symphony™

Instruction
Harmony Series

Modular Power System II

ABB

Preface

The Modular Power System II supplies 5 VDC, 15 VDC, –15 VDC, 24 VDC, 48 VDC, and 125 VDC power to Harmony components of the Symphony™ Enterprise Management and Control System. This power system can operate with 120 VAC, 240 VAC, or 125 VDC input power.

NOTE: The Modular Power System II can be used to power INFI 90® OPEN Strategic Enterprise Management System devices.

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.

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Special Handling
This device uses electrostatic sensitive devices.

SPECIFIC WARNINGS

Verify the main power and power entry panel circuit breakers are turned off before starting installation, retrofit, upgrade, or wiring procedures. Failure to do so could result in severe or fatal shock. Do not turn the power on until the installation, retrofit, upgrade, or wiring procedures are complete. (p. 3-5, 3-13, 3-14, 3-16, 3-17, 7-5, 7-8, 7-10, 7-13)

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. (p. 6-4)

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. (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. 7-2, 7-3, 7-10)

SPECIFIC WARNINGS (continued)	Handle the module by surfaces other than the heat sink. The heat sink may be hot and may cause severe burns. (p. 7-3) 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. 7-5)
SPECIFIC CAUTIONS	Do not install the IPFLD48 and IPFLD125 field power modules together in the same IPCHS01 or IPCHS02 chassis. Equipment damage will result. (p. 3-28)

Support Services

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Introduction

Section 1

Overview

The Modular Power System II supplies 5 VDC, 15 VDC, –15 VDC, 24 VDC, 48 VDC, and 125 VDC power to Harmony components of the Symphony Enterprise Management and Control System. The Harmony components include the Harmony Input/Output System devices (I/O blocks) and Harmony Rack I/O devices.

NOTE: The 24 VDC power system output is actually 25.5 VDC. This instruction refers to the actual voltage in most cases.

Figure 1-1 shows a front view of a typical power system. The modules used in the power module chassis will vary according to system requirements.

The power system is designed to operate in several configurations of power module redundancy (N, N+1, N+x, and 2N). Benefits of the Modular Power System II are:

- Power factor correction.
- On-line replaceable components.
- Monitoring functions.
- Directly accepts 120 VAC, 240 VAC, or 125 VDC inputs.

NOTES:

1. The Modular Power System II can be used to power INFI 90 OPEN system devices.

2. This power system is a direct replacement for INFI 90 DC and AC modular power systems in their entireties. Components of these previous power systems cannot be used with Modular Power System II. Modular Power System II fits in the same cabinet space as the INFI 90 DC or AC modular power system that uses a power mounting unit.

Intended User

This instruction is intended for engineers, technicians, and system designers as a source of technical information on the Modular Power System II. This instruction should be used by

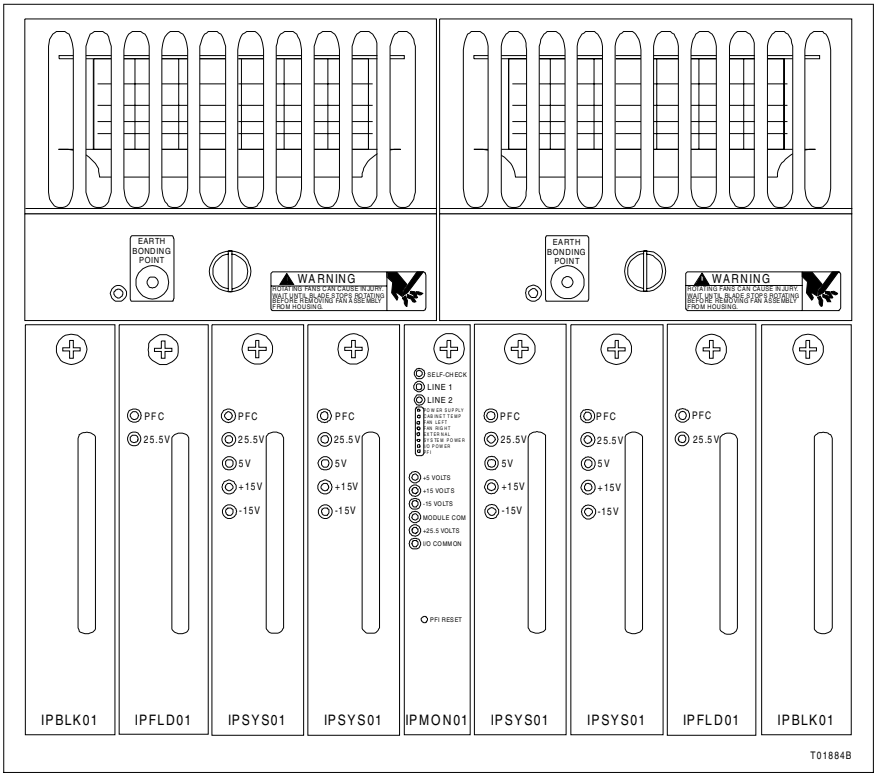

Figure 1-1. Modular Power System II Front View (Typical)

those installing, operating, troubleshooting, maintaining, and replacing the power system and power system components.

Those working with the power system should have experience working with and know the precautions to take around AC and 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 Modular Power System II consists of a power module chassis, fan chassis, power entry circuit breakers or switches, system fans, power monitor module, and power modules: System power module, Harmony power module, field power modules.

