE: Plug your wrist strap ground cord into the receptacle labeled WRIST STRAP GND when working with the system.

1. Place circuit breakers CB1 and CB2 (see Figure 3-1) on the front of the panel to the ***off*** position before connecting AC power input wiring.

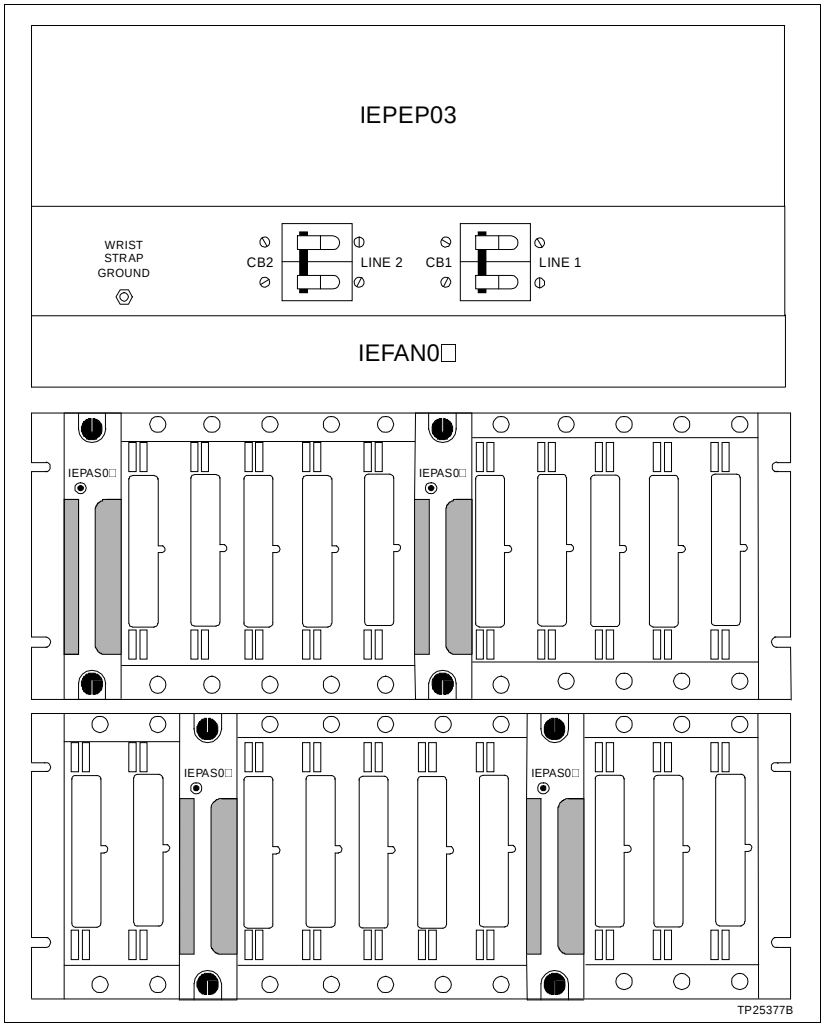

Figure 3-1. Circuit Breakers CB1/CB2

2. Connect the primary 120 VAC or 240 VAC power lines to TB1-1, TB1-2 and TB1-3.

3. Connect the secondary AC power lines (if used) to TB1-4, TB1-5 and TB1-6. Both inputs must be the same nominal voltage level.

If only one AC power input is being used, proceed with Step 4. If not, skip to Step 5.

4. Connect TB1-1 to TB1-4, TB1-2 to TB1-5, and TB1-3 to TB1-6. Use 12 AWG as a minimum and 6 AWG as a maximum. Note that this step avoids false bad status information because it connects line 1 and line 2 inputs together.

5. Connect cable 6637813_1 from J2 on the power entry panel to the system power bus bar. This cable provides connections to sample the DC bus voltages, monitor the power module status signal and output a power fail interrupt signal.

See the wiring diagrams at the end of this manual (see Figure C-1) for the correct system power bus bar connections.

6. Connect cable 6637814_2 from TB2-4, TB2-5 and TB2-6 on the power entry panel to the input power bus bar for distribution of AC power to the module mounting unit.

7. Connect cable 6637818_2 from the input power bus bar to each module mounting unit backplane (see Figure C-1).

8. Connect the fan assembly power cable to connector J1 labeled FAN OUT on the panel.

9. Connect a wire equivalent to power wiring but not less than 10 AWG from the GND stud of the panel to the cabinet frame for AC safety grounding.

10. There are 2 extra voltage monitor inputs available to monitor external power supply voltages. Use terminal block TB4 labeled AUX BUS MONITOR for this purpose. Attach 1 input to terminals 1 (+) and 2 (-) labeled CH1. Connect the other input to terminals 3 (+) and 4 (-) labeled CH2. Inputs can be +24, +48 or +125 VDC. Refer to ***Bus Monitor Module*** in this section for dipswitch and jumper settings to enable these inputs and select the input voltage.

11. Wire the auxiliary status inputs to terminal block TB3-1 (STATUS IN 1), TB3-2 (COM), and TB3-3 (STATUS IN 2). Insure that the inputs are low true, open collector or contact type referenced to DC common (terminal COM) and reflect the jumper settings of the bus monitor module (NO or NC). The alarm inputs must have the current carrying capability to sink at least 1 mA.

If the system uses the Plant Loop communication network continue to Step 12. If the system uses the INFI-NET communication network go to Step 13.

12. Connect cable 6634205_1 from TB3-4 (STATUS OUT) to the P3 card edge connector of the bus interface module (BIM). Doing so enables the BIM module to send the status message to the loop interface module (LIM) and to other nodes on the Plant Loop communication system.

Go to Step 16.

13. Connect an 18 AWG wire from TB3-4 (STATUS OUT) on the power entry panel to TB1-8 on the NTCL01 termination unit.

14. If 2 NTCL01 termination units connect to redundant network interface I/O modules:

a. Put two 18 AWG wires on a lug. Attach the lug to TB3-4 (STATUS OUT) on the power entry panel.

b. Attach the one wire to TB1-8 on the primary NTCL01 termination unit; the second wire attaches to TB1-8 on the secondary termination unit.

15. If redundant network interface I/O modules are being used with the NICL01 termination module:

a. Put two 18 AWG wires on a lug. Attach the lug to TB3-4 (STATUS OUT) on the power entry panel.

b. Attach the primary wire to TB2-4 on the primary NICL01 termination module; the second wire attaches to TB2-4 on the secondary termination module.

16. Use TB3-5, TB3-6, TB3-7 and TB3-8 for connecting the alarms. Use 18 AWG wire. Terminals 5 (**+**) and 6 (**-**) are labeled PWR SYS. These are the output connections for the power system alarm. Terminals 7 (**+**) and 8 (**-**) labeled BUS VOLT are the bus voltage alarm annunciators.

NOTE: Wire your system per the color codes of the wiring diagrams in Appendix C.

AC Transfer Module

Before installing the AC transfer module (IEPEP03 Power Entry Panel only), set switch S1 to the rear for 120 VAC operation (silk-screened 110 on board), or to the front for 240 VAC operation (silk-screened 220 on board). Figure 3-2 shows the location of S1 on the AC transfer module.

Figure 3-2. AC Transfer Module, Switch S1

The AC transfer module mounts from the rear of the system cabinet (see Figure 3-3). The AC transfer module mounts in the left-most slot. This board has a keyed edge connector to prevent incorrect mounting.

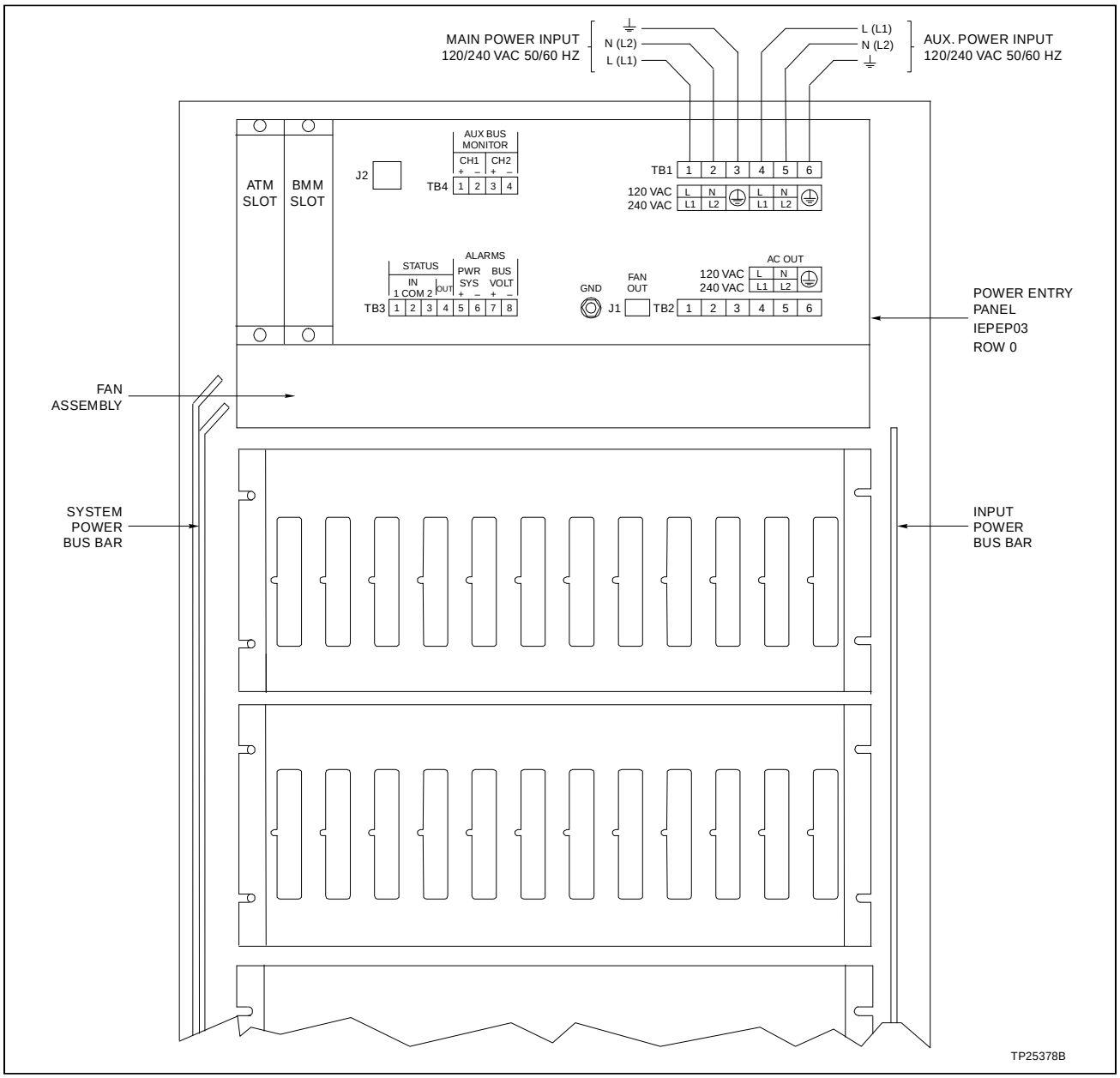

Figure 3-3. IEPEP03 Power Entry Panel, Rear View

To mount the module:

> **NOTE:** Be careful not to bump switch S1 when installing the AC transfer module. Accidentally moving the switch to the 240 position will cause the module to go into error mode.

1. Grasp the sides of the faceplate.

2. Line up circuit board edges with card guides in the power entry panel opening.

3. Slide the module in until it locks in place.

4. Turn the 2 locking screws on the AC transfer module faceplate 1/2-turn to lock the module in place.

Bus Monitor Module

Before mounting the bus monitor module (IEPEP03 Power Entry Panel only), set switch S1 and jumpers J1 through J8. Figure 3-4 shows the switch and jumper locations on the bus monitor module circuit board. Refer to Table 3-1 for the bus monitor module switch settings. Refer to Table 3-2 for the bus monitor module jumper settings.

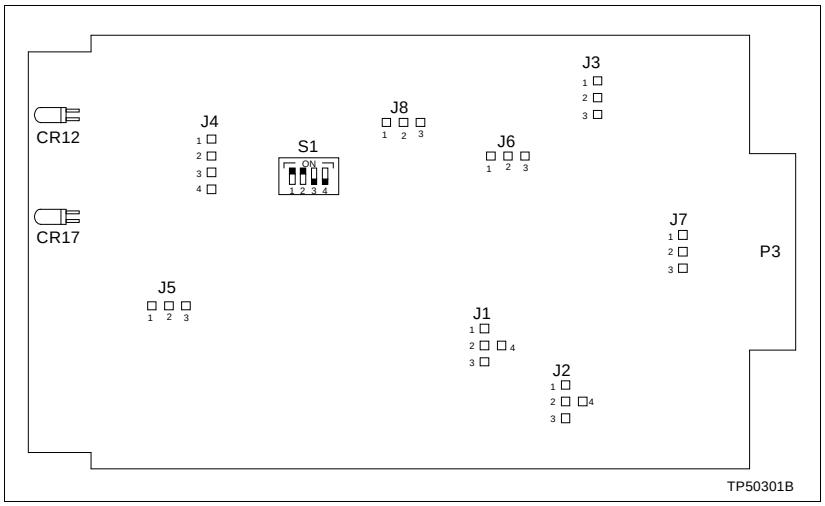

Figure 3-4. Bus Monitor Module, Switch S1 and Jumpers J1 through J8

The bus monitor module mounts from the rear of the system cabinet (see Figure 3-3). The bus monitor module mounts in the right-most slot. This board has a keyed edge connector to prevent incorrect mounting.

To mount the module:

1. Grasp the sides of the faceplate.

2. Line up circuit board edges with card guides in the power entry panel opening.

3. Slide the module in until it locks in place.

4. Turn the 2 locking screws on the bus monitor module faceplate 1/2-turn to lock the module in place.

Table 3-1. Bus Monitor Module Switch Settings

Switch S1 Position				Function[1]
1	2	3	4	
0				Enable 5, ±15 VDC monitoring
1				Disable 5, ±15 VDC monitoring
	0			Enable 24 VDC monitoring
	1			Disable 24 VDC monitoring
		0		Enable auxiliary bus monitoring CH1
		1		Disable auxiliary bus monitoring CH1
			0	Enable auxiliary bus monitoring CH2
			1	Disable auxiliary bus monitoring CH2

NOTES: 0 = CLOSED or ON, 1 = OPEN or OFF
1. Do not enable all inputs simultaneously. Doing so will cause a bad status signal. Unused monitor inputs must be disabled. Figure 3-4 shows the factory settings of switch S1.

Table 3-2. Bus Monitor Module Jumper Settings

Jumper Number	Jumper Position	Function[1]
J1		**Auxiliary bus monitor, channel 1:**
	1-2	Selects 24 VDC external power
	2-4	Selects 48 VDC external power
	2-3	Selects 125 VDC external power
J2		**Auxiliary bus monitor, channel 2:**
	1-2	Selects 24 VDC external power
	2-4	Selects 48 VDC external power
	2-3	Selects 125 VDC external power
J3		**AC input voltage, line 2:**
	1-2	Selects 120 VAC input
	2-3	Selects 240 VAC input
J4		**Auxiliary status input 1:**
	1-2	Normally open status input
	2-3	Normally closed status input
	3-4	Not used
J5		**Auxiliary status input 2:**
	1-2	Normally open status input
	2-3	Normally closed status input
J6	1-2	Must be set as shown
J7		**AC input voltage, line 1:**
	1-2	Selects 120 VAC input
	2-3	Selects 240 VAC input
J8	2-3	Must be set as shown

NOTE:
1. Placing a shorting strap over the jumper pins selects the function.

Fan Assembly

The IEFAN01 or IEFAN02 fan assembly mounts directly beneath the power entry panel and above the power mounting unit or the first module mounting unit (see Figure C-2). Attach the fan power cable to the J1 connector on the power entry panel.

Power Modules

Power modules mount directly in the module mounting unit or power mounting unit. Use any slot except the right-most slot (slot 12) when mounting a power module in a module mounting unit.

Mount the power modules in any slot when using a power mounting unit. Figure 3-5 shows the recommended mounting pattern and spacing when mounting power modules in module mounting units. This installation scheme provides the best heat dissipation and power distribution. For optimum heat dissipation and power distribution, do not exceed more than two IEPAS02 modules in any module mounting unit. Install at least one IEPAS02 module in the module mounting unit with the largest load (e.g., a module mounting unit containing several multi-function processor modules).

> **NOTE:** Power mounting units can hold a maximum of 12 power modules mounted side by side. However the total five VDC current load on the power mounting unit cannot exceed 100 amps. The total 24 VDC current load on the power mounting unit cannot exceed 60 amps.

