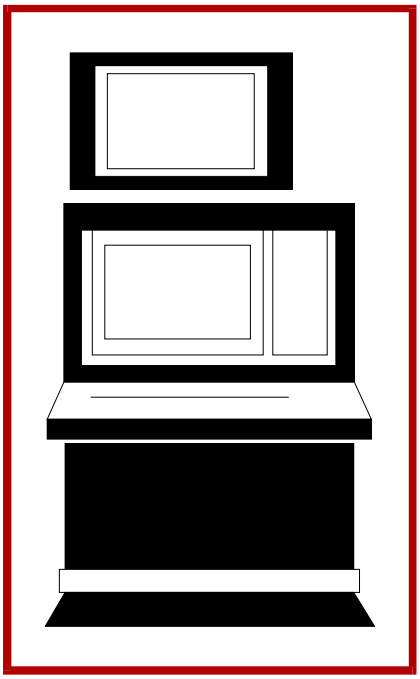
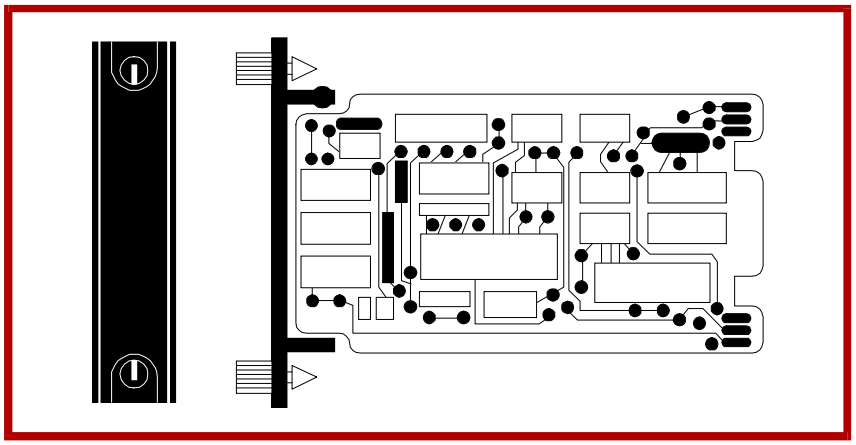
Bailey® infi 90®

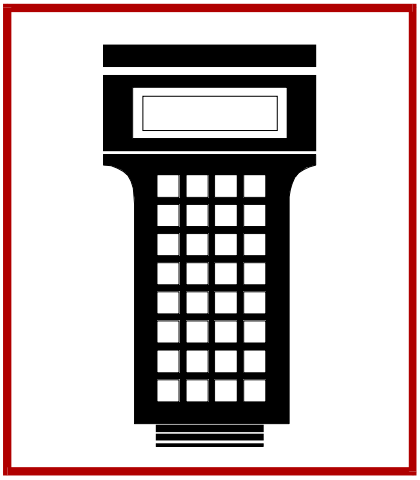
E96-542

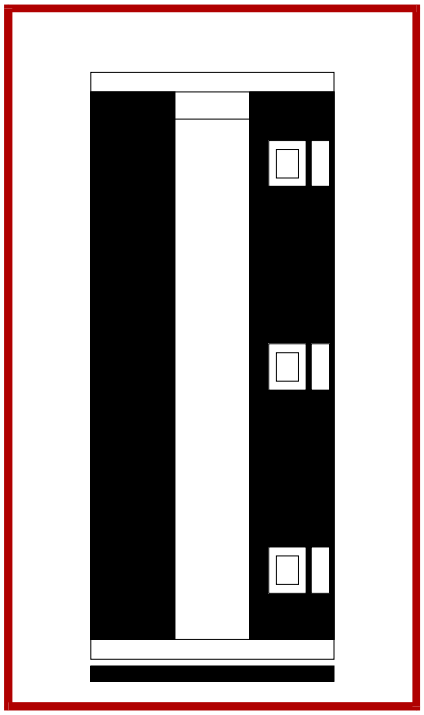
Instruction

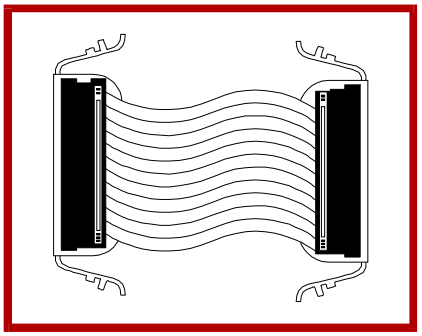
Modular Power System II

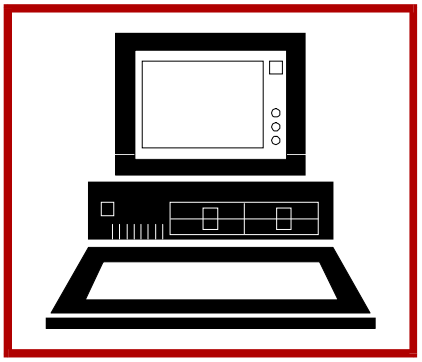












Bailey Process Control and Automation Solutions from Elsag Bailey Group

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 INFI 90® OPEN Modular Power System II supplies 5, 15, -15, 25.5, 48 and 125 VDC power to an INFI 90 OPEN cabinet. This power system can operate on 120/240 VAC or 125 VDC input power. This power system is a direct replacement of the Network 90™ power system and INFI 90 modular power system in their entireties. Components of the Network 90 power system or the INFI 90 modular power system cannot be used with INFI 90 OPEN Modular Power System II components. The INFI 90 OPEN Modular Power System II fits in the same cabinet space as an INFI 90 modular power system that uses a power mounting unit. Benefits of the modular power system II are power factor correction, on-line replaceable components, and improved monitoring functions that are selectable. The system can operate in either an N, N+1 or N+x configuration or 2N configuration.

This instruction provides information on modular power system II installation, operation, maintenance and troubleshooting. Anyone installing or operating the modular power system should read and understand this instruction.

List of Effective Pages

Total number of pages in this instruction is 108, consisting of the following:

Page No.	Change Date
Preface	Original
List of Effective Pages	Original
iii through x	Original
1-1 through 1-13	Original
2-1 through 2-9	Original
3-1 through 3-24	Original
4-1 through 4-4	Original
5-1 through 5-5	Original
6-1 through 6-6	Original
7-1 through 7-15	Original
8-1	Original
A-1 through A-5	Original
B-1 through B-10	Original
C-1 through C-3	Original
Index-1 through Index-3	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 insure that contact with energized parts is avoided when servicing.

Special Handling
This device uses electrostatic sensitive devices.

SPECIFIC WARNINGS

Insure the fan blades have stopped rotating before removing the fan assembly from the fan chassis. Removing an operating fan assembly exposes rotating fan blades that can cause injury. (p. 3-6, 7-5)

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. 3-10, 3-14, 7-6, 7-9, 7-11, 7-14)

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. 6-3)

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. 6-3)

Never clean electrical parts or components with live power present. Doing so exposes you to an electrical shock hazard. (p. 6-5)

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 removed from the printed circuit board. (p. 6-5)

Allow 30 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. 7-3, 7-4, 7-11)

Handle the module by surfaces other than the heat sink. The heat sink may be hot and may cause severe burns. (p. 7-4)

Safety Summary (continued)

SPECIFIC CAUTIONS	Do not install the IPFLD48 and IPFLD125 field power modules together in the same IPCHS01 chassis. Equipment damage will result. (p. 2-3, 3-23)

Sommaire de Sécurité

AVERTISSEMENTS D'ORDRE GÉNÉRAL	**Environnement de l'équipement** Ne pas soumettre les composants à une atmosphère corrosive lors du transport, de l'entreposage ou l'utilisation. **Possibilité de chocs électriques durant l'entretien** Débrancher l'alimentation ou prendre les précautions pour éviter tout contact avec des composants sous tension durant l'entretien. **Précautions de manutention** Ce module contient des composants sensibles aux décharges électrostatiques.
AVERTISSEMENTS D'ORDRE SPÉCIFIQUE	S'assurer que les pales du ventilateur sont arrêtées avant de retirer le ventilateur de son châssis. En retirant un ventilateur toujours en marche, le pales du ventilateur sont exposées, ce qui peut causer des blessures. (p. 3-6, 7-5) 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. (p. 3-10, 3-14, 7-6, 7-9, 7-11, 7-14) 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. 6-3) Ne jamais nettoyer des pièces ou composants électriques dont les circuits sont sous tension; les circuits alimentés pourraient causer un choc électrique. (p. 6-5)

AVERTISSEMENTS D'ORDRE SPÉCIFIQUE (SUITE)	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 d'alimentation. Le cas échéant, un avertissement signalant la présence de sources d'alimentation multiples doit être apposé sur la porte de l'armoire. (p. 6-3) Des lunettes de protection devraient être portées lors de travail avec des solvants nettoyants. Lorsqu'on enlève les solvants des circuits imprimés à l'aide d'air comprimé, les éclaboussures de solvant pourraient causer des blessures aux yeux. (p. 6-5) Allouer 30 seconds pour permettre aux capaciteurs filtres de ligne de se décharger avant de manipuler le module après l'avoir retiré. Un manquement à cette précaution pourrait causer un choc sévère ou fatal. (p. 7-3, 7-4, 7-11) Le module doit être manipulé à l'aide de surfaces autres que le dissipatour thermique. Ce dernier risque d'être chaud et de provoquer des brûlures sérieuses. (p. 7-4)
ATTENTIONS D'ORDRE SPÉCIFIQUE	Ne pas installer les modules d'alimentation de champ IPFLD48 et IPFLD125 dans le même châssis IPCHS01. CECI causerait des dommages à l'équipement. (p. 2-3, 3-23)

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Trademarks and Registrations

Registrations and trademarks used in this document include:

® INFI 90	Registered trademark of Elsag Bailey Process Automation
® INFI-NET	Registered trademark of Elsag Bailey Process Automation
® Network 90	Registered trademark of Elsag Bailey Process Automation

SECTION 1 - INTRODUCTION

OVERVIEW

The INFI 90 OPEN Modular Power System II supplies 5, 15, -15, 25.5, 48 and 125 VDC power to an INFI 90 OPEN cabinet. This power system replaces the Network 90 power system or the INFI 90 OPEN modular power system. Figure 1-1 shows a front view of a typical power system. The modules used in the power module chassis will vary according to user requirements. The Modular Power System II fits in the same cabinet space as an INFI 90 OPEN modular power system with a power

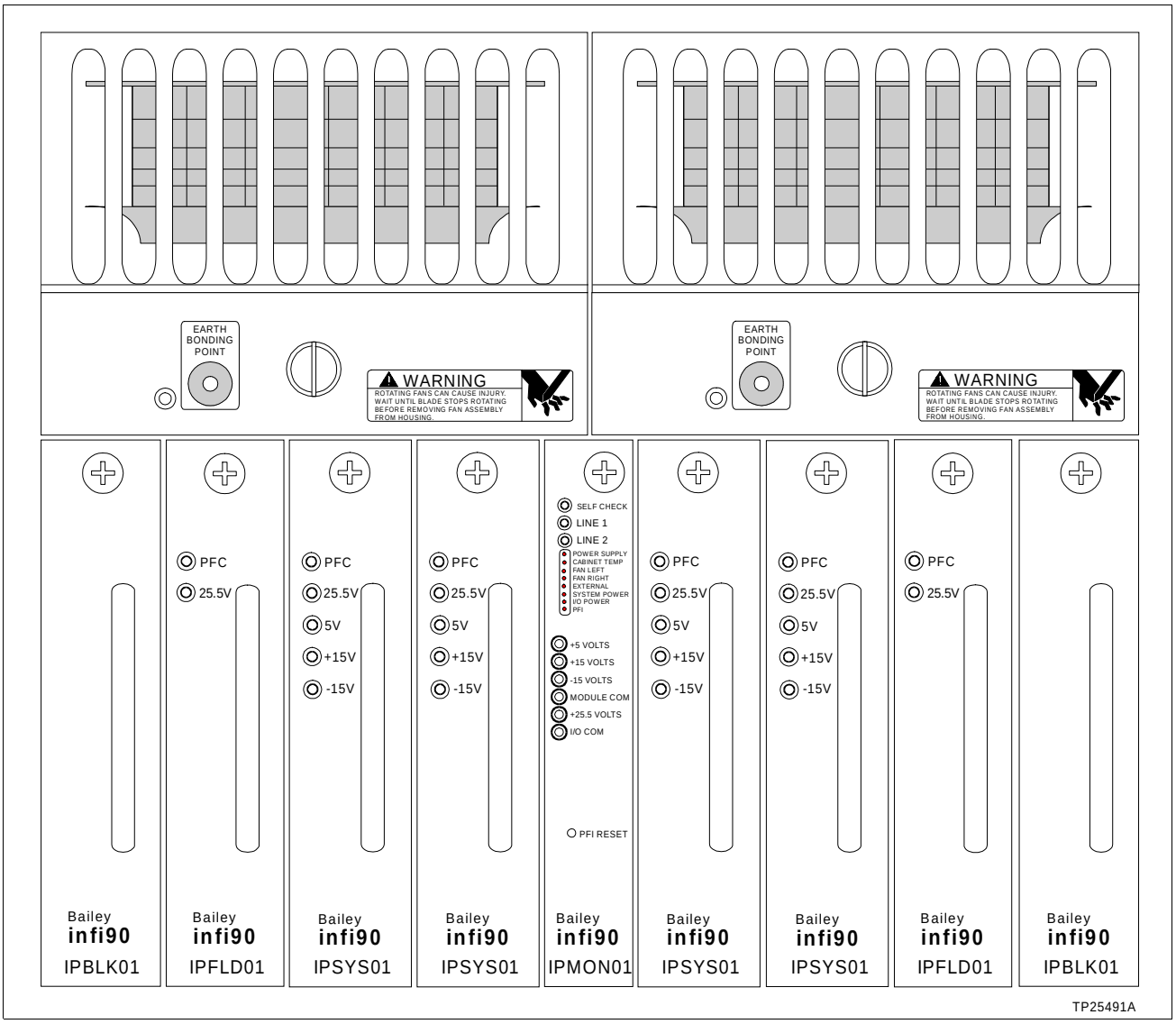

Figure 1-1. Modular Power System II Front View (Typical)

mounting unit. Components of the Network 90 power system and INFI 90 OPEN modular power system cannot be used with components of the INFI 90 OPEN Modular Power System II. This system is designed to operate in several configurations of power module redundancy (N, N+1, N+x or 2N). Benefits of the INFI 90 OPEN Modular Power System II are:

- Power factor correction.
- On-line replaceable components.
- Improved monitoring functions.
- Directly accepts 125 VDC inputs.

INTENDED USER

This instruction is written for engineers, technicians and system designers as a source of technical information on the INFI 90 OPEN Modular Power System II. This instruction should be used by those planning to purchase, install, operate, troubleshoot, maintain or replace this power system. Those working with the power system should have experience working with and know the precautions to take around AC/DC power. A knowledge of how to use basic electronic test equipment (digital multimeter), and electrical and electronic principles is also required.

POWER SYSTEM DESCRIPTION

The INFI 90 OPEN Modular Power System II consists of a power module chassis, fan chassis, power entry circuit breakers or switches, system fans, system power modules, field power modules and a power monitor module.

System Power Module

The IPSYS01 System Power Modules are rack mounted circuit boards that supplies 5, 15 and -15 VDC system voltages, and 25.5 VDC I/O power to an INFI 90 OPEN cabinet. The system power module can accept 120/240 VAC or 125 VDC input power. The AC inputs have active power factor correction to greater than 0.95. Current sharing circuitry enables the system power modules to equally share output current. The module monitors the DC/DC converters and power factor corrector and displays the status on five red/green faceplate LEDs. The system power module mounts in one power module chassis mounting slot.

Field Power Modules

The IPFLD01 and the IPFLD24 Field Power Modules are the same as the system power module except that they output 25.5 VDC field I/O power only at 143 watts and 286 watts respectively. The IPFLD48 and IPFLD125 field power modules output

49.1 VDC and 125.6 VDC respectively. The field power modules have the same power factor correction and internal monitoring circuitry. There are only two red/green LEDs on the field power modules: one for the DC to DC converter status and one for the power factor corrector status. The field power module mounts in one power module chassis mounting slot.

> **NOTE:** IPFLD48 and IPFLD125 field power modules cannot be installed in the same IPCHS01 power module chassis.

Power Monitor Module

The IPMON01 Power Monitor Module monitors system level and status input functions, which include:

- All system bus voltages (5, 15, -15 VDC) and I/O bus voltage (25.5 VDC, 48 VDC and 125 VDC).
- Two selectable auxiliary inputs for 24, 48 or 125 VDC external sources.
- Two cabinet temperature monitor inputs.
- One power fail interrupt (PFI) alarm that can be configured for latching or nonlatching.
- Two logic level status inputs. These contact logic inputs can be selected to accept normally open (N.O.) or normally closed (N.C.) contact inputs.
- Three isolated outputs for bus alarm, power alarm, and I/O alarm.
- One power system status output for use on Plant Loop or INFI-NET® communication networks.
- Two fan status inputs.
- One power supply status signal from each power module.
- The status of power monitor module internal circuitry.

This power monitor module mounts in the center power module chassis slot. The power monitor module faceplate has three red/green LEDs to indicate power monitor module status and AC/DC input power lines status. Eight additional LEDs are used to show the state of status inputs. There are six test points that accept a voltmeter probe for checking 5, 15, -15 and 25.5 VDC bus voltages (two test points are system common and I/O common). The power fail interrupt (PFI) reset pushbutton is used to reset a PFI signal when the PFI latched option is enabled.

Power Module Chassis

The IPCHS01 Power Module Chassis provides power input, power output bus bars, and various terminals for status inputs, outputs and mounting of up to eight power modules and one power monitor module. There are nine mounting slots total. The center slot is dedicated to the power monitor module. Four slots on each side of the power monitor module hold power modules and have isolated power inputs. All the power module outputs share the same bus. System power for the cabinet is made available at bus bars on the power module chassis backplane and at one of the terminal strips (for ±15 VDC). Cables connect the bus bars and terminals to the system power bus bar for distribution to the cabinet. Power modules and the power monitor module can be removed from the power module chassis and replaced while the system is on-line. Only IPSYS01, IPFLD01, IPFLD24, IPFLD48 or IPFLD125 power modules and the IPMON01 power monitor module can be mounted in the power module chassis.

NOTE: The IPFLD48 and the IPFLD125 power modules cannot be mixed in the same power module chassis at the same time.

Power Entry Circuit Breaker or Switch

The IPECB11 or IPECB13 Power Entry Circuit Breaker and IPESW11 or IPESW13 Power Entry Switch terminate the AC/DC power input lines and provide line filtering before feeding power to the power module chassis backplane. These devices are mounted on the rear of the power fan chassis. One circuit breaker or switch is used on N, N+1, or N+x redundant systems (Fig. 1-2); two are used on 2N redundant systems (Fig. 1-3). The isolated inputs on 2N redundant systems allow use of mixed power inputs (i.e., 125 VDC and 120/240 VAC) because two separate power entry circuit breakers or switches feed isolated power inputs to the power module chassis.

Fan Chassis and System Fans

The IPFCH01 Power Fan Chassis mounts two system power fans. There are three types of fans in the INFI 90 OPEN Modular Power System II structure:

- IPFAN11 Power System Fan (120 VAC).
- IPFAN12 Power System Fan (240 VAC).
- IPFAN13 Power System Fan (125 VDC).

The fan chassis provides a power connection, fan monitoring, and control via a cable connection to the power module chassis backplane.

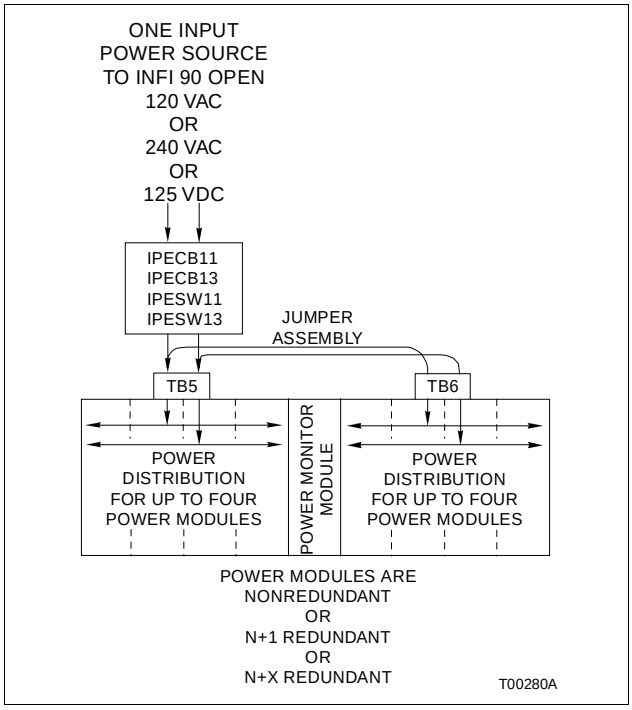

Figure 1-2. Block Diagram of Input Power for N, N+1 and N+x Redundant Systems

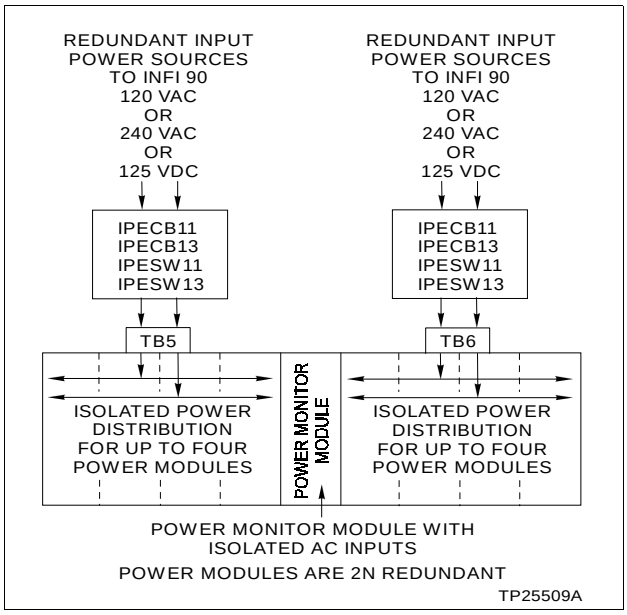

Figure 1-3. Block Diagram of Input Power for 2N Redundant Systems

The power system fans mount side-by-side in the fan chassis. Hall effect sensors on the power system fans provide fan speed information to the power monitor module. Fan speed is controlled as a function of cabinet temperature. One fan is capable of cooling the cabinet and a failed fan can be replaced while the system is on-line.

FEATURES

- 2N or N, N+1 or N+x redundancy increases availability.
- Accepts 120/240 VAC or 125 VDC input power.
- The high output capacity of each power module means fewer modules are required.
- Active load sharing by the power modules insures all power modules equally share the load.
- Input power factor correction on all power modules lowers upstream investments such as electrical distribution and uninterrupted power supply (UPS).
- Redundant fans are on-line replaceable.
- Power monitoring of AC/DC power input, system bus and I/O bus voltages, cabinet temperature, power system fan speed, auxiliary channels, and contact inputs.

INSTRUCTION CONTENT

This instruction is divided into eight sections and three appendices. Read this instruction before installing or operating the INFI 90 OPEN Modular Power System II. A summary of section content follows:

Introduction — Contains general information and technical specifications.

Description and Operation — Uses block diagrams, schematics and text to explain power system operation.

Installation — Covers the preliminary steps to install the system components and prepare for operation. It covers dipswitch and jumper settings, mounting, wiring and preoperational checks.

Operating Procedures — Provides information on daily use, power monitor module and power module LED states, PFI reset pushbutton and test points.

Troubleshooting — Explains the meaning of LED indicators and contains troubleshooting procedures.

Maintenance — Contains scheduled maintenance tasks and procedures.

Repair and Replacement Procedures — Contains procedures that explain how to replace power system components. It also has a spare parts list with Elsag Bailey part numbers for related parts, cables and fuses.

Support Services — Explains the services and training that Elsag Bailey makes available to their customers.

Appendices Provides a quick reference of power monitor module dipswitch and jumper settings, LED states, sizing the power system and wiring diagrams.

HOW TO USE THIS INSTRUCTION

Read this instruction before handling the INFI 90 OPEN Modular Power System II. Refer to a specific section for information as needed.

1. Read the operating procedures section before installing the power system.

2. Do the steps in the installation section.

3. Refer to the troubleshooting section to resolve problems if they occur.

4. Refer to the maintenance section for scheduled maintenance requirements.

5. Refer to the repair and replacement procedures to replace a part or find a part number.

6. Use the support services section for information on ordering parts and warranty information.

7. Refer to the appendices for a quick reference of power monitor module dipswitch and jumper settings, and module LED states, power system sizing procedures and wiring diagrams.

REFERENCE DOCUMENTS

Table 1-1 lists documents that contain information relevant to the INFI 90 OPEN Modular Power System II.

Table 1-1. Reference Documents

Number	Title
I-E96-500	Site Planning and Preparation

GLOSSARY OF TERMS AND ABBREVIATIONS

Table 1-2 contains those terms and abbreviations that are unique to Elsag Bailey or have a definition that is different from standard industry usage.

Table 1-2. Glossary of Terms and Abbreviations

Term	Definition
PFI	Power fail interrupt. A signal that causes active controller or processor modules (MFCs or MFPs) to reset and the communication system to be bypassed, when generated in the INFI 90 OPEN system by an out of tolerance bus voltage.
Termination Module	Provides input/output connection between plant equipment and the INFI 90 OPEN/ Network 90 modules.
Termination Unit	

NOMENCLATURE

Table 1-3 lists INFI 90 OPEN Modular Power System II nomenclatures.

Table 1-3. Nomenclature

Nomenclature	Description
IPBLK01	Power blank faceplate
IPCHS01	Power module chassis
IPECB11	Power entry circuit breaker (120/240 VAC input)
IPECB13	Power entry circuit breaker (125 VDC input)
IPESW11	Power entry switch (120/240 VAC input)
IPESW13	Power entry switch (125 VDC input)
IPFAN11	Power system fan (120 VAC input)
IPFAN12	Power system fan (240 VAC input)
IPFAN13	Power system fan (125 VDC input)
IPFCH01	Power fan chassis
IPFLD01	Field power module (25.5 VDC output, 120/240 VAC and 125 VDC input)
IPFLD24	Field power module (25.5 VDC output, 120/240 VAC and 125 VDC input) (twice the maximum capacity of the IPFLD01)
IPFLD48	Field power module (49.1 VDC output, 120/240 VAC and 125 VDC input)
IPFLD125	Field power module (125.6 VDC output, 120/240 VAC and 125 VDC input)
IPMON01	Power monitor module
IPSYS01	System power module (5, 15, -15 and 25.5 VDC outputs, 120/240 VAC and 125 VDC input)

SPECIFICATIONS

Table 1-4 lists INFI 90 OPEN Modular Power System II specifications.