System Power Module

The IPSYS01 System Power module is a rack mounted circuit board that supplies 5 VDC, 15 VDC, and –15 VDC system operating voltages to rack I/O devices and 25.5 VDC field I/O power to a cabinet. The system power module can accept 120 VAC, 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-to-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 IPFLD24 Field Power modules are similar to 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 field I/O power 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.

Harmony Power Module

The IPBLC01 Harmony Power module is identical to the IPFLD24 field power module except that it supplies 25.5 VDC operating voltage to power the Harmony components of the Symphony system. The Harmony power module mounts in one power module chassis mounting slot.

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), Harmony bus voltages (24 VDC A and B), I/O bus voltages (24 VDC, 48 VDC, and 125 VDC).
- Two selectable auxiliary inputs for 24 VDC, 48 VDC, 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 or normally closed contact inputs.
- Three isolated outputs for bus alarm, power alarm, and I/O alarm.
- One power system status output for use on the Symphony Control Net (Cnet) or the INFI 90 OPEN INFI-NET® communication network.
- Two fan status inputs.
- One power supply status signal from each power module.
- Power monitor module internal circuitry status.

The 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 line 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 reset pushbutton is used to reset a PFI signal when the PFI latched option is enabled.

Power Module Chassis

The Modular Power System II supports two different power module chassis: IPCHS01 and IPCHS02. The IPCHS01 chassis supports Harmony rack I/O power connection only. It cannot be used for Harmony I/O block power connection. The IPCHS02 chassis supports both Harmony I/O block connection and Harmony rack I/O connection.

IPCHS01 Chassis

The IPCHS01 Power Module Chassis provides power input connection, power output bus bars, and various terminals for status inputs and outputs. It provides mounting for 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 terminal strips (for ±15 VDC and 48/125 VDC). Cables connect the bus bars and ±15 VDC terminals to the system power bus bar for distribution to the cabinet. The 48/125 VDC terminals are user outputs.

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, and IPFLD125 power modules and the IPMON01 power monitor module can be mounted in this power module chassis.

NOTE: The IPFLD48 and the IPFLD125 power modules cannot coexist in the same power module chassis.

IPCHS02 Chassis

The IPCHS02 Power Module Chassis is identical to the IPCHS01 chassis except that it has additional bus bars for Harmony power (25.5 VDC) and ground and a power distribution assembly circuit board that attaches to the bus bars. The power distribution assembly supports redundant power distribution to Harmony devices. This circuit board has connectors installed for attaching the Harmony I/O power cables.

Power modules and the power monitor module can be removed from the power module chassis and replaced while the system is on-line. The IPSYS01, IPFLD01, IPFLD24, IPFLD48, and IPFLD125 power modules, the IPMON01 power monitor module, and additionally the IPBLC01 Harmony Power module can be mounted in this power module chassis.

NOTE: The IPFLD48 and the IPFLD125 power modules cannot coexist in the same power module chassis.

Power Entry Circuit Breaker or Switch

The IPECB11 or IPECB13 Power Entry Circuit Breaker and IPESW11 or IPESW13 Power Entry Switch terminate the AC or DC power input lines and provide line filtering before feeding power to the power module chassis backplane. These devices are mounted on the back of the power fan chassis. One circuit breaker or switch is used on N, N+1, and 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

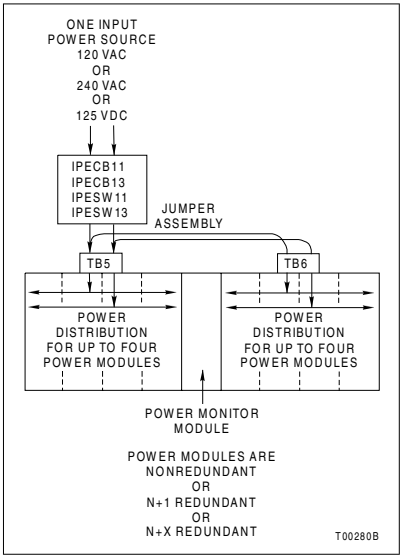

Figure 1-2. Input Power for N, N+1, and N+x Redundant Systems

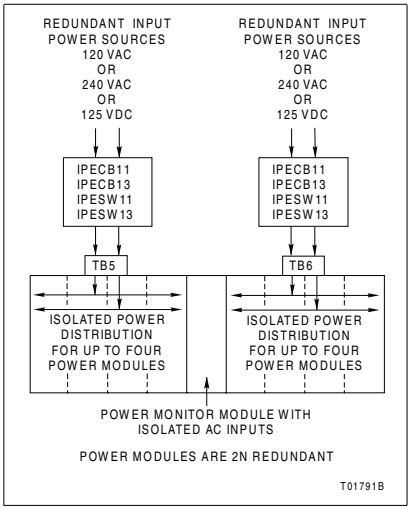

Figure 1-3. Input Power for 2N Redundant Systems

for 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 Modular Power System II structure:

- IPFAN11 Power System Fan (120 VAC).
- IPFAN12 Power System Fan (240 VAC).
- IPFAN13 Power System Fan (125 VDC).
- IPFAN14 Power system Fan (120/240 VAC, 125 VDC).

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

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 capa-

ble of cooling the cabinet and a failed fan can be replaced while the system is on-line.

Power Module Usage by System

Table 1-1 shows the typical power module usage.