WARNING	**Do not remove the plastic covers on the module mounting unit backplane. These covers protect against accidental contact with AC voltage. Severe or fatal shock could result.**
AVERTISSEMENT	**Ne retirez pas les couvercles de plastique situés sur le panneau arrière du châssis de montage des modules. Ces couvercles constituent une protection contre les contacts accidentels avec la tension c.a., qui risquent de provoquer des chocs sérieux et même mortels.**

Before handling the power modules:

1. Verify that all devices connected to the module are properly grounded before using them.

2. Avoid touching the circuitry when handling the module.

3. Always use grounding straps (field static kits) when working with the modules.

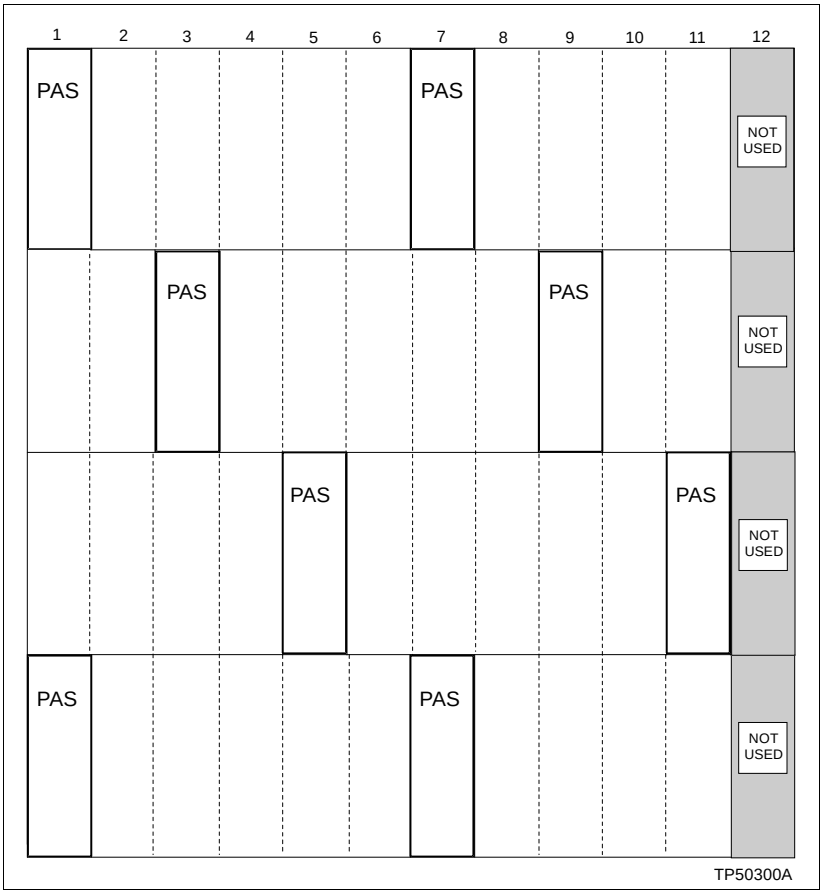

Figure 3-5. Recommended Power Module Layout for Module Mounting Unit

To install the power supply module:

1. Set jumpers J1 through J3 on the IEPAS02 module and set jumpers J1 and J2 on the IEPAF02 module (the IEPAF02 module does not have J3) for the module operation desired. Table 3-3 lists the IEPAS02 and IEPAF02 jumper settings. Figure 3-6 shows the jumper locations on the IEPAS02 and IEPAF02 power modules. Refer to Table 4-2 for information on the monitoring priority levels of the power module jumper settings.

2. Grasp the module faceplate handle and align the top and bottom edges of the circuit board with the guides in the module mounting unit.

3. Hold the module by the faceplate handle and slide it into the MMU slot. Push on the faceplate until the rear edge connectors of the power module are firmly seated in the backplane connectors.

4. Firmly press the module handle as you use a blade screwdriver to push and turn the 2 concentric screws 1/2-turn clockwise to lock the module in place.

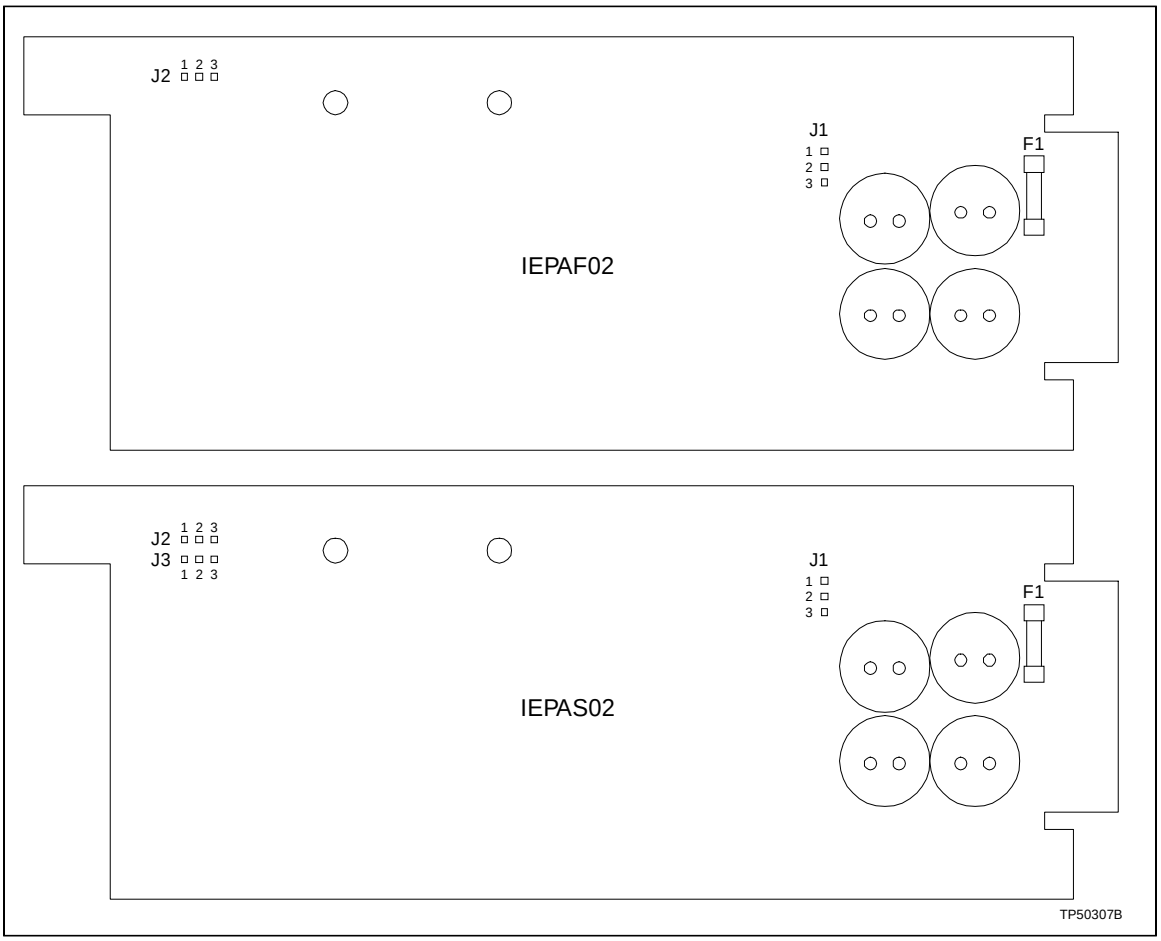

Figure 3-6. IEPAF02 and IEPAS02 Power Module Board Layout

Table 3-3. IEPAS02 and IEPAF02 Power Module Jumper Settings

Jumper Number	Jumper Position	Function
J1	1-2	120 VAC
	2-3	240 VAC
J2	1-2	Enable 24 VDC undercurrent monitoring
	2-3	Disable 24 VDC undercurrent monitoring
J3[1]	1-2	Enable 5 VDC undercurrent monitoring
	2-3	Disable 5 VDC undercurrent monitoring

NOTE:
1. The IEPAF02 does not have jumper J3.

WARNING **Allow five seconds for the line filter capacitors to discharge before handling the module after removal. Failure to do so could result in severe or fatal shock.**

AVERTISSEMENT	**Après avoir retiré le module, laissez les condensateurs de filtres antiparasites se décharger pendant cinq secondes avant de manipuler celui-ci, afin d'éviter les chocs sérieux et même mortels.**

WARNING	**Handle the module by surfaces other than the heat sink. The heat sink may be hot and may cause severe burns.**
AVERTISSEMENT	**Le module doit être manipulé à l'aide de surfaces autres que le dissipatour thermique. Ce dernier resque d'être chaud et de provoquer des brûlures sérieuses.**

To remove the module:

1. Use a blade screwdriver to push and turn the 2 concentric screws 1/2-turn in either direction.

2. Slide the module part way out.

3. Allow 5 seconds for the module capacitors to discharge. Then remove the module from its mounting unit.

IEPEP01 AND IEPEP02 POWER ENTRY PANEL WIRING

NOTE: The IEPEP01 Power Entry Panel requires you to supply an external circuit breaker or fuse. The breaker or fuse must be able to handle the current and voltage listed in the specifications table (Table 1-4).

CAUTION	**Verify the line voltage select switch is properly configured before energizing the power entry panel. Failure to do so could permanently damage the PFI circuit board by exposing it to improper input voltage levels.**
ATTENTION	**Assurez-vous que l'interrupteur de sélection de la tension de ligne est adéquatement configuré avant de mettre sous tension le panneau d'entrée des alimentations. Toute négligence à cet égard risque d'endommager de facon permanente la carte de détection des coupures d'alimentation (PFI) en l'exposant à des niveaux inadéquats de tension d'entrée.**

1. Set the slide switch on the rear of the power entry panel to either 120 V or 240 V to match the line voltage. This switch sets the power fail interrupt (PFI) detection circuit to determine low level or loss of input. Figure 3-7 shows this switch on the rear of the IEPEP01 and IEPEP02 power entry panels.

2. Connect cable 6638084_1 from the PFI connector on the rear of the panel to the system power bus bar. This connection distributes a power fail interrupt to the process control modules in the cabinet.

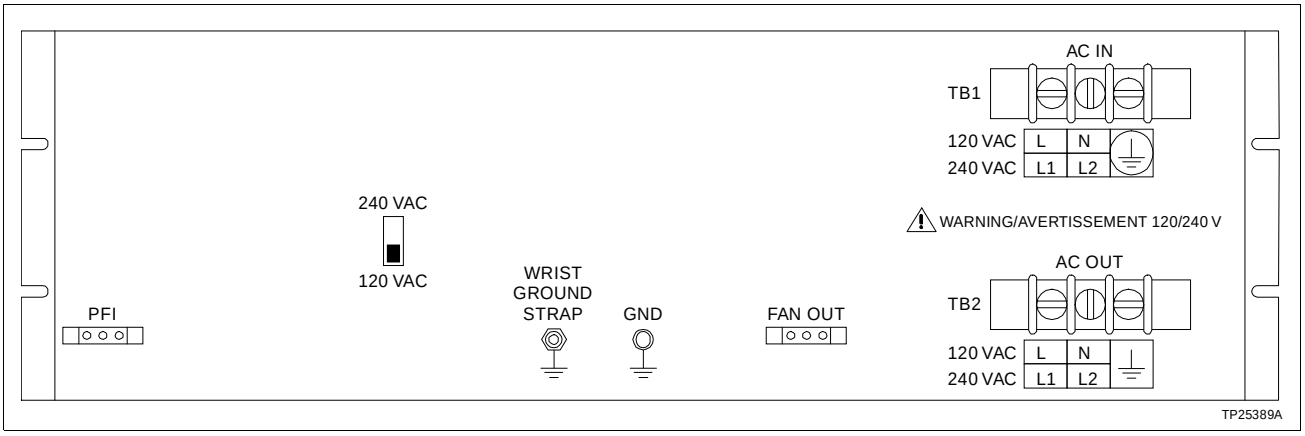

Figure 3-7. Rear of IEPEP01 and IEPEP02 Power Entry Panels

Figure C-3 shows a wiring diagram of the IEPEP01 and IEPEP02 Power Entry Panels with module mounting units. Figure C-4 shows the IEPEP01 and IEPEP02 Power Entry Panels with a power mounting unit.

3. Connect cable 6637814_1 from TB2 on the rear of the power entry panel panel to the input power bus bar. This connection places AC power on the input power bus bar.

4. Plug the fan assembly power cable into the FAN OUT connector on the rear of the panel.

5. Connect a yellow/green wire equivalent to the power wiring size (not less than 10 AWG) from the GND bolt on the panel to the cabinet frame for AC safety grounding (see Figure C-3).

6. Apply power by connecting the 120/240 VAC, 50/60 hertz power input to terminal block TB1 on the rear of the panel.

NOTE: Wire your system using the color codes in the wiring diagram of Figure C-3 or C-4.

IEPMU01 AND IEPMU02 POWER MOUNTING UNIT INSTALLATION

WARNING	**Verify the main power and power entry panel circuit breakers are turned off before starting installation, retrofit, upgrade, or wiring procedures. Failure to do so could result in severe or fatal shock. Do not turn the power on until the installation, retrofit, upgrade, or wiring procedures are complete.**
AVERTISSEMENT	**Assurez-vous que le disjoncteur d'alimentation principal et le disjoncteur de panneau d'entrée des alimentations sont éteints avant de procéder, à la mise jour, à l'extension ou au câblage, dans le but d'éviter les chocs sérieux et même mortels. Ne rétablissez pas l'alimentation tant que ces procédures ne sont pas terminées.**

Required Tools

The following tools are needed to install the power mounting unit:

- 16-inch blade screwdriver.
- 7/16-inch nut driver.
- Pliers.
- Volt/ohmmeter.
- Heat gun.

Installation in the INFI 90 Cabinet

NOTE: Install the IEPMU01 unit from the rear of the cabinet, the IEPMU02 unit from the front.

1. Mount the power mounting unit directly beneath the fan assembly.

2. Secure both sides of the power mounting unit to the cabinet mounting rails.

3. Proceed to ***Wiring Instructions***.

Wiring Instructions

NOTE: Do all wiring at the rear of the cabinet. Wires are color-coded.

Steps 1 through 23 and Figures C-2 and C-4 apply to INFI 90 cabinets only. Refer to Appendix D for instructions on retrofitting the power mounting unit in Network 90 cabinets.

1. Attach the AC input wire harness (part number 6637814_2) to TB2 on the power entry panel (PEP). Attach the other end of the wire harness to the terminal block on the right side of the power mounting unit. Wire and terminal assignments on the PMU terminals are:

Green/Yellow - to ground tab (top)
Blue - to L2 Neutral (middle)
Brown - to L1 Hot (bottom)

2. On the left side of the PMU card cage starting at the third conductive strip (from the top), attach one end of the first heavy 0 AWG wire assembly (part number 6632285_45).

NOTE: For Steps 2 and 5, before installing the 0 AWG (part number 6632285_45) braided wire, shape it into a **[** form to avoid overstressing the PMU bus bar terminals.

3. Attach the other end to the system MCOM tab at the top of the system power bus bar.

4. Slide heat shrink tubing over the PMU card cage connection (see Figure 3-8). After properly covering the connections, use the heat gun to shrink the tubing into place.

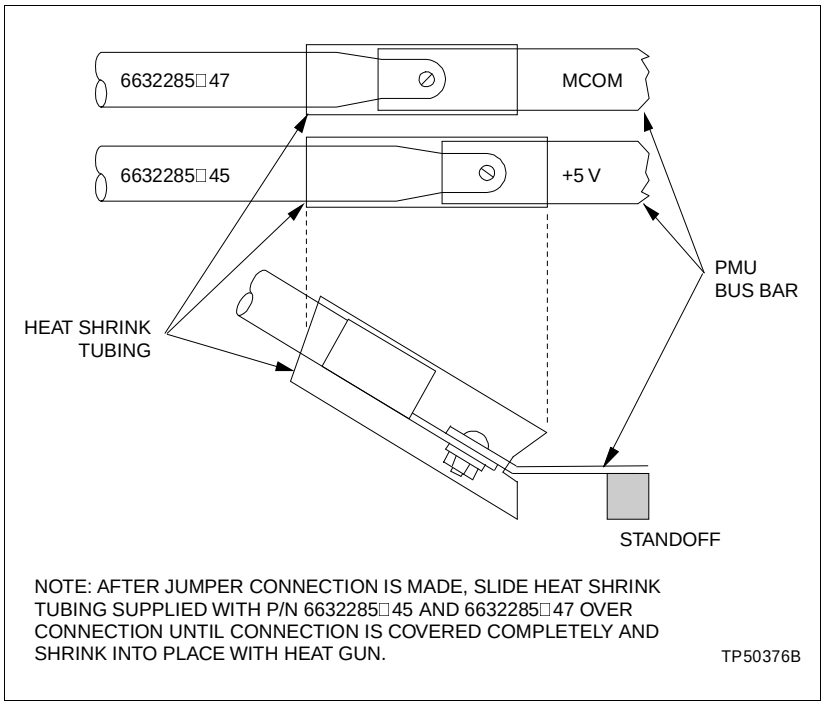

Figure 3-8. Heat Shrink Tubing for 5 VDC Connection

5. On the left side of the PMU card cage at the fourth conductive strip (from the top), attach one end of the second heavy 0 AWG wire assembly (part number 6632285_45).

6. Attach the other end to the system +5 VDC tab at the top of the system power bus bar.

7. Slide heat shrink tubing over the power mounting unit connection (see Figure 3-8). After properly covering the connections, use the heat gun to shrink the tubing into place.