Table 1-4. Specifications

<table>
<tr><th>Property</th><th>Characteristic/Value</th></tr>
<tr><td>MPS II inputs
Input voltage</td><td>
<table>
<tr><th rowspan="2">External Ambient Temp.</th><th colspan="2">Input Voltage</th></tr>
<tr><th>Nominal</th><th>Operating Range</th></tr>
<tr><td rowspan="3">0° - 55°C
(32° - 131°F)</td><td>120 VAC</td><td>102 - 132 VAC</td></tr>
<tr><td>240 VAC</td><td>204 - 264 VAC</td></tr>
<tr><td>125 VDC</td><td>102 - 144 VDC</td></tr>
</table>
Input current
Peak inrush current
Frequency
Total harmonic distortion
Efficiency
Power factor</td><td>20 A max. per side
15 A per power module for 100 msecs max. for AC or DC input power
47 to 63 Hz
Less than 5%
60% at full rated load
Actively corrected to 0.95 min. at input currents greater than 0.5 A</td></tr>
<tr><td>Power module inputs (IPSYS01, IPFLD01, IPFLD24, IPFLD48, IPFLD125)
Input voltage
Input current</td><td>102 to 264 VAC
102 to 144 VDC
<table>
<tr><th rowspan="2">Module</th><th colspan="3">Full Load Input Current (A)</th></tr>
<tr><th>120 VAC</th><th>240 VAC</th><th>125 VDC</th></tr>
<tr><td>IPSYS01</td><td>4.3</td><td>2.0</td><td>4.3</td></tr>
<tr><td>IFLD01</td><td>2.2</td><td>1.0</td><td>2.2</td></tr>
<tr><td>IPFLD24</td><td>4.7</td><td>2.4</td><td>4.7</td></tr>
<tr><td>IPFLD48</td><td>4.4</td><td>2.2</td><td>4.4</td></tr>
<tr><td>IPFLD125</td><td>4.7</td><td>2.4</td><td>4.7</td></tr>
</table></td></tr>
<tr><td>Power module outputs (IPSYS01, IPFLD01, IPFLD24, IPFLD48, IPFLD125)</td><td>
<table>
<tr><th>Module Outputs</th><th colspan="4">IPSYS01[1]</th><th>IPFLD01
IPFLD24</th><th>IPFLD48</th><th>IPFLD125</th></tr>
<tr><td>Nominal voltage (VDC)</td><td>5.09</td><td>15.10</td><td>-15.10</td><td>25.50</td><td>25.50</td><td>49.1</td><td>125.6</td></tr>
<tr><td>Minimum voltage (VDC)</td><td>5.04</td><td>14.95</td><td>-14.95</td><td>24.35</td><td>24.35</td><td>48.5</td><td>124.2</td></tr>
<tr><td>Maximum voltage (VDC)</td><td>5.25</td><td>15.75</td><td>-15.75</td><td>26.80</td><td>26.80</td><td>49.6</td><td>127.1</td></tr>
<tr><td>Maximum ripple and noise (mV_{pp})</td><td>100</td><td>150</td><td>150</td><td>250</td><td>250</td><td>600</td><td>1000</td></tr>
<tr><td>Full load current (A)</td><td>17.00</td><td>1.80</td><td>1.80</td><td>5.60</td><td>5.60/11.2[2]</td><td>5.45</td><td>2.3</td></tr>
</table>
NOTES:
1. Total module power output cannot exceed 260 W.
2. 11.2 A for IPFLD24 module.</td></tr>
</table>

Table 1-4. Specifications (continued)

<table>
<tr><th>Property</th><th>Characteristic/Value</th></tr>
<tr><td>Power module outputs (IPSYS01, IPFLD01, IPFLD24, IPFLD48, IPFLD125) (continued)</td><td></td></tr>
<tr><td>Load sharing</td><td>Current shared equally between modules within 5% (highest current load to lowest current load) at full load</td></tr>
<tr><td>Line regulation</td><td>±0.5% of the nominal output voltage over the input voltage range</td></tr>
<tr><td>Load regulation</td><td>Within specified minimum and maximum outputs from 0% to 100% load</td></tr>
<tr><td>Hold up time</td><td>20 msecs following loss of power</td></tr>
<tr><td>Power monitor module (IPMON01) power input</td><td></td></tr>
<tr><td>Input power</td><td>0.3 A at 120 VAC
0.2 A at 240 VAC and 125 VDC</td></tr>
<tr><td>Frequency</td><td>47 to 63 Hz</td></tr>
<tr><td>Power monitor module (IPMON01) status signal inputs and outputs</td><td></td></tr>
<tr><td>System bus voltage monitor trip points</td><td>
<table>
<tr><th rowspan="2">Voltage Bus Nominal (VDC)</th><th colspan="2">Low Trip</th><th colspan="2">High Trip</th></tr>
<tr><th>Min</th><th>Max</th><th>Min</th><th>Max</th></tr>
<tr><td>5</td><td>4.75</td><td>4.80</td><td>NA[1]</td><td>NA[1]</td></tr>
<tr><td>15</td><td>14.50</td><td>14.70</td><td>NA[1]</td><td>NA[1]</td></tr>
<tr><td>-15</td><td>-14.50</td><td>-14.70</td><td>NA[1]</td><td>NA[1]</td></tr>
<tr><td>25.5</td><td>24.20</td><td>24.50</td><td>NA[1]</td><td>NA[1]</td></tr>
<tr><td>25.5 (aux)</td><td>21.40</td><td>21.60</td><td>27.00</td><td>27.40</td></tr>
<tr><td>48 (aux)</td><td>42.50</td><td>43.35</td><td>54.00</td><td>54.60</td></tr>
<tr><td>125 (aux)</td><td>113.05</td><td>115.05</td><td>142.75</td><td>144.75</td></tr>
</table>
NOTE: 1. Power module provides overvoltage protection.
</td></tr>
<tr><td>Input voltage monitor trip points</td><td>
<table>
<tr><th rowspan="2">Input Voltage (Nominal)</th><th colspan="2">Low Trip[1]</th></tr>
<tr><th>Min</th><th>Max</th></tr>
<tr><td>120 VAC</td><td>88</td><td>90</td></tr>
<tr><td>240 VAC</td><td>176</td><td>180</td></tr>
<tr><td>125 VDC</td><td>88</td><td>90</td></tr>
</table>
NOTE: 1. The MPS II system will operate at voltages as low as the input voltage monitor low trip point, however operation below the minimum system input voltage specification is not recommended.
</td></tr>
<tr><td>Logic status inputs</td><td>2 inputs, logic 0 = fault
Logic 0 ≤ 0.8 VDC at 10 mA sink current
Logic 1 ≥ 3.1VDC at 80 µA source current</td></tr>
<tr><td>Fan status inputs</td><td>2 inputs for fan speed monitoring of low fan speed (fan speed controlled as a function on internal cabinet temperature)</td></tr>
<tr><td>Power fail interrupt (PFI)</td><td>1 output, open collector driven (nonisolated), logic 0 = power failure
Logic 0 ≤ 0.8 VDC at 10 mA sink current
Logic 1 ≥ 4.75 to 5.25 VDC at 80 µA source current</td></tr>
</table>

Table 1-4. Specifications (continued)

Property	Characteristic/Value
Power monitor module (IPMON01) status signal inputs and outputs (continued)	
Status out	1 output, open collector driven (nonisolated), logic 0 = fault Logic 0 ≤ 0.8 VDC at 10 mA sink current Logic 1 ≥ 4.75 to 5.25 VDC at 80 µA source current
Bus alarm	1 output, opto-isolated open collector driven (24 V), logic 1 = fault Logic 0 ≤ 1.2 VDC at 150 mA sink current Logic 1 ≥ 5 to 30 VDC at 80 µA source current
Power alarm	1 output, opto-isolated open collector driven (24 V), logic 1 = fault Logic 0 ≤ 1.2 VDC at 150 mA sink current Logic 1 ≥ 5 to 30 VDC at 80 µA source current
I/O alarm	1 output, opto-isolated open collector driven (24 V), logic 1 = fault Logic 0 ≤ 1.2 VDC at 150 mA sink current Logic 1 ≥ 5 to 30 VDC at 80 µA source current
Power module chassis (IPCHS01) capacity	
Input power capacity	20 A max. per side
Output bus capacity	85 A at 5.1 VDC max. 15 A at ±15.1 VDC max. 85 A at 25.5 VDC max. 12 A at 48 VDC max. 12 A at 125 VDC max.
Power entry circuit breaker and switch (IPECB11/13 and IPEWS11/13)	
Input voltage IPECB11 and IPEWS11 IPECB13 and IPEWS13	 102 to 264 VAC 102 to 144 VDC
Input current	20 A max.
Voltage drop across breaker and switch	2 V drop at 20 A nominal
System fans	
Input power IPFAN11 IPFAN12 IPFAN13	 0.6 A nominal at 120 VAC 0.4 A nominal at 240 VAC 0.7 A nominal at 125 VDC
Frequency	47 to 63 Hz
Environmental	
Electromagnetic/radio frequency interference	Meets IEC 801.3, level 3, 80 MHz to 1 GHz with no loss of function or false status information for all units. **NOTE:** Do not use RFI sources producing 10 V/m at 84.9 MHz within 2.2 m (7.2 ft) of the MPS II system
Fast transient/burst susceptibility	Meets IEC 801.4, level 3, mains 2 kV at 2.5 kHz, outputs 1 kV at 5.0 kHz with no loss of function or false status information
Transient surge	Meets IEC 801.5, level 3, 2 kV with no loss of function or false status information
Electrostatic discharge	Meets IEC 801.2, level 3 with no loss of function or false status information

Table 1-4. Specifications (continued)

<table>
<tr><th>Property</th><th>Characteristic/Value</th></tr>
<tr><td>Environmental (continued)</td><td></td></tr>
<tr><td>Temperature
Operating enclosure (internal)
Operating enclosure (external)
Storage and transport</td><td>
0° to 70°C (32° to 158°F)
0° to 55°C (32° to 131°F)
-40° to 85°C (-40° to 185°F)</td></tr>
<tr><td>Relative humidity
Operating</td><td>20% to 90% up to 55°C (131°F) noncondensing
20% to 45% at 55° to 70°C (131° to 158°F) noncondensing</td></tr>
<tr><td>Altitude
Operating
Storage and transport</td><td>
Sea level to 3,048 m (10,000 ft)
Up to 9,144 m (30,000 ft)</td></tr>
<tr><td>Air quality</td><td>Noncorrosive per ISA S71.04 class LA, LB, LC severity level 1</td></tr>
<tr><td>Weight and dimensions</td><td>
<table>
<tr><th>Component[1]</th><th>Weight kg (lb)</th><th>Height mm (in.)</th><th>Width mm (in.)</th><th>Depth mm (in.)</th></tr>
<tr><td>IPBLK01 Power Blank Faceplate</td><td>0.89 (1.95)</td><td>218.40 (8.60)</td><td>48.30 (1.90)</td><td>444.50[2] (17.50)</td></tr>
<tr><td>IPCHS01 Power Module Chassis</td><td>7.55 (16.60)</td><td>223.50 (8.80)</td><td>482.60 (19.00)</td><td>444.50 (17.50)</td></tr>
<tr><td>IPECB11/13 Power Entry Circuit Breaker</td><td>2.55 (5.60)</td><td>114.30 (4.50)</td><td>193.04 (7.60)</td><td>162.56 (6.40)</td></tr>
<tr><td>IPESW11/13 Power Entry Switch</td><td>2.55 (5.60)</td><td>114.30 (4.50)</td><td>193.04 (7.60)</td><td>162.56 (6.40)</td></tr>
<tr><td>IPFAN11/12/13 Power System Fan</td><td>3.23 (7.10)</td><td>152.40 (6.00)</td><td>210.82 (8.30)</td><td>444.50 (17.50)</td></tr>
<tr><td>IPFCH01 Power Fan Chassis</td><td>10.20 (22.40)</td><td>203.20 (8.00)</td><td>482.60 (19.00)</td><td>472.44 (18.60)</td></tr>
<tr><td>IPFLD01 Field Power Module</td><td>2.36 (5.20)</td><td>218.40 (8.60)</td><td>48.30 (1.90)</td><td>444.50[2] (17.50)</td></tr>
<tr><td>IPFLD24 Field Power Module</td><td>2.49 (5.46)</td><td>218.40 (8.60)</td><td>48.30 (1.90)</td><td>444.50[2] (17.50)</td></tr>
<tr><td>IPFLD48 Field Power Module</td><td>2.55 (5.62)</td><td>218.40 (8.60)</td><td>48.30 (1.90)</td><td>444.50[2] (17.50)</td></tr>
<tr><td>IPFLD125 Field Power Module</td><td>2.55 (5.62)</td><td>218.40 (8.60)</td><td>48.30 (1.90)</td><td>444.50[2] (17.50)</td></tr>
<tr><td>IPMON01 Power Monitor Module</td><td>0.71 (1.56)</td><td>218.40 (8.60)</td><td>35.56 (1.40)</td><td>401.32 (15.80)</td></tr>
<tr><td>IPSYS01 System Power Module</td><td>2.55 (5.60)</td><td>218.40 (8.60)</td><td>48.30 (1.90)</td><td>444.50[2] (17.50)</td></tr>
</table>
NOTES:
1. The total system weight is 48 kg (106 lb) maximum.
2. Dimension includes the handle.
</td></tr>
<tr><td>Installation category</td><td>IEC 1010-1
Category III, for mains
Category II, for mains to the IPCHS01 chassis
Category I, for outputs</td></tr>
<tr><td>Vibration</td><td>13.2 to 100 Hz, 0.7 Gs
2 to 13.2 Hz, 12 mm (0.47 in.) peak-to-peak displacement</td></tr>
</table>

Table 1-4. Specifications (continued)

Property	Characteristic/Value
Certification	
CSA C22.2, No. 142	Certified for process control equipment in an ordinary (nonhazardous) environment
FM	Class I, Division 2, Groups A, B, C, D

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

SECTION 1 - INTRODUCTION

OVERVIEW

The INFI 90 OPEN Modular Power System II supplies 5, 15, -15, 25.5, 48 and 125 VDC power to an INFI 90 OPEN cabinet. This power system replaces the Network 90 power system or the INFI 90 OPEN modular power system. Figure 1-1 shows a front view of a typical power system. The modules used in the power module chassis will vary according to user requirements. The Modular Power System II fits in the same cabinet space as an INFI 90 OPEN modular power system with a power

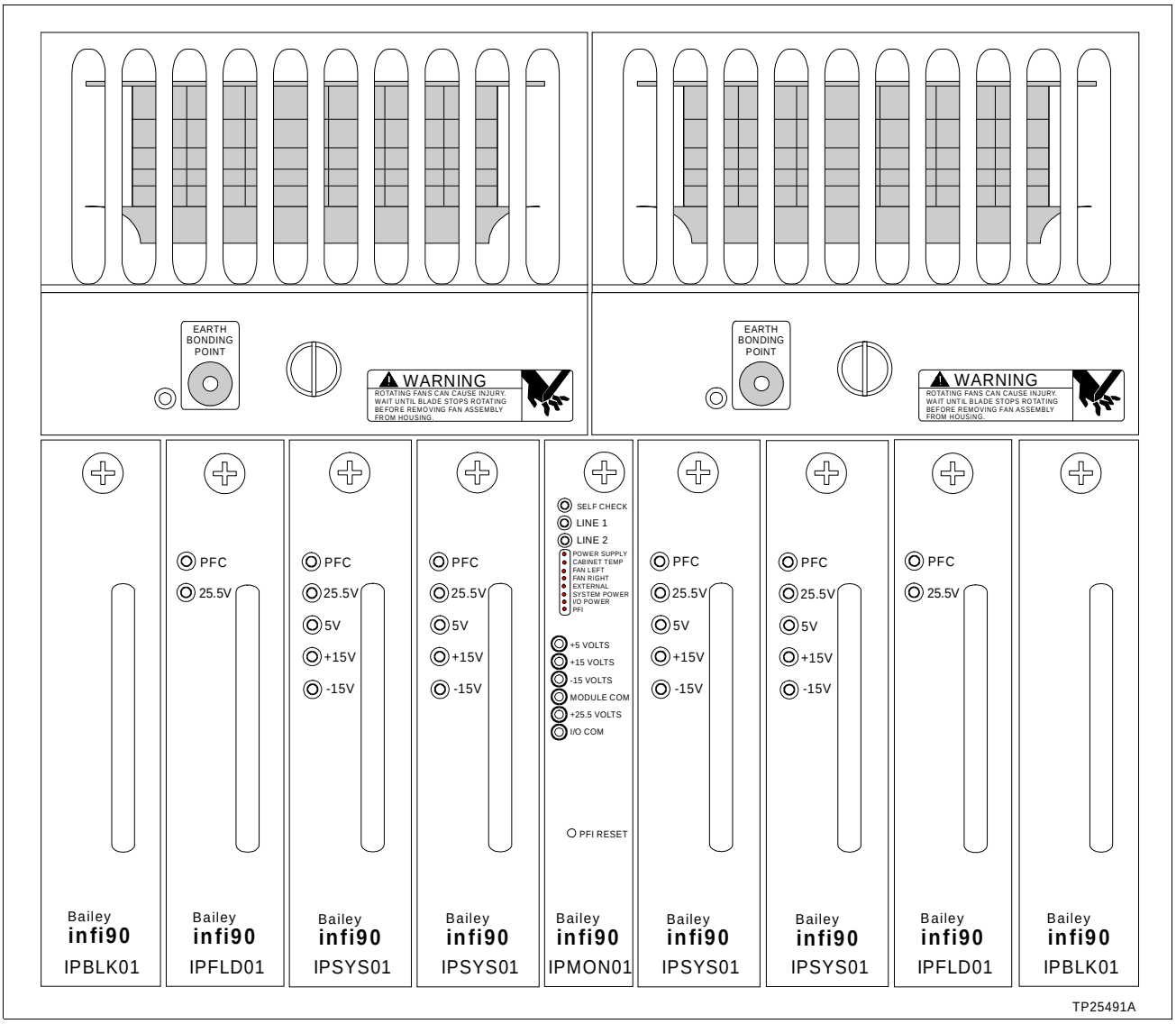

Figure 1-1. Modular Power System II Front View (Typical)

mounting unit. Components of the Network 90 power system and INFI 90 OPEN modular power system cannot be used with components of the INFI 90 OPEN Modular Power System II. This system is designed to operate in several configurations of power module redundancy (N, N+1, N+x or 2N). Benefits of the INFI 90 OPEN Modular Power System II are:

- Power factor correction.
- On-line replaceable components.
- Improved monitoring functions.
- Directly accepts 125 VDC inputs.

INTENDED USER

This instruction is written for engineers, technicians and system designers as a source of technical information on the INFI 90 OPEN Modular Power System II. This instruction should be used by those planning to purchase, install, operate, troubleshoot, maintain or replace this power system. Those working with the power system should have experience working with and know the precautions to take around AC/DC power. A knowledge of how to use basic electronic test equipment (digital multimeter), and electrical and electronic principles is also required.

POWER SYSTEM DESCRIPTION

The INFI 90 OPEN Modular Power System II consists of a power module chassis, fan chassis, power entry circuit breakers or switches, system fans, system power modules, field power modules and a power monitor module.

System Power Module

The IPSYS01 System Power Modules are rack mounted circuit boards that supplies 5, 15 and -15 VDC system voltages, and 25.5 VDC I/O power to an INFI 90 OPEN cabinet. The system power module can accept 120/240 VAC or 125 VDC input power. The AC inputs have active power factor correction to greater than 0.95. Current sharing circuitry enables the system power modules to equally share output current. The module monitors the DC/DC converters and power factor corrector and displays the status on five red/green faceplate LEDs. The system power module mounts in one power module chassis mounting slot.

Field Power Modules

The IPFLD01 and the IPFLD24 Field Power Modules are the same as the system power module except that they output 25.5 VDC field I/O power only at 143 watts and 286 watts respectively. The IPFLD48 and IPFLD125 field power modules output

49.1 VDC and 125.6 VDC respectively. The field power modules have the same power factor correction and internal monitoring circuitry. There are only two red/green LEDs on the field power modules: one for the DC to DC converter status and one for the power factor corrector status. The field power module mounts in one power module chassis mounting slot.

> **NOTE:** IPFLD48 and IPFLD125 field power modules cannot be installed in the same IPCHS01 power module chassis.

Power Monitor Module

The IPMON01 Power Monitor Module monitors system level and status input functions, which include:

- All system bus voltages (5, 15, -15 VDC) and I/O bus voltage (25.5 VDC, 48 VDC and 125 VDC).
- Two selectable auxiliary inputs for 24, 48 or 125 VDC external sources.
- Two cabinet temperature monitor inputs.
- One power fail interrupt (PFI) alarm that can be configured for latching or nonlatching.
- Two logic level status inputs. These contact logic inputs can be selected to accept normally open (N.O.) or normally closed (N.C.) contact inputs.
- Three isolated outputs for bus alarm, power alarm, and I/O alarm.
- One power system status output for use on Plant Loop or INFI-NET® communication networks.
- Two fan status inputs.
- One power supply status signal from each power module.
- The status of power monitor module internal circuitry.

This power monitor module mounts in the center power module chassis slot. The power monitor module faceplate has three red/green LEDs to indicate power monitor module status and AC/DC input power lines status. Eight additional LEDs are used to show the state of status inputs. There are six test points that accept a voltmeter probe for checking 5, 15, -15 and 25.5 VDC bus voltages (two test points are system common and I/O common). The power fail interrupt (PFI) reset pushbutton is used to reset a PFI signal when the PFI latched option is enabled.

Power Module Chassis

The IPCHS01 Power Module Chassis provides power input, power output bus bars, and various terminals for status inputs, outputs and mounting of up to eight power modules and one power monitor module. There are nine mounting slots total. The center slot is dedicated to the power monitor module. Four slots on each side of the power monitor module hold power modules and have isolated power inputs. All the power module outputs share the same bus. System power for the cabinet is made available at bus bars on the power module chassis backplane and at one of the terminal strips (for ±15 VDC). Cables connect the bus bars and terminals to the system power bus bar for distribution to the cabinet. Power modules and the power monitor module can be removed from the power module chassis and replaced while the system is on-line. Only IPSYS01, IPFLD01, IPFLD24, IPFLD48 or IPFLD125 power modules and the IPMON01 power monitor module can be mounted in the power module chassis.

NOTE: The IPFLD48 and the IPFLD125 power modules cannot be mixed in the same power module chassis at the same time.

Power Entry Circuit Breaker or Switch

The IPECB11 or IPECB13 Power Entry Circuit Breaker and IPESW11 or IPESW13 Power Entry Switch terminate the AC/DC power input lines and provide line filtering before feeding power to the power module chassis backplane. These devices are mounted on the rear of the power fan chassis. One circuit breaker or switch is used on N, N+1, or N+x redundant systems (Fig. 1-2); two are used on 2N redundant systems (Fig. 1-3). The isolated inputs on 2N redundant systems allow use of mixed power inputs (i.e., 125 VDC and 120/240 VAC) because two separate power entry circuit breakers or switches feed isolated power inputs to the power module chassis.

Fan Chassis and System Fans

The IPFCH01 Power Fan Chassis mounts two system power fans. There are three types of fans in the INFI 90 OPEN Modular Power System II structure:

- IPFAN11 Power System Fan (120 VAC).
- IPFAN12 Power System Fan (240 VAC).
- IPFAN13 Power System Fan (125 VDC).

The fan chassis provides a power connection, fan monitoring, and control via a cable connection to the power module chassis backplane.

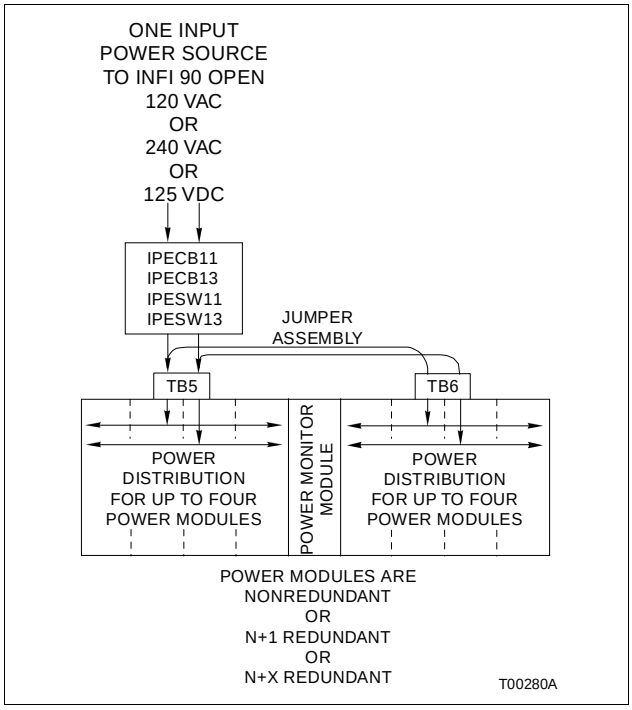

Figure 1-2. Block Diagram of Input Power for N, N+1 and N+x Redundant Systems

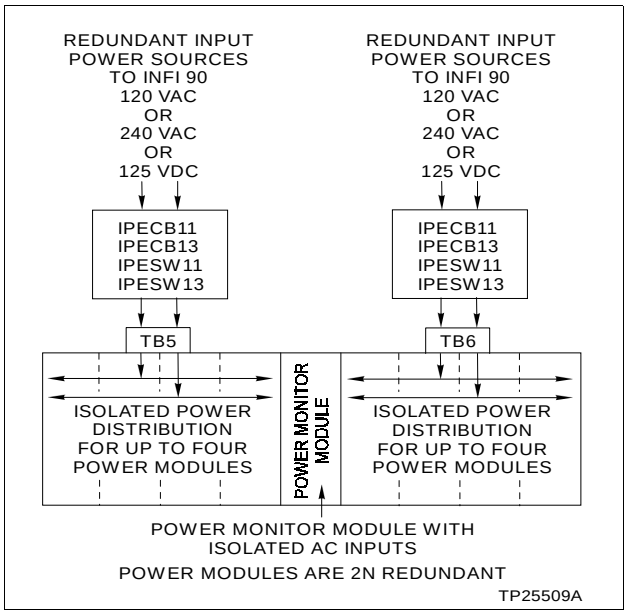

Figure 1-3. Block Diagram of Input Power for 2N Redundant Systems

The power system fans mount side-by-side in the fan chassis. Hall effect sensors on the power system fans provide fan speed information to the power monitor module. Fan speed is controlled as a function of cabinet temperature. One fan is capable of cooling the cabinet and a failed fan can be replaced while the system is on-line.

FEATURES

- 2N or N, N+1 or N+x redundancy increases availability.
- Accepts 120/240 VAC or 125 VDC input power.
- The high output capacity of each power module means fewer modules are required.
- Active load sharing by the power modules insures all power modules equally share the load.
- Input power factor correction on all power modules lowers upstream investments such as electrical distribution and uninterrupted power supply (UPS).
- Redundant fans are on-line replaceable.
- Power monitoring of AC/DC power input, system bus and I/O bus voltages, cabinet temperature, power system fan speed, auxiliary channels, and contact inputs.

INSTRUCTION CONTENT

This instruction is divided into eight sections and three appendices. Read this instruction before installing or operating the INFI 90 OPEN Modular Power System II. A summary of section content follows:

Introduction — Contains general information and technical specifications.

Description and Operation — Uses block diagrams, schematics and text to explain power system operation.

Installation — Covers the preliminary steps to install the system components and prepare for operation. It covers dipswitch and jumper settings, mounting, wiring and preoperational checks.

Operating Procedures — Provides information on daily use, power monitor module and power module LED states, PFI reset pushbutton and test points.

Troubleshooting — Explains the meaning of LED indicators and contains troubleshooting procedures.

Maintenance — Contains scheduled maintenance tasks and procedures.

Repair and Replacement Procedures — Contains procedures that explain how to replace power system components. It also has a spare parts list with Elsag Bailey part numbers for related parts, cables and fuses.

Support Services — Explains the services and training that Elsag Bailey makes available to their customers.

Appendices Provides a quick reference of power monitor module dipswitch and jumper settings, LED states, sizing the power system and wiring diagrams.

HOW TO USE THIS INSTRUCTION

Read this instruction before handling the INFI 90 OPEN Modular Power System II. Refer to a specific section for information as needed.

1. Read the operating procedures section before installing the power system.

2. Do the steps in the installation section.

3. Refer to the troubleshooting section to resolve problems if they occur.

4. Refer to the maintenance section for scheduled maintenance requirements.

5. Refer to the repair and replacement procedures to replace a part or find a part number.

6. Use the support services section for information on ordering parts and warranty information.

7. Refer to the appendices for a quick reference of power monitor module dipswitch and jumper settings, and module LED states, power system sizing procedures and wiring diagrams.

REFERENCE DOCUMENTS

Table 1-1 lists documents that contain information relevant to the INFI 90 OPEN Modular Power System II.

Table 1-1. Reference Documents

Number	Title
I-E96-500	Site Planning and Preparation

GLOSSARY OF TERMS AND ABBREVIATIONS

Table 1-2 contains those terms and abbreviations that are unique to Elsag Bailey or have a definition that is different from standard industry usage.

Table 1-2. Glossary of Terms and Abbreviations

Term	Definition
PFI	Power fail interrupt. A signal that causes active controller or processor modules (MFCs or MFPs) to reset and the communication system to be bypassed, when generated in the INFI 90 OPEN system by an out of tolerance bus voltage.
Termination Module	Provides input/output connection between plant equipment and the INFI 90 OPEN/ Network 90 modules.
Termination Unit	

NOMENCLATURE

Table 1-3 lists INFI 90 OPEN Modular Power System II nomenclatures.

Table 1-3. Nomenclature

Nomenclature	Description
IPBLK01	Power blank faceplate
IPCHS01	Power module chassis
IPECB11	Power entry circuit breaker (120/240 VAC input)
IPECB13	Power entry circuit breaker (125 VDC input)
IPESW11	Power entry switch (120/240 VAC input)
IPESW13	Power entry switch (125 VDC input)
IPFAN11	Power system fan (120 VAC input)
IPFAN12	Power system fan (240 VAC input)
IPFAN13	Power system fan (125 VDC input)
IPFCH01	Power fan chassis
IPFLD01	Field power module (25.5 VDC output, 120/240 VAC and 125 VDC input)
IPFLD24	Field power module (25.5 VDC output, 120/240 VAC and 125 VDC input) (twice the maximum capacity of the IPFLD01)
IPFLD48	Field power module (49.1 VDC output, 120/240 VAC and 125 VDC input)
IPFLD125	Field power module (125.6 VDC output, 120/240 VAC and 125 VDC input)
IPMON01	Power monitor module
IPSYS01	System power module (5, 15, -15 and 25.5 VDC outputs, 120/240 VAC and 125 VDC input)

SPECIFICATIONS

Table 1-4 lists INFI 90 OPEN Modular Power System II specifications.