Table 1-1. Typical Power Module Usage

Power Module	Harmony I/O System	Harmony Rack I/O
IPBLC01	•	
IPFLD01		•
IPFLD24	•	•
IPFLD48	•	•
IPFLD125	•	•
IPSYS01		•

Features

- 2N or N, N+1, and N+x redundancy increases availability.
- Accepts 120 VAC, 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 or 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 several sections and appendices. Read this instruction before installing or operating the

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. A parts list is also included.

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 Contains procedures that explain how to replace power system components.

How to Use This Instruction

Read this instruction before installing and operating the Modular Power System II. To use this instruction:

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

2. Perform 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.

6. Refer to the appendices for wiring diagrams and power system sizing information.

Reference Documents

Table 1-2 lists documents that contain information related to the Modular Power System II.

Table 1-2. Reference Documents

Number	Title
I-E96-500	Site Planning and Preparation
WPBEEUI200501?0	Module Mounting Units (IEMMU11, IEMMU12, IEMMU21, IEMMU22)
WBPEEUI210506?0	Power System Sizing
WPBEEUI240760?0	Harmony Input/Output System, Block Power and Mounting Hardware

Document Conventions

The ? in a part number and document number identifies any positions that are variable positions (e.g., 1949480?1). In a part number, the ? is a place holder for the revision letter.

Glossary of Terms and Abbreviations

Table 1-3 contains those terms and abbreviations that are unique to ABB Automation Inc. or have a definition that is different from standard industry usage.

Table 1-3. Glossary of Terms and Abbreviations

Term	Definition
PFI	Power fail interrupt. A signal that causes active controllers to reset and the communication system to be bypassed, when generated in the system by an out of tolerance bus voltage.
Termination module	Provides input/output connection between plant equipment and the rack I/O devices.
Termination unit	

Nomenclature

Table 1-4 lists Modular Power System II nomenclatures.

Table 1-4. Nomenclature

Nomenclature	Description
IPBLC01	Harmony power module (25.5 VDC output, 120/240 VAC and 125 VDC input)
IPBLK01	Power blank faceplate
IPCHS01	Power module chassis
IPCHS02	Power module chassis (for Harmony I/O system)
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) **NOTE**: Twice the maximum capacity of 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)

System Current Capacities

Table 1-5 lists the system current capacities. The value given in this table for 25.5 VDC IFP is for estimation purposes only. Refer to the ***Harmony I/O System, Block Power and***

Mounting Hardware instruction for the method to calculate the actual current capacity for a block mounting column.

Table 1-5. System Current Capacities

Voltage (VDC)	Maximum Current (A)
5	85
15	15
–15	15
25.5 BLP	5.6
25.5 IFP	8
25.5 I/O	85
49.1	12[1]
125.6	12[1]

NOTE:
1. Uses 3.3 to 0.83 sq-mm (12 to 18 AWG) wiring. Refer to manufacturer's specifications for maximum current ratings.

Specifications

Table 1-6 lists Modular Power System II specifications.

Table 1-6. Modular Power System Specifications

<table>
<tr><th>Property</th><th>Characteristic/Value</th></tr>
<tr><td>MPS II inputs</td><td></td></tr>
<tr><td>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° to 55°C
(32° to 131°F)</td><td>120 VAC</td><td>102 to 132 VAC</td></tr>
<tr><td>240 VAC</td><td>204 to 264 VAC</td></tr>
<tr><td>125 VDC</td><td>102 to 144 VDC</td></tr>
</table>
</td></tr>
<tr><td>Input current</td><td>20 A maximum per side</td></tr>
<tr><td>Peak inrush current</td><td>15 A per power module for 100 msecs maximum for AC or DC input power</td></tr>
<tr><td>Frequency</td><td>47 to 63 Hz</td></tr>
<tr><td>Total harmonic distortion</td><td>Less than 5%</td></tr>
</table>

Table 1-6. Modular Power System Specifications *(continued)*

Property	Characteristic/Value
MPS II inputs *(continued)*	
Efficiency	60% at full rated load
Power factor	Actively corrected to 0.95 minimum at input currents greater than 0.5 A
Power modules	IPBLC01, IPSYS01, IPFLD01, IPFLD24, IPFLD48, IPFLD125 Refer to Table 1-7
Power monitor module	IPMON01 Refer to Table 1-8
Power module chassis	IPCHS01, IPCHS02
Input power capacity	20 A maximum per side
Output bus capacity	85 A at 5.1 VDC maximum 15 A at ±15.1 VDC maximum 85 A at 25.5 VDC maximum 12 A at 49.1 VDC maximum 12 A at 125.6 VDC maximum
IPCHS02 Harmony connector rating	Approximately 7 A
Power entry circuit breaker Power entry switch	IPECB11, IPECB13 IPEWS11, IPEWS13
Input voltage IPECB11 and IPEWS11 IPECB13 and IPEWS13	 102 to 264 VAC 102 to 144 VDC
Input current	20 A maximum
Voltage drop across breaker and switch	2 V drop at 20 A nominal
System fan	IPFAN14
Input power	 0.72 A nominal at 120 VAC 0.42 A nominal at 240 VAC 0.5 A nominal at 125 VDC
Frequency	47 to 63 Hz

Table 1-6. Modular Power System Specifications *(continued)*

<table>
<tr><th>Property</th><th>Characteristic/Value</th></tr>
<tr><td>Weight and dimensions