8. Attach one end of the 10 AWG wire assembly to the system power bus bar I/O COM. Attach the other end to the PMU I/O COM pick-up faston (see Figure 3-9).

> **NOTE:** For Steps 8 and 11, if more than 15 A are required, use another system power bus bar connection and attach it to the PMU I/O terminals, or if desired, stack the ends going to the power mounting unit on a 6 AWG ring lug and connect to the heavy terminal.

9. Attach one end of 10 AWG wire assembly to the system power bus bar +24 VDC. Attach the other end of 10 AWG wire assembly to the PMU +24 VDC.

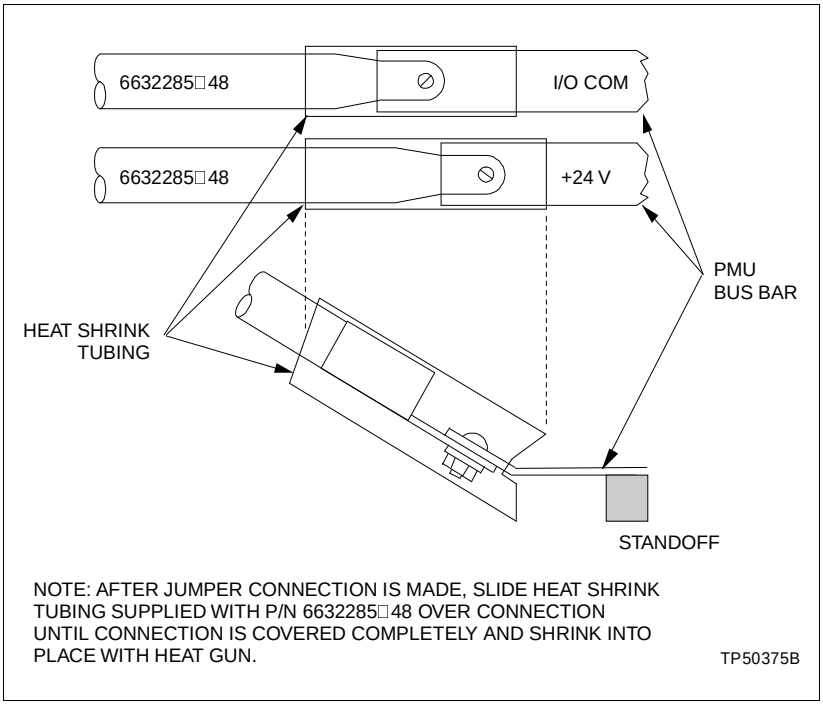

Figure 3-9. Heat Shrink Tubing for 24 VDC Connection

10. Attach one spade lug end of 10 AWG wire assembly to the PMU +15 VDC. Attach the other spade lug end to system power bus bar +15 VDC.

11. Attach one spade lug end of a 10 AWG wire assembly to PMU -15 VDC. Attach the other spade lug end to system power bus bar -15 VDC.

12. Attach the spade lug end of cable 6637813_1 (IEPEP03 panel only) to STATUS on the PMU card cage (see Figure C-2).

13. Make the other signal connections from J2 to the system power bus bar using cable 6637813_1.

14. Use an ohmmeter to verify continuity between TB2 on the IEPEP03 and the AC terminals on the power mounting unit.

15. Verify the circuit breakers on the PEP panel are in the ***off*** position. If you are wiring an IEPEP01 panel, verify that the external circuit breakers are in the ***off*** position.

16. Unplug all process and I/O modules from the MMU backplane.

17. Verify that all wiring connections are complete before turning the source power on.

18. Turn source power on.

19. Use a voltmeter to measure 120/240 VAC power at TB1.

20. Turn the PEP circuit breakers on.

> **NOTE:** Before doing Step 21, verify that switch and jumper settings on the power modules are correct. Refer to Table 3-3 for settings.

21. Install the required number (calculated from ***SIZING THE MODULAR POWER SYSTEM*** in Appendix B) of IEPAS02 and IEPAF02 power modules in the PMU card cage, one at a time. Slide one power module along the guides until it is seated in the PMU backplane.

22. Turn the 2 latching screws until they lock. Verify that the status LED turns green on each power module. If it does not, refer to Section 5.

23. Do not install the process modules at this time. Refer to ***RECOMMENDED START-UP PROCEDURES*** in Section 4, Steps 5 through 9.

SECTION 4 - OPERATING PROCEDURES

INTRODUCTION

This section contains information regarding modular power system operation. This section includes information on status LEDS for the AC transfer, bus monitor and power modules. It explains how to start up the power module and how to remove it during operation.

> **NOTE:** The modular power system requires no user calibration; all components are factory calibrated.

LED INDICATORS

When the modular power system is operating, observe the status LEDs. The following paragraphs explain how to interpret these LEDs. Also, refer to Tables 4-1 and 4-2.

AC Transfer Module

The AC transfer module (IEPEP03 Power Entry Panel only) has three status LEDs: a module status LED, line one and line two AC input status LEDs. All LEDs are red/green LEDs. When the system is receiving power and operating normally, the module status LED is green. Also, the line one and two AC input status LEDs are green under normal operation. The only time the module status LED turns red is if the module fails. A failure means that the internally generated supply voltages or references have fallen below the minimum acceptable level. In a redundant supply line configuration, a failure in the primary input turns line one AC input status LED red; a failure in the secondary input turns line two AC input status LED red. Refer to Table 4-1 for a listing of status LED conditions.

Bus Monitor Module

The bus monitor module has two LEDs: module status and system status. The module status LED is green when the module is operating properly. It turns red if the module fails. A failure means that the internally generated supply voltages or references have fallen below the minimum acceptable level.

The system status LED is green when everything in the system is satisfactory (refer to Table 4-1). If for some reason a bus voltage fails or falls out of tolerance, one of the AC inputs fails, external status, auxiliary power supply inputs are low, or the AC transfer module (ATM) fails, the LED turns red.

Table 4-1. Status LEDs, AC Transfer and Bus Monitor Modules

Module	LED/Condition		Condition
AC transfer module	Status	Green	Normal
		Red	Module has failed
	Line 1	Green	Line 1 input is good
		Red	Line 1 input has failed
	Line 2	Green	Line 2 input is good
		Red	Line 2 input has failed
Bus monitor module	Status	Green	Normal
		Red	Module has failed
	System Status	Green	Normal
		Red	Bad power system status

Power Module

The power module has one LED, module status. This LED is green when the module is operating normally. This LED has five possible states that describe the status of the power module. Refer to Table 4-2 for a list of power supply faults, the LED states, priority level and associated power module status signal.

Table 4-2. Status LEDs, Priority Level and Status Signal for IEPAS02 and IEPAF02 Power Modules

LED State	Fault	Priority Level [1]	Power Module Status Signal
Red	5 V DC/DC converter failure	1	Low
	24 V DC/DC converter failure		
	+15 V DC/DC converter failure		
	-15 V DC/DC converter failure		
Alternating red and green[2]	5 V DC/DC converter over-temperature [85°C (192°F)]	2	Low
	24 V DC/DC converter over-temperature [85°C (192°F)]		
Blinking green	5 V DC/DC converter overcurrent (13 A typical)	3	Low
	24 V DC/DC converter overcurrent (4 A typical)		
Blinking red[3]	5 V DC/DC converter undercurrent (<0.5 A typical)	4	Low
	24 V DC/DC converter undercurrent (<0.3 A typical)		
Green	No faults	5	High

NOTES:

1. Faults with the highest priority will override faults with a lower priority. A 1 represents the highest priority and a 5 represents the lowest priority.
2. If the 5 V or 24 V DC/DC converter temperature reaches 90°C (203°F) it will shut down and the status LED will show a failure (red).
3. A converter undercurrent condition (blinking red LED) indicates that the power module is not supplying current to the system. It may be desirable to disable the status LED for converter undercurrent when certain conditions exist such as a small or no 24 VDC load. Disable the undercurrent status LED by referring to Table 3-3 for the power module jumper settings.

REMOVING ATM OR BMM MODULES DURING OPERATION

While the power system is in operation, ***do not remove*** the AC transfer module (IEPEP03 Power Entry Panel only) without first verifying that line one is operational. Removing the ATM module causes the system to transfer to line one. If the ATM module transfers from line one to line two because of a problem, the whole system will go down when the ATM module is removed. Before removing the ATM module, line one must be operational. Additionally, removal of the ATM module takes the bus monitor module off-line because it receives its power from the ATM module.

To avoid unintentional triggering of the PFI signal when handling the bus monitor module or the AC transfer module, insert or remove the bus monitor module only when the AC transfer module is in its designated slot.

RECOMMENDED START-UP PROCEDURES

Follow the procedures in Steps 1 through 9 before applying power to the system.

1. Verify that all connections are secure.

2. Insure that all input power bus bar receptacles are covered with insulated receptacles.

3. Install the power modules only (refer to Section 3 for details).

4. Turn power on.

5. Measure the bus voltages at the test jacks of the bus monitor module (+5, +15 and -15 VDC are with respect to DC common; +24 is VDC with respect to I/O COM). Table 4-3 shows the maximum and minimum unloaded DC bus voltage levels required to begin installing modules.

6. When the bus voltages are at acceptable levels, start adding process control modules.

7. Continue adding process control modules until the system cabinet is filled.

8. Verify that the system voltages are within specification. Refer to Table 1-4 for system specifications.

9. Put a blank faceplate (Bailey part number 6636586_1) over any unused PMU slots. If your MMU card cages have any unused slots, place the cap (Bailey part number 6638748_1) on the backplane by snapping in the top then the bottom.

Table 4-3. Unloaded DC Bus Output Voltage Requirements

5 VDC		24 VDC		+15 VDC		-15 VDC	
Min	Max	Min	Max	Min	Max	Min	Max
5.1	5.3	25.7	26.0	15	15.75	-15	-15.75

SECTION 5 - TROUBLESHOOTING

INTRODUCTION

This section provides troubleshooting tools to help you locate and correct modular power system problems. These are general troubleshooting procedures and are not exhaustive of all possible causes.

TROUBLESHOOTING FLOWCHARTS

The flowcharts in Figures 5-1 and 5-2 represent basic troubleshooting procedures for the IEPEP01, IEPEP02 and IEPEP03 Power Entry Panels.

IEPEP01 and IEPEP02 Systems

Systems with an IEPEP01 or IEPEP02 Power Entry Panel only monitor the AC power input. There are no bus voltage or other power system status indicators on the power entry panel. If AC input power is lost or goes low, a power fail interrupt (PFI) signal is sent to the process control modules. Figure 5-1 shows a troubleshooting flowchart for IEPEP01 and IEPEP02 systems.

To troubleshoot the system:

1. Check system and I/O power. If system and I/O power are good, an overload condition may exist in the power modules.

2. Check for red status LEDs on the power modules.

3. If there are power modules with red LEDs, install additional power modules.

4. Check power modules that had red LEDs. If they are still red, they have failed. Remove and replace them.

5. Check the PFI signal. If it is good, there is a power entry panel failure. Replace the power entry panel. This should be done by a qualified service technician.

IEPEP03 Systems

Any power system problem will cause a bad status flag at the operator interface. This alarm appears under the *S* group on the system status display of an operator interface station (OIS), management command system (MCS), or LAN-90 process control view computer. Additionally, the LEDs on the power supply, bus monitor or AC transfer module go red to indicate bad

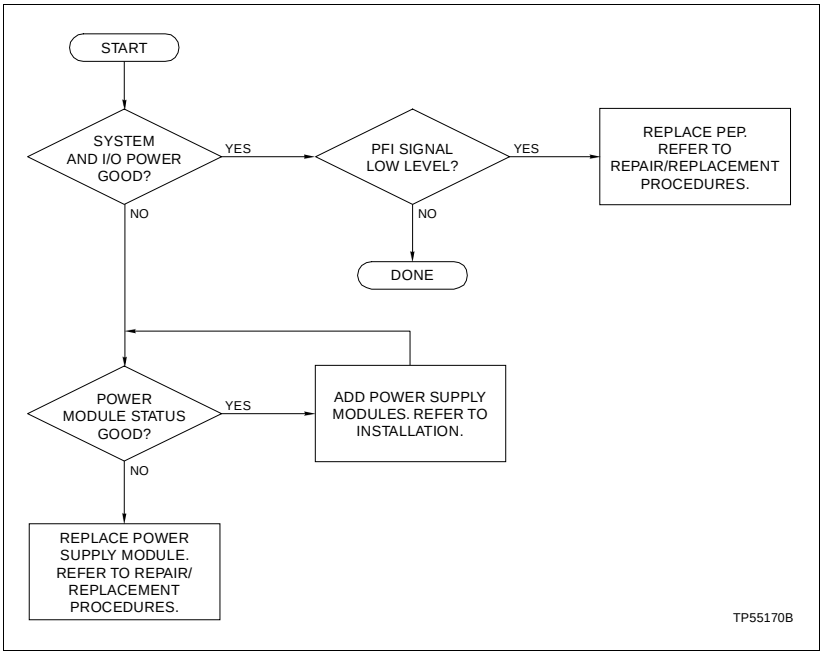

Figure 5-1. Troubleshooting Flowchart, IEPEP01 and IEPEP02 Power Entry Panels

status. Figure 5-2 shows a troubleshooting flowchart for an IEPEP03 system.

Another way to detect bad power system status is to hard wire alarms to the customer alarm outputs. These outputs turn off to indicate a low bus voltage and other power system problems.

If bad status is detected:

1. Check the LEDs on the AC transfer and bus monitor modules.

2. If the AC transfer module status LED is red, the module has failed and must be replaced. Note that a defective AC transfer module may cause the bus monitor module to show bad status.

> **NOTE:** Before removing the ATM module, measure AC input line 1 to verify that it is operational and within tolerance (+102 to +132 VAC for 120 VAC input; +204 to +264 VAC for 240 VAC input).

3. If the bus monitor module status LED is red, the module has failed and must be replaced.

> **NOTE:** Refer to Section 7 for details on module removal and replacement.

4. If the LEDs on both modules are green, check the AC input line 1 and line 2 LEDs on the AC transfer module.

5. If either of the AC input line LEDs are red, this means a loss of AC input power, or bad quality. If both LEDs are red, switch S1 may have been moved when the ATM module was installed. Check switch setting for 120/240 VAC and set to the appropriate setting.

6. Verify that the circuit breakers are in the ***on*** position.

7. If the circuit breakers are on and the AC input line LEDs are still red, the power entry panel has failed. Replace the power entry panel.

8. If all AC transfer module LEDs are green, look at the bus monitor module LEDs.

9. If the bus monitor module status LED is red, the module has failed and must be replaced. If it is green, proceed.

10. If the system status LED is red, measure the bus voltages at the test jacks on the module front panel. If the system status LED is green there is no problem.

11. Install additional power modules if the bus voltages measured in Step 10 are low.

12. If the measurements made in Step 10 are good, check the power module LEDs. If any LEDs are red, that power module has failed. Install a good power module before removing the failed power module.

13. If any power modules have blinking red and green LEDs, those modules are over temperature. Check the fan assembly for proper operation. Check the condition of cabinet air filter and clean or replace if dirty.

14. Check the power modules for blinking green LEDs. Blinking green LEDs indicate an overcurrent condition. Install additional power modules.

15. If any power module LEDs are blinking red, an undercurrent condition may exist because of low 5 or 24 VDC loads on the system. If the 5 and 24 VDC loads are normal, insert a good power module then remove the power module with the blinking red LED.

16. Disable the 5 or 24 VDC undercurrent detection on all power modules if the system load for those voltages is low.

17. If the system status LED is red, the bus voltages check good and there are no LED conditions on the power modules, the problem is caused by the external inputs being monitored by the bus monitor module.

18. If customer external power supply voltages are being monitored at the AUX BUS MONITOR inputs to the power entry panel, verify the jumper settings on the bus monitor module are correctly set for the voltage levels being monitored (refer to Table 3-2 for jumper settings).

19. If switch settings are okay, measure the voltages between terminals 1 and 2 and terminals 3 and 4 of TB4 on the PEP rear panel. Voltages should be:

- Greater than 22 VDC if set for 24 VDC.
- Greater than 44 VDC if set for 48 VDC.
- Greater than 115 VDC if set for 125 VDC.

If the voltages are correct, there is a problem in one of the auxiliary status inputs (STATUS IN) at terminal block TB3 on the power entry panel.

20. Measure the voltage from terminal 1 and terminal 3 with respect to terminal 2 of TB3. The voltages at these terminals will depend on how J4 and J5 are set on the bus monitor module.

If J4 and J5 are set for normally open (NO) and the voltage measures less than 3.1 VDC, the input status is bad. If J4 and J5 are set for normally closed (NC) and the voltage measures more than 3.1 VDC, the input status is bad. To verify that the external device is causing the bad status, remove the suspect input wire. The system status LED should turn green if the external device was pulling the input low or high, causing the status. Otherwise, the bus monitor module is defective.