Table 1-4. Specifications

<table>
<tr><th>Property</th><th>Characteristic/Value</th></tr>
<tr><td>MPS II inputs
Input voltage</td><td>
<table>
<tr><th rowspan="2">External Ambient Temp.</th><th colspan="2">Input Voltage</th></tr>
<tr><th>Nominal</th><th>Operating Range</th></tr>
<tr><td rowspan="3">0° - 55°C
(32° - 131°F)</td><td>120 VAC</td><td>102 - 132 VAC</td></tr>
<tr><td>240 VAC</td><td>204 - 264 VAC</td></tr>
<tr><td>125 VDC</td><td>102 - 144 VDC</td></tr>
</table>
Input current
Peak inrush current
Frequency
Total harmonic distortion
Efficiency
Power factor</td><td>20 A max. per side
15 A per power module for 100 msecs max. for AC or DC input power
47 to 63 Hz
Less than 5%
60% at full rated load
Actively corrected to 0.95 min. at input currents greater than 0.5 A</td></tr>
<tr><td>Power module inputs (IPSYS01, IPFLD01, IPFLD24, IPFLD48, IPFLD125)
Input voltage
Input current</td><td>102 to 264 VAC
102 to 144 VDC
<table>
<tr><th rowspan="2">Module</th><th colspan="3">Full Load Input Current (A)</th></tr>
<tr><th>120 VAC</th><th>240 VAC</th><th>125 VDC</th></tr>
<tr><td>IPSYS01</td><td>4.3</td><td>2.0</td><td>4.3</td></tr>
<tr><td>IFLD01</td><td>2.2</td><td>1.0</td><td>2.2</td></tr>
<tr><td>IPFLD24</td><td>4.7</td><td>2.4</td><td>4.7</td></tr>
<tr><td>IPFLD48</td><td>4.4</td><td>2.2</td><td>4.4</td></tr>
<tr><td>IPFLD125</td><td>4.7</td><td>2.4</td><td>4.7</td></tr>
</table></td></tr>
<tr><td>Power module outputs (IPSYS01, IPFLD01, IPFLD24, IPFLD48, IPFLD125)</td><td>
<table>
<tr><th>Module Outputs</th><th colspan="4">IPSYS01[1]</th><th>IPFLD01
IPFLD24</th><th>IPFLD48</th><th>IPFLD125</th></tr>
<tr><td>Nominal voltage (VDC)</td><td>5.09</td><td>15.10</td><td>-15.10</td><td>25.50</td><td>25.50</td><td>49.1</td><td>125.6</td></tr>
<tr><td>Minimum voltage (VDC)</td><td>5.04</td><td>14.95</td><td>-14.95</td><td>24.35</td><td>24.35</td><td>48.5</td><td>124.2</td></tr>
<tr><td>Maximum voltage (VDC)</td><td>5.25</td><td>15.75</td><td>-15.75</td><td>26.80</td><td>26.80</td><td>49.6</td><td>127.1</td></tr>
<tr><td>Maximum ripple and noise (mV_{pp})</td><td>100</td><td>150</td><td>150</td><td>250</td><td>250</td><td>600</td><td>1000</td></tr>
<tr><td>Full load current (A)</td><td>17.00</td><td>1.80</td><td>1.80</td><td>5.60</td><td>5.60/11.2[2]</td><td>5.45</td><td>2.3</td></tr>
</table>
NOTES:
1. Total module power output cannot exceed 260 W.
2. 11.2 A for IPFLD24 module.</td></tr>
</table>

Table 1-4. Specifications (continued)

<table>
<tr><th>Property</th><th>Characteristic/Value</th></tr>
<tr><td>Power module outputs (IPSYS01, IPFLD01, IPFLD24, IPFLD48, IPFLD125) (continued)</td><td></td></tr>
<tr><td>Load sharing</td><td>Current shared equally between modules within 5% (highest current load to lowest current load) at full load</td></tr>
<tr><td>Line regulation</td><td>±0.5% of the nominal output voltage over the input voltage range</td></tr>
<tr><td>Load regulation</td><td>Within specified minimum and maximum outputs from 0% to 100% load</td></tr>
<tr><td>Hold up time</td><td>20 msecs following loss of power</td></tr>
<tr><td>Power monitor module (IPMON01) power input</td><td></td></tr>
<tr><td>Input power</td><td>0.3 A at 120 VAC
0.2 A at 240 VAC and 125 VDC</td></tr>
<tr><td>Frequency</td><td>47 to 63 Hz</td></tr>
<tr><td>Power monitor module (IPMON01) status signal inputs and outputs</td><td></td></tr>
<tr><td>System bus voltage monitor trip points</td><td>
<table>
<tr><th rowspan="2">Voltage Bus Nominal (VDC)</th><th colspan="2">Low Trip</th><th colspan="2">High Trip</th></tr>
<tr><th>Min</th><th>Max</th><th>Min</th><th>Max</th></tr>
<tr><td>5</td><td>4.75</td><td>4.80</td><td>NA[1]</td><td>NA[1]</td></tr>
<tr><td>15</td><td>14.50</td><td>14.70</td><td>NA[1]</td><td>NA[1]</td></tr>
<tr><td>-15</td><td>-14.50</td><td>-14.70</td><td>NA[1]</td><td>NA[1]</td></tr>
<tr><td>25.5</td><td>24.20</td><td>24.50</td><td>NA[1]</td><td>NA[1]</td></tr>
<tr><td>25.5 (aux)</td><td>21.40</td><td>21.60</td><td>27.00</td><td>27.40</td></tr>
<tr><td>48 (aux)</td><td>42.50</td><td>43.35</td><td>54.00</td><td>54.60</td></tr>
<tr><td>125 (aux)</td><td>113.05</td><td>115.05</td><td>142.75</td><td>144.75</td></tr>
</table>
NOTE: 1. Power module provides overvoltage protection.
</td></tr>
<tr><td>Input voltage monitor trip points</td><td>
<table>
<tr><th rowspan="2">Input Voltage (Nominal)</th><th colspan="2">Low Trip[1]</th></tr>
<tr><th>Min</th><th>Max</th></tr>
<tr><td>120 VAC</td><td>88</td><td>90</td></tr>
<tr><td>240 VAC</td><td>176</td><td>180</td></tr>
<tr><td>125 VDC</td><td>88</td><td>90</td></tr>
</table>
NOTE: 1. The MPS II system will operate at voltages as low as the input voltage monitor low trip point, however operation below the minimum system input voltage specification is not recommended.
</td></tr>
<tr><td>Logic status inputs</td><td>2 inputs, logic 0 = fault
Logic 0 ≤ 0.8 VDC at 10 mA sink current
Logic 1 ≥ 3.1VDC at 80 µA source current</td></tr>
<tr><td>Fan status inputs</td><td>2 inputs for fan speed monitoring of low fan speed (fan speed controlled as a function on internal cabinet temperature)</td></tr>
<tr><td>Power fail interrupt (PFI)</td><td>1 output, open collector driven (nonisolated), logic 0 = power failure
Logic 0 ≤ 0.8 VDC at 10 mA sink current
Logic 1 ≥ 4.75 to 5.25 VDC at 80 µA source current</td></tr>
</table>

Table 1-4. Specifications (continued)

Property	Characteristic/Value
Power monitor module (IPMON01) status signal inputs and outputs (continued)	
Status out	1 output, open collector driven (nonisolated), logic 0 = fault Logic 0 ≤ 0.8 VDC at 10 mA sink current Logic 1 ≥ 4.75 to 5.25 VDC at 80 µA source current
Bus alarm	1 output, opto-isolated open collector driven (24 V), logic 1 = fault Logic 0 ≤ 1.2 VDC at 150 mA sink current Logic 1 ≥ 5 to 30 VDC at 80 µA source current
Power alarm	1 output, opto-isolated open collector driven (24 V), logic 1 = fault Logic 0 ≤ 1.2 VDC at 150 mA sink current Logic 1 ≥ 5 to 30 VDC at 80 µA source current
I/O alarm	1 output, opto-isolated open collector driven (24 V), logic 1 = fault Logic 0 ≤ 1.2 VDC at 150 mA sink current Logic 1 ≥ 5 to 30 VDC at 80 µA source current
Power module chassis (IPCHS01) capacity	
Input power capacity	20 A max. per side
Output bus capacity	85 A at 5.1 VDC max. 15 A at ±15.1 VDC max. 85 A at 25.5 VDC max. 12 A at 48 VDC max. 12 A at 125 VDC max.
Power entry circuit breaker and switch (IPECB11/13 and IPEWS11/13)	
Input voltage IPECB11 and IPEWS11 IPECB13 and IPEWS13	 102 to 264 VAC 102 to 144 VDC
Input current	20 A max.
Voltage drop across breaker and switch	2 V drop at 20 A nominal
System fans	
Input power IPFAN11 IPFAN12 IPFAN13	 0.6 A nominal at 120 VAC 0.4 A nominal at 240 VAC 0.7 A nominal at 125 VDC
Frequency	47 to 63 Hz
Environmental	
Electromagnetic/radio frequency interference	Meets IEC 801.3, level 3, 80 MHz to 1 GHz with no loss of function or false status information for all units. **NOTE:** Do not use RFI sources producing 10 V/m at 84.9 MHz within 2.2 m (7.2 ft) of the MPS II system
Fast transient/burst susceptibility	Meets IEC 801.4, level 3, mains 2 kV at 2.5 kHz, outputs 1 kV at 5.0 kHz with no loss of function or false status information
Transient surge	Meets IEC 801.5, level 3, 2 kV with no loss of function or false status information
Electrostatic discharge	Meets IEC 801.2, level 3 with no loss of function or false status information

Table 1-4. Specifications (continued)

<table>
<tr><th>Property</th><th>Characteristic/Value</th></tr>
<tr><td>Environmental (continued)</td><td></td></tr>
<tr><td>Temperature
Operating enclosure (internal)
Operating enclosure (external)
Storage and transport</td><td>
0° to 70°C (32° to 158°F)
0° to 55°C (32° to 131°F)
-40° to 85°C (-40° to 185°F)</td></tr>
<tr><td>Relative humidity
Operating</td><td>20% to 90% up to 55°C (131°F) noncondensing
20% to 45% at 55° to 70°C (131° to 158°F) noncondensing</td></tr>
<tr><td>Altitude
Operating
Storage and transport</td><td>
Sea level to 3,048 m (10,000 ft)
Up to 9,144 m (30,000 ft)</td></tr>
<tr><td>Air quality</td><td>Noncorrosive per ISA S71.04 class LA, LB, LC severity level 1</td></tr>
<tr><td>Weight and dimensions</td><td>
<table>
<tr><th>Component[1]</th><th>Weight kg (lb)</th><th>Height mm (in.)</th><th>Width mm (in.)</th><th>Depth mm (in.)</th></tr>
<tr><td>IPBLK01 Power Blank Faceplate</td><td>0.89 (1.95)</td><td>218.40 (8.60)</td><td>48.30 (1.90)</td><td>444.50[2] (17.50)</td></tr>
<tr><td>IPCHS01 Power Module Chassis</td><td>7.55 (16.60)</td><td>223.50 (8.80)</td><td>482.60 (19.00)</td><td>444.50 (17.50)</td></tr>
<tr><td>IPECB11/13 Power Entry Circuit Breaker</td><td>2.55 (5.60)</td><td>114.30 (4.50)</td><td>193.04 (7.60)</td><td>162.56 (6.40)</td></tr>
<tr><td>IPESW11/13 Power Entry Switch</td><td>2.55 (5.60)</td><td>114.30 (4.50)</td><td>193.04 (7.60)</td><td>162.56 (6.40)</td></tr>
<tr><td>IPFAN11/12/13 Power System Fan</td><td>3.23 (7.10)</td><td>152.40 (6.00)</td><td>210.82 (8.30)</td><td>444.50 (17.50)</td></tr>
<tr><td>IPFCH01 Power Fan Chassis</td><td>10.20 (22.40)</td><td>203.20 (8.00)</td><td>482.60 (19.00)</td><td>472.44 (18.60)</td></tr>
<tr><td>IPFLD01 Field Power Module</td><td>2.36 (5.20)</td><td>218.40 (8.60)</td><td>48.30 (1.90)</td><td>444.50[2] (17.50)</td></tr>
<tr><td>IPFLD24 Field Power Module</td><td>2.49 (5.46)</td><td>218.40 (8.60)</td><td>48.30 (1.90)</td><td>444.50[2] (17.50)</td></tr>
<tr><td>IPFLD48 Field Power Module</td><td>2.55 (5.62)</td><td>218.40 (8.60)</td><td>48.30 (1.90)</td><td>444.50[2] (17.50)</td></tr>
<tr><td>IPFLD125 Field Power Module</td><td>2.55 (5.62)</td><td>218.40 (8.60)</td><td>48.30 (1.90)</td><td>444.50[2] (17.50)</td></tr>
<tr><td>IPMON01 Power Monitor Module</td><td>0.71 (1.56)</td><td>218.40 (8.60)</td><td>35.56 (1.40)</td><td>401.32 (15.80)</td></tr>
<tr><td>IPSYS01 System Power Module</td><td>2.55 (5.60)</td><td>218.40 (8.60)</td><td>48.30 (1.90)</td><td>444.50[2] (17.50)</td></tr>
</table>
NOTES:
1. The total system weight is 48 kg (106 lb) maximum.
2. Dimension includes the handle.
</td></tr>
<tr><td>Installation category</td><td>IEC 1010-1
Category III, for mains
Category II, for mains to the IPCHS01 chassis
Category I, for outputs</td></tr>
<tr><td>Vibration</td><td>13.2 to 100 Hz, 0.7 Gs
2 to 13.2 Hz, 12 mm (0.47 in.) peak-to-peak displacement</td></tr>
</table>

Table 1-4. Specifications (continued)

Property	Characteristic/Value
Certification	
CSA C22.2, No. 142	Certified for process control equipment in an ordinary (nonhazardous) environment
FM	Class I, Division 2, Groups A, B, C, D

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

SECTION 2 - DESCRIPTION AND OPERATION

INTRODUCTION

Section 2 explains the functional operation of the INFI 90 OPEN Modular Power System II. The Modular Power System II consists of system power modules and field power modules, a power monitor module, power module chassis, power entry circuit breakers or switches, power fan chassis and fan assemblies. Figure 2-1 shows the system architecture of the INFI 90 OPEN Modular Power System II.

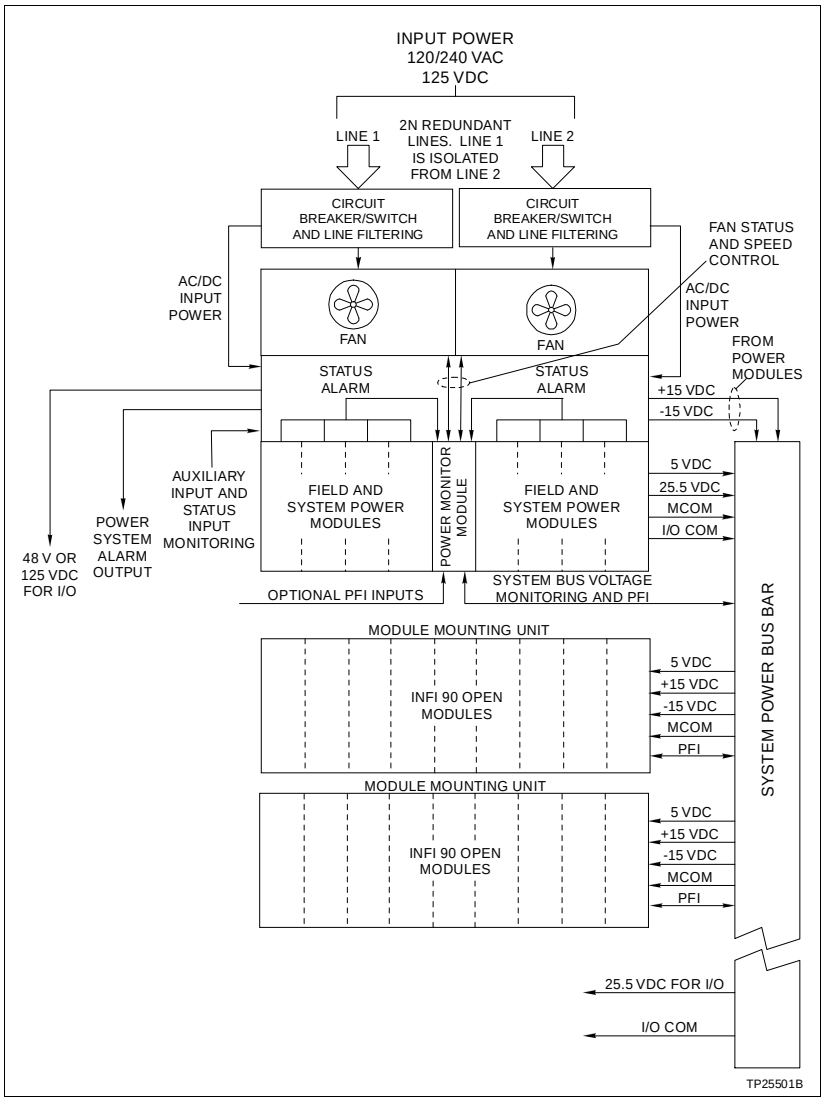

Figure 2-1. Modular Power System II Architecture

POWER ENTRY

The IPECB11 or IPECB13 Power Entry Circuit Breaker and IPESW11 or IPESW13 Power Entry Switch connects 120/240 VAC (50/60 hertz) or 125 VDC line power to an INFI 90 OPEN system cabinet. The power entry circuit breaker or switch normally mounts on the rear of the IPFCH01 Power Fan Chassis. The power entry switch is for use in hazardous locations. Both the power circuit breaker and switch provide power line filtering.

Two power entry circuit breakers or switches are installed in systems requiring 2N redundancy; one power entry circuit breaker or switch is installed for N, N+1 or N+x redundancy. Two independent power input lines feed 2N redundant systems. Having two power entry circuit breakers or switches feed isolated power input terminals on the IPCHS01 Power Module Chassis backplane make it possible to feed a 2N redundant power system with mixed input voltages (i.e., 125 VDC and 120 VAC, 120 VAC and 240 VAC, etc.).

POWER DISTRIBUTION

Filtered input power is fed from the power entry circuit breaker or switch to terminals on the IPCHS01 Power Module Chassis backplane, where it is distributed to the power modules that are mounted in any of eight mounting slots in the power module chassis. The power module chassis backplane isolates the input lines of 2N redundant systems and each isolated input distributes power to four of the eight chassis slots. On N, N+1 and N+x redundant systems, these isolated power inputs are both connected to the same power entry circuit breaker or switch via a jumper on the power module chassis.

System power bus bars and field power bus bars are mounted on the power module chassis backplane (Fig. 2-2). Refer to the caution on installation of IPFLD48 and IPFLD125 field power modules. Refer to Table 2-1 for power module bus bar requirements and to Figure 2-2 for location of bus bars and connectors. Also mounted on the power module chassis backplane are various connectors for ±15 VDC, fan power, alarm outputs, optionally selected auxiliary input and status input monitoring, and system bus voltage and power fail interrupt (PFI) monitoring. Cables connect the power module chassis backplane bus bars to the system power bus bar that distributes system power to the module mounting units inside the cabinet. Wiring from the +15 and -15 terminals on the backplane connects ±15 VDC to the system power bus bar.

CAUTION	**Do not install the IPFLD48 and IPFLD125 field power modules together in the same IPCHS01 chassis. Equipment damage will result.**
ATTENTION	**Ne pas installer les modules d'alimentation de champ IPFLD48 et IPFLD125 dans le même châssis IPCHS01. CECI causerait des dommages à l'équipement.**

Table 2-1. Power Module/Bus Bar Requirements

Power Module	IPCHS01 Bus Bar
IPSYS01	+5 VDC +15 VDC (TB1)[1] -15 VDC (TB1)[1] MCOM +25.5 VDC I/O COM
IPFLD01	+25.5 VDC I/O COM
IPFLD24	+25.5 VDC I/O COM
IPFLD48[2]	48/125 VDC (TB4) I/O COM
IPFLD125[2]	48/125 VDC (TB4) I/O COM

NOTES:
1. +15, -15, 48/125 VDC bus bars are contained within the printed circuit board.
2. IPFLD48 and IPFLD125 field power modules cannot be used in the same IPCHS01 power module chassis.

SYSTEM COOLING

Cabinet cooling is provided by redundant fans which mount in the IPFCH01 Power Fan Chassis at the top of the cabinet. Both fans operate at a controlled speed (high or low). During normal operation, both fans operate at a low speed depending on cabinet cooling requirements. If the internal cabinet temperature goes above 50 degrees Celsius (122 degrees Fahrenheit), the fans operate at high speed. When the ambient cabinet temperature goes below 40 degrees Celsius (104 degrees Fahrenheit), the fans operate at low speed.

Cabinet temperature monitoring and speed control signals are handled by circuitry on the IPMON01 Power Monitor Module. Fan speed is monitored using a hall effect sensor. If one fan fails, the other fan can provide full cabinet cooling. Cabinet temperature is monitored from temperature sensors on the power monitor module. If cabinet overtemperature occurs or fan failure occurs, the power monitor module generates a power system alarm. Red alarm LEDs on the faceplate light to

indicate the cause of the failure or problem. Refer to ***POWER MONITOR MODULE*** for more information on these features.

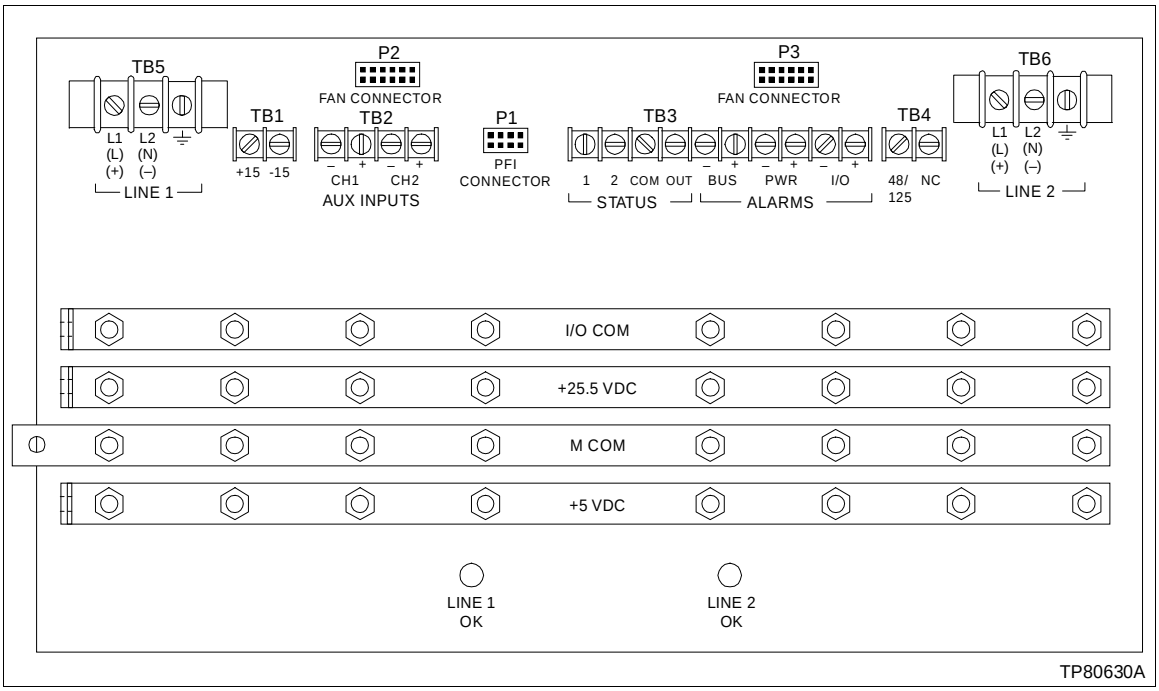

Figure 2-2. IPCHS01 Backplane Bus Bars and Connectors

POWER MONITOR MODULE

There are a variety of power monitor module configurations available that enable the INFI 90 OPEN power system to be tailored to growing or changing power monitoring and alarm requirements. Figure 2-3 shows a block diagram of the power monitor module status signal logic.

AC/DC Inputs

The power monitor module inputs 120/240 VAC or 125 VDC power from the power module chassis backplane. In 2N redundant systems, the power input lines to the power monitor module are isolated on the circuit board. Inputs are regulated to generate 5, 15 and -15 VDC power and reference voltages for monitoring system bus voltages. Both AC inputs are fed through isolation circuitry to the power input monitoring circuitry and then to status signal logic. The status signal logic drives three LEDs that indicate the status of the AC/DC input lines: line one, line two and external. The line one and line two LEDs are green during normal operation and turn red to indicate bad status. The external LED is off during normal operation and turns red to indicate bad status.

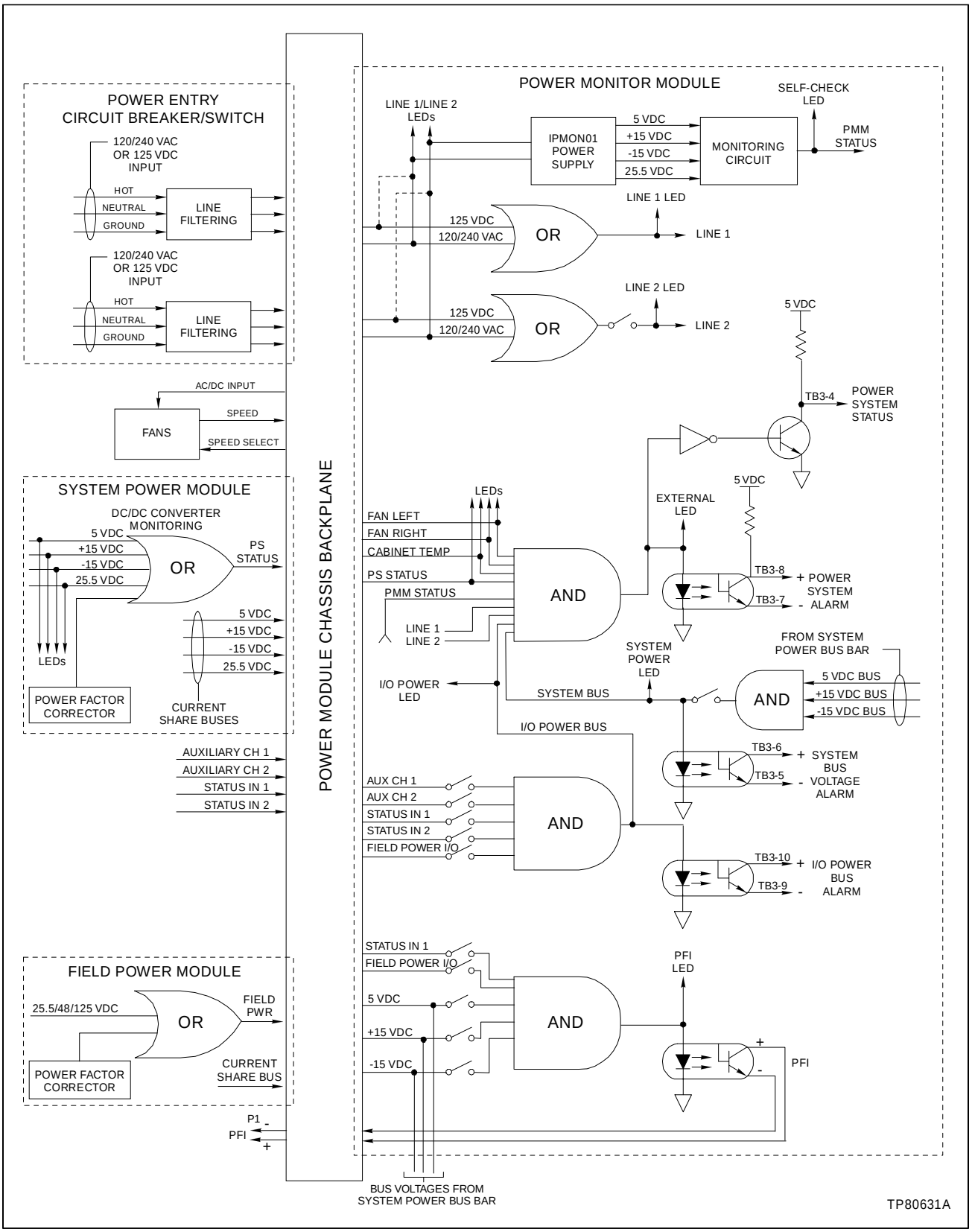

Figure 2-3. Status Signal Block Diagram

Power Monitor Module Status

The power monitor module monitors the status of its internal power module voltage buses and reference voltages. If circuitry fails, resulting in an on-board power failure or out of tolerance voltage, a monitor module status signal drives the self-check LED (green for good status, red for bad status) on the module faceplate. Additionally, this signal is fed into the status signal logic circuitry and output to the external LED.