Modules</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[2] mm (in.)</th></tr>
<tr><td>IPBLC01 Harmony Power</td><td>2.49 (5.46)</td><td>218.40 (8.60)</td><td>48.30 (1.90)</td><td>440.50 (17.50)</td></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 (17.50)</td></tr>
<tr><td>IPFLD01 Field Power</td><td>2.36 (5.20)</td><td>218.40 (8.60)</td><td>48.30 (1.90)</td><td>444.50 (17.50)</td></tr>
<tr><td>IPFLD24 Field Power</td><td>2.49 (5.46)</td><td>218.40 (8.60)</td><td>48.30 (1.90)</td><td>444.50 (17.50)</td></tr>
<tr><td>IPFLD48 Field Power</td><td>2.55 (5.62)</td><td>218.40 (8.60)</td><td>48.30 (1.90)</td><td>444.50 (17.50)</td></tr>
<tr><td>IPFLD125 Field Power</td><td>2.55 (5.62)</td><td>218.40 (8.60)</td><td>48.30 (1.90)</td><td>444.50 (17.50)</td></tr>
<tr><td>IPMON01 Power Monitor</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</td><td>2.55 (5.60)</td><td>218.40 (8.60)</td><td>48.30 (1.90)</td><td>444.50 (17.50)</td></tr>
</table>
NOTES:
1. The total system weight is 48 kg (106 lb) maximum.
2. Dimension includes the handle.

Chassis/fans
<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>IPCHS0/021 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>
</table>
NOTE:
1. The total system weight is 48 kg (106 lb) maximum.
</td></tr>
</table>

Table 1-6. Modular Power System Specifications *(continued)*

Property	Characteristic/Value
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 or greater 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.
Temperature Operating enclosure (internal) Operating enclosure (external) Storage and transport	 0° to 70°C (32° to 158°F) 0° to 55°C (32° to 131°F) –40° to 85°C (–40° to 185°F)
Relative humidity Operating	 20% to 90% up to 55°C (131°F) noncondensing 20% to 45% at 55° to 70°C (131° to 158°F) noncondensing
Altitude Operating Storage and transport	 Sea level to 3,048 m (10,000 ft) Up to 9,144 m (30,000 ft)
Air quality	Noncorrosive per ISA S71.04 class LA, LB, LC severity level 1
Overvoltage category	IEC 1010-1 Category III, for mains Category II, for mains to the IPCHS01 and IPCHS02 chassis Category I, for outputs
Vibration	13.2 to 100 Hz, 0.7 Gs 2 to 13.2 Hz, 12 mm (0.47 in.) peak-to-peak displacement
Certification	
CSA C22.2, No. 142 FM	Certified for process control equipment in an ordinary (nonhazardous) environment Approved for Class I, Division 2, Groups A, B, C, D

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Table 1-7. Power Module Specifications

<table>
<tr><th>Property</th><th>Characteristic/Value</th></tr>
<tr><td>Power inputs
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>IPBLC01</td><td>4.7</td><td>2.4</td><td>4.7</td></tr>
<tr><td>IPFLD01</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>
<tr><td>IPSYS01</td><td>4.3</td><td>2.0</td><td>4.3</td></tr>
</table></td></tr>
<tr><td>Power outputs
Output voltage and current</td><td>
<table>
<tr><th>Module Outputs</th><th colspan="4">IPSYS01[1]</th><th>IPBLC01
IPFLD01
IPFLD24</th><th>IPFLD48</th><th>IPFLD125</th></tr>
<tr><td>Nominal 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 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 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 (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 and IPBLC01 modules.

Load sharing — Current shared equally between modules within 5% (highest current load to lowest current load) at full load
Line regulation — ±0.5% of the nominal output voltage over the input voltage range
Load regulation — Within specified minimum and maximum outputs from 0% to 100% load
Hold up time — 20 msecs following loss of power</td></tr>
<tr><td>Heat dissipation</td><td>190 W (IPBLC01, IPFLS24, IPFLD48, IPFLD125)
95 W (IPFLD01)
175 W (IPSYS01)</td></tr>
</table>

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Table 1-8. Power Monitor Module Specifications

<table>
<tr><th>Property</th><th>Characteristic/Value</th></tr>
<tr><td>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>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>49.1 (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>Status signal inputs and outputs (continued)</td><td></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 1-8. Power Monitor Module Specifications *(continued)*

Property	Characteristic/Value
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

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Description and Operation

Section 2

Introduction

This section explains the functional operation of the Modular Power System II. The power system consists of power modules, power monitor module, power module chassis, power entry circuit breakers or switches, power fan chassis, and fan assemblies.

System Architecture

Figure 2-1 shows the system architecture of the Modular Power System II. The power system provides the operating voltages for Harmony devices such as Harmony I/O blocks and rack I/O devices as well as power to operate field devices.

At the left side of the figure, the BLP A (block logic power) and BLP B lines shown entering the Harmony mounting column are redundant 25.5 VDC outputs that provide the operating voltage for I/O blocks. BLC (block logic common) is the return line for these voltages. The IFP (internal field power) line shown entering the Harmony mounting column is 25.5 VDC I/O power for field devices and IFC (internal field common) is its return line.

At the right side of the figure, the 5 VDC, 15 VDC, and –15 VDC lines shown entering the system power bus bar are the operating voltages for the rack I/O devices. MCOM (module common) is the return line for these voltages. The 25.5 VDC line shown entering the system power bus bar is I/O power for field devices and I/O COM is its return line.