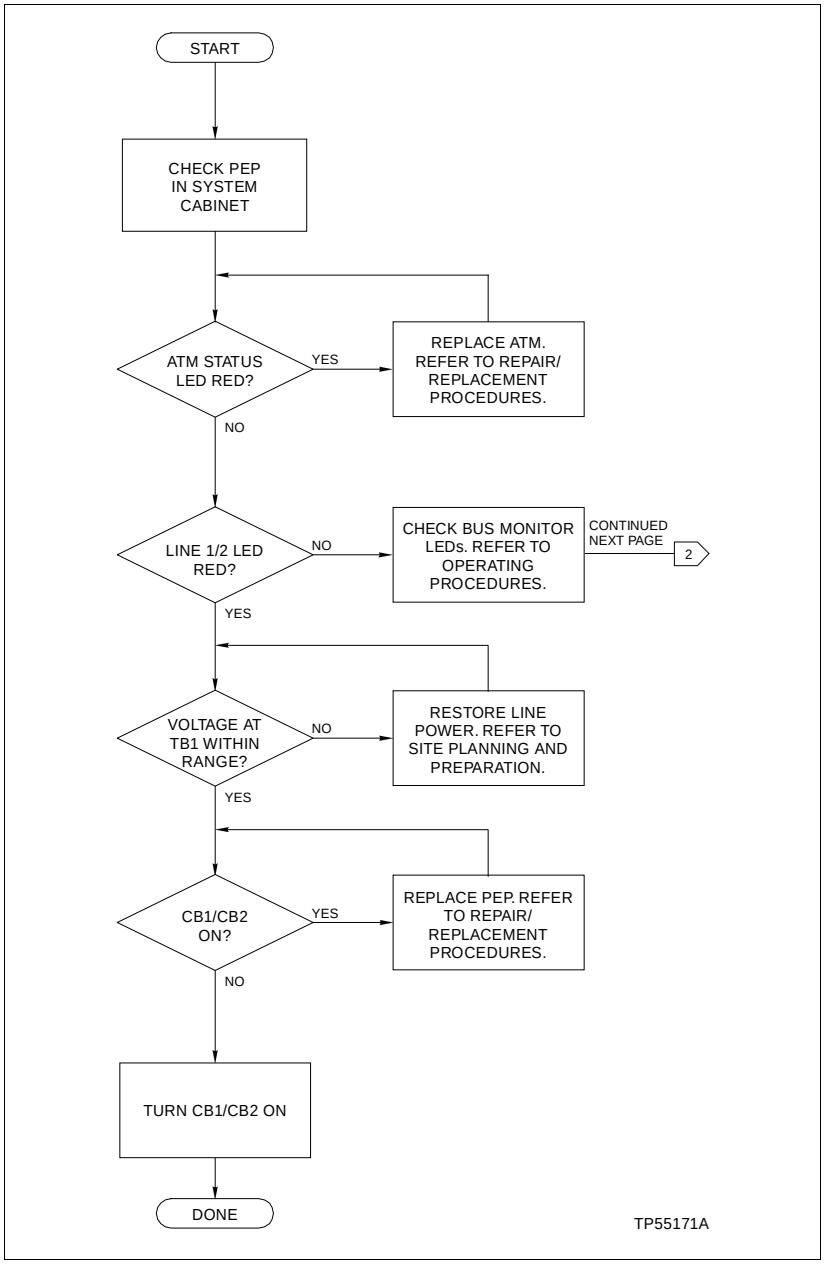

Figure 5-2. Troubleshooting Flowchart, IEPEP03 Power Entry Panel (Page 1 of 3)

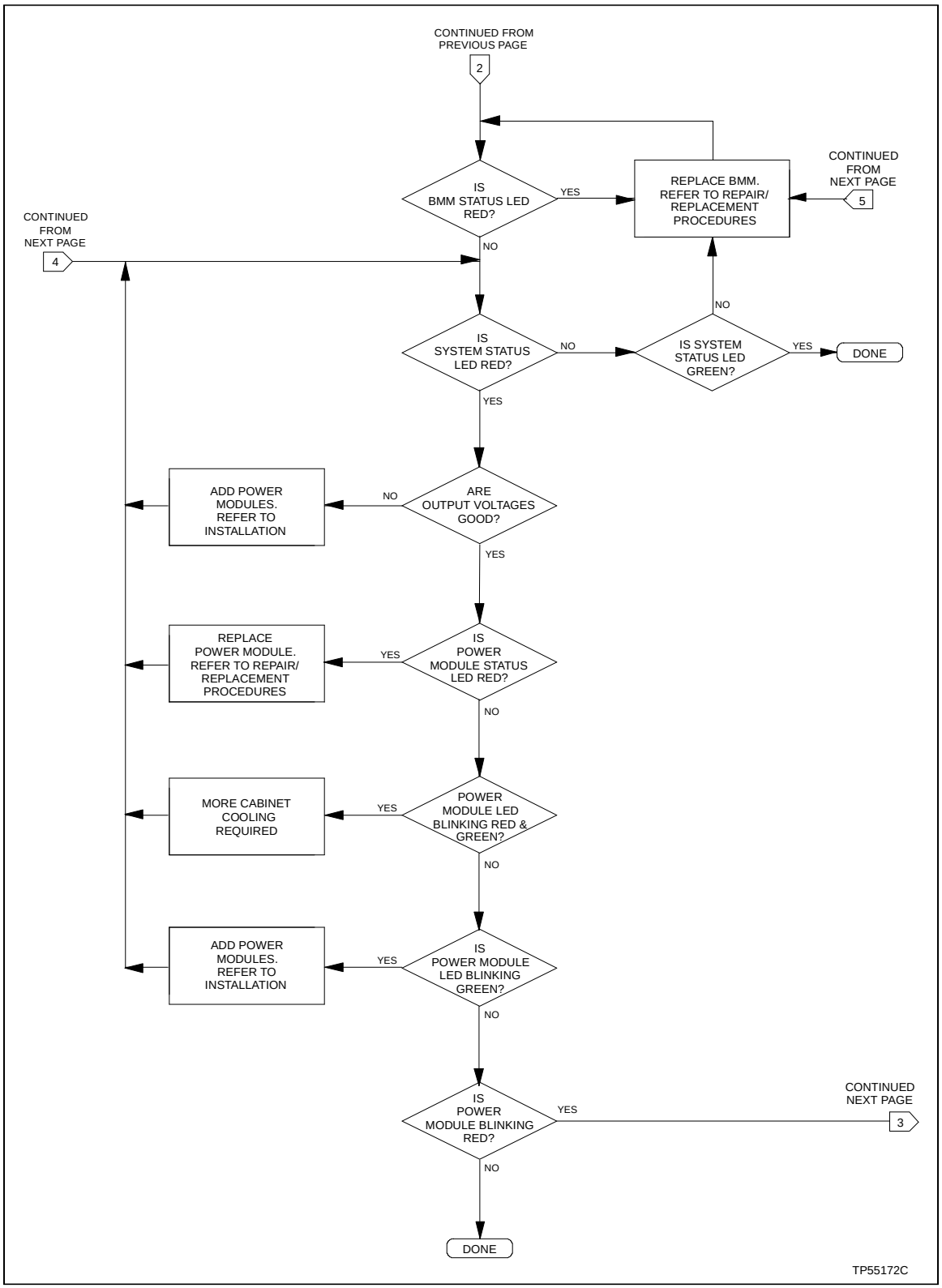

Figure 5-2. Troubleshooting Flowchart, IEPEP03 Power Entry Panel (Page 2 of 3)

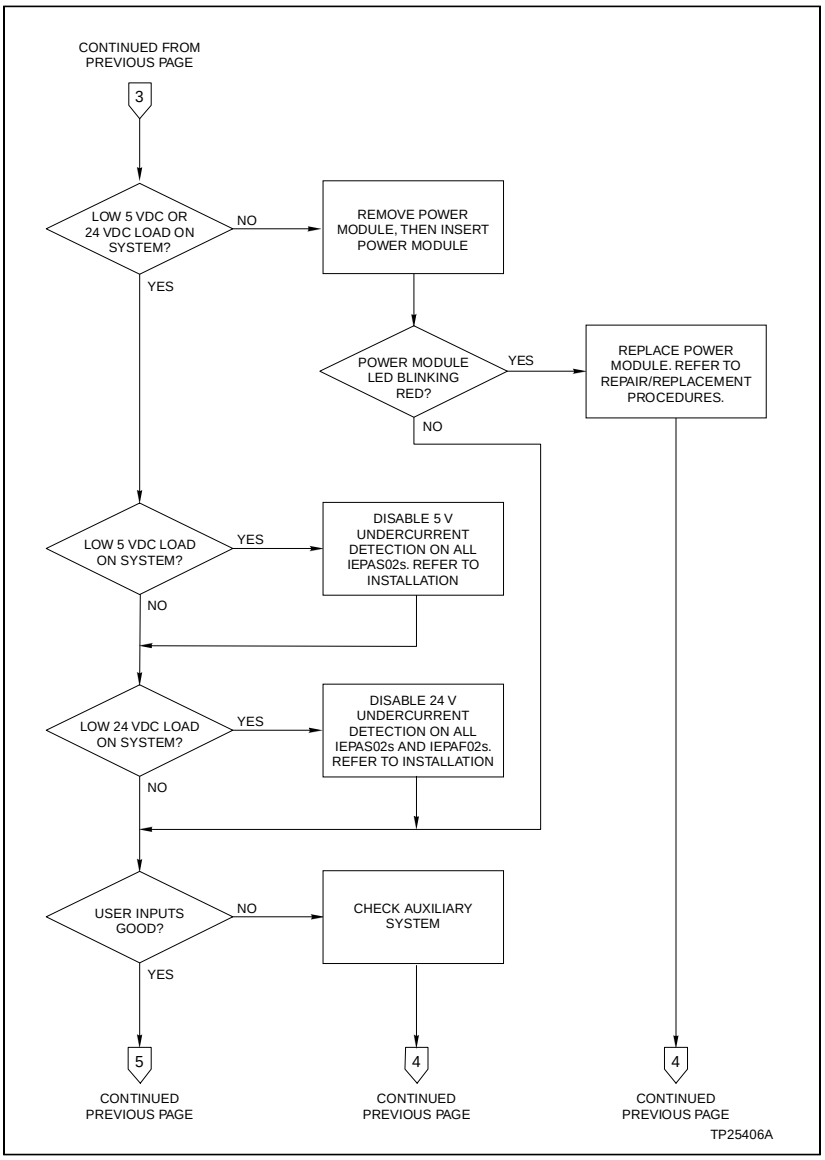

Figure 5-2. Troubleshooting Flowchart, IEPEP03 Power Entry Panel (Page 3 of 3)

SECTION 6 - MAINTENANCE

INTRODUCTION

WARNING	**There are exposed AC and DC connections inside the cabinet. These exposed electrical connections present a shock hazard that can cause injury or death.**
AVERTISSEMENT	**Cette armoire comporte des connexions c.a. et c.c. dénudées. Ces connexions électriques présentent un danger d'électrocution pouvant entraîner des blessures ou la mort.**

WARNING	**Never clean electrical parts or components with the AC power on. Doing so exposes you to a fatal electrical shock hazard.**
AVERTISSEMENT	**Il ne faut jamais nettoyer des piècesou des composants électriques lorsqu'ils sont sous tension. Cedi présente un risque d'électrocution fatale.**

WARNING	**If input or output circuits are a shock hazard after disconnecting system power at the power entry panel, then the door of the cabinet containing these externally powered circuits must be marked with a warning stating that multiple power sources exist.**
AVERTISSEMENT	**Si des circuits d'entrée ou de sortie sont alimentés à partir de sources externes, ils présentent un risque de choc électrique même lorsque l'alimentation du système est débranchée du panneau d'entrée l'alimentation. Le cas échéant, un avertissement signalant la présence de sources d'alimentation multiples doit être apposé sur la porte de l'armoire.**

WARNING	**Wear eye protection whenever working with cleaning solvents. When removing solvents from printed circuit boards using compressed air, injury to the eyes could result from splashing solvent as it is blown off the printed circuit board.**
AVERTISSEMENT	**Portez toujours des lunettes de protection lorsque vous utilisez des solvants de nettoyage. L'aircomprimé servant à enlever le solvant des cartes de circuits imprimés provoque des éclaboussures qui risquent d'atteindre les yeux.**

This section contains a modular power system preventive maintenance schedule and procedures. Doing the preventive maintenance procedures as scheduled maintains good, dependable modular power system operation.

This section presents procedures that the customer should be able to perform on site. These preventive maintenance procedures should be used as a guideline to assist in establishing good preventive maintenance practices. Select the minimum steps required to meet the cleaning needs of your system.

Personnel performing preventive maintenance should meet the following qualifications.

- Maintenance personnel should be qualified electrical technicians or engineers that know the proper use of test equipment such as digital multimeters.

- Maintenance personnel should be familiar with the INFI 90 modular power system, have experience working with process control systems, and know what precautions to take when working on live AC systems.

PREVENTIVE MAINTENANCE SCHEDULE

Table 6-1 is the preventive maintenance schedule for the modular power system. The table lists the preventive maintenance tasks in groups according to their specified maintenance interval. Some tasks in Table 6-1 are self explanatory. Instructions for tasks that require further explanation are covered in ***PREVENTIVE MAINTENANCE PROCEDURES*** in this section.

NOTE: The preventive maintenance schedule list is for general purposes only. Your application may require special attention.

Table 6-1. Preventive Maintenance Schedule

Task	Frequency
Check the cabinet air filters. Clean or replace them as necessary. Check the air filter more frequently in excessively dirty environments. Refer to procedure.	3 months
Check cabinet, power entry panel and power modules for dust. Clean as necessary using an antistatic vacuum.	
Check all signal, power and ground connections within the cabinet and verify that they are secure. Refer to procedure.	
Check modular power supply outputs. Refer to procedure.	6 months
Do a visual inspection of the fan assembly. Verify that all fans are rotating and replace if necessary. Refer to the appropriate INFI 90 power system manual for replacement instructions.	
Check the quality of the plant power and grounding system. Follow the power and grounding system verification procedures in the INFI 90 site preparation and planning instruction.	12 months
Inspect all control, I/O modules and power modules, giving particular attention to power supply contacts and heat sinks. Clean as necessary. Refer to procedure.	^
Inspect and check the power entry panel. In high vibration environments testing may be necessary at shorter intervals. Refer to procedure.	2 years

Table 6-1. Preventive Maintenance Schedule (continued)

Task	Frequency
Replace power modules. Call Bailey sales and service for information.	5 years
Complete all checks and inspections in this table. Replacement tasks should be done at the scheduled frequency.	Shutdown

EQUIPMENT REQUIRED

Following is a list of tools and equipment required for the maintenance procedures.

- Antistatic vacuum.
- Digital multimeter.
- Flathead torque screwdriver (Newton meters/inch-pounds).
- Four-inch flathead screwdriver.
- 16-inch flathead screwdriver.
- Isopropyl alcohol (99.5% electronic grade).
- Foam-tipped swab.
- Eberhard Faber (400A) pink pearl eraser or equivalent.
- Fiberglass burnishing brush.
- Lint-free cloths.
- Small needle nose pliers.

PREVENTIVE MAINTENANCE PROCEDURES

This section covers tasks from Table 6-1 that require specific instructions or further explanation. The tasks and instructions covered are:

- Cabinet air filter cleaning or replacement.
- How to check signal, power and ground connections.
- Checking modular power supply outputs.
- The power entry panel preventive maintenance procedure.
- Specific instructions on cleaning printed circuit boards and edge connectors.

Refer to Section 7 for instructions on how to replace the fan assembly.

Cabinet Filter Cleaning/Replacement

The cabinet air filter mounts over the lower air vent, inside the cabinet front door. To replace the air filter:

1. Use a flathead screwdriver to remove one screw securing the mounting plate at the top of the air filter mounting bracket.

2. Pull the mounting bracket (and air filter) off the cabinet door.

3. Remove the air filter from its mounting bracket.

4. Either clean or replace the air filter.

5. If the air filter stays dry and relatively clean, use compressed air to blow dust and dirt free from the filter.

6. Clean a dirty filter in water and a mild detergent (i.e., dish washing soap). Agitate the filter or squeeze the soapy water through the filter to remove dirt.

7. When the filter is clean, rinse the filter thoroughly with water.

8. Air dry the filter before replacing it.

9. Wipe any dust or dirt from the mounting bracket.

10. Return the dry filter to its mounting bracket.

11. Place the mounting bracket into position on cabinet door and tighten the screw that holds the mounting plate over the air filter mounting bracket.

Checking Connections

NOTE: Power to the cabinet should be off while performing this preventive maintenance task.

Check all signal wiring, power and ground connections within the cabinet to verify their integrity. When checking connections, always turn a screw, nut or other fastening device in the direction to tighten only. If the connection is loose, it will be tightened. If the connection is tight, the tightening action will verify that it is secure. There must not be any motion done to loosen the connection.

1. Verify that all phase, neutral and grounding conductor connections on the power entry panel are secure.

2. Verify that all other power connections within the cabinet, including bus bars and connections to the power supplies are secure.

3. Verify that all field wiring connections to the termination units or termination modules are secure.

Checking Power Module Outputs

To check modular power supply outputs on IEPEP01 and IEPEP02 power entry panel systems, check the bus voltages on the system power bus bar. There are test jacks on the bus monitor module for checking bus voltages on IEPEP03 power entry panel systems. Appendix C contains complete modular power system wiring diagrams.