Power Module Monitoring

The power module sends a status signal to the power monitor module (refer to ***POWER MODULES***). The power monitor module inputs two power module status inputs: one status input from each side of the isolated mounting slots in the power mounting chassis. Thus, both sets of power modules in a 2N redundant system are monitored. An N, N+1 or N+x redundant system also uses both power status inputs. The power module status input to the power monitor module isolates the signal, then feeds it to the status logic circuitry. A bad status signal logically turns on the external LED on the power monitor faceplate. The bad status signal also causes the isolated output of the power system alarm (user alarm) to turn off (normally closed). A power system status alarm is also issued to the cabinet communication modules for transmission over the Plant Loop or INFI-NET communication network to operator interface station monitors.

System Bus and I/O Voltage Monitoring

The power monitor module monitors the system bus voltages (5, 15 and -15 VDC outputs of power system modules) via a power module chassis cable connection to the system power bus bar. The system bus voltages are compared to reference voltages on the power module. Dipswitches in the status signal logic circuitry allow a selection of using the PFI, I/O power, or system power LEDs (in any combination) when a system bus voltage failure or out of tolerance condition occurs.

If enabled, a failed system bus can cause a system bus voltage alarm, I/O power bus alarm, power system alarm, or PFI alarm. The system bus voltage alarm, I/O power alarm, and power system alarm are isolated outputs that can be used to drive annunciator panels or relays. A power system status signal is also routed internally to communication modules within the cabinet so that the power system status can be placed on the communication network (Plant Loop or INFI-NET) and sent to operator interface station monitors.

Field I/O voltage (25.5 VDC, 48 VDC or 125 VDC) is moni tored via the power module chassis backplane. The field I/O voltage bus circuitry operates in the same manner as the system bus

voltage circuitry. The field I/O voltage monitoring circuitry can be enabled to use the I/O power or PFI LED (any combination) upon a bus failure or out of tolerance condition.

Fan and Temperature Monitoring

The power monitor module monitors fan rotation speed and cabinet temperature. It contains the control circuitry required to control fan speed based on the cabinet temperature.

A jumper on the module selects the high temperature limit for the cabinet: 50, 60 or 70 degrees Celsius (122, 140 or 158 degrees Fahrenheit). The cabinet temperature is compared to the jumper-selected high temperature limit and a signal is sent to the signal logic circuitry if the internal cabinet temperature is above the limit. The signal logic circuitry ORs the two temperature sensor signals to drive the cabinet temp LED and the external LED red for an overtemperature condition. The signal is sent to the power system output isolation circuitry where it departs the circuit board as a power system alarm and power system status signal.

Fan speed is detected with a hall effect sensor. This information is sent to circuitry that reads the fan speed and sends a speed adjusting signal to the fan motor depending on the cabinet temperature. The fans operate at high speed when the internal cabinet temperature goes above 50 degrees Celsius (122 degrees Fahrenheit). When the internal cabinet temperature falls below 40 degrees Celsius (102 degrees Fahrenheit), the fans operate at a low speed. Each fan status signal is sent to its corresponding LED: fan left or fan right. The fan status signals are sent to the signal logic circuitry where they are ANDed. The result is sent to the external LED and on to the power system output isolation circuitry where it departs the circuit board as a power system status signal and power system alarm (if an error condition exists).

Auxiliary and Status Inputs

The auxiliary and status inputs use the same signal logic circuitry and alarm scheme as the system bus voltage and I/O power bus monitoring systems. There are two auxiliary channel inputs that can be used to monitor external sources (24, 48 or 125 VDC). The two status inputs are logic level status inputs that monitor contact specific logic inputs. Setting jumpers on these inputs selects either normally open (N.O.) or normally closed (N.C.) contact inputs.

The auxiliary channel inputs operate in the same manner as the field I/O voltage inputs except that jumpers must be set to select 24, 48 or 125 VDC high and low trip points. The auxiliary channel input monitoring circuitry can be enabled to use

the I/O power LED upon a bus failure or out of tolerance condition.

The status inputs have additional circuitry for setting up operation as N.O. or N.C. contacts. Status input one can be enabled to use the PFI and I/O power LEDs (any combination). Thus, a status input one failure can alarm via the PFI alarm, power system alarm, and I/O power bus alarm. Status input two can only be enabled to operate on the I/O power bus. A failure on status input two will issue a power system alarm and I/O power bus alarm, and red light the I/O power and external LEDs.

POWER MODULES

There are five power modules: IPSYS01 System Power Module, IPFLD01, IPFLD24, IPFLD48 and the IPFLD125 Field Power Modules. The system power module outputs 5, 15, -15 and 25.5 VDC power. The IPFLD01 and IPFLD24 outputs 25.5 VDC while the IPFLD48 outputs 49.1 VDC and the IPFLD125 outputs 125.6 VDC. Power modules accept 120/240 VAC and 125 VDC input power.

The AC input power modules have power factor correction circuitry that corrects the power factor to greater than 0.95. AC power enters the fused input of the power module, and is rectified and amplified to 380 VDC by the power factor correction circuitry. This DC voltage supplies the input to the DC/DC converters that produce the system and I/O bus voltage.

Each DC/DC converter output has an associated current sharing bus. This circuitry regulates how much current is delivered from each power module in the system. In 2N systems under normal operation, the modules will be delivering approximately half power or less. If one of the AC lines fails, the redundant set of modules increases their current output to meet the demand of the cabinet. When power is restored to the failed input line, all modules share the current load and return to operating at half power or less.

Each of the system voltage current sharing buses and the I/O power bus are monitored for DC/DC converter overcurrent and failure. If any of the DC/DC converters go into overcurrent, the associated LED on the power module faceplate blinks green (solid green is normal operation). A red LED indicates a voltage failure.

The system bus voltages are logically ANDed to produce a system status signal (internal to the power module). Figure 2-4 shows the power module status signal logic. The system status signal, the 25.5 VDC overcurrent condition, and the logic signal from the power factor corrector monitor are logically ORed to produce the power module status signal. This isolated status

signal is monitored by the power monitor module (refer to ***Power Module Monitoring***). Figure 2-5 shows the field power module signal status.

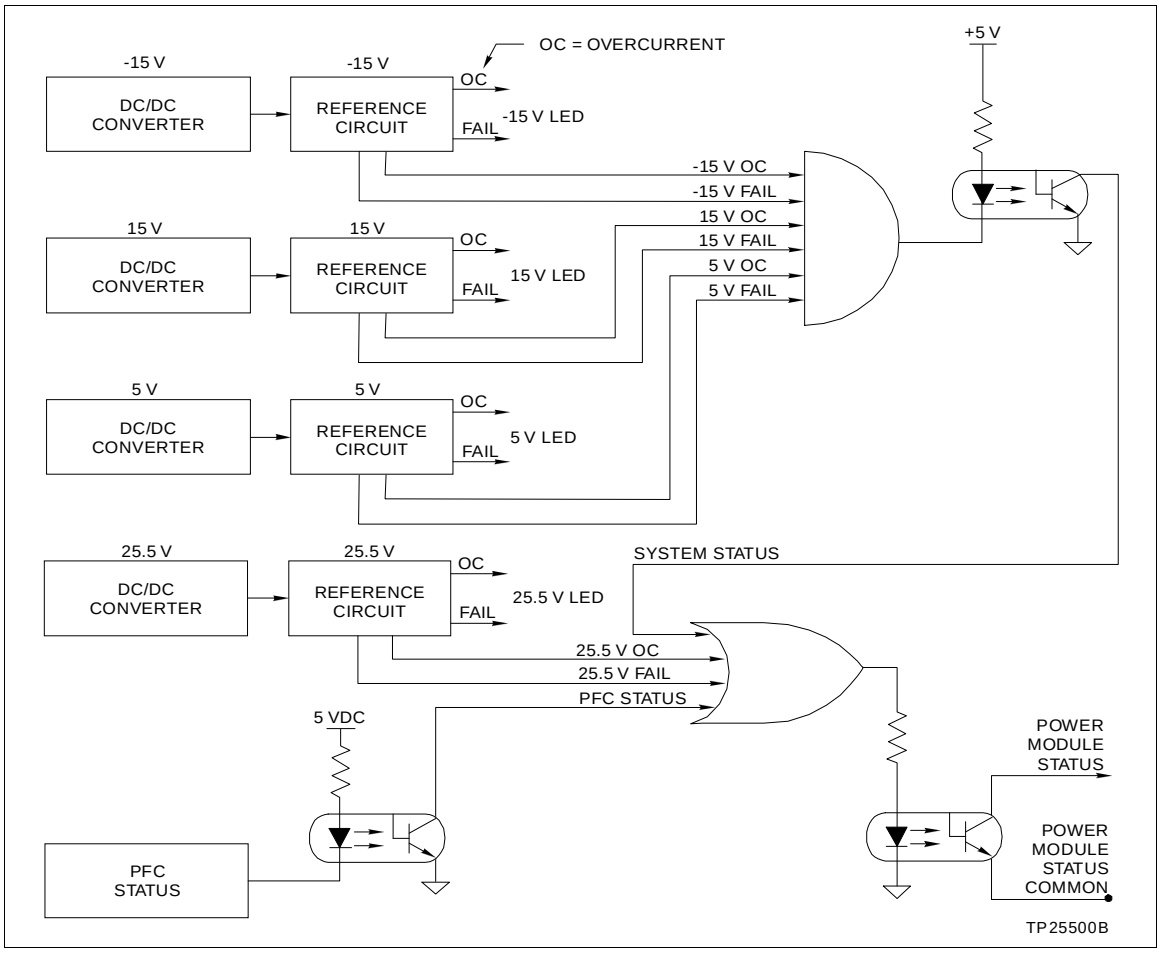

Figure 2-4. IPSYS01 Status Signals

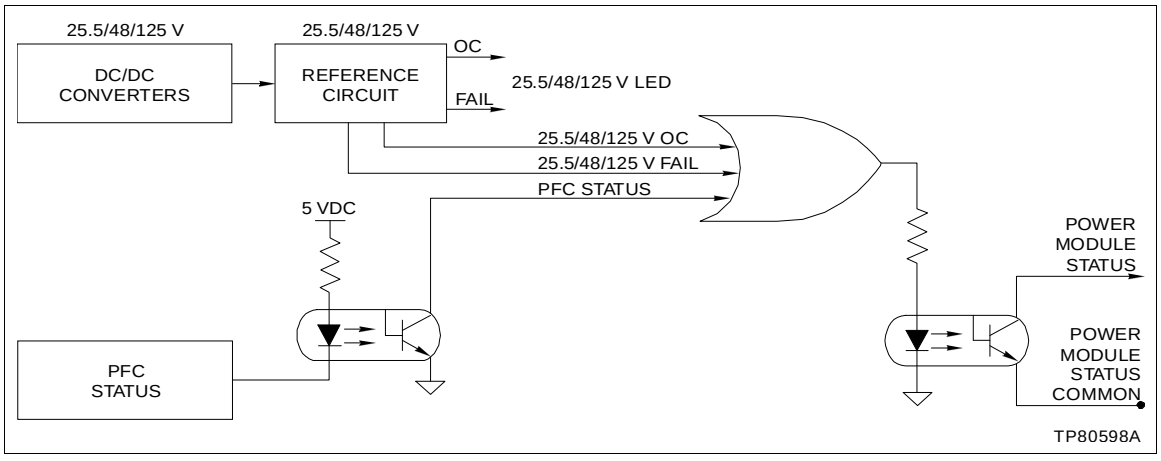

Figure 2-5. IPFLD Field Power Module Status Signals

SECTION 3 - INSTALLATION

INTRODUCTION

Section 3 explains hardware preparation and installation in detail. The information applies to new installations. Follow the procedures in this section to install the INFI 90 OPEN Modular Power System II before applying power to the system.

> **NOTE:** Normally, the cabinet is fully wired and ready to go upon receipt. The following information is provided in the event that repair, replacement, rewiring or additions to the INFI 90 OPEN Modular Power System II need to be made. Refer to ***AC/DC FEEDER LINES*** to install input power feeder lines to the power entry circuit breaker or switch. Feeder lines should be suitable for environments that are 15 degrees Celsius (27 degrees Fahrenheit) above the highest surrounding ambient temperature.

SPECIAL HANDLING

Observe these steps when handling electronic circuitry:

> **NOTE:** Always use Elsag Bailey's field static kit (part number 1948385□1 - 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 Semiconductors.*** Verify that all devices connected to the modules are properly grounded before using them.

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

6. ***Use an 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 circuit breaker or switch and on the front of the fans at the earth

grounding point. The grounding plug on the power entry circuit breaker or switch 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.

UNPACKING AND INSPECTION

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

2. Notify the nearest Elsag Bailey sales office of any 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.

POWER SYSTEM INSTALLATION

Always install the system components in the following order.

1. Install the system power cables (5 VDC, MCOM, 15, -15, and 25.5 VDC, I/O COM and 24 VDC) to the cabinet system power bus bar.

2. Mount the fan chassis.

3. Mount the power module chassis.

4. Install the fan cables.

5. Install the fans.

6. Mount the power entry circuit breakers or switches.

7. Complete the installation of system wiring, including customer wiring for 48/125 VDC.

8. Connect the grounding studs on the power entry circuit breakers or switches and fan chassis to AC safety ground.

9. Connect the AC/DC feeder lines to the power entry circuit breakers or switches.

10. Install the power monitor module, power modules and blank faceplates.

INSTALLING SYSTEM POWER CABLES

Connect the 5 VDC, MCOM, 25.5 VDC and I/O COM system power cables to the system power bus bar before installing anything else. Refer to Appendix C for wiring diagrams. Refer to Table 7-1 for a list of cable part numbers. To install the system power cables:

1. Connect one end of the 5 VDC cable to the 5 V connector at the top of the system power bus bar (top connector on the system power bus bar). Use a No. ¼-28 x 0.5-inch brass cap screw and nut with two external tooth lockwashers provided with the INFI 90 OPEN Modular Power System II. There should be a lockwasher used on each side of the system bus bar (Fig. 3-1).

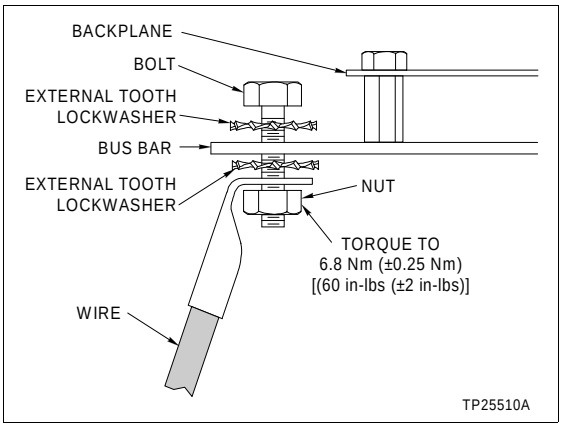

Figure 3-1. Connecting System Power Cables

2. Connect the straight ring lug end of the MCOM cable to the MCOM bus bar (second connector from the top of the system power bus bar). Use a No. ¼-28 x 0.5-inch brass cap screw and nut with two external tooth lockwashers provided with the INFI 90 OPEN Modular Power System II. There should be a lockwasher used on each side of the system bus bar (Fig. 3-1).

3. Connect one end of the I/O COM cable to the I/O common connector at the top of the system power bus bar (third connector from the top of the system bus bar). Use a No. ¼-28 x 0.5-inch brass cap screw and nut with two external tooth lockwashers provided with the INFI 90 OPEN Modular Power System II. There should be a lockwasher used on each side of the system bus bar (Fig. 3-1).

4. Connect one end of the 25.5 VDC cable to the 24 V connector at the top of the system power bus bar (fourth connector from the top of the system power bus bar). Refer to Appendix C

for a wiring diagram of the system power bus bar. Use a No. ¼-28 x 0.5-inch brass cap screw and nut with two external tooth lockwashers provided with the INFI 90 OPEN Modular Power System II. There should be a lockwasher used on each side of the system bus bar (Fig. 3-1).

5. Connect the quick connector end of the 15 VDC cable to the 15 V tab at the top of the system power bus bar (Fig. C-3).

6. Connect the quick connector end of the -15 VDC cable to the -15 V tab at the top of the system power bus bar (Fig. C-3).

CHASSIS MOUNTING

There are two chassis to mount: IPFCH01 Power Fan Chassis and IPCHS01 Power Module Chassis. The chassis occupy approximately 381 millimeters (15 inches) of vertical space at the top of the cabinet, 152.75 millimeters (6.25 inches) for the fan chassis, and 222.3 millimeters (8.75 inches) for the power module chassis.

NOTE: The power module chassis and fan chassis must always be mounted at the top of the cabinet to insure proper cabinet cooling.

IPFCH01 Power Fan Chassis Mounting

Mount the fan chassis to the side rails inside the cabinet. To mount the fan chassis:

1. The fan chassis requires four No. 10-32 clip nuts and six No. 10-32 self-lock bolts (included with the chassis). Determine where the clip nuts will go in the cabinet side mounting rails and clip them to the side rails. Figure 3-2 shows the spacing required for the clip nuts.

2. Insert the fan chassis into its mounting position from the rear of the cabinet. The openings for fan assembly mounting face the front of the cabinet and the power connectors on the fan chassis backplane face the rear of the cabinet.

3. Align the four mounting screw holes on the side flanges of the fan chassis with the clip nuts that are clipped to the side mounting rails inside the cabinet, and secure the fan chassis in place using the four self-lock bolts.

4. Install two self-lock bolts in the mounting holes on the front top side of the fan chassis to secure it to the upper mounting bracket (Fig. 3-2).

NOTE: The upper mounting bracket is supplied with the cabinet assembly.

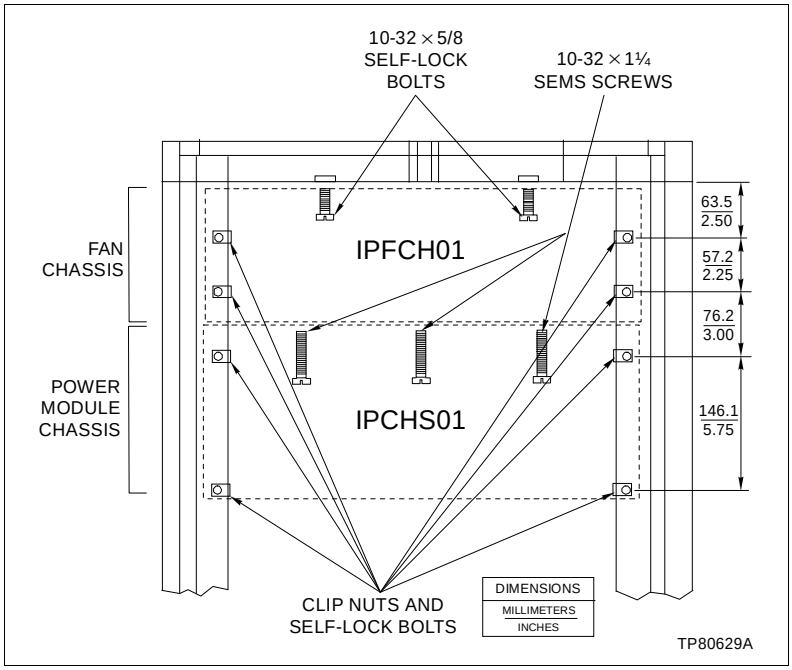

Figure 3-2. Clip Nut Spacing

IPCHS01 Power Module Chassis Mounting

Mount the power module chassis to the top side rails inside the INFI 90 OPEN or Network 90 cabinet. The power module chassis mounts directly below the fan chassis. To mount the power module chassis:

1. The power module chassis requires four No. 10-32 clip nuts and four No. 10-32 self-lock bolts for mounting (included with the power module chassis). Determine where the four No. 10-32 clip nuts will go in the cabinet side mounting rails (Fig. 3-2) and clip them to the side rails.

2. Insert the power module chassis into its mounting position from the rear of the cabinet. The slot openings for power modules and the power monitor module face the front of the cabinet and the power module chassis backplane faces the rear of the cabinet.

3. Align the four mounting screw holes on the side flanges of the power module chassis with the clip nuts that are clipped to the side mounting rails inside the cabinet and secure the power mounting unit in place using the four self-lock bolts .

4. Install three No. 10-32 x 1-¼ Sems screws (supplied with IPFCH01 chassis) to secure the front edge of the IPCHS01 chassis to the front edge of the IPFCH01 chassis (Fig. 3-2).

INSTALLING THE FAN ASSEMBLY

WARNING	**Insure the fan blades have stopped rotating before removing the fan assembly from the fan chassis. Removing an operating fan assembly exposes rotating fan blades that can cause injury.**
AVERTISSEMENT	**S'assurer que les pales du ventilateur sont arrêtées avant de retirer le ventilateur de son châssis. En retirant un ventilateur toujours en marche, le pales du ventilateur sont exposées, ce qui peut causer des blessures.**

The fan assemblies insert into the fan chassis from the front of the cabinet. When fully inserted, a connector on the back of the fan assembly makes contact with the power connector mounted on the backplane of the fan chassis.

NOTE: Each fan assembly nomenclature includes a unique power cable. Table 3-1 lists the cable required per fan assembly nomenclature and input voltage. Two labels showing the required voltage are included with each cable. Place one label on the front of the fan chassis and one label beside the input power terminal strip (TB5 or TB6) for that fan assembly (Figs. 3-3 through 3-6).

Table 3-1. Fan Cable Part Numbers

Nomenclature	Cable Part Number	Operating Voltage
IPFAN11	6641557□1	120 VAC
IPFAN12	6641557□2	240 VAC
IPFAN13	6641557□3	125 VDC

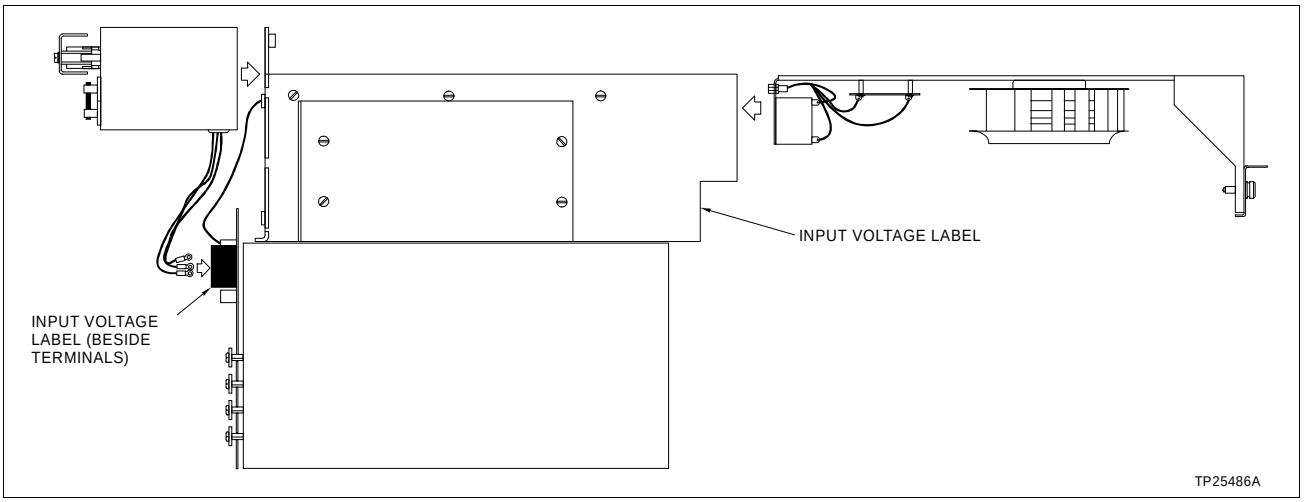

Figure 3-3. Power Entry Circuit Breaker or Switch and Fan Assembly Installation (Side View)

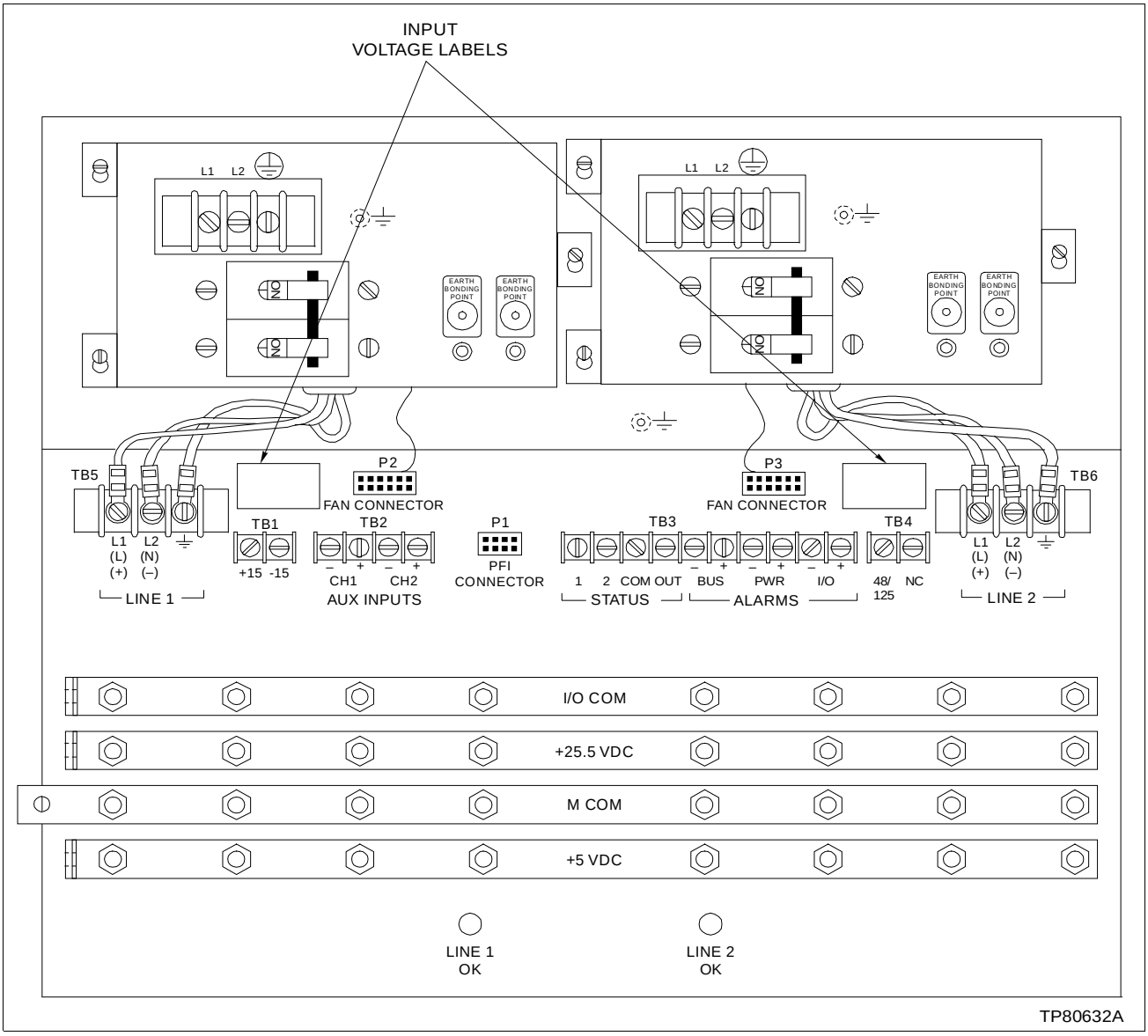

Figure 3-4. Power Entry Circuit Breaker or Switch Installation (Rear View)

To install a fan assembly:

1. Install the fan cable by inserting the J1 connector of the fan cable into the opening in the back of the fan chassis. Note the orientation of the J1 connector in Figure C-3 to properly install the fan cable.

2. Insert the J2 connector of the fan cable to the appropriate connector directly below it on the power module chassis back-plane (P2 or P3).

3. Using the supplied cable tie, secure the fan cable to the rear of the fan chassis using the H-hole provided (Fig. C-3).