The power system can provide 25.5 VDC, 49.1 VDC, and 125.6 VDC power for I/O devices.

Power Entry

The IPECB11 or IPECB13 Power Entry Circuit Breaker and IPESW11 or IPESW13 Power Entry Switch connects 120 or 240 VAC (50/60 hertz) or 125 VDC line power to the cabinet.

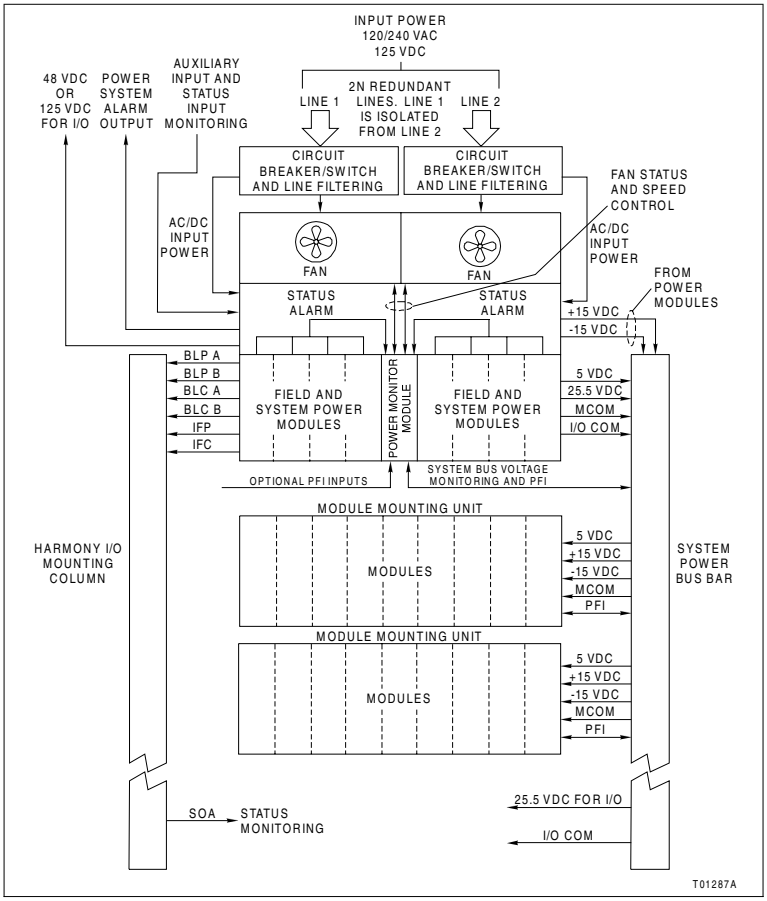

Figure 2-1. Modular Power System II Architecture

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 or IPCHS02 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 or IPCHS02 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 (Table 2-1). Refer to Figure 2-2 (IPCHS01) or Figure 2-3 (IPCHS02) for the location of the bus bars and connectors.

Table 2-1. Power Chassis Bus Bars

Bus Bar	Power Module Support	IPCHS01	IPCHS02
+24 VDC A[1] +24 VDC B[1] 24 VDC COM	IPBLC01		•
+25.5 VDC I/O COM	IPFLD01	•	•
+25.5 VDC I/O COM	IPFLD24	•	•
48/125 VDC (TB4) I/O COM	IPFLD48[2]	•	•
48/125 VDC (TB4) I/O COM	IPFLD125[2]	•	•

Table 2-1. Power Chassis Bus Bars *(continued)*

Bus Bar	Power Module Support	IPCHS01	IPCHS02
+5 VDC +15 VDC (TB1)[3] –15 VDC (TB1)[3] MCOM +25.5 VDC I/O COM	IPSYS01	•	•

NOTES:
1. +24 VDC A is supplied from power modules on the right side of the chassis; +24 VDC B is supplied from power modules on the left side of the chassis.
2. IPFLD48 and IPFLD125 field power modules cannot coexist in the same IPCHS01 or IPCHS02 power module chassis.
3. +15, –15, and 48/125 VDC busses are contained within the printed circuit board.