CHECKING BUS VOLTAGES ON IEPEP01 AND IEPEP02 SYSTEMS

1. Verify all power module status LEDs are green.

2. If any of the status LEDs are not green, refer to Section 5 to troubleshoot and correct the problem before proceeding.

3. Measure the bus voltages at the system power bus bar. Appendix C shows wiring diagrams of the IEPEP01 and IEPEP02 power entry panels and bus bars. This test should be done with the system loaded.

4. Use a digital voltmeter to measure +5, +15, and -15 VDC with respect to DC common.

5. Measure 24 VDC with respect to I/O common using a digital voltmeter.

6. The measured voltages should be within the specifications under module voltage requirements in Table 1-4.

7. If the module bus voltages are not within specification, verify that the system is properly sized. Refer to Appendix B for the power system sizing procedure.

CHECKING BUS VOLTAGES ON IEPEP03 SYSTEMS

1. Verify all power module status LEDs are green.

2. If any of the status LEDs are not green, refer to Section 5 to troubleshoot and correct the problem before proceeding.

3. Measure the bus voltages at the test jacks on the bus monitor module. This test should be done with the system loaded.

4. Use a digital voltmeter to measure +5, +15, and -15 VDC with respect to DC common.

5. Measure 24 VDC with respect to I/O common using a digital voltmeter.

6. The measured voltages should be within the specifications under module voltage requirements in Table 1-4.

7. If the module bus voltages are not within specification, verify that the system is properly sized. Refer to Appendix B for the power system sizing procedure.

Power Entry Panel Inspection and Check

This procedure applies to IEPEP01, IEPEP02 and IEPEP03 Power Entry Panels. The system must be shut down to perform this maintenance task.

NOTE: Removal of the power entry panel may require two people.

1. Turn off power at the external circuit breakers that feed power to the power entry panel.

2. Use the 4-inch screwdriver to disconnect all wires and cables from the rear of the power entry panel. Label the wires according to their terminal assignments.

3. Use the 16-inch flathead screwdriver to remove the 4 screws (2 on each side) that hold the power entry panel in position.

4. Remove the power entry panel by sliding it out the back of the cabinet.

5. Remove the top cover from the power entry panel by removing the 3 screws securing it at the rear of the power entry panel.

6. Check the tightness of all power wiring screws within the power entry panel. Torque all No. 6 screws to 0.90 Newton meters (8 in-lbs). Torque all No. 8 screws to 1.58 Newton meters (14 in-lbs).

7. Inspect and clean the power entry panel, AC transfer module and bus monitor module.

8. Replace the power entry panel top cover and install the power entry panel.

9. Connect all wires and cables removed from the power entry panel in Step 2.

Printed Circuit Board Cleaning

There are several circuit board cleaning procedures in this section. These procedures cover circuit board cleaning and washing, cleaning edge connectors and circuit board laminate between edge connectors. Use the procedures that meet the

needs of each circuit board. Remove all dust, dirt, oil, corrosion or any other contaminant from the circuit board.

Do all cleaning and handling of the printed circuit boards at static safe work stations. Always observe the steps in ***Special Handling*** in Section 3 when handling printed circuit boards.

GENERAL CLEANING AND WASHING

If the printed circuit board needs minor cleaning, remove dust and residue from the printed circuit board surface using clean, dry, filtered compressed air or an antistatic field service vacuum cleaner.

An alternate method of washing the printed circuit board is:

1. Clean the printed circuit board by spraying or wiping the board with isopropyl alcohol (99.5% electronic grade). Use a foam tipped swab to apply the alcohol when wiping the board.

2. When the circuit board is clean, remove excess solvent by using compressed air to blow it free of the circuit board.

EDGE CONNECTOR CLEANING

1. Use a solvent mixture of 80% isopropyl alcohol (99.5% electronic grade) and 20% distilled water.

2. Soak a lint free cloth with the solvent mixture.

3. Work the cloth back and forth parallel to the edge connector contacts.

4. Repeat with a clean cloth that is soaked with the solvent mixture.

5. Dry the edge connector contact area by wiping with a clean lint free cloth.

To clean tarnished or deeply stained edge connector contacts:

1. Use an Eberhard Faber (400A) pink pearl eraser or equivalent to remove tarnish or stains. Fiberglass or nylon burnishing brushes may also be used.

2. Minimize electrostatic discharge by using the 80/20 isopropyl alcohol/water solution during burnishing.

3. Do not use excessive force while burnishing. Use only enough force to shine the contact surface. Inspect the edge connector after cleaning to assure no loss of contact surface.

4. Wipe clean with a lint-free cloth.

CLEANING FEMALE EDGE CONNECTORS

1. Use a foam tipped swab or a lint free cloth wrapped over a piece of scrap circuit board. Soak the swab or cloth in electronic grade isopropyl alcohol.

2. Insert the swab of cloth covered circuit board into edge connector and work it back and forth to clean the contacts.

3. Rinse the edge connector contacts by spraying with isopropyl alcohol.

4. Remove excess alcohol and dry using compressed air.

SECTION 7 - REPAIR/REPLACEMENT PROCEDURES

INTRODUCTION

Although the modular power system is designed to give long, troublefree service, some components may need to be replaced periodically. This section explains the replacement procedures and lists spare part numbers.

SPARE PARTS

Table 7-1 lists a description and Bailey part number of spare parts that can be stocked. It is impractical to specify a recommended quantity of spare parts because Bailey Controls Company custom designs every system. Contact Bailey Controls Company for help determining the quantity of spare parts to keep on hand for your particular system.

Table 7-1. Spare Part Numbers and Description

Description	Part No./Nomenclature	Remarks
AC field power module	IEPAF02	Can replace an IEPAF01 module
AC power cables	6637814_2	Connects PEP to PMU or to input power bus bar
	6637818_2	Connects input power bus bar to MMU
AC system power module	IEPAS02	Can replace an IEPAS01 module
AC transfer module	6637827_1	Used in IEPEP03
Bus monitor module	6637830_1	Used in IEPEP03
Cabinet filter	199914_20	IECAB01and IECAB03
DC power cable	1948509_5	Connects MMU to system power bus bar
Fuse, 1 A	Bussman® AGC1 or equivalent 194776A11001	Fuse in IEFAN02 assembly
Fuse, 2 A	Bussman AGC2 or equivalent 194776A12001	Fuse in IEFAN01 assembly
Fuse, 3 A	Bussman GMA-3 fast acting or equivalent 1948182_23001	Fuse in IEPAS02 and IEPAF02 modules
IEFAN01 assembly (120 VAC)	1947419_1	—
IEFAN02 assembly (240 VAC)	1947419_2	—
Insulated quick connect receptacle	1948529_1	—
PFI cable	6638084_1	Connects IEPEP01/02 to system power bus bar

® Bussman is a registered trademark of McGraw Edison Company.

Table 7-1. Spare Part Numbers and Description (continued)

Description	Part No./Nomenclature	Remarks
PFI cable (cont.)	6637813_1	Connects IEPEP03 to system power bus bar
Power entry panel	IEPEP01	Single AC feed with no circuit breaker
	IEPEP02	Single AC feed with circuit breaker
	IEPEP03	Redundant AC feed with circuit breakers
Node status output cable	66334205_1	Connects IEPEP01/02/03 to INBIM02 or INPTM01

AC TRANSFER MODULE REPLACEMENT

NOTES:

1. The AC transfer module can be removed under power if line one is verified operational and within tolerance.

2. The bus monitor module goes off-line when the AC transfer module is removed. The bus monitor module ***must be*** removed ***first***. Then remove the AC transfer module.

To replace the AC transfer module:

1. Turn the 2 thumbscrews 1/2-turn to release the bus monitor module faceplate. Pull on the faceplate to slide the module out.

2. Turn the 2 thumbscrews 1/2-turn to release the AC transfer module faceplate. Pull on the faceplate to slide the module out.

3. Set switch S1 on the replacement to match the setting of the ATM module just removed.

4. Insert the replacement AC transfer module. Grasp it by the faceplate. Align the top and bottom edges of the circuit board with the guides in the panel.

5. Hold the module by the faceplate and slide it into the slot; push until the rear edges are firmly seated in the backplane connectors.

6. Reinsert the bus monitor module. Grasp it by the faceplate. Align the top and bottom edges of the circuit board with the guides in the panel.

7. Hold the module by the faceplate and slide it into the slot; push until the rear edges are firmly seated in the backplane connectors.

8. Latch both modules in place by turning the faceplate thumbscrews 1/2-turn.

BUS MONITOR MODULE REPLACEMENT

NOTE: The bus monitor module can be removed under power. Replace with another bus monitor module as soon as possible.

To replace the bus monitor module:

1. Turn the 2 thumbscrews on the module faceplate 1/2-turn in either direction to release the module. Slide the module out.

2. Set switch S1 and jumpers J1 through J8 on the replacement to match the settings of the BMM module just removed.

3. Grasp the replacement module by the faceplate.

4. Align the top and bottom edges of the circuit board with the guides in the panel.

5. Hold the module by the faceplate and slide it into the slot; push until the rear edges are firmly seated in the backplane connectors.

6. Turn the 2 thumbscrews on the module faceplate 1/2-turn to lock the module in place.

FAN ASSEMBLY

Fuse Replacement

1. Disconnect power from the fan assembly by unplugging it from J4 on the IEPEP01 or IEPEP02 power entry panel or J1 on the IEPEP03 power entry panel.

2. Remove the fuse by turning the fuse holder cap counterclockwise until it releases.

3. Use the fuse holder cap to pull the fuse from its holder.

4. Put an identically rated replacement fuse in the fuse holder cap.

5. Touching only the fuse holder cap, insert the fuse into the fuse holder and turn the fuse holder cap clockwise until secure.

6. Connect the fan assembly to power by connecting it to J4 on IEPEP01 and IEPEP02 power entry panels or J1 on IEPEP03 power entry panels.

Fan Assembly Replacement

1. Unplug the fan assembly.

2. Remove and save the 4 screws on the front of the assembly that attach it to the cabinet frame.

3. Carefully slide the assembly out of its mounting position. Be careful not to disturb other cabinet wiring.

4. Verify that the replacement assembly has the same AC power requirements as the one just removed.

5. Slide the replacement assembly into the same spot vacated by the faulty fan assembly.

6. Secure the fan assembly into its mounting position with the 4 screws removed in Step 2.

7. Plug the power cord into the connector labeled J1 on the power entry panel.

8. Listen for fan rotation to verify that the replacement assembly is operating.

POWER MODULE

Before replacing IEPAS01 or IEPAF01 power module with IEPAS02 or IEPAF02 power module read the information in Appendix E. Power modules can be removed under power. Always insert a replacement power module before removing a power module.

Power Module Replacement

1. Set the jumper settings on the replacement power module.

2. Grasp the replacement module by its faceplate handle.

3. Align the top and bottom edges of the circuit board with the guides of its slot in the power mounting unit or module mounting unit.

4. Hold the module by the faceplate handle and slide it into the slot; push until the rear edges are firmly seated in the backplane connectors.

5. Firmly press the module handle while using a flat blade screwdriver to push and turn the 2 concentric screws 1/2-turn clockwise to lock the module in place.

6. Verify the status LED turns green.

7. Use a flat blade screwdriver to turn the 2 concentric screws 1/2-turn in either direction on the power module being replaced.

WARNING	**Allow five seconds for the line filter capacitors to discharge before handling the module after removal. Failure to do so could result in severe or fatal shock.**
AVERTISSEMENT	**Après avoir retiré le modle, laissex les condensateurs de filtres antiparasites se décharger pendant cinq secondes avant de manipuler celui-ci, afin d'éviter les chocs sérieux et même mortels.**

WARNING	**Handle the module by surfaces other than the heat sink. The heat sink may be hot and may cause severe burns.**
AVERTISSEMENT	**Le module doit être manipulé à l'aide de surfaces autres que le dissipatour thermique. Ce dernier resque d'être chaud et de provoquer des brûlures sérieuses.**

8. Grasp the faceplate handle and partially pull out the module.

9. Allow at least 5 seconds for the line filter capacitors to discharge then remove it completely from power mounting unit or module mounting unit.

Power Module Fuse Replacement

Do the steps in ***Power Module Replacement*** in this section to remove the power module from its mounting unit. To replace the power module fuse:

1. Lay the module on an antistatic mat.

2. Locate fuse F1 at the rear of the module by the P1 edge connector (see Figure 3-6).

3. Use a fuse removal tool to extract fuse F1.

4. Insert a new 3 A slow blow fuse.

5. To install the power module after changing its fuse, repeat the steps in ***Power Module Replacement*** in this section.

POWER ENTRY PANEL REPLACEMENT

WARNING	**Verify the main power and power entry panel circuit breakers are turned off before starting installation, retrofit, upgrade, or wiring procedures. Failure to do so could result in severe or fatal shock. Do not turn the power on until the installation, retrofit, upgrade, or wiring procedures are complete.**
AVERTISSEMENT	**Assurez-vous que le disjoncteur d'alimentation principal et le disjoncteur de panneau d'entrée des alimentations sont éteints avant de procéder à l'installation, à la mise à jour, à l'extension ou au câblage, dans le but d'éviter les chocs sérieux et même mortels. Ne rétablissez pas l'alimentation tant que ces procédures ne sont pas terminées.**

1. Turn off power to the cabinet at the AC power source.

2. Open the rear door of the cabinet to gain access to the rear of the power entry panel.

3. Remove all wiring from the power entry panel. Label the wires as you remove them.

4. From the rear of the cabinet, use a 16-inch bladed screwdriver to remove the 4 mounting screws.

5. Pull the power entry panel out of the cabinet.

6. From the rear of the cabinet, insert the replacement power entry panel in the same mounting space.

7. Secure the power entry panel to the cabinet with the 4 mounting screws.

8. With power entry panel circuit breakers off, connect the wiring that was removed in Step 3. Appendix C contains power entry panel wiring diagrams.

9. If it is an IEPEP01 or IEPEP02 panel, check the 120/240 VAC switch to verify that it is set for the correct line voltage.

10. If it is an IEPEP03 panel, set the jumpers and dipswitches on the bus monitor module for the desired operation. Verify that the switch on the AC transfer module is set for the correct line voltage.

11. Turn on the power to the power entry panel at the AC source.

12. Turn on the power to the cabinet at the power entry panel circuit breakers and check for proper operation.

SECTION 8 - SUPPORT SERVICES

INTRODUCTION

Bailey Controls Company is ready to help in the use and repair of its products. Contact your nearest sales office to make requests for sales, applications, installation, repair, overhaul and maintenance contract services.

REPLACEMENT PARTS AND ORDERING INFORMATION

When making repairs at your facility, order replacement parts from a Bailey sales office. Provide this information:

1. Part description, part number and quantity.

2. Model and serial numbers (if applicable).

3. Bailey Controls Company instruction manual number, page number and reference figure that identifies the part.

When ordering standard parts, use Bailey Controls Company part numbers and descriptions. Order parts without commercial descriptions from the nearest Bailey Controls Company sales office.

TRAINING

Bailey Controls Company has a modern training facility available for training your personnel. On-site training is also available. Contact a Bailey Controls Company sales office for specific information and scheduling.

TECHNICAL DOCUMENTATION

Additional copies of this manual, or other Bailey Controls Company manuals, can be obtained from the nearest Bailey Controls Company sales office at a reasonable charge.

APPENDIX A - QUICK REFERENCE GUIDE

INTRODUCTION

Use Table A-1 as a quick reference to check jumper and switch settings for the IEPAS02 and IEPAF02 Power Modules, bus monitor module and AC transfer module.

Table A-1. Switch and Jumper Setting Reference Guide

Device	Switch Position	Jumper Position	Function
AC transfer module	S1 - 120		120 VAC operation
	S1 - 240		240 VAC operation
Bus monitor module	S1 = 0011		Factory default setting, 5, ±15, 24 VDC monitoring enabled. External monitoring disabled.
		J1	**Auxiliary bus monitor, channel 1:**
		1-2	Selects 24 VDC external power
		2-4	Selects 48 VDC external power
		2-3	Selects 125 VDC external power
		J2	**Auxiliary bus monitor, channel 2:**
		1-2	Selects 24 VDC external power
		2-4	Selects 48 VDC external power
		2-3	Selects 125 VDC external power
		J3	**AC input voltage, line 2:**
		1-2	Selects 120 VAC input
		2-3	Selects 240 VAC input
		J4	**Auxiliary status input 1:**
		1-2	Normally open status input
		2-3	Normally closed status input
		3-4	Not used
		J5	**Auxiliary status input 2:**
		1-2	Normally open status input
		2-3	Normally closed status input
		J6	
		1-2	Must be set as shown
		J7	**AC input voltage, line 1:**
		1-2	Selects 120 VAC input
		2-3	Selects 240 VAC input
		J8	
		2-3	Must be set as shown

Table A-1. Switch and Jumper Setting Reference Guide (continued)

Device	Switch Position	Jumper Position	Function
IEPAS02 Power Module		**J1**	**AC input voltage:**
		1-2	120 VAC
		2-3	240 VAC
		J2	
		1-2	Enable 24 VDC undercurrent monitoring
		2-3	Disable 24 VDC undercurrent monitoring
		J3	
		1-2	Enable 5 VDC undercurrent monitoring
		2-3	Disable 5 VDC undercurrent monitoring
IEPAF02 Power Module		**J1**	**AC input voltage:**
		1-2	120 VAC
		2-3	240 VAC
		J2	
		1-2	Enable 24 VDC undercurrent monitoring
		2-3	Disable 24 VDC undercurrent monitoring

APPENDIX B - MODULE POWER REQUIREMENTS

INTRODUCTION

This section lists the power requirements of INFI 90 modules, termination units and termination modules. Use this information to calculate the +5, +15, -15 and +24 VDC module current requirements for each INFI 90 cabinet. The procedure for calculating current requirements includes a worksheet for calculating any current requirements for system powered I/O.