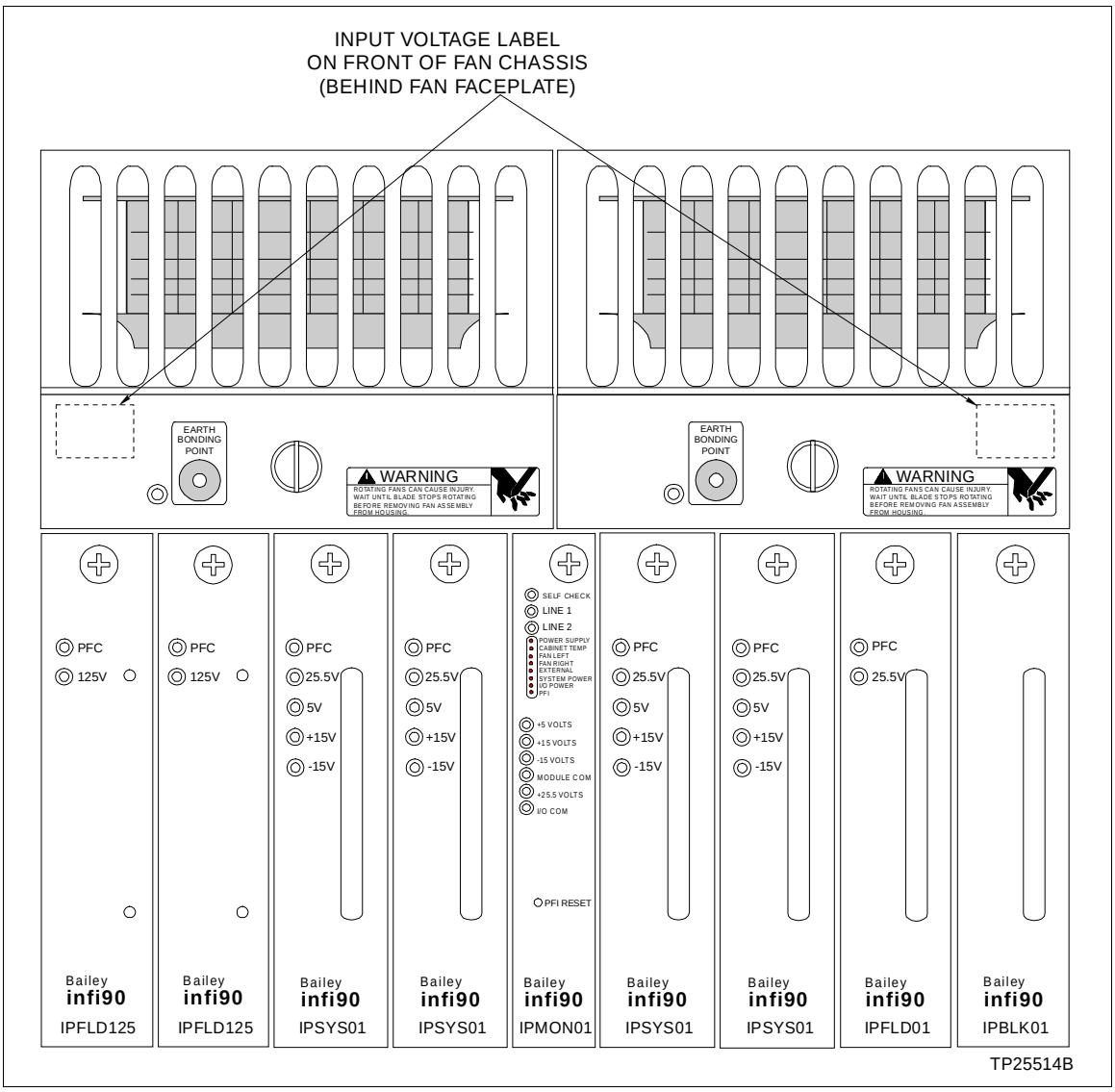

Figure 3-5. Example Mounting Sequence (IPMON01, IPSYS01, IPFLD01, IPBLK01, IPFLD125)

4. Place one of the labels (included with the fan cable) indicating the operating voltage on the front of the fan chassis (Figs. 3-3, 3-5 and 3-6). Place the other label beside the terminal strip that connects input power from the main service for that fan assembly (Fig. 3-4).

5. Engage the rails at the top of the fan assembly with the rails at the top of the fan chassis and insert the fan assembly into the fan chassis (Fig. 3-3).

6. Secure the fan assembly by tightening the thumbscrew clockwise.

Repeat the procedure for the other fan assembly.

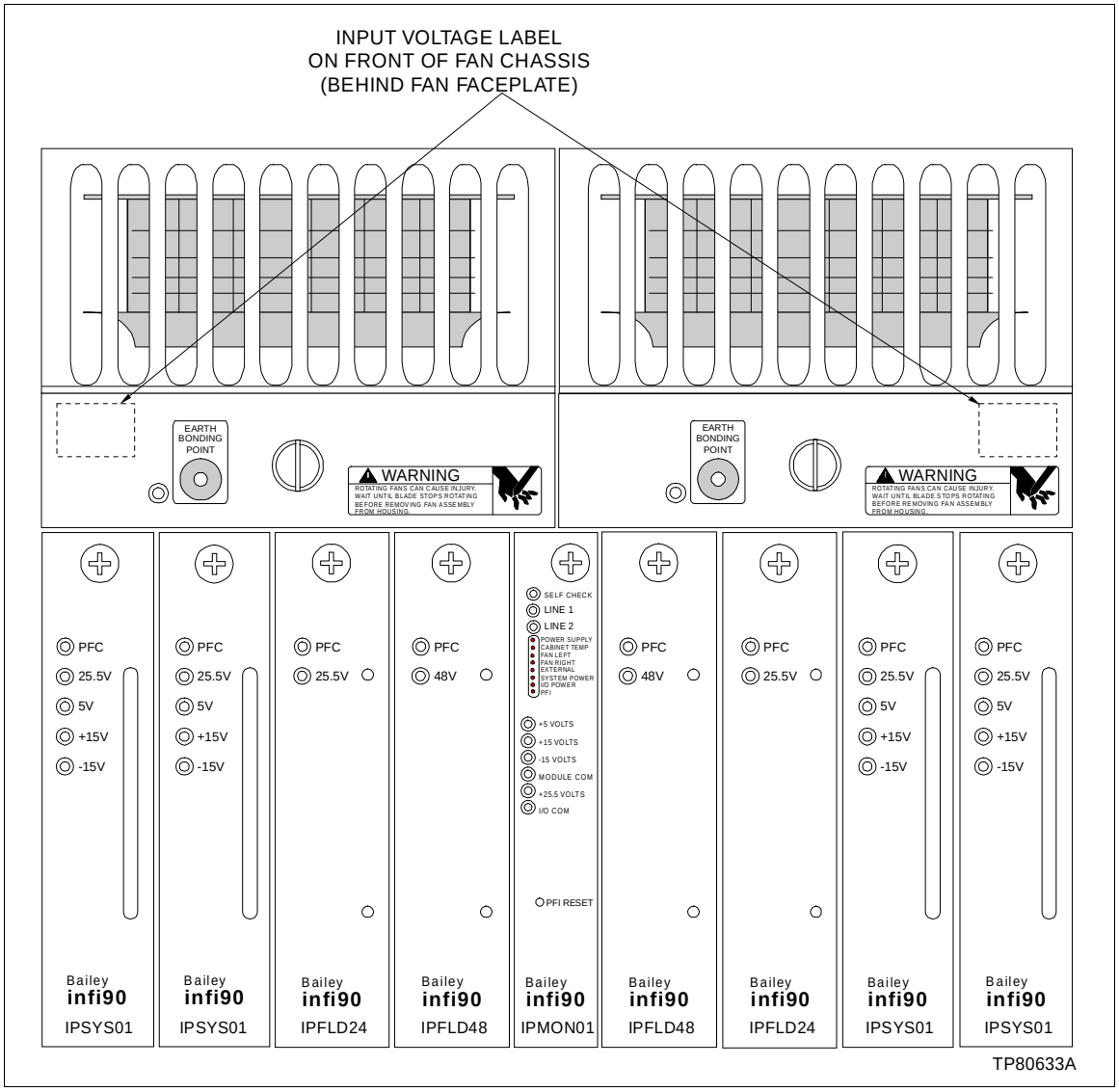

Figure 3-6. Example Mounting Sequence (IPMON01, IPSYS01, IPFLD24, IPFLD48)

POWER ENTRY CIRCUIT BREAKER OR SWITCH

Mount the appropriate power entry circuit breaker or switch to the back of the fan chassis (Fig. 3-3). Mount one power entry circuit breaker or switch for N, N+1 or N+x redundancy. For 2N redundancy, mount two power entry units. The three lead wires that connect filtered input power to the power module chassis backplane should hang down from the power entry circuit breaker or switch.

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. Install the three No. 10-32 Sems mounting screws (shipped with the power entry circuit breaker or switch) in the appropriate holes on the fan chassis. Partially tighten them leaving enough space for the key holes on the power entry circuit breaker or switch brackets to slip over the mounting screws.

2. Align the mounting bracket holes on the power entry circuit breaker or switch with the mounting screws and install by lowering the key holes on the power entry circuit breaker or switch onto the mounting screws.

> **NOTE:** The power entry circuit breaker or switch mounts over the fan power and status cable (Figs. 3-3 and 3-4). The lower side of the power entry circuit breaker or switch has been designed to protect the cable insulation. Make sure the fan cable is routed from connector to connector via the lower side of the power entry circuit breaker or switch.

3. Tighten the mounting screws to secure the power entry circuit breaker or switch.

4. Connect the three lead wires from the power entry circuit breaker or switch to the input power terminals (TB5 or TB6) directly below it on the power module chassis backplane. The terminal screws on the power module chassis backplane should be tightened to 2.3 Newton meters (20 in.-lbs).

   a. Connect the brown lead wire to the L1 terminal (hot or positive) of TB5 or TB6.

   b. Connect the blue lead wire to the L2 terminal (neutral or negative) of TB5 or TB6.

   c. Connect the yellow/green lead wire to the ground terminal (safety ground) of TB5 or TB6.

5. If the system requires 2N redundancy, repeat the procedure to install a second power entry circuit breaker or switch on the other fan chassis.

6. If the system is using N, N+1 or N+x redundancy, install the input power jumper cable that connects TB5 to TB6 on the power module chassis. Refer to Appendix C for wiring diagrams.

SYSTEM POWER WIRING (COMPLETION)

Complete the installation and connection of system power wiring. For new installations, refer to the ***Site Planning and Preparation*** instruction for power and grounding requirements of Elsag Bailey control systems. The terminal screws on the power module chassis backplane should be tightened to 2.3 Newton meters (20 inch-pounds). Nuts and bolts that secure the cables that connect the power module chassis bus bars to the system power bus bar should be tightened to 6.8 Newton meters (±0.25 Newton meters) [60 inch-pounds (±2 inch-pounds)]. Refer to Table 7-1 for a list of cable part numbers. Refer to Appendix C for wiring diagrams of the INFI 90 OPEN Modular Power System II.

Complete the installation of system power cables that connect the power module chassis backplane bus bars to the INFI 90 OPEN cabinet system power bus bar.

1. Connect the free end of the 25.5 VDC cable to the 25.5 VDC bus bar on the power module chassis backplane. Use a No. ¼-28 x 0.5 brass cap screw and nut with two external tooth lockwashers provided with the INFI 90 OPEN Modular Power System II. There should be a lockwasher used on each side of the backplane bus bar (Fig. 3-1).

2. Connect the free end of the I/O COM cable to the I/O common bus bar on the power module chassis backplane. Use a No. ¼-28 x 0.5-inch brass cap screw and nut with two external tooth lockwashers provided with the INFI 90 OPEN Modular Power System II. There should be a lockwasher used on each side of the backplane bus bar (Fig. 3-1).

3. Connect the bent ring lug end of the MCOM cable to the module common bus bar on the power module chassis backplane. Use a No. ¼-28 x 0.5-inch brass cap screw and nut with two external tooth lockwashers provided with the INFI 90 Modular Power System II. There should be a lockwasher used on each side of the backplane bus bar (Fig. 3-1).

4. Connect the free end of the 5 VDC cable to the 5 VDC bus bar on the power module chassis backplane. Use a No. ¼-28 x 0.5-inch brass cap screw and nut with two external tooth lockwashers provided with the INFI 90 OPEN Modular Power System II. There should be a lockwasher used on each side of the backplane bus bar (Fig. 3-1).

5. Connect the ring lug end of the +15 VDC cable to terminal strip TB1 (+15 terminal) on the power module chassis backplane.

6. Connect the ring lug end of the -15 VDC cable to terminal strip TB1 (-15 terminal) on the power module chassis backplane.

7. Connect the DC bus cable connector J1 to connector P1 on the power module chassis backplane.

8. Connect the seven quick connectors on the DC bus cable to the system power bus bar (refer to the wiring diagrams in Appendix C for correct wiring).

9. If the system uses a Plant Loop communication network, continue with Step 10. If the system uses an INFI-NET communication network, go to Step 12.

10. Connect cable 6634205□1 from the OUT terminal of TB3 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 network.

11. For systems with redundant BIM modules, connect another cable from the OUT terminal of TB3 to the P3 edge connector of the redundant BIM module. Only one pair of redundant BIM modules per cabinet need to be connected to TB3. Go to Step 18.

12. Crimp a ring lug to both ends of an 18 to 14 AWG wire.

13. Connect one end of the 18 to 14 AWG wire to the OUT terminal on terminal strip TB3 on the power module chassis backplane. Connect the other end of the wire to TB1-8 on the NTCL01 termination unit.

14. If two NTCL01 termination units connect to redundant network interface modules, attach another wire with ring lugs to terminal strip TB3 on the power module chassis backplane. Connect the other end of the wire to TB1-8 on the redundant NTCL01 termination unit.

15. For cabinets with multiple INFI 90 OPEN interfaces, connect the NTCL01 termination units in series. The first and last termination unit in the series connection should connect to terminal strip TB3 on the power module chassis backplane. Refer to Appendix C for a wiring diagram.

16. If redundant network interface modules are being used with the NICL01 termination module:

    a. Put ring lugs on both ends of two 18 to 14 AWG wires. Attach one end of each wire to the OUT terminal on terminal strip TB3 on the power module chassis backplane.

    b. Attach the other end of one wire to TB2-4 on the primary NICL01 termination module; attach the other end of the second wire to TB2-4 on the secondary termination module.

17. For cabinets with multiple INFI 90 OPEN interfaces, connect the NICL01 termination modules in series. The first and last termination module in the series connection should connect to terminal strip TB3 on the power module chassis backplane. Refer to Appendix C for a wiring diagram.

18. Steps 18a through 18c are optional. These terminals provide a connection for external alarms, monitoring external sources, and status inputs.

    a. The ALARMS terminals on TB3 (BUS, PWR and I/O) are opto-isolated open collector outputs for connection to external system voltage bus, power system and I/O voltage bus alarms. Use 18 to 14 AWG wire to connect the external alarms to these terminals.

    b. The AUX INPUTS terminals on TB2 (CH1 and CH2) are inputs for monitoring external 24, 48 or 125 VDC sources. Appendix C contains a wiring diagram for these inputs. Refer to ***INSTALLING THE POWER MONITOR MODULE*** for information on setting the required dipswitches and jumpers to use these inputs.

    c. The STATUS terminals on TB3 (1 and 2) are digital logic contact inputs. These inputs can be set up for operation as normally open (N.O.) or normally closed (N.C.) logic inputs. Appendix C contains a wiring diagram of these inputs. Refer to ***INSTALLING THE POWER MONITOR MODULE*** for information on setting up these inputs.

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

AC SAFETY GROUND WIRING

Use the following procedures to connect the power entry circuit breaker or switch and fan chassis to the cabinet AC safety ground.

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. Crimp ring lugs to one end of three 12 AWG minimum green/yellow wires that are long enough to reach from the fan chassis and power entry circuit breakers or switches to one of the safety ground bolts (green bolt) at the top of the cabinet.

2. Connect a wire to each of the safety ground studs (one on each power entry circuit breaker or switch and one on the fan chassis). Secure the ring lug to the safety ground stud using an external tooth lockwasher and nut. Refer to Appendix C for wiring diagrams.

3. Remove the bolt and external tooth lockwasher. Install the AC safety ground wires by inserting the bolt through the external tooth lockwasher first and then the ring lugs (the ring lugs should be between the lockwasher and flatwasher). Tighten the AC safety bolt to 6.8 Newton meters (±0.25 Newton meters) [60 in.-lbs (±2 in.-lbs)].

AC/DC FEEDER LINES

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. Verify that power is off at the main service circuit breaker.

2. Install the AC/DC feeder lines to the terminals on the power entry circuit breaker or switch.

   a. Install the hot power line (positive) to terminal L1.

   b. Install the neutral power line (negative) to terminal L2.

   c. Install the safety ground to the ground terminal.

3. Remove all control and I/O modules from the module mounting units so that the power system is not loaded.

4. Check for shorts on the input power. If any shorts are evident, correct the wiring problem before continuing with the installation procedures.

5. Check for shorts on the system power outputs. If any shorts are evident, correct the wiring problem before continuing with installation procedures.

6. Install the power monitor module and power modules. Do not install the control modules and I/O modules until the power system is completely installed and operating.

INSTALLING THE POWER MONITOR MODULE

The IPMON01 Power Monitor Module mounts in a dedicated center mounting slot of the nine-slot power module chassis (Figs. 3-5 and 3-6).

> **NOTE:** The system power modules and field power modules can be mounted in any sequence on each side of the power monitor module. Empty slots must have blank faceplates mounted in them.

There are five dipswitches on the power monitor module that set up how various bus voltage status alarms and power fail interrupts (PFI) operate. Figure 3-7 shows the IPMON01 circuit board layout. Refer to Tables 3-2 through 3-6 for monitoring options set by the dipswitches. There are 13 jumpers on the power monitor module that select options such as input voltage, high and low trip points, and temperature trip points. Refer to Tables 3-7 through 3-10 for power monitor module jumper settings.

Dipswitch SW1

Dipswitch SW1 is a two-pole dipswitch that enables or disables two power monitoring options. Pole one enables or disables the power monitor module to monitor the second input power line (applicable in 2N redundant systems only). When enabled, the status of the second input power line is indicated by the external LED on the power monitor module faceplate. If a fault occurs, the power monitor module generates a power alarm

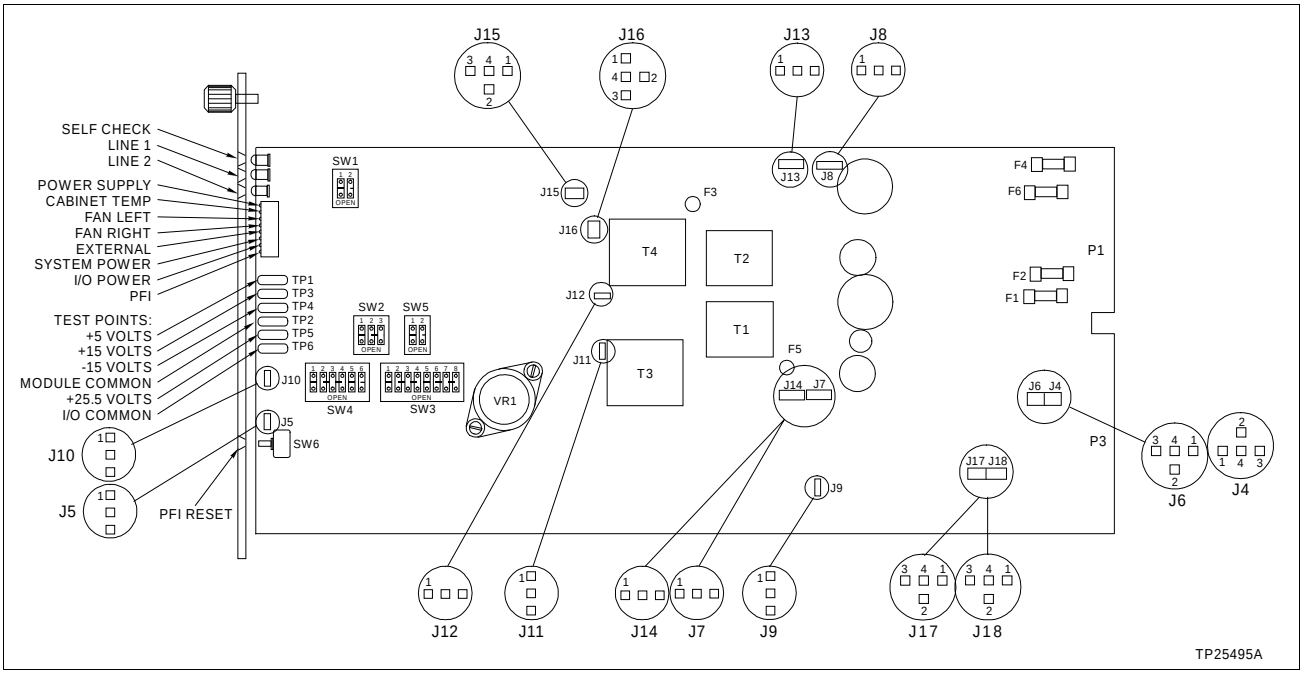

Figure 3-7. IPMON01 Circuit Board Layout

(available at terminal strip TB3, ALARMS PWR terminals on the power module chassis backplane) and a power system status (output at terminal strip TB3, STATUS OUT terminals). The power alarm is an opto-isolated open collector output that is available. Power system status is an internal system status signal.

Pole two enables or disables the power monitor module to monitor the power system bus voltages (5, 15 or -15 VDC). When enabled, the status of the power system bus voltages is indicated by the external LED and system power LED on the module faceplate. If a fault occurs, the power monitor module generates a power alarm, bus alarm, and power system status. The power alarm and bus alarm are available on the power module chassis backplane terminal strip TB3 (ALARMS PWR and ALARMS BUS terminals respectively). These outputs are opto-isolated open collector outputs. The power system status signal is internal to the INFI 90 OPEN system and it is sent to consoles on the Network 90 or INFI 90 OPEN communication system. Refer to Table 3-2 for dipswitch SW1 settings.

Dipswitch SW2

Dipswitch SW2 is a three-pole dipswitch that enables or disables the power monitor module to generate a PFI signal for a selected status one input logic state and for a 25.5 VDC bus fault. Pole one enables or disables the power monitor module to generate a PFI signal for a status one input logic state. Jumper J10 must be set in conjunction with pole one on dipswitch

Table 3-2. IPMON01 Dipswitch SW1 Settings

Option	Enabled	Dipswitch Pole 1	Dipswitch Pole 2	User Setting
Enable power source line 2 monitoring	Yes	0		
	No	1		
Enable 5/15/-15 VDC system bus monitoring	Yes		0	
	No		1	

NOTE: 0 = CLOSED or ON, 1 = OPEN or OFF.

SW2 to set up a N.O. or N.C. contact input (Table 3-10). This input is physically located on terminal strip TB3 (STATUS 1 and STATUS COM terminals) on the power module chassis backplane. Pole two enables or disables the power monitor module to generate a PFI signal for a 25.5 VDC bus fault. The PFI LED on the power monitor module faceplate indicates when a PFI signal is generated. Pole 3 is for future use and should be set to one. Refer to Table 3-3 for dipswitch SW2 settings.

Table 3-3. IPMON01 Dipswitch SW2 Settings

Option	Enabled	Dipswitch Pole 1	Dipswitch Pole 2	Dipswitch Pole 3	User Setting
Generate PFI signal for STATUS 1 input fault	Yes	0			
	No	1			
Generate PFI signal for 25.5 VDC bus fault	Yes		0		
	No		1		
For future use, must be set to 1	Yes			0	1
	No			1	

NOTE: 0 = CLOSED or ON, 1 = OPEN or OFF.

Dipswitch SW3

Dipswitch SW3 is an eight-pole dipswitch that enables or disables the power monitor module to indicate a fault on external inputs and the 25.5 VDC bus via the I/O power LED (on the IPMON01 faceplate). Inputs include two auxiliary inputs for 24, 48 or 125 VDC and two status inputs (contact inputs). When a fault occurs on an enabled input, an I/O alarm is generated by the power monitor module. This alarm is an opto-isolated open collector output that is available to the user at terminal strip TB3 (ALARMS I/O terminals) on the power module chassis backplane. Refer to Table 3-4 for dipswitch SW3 settings.

NOTE: The external LED turns on in addition to the I/O power LED to indicate a fault when any of these options are enabled.

Table 3-4. IPMON01 Dipswitch SW3 Settings

Option	Enabled	Dipswitch Pole 1	2	3	4	5	6	7	8	User Setting
Enables I/O power LED to indicate a STATUS 1 input fault	Yes	0								
	No	1								
Enables I/O power LED to indicate a STATUS 2 input fault	Yes		0							
	No		1							
Enables I/O power LED to indicate a CH2 AUX INPUT fault	Yes			0						
	No			1						
Enables I/O power LED to indicate a CH1 AUX INPUT fault	Yes				0					
	No				1					
Enables I/O power LED to indicate a 25.5 VDC bus fault	Yes					0				
	No					1				
For future use, must be set to 1	Yes						0			1
	No						1			
Enables I/O power LED to indicate a 48/125 VDC bus fault	Yes							0		
	No							1		
For future use, must be set to 1	Yes								0	1
	No								1	

NOTE: 0 = CLOSED or ON, 1 = OPEN or OFF.

Pole one enables or disables monitoring of the status one input via the I/O power LED. Jumper J10 must be set in conjunction with pole one to set up the status one input as a N.O. or N.C. contact input. Pole two enables or disables monitoring of the status two input via the I/O power LED. Jumper J5 must be set in conjunction with pole two to set up the status two input as a N.O. or N.C. contact input. Refer to Table 3-10 for jumper settings to set up the status input contact types. Terminals for these inputs are on terminal strip TB3 (STATUS 1, STATUS 2, and STATUS COM terminals) on the power module chassis backplane.

Poles three and four enable or disable monitoring of the auxiliary inputs one and two (respectively) via the I/O power LED. Jumpers J4, J6, J17 and J18 must be set in conjunction with poles three and four to select a high and low trip point fault condition for the input voltage being monitored (24, 48 or 125 VDC). Refer to Table 3-8 for jumper settings to set up the trip points for auxiliary inputs one and two. Refer to Table 1-4 for auxiliary input trip point specifications. Terminals for these inputs are located on terminal strip TB4 (AUX INPUTS CH1 and AUX INPUTS CH2 terminals) on the power module chassis backplane. Poles six and eight are reserved for future use. Pole seven enables or disables monitoring of the 48/125 VDC bus via the I/O power LED. Refer to Table 3-4 for dipswitch SW3 settings.

Dipswitch SW4

Dipswitch SW4 is a six-pole dipswitch that enables or disables the power monitor module to generate a PFI signal when a fault occurs on one of the system buses (5, 15 and -15 VDC). The PFI LED on the module faceplate indicates when a PFI signal is generated.

Pole one enables or disables the power monitor module to generate a PFI signal when there is a fault on the 15 VDC bus. Pole two enables or disables the power monitor module to generate a PFI signal when there is a fault on the -15 VDC bus. Pole five enables or disables the power monitor module to generate a PFI signal when there is a fault on the 5 VDC bus. Pole six enables or disables the power monitor module to generate a PFI signal when there is a fault on the 48/125 VDC bus.

Poles three and four are for future use and must be set to one. Refer to Table 3-5 for dipswitch SW4 settings.

Table 3-5. IPMON01 Dipswitch SW4 Settings

Option	Enabled	Dipswitch Pole						User Setting
		1	2	3	4	5	6	
Generate PFI signal for 15 VDC bus fault	Yes	0						
	No	1						
Generate PFI signal for -15 VDC bus fault	Yes		0					
	No		1					
For future use, must be set to 1	Yes			0				1
	No			1				
For future use, must be set to 1	Yes				0			1
	No				1			
Generate PFI signal for 5 VDC bus fault	Yes					0		
	No					1		
Generate PFI signal for 48/125 VDC bus fault	Yes						0	
	No						1	

NOTE: 0 = CLOSED or ON, 1 = OPEN or OFF.

Dipswitch SW5

Dipswitch SW5 is a two-pole dipswitch that enables the power monitor to latch a PFI signal. When a PFI signal is latched, the PFI LED on the module faceplate remains on after the PFI condition returns to a normal state (no PFI). Use the PFI reset pushbutton to turn off the PFI LED when the PFI signal is latched. Pole one of dipswitch SW5 enables or disables PFI signal latching. Pole two of dipswitch SW5 is not used and should be set to one. Refer to Table 3-6 for dipswitch SW5 settings.

Table 3-6. IPMON01 Dipswitch SW5 Settings

Option	Enabled	Dipswitch Pole 1	Dipswitch Pole 2	User Settings
Latch PFI signal	Yes	0		
	No	1		
Not used, must be set to 1	Yes		0	1
	No		1	

NOTE: 0 = CLOSED or ON, 1 = OPEN or OFF.

IPMON01 Input Voltage Jumper Settings

There are six jumpers that tell the IPMON01 module what input voltage to expect on input lines one and two (three jumpers for each input line). Table 3-7 lists how to set the jumpers for the input line voltage. All three of the jumpers for one input line (i.e., jumpers J8, J12 and J13 for input line one, and jumpers J7, J11 and J14 for input line two) must be set to the same input voltage.

Table 3-7. IPMON01 Input Voltage Jumper Settings

Function	Jumper	Jumper Setting 120 VAC	Jumper Setting 240 VAC	Jumper Setting 125 VDC	User Setting
Voltage on input line 1	J8	1-2	2-3	1-2	
	J12	1-2	2-3	1-2	
	J13	1-2	1-2	2-3	
Voltage on input line 2	J7	1-2	2-3	1-2	
	J11	1-2	2-3	1-2	
	J14	1-2	1-2	2-3	

IPMON01 Auxiliary Input Trip Points Jumper Settings

Jumpers J4 and J6 set up auxiliary input one to alarm on a high trip point and low trip point for the external voltage being monitored (24, 48 or 125 VDC). Jumpers J17 and J18 set up low and high trip points for the external voltage being monitored by auxiliary input two. The auxiliary inputs are available at terminal strip TB2 on the power module chassis backplane. Trip points for the auxiliary inputs are listed in Table 1-4. Refer to ***Dipswitch SW3*** and ***Dipswitch SW4*** for an explanation of the setup choices for module LEDs and alarm outputs when using the auxiliary inputs. Refer to Table 3-8 for auxiliary input trip point jumper settings.