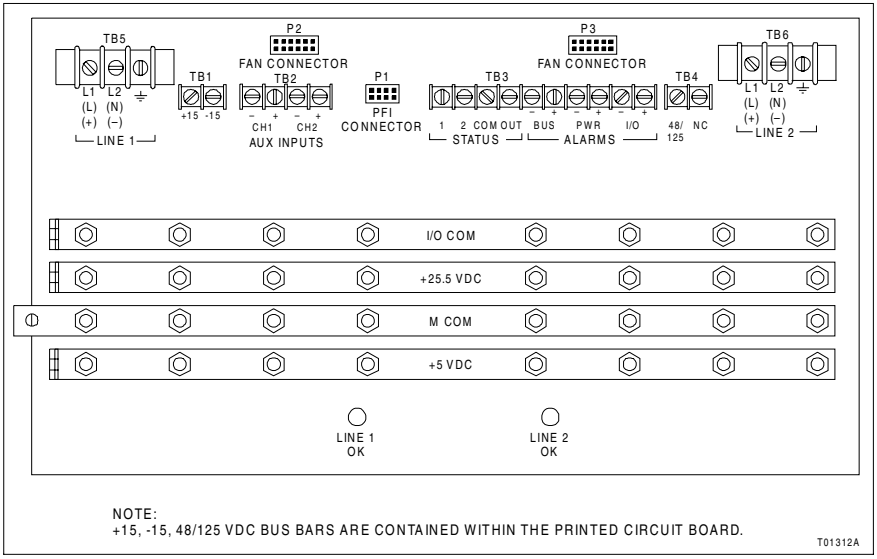

Figure 2-2. IPCHS01 Backplane

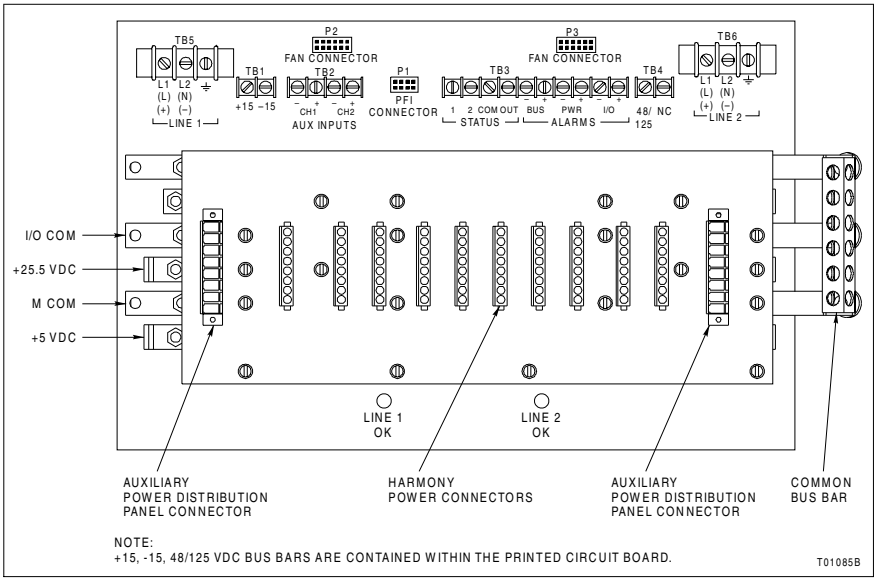

Figure 2-3. IPCHS02 Backplane

The IPCHS02 chassis has additional bus bars that feed the Harmony power connectors and auxiliary power distribution panel connectors. Also mounted on the power module chassis backplane are various connectors for ±15 VDC and 48/ 125 VDC, fan power, alarm outputs, optionally selected auxiliary input and status input monitoring (e.g., SOA), and system bus voltage and power fail interrupt (PFI) monitoring.

For Harmony I/O system devices (i.e., I/O blocks), cables connect from the power module chassis backplane connectors (IPCHS02 only) to the block mounting columns to distribute 25.5 VDC block power and 25.5 VDC internal field power.

For Harmony rack I/O devices, 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.

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 over temperature 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.

Power Monitor Module

There are a variety of power monitor module configurations available that enable the Modular Power System II to be tailored to growing or changing power monitoring and alarm requirements. Figure 2-4 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/DC inputs are fed through isolation circuitry to the power input monitoring circuitry then to the 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