After calculating the current requirements for each cabinet, calculate the number of modular power supplies needed for each cabinet by following the instructions in ***SIZING THE MODULAR POWER SYSTEM*** in this section. Finally, follow the procedure to verify that the total current draw of the power cabinet is within the power entry panel specifications.

CALCULATING CURRENT REQUIREMENTS

Tables B-1 and B-2 contain a list of all INFI 90 modules, termination units and termination modules, and their operating current requirements. Use Table B-3 to calculate system powered I/O current requirements. To use the information in these tables:

> **NOTE:** Current consumption values listed in the tables apply to one module. Multiply the value of current consumption per module by the number of those modules in the cabinet. For example, if a cabinet contains four IMASI02 modules, the total +5 VDC current consumption of these modules is 4 x 85 mA = 340 mA.

1. Make a list of modules contained in the cabinet you are sizing for modular power supplies.

2. Calculate the +5 VDC current requirement for each cabinet.

   a. Refer to Table B-1 for the +5 VDC current requirement of each module.

   b. Total the +5 VDC current requirement per cabinet.

3. Calculate the +15 VDC current requirement for each cabinet.

   a. Refer to Table B-1 for the +15 VDC current requirement of each module.

   b. Total the +15 VDC current requirement per cabinet.

4. Calculate the -15 VDC current requirement for each cabinet.

   a. Refer to Table B-1 for the -15 VDC current requirement of each module.

   b. Total the -15 VDC current requirement per cabinet.

5. Calculate the +24 VDC current requirement.

   a. Refer to Table B-1 for the +24 VDC current requirement for each module.

   b. Table B-2 lists +24 VDC current requirements of termination units and termination modules.

   c. Total the +24 VDC current requirement per cabinet.

6. Add the current requirement of any system powered I/O using +24 VDC to the total from Step 5c. Table B-3 gives an overview of how to calculate the system powered I/O current requirement.

Table B-1. DC Current Consumption for INFI 90 Modules

INFI 90 Modules	No. of Modules/ Cabinet	Current Consumption Per Module (mA)							
		5 V	Total 5 V	+15 V	Total +15 V	-15 V	Total -15 V	24 V	Total 24 V
IISAC01		0		0		0		530	
IMAMM03		725		125		30		0	
IMAOM01		1045		0		0		0	
IMASI02		95		30		25		0	
IMASI03		330		140		40		0	
IMASM01		120		85		45		0	
IMASM02 IMASM03		400		80		40		6	
IMASM04		550		45		30		0	
IMASO01		530		220		225		50	
IMCIS02		300		30		25		7	
IMCOM03 IMCOM04		660		55		50		7	
IMCPM01		0		0		0		0	
IMCPM02		825		0		0		0	
IMDSI02		60		0		0		0	
IMDSM04		1500		0		0		65	
IMDSM05		600		0		0		0	
Total for page									

Table B-1. DC Current Consumption for INFI 90 Modules (continued)

INFI 90 Modules	No. of Modules/ Cabinet	Current Consumption Per Module (mA)							
		5 V	Total 5 V	+15 V	Total +15 V	-15 V	Total -15 V	24 V	Total 24 V
IMDSO01 IMDSO02 IMDSO03		150		0		0		0	
IMDSO04		165		0		0		0	
IMFBS01		100		30		20		0	
IMFCS01		220		7		10		0	
IMHSS01 IMHSS02		180		80		70		20	
IMLMM02		660		0		0		0	
IMMFC03		4200		40		20		0	
IMMFC04		1400		0		0		0	
IMMFC05		1000		0		0		0	
IMMFP01 IMMFP02		2000		0		0		0	
IMMFP03		2000		0		0		0	
IMMPC01		4200		40		20		0	
IMMPI01		415		0		0		0	
IMMPI02		700		0		0		0	
IMQRC01		660		55		50		7	
IMQRS01 IMQRS02		300		30		25		7	
IMRIO02		1600		20		90		0	
IMSPM01		1330		30		25		0	
INBIM01 INBIM02 INBTM01		1100		0		0		0	
INICT01		4200		40		20		0	
INICT03		1958		0		0		0	
INIIT01		4200		40		20		0	
INIIT02 INIIT03		2000		0		0		0	
INIPT01		4200		40		20		0	
INLIM03		2200		90		90		0	
INNIS01		900		5		200		0	
INNPM01		2000		0		0		0	
INPCT01 INPPT01		4200		40		20		0	
INPTM01		1100		0		0		0	
Total for page									

Table B-1. DC Current Consumption for INFI 90 Modules (continued)

INFI 90 Modules	No. of Modules/ Cabinet	Current Consumption Per Module (mA)							
		5 V	Total 5 V	+15 V	Total +15 V	-15 V	Total -15 V	24 V	Total 24 V
INSIM01		1500		30		25		0	
NCTM01		1500		0		0		0	
NDCS03		0		0		0		510	
NDIS01		0		0		0		360	
NDLS02		0		0		0		320	
NLIS01		900		5		200		0	
NLSM01 NLSM02		4200		40		20		0	
NMFC01 NMFC02		4600		40		20			
NSBM01		1000		0		0		0	
NSSM01		4200		0		0		0	
Total for page									
Cabinet total									

Table B-2. 24 VDC Current Consumption of Termination Units and Termination Modules

Termination Unit/Module	TU/TMs Using System Power per Cabinet	24 VDC Current Consumption per TU/TM (mA)	24 VDC TU/TM Current Consumption per Cabinet
NTCL01 NICL01		40	
NTDO02		90	
NTFB01		65	
NTMF01 NIMF01 NIMF02		130	
NTMP01 NIMP01 NIMP02		230	
NTRL03 NIRL01 NIRL02 NIRL03		130	
NTRL02		190	
Total			

The total current requirements of system powered analog inputs, analog outputs, digital inputs, digital outputs, and thermocouple inputs make up the system powered I/O current requirements. Fill in column two of Table B-3, then multiply it by column three (quantity of inputs or outputs times the current per input or output). For digital outputs, specify the current requirements for the digital outputs in your system. Complete the calculation to determine the current requirements by filling in all five rows as necessary then totaling the current requirements in column four.

Table B-3. System Powered I/O Current Consumption

Type of Input/Output	No. of Inputs/Ouputs	Current Consumption per Input/Output (mA)	Total Current Consumption for System Power I/O
Analog outputs		20	
Analog inputs		20	
TC inputs		20	
Digital inputs		5	
Digital outputs		NOTE 1	
Total I/O current consumption			

NOTE:
1. Use the typical current requirements of your particular digital outputs.

SIZING THE MODULAR POWER SYSTEM

The following text and equations explain how to calculate the number of IEPAS02 and IEPAF02 power supply modules needed for a particular system.

Cabinet requirements for 5 VDC, +15 VDC, -15 VDC and 24VDC power are calculated by adding the individual module current requirements. Refer to ***CALCULATING CURRENT REQUIREMENTS*** in this section to determine the current requirements of your system. Refer to product specifications for current requirements of new modules not listed.

Sizing Systems with IEPAS02 Modules Only

A Total 5 VDC current requirements for system cabinet.

B Total 24 VDC current requirements for associated I/O.

C Total +15 VDC current requirements for system cabinet.

D Total -15 VDC current requirements for system cabinet.

Q1 Number of IEPAS02 power modules needed to meet 5 VDC current requirements.

Q2 Number of IEPAS02 power modules needed to meet 24 VDC current requirements.

Q3 Number of IEPAS02 power modules needed to meet +15 VDC current requirements.

Q4 Number of IEPAS02 power modules needed to meet -15 VDC current requirements.

Q5 Total power needed.

QS Total number of IEPAS02 power modules needed to power the system.

Then solve the following equations:

$$Q1 = \frac{A}{13}$$

$$Q2 = \frac{B}{4}$$

$$Q3 = \frac{C}{0.8}$$

$$Q4 = \frac{D}{0.8}$$

$$Q5 = \frac{\langle A \times 5.225 \rangle + \langle B \times 25.8 \rangle + \langle C \times 15.3 \rangle + \langle D + 15.3 \rangle}{130}$$

QS = Largest of Q1, Q2, Q3, Q4 and Q5.

Round the value of QS to the next highest integer. This number represents the number of IEPAS02 power modules needed to satisfy system requirements. If using N+1 redundancy, add 1 to the value of QS.

System Calculation Example Using IEPAS02 Modules Only

Assume that the current requirements for a set of modules residing in a system cabinet has been calculated.

Additionally, the current requirements for 24 VDC I/O power was calculated. The results are:

A = 26.5 A (5 VDC current requirement)

B = 3.1 A (24 VDC and associated I/O current)

C = 0.9 A (+15 VDC current requirement)

D = 0.4 A (-15 VDC current requirement)

Substitute these values into the equations and solve for Q.

$$Q1 = \frac{26.5}{13} = 2.038$$

$$Q2 = \frac{3.1}{4} = 0.775$$

$$Q3 = \frac{0.9}{0.8} = 1.125$$

$$Q4 = \frac{0.4}{0.8} = 0.5$$

$$Q5 = \frac{\langle 26.5 \times 5.225 \rangle + \langle 3.1 \times 25.8 \rangle + \langle 0.9 \times 15.3 \rangle + \langle 0.4 + 15.3 \rangle}{130}$$

$$= \frac{\langle 138.46 + 79.98 + 13.77 + 6.12 \rangle}{130} = 1.833$$

QS = Largest of Q1, Q2, Q3, Q4 and Q5 = 2.038

Number of power modules required for system.

QS = 2.038

Round the value of QS to the next highest integer.

QS = 3 IEPAS02 modules

With N+1 redundancy where N = QS.

$QS_{(N+1)}$ = 3 + 1 = 4 IEPAS02 modules

For Systems Using Both IEPAS02 and IEPAF02 Modules

Let:

A Total 5 VDC current requirements for system cabinet.

B Total 24 VDC current requirements for associated I/O.

C Total +15 VDC current requirements for system cabinet.

D Total -15 VDC current requirements for system cabinet.

Q1 Number of IEPAS02 power modules needed to meet 5 V current requirements.

Q2 Number of IEPAS02 power modules needed to meet 24 V current requirements.

Q3 Number of IEPAS02 power modules needed to meet +15 V current requirements.

Q4 Number of IEPAS02 power modules needed to meet -15 V current requirements.

Q5 Total power needed.

PS Total 5, +15, and -15 V power requirements.

PF Total 24 V power requirement.

QS Total number of IEPAS02 power modules needed to power the system.

QF Total number of IEPAF02 power modules needed to power associated I/O.

Then solve the following equations:

$$Q1 = \frac{A}{13}$$

$$Q2 = \frac{B}{4}$$

$$Q3 = \frac{C}{0.8}$$

$$Q4 = \frac{D}{0.8}$$

$$Q5 = \frac{\langle A \times 5.225 \rangle + \langle B \times 25.8 \rangle + \langle C \times 15.3 \rangle + \langle D + 15.3 \rangle}{130}$$

QN = Largest of Q1, Q2, Q3, Q4 and Q5.

Round up the value of QN to the next highest integer.

$$PS = (A \times 5.225) + (C \times 15.3) + (D \times 15.3)$$

$$PF = B \times 25.8$$

$$Q6 = 130 - \frac{PF}{QN}$$ (if Q6 > 92 then set Q6 = 92)

$$Q7 = \frac{PS}{Q6}$$

QS = Largest of Q1, Q3, Q4 and Q7.

Round the value of QS to the next highest integer. This number represents the number of IEPAS02 power modules needed to satisfy system requirements.

QF = QN - QS

QF represents the number of IEPAF02 power modules needed to satisfy associated I/O requirements. If using N+1 redun-

dancy, add 1 to the value of QS. The IEPAS02 can supply all the system voltages.

System Calculation Example Using IEPAS02 and IEPAF02 Modules

Assume that the current requirements for a set of modules residing in a system cabinet has been calculated.

Additionally, the current requirement for 24 VDC I/O power was calculated. The results are:

A = 26.5 A (5 VDC current requirement)

B = 16 A (24 VDC and associated I/O current requirement)

C = 0.9 A (+15 VDC current requirement)

D = 0.4 A (-15 VDC current requirement)

Substitute these values into the equation and solve for Q.

$$Q1 = \frac{26.5}{13} = 2.038$$

$$Q2 = \frac{16}{4} = 4$$

$$Q3 = \frac{0.9}{0.8} = 1.125$$

$$Q4 = \frac{0.4}{0.8} = 0.5$$

$$Q5 = \frac{\langle 26.5 \times 5.225 \rangle + \langle 16 \times 25.8 \rangle + \langle 0.9 \times 15.3 \rangle + \langle 0.4 + 15.3 \rangle}{130} = 4.39$$

QN = Largest of Q1, Q2, Q3, Q4 and Q5 = 4.39

Round QN up to the next highest integer.

QN = 5

PS = (*A* × 5.225) + (*C* × 15.3) + (*D* × 15.3)

= (26.5 × 5.225) + (0.9 × 15.3) + (0.4 × 15.3) = 158.35

PF = *B* × 25.8 = (16 × 25.8) = 412.8

$$Q6 = 130 - \frac{PF}{QN} = 130 - \frac{412.8}{5}$$ (if Q6 > 92 then set Q6 = 92) = 47.44

$$Q7 = \frac{PS}{Q6} = \frac{158.35}{47.44} = 3.33$$

QS = Largest of Q1, Q3, Q4 and Q7 = 3.33

Round the value of QS to the next highest integer. This number represents the number of IEPAS02 power modules needed to satisfy system requirements.

$QS = 4$

$QF = QN - QS = 5 - 4 = 1$ IEPAF02 module

Number of IEPAS02 power modules required for the system.

$QS = 4$ IEPAS02 modules

With N+1 redundancy where N = QS.

$QS_{(N+1)} = N + 1 = 5$ IEPAS02 modules

MAXIMUM POWER ENTRY PANEL CURRENT DRAW

Use the value of Q5 × 30 (total power from the modular power system sizing procedure) to determine if your system is within specification of the power entry panel. The following equations show how to determine the current draw on the power entry panel.

$\frac{Q5 \times 130}{47.25}$ for 120 VAC systems.

$\frac{Q5 \times 130}{94.5}$ for 240 VAC systems.

The resulting quotient is the maximum current draw on the power entry panel. The specified current limits on the power entry panel are:

- 20 amps for 120 VAC systems.
- 10 amps for 240 VAC systems.

APPENDIX C - WIRING DIAGRAMS

INTRODUCTION

Appendix C contains system cabinet wiring diagrams for the module mounting unit and power mounting unit. Figure C-1 shows how to wire the IEPEP03 Power Entry Panel to module mounting units. Figure C-2 shows how to wire the IEPEP03 Power Entry Panel to power mounting units. Figures C-3 and C-4 show how to wire the IEPEP01 and IEPEP02 Power Entry Panels to module mounting units and power mounting units respectively.