Table 3-8. IPMON01 Auxiliary Input Trip Points Jumper Settings

Function		Jumper	Jumper Setting			User Setting
Auxiliary Input	Trip Point		24 VDC	48 VDC	125 VDC	
1	Low	J6	1-4	3-4	2-4	
	High	J4	1-4	3-4	2-4	
2	Low	J17	1-4	3-4	2-4	
	High	J18	1-4	3-4	2-4	

IPMON01 Temperature Trip Point Jumper Settings

Jumpers J15 and J16 select the internal cabinet temperature trip points that the power monitor module uses to generate a cabinet overtemperature warning. The cabinet temp LED turns on to indicate that the internal cabinet temperature is above the selected trip point. There must always be a temperature trip point selected (jumper installed), otherwise the monitor module cannot monitor cabinet temperature. Jumpers J15 and J16 should be set the same. Refer to Table 3-9 for temperature trip point jumper settings.

Table 3-9. IPMON01 Temperature Trip Points Jumper Settings

Function	Jumper	Jumper Setting			User Setting
		50°C (122°F)	60°C (140°F)	70°C (158°F)	
Temperature sensor 1, trip point	J16	3-4	2-4	1-4	
Temperature sensor 2, trip point	J15	3-4	2-4	1-4	

IPMON01 Status Inputs Jumper Settings

Jumpers J5 and J10 set up status inputs one and two for operation as N.O. or N.C. contact inputs. Jumper J9 sets the power monitor module to operate with the 48/125 VDC input set to either 48 VDC or 125 VDC. These inputs are available at terminal strip TB3 (STATUS 1, STATUS 2, and STATUS COM terminals). When the power monitor module detects that a contact has changed states from normal operation, it generates an alarm based on the setup of dipswitch SW3. Dipswitch SW2 enables or disables the power monitor module to generate a PFI signal based on the state of status input one. Refer to ***Dipswitch SW2*** and ***Dipswitch SW3*** for more information on the use of those dipswitches in conjunction with jumpers J5 and J10. Refer to Table 3-10 for status input jumper settings.

To install the power monitor module:

1. Select the monitoring options and set the module dipswitch and jumpers accordingly. Refer to Tables 3-2 through 3-6 for

Table 3-10. IPMON01 Status Inputs Jumper Settings

Function	Jumper	Jumper Settings[1]		User Setting
Status input 1, contact input	J10	1-2 (N.O.)	2-3 (N.C.)	
Status input 2, contact input	J5	1-2 (N.O.)	2-3 (N.C.)	
48/125 VDC select	J9	1-2 (48 VDC)	2-3 (125 VDC)	

NOTE:
1. N.O. = normally open, N.C. = normally closed.

dipswitch settings and Tables 3-7 through 3-10 for jumper settings.

2. Verify the fuses are installed and in good condition. Replace any fuses that are missing or damaged. Refer to Table 7-1 for a list of Elsag Bailey part numbers and fuse ratings.

3. After setting the dipswitches and jumpers, grasp the sides of the faceplate and line up the circuit board edges with the center slot card guides in the power module chassis opening.

4. Firmly slide the module into its mounting slot until it is completely seated in its backplane connector.

5. Turn the thumbscrew at the top of the module faceplate clockwise to lock the module in place.

6. Turn on power to the cabinet.

7. Observe the LEDs on the power monitor module. The self-check, line 1 and line 2 LEDs should be green. All other LEDs should be either off or red (refer to Table 4-1 for a complete list of power monitor module LED states).

8. If the self-check, line 1 or line 2 LED is red, there is a problem with the input power. Refer to ***TROUBLESHOOTING*** in Section 5 for assistance in locating and correcting the problem.

9. Proceed to the power module installation procedure.

INSTALLING THE POWER MODULES

IPSYS01 System Power Modules and IPFLD01, IPFLD24, IPFLD48 or IPFLD125 Field Power Modules mount in up to eight power module chassis slots (four on each side of the power monitor module). In 2N power systems, the required number of power modules are doubled and half are mounted on each side of the power monitor module. When the system is

wired for 2N redundancy, the power inputs are isolated, but the outputs of all power modules share the output load.

> **NOTE:** Because 2N systems have isolated power inputs, mixed input power can be used on 2N power systems (i.e., inputting 125 VDC power to one power entry circuit breaker or switch and inputting 120 VAC to the other power entry circuit breaker or switch). Each of the isolated power inputs must power an equal number of power modules in 2N systems.

In N, N+1 or N+x power systems, one power module is added to the required number of power modules. When the system is wired for N, N+1 or N+x operation, all inputs and outputs are tied together. Therefore, the power modules can be mounted in any power module chassis slot.

CAUTION	**Do not install the IPFLD48 and IPFLD125 field power modules together in the same IPCHS01 chassis. Equipment damage will result.**
ATTENTION	**Ne pas installer les modules d'alimentation de champ IPFLD48 et IPFLD125 dans le même châssis IPCHS01. CECI causerait des dommages à l'équipement.**

There are no jumpers or dipswitches on the IPSYS01 System Power Module or the IPFLD01, IPFLD24, IPFLD48 or IPFLD125 Field Power Modules. Therefore, the modules are ready to install. To install:

1. Check the fuses (F5 and F6). They should be installed and in good condition before installing the power module. Figure 3-8 shows the IPSYS01 circuit board layout (the IPFLD circuit board layout is very similar except for the LEDs). If a fuse is missing or damaged, install or replace it with an equivalent fuse. Refer to Table 7-1 for the Elsag Bailey part number and description of this fuse.

> **NOTE:** Replace both fuses if one of the fuses is blown.

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. Hold the module by the faceplate handle and firmly slide it into the power module chassis slot until the rear edge connector is firmly seated in the backplane connector.

3. Turn the thumbscrew at the top of the module clockwise to lock the module in place.

4. Observe the LEDs on the system and field power modules. All LEDs should be solid green (refer to Table 4-2 for a complete list of power module LED states).

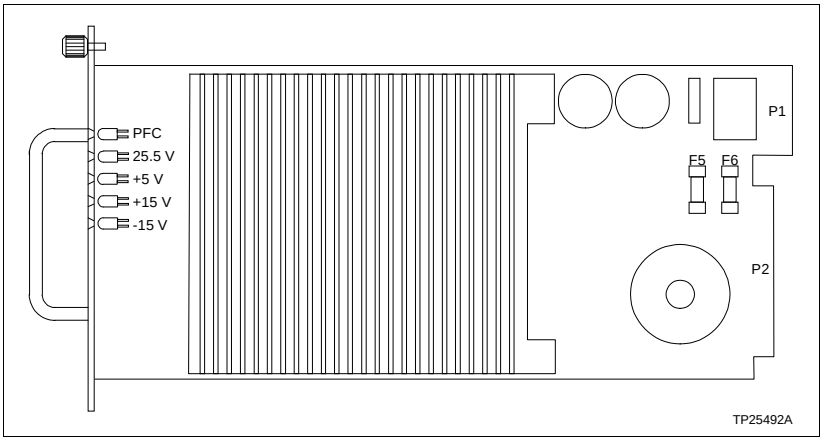

Figure 3-8. IPSYS01 Circuit Board Layout

5. If any of the LEDs are red, find and correct the problem before applying power to the cabinet control and I/O modules. Refer to ***TROUBLESHOOTING*** in Section 5 for assistance.

6. Repeat the procedure for the remaining modules. For 2N systems, install an equal number of system and field power modules on each side of the IPMON01 module.

7. If the system is operating properly, insert the control and I/O modules into the module mounting unit.

8. When the entire cabinet is under power, check the power monitor module and power module LEDs again to verify the system is operating properly.

INSTALLING BLANK FACEPLATES

Install an IPBLK01 Power Blank Faceplate in all of the empty slots in the power module chassis to insure proper air flow through the system.

1. Align the blank faceplate with the empty power mounting chassis slot.

2. When the faceplate is flush with the power module faceplates, turn the thumbscrew at the top of the faceplate clockwise to lock the blank faceplate in place.

SECTION 4 - OPERATING PROCEDURES

INTRODUCTION

Section 4 contains information regarding INFI 90 OPEN Modular Power System II operation. This section includes information on system and field power module status LEDs, and power monitor module status LEDs, test points, and the power fail interrupt (PFI) reset pushbutton.

LEDs

There are LEDs on the IPSYS01 System Power Module, IPFLD01, IPFLD24, IPFLD48, IPFLD125 Field Power Modules and IPMON01 Power Monitor Module that provide information on system bus voltages, power system status and operation. The following text explains the use of those LEDs. Tables 4-1 and 4-2 provide a complete list of LED states.

Power Monitor Module

The IPMON01 Power Monitor Module has three red/green status LEDs and eight red alarm LEDs on the module faceplate. Table 4-1 lists power monitor module LED states. Figure 4-1 shows the IPMON01 module faceplate LEDs.

NOTE: LED operation is configured at the time of installation via dipswitch and jumper settings. Each LED can be configured for monitoring multiple lines, buses and signals. Because of the numerous options available, it is a good practice to keep a copy of the dipswitch and jumper configuration inside or near the cabinet as a reference guide to identify the sources of an alarm signal or status LED signals.

Table 4-1. IPMON01 LED States

LED	LED State	Meaning
Self-check	Green	Good
	Red	Bad
	Off	Power off
Line 1	Green	Good
	Red	Bad
	Off	Power off
Line 2	Green	Good
	Red	Bad
	Off	Disabled or power off
Power supply	Red	Bad
	Off	Good

Table 4-1. IPMON01 LED States (continued)

LED	LED State	Meaning
Cabinet temp	Red	Overtemperature
	Off	Within limit
Fan left	Red	Failed
	Off	Operating
Fan right	Red	Failed
	Off	Operating
External	Red	Fault
	Off	Good
System power	Red	Fault
	Off	Good or disabled
I/O power	Red	Fault
	Off	Good or disabled
PFI status	Red	Fault
	Off	Good or disabled

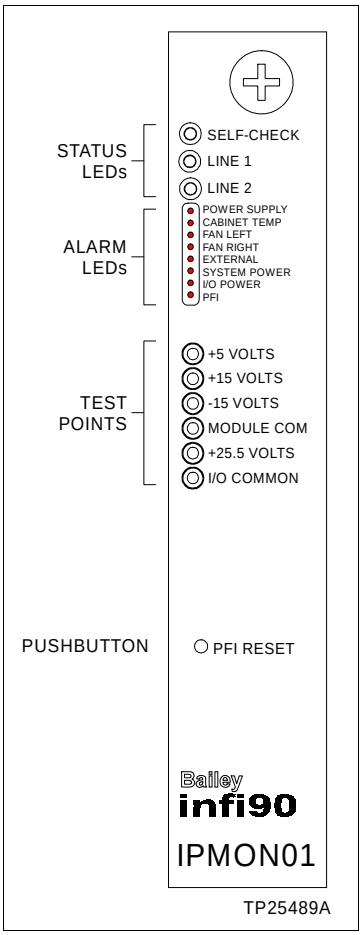

Figure 4-1. IPMON01 Faceplate LEDs

The self-check LED and line one LED are red/green status LEDs that are green during normal operation. The self-check LED turns red if the power monitor module detects an on-board hardware failure. The line one LED indicates the status of input power on N, N+1 or N+x redundant systems and turns red if the input power drops below the specified range. These LEDs are always enabled. The line two LED needs to be enabled to indicate the status of a second input power line on 2N systems.

The other eight alarm LEDs indicate the status of selected monitoring signals according to the module dipswitch and jumper configuration. Four LEDs (PFI, system power, I/O power and external) can be set up for monitoring numerous lines and signals. The PFI LED can be enabled to indicate any one or more of the system and I/O bus voltages, status input line one, or any combination of lines and buses. The I/O power LED can be set up to reflect the condition of status input lines one and two (contact inputs), and auxiliary input lines one and two (for monitoring 24, 48 and 125 VDC external power sources). The external LED can be enabled to indicate the status of line two input power and 5, 15 and -15 VDC bus voltages. If any one or more of the signals or lines associated with a LED goes bad, the LED turns red. These LEDs are off under normal operation, or disabled.

Jumpers set up the operation of the remaining five LEDs. These jumpers select the input power line sensing and operating voltage, high and low trip points for auxiliary 24, 48 or 125 VDC I/O monitoring, temperature sensor trip points, and 25.5 VDC I/O bus voltage. These LEDs operate like the other red LEDs: off for normal operation or disabled, red for a failure.

Power System and Field Modules

The power system and field module LEDs are always enabled. Table 4-2 lists the system and field power module LED states. Figure 4-2 shows IPSYS01 and IPFLD01, IPFLD24, IPFLD48, and IPFLD125 faceplate LEDs.

The PFC LED reflects the status of the power factor corrector. A red LED indicates a failed power factor corrector. A green LED indicates normal operation. Likewise, on the voltage LEDs, green indicates normal operation and red indicates failure. The voltage LEDs blink green to indicate a DC/DC converter overcurrent condition.

Table 4-2. IPSYS01, IPFLD01, IPFLD24, IPFLD48 and IPFLD125 LED States

LED	LED State	Meaning
PFC	Green	Normal
	Red	Failed

Table 4-2. IPSYS01, IPFLD01, IPFLD24, IPFLD48 and IPFLD125 LED States (continued)

LED	LED State	Meaning
25.5 V, 5 V, +15 V, -15 V, 48 V and 125 V	Green	Good
	Blinking green	Converter overcurrent
	Red	Converter failure

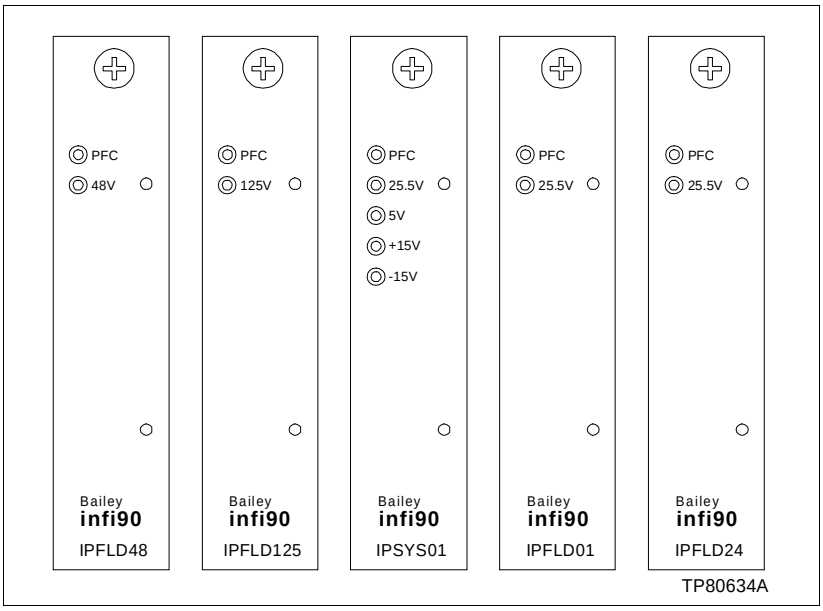

Figure 4-2. IPSYS01 and IPFLD Faceplate LEDs

TEST POINTS

There are six test points (+5 volts, +15 volts, -15 volts, module common, +25.5 volts, and I/O common) on the IPMON01 faceplate. These points provide a place to take bus voltage measurements using voltmeter probes (Fig. 4-1).

POWER FAIL INTERRUPT RESET PUSHBUTTON

Use the PFI pushbutton (Fig. 4-1) to reset a latched PFI signal. This option is enabled by a dipswitch when the power monitor module is installed. When a PFI signal is latched and a PFI alarm occurs, the alarm (LED) stays on even though the PFI condition has returned to normal. The PFI LED will remain on until it is reset by the PFI reset pushbutton. An unlatched PFI signal allows the PFI alarm (LED) to return to normal if the PFI condition returns to normal.

SECTION 5 - TROUBLESHOOTING

INTRODUCTION

Section 5 provides troubleshooting tools consisting of tables containing troubleshooting procedures to help locate and correct INFI 90 OPEN Modular Power System II problems. These are general troubleshooting guidelines and are not exhaustive of all possible causes.

TROUBLESHOOTING PROCEDURES

Tables 5-1 and 5-2 contain troubleshooting procedures that are listed by LED state, cause and corrective action. Use these tables to correct power system problems that are revealed by LEDS on the system and field power modules (Table 5-1) and the power monitor module (Table 5-2).

Table 5-1. IPSYS01 and IPFLD Field Modules LED Troubleshooting Procedures

LED	LED state	Cause	Corrective Action
PFC	Red	Power factor corrector failure.	Replace the power module.
5 V, +15 V or -15 V, 25.5 V, 48 V, 125 V	Blinking green	DC/DC converter overcurrent.	1. If the blinking green LED occurs during initial start-up, check sizing calculations and add power modules to the system if required. 2. If the system has been operating normally, some other power module has a problem. a. Insert an additional power supply module of the same type that is blinking. b. One at a time, remove the power modules that are not blinking green. ***Do not remove the module with the blinking green LED.*** If the module that is blinking green continues, insert the module that was removed. c. Continue removing modules one at a time. The bad module is removed when the module with the blinking green LED stops blinking. d. Replace the bad power module. e. If the original blinking LED continues blinking after all the other power modules are checked, replace the power module with the blinking green LED.
5 V, +15 V, -15 V or 25.5 V	Red	DC/DC converter failure.	Replace the power module.

Table 5-1. IPSYS01 and IPFLD Field Modules LED Troubleshooting Procedures (continued)

LED	LED state	Cause	Corrective Action
5 V, +15 V, -15 V, and 25.5 V, 48 V, 125 V	All red	Blown power module fuse. Input power failure on 2N redundant systems. Brownout on N, N+1 or N+x redundant systems.	1. On 2N redundant systems, if all the LEDs on the power modules are red, check the power monitor module LEDs. a. If line 1 LED on the power monitor module is green and all the LEDs on the power module are red, the power module fuse is open. b. If line 1 LED on the power monitor module is red, then the line 1 circuit breaker or switch is open or there is an input power failure. c. If the line 2 LED on the power monitor module is red, then the line 2 circuit breaker or switch is open or there is an input power failure. 2. For N, N+1 or N+x redundant systems, brownout (low input power voltage). Check input voltage and correct problem if the input voltage is out of specification.
5 V, +15 V, -15 V or 25.5 V, 48 V, 125 V	Off	Lost AC/DC input power (on N, N+1 or N+x systems only).	1. Check if power entry panel circuit breaker or switch is on. 2. Check the AC/DC input power to the power module chassis backplane terminals TB5 and TB6. If there is no power, check the AC/DC input power connections. All connections should be secure and wired correctly according to the color code in the wiring diagrams in Appendix C.
		Other system failure.	Check the power monitor alarm LEDs to determine the cause.

Table 5-2. IPMON01 Status LEDs Troubleshooting Procedures

LED	LED State	Problem	Corrective Action
Self-check	Green	Normal operation.	None.
	Red	Failed power monitor module voltage.	Replace power monitor module.
	Off	Total loss of system power or internal power monitor module failure.	If line 1 and 2 LEDs are green, replace the power monitor module. If line 1 and 2 LEDs are off, there is a total loss of power.
Line 1	Green	Normal operation.	None.
	Red	Input power voltage out of tolerance. No power on line 1 of 2N redundant systems. Loose or incorrectly installed wiring.	1. Verify that the power entry circuit breaker or switch is on. 2. Check for loose or incorrectly installed power wiring. Refer to Appendix C for wiring diagrams. 3. If all wiring checks good, measure the AC/DC input voltage and verify that it is within system specification. If it is not, refer to the ***Site Planning and Preparation*** instruction to correct the problem.
	Off	Total loss of power if the self-check LED is off. Blown fuse if there are other power monitor module LEDs on.	1. If all LEDs are off, check the AC input voltage at TB5 on the power module chassis backplane. If power is available at the power entry circuit breaker or switch terminals and the circuit breaker or switch is on, replace the power entry circuit breaker or switch. 2. Check and replace the power monitor fuse.

Table 5-2. IPMON01 Status LEDs Troubleshooting Procedures (continued)

LED	LED State	Problem	Corrective Action
Line 2	Green	Enabled and normal operation.	None.
	Red	Input power voltage out of tolerance. No power on line 2 on 2N redundant systems. Loose or incorrectly installed wiring.	1. Verify that the power entry circuit breaker or switch is on. 2. Check for loose or incorrectly installed power wiring. Refer to Appendix C for wiring diagrams. 3. If all wiring checks good, measure the AC/DC input voltage and verify that it is within system specification. If it is not, refer to the ***Site Planning and Preparation*** instruction to correct the problem.
	Off	Line 2 LED disabled. Total loss of power if the self-check LED is off. Blown fuse if there are other power monitor module LEDs on.	1. If the line 2 LED is disabled, none. 2. If all LEDs are off, check the AC input voltage at TB6 on the power module chassis backplane. If power is available at the power entry circuit breaker or switch terminals and the circuit breaker or switch is on, replace the power entry circuit breaker or switch. 3. Check and replace the power monitor fuse.

Table 5-3. IPMON01 Alarm LEDs Troubleshooting Procedures

LED	LED State	Problem	Corrective Action
Power supply	Off	Normal operation.	None.
	Red	Bad power module, more power modules needed.	Check the power module LEDs. If any are red, replace the power module. If any are blinking green, refer to Table 5-1 for corrective action.
		Failed power monitor module.	If the power modules have solid green LEDs and the system bus voltages are good, replace the power monitor module.
Cabinet temp	Off	Normal operation.	None.
	Red	Cabinet temperature too high. Fans have failed.	Is the fan left or fan right LED on? If so, replace the failed fan.
		Dirty cabinet air filter.	Check the cabinet air filter. Refer to ***MAINTENANCE*** in Section 6 for the cabinet air filter cleaning procedure if necessary.
		External cabinet temperature is too high for limit set by power monitor module jumper.	Is the external ambient temperature above 55°C (140°F)? Lower the external ambient temperature.
Fan left	Off	Normal operation.	None.
	Red	Bad fan or open fan fuses.	Make a visual check of the left fan and verify that it is not rotating. If it is not rotating, remove it and check the fan fuses. If the fuses are good, replace the fan. If the fan is operating, replace the power monitor module.
		Broken fan cable.	Check and replace the left fan cable if the fan is replaced and the fan left LED is still red. If the fan is operating after replacing the cable, and the power monitor module LED is still red, replace the power monitor module.

Table 5-3. IPMON01 Alarm LEDs Troubleshooting Procedures (continued)

LED	LED State	Problem	Corrective Action
Fan right	Off	Normal operation.	None.
	Red	Bad fan or open fan fuses.	Make a visual check of the right fan and verify that it is not rotating. If it is not rotating, remove it and check the fan fuses. If the fuses are good, replace the fan. If the fan is operating, replace the power monitor module.
		Broken fan cable.	Check and replace the right fan cable if the fan is replaced and the fan left LED is still red. If the fan is operating after replacing the cable and the power monitor module LED is still red, replace the power monitor module.
External	Off	Normal operation.	None.
	Red and one or more other LEDs are red	One or more power status monitoring points are in a fault condition (external fault status).	Check the other alarm and status LEDs for the source of the alarm. If the other LEDs are off or green, replace the power monitor module.
System power	Off	Normal operation.	None.
	Red	Out of tolerance or failed system bus voltage (5, 15, -15 VDC).	Check the system power module LEDs for failed power modules. Check system bus voltages using the power monitor module faceplate test points. Repair system bus fault if the bus voltages are low and the power modules check good. Refer to Tables 3-2 through 3-6 for power monitor module dipswitch settings.
I/O power	Off	Normal operation.	None.
	Red	Auxiliary channels 1 or 2 out of tolerance.	Check the auxiliary channel power sources.
		Status inputs 1 or 2 indicate a fault condition.	Check the status inputs and status input setup jumpers (N.O. or N.C. inputs). Refer to ***INSTALLATION*** in Section 3 for power monitor module jumper settings.
		25.5 VDC bus failure.	Check the field power module LEDs for failed power modules. Check the 25.5 VDC bus voltage using the power monitor module faceplate test points. Repair system bus fault if the bus voltages are low and the power modules check good. Refer to Tables 3-2 through 3-6 for power monitor module dipswitch settings.
		48 VDC or 125 VDC bus failure.	Check the field power module LEDs for failed power modules. Check the 48 VDC or the 125 VDC bus voltage by measuring with a voltmeter from TB4-1 (48/125) to the I/O COM bus bar on the power system backplane PCB. Refer to Figure C-1 for TB4-1 location. Repair system bus fault if the bus voltages are low and the power modules check good. Refer to Tables 3-2 through 3-6 for power monitor module dipswitch settings.
PFI	Off	Normal operation.	None.
	Red	PFI signal latched.	Check the PFI signal latch option on the power monitor module. Refer to Table 3-6 for the power monitor module dipswitch settings.

Table 5-3. IPMON01 Alarm LEDs Troubleshooting Procedures (continued)

LED	LED State	Problem	Corrective Action
PFI (continued)	Red	System bus voltage fault.	Check the system power module LEDs for failed power modules. Check system bus voltages using the power monitor module faceplate test points. Repair system bus fault if voltages are low and power modules are good. Refer to Tables 3-2 through 3-6 for power monitor module dipswitch settings.
		25.5 VDC bus voltage fault.	Check the field power module LEDs for failed power modules. Check the 25.5 VDC bus voltage using the power monitor module faceplate test points. Repair system bus fault if voltages are low and power modules are good. Refer to Tables 3-2 through 3-6 for power monitor module dipswitch settings.
		48 VDC or 125 VDC bus voltage fault	Check the field power module LEDs for failed power modules. Check the 48 VDC or 125 VDC bus voltage by measuring with a voltmeter from TB4-1 (48/125) to the I/O COM bus bar on the power system backplane PCB. Refer to Figure C-1 for TB4-1 location. Repair system bus fault if the bus voltages are low and the power modules check good. Refer to Tables 3-2 through 3-6 for power monitor module dipswitch settings.

SECTION 6 - MAINTENANCE

INTRODUCTION

Section 6 contains an INFI 90 OPEN Modular Power System II preventive maintenance schedule and procedures. Doing the preventive maintenance procedures as scheduled maintains dependable modular power system operation.

This section presents procedures that can be performed on-site. These preventive maintenance procedures should be used as guidelines to assist you 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.

- Qualified electrical technicians or engineers that know the proper use of test equipment such as digital multimeters.
- Familiar with the INFI 90 OPEN Modular Power System II, have experience working with process control systems, and know what precautions to take when working on live electrical systems.

PREVENTIVE MAINTENANCE SCHEDULE

Table 6-1 is the preventive maintenance schedule for the INFI 90 OPEN Modular Power System II. 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 under ***PREVENTIVE MAINTENANCE PROCEDURES***.

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

Table 6-1. Preventive Maintenance Schedule

Task	Frequency
Check 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 for dust, giving attention to the heat sinks on the power modules. 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

Table 6-1. Preventive Maintenance Schedule (continued)

Task	Frequency
Do a visual inspection of the fan assembly. Verify that both fans are rotating and replace if necessary. Refer to Section 7 for replacement instructions.	6 months
Check the quality of the plant power and grounding system. Follow the power and grounding system verification procedures in the ***Site Planning and Preparation*** instruction.	12 months
Inspect all control, I/O, and power modules, giving particular attention to power supply contacts and heat sinks. Clean as necessary. Refer to procedure.	
Replace power supply. Call Elsag Bailey sales and service for exchange information. (Components such as electrolytic capacitors deteriorate over time and need to be replaced.)	5 years
Complete all checks and inspections in this table. Replacement tasks should be done at the scheduled frequency.	Shutdown

EQUIPMENT REQUIRED

Listed are tools and equipment required for maintenance procedures.

- Antistatic vacuum.
- Digital multimeter.
- Isopropyl alcohol (99.5 percent electronic grade).
- Compressed air.
- Foam tipped swab.
- Composition pink pearl eraser (Eberhard Faber 400A).
- Fiberglass burnishing brush.
- Lint free cloths.
- Small needle nose pliers.
- Mild detergent (i.e., dishwashing soap).

PREVENTIVE MAINTENANCE PROCEDURES

This section covers tasks from Table 6-1 that require specific instructions or further explanation:

- Cleaning or replacing cabinet air filters.
- Checking signal, power and ground connections.
- Checking power module outputs.
- Cleaning printed circuit boards and edge connectors.

Cabinet Filter Cleaning and 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. To clean the filter:

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

   b. Clean a dirty filter in water and a mild detergent (i.e., dishwashing soap). Agitate the filter or squeeze the soapy water through the filter to remove built-up dirt.

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

   d. Air dry the filter before replacing it.

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

6. Return the dry filter to its mounting bracket.

7. 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.

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.** **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	**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.** **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 d'alimentation. Le cas échéant, un avertissement signalant la présence de sources d'alimentation multiples doit être apposé sur la porte de l'armoire.**

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 positive and negative input, and grounding conductor connections on the power entry circuit breaker or switch 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

There are test jacks on the power monitor module for checking power system bus voltages.