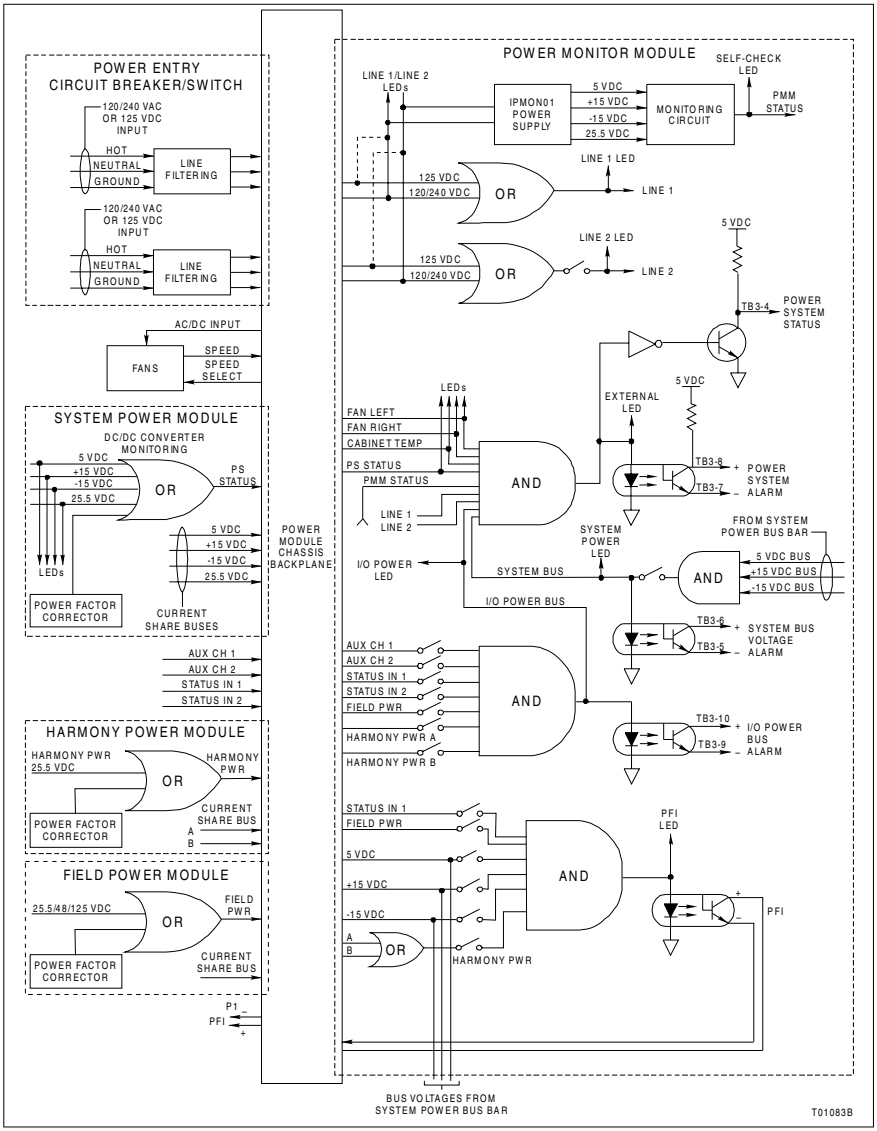

Figure 2-4. Status Signal Block Diagram

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.

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. 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 Cnet to human system interfaces (e.g. Conductor work stations).

System Bus Voltage Monitoring

The power monitor module monitors system bus voltages which include the 5, 15, –15 VDC outputs of system power modules. The voltages are monitored via a power module chassis cable connection to the system power bus bar. The voltages are compared to reference voltages on the power module.

Dipswitches allow selecting the PFI, I/O power, and system power LEDs (in any combination) to indicate a system bus

voltage failure or out-of-tolerance condition. If enabled, a bad voltage reading will cause a system bus voltage alarm, I/O power bus alarm, power system status alarm, and PFI alarm dependent on the dipswitch settings. The system bus voltage alarm, I/O power alarm, and power system status 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 and sent to operator interfaces.

Harmony Bus Voltage Monitoring

The power monitor module monitors the 25.5 VDC A and B Harmony bus voltages. The voltages are monitored via the power module chassis backplane. The voltage is compared to a reference voltage on the power module. Dipswitches allow selecting the PFI and I/O power to indicate a bus failure or out of tolerance condition. If enabled, a bad voltage reading will cause an I/O power bus alarm, power system alarm, and PFI alarm dependent on the dipswitch settings. The I/O power alarm is an isolated outputs that can be used to drive an annunciator panel or relay.

Field I/O Voltage Monitoring

The power monitor module monitors field I/O voltages of 25.5 VDC, 49.1 VDC, and 125.6 VDC. The voltages are monitored via the power module chassis backplane. The field I/O voltage monitoring circuitry operates in the same manner as the system bus voltage monitoring circuitry. Dipswitches allow selecting the I/O power and PFI LEDs to indicate a bus failure or out of tolerance condition. If enabled, a bad voltage reading will cause an I/O power bus alarm, power system alarm, and PFI alarm dependent on the dipswitch settings. The I/O power alarm is an isolated outputs that can be used to drive an annunciator panel or relay.

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 temperature LED and the external LED red for an over temperature 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 monitoring system. 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. Jumpers select either normally open (NO) or normally closed (NC) contact inputs.

The auxiliary channel inputs (AUX CH 1 and AUX CH 2) operate the same 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 to indicate a bus failure or out-of-tolerance condition.

The status inputs (STATUS IN 1 and STATUS IN 2) have additional circuitry for setting up operation as NO or NC contacts. Status input one can be enabled to use the PFI and I/O power LEDs. 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 several power modules: IPSYS01 System Power module; IPFLD01, IPFLD24, IPFLD48, IPFLD125 Field Power modules; and the IPBLC01 Harmony Power module. The system power module outputs 5, 15, –15, and 25.5 VDC power. The IPBLC01 module outputs 25.5 VDC. The IPFLD01 and IPFLD24 modules output 25.5 VDC, the IPFLD48 module outputs 49.1 VDC, and the IPFLD125 module 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-to-DC converters that produce the system and I/O bus voltage.

Each DC-to-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-to-DC converter overcurrent and failure. If any of the DC-to-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 2-5 shows the power module status signal logic. The system status signal, the 25.5 VDC over current 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 2-6 shows the field power module signal status.