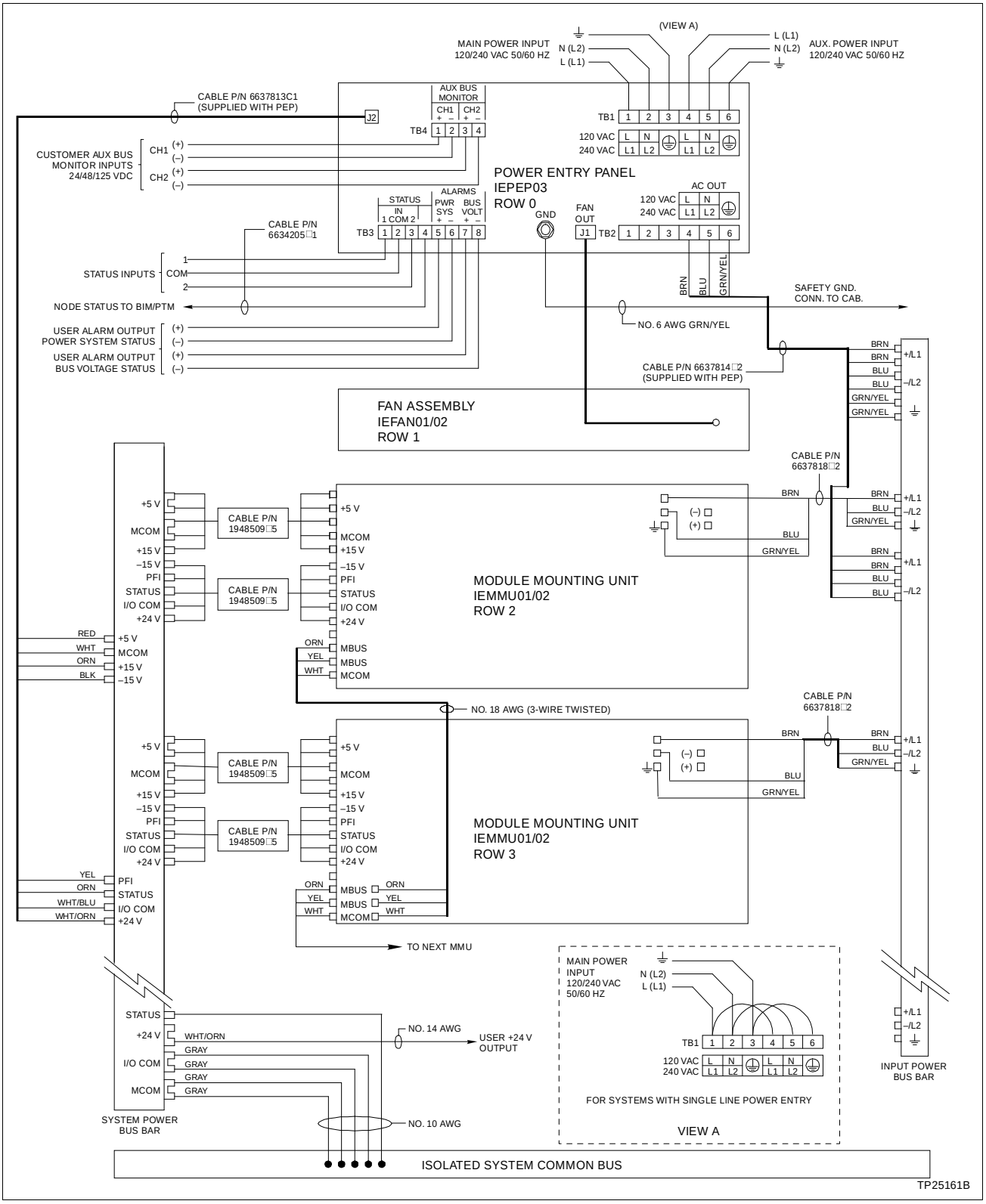

Figure C-1. IEPEP03 Power Entry Panel and Module Mounting Unit Wiring Diagram

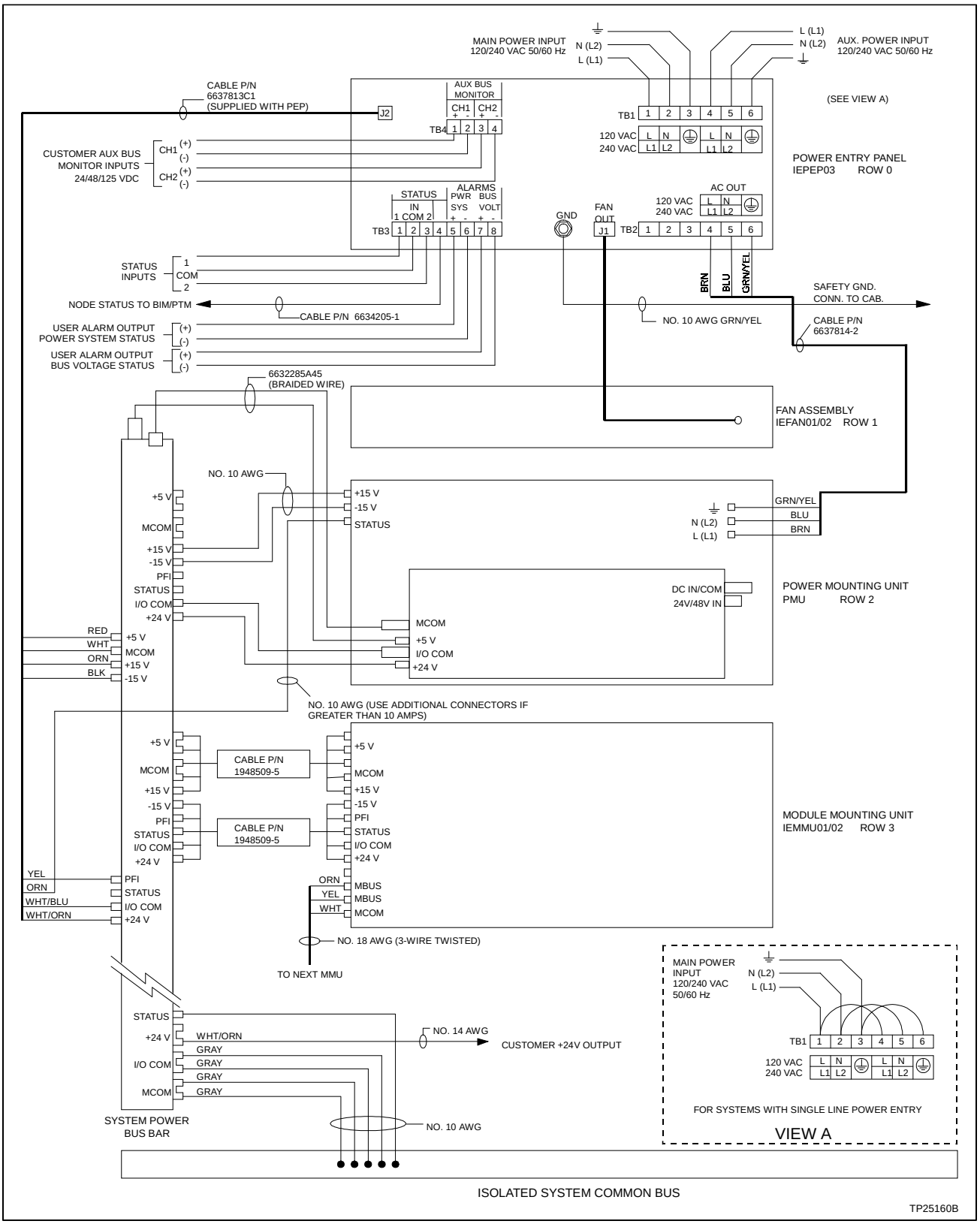

Figure C-2. IEPEP03 Power Entry Panel and Power Mounting Unit Wiring Diagram

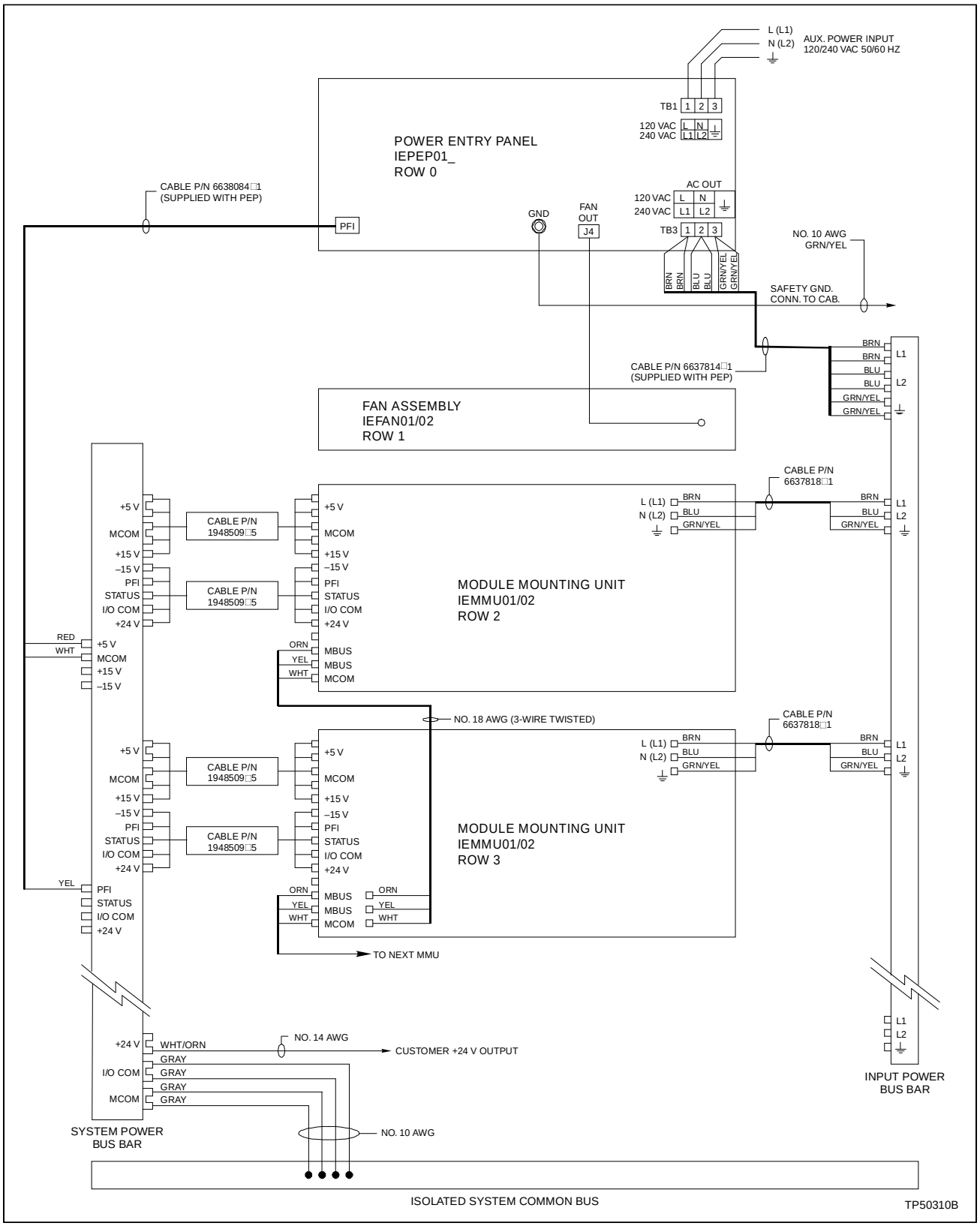

Figure C-3. IEPEP01/IEPEP02 Power Entry Panel and Module Mounting Unit Wiring Diagram

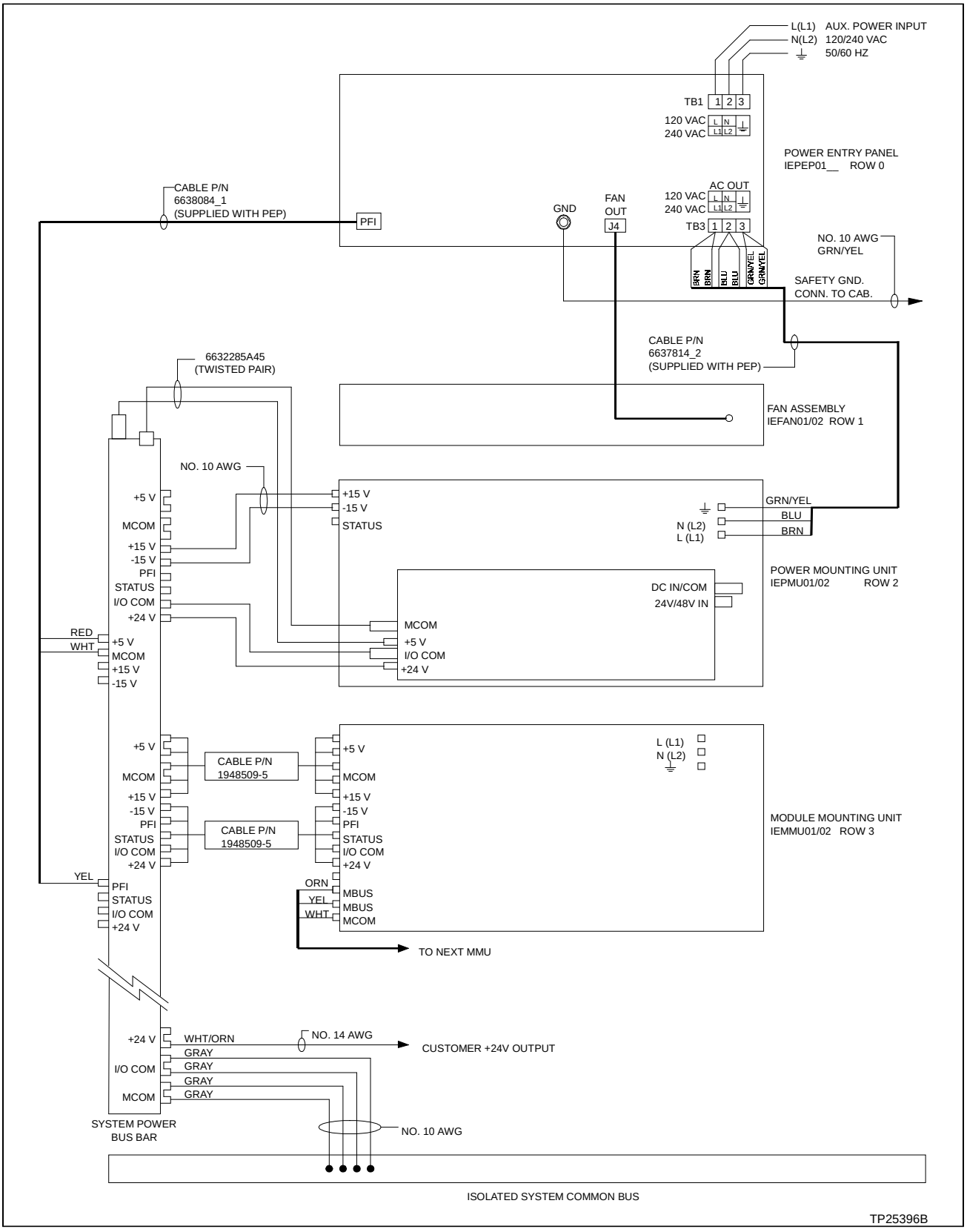

Figure C-4. IEPEP01/IEPEP02 Power Entry Panel and Power Mounting Unit Wiring Diagram

APPENDIX D - RETROFITTING THE MODULAR POWER SYSTEM

INTRODUCTION

WARNING	**Verify the main power and power entry panel circuit breakers are turned off before starting installation, retrofit, upgrade, or wiring procedures. Failure to do so could result in severe or fatal shock. Do not turn the power on until the installation, retrofit, upgrade, or wiring procedures are complete.**
AVERTISSEMENT	**Assurez-vous que le disjoncteur d'alimentation principal et le disjoncteur de panneau d'entrée des alimentations sont éteints avant de procéder, à la mise à jour, à l'extension ou au câblage, dans le but d'éviter les chocs sérieux et même mortels. Ne rétablissez pas l'alimentation tant que ces procédures ne sont pas terminées.**

Network 90 systems can be retrofitted with the INFI 90 AC Modular Power System. This appendix addresses only one of several possible power system and cabinet combinations. It describes the retrofitting procedures for one specific configuration that requires +5, ±15 and +24 VDC for system and I/O power. If these procedures do not match your particular configuration, please call your Bailey Controls Company sales engineer.

Regardless of your present configuration, you must have the following hardware in addition to the IEPMU01 or IEPMU02 power mounting unit to retrofit your system:

1. IEPEP01, IEPEP02 or IEPEP03 power entry panel.

2. IEFAN01 or IEFAN02 fan assembly.

3. IEFAS01 fastener kit (mounting hardware).

4. Rectangular spacer (if required). Consult with your Bailey representative to custom make the spacer.

NOTES:

1. Bailey suggests that 2 people do the removal and retrofitting tasks.

2. When removing Network 90 power supply hardware, save all screws. You can use these screws to install the INFI 90 modular power system hardware. If you require more hardware, get it from the IEFAS01 mounting hardware kit.

3. Label all wires and cables while disconnecting them from the system.

4. The complete procedure from removing the old system to powering up the new system should take approximately 3 hours.

NETWORK 90 POWER SYSTEM REMOVAL

Required Tools

The following tools are needed for the retrofitting procedure:

- 16-inch blade screwdriver.
- 1/2-inch nut driver.
- Pliers.
- Volt/ohmmeter.
- Heat gun.

Power Entry Panel Removal

1. Turn the main power feed to the cabinet and circuit breakers off.

2. Use a voltmeter to test TB5. Verify that no power is present.

3. Disconnect the wiring from TB5 (AC IN).

4. Disconnect the AC wiring from TB2, TB3 and TB4.

5. Disconnect the chassis ground wire from the power entry panel, but leave it attached to the cabinet and label it. It will be used with the new power entry panel (PEP).

6. Disconnect the 2 monitor connectors from J1 and J2.

7. Disconnect status and cascade connections from TB1 and label them.

> **NOTE:** When removing status and cascade connections, identify them with colored tape or labels. This will help in connecting them to the new PEP panel.

8. Remove the 4 screws securing the PEP panel to the mounting rails.

9. Remove the 2 screws that attach the front of the PEP panel to the support bracket.

10. Remove the plastic nipples (if present) on both sides of the PEP mounting brackets.

11. Push the power entry panel from the front while another person pulls from behind.

I/O Power Panel Removal

NOTE: If you are removing the I/O power panel by yourself, remove the individual power supplies from the panel first.

1. Disconnect E1 and E2 wires. Remove E2 connection.

2. Disconnect I/O monitor connector from J1.

3. Disconnect 24 VDC and common wiring from TB1, TB2 and TB3. Remove wiring from TB1. Mark wires removed from TB2 and TB3.