1. Verify all power module status LEDs are green. If any of the status LEDs are not green, refer to ***TROUBLESHOOTING*** in Section 5 to correct the problem before proceeding.

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

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

4. Depending on the field power module being checked, measure 25.5 VDC, 49.1 VDC or 125.6 VDC with respect to I/O common using a voltmeter.

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

6. If the module bus voltages are not within specification, verify that the system is properly sized. Refer to Appendix B to size the power system.

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 under

SPECIAL HANDLING in Section 3 when handling printed circuit boards.

WARNING

Never clean electrical parts or components with live power present. Doing so exposes you to an electrical shock hazard.

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 removed from the printed circuit board.

AVERTISSEMENT

Ne jamais nettoyer des pièces ou composants électriques dont les circuits sont sous tension; les circuits alimentés pourraient causer un choc électrique.

Des lunettes de protection devraient être portées lors de travail avec des solvants nettoyants. Lorsqu'on enlève les solvants des circuits imprimés à l'aide d'air comprimé, les éclaboussures de solvant pourraient causer des blessures aux yeux.

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.

To wash the printed circuit board:

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

2. 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.

SECTION 7 - REPAIR AND REPLACEMENT PROCEDURES

INTRODUCTION

Section 7 explains how to replace components of the INFI 90 OPEN Modular Power System II. It also includes fuse replacement procedures for the IPMON01 Power Monitor Module, IPSYS01 System Power Module and the IPFLD Field Power Modules. The components of the INFI 90 OPEN Modular Power System II can be replaced on-line, except for the power entry circuit breaker or switch, power fan chassis, and power module chassis. Always observe the special handling instructions under ***SPECIAL HANDLING*** in Section 3 when handling power system circuitry.

SPARE PARTS

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

Table 7-1. Spare Part Numbers or Nomenclatures

Nomenclature/ Part Number	Description
IPBLK01	Power blank faceplate
IPCHS01	Power module chassis (120/240 VAC or 125 VDC)
IPECB11 IPECB13	Power entry circuit breaker (120/240 VAC) Power entry circuit breaker (125 VDC)
IPESW11 IPESW13	Power entry switch (120/240 VAC) Power entry switch (125 VDC)
IPFAN11 IPFAN12 IPFAN13	Power system fan (120 VAC) Power system fan (240 VAC) Power system fan (125 VDC)
IPFCH01	Power fan chassis
IPFLD01	Field power module (25.5 VDC output, 120/240 VAC or 125 VDC input)
IPFLD24	Field power module, (25.5 VDC output, 120/240 VAC or 125 VDC input) (twice the maximum capacity of the IPFLD01)
IPFLD48	Field power module (49.1 VDC output, 120/240 VAC or 125 VDC input)
IPFLD125	Field power module (125.6 VDC output, 120/240 VAC or 125 VDC input)
IPMON01	Power monitor module (120/240 VAC or 125 VDC)
IPSYS01	System power module (5, 15, -15, and 25.5 VDC outputs, 120/240 VAC or 125 VDC input)
NBJAC16010	10-32 x $^{5}/_{8}$ self-lock bolt
NBZHA16020	10-32 x 1-$^{1}/_{4}$ Sems screw

Table 7-1. Spare Part Numbers or Nomenclatures (continued)

Nomenclature/ Part Number	Description
NIDHA16008	10-32 x 1/2 Sems screw
NMPCC16002	10-32 clip nut
1945820□10310[1]	1/32 mA, 125 VAC fuse (fuses F3 and F5 on the IPMON01)
1948182□22001[1]	2 A, 250 VAC fuse (fuses F1, F2, F4 and F6 on the IPMON01)
1948182□32001[1]	2 A, 250 VAC slo-blo fuse (fuses F1 and F2 on IPFAN11/12, fuse F1 on IPFAN13)
1949240□6301[1]	6.3 A, 250 VAC fuse (fuses F5 and F6 on the IPSYS01 and on all IPFLD field power units)
6632285□50 6632285□51 6632285□52	System power cable, connects power module chassis bus bars to system power bus bar: Module common (MCOM) cable 5 VDC cable 25.5 VDC and I/O common (I/O COM) cable
6632285□53	System power cable, connects power module chassis terminals TB1 (±15) to the system power bus bar
6634205□1	Cable assembly, connects power system status output terminal TB3 (STATUS OUT) to the bus interface module (P3 connector)
6637814□3	Input power jumper cable, jumpers power module chassis terminals TB5 to TB6 on N, N+1 or N+x redundant systems
6641490□03	Protective cover for terminal blocks
6641554□1	DC bus cable, connects power module chassis to system power bus bar
6641557□1 6641557□2 6641557□3	Power and status cable, connects power module chassis to power fan chassis: 120 VAC cable 240 VAC cable 125 VDC cable
6641569□1	Protective cover for bus bars

NOTE:
1. All fuses must be replaced with the same manufactured fuse to maintain CSA certification.

POWER MONITOR MODULE

The power monitor module can be removed and installed under power. Additionally, there are six fuses that can be replaced by the customer.

Module Replacement

1. Turn the thumbscrew at the top of the module faceplate clockwise to release the module.

2. Grasp the bottom of the faceplate and pull the module from the power module chassis.

WARNING	**Allow 30 seconds for the line filter capacitors to discharge before handling the module after removal. Failure to do could result in severe or fatal shock.**
AVERTISSEMENT	**Allouer 30 seconds pour permettre aux capaciteurs filtres de ligne de se décharger avant de manipuler le module après l'avoir retiré. Un manquement à cette précaution pourrait causer un choc sévère ou fatal.**

3. Set the jumpers and dipswitches on the replacement module. Refer to Tables 3-2 through 3-6 for dipswitch settings. Tables 3-7 through 3-10 list jumper settings.

4. Grasp the module by the faceplate and align the top and bottom edges of the circuit board with the guides of its mounting slot in the power module chassis.

5. Hold the module by the faceplate and firmly push the module into its mounting slot until the rear edge connectors are completely seated in the backplane connectors.

6. Verify that the self-check, line 1, and line 2 LEDs are green. If they are off or red, refer to ***TROUBLESHOOTING*** in Section 5 for corrective action.

7. Turn the thumbscrew clockwise to lock the module in place.

Fuse Replacement

There are six fuses (F1 through F6) on the IPMON01 module. Refer to Table 7-1 for a description of the fuses and the Elsag Bailey part numbers. To replace a fuse:

> **NOTE:** Sets of fuses should be replaced in pairs, except for fuses F3 and F5 which are independent of each other. For example, if one of the fuses in the pair of F1 and F2 opens, replace both. This also applies to fuse pair F4 and F6. Fuses should be replaced with the same manufactured fuse to maintain CSA certification.

1. Follow the steps under ***Module Replacement*** to remove the power monitor module from the power module chassis and replace it after changing a fuse.

2. Lay the module on an antistatic mat.

3. Locate the open fuse. Refer to Figure 3-7 for the IPMON01 circuit board layout.

4. Use a fuse removal tool to remove the standard fuse clip mounted fuses (F1, F2, F4 and F6). Fuses F3 and F5 use vertically mounted printed circuit board fuse sockets.

5. Replace any open fuse with an equivalent replacement fuse. Replace sets of fuses in pairs (F1 and F2 are pairs, and F4 and F6 are pairs). Fuses F3 and F5 can be replaced individually. Refer to Table 7-1 for a list of Elsag Bailey part numbers and descriptions.

POWER MODULES

The power module replacement procedure and fuse replacement procedures apply to the IPSYS01 System Power Module and the IPFLD Field Power Modules. Power modules can be replaced on-line.

Module Replacement

1. Turn the thumbscrew at the top of the power module faceplate clockwise to release the module.

2. Grasp the handle on the power module faceplate and partially pull out the module from the power module chassis.

WARNING	**Allow 30 seconds for the line filter capacitors to discharge before handling the module after removal. Failure to do could result in severe or fatal shock.**
AVERTISSEMENT	**Allouer 30 seconds pour permettre aux capaciteurs filtres de ligne de se décharger avant de manipuler le module après l'avoir retiré. Un manquement à cette précaution pourrait causer un choc sévère ou fatal.**

3. Allow at least 30 seconds for the line filter capacitors to discharge then remove it completely from the power module chassis.

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 risque d'être chaud et de provoquer des brûlures sérieuses.**

4. Grasp the replacement module by the faceplate handle.

5. Align the top and bottom edges of the circuit board with the guides of its mounting slot in the power module chassis.

6. Hold the module by the faceplate handle and firmly push it into its mounting slot; push until the rear edge connectors are firmly seated in the backplane connectors. Turn the thumbscrew until the module is secured in its mounting slot.

7. Verify the status LEDs turn green.

Fuse Replacement

There are two fuses (F5 and F6) on the IPSYS01 and the IPFLD modules that can be replaced. Refer to Table 7-1 for a description and the Elsag Bailey part number of these fuses.

NOTE: If one of the fuses in the pair F5 and F6 opens, replace both fuses.

1. Follow the steps under ***Module Replacement*** to remove and replace the power module from the power module chassis.

2. Lay the module on an antistatic mat.

3. Locate the open fuse. Refer to Figure 3-8 for the IPSYS01 and the IPFLD modules circuit board layouts.

4. Use a fuse removal tool to remove both the standard fuse clip mounted fuses (F5 and F6).

5. Replace fuses F5 and F6 with equivalent replacement fuses. Use fuses from the same manufacturer as the fuse removed to maintain CSA certification. Refer to Table 7-1 for a list of Elsag Bailey part numbers and descriptions.

POWER SYSTEM FAN

The IPFAN11, IPFAN12 and IPFAN13 Power System Fans can be replaced on-line. The IPFAN11 and IPFAN12 Power System Fans have two replaceable fuses. The IPFAN13 Power System Fan has one replaceable fuse.

Fan Assembly Replacement

NOTE: Each fan assembly uses a different power cable according to its power requirements. Always replace a fan assembly with the same nomenclature fan assembly.

WARNING	**Insure the fan blades have stopped rotating before removing the fan assembly from the fan chassis. Removing an operating fan assembly exposes rotating fan blades that can cause injury.**
AVERTISSEMENT	**S'assurer que les pales du ventilateur sont arrêtées avant de retirer le ventilateur de son châssis. En retirant un ventilateur toujours en marche, le pales du ventilateur sont exposées, ce qui peut causer des blessures.**

1. Turn the thumbscrew on the front of the fan assembly counterclockwise until the fan assembly is released from the power fan chassis.

2. Pull the fan from the assembly to disconnect it from power, ***but do not remove it from the fan chassis until the fan blades stop rotating***. When the fan blades stop rotating, support it with both hands while removing it from the power fan chassis.

3. Insert the replacement fan assembly into the power fan chassis (Fig. 3-3).

4. Firmly push the replacement fan assembly into the chassis until the power connectors make complete contact.

5. Secure the fan assembly by tightening the lock-in thumbscrew clockwise.

6. Do a visual verification of fan rotation and verify that the fan left and fan right LEDs on the power monitor module are off.

Fan Cable Replacement

Power to the cabinet must be off while replacing the fan cable. To replace the fan cable:

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 power source. Open the rear door of the cabinet to gain access to the power entry circuit breaker or switch.

2. Turn off the power entry circuit breaker or switch.

3. Remove the terminal block protective covers (on the side of the system that is having the fan cable replaced) and bus bar protective cover.

4. Remove the service lines connected to the L1 (+), L2 (–) and ground terminals on the power entry circuit breaker or switch.

5. Remove the wiring from the power entry circuit breaker or switch to connector TB5 or TB6 terminals L1 (+), L2 (–) and ground on the power module chassis.

6. Use a screwdriver to loosen the three Sems mounting screws that secure the power entry circuit breaker or switch to the power fan chassis enough to lift the power entry circuit breaker or switch off of its mounting screws. It is not necessary to remove the screws completely.

> **NOTE:** On N, N+1 or N+x redundant systems, one fan cable is exposed and does not require removing a power entry circuit breaker or switch. Nevertheless, turn off power to the cabinet before attempting to replace the fan cable.

7. Turn the thumbscrew on the front of the fan assembly counterclockwise to release it.

8. Pull out the fan assembly to remove it.

9. There are two tabs on each side of the connector (J1) that secure the connector to the fan chassis. Remove the fan cable by reaching inside the front of the fan chassis to use a pair of wire cutters to cut off the connector tabs. Then push the fan cable connector out the back of the fan chassis.

10. Remove the J2 connector on the fan cable from the P2 or P3 connector on the power module chassis backplane.

> **NOTE:** There are three unique fan cables. A fan will operate only if it has the proper cable to supply power. Refer to Table 7-1 to verify the correct fan cable is being used. A label on the front of the fan chassis and beside terminals TB5 or TB6 on the power module backplane states the input voltage rating (Fig. 3-3).

11. Attach the J1 connector on the replacement fan cable to the cable connector opening on the fan chassis. Note the orientation of the J1 connector in Figure C-3 to properly install the fan cable.

12. Attach the J2 connector on the replacement fan cable to the P2 or P3 connector on the power module chassis backplane.

13. If a power entry circuit breaker or switch was removed to replace the fan cable, align the key holes on the power entry circuit breaker or switch with the mounting screws. Install the

power entry circuit breaker or switch by lowering the key holes onto the mounting screws.

> **NOTE:** The power entry circuit breaker or switch, mounts over the power fan and status cable (Fig. 3-3). The lower side of the power entry circuit breaker or switch has been designed to protect the cable insulation. Make sure the cable is routed from connector to connector via the lower side of the power entry circuit breaker or switch.

14. Tighten the mounting screws until they are secure.

15. Connect the three lead wires from the power entry circuit breaker to the set of power input terminals (TB5 or TB6) directly below on the power module chassis backplane. Tighten the terminal screws to 2.3 Newton meters (20 in-lbs).

    a. Connect the brown lead wire to the L1 (+) terminal of TB5 or TB6.

    b. Connect the blue lead wire to the L2 (–) terminal of TB5 or TB6.

    c. Connect the green/yellow lead wire to the ground terminal of TB5 or TB6.

16. Connect the AC/DC service lines to the L1 (hot, +), L2 (neutral, –), and ground terminals on the power entry circuit breaker or switch. Tighten the terminal screws to 2.3 Newton meters (20 in-lbs).

17. Replace the protective covers for the terminal blocks and power modules chassis backplane bus bars.

18. Turn on the power source to the cabinet.

19. Turn on the circuit breaker or switch on the power entry circuit breaker or switch.

20. Verify system operation via the power monitor module LEDs.

Fuse Replacement

There are two fuses on IPFAN11 and IPFAN12 fans (F1 and F2) and one fuse on the IPFAN13 fan (F1) that are replaceable. Refer to Table 7-1 for a description and list of Elsag Bailey part numbers.

1. Follow the steps under ***Fan Assembly Replacement*** to remove the fan assembly from the power fan chassis.

2. Lay the fan assembly on an antistatic mat.

3. Locate the open fuse.

4. Use a fuse removal tool to remove the standard fuse clip mounted fuses.

5. Replace the open fuse with an equivalent replacement fuse. Use replacement fuses from the same manufacturer to maintain CSA certification. Refer to Table 7-1 for a list of Elsag Bailey part numbers and description.

POWER ENTRY CIRCUIT BREAKER OR SWITCH REPLACEMENT

Power to the cabinet must be off while replacing the IPECB11 or IPECB13 Power Entry Circuit Breaker and IPESW11 or IPESW13 Power Entry Switch.

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 power source. Open the rear door of the cabinet to gain access to the power entry circuit breaker or switch. Turn off the power entry circuit breaker or switch.

2. Remove the terminal block protective covers from the power module chassis backplane and power entry circuit breaker or switch.

3. Remove the service lines connected to the L1 (+), L2 (–) and ground terminals on the power entry circuit breaker or switch.

4. Remove the wiring from the power entry circuit breaker or switch to connector TB5 or TB6 terminals L1 (+), L2 (–) and ground.

5. Use a screwdriver to loosen the three Sems screws that secure the power entry circuit breaker or switch to the power fan chassis (or other mounting location) enough to lift the power entry circuit breaker or switch off of its mounting screws. It is not necessary to remove the screws completely.

6. Align the key holes on the replacement power entry circuit breaker or switch with the mounting screws and install by lowering the key holes onto the mounting screws.

> **NOTE:** The power entry circuit breaker or switch mounts over the power fan and status cable (Fig. 3-3). The lower side of the power entry circuit breaker or switch has been designed to protect the cable insulation. Make sure the cable is routed from connector to connector via the lower side of the power entry circuit breaker or switch.

7. Tighten the mounting screws until they are secure.

8. Connect the three lead wires from the power entry circuit breaker to the power input terminals (TB5 or TB6) directly below on the power module chassis backplane. Tighten the terminal screws to 2.3 Newton meters (20 in-lbs).

   a. Connect the brown lead wire to the L1 (+) terminal of TB5 or TB6.

   b. Connect the blue lead wire to the L2 (–) terminal of TB5 or TB6.

   c. Connect the green/yellow lead wire to the ground terminal of TB5 or TB6.

9. Connect the power service lines to the L1 (hot, +), L2 (neutral, –), and ground terminals on the power entry circuit breaker or switch. Tighten the terminal screws to 2.3 Newton meters (20 in-lbs).

10. Replace the terminal block protective covers to the power module chassis backplane and power entry circuit breaker or switch.

11. Turn on the power source to the cabinet.

12. Turn on the circuit breaker or switch on the power entry circuit breaker or switch.

13. Verify system operation via the power monitor module LEDs.

POWER MODULE CHASSIS REPLACEMENT

Power to the cabinet must be off while replacing the IPCHS01 Power Module Chassis.

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 power source.

2. Turn off the power entry circuit breakers or switches.

3. Remove the power monitor module and all the power modules and blank faceplates from the power module chassis. Grasp the faceplate handle on each power module and partially pull the power module from the power module chassis.

WARNING	**Allow 30 seconds for the line filter capacitors to discharge before handling the module after removal. Failure to do could result in severe or fatal shock.**
AVERTISSEMENT	**Allouer 30 seconds pour permettre aux capaciteurs filtres de ligne de se décharger avant de manipuler le module après l'avoir retiré. Un manquement à cette précaution pourrait causer un choc sévère ou fatal.**

4. After the 30 seconds required for the line filter capacitors to discharge, remove the modules completely from the power module chassis.

5. Remove the protective covers from the terminal blocks and the power module chassis bus bars.

6. Disconnect all cables and wiring from the power module chassis backplane (Figs. C-1 through C-3). Label the wires as they are removed.

   a. Disconnect the leads from the power entry circuit breaker or switch to terminal strips TB5 and TB6.

   b. Disconnect the fan power and status cable at the P2 and P3 connectors.

   c. Disconnect the PFI and system bus voltage monitoring cable from the P1 connector.

d. Disconnect the power system status cable from the STATUS OUT terminal on the TB3 terminal strip.

e. Disconnect any wiring for auxiliary inputs, status inputs, and customer alarm from terminal strips TB2, TB3 and TB4.

f. Disconnect the ±15 VDC leads from terminal strip TB1.

g. Disconnect the cables that connect the power module chassis backplane bus bars to the system power bus bars. Disconnect the cables at the I/O common, 25.5 VDC, module common, and 5 VDC bus bars.

7. Loosen and remove the three Sems screws at the front of the power module chassis that secure it to the fan chassis.

8. Loosen and remove the four mounting screws that secure the power module chassis to the side rails inside the cabinet.

9. Remove the chassis from the rear of the cabinet.

10. Insert the replacement power module chassis into its mounting position from the rear of the cabinet. The slot openings for power supplies and the power monitor face the front of the cabinet and the power module chassis backplane faces the rear of the cabinet.

11. Align the four mounting screw holes on the side flanges of the power module chassis with the clip nuts on the side mounting rails inside the cabinet and secure the power mounting unit in place using the four self-lock bolts.

12. Install the three Sems screws to secure the front edge of the power module chassis to the front edge of the fan chassis (Fig. 3-2).

13. Connect all wiring and cables that were disconnected from the power module chassis backplane. The terminal screws on the power module chassis backplane should be tightened to 2.3 Newton meters (20 in-lbs). Nuts and bolts that secure the cables that connect the power module chassis bus bars to the system power bus bar should be tightened to 6.8 Newton meters (±0.25 Newton meters) [60 in.-lbs (±2 in.-lbs)].

14. Remove all control and I/O modules from the module mounting units so that the power system is not loaded. Do not install the control and I/O modules until the power system is completely installed and operating.

15. Check for shorts on the input power. If any shorts are evident, correct the wiring problem before continuing with the installation procedures.

16. Check for shorts on the system power outputs. If any shorts are evident, correct the wiring problem before continuing with installation procedures.

17. Replace the protective covers on the terminal blocks and power module chassis bus bars.

18. Turn on power to the cabinet at the power entry circuit breakers or switches and at the power source.

19. Install the power monitor module that was removed from the power module chassis.

20. Observe the LEDs on the power monitor module. The self-check, line 1 and line 2 LEDs should be green. All other LEDs should be either off or red (Table 4-1).

21. If the self-check, line 1 or line 2 LED is red, there is a problem with the input power. Refer to ***TROUBLESHOOTING*** in Section 5 for assistance in locating and correcting the problem.

22. Begin installing power modules. Grasp the module faceplate handle and align the top and bottom edges of the circuit board with the guides in the module mounting unit.

23. Hold the module by the faceplate handle and firmly push it into the power module chassis slot until the rear edge connectors are completely seated in the backplane connectors.

24. Press the module handle while pushing and turning the thumbscrew at the top of the module clockwise to lock the module in place.

25. Observe the LEDs on the system and field power modules. All LEDs should be solid green (refer to Table 4-2 for a complete list of power module LED states).

26. If any of the LEDs are red, find and correct the problem before applying power to the cabinet control and I/O modules. Refer to ***TROUBLESHOOTING*** in Section 5 for assistance.

27. Repeat the procedure for the remaining power modules. For 2N systems, install an equal number of system and field power modules on each side of the IPMON01 module.

28. If the system is operating properly, insert the control and I/O modules into the module mounting unit.

29. When the entire cabinet is under power, check the power monitor module and power module LEDs again to verify the system is operating properly.

FAN CHASSIS REPLACEMENT

Power to the cabinet must be off while replacing the IPFCH01 Power Fan Chassis.

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 power source.

2. Turn off the power entry circuit breakers or switches.

3. Remove the power entry circuit breaker or switch (refer to ***POWER ENTRY CIRCUIT BREAKER OR SWITCH REPLACEMENT***).

4. Remove the power module chassis (refer to ***POWER MODULE CHASSIS REPLACEMENT***).

5. Remove the fan assemblies from the fan chassis (refer to ***Fan Assembly Replacement***).

6. Disconnect the J1 connector on the fan cable from the fan chassis.

7. From the front of the chassis, use a pair of needle nose pliers to squeeze the tabs on each side of the connector to release it and push it out the back of the chassis.

8. Use a nutdriver to remove the two mounting screws that secure the chassis to the mounting support bracket at the top of cabinet.

9. Use a nutdriver to remove the four mounting screws that secure the power fan chassis to the side mounting rails inside the cabinet.

10. Remove the power fan chassis from the rear of the cabinet.

11. Insert the replacement fan chassis into its mounting position from the rear of the cabinet. The openings for fan assembly mounting face the front of the cabinet and the power connectors on the fan chassis backplane face the rear of the cabinet.

12. Align the four mounting screw holes on the side flanges of the fan chassis with the clip nuts on the side mounting rails inside the cabinet and secure the power mounting unit in place using the four self-lock bolts.

13. Align the two mounting screw holes at the top of the fan chassis with the welded nuts on the mounting support bracket and secure using two mounting screws.

14. Install the fan cables that were previously removed. Note the orientation of the J1 connector in Figure C-3 to properly install the fan cable.

> **NOTE:** There are three unique fan cables. A specific cable is required to work with each of the fan assembly nomenclatures. Care should be taken when installing the fan cables in systems that use mixed power inputs.

15. Insert each fan assembly into the power fan chassis (Fig. 3-3).

16. Secure the fan assembly by tightening the thumbscrew clockwise.

17. Replace the power entry circuit breaker or switch (refer to ***POWER ENTRY CIRCUIT BREAKER OR SWITCH REPLACEMENT***).

18. Replace the power module chassis that was previously removed (refer to ***POWER MODULE CHASSIS REPLACEMENT***). Follow the system start-up procedures before turning on power to the cabinet.

SECTION 8 - SUPPORT SERVICES

INTRODUCTION

Elsag Bailey Process Automation is ready to help in the use and repair of its products. Contact the 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 your local sales office. Provide the following information:

1. Part description, part number and quantity.

2. Model and serial numbers (if applicable).

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

Order parts without commercial descriptions from your local sales office.

TRAINING

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

TECHNICAL DOCUMENTATION

Additional copies of this instruction, or other instructions, can be obtained from your local sales office at a reasonable charge.

APPENDIX A - QUICK REFERENCE GUIDE

INTRODUCTION

Appendix A contains a quick reference guide of IPMON01 Power Monitor Module dipswitch and jumper settings and LED states. This section also contains IPSYS01 System Power Module and IPFLD Field Power Modules LED states. Use these tables to set power monitor module options using the dipswitches and jumper.

IPMON01 DIPSWITCH AND JUMPER SETTINGS

Tables A-1 through A-5 list power monitor module dipswitch settings. Tables A-6 through A-9 list power monitor module jumper settings. Refer to Section 3 for a detailed description of dipswitch and jumper options.

Table A-1. IPMON01 Dipswitch SW1 Settings

Option	Enabled	Dipswitch Pole 1	Dipswitch Pole 2	User Setting
Enable power source line 2 monitoring	Yes	0		
	No	1		
Enable 5/15/-15 VDC system bus monitoring	Yes		0	
	No		1	

NOTE: 0 = CLOSED or ON, 1 = OPEN or OFF.

Table A-2. IPMON01 Dipswitch SW2 Settings

Option	Enabled	Dipswitch Pole 1	Dipswitch Pole 2	Dipswitch Pole 3	User Setting
Generate PFI signal for STATUS 1 input fault	Yes	0			
	No	1			
Generate PFI signal for 25.5 VDC bus fault	Yes		0		
	No		1		
For future use, must be set to 1	Yes			0	1
	No			1	

NOTE: 0 = CLOSED or ON, 1 = OPEN or OFF.

Table A-3. IPMON01 Dipswitch SW3 Settings

Option	Enabled	Dipswitch Pole 1	2	3	4	5	6	7	8	User Setting
Enables I/O power LED to indicate a STATUS 1 input fault	Yes	0								
	No	1								
Enables I/O power LED to indicate a STATUS 2 input fault	Yes		0							
	No		1							
Enables I/O power LED to indicate a CH2 AUX INPUT fault	Yes			0						
	No			1						
Enables I/O power LED to indicate a CH1 AUX INPUT fault	Yes				0					
	No				1					
Enables I/O power LED to indicate a 25.5 VDC bus fault	Yes					0				
	No					1				
For future use, must be set to 1	Yes						0			1
	No						1			
Enables I/O power LED to indicate a 48/125 VDC bus fault	Yes							0		
	No							1		
For future use, must be set to 1	Yes								0	1
	No								1	

NOTE: 0 = CLOSED or ON, 1 = OPEN or OFF.

Table A-4. IPMON01 Dipswitch SW4 Settings

Option	Enabled	Dipswitch Pole 1	2	3	4	5	6	User Setting
Generate PFI signal for 15 VDC bus fault	Yes	0						
	No	1						
Generate PFI signal for -15 VDC bus fault	Yes		0					
	No		1					
For future use, must be set to 1	Yes			0				1
	No			1				
For future use, must be set to 1	Yes				0			1
	No				1			
Generate PFI signal for 5 VDC bus fault	Yes					0		
	No					1		
Generate PFI signal for 48/125 VDC bus fault	Yes						0	
	No						1	

NOTE: 0 = CLOSED or ON, 1 = OPEN or OFF.

Table A-5. IPMON01 Dipswitch SW5 Settings

Option	Enabled	Dipswitch Pole 1	Dipswitch Pole 2	User Settings
Latch PFI signal	Yes	0		
	No	1		
Not used, must be set to 1	Yes		0	1
	No		1	

NOTE: 0 = CLOSED or ON, 1 = OPEN or OFF.

Table A-6. IPMON01 Input Voltage Jumper Settings

Function	Jumper	Jumper Setting			User Setting
		120 VAC	240 VAC	125 VDC	
Voltage on input line 1	J8	1-2	2-3	1-2	
	J12	1-2	2-3	1-2	
	J13	1-2	1-2	2-3	
Voltage on input line 2	J7	1-2	2-3	1-2	
	J11	1-2	2-3	1-2	
	J14	1-2	1-2	2-3	

NOTE: All 3 jumpers for an input line must be set to the same input voltage (i.e., for line 1, set J8, J12 and J13 to the same input voltage; for line 2, set J7, J11 and J14 to the same input voltage).

Table A-7. IPMON01 Auxiliary Input Trip Points Jumper Settings

Function		Jumper	Jumper Setting			User Setting
Auxiliary Input	Trip Point		24 VDC	48 VDC	125 VDC	
1	Low	J6	1-4	3-4	2-4	
	High	J4	1-4	3-4	2-4	
2	Low	J17	1-4	3-4	2-4	
	High	J18	1-4	3-4	2-4	

Table A-8. IPMON01 Temperature Trip Points Jumper Settings

Function	Jumper	Jumper Setting			User Setting
		50°C (122°F)	60°C (140°F)	70°C (158°F)	
Temperature sensor 1, trip point	J16	3-4	2-4	1-4	
Temperature sensor 2, trip point	J15	3-4	2-4	1-4	

NOTE: Jumpers J15 and J16 should be set the same.

Table A-9. IPMON01 Status Inputs Jumper Settings

Function	Jumper	Jumper Settings[1]		User Setting
		N.O.	N.C.	
Status input 1, contact input	J10	1-2	2-3	
Status input 2, contact input	J5	1-2	2-3	
48/125 VDC select	J9	1-2 (48 VDC)	2-3 (125 VDC)	

NOTE: 1. N.O. = normally open, N.C. = normally closed.

IPMON01 LED STATES

Table A-10 lists IPMON01 module LED states.

Table A-10. IPMON01 LED States

LED	LED State	Meaning
Self-check	Green	Good
	Red	Bad
	Off	Power off
Line 1	Green	Good
	Red	Bad
	Off	Power off
Line 2	Green	Good
	Red	Bad
	Off	Disabled or power off
Power supply	Red	Bad
	Off	Good
Cabinet temp	Red	Overtemperature
	Off	Within limit
Fan left	Red	Failed
	Off	Operating
Fan right	Red	Failed
	Off	Operating
External	Red	Fault
	Off	Good
System power	Red	Fault
	Off	Good or disabled
I/O power	Red	Fault
	Off	Good or disabled
PFI status	Red	Fault
	Off	Good or disabled

IPSYS01 and IPFLD LED STATES

Table A-11 lists IPSYS01, IPFLD01, IPFLD24, IPFLD48 and IPFLD125 modules LED states.

NOTE: The IPFLD01 and the IPFLD24 modules have only PFC and 25.5 V LEDs. The IPFLD48 module has only PFC and 48 V LEDs. The IPFLD125 module has only PFC and 125 V LEDs.

Table A-11. IPSYS01 and IPFLD LED States

LED	LED State	Meaning
PFC	Green	Normal
	Red	Failed
25.5 V, 5 V, +15 V and -15 V, 48 V and 125 V	Green	Good
	Blinking green	Converter overcurrent
	Red	Converter failure

APPENDIX B - SIZING THE POWER SYSTEM

INTRODUCTION

Appendix B lists the power requirements of INFI 90 OPEN modules, and termination units or modules. Use this information to calculate the 5, 15, -15, 25.5, 48 or 125 VDC current requirements for the modules in an INFI 90 OPEN cabinet. The procedure for calculating current requirements includes a worksheet for calculating any current requirements for system powered I/O.

> **NOTE:** The power system sizing procedures in this instruction apply to the INFI 90 OPEN Modular Power System II only. Do not use these procedures to size other Elsag Bailey power systems.

To size the INFI 90 OPEN Modular Power System II:

1. Calculate the system bus voltage and system power I/O current requirements for the cabinet (refer to ***CALCULATING SYSTEM CURRENT REQUIREMENTS*** and ***CALCULATING I/O CURRENT REQUIREMENTS***).

2. Verify that the system and I/O current requirements are within the DC bus bar capacity (refer to ***SYSTEM AND I/O CURRENT CAPACITIES***).

3. Size the power system (refer to ***SIZING THE MODULAR POWER SYSTEM II*** and ***EXAMPLE SIZING CALCULATION***).

4. Calculate the maximum current draw on the power entry circuit breaker or switches to verify that the total current draw of the cabinet circuitry is within specifications (refer to ***MAXIMUM POWER ENTRY CIRCUIT BREAKER OR SWITCH CURRENT DRAW*** and ***EXAMPLE CABINET CURRENT DRAW CALCULATION***).

CALCULATING SYSTEM CURRENT REQUIREMENTS

> **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 × 95 mA = 380 mA.

Tables B-1 and B-2 list all INFI 90 OPEN modules and termination devices and their operating current requirements. Use

Table B-3 to calculate system powered I/O current requirements.

1. Make a list of modules contained in the cabinet being sized for system and field power modules.

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 25.5 VDC current requirement.

   a. Refer to Table B-1 for the 25.5 VDC current requirement for each module.

   b. Table B-2 lists 25.5 VDC current requirements of termination units and termination modules.

   c. Total the 25.5 VDC current requirement per cabinet.

6. Calculate the 48 VDC current requirements. Refer to Table B-3.

7. Calculate the 125 VDC current requirements. Refer to Table B-3.

8. Add the current requirement of any system powered I/O using 25.5 VDC to the total from Step 5c. The procedure under ***CALCULATING I/O CURRENT REQUIREMENTS*** gives an overview of how to calculate the system powered I/O current requirement.

Table B-1. DC Current Consumption for INFI 90 OPEN 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	25.5 V	Total 25.5 V
IISAC01		0		0		0		530	
IMAMM03		725		125		30		0	
IMAOM01		1,045		0		0		0	
IMASI02		95		30		25		0	
IMASI03		330		140		40		0	
IMASM01		120		85		45		0	
IMASM02/03		400		80		40		6	
IMASM04		550		45		30		0	
IMASO01		530		220		225		50	
IMCIS02		300		30		25		7	
IMCOM03/04		660		55		50		7	
IMCPM01		0		0		0		0	
IMCPM02		825		0		0		0	
IMDSI02		60		0		0		0	
IMDSM04		1,500		0		0		65	
IMDSM05		600		0		0		0	
IMDSO01/02/03		150		0		0		0	
IMDSO04		165		0		0		0	
IMFBS01		100		30		20		0	
IMFCS01		220		7		10		0	
IMHSS01/02		180		80		70		20	
IMHSS03		940		27		18		570	
IMLMM02		660		0		0		0	
IMMFC03		4,200		40		20		0	
IMMFC04		1,400		0		0		0	
IMMFC05		1,000		0		0		0	
IMMFP01/02		2,000		0		0		0	
IMMFP03		2,000		0		0		0	
IMMPC01		4,200		40		20		0	
IMMPI01		415		0		0		0	
IMMPI02		700		0		0		0	
IMQRC01		660		55		50		7	
IMQRS01/02		300		30		25		7	
IMRIO02		1,600		20		90		0	
IMSPM01		1,330		30		25		0	
INBIM01/02 INBTM01		1,100		0		0		0	
INICT01		4,200		40		20		0	
INICT03		1,958		0		0		0	

Table B-1. DC Current Consumption for INFI 90 OPEN 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	25.5 V	Total 25.5 V
INIIT01		4,200		40		20		0	
INIIT02/03		2,000		0		0		0	
INIPT01		4,200		40		20		0	
INLIM03		2,200		90		90		0	
INNIS01		900		5		200		0	
INNPM01		2,000		0		0		0	
INPCT01 INPPT01		4,200		40		20		0	
INPTM01		1,100		0		0		0	
INSIM01		1,500		30		25		0	
NCTM01		1,500		0		0		0	
NDCS03		0		0		0		510	
NDIS01		0		0		0		360	
NDLS02		0		0		0		320	
NLIS01		900		5		200		0	
NLSM01/02		4,200		40		20		0	
NMFC01/02		4,600		40		20		0	
NSBM01		1,000		0		0		0	
NSSM01		4,200		0		0		0	
Total									

Table B-2. 25.5 VDC Current Consumption of Termination Units or Modules

Termination Unit/Module	TU/TMs Using System Power per Cabinet	25.5 VDC Current Consumption per TU/TM (mA)	25.5 VDC TU/TM Current Consumption per Cabinet
NTCL01 NICL01		40	
NTDO02		90	
NTFB01		65	
NTMF01 NIMF01/02		130	
NTMP01 NIMP01/02		230	
NTRL03 NIRL01/02/03		130	
NTRL02		190	
Total			

CALCULATING I/O CURRENT REQUIREMENTS

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	Number of Inputs/ Outputs	Current Consumption per Input/ Output (mA)	Total Current Consumption for System Power I/O
Analog outputs		20	
Analog 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.

SYSTEM AND I/O CURRENT CAPACITIES

Before sizing the power system, verify that the current requirements of all system and I/O voltages are within the capacity of the DC bus bars and ±15 VDC wiring. Refer to Table B-4 and verify that the calculated system and I/O current requirements are within the current values listed. If the system and I/O current requirements are not within the specified maximums, modify the cabinet configuration to reduce the total system and I/O current required.

Table B-4. System Current Capacity

Voltage (VDC)	Maximum Current (A)
5	85
15	15
-15	15
25.5	85
48	12
125	12

SIZING THE MODULAR POWER SYSTEM II

The following text and equations explain how to calculate the number of IPSYS01 System Power Modules and IPFLD01, IPFLD24, IPFLD48 or IPFLD125 Field Power Modules needed for a particular system. The calculations take into account sizing the power system for N+1 and 2N redundancy.

Cabinet requirements for 5, 15, -15 25.5, 48 and 125 VDC power are calculated by adding the individual module current requirements. To determine the current requirements of your system, refer to ***CALCULATING SYSTEM CURRENT REQUIREMENTS*** and ***CALCULATING I/O CURRENT REQUIREMENTS***. Refer to product specifications for current requirements of new modules not listed.

A = total 5 VDC current requirements for system cabinet

B = total 15 VDC current requirements for system cabinet

C = total -15 VDC current requirements for system cabinet

D = total 25.5 VDC current requirements for associated I/O

E = total 48 or 125 VDC current requirements for associated I/O

N1 = no. of IPSYS01 power modules needed to meet 5 VDC current requirements

N2 = no. of IPSYS01 power modules needed to meet 15 VDC current requirements

N3 = no. of IPSYS01 power modules needed to meet -15 VDC current requirements

N4 = no. of IPSYS01 power modules needed to meet 25.5 VDC current requirements

N5 = no. of IPFLD48 or IPFLD125 power modules needed

NS = total no. of IPSYS01 power modules needed to power the system

Then solve the following equations:

$$N1 = \frac{A}{17}$$

$$N2 = \frac{B}{1.8}$$

$$N3 = \frac{C}{1.8}$$

$$N4 = \frac{D}{5.6}$$

$$N5 = \frac{E}{5.45} \quad \textit{(for IPFLD48)}$$

$$N5 = \frac{E}{2.3} \quad \textit{(for IPFLD125)}$$

Round up all values of N1 through N3 to the next highest integer.

NP = total no. of IPFLD48 or IPFLD125 power modules are needed. If N5 < 1, NP = 1. If N5 ≥ 1, NP = N5 rounded to the next highest integer.

NS = largest of N1, N2 and N3

NF = total no. of IPFLD01 power modules needed to power the system. If using IPFLD24 modules instead of IPFLD01 module, then NF ÷ 2 = the total no of IPFLD24 modules needed to power the system

N4 – NS = NF

If NF ≤ 0, no IPFLD01 or IPFLD24 modules are needed.

IF NF ≥ 0, then NF rounded to the next highest integer equals the number of IPFLD01 modules needed. If IPFLD24 modules are being used, NF divided by two rounded up to the next highest integer equals the number of IPFLD24 modules needed .

PA = total power of the 5.09 VDC bus

PB = total power of the 15.1 VDC bus

PC = total power of the -15.1 VDC bus

PD = total power of the 25.5 VDC bus

PG = average I/O power per module

PH = average system power per module

$PA = A \times 5.09$

$PB = B \times 15.1$

$PC = C \times (-15.1)$

$PD = D \times 25.6$

$$PG = \frac{PD}{(NF + NS)}$$

$$PH = \frac{(PA + PB + PC)}{NS}$$

If (PG + PH) ≥ 260, then NS = NS + 1, otherwise:

If using IPFLD01 modules:
For N, N+1, or N+x redundancy, add one IPSYS01 power module to NS. NF is the number of IPFLD01 power modules required.

If using IPFLD24 modules:
For N, N+1 or N+x redundancy, add one IPSYS01 power module to NS. Add one IPFLD24 module to NF divided by two.

If using IPFLD48 or IPFLD125 modules:
For N, N+1, or N+x redundancy, the number of power modules required is NP + 1.

For 2N redundancy, double NS, NF and NP (two power entry circuit breakers or switches are required).

MAXIMUM POWER ENTRY CIRCUIT BREAKER OR SWITCH CURRENT DRAW

The current draw of the system must be within the specifications of the power entry circuit breaker or switch. Calculate the total current draw on the power entry circuit breaker or switch by multiplying the number of power modules by the total current draw of those modules.

When calculating the maximum current draw, consider a redundant IPSYS01 module in an N+1 redundant system to draw its no load current. This also applies to N and N+x redundant systems. Consider each of the redundant IPSYS01 modules in an N+x redundant system to draw its no load current. On 2N redundant systems, the maximum current draw will be half of the total full load current of all power modules being used in the 2N configuration. Include the current draw of the specific power system fan being used and the IPMON01 power monitor module.

The specified maximum current limit on the power entry circuit breaker or switch is 20 amps for 120/240 VAC and 125 VDC systems. Table B-5 lists the current draw of INFI 90 Modular Power System II components.

Table B-5. Component Current Draw

Modular Power System II Device	Input Current (A)		
	120 VAC	240 VAC	125 VDC
IPFAN11	0.6	NA	NA
IPFAN12	NA	0.4	NA
IPFAN13	NA	NA	0.7
IPFLD01 (full load)	2.2	1.0	2.2
IPFLD01 (no load)	0.3	0.2	0.3
IPFLD24 (full load)	4.7	2.4	4.7
IPFLD24 (no load)	0.5	0.3	0.5
IPFLD48 (full load)	4.4	2.2	4.4
IPFLD48 (no load)	0.5	0.3	0.5
IPFLD125 (full load)	4.7	2.4	4.7
IPFLD125 (no load)	0.5	0.3	0.5
IPMON01	0.3	0.2	0.2
IPSYS01 (full load)	4.3	2.0	4.3
IPSYS01 (no load)	0.5	0.3	0.5

EXAMPLE SIZING CALCULATION

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 were calculated. The results are:

A = 32 A (5.09 VDC current requirement)

B = 0.9 A (15.1 VDC current requirement)

C = 0.4 A (-15.1 VDC current requirement)

D = 12 A (25.5 VDC and associated I/O current)

Substitute these values into the equations and solve for NS.

$$N1 = \frac{32}{17}$$

N1 = 1.88 = 2 (rounded up to next highest integer)

$$N2 = \frac{0.9}{1.8}$$

N2 = 0.5 = 1 (rounded up to next highest integer)

$$N3 = \frac{0.4}{1.8}$$

N3 = 0.22 = 1 (rounded up to next highest integer)

$$N4 = \frac{12}{5.6}$$

N4 = 2.14 = 3 (rounded up to next highest integer)

NS = 2 (the greater of N1, N2, and N3)

NF = 3 – 2 = 1

PA = 32 × 5.09 = 162.9

PB = 0.9 × 15.1 = 13.6

PC = 0.4 × (-15.1) = 6

PD = 12 × 25.6 = 307.2

$$PG = \frac{307.2}{(1+2)} = 102.4$$

$$PH = \frac{162.9 + 13.6 + 6}{2} = 91.25$$

PG + PH = 193.65 which is less than 260

Therefore, NS = 2 and NS_{N+1} = 2 + 1 = 3 and NF_{N+1} = 1.

For 2N redundancy, NS_{2N} = 2 × 2 = 4 and NF_{2N} = 1 × 2 = 2.

EXAMPLE CABINET CURRENT DRAW CALCULATION

Using the figures from the example sizing calculation, the following examples show how to calculate the current draw of N+1 and 2N systems.

For an N+1 system calculation, there are two system power modules operating at full load, one system power module (the redundant power module in the N+1 system) operating at no load, and one field power module. Assuming a 120 VAC system, the total current draw on the power entry circuit breaker or switch is:

(2 IPSYS01 modules) × (4.3 A/module) = 8.6 A current draw for the IPSYS01 modules

(1 IPSYS01 module) × (0.5 A/module) = 0.5 A current draw for the IPSYS01 module

(1 IPFLD01 module) × (2.2 A/module) = 2.2 A current draw for the IPFLD01 module

(1 IPMON01 module) × (0.3 A/module) = 0.3 A current draw for the IPMON01 module

(2 IPFAN11 fans) × (0.6 A/fan) = 1.2 A current draw for the IPFAN11 fans

The total current draw on the power entry circuit breaker or switch is:

8.6 A + 0.5 A + 2.2 A + 0.3 A + 1.2 A = 12.8 A

Therefore, the current draw on the power entry circuit breaker or switch is within the 20-amp specification for an N+1 configuration.

For a 2N system calculation, each power entry circuit breaker or switch supplies two system power modules, one field power module, the power monitor module and two fans. Calculate the total current draw on one power entry circuit breaker or switch assuming a 120 VAC system.

(2 IPSYS01 modules) × (4.3 A/module) = 8.6 A current draw for the IPSYS01 modules

(1 IPFLD01 module) × (2.2 A/module) = 2.2 A current draw for the IPFLD01 module

(1 IPMON01 module) × (0.3 A/module) = 0.3 A current draw for the IPMON01 module

(2 IPFAN11 fans) × (0.6 A/fan) = 1.2 A current draw for the IPFAN11 fans

The total current draw on each power entry circuit breaker or switch is:

8.6 A + 2.2 A + 0.3 A + 1.2 A = 12.3 A

Therefore, the current draw on the power entry circuit breaker or switch is within the 20-amp (per side) specification for a 2N configuration.

APPENDIX C - WIRING DIAGRAMS

INTRODUCTION

Appendix C contains system cabinet wiring diagrams for the INFI 90 OPEN Modular Power System II. Figure C-1 shows how to wire the auxiliary inputs channels, status inputs and customer alarms. Figure C-2 shows a wiring diagram for a 2N redundant system. Figure C-3 shows a wiring diagram for an N, N+1 and N+x redundant system.

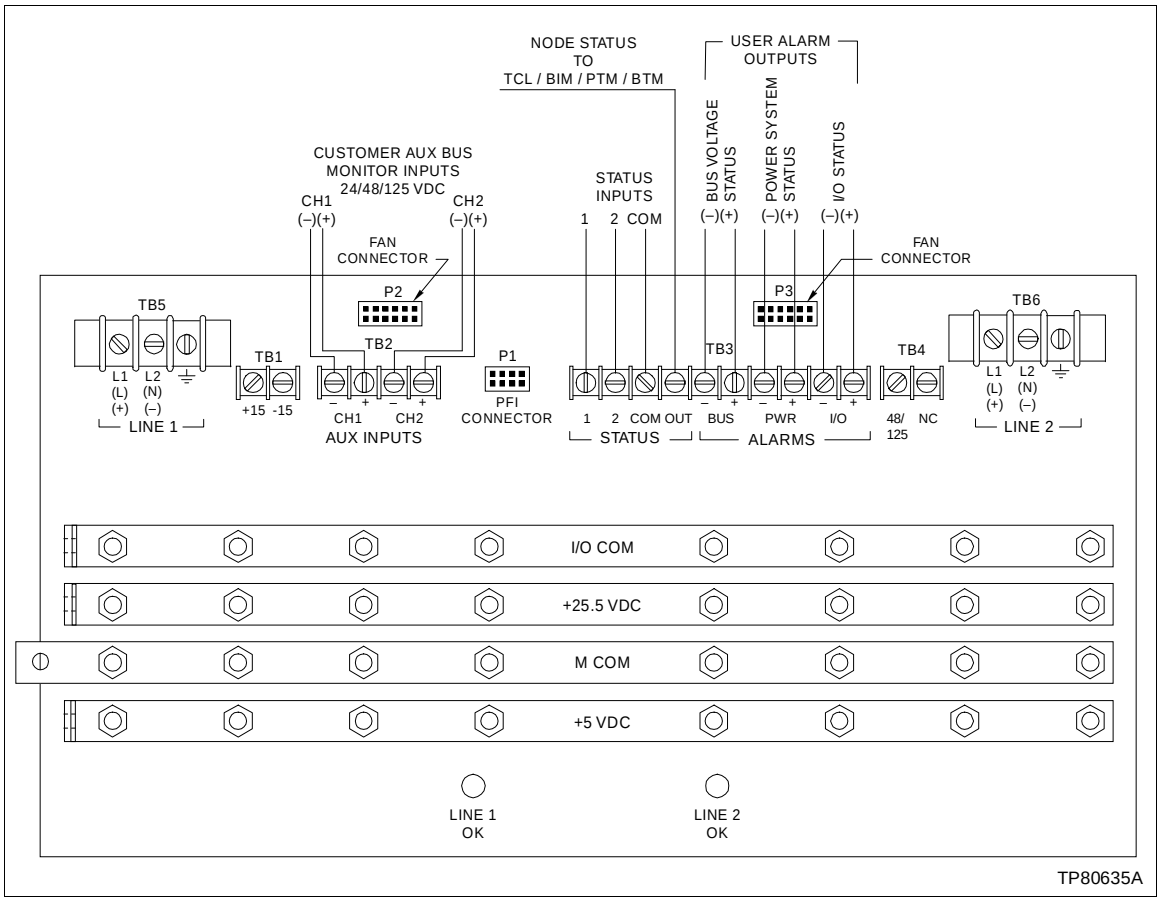

Figure C-1. Alarms and Auxiliary Inputs Wiring Diagram

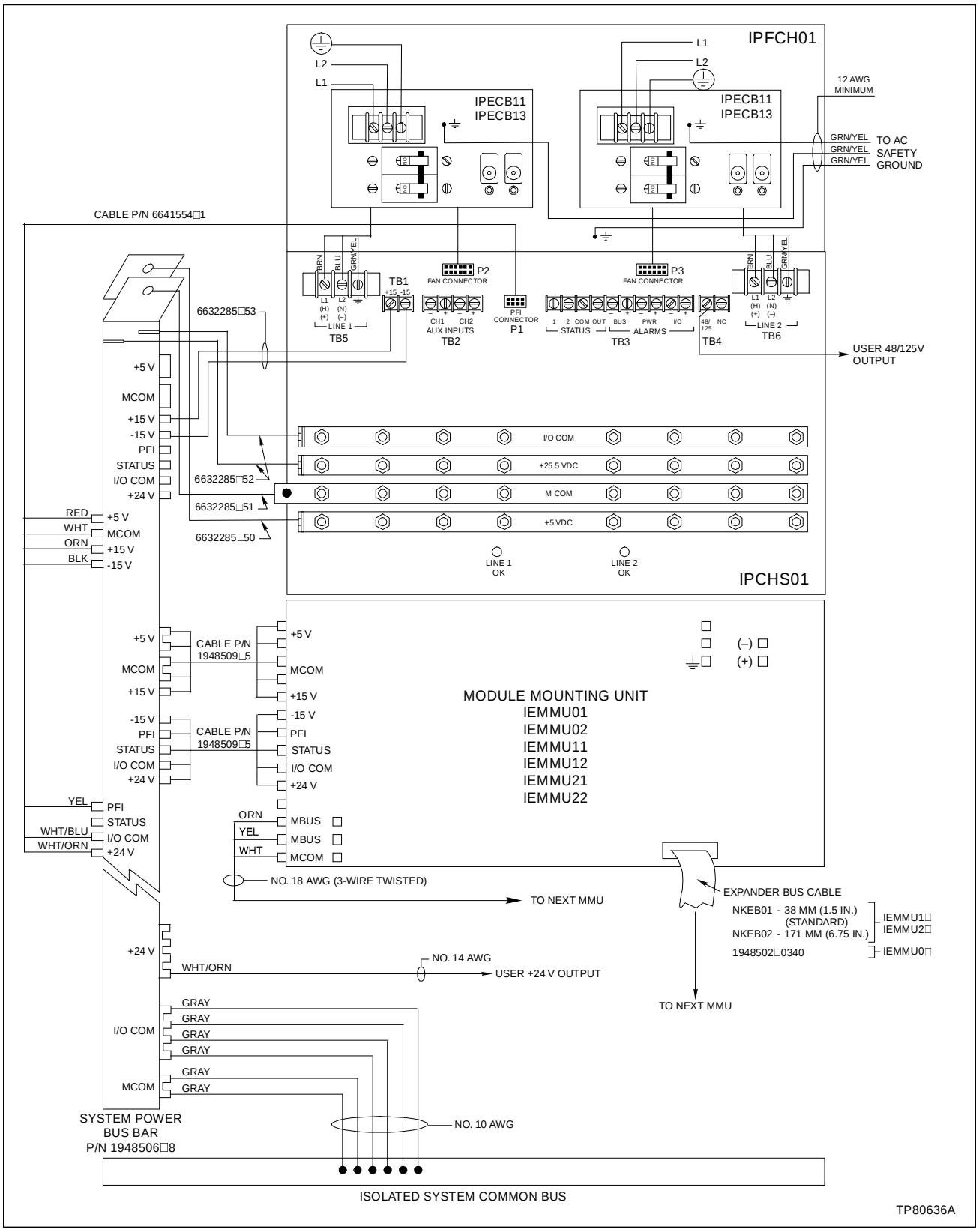

Figure C-2. 2N Redundancy System Wiring Diagram

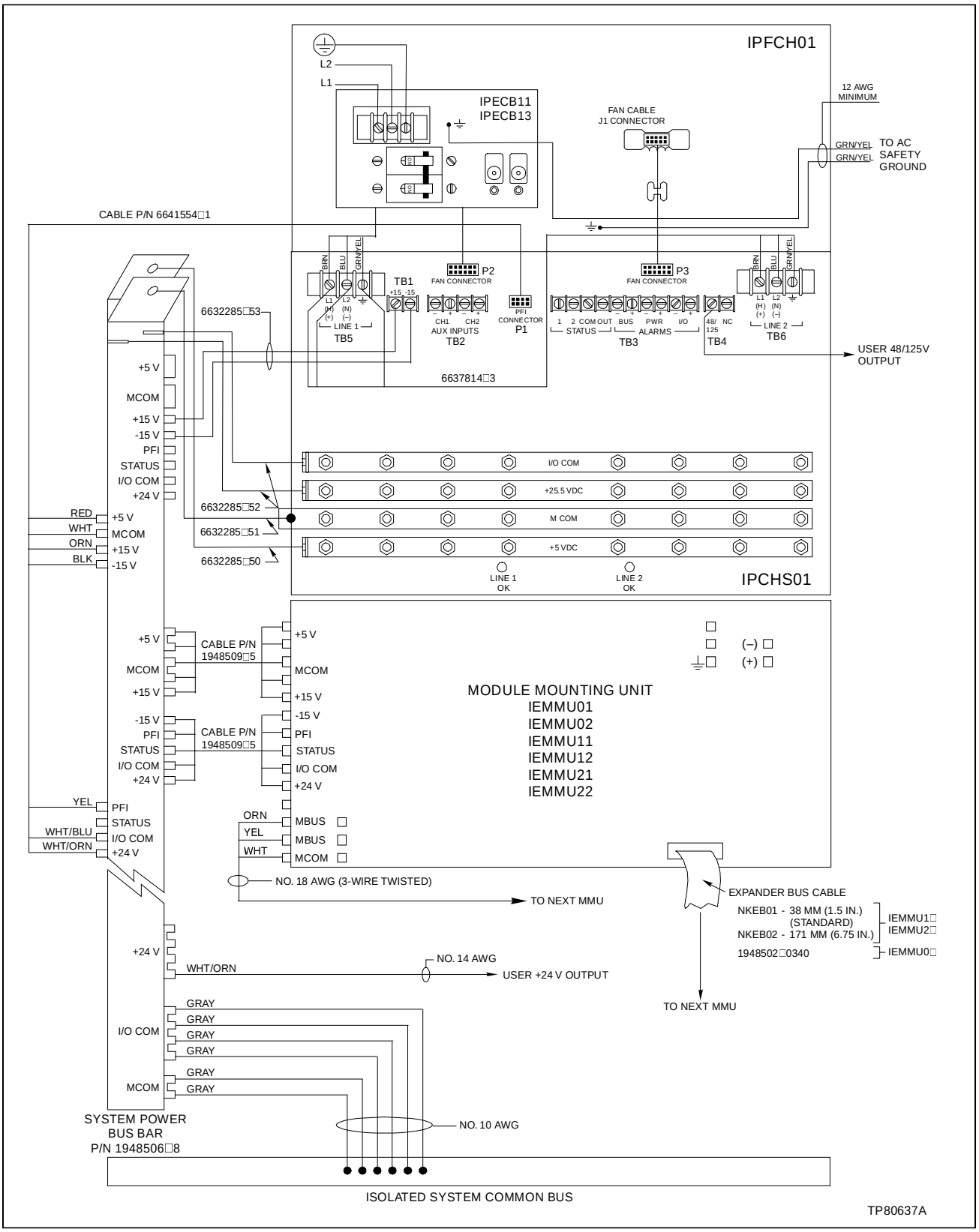

Figure C-3. N, N+1 and N+x Redundancy System Wiring Diagram

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