4. Disconnect and remove AC wiring from TB5.

5. Disconnect cascade and alarm wiring from TB4. Remove wiring from TB4-2, TB4-3 and TB4-4.

6. Disconnect and remove all wiring from NPSI03 and NPSI04 power supplies.

7. Remove the 4 screws securing the I/O power panel to the mounting rails.

8. Pull the I/O power panel out.

Module Power Panel Removal

1. Disconnect and remove heavy strap cables from 5 V and COMM (E1 through E4) for both power supplies.

2. Disconnect DC wiring from TB1, TB2, TB3, TB4 and TB5. Remove wiring from TB2. Label wires disconnected from TB4 and TB5.

3. Disconnect and remove sense (J1, J2) and module monitor out (J3) connectors.

4. Disconnect connections from J4 and J5 and label the cables.

5. Disconnect connections E5 and E6. Disconnect and remove power wiring from supplies.

6. Remove the 4 screws securing each module power supply. Remove power supply.

7. Remove the 4 screws securing the module power panel to the mounting rails.

8. Pull the module power panel out.

Fan Assembly Removal

1. Disconnect and remove AC wiring from TB1.

2. Disconnect and remove fan status wiring from TB2.

3. Remove the 4 screws securing the fan assembly to the mounting rails.

4. Pull the fan assembly out.

NOTE: You will be able to use the +24 VDC wiring and the I/O common cable from the Network 90 installation. Remove the other wiring by cutting the tie wraps that secure it to the sides of the cabinet.

Installing the INFI 90 Power System

Install the INFI 90 power system hardware from the bottom up as explained in Steps 1 through 11.

NOTE: Before mounting the hardware, determine where the speed nuts will go. Use a pair of pliers to crimp them onto the mounting rails. All hardware requires 4 screws (2 screws in front, 2 screws in back).

1. Install the row 4 spacer (if required) directly above the first MMU in your cabinet.

2. Install the power mounting unit (PMU) above the spacer installed in Step 1.

3. If a terminal block is present at the top of the cabinet, do the appropriate wiring.

4. Shape the heavy 0 AWG (MCOM and +5 V) strap cables (part number 6632285_45) in a **[** fashion.

5. Attach one end of each cable to its respective cabinet bus bar first so as not to stress the PMU bus (see Figures D-1 and D-2).

6. Attach the other ends to the MCOM and +5 VDC bus bars of the power mounting unit.

7. Slide heat shrink tubing over PMU connection (see Figure 3-8).

8. Insure that connections are properly covered, then use a heat gun to shrink the tubing into place.

9. Install the fan assembly directly above the PMU.

10. Install the power entry panel directly above the fan assembly.

11. Install row 0 spacer.

Wiring the INFI 90 Power System

NOTE: Before wiring the system, verify the AC transfer module and bus monitor module switch and jumper settings are correct. Refer to Section 3 for switch and jumper setting information; see Figures D-1 and D-2 for wiring diagrams of the INFI 90 modular power system in a Network 90 cabinet.

1. Attach one end of the 6 AWG wire assembly to PMU I/O COM. Attach the other end to the isolated system common bus.

2. Connect the +24 VDC, originally from TB2 and TB3 of the I/O power panel, to the +24 VDC bus bar on the PMU back-plane by stacking all wires onto a 6 AWG lug (or connect each wire [6 total] separately).

3. Slide heat shrink tubing over the PMU connection (see Figure 3-9).

4. Wire the auxiliary status input to TB3 (IEPEP03 panel only). Refer to the IEPEP03 installation procedure in Section 3 for more details.

5. Attach the AC cable (part number 6637814_2) from TB2 on the IEPEP03 panel or TB3 on the IEPEP01 and IEPEP02 panels to the AC terminal block on the PMU backplane.

6. Attach the J2 molex connector (part number 6637813_1) to the J2 socket on the IEPEP03 panel. Attach part number 6638084_1 to PFI on the IEPEP01 or IEPEP02 panel.

7. Attach the other ends of the J2 connector (or PFI) as shown in the wiring diagrams (see Figures D-1 and D-2).

8. Connect the status signal wires removed in Step 7 of ***Power Entry Panel Removal*** in this section to TB3-4. Wire COM on TB3-2 to the isolated system common bus bar (IEPEP03 panel only).

9. Attach any auxiliary bus monitor (24, 48, 125 VDC) input wires to TB4 (IEPEP03 panel only).

10. Attach fan cable to J4 on IEPEP01 and IEPEP02 panels, or J1 on IEPEP03 panel.

11. Connect the cabinet ground wire to the ground stud on the PEP panel.

12. Connect the source wiring to TB1.

13. Use an ohmmeter to verify continuity between TB2 (or TB3) on the power entry panel and the AC terminal connections on the PMU backplane.

14. Verify the circuit breakers on the PEP panel are in the ***off*** position.

15. Unplug all process and I/O modules from the MMU backplane.

> **NOTE:** If your MMU has any unused slots, place the cap (part number 6638748_1) on the backplane by snapping in the top then the bottom. Install a blank faceplate (part number 6636586_1) in any unused PMU slots.

16. Determine the number of IEPAS02 and IEPAF02 modules the cabinet will require by following the sizing procedures in Appendix E.

17. Verify that switch and jumper settings on the power supply modules are correct. Refer to Section 3 for settings.

18. Refer to ***RECOMMENDED START-UP PROCEDURES*** in Section 4 and follow the procedure for applying power to the system.

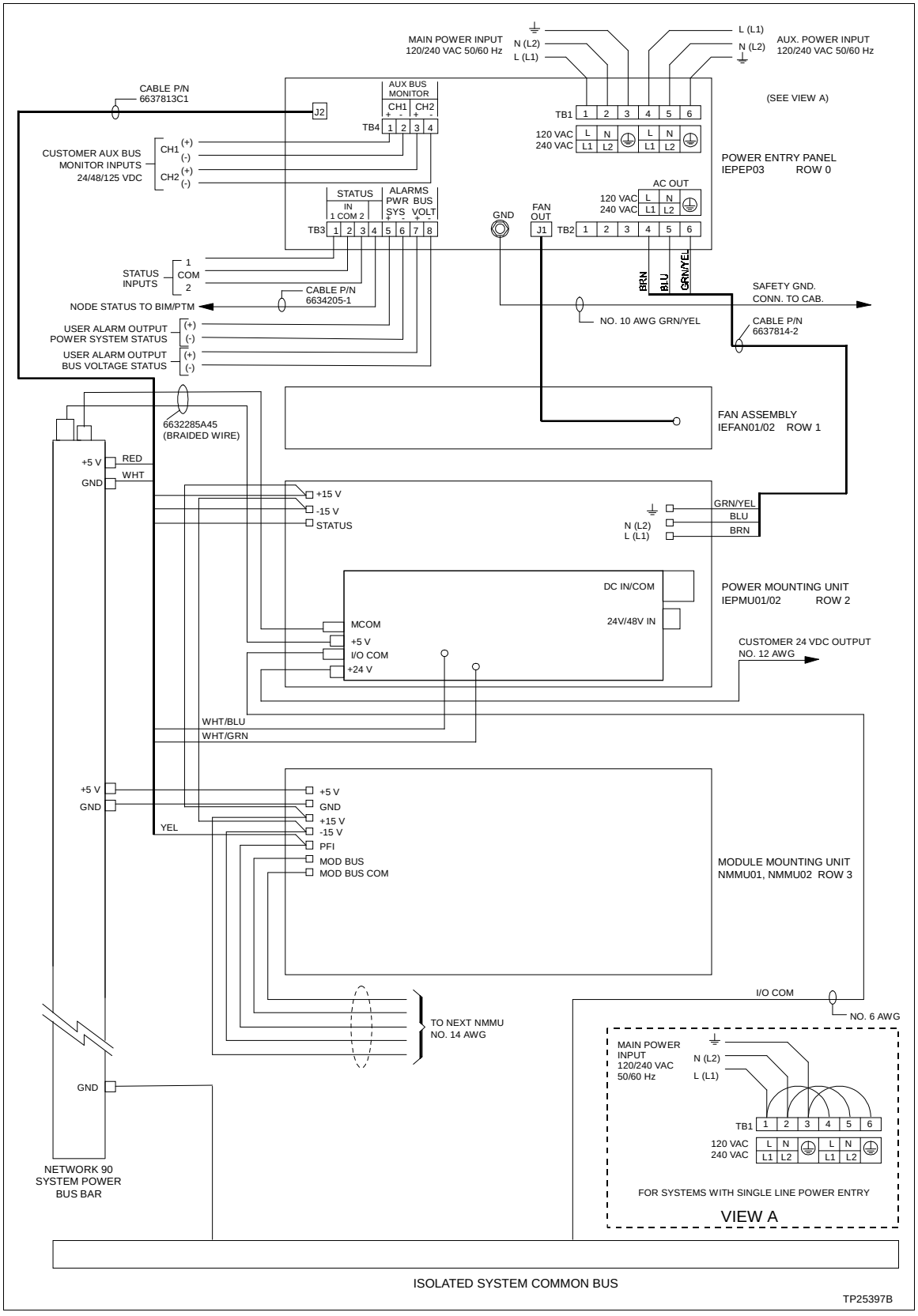

Figure D-1. Wiring Diagram of IEPEP03 Power Entry Panel and Power Mounting Unit, Network 90 Cabinet

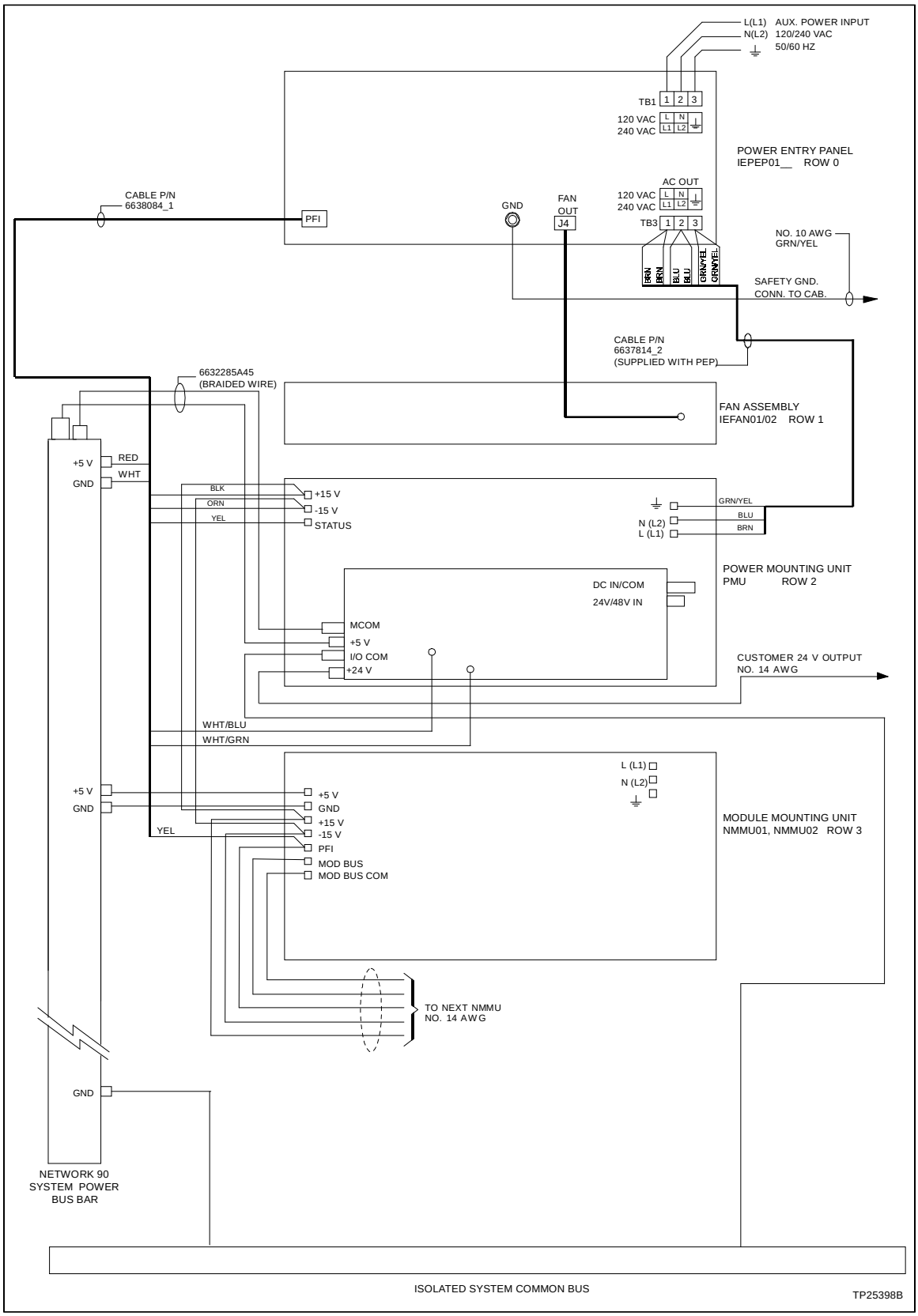

Figure D-2. Wiring Diagram of IEPEP01 and IEPEP02 Power Entry Panel and Power Mounting Unit, Network 90 Cabinet

APPENDIX E - IEPAS01/IEPAF01 POWER MODULE REPLACEMENT

INTRODUCTION

The IEPAS02 and IEPAF02 power modules are compatible replacements for the IEPAS01 and IEPAF01 power modules respectively. The IEPAS02 and IEPAF02 modules have design enhancements and features that are not available in the previous power modules. The information in this appendix pertains to replacing IEPAS01 and IEPAF01 power modules with IEPAS02 and IEPAF02 power modules.

REPLACING POWER MODULES

The IEPAS02 module can directly replace the IEPAS01 power module in all applications. Because the IEPAS02 can supply more power, there is no power deficiency when replacing an IEPAS01 module with an IEPAS02 module.

The IEPAF02 module can directly replace the IEPAF01 module in all applications. The power output of these modules is equal.

POWER SYSTEM SIZING

The IEPAS02 power module can deliver more power than the IEPAS01 module. Refer to Table E-1 to compare total power and current outputs of each module. Because of the difference in load capability, systems using both IEPAS01 and IEPAS02 modules must use the power system sizing procedures for IEPAS01 modules (i.e., based on 102 watts output per power module).

Table E-1. IEPAS01/IEPAS02 Modules Power and Current Outputs

Module	Maximum Power (W)	Maximum Current Outputs (A)		
		5 VDC	±15 VDC	24 VDC
IEPAS01	102	10	0.5	4.0
IEPAS02	130	13	0.8	4.0

NOTE: The power output capabilities of the IEPAF01 power module and the IEPAF02 power modules are equal.

LOAD SHARING

All power modules share the same load buses. The load sharing scheme relies on power module voltage outputs being equal. Equal load sharing on a particular bus depends upon the power module voltage outputs being equal. A power module with a higher voltage output will tend to supply more of the load on a particular bus than its lower voltage output counterparts.

The IEPAS01 module output voltages are factory adjusted at full load conditions. These output voltages can show minor changes because of loading, temperature, component aging, and environment. The IEPAS02 power module does not require factory calibration, and will automatically adjust its outputs to compensate for changes that affect the output voltages. The IEPAS01 module outputs tend to output a higher voltage than the IEPAS02 modules in systems with a light load. Therefore, the remaining IEPAS01 modules will share more of the load as IEPAS02 modules replace them. The IEPAF01 power module and IEPAF02 power module exhibit these same characteristics.

SYSTEM EFFECTS ON MODULE LEDS

Replacing an IEPAS01 or IEPAF01 power module with an IEPAS02 or IEPAF02 power module should have no effect on system operation. Nevertheless, in some cases replacing an IEPAS01 or IEPAF01 power module with an IEPAS02 or IEPAF02 power module may cause a remaining IEPAS01 or IEPAF01 power module status LED to turn red or blinking green. A red LED may indicate that an output voltage is too low or an output voltage is too high resulting in an overload condition (earlier versions of the IEPAS01 or IEPAF01 power module). A blinking green LED on an IEPAS01 or IEPAF01 power module indicates an overload condition because the output is too high. If one of these effects occurs from replacing an IEPAS01 or IEPAF01 power module with an IEPAS02 or IEPAF02 power module, there are two courses of action.

1. Replace the IEPAS01 or IEPAF01 power module with a new IEPAS01 or IEPAF01 power module. Return the overloading IEPAS01 or IEPAF01 power module to the factory for testing and calibration.

2. Replace the IEPAS01 or IEPAF01 power module with an IEPAS02 or IEPAF02 power module.

> **NOTE:** System integration testing shows that no disruption of cabinet power occurs when replacing an IEPAS01 or IEPAF01 power module with an IEPAS02 or IEPAF02 power module. Always install a replacement power module and verify that it is operating properly before removing a power module.

Refer to Appendix A for IEPAS02 and IEPAF02 power module jumper settings. Refer to Section 7 for power module replacement procedures. Enhancements to the IEPAS02 and IEPAF02 power modules give the module LEDs additional functionality. Refer to Table 4-2 for a description of IEPAS02 and IEPAF02 power module LED states.

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