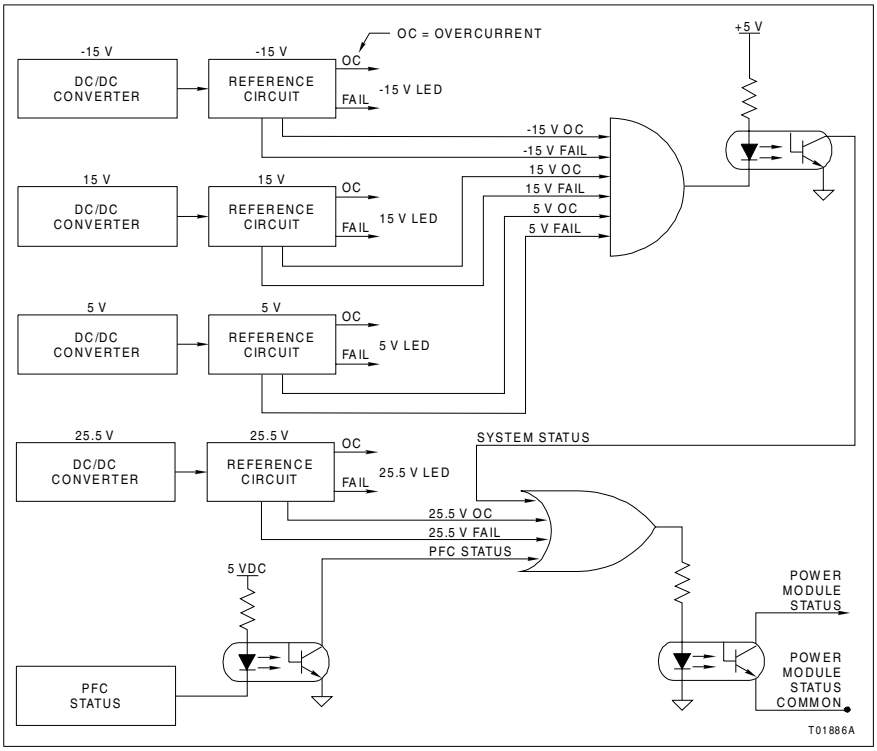

Figure 2-5. System Power Module Status Signals

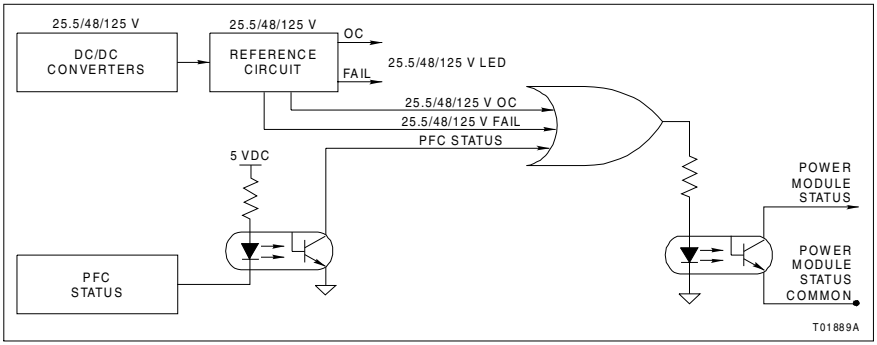

Figure 2-6. Field Power Modules and Harmony Power Module Status Signals

Installation

Section 3

Introduction

This section explains hardware preparation and installation in detail. The information applies to new installations. Follow the procedures in this section to install the Modular Power System II.

NOTES:

1. 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 Modular Power System II need to be made.

2. 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 1948385A1 - consisting of two wrist straps, ground cord assembly, alligator clip, and static dissipative work surface) when working with the modules. The kit grounds a technician and the static dissipative work surface to the same ground point to prevent damage to the modules by electrostatic discharge.

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

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

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

4. ***Avoid Partial Connection of 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 ABB 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.

Parts List

Tables 3-1 through 3-6 comprise the Modular Power System II installation and also replacement parts list.

Table 3-1. Power System Modules and Chassis

Nomenclature	Description
IPBLC01	Harmony power module (25.5 VDC output, 120/240 VAC or 125 VDC input).
IPCHS01	Power module chassis (120/240 VAC or 125 VDC); supports Harmony rack I/O only.

Table 3-1. Power System Modules and Chassis *(continued)*

Nomenclature	Description
IPCHS02	Power module chassis (120/240 VAC or 125 VDC); supports both Harmony I/O system (i.e., I/O blocks) and Harmony rack I/O.
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).

Table 3-2. Fans, Fan Chassis, and Power Entry Circuit Breaker and Switches

Nomenclature	Description
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 IPFAM14	Power system fan (120 VAC) Power system fan (240 VAC) Power system fan (125 VDC) Power system fan (120/240 VAC, 125 VDC)
IPFCH01	Power fan chassis

Table 3-3. Cables

Nomenclature/ Part Number	Description
P-MK-HRM-PWR1000x	Harmony power cable extension (x = length in meters from 1 to 8)
P-MK-HRM-PWR2000x	IPCHS02 to auxiliary power distribution panel cable[1] (x = length in meters from 1 to 8)
6632285?53	±15 VDC cable; TB1 ±15 VDC to system power bus bar
6632285?52	25.5 VDC cable; 25.5 VDC bus bar to system power bus bar
6632285?51	MCOM cable; MCOM bus bar to system power bus bar
6632285?50	5 VDC cable; 5 VDC bus bar to system power bus bar
6634205?1	STATUS OUT cable; TB3 STATUS OUT to bus interface module P3 connector

Table 3-3. Cables *(continued)*

Nomenclature/ Part Number	Description
6637814?3	Input power jumper cable; TB5 LINE 1 to TB6 LINE 2 for N, N+1, or N+x redundant systems
6641554?1	PFI cable, P1 PFI connector to system power bus bar
6641557?1 6641557?2 6641557?3	Fan power and status cable; connects power module chassis to power fan chassis: 120 VAC cable 240 VAC cable 125 VDC cable

NOTE:
1. Cable connects BLP and IFP from the IPCHS02 Power Module Chassis to the P-HA-MSC-DIST1000 Auxiliary Power Distribution Panel.

Table 3-4. Fuses

ABB Part Number[1]	Commercial Part Number	Description
1945820A10310	IEC127	1/32 mA, 125 VAC fuse (fuses F3 and F5 on the IPMON01)
1948182A22001	T2A/250V	2 A, 250 VAC time lag fuse (fuses F1, F2, F4 and F6 on the IPMON01)
1948182A32001	AGC3	2 A, 250 VAC time lag fuse (fuses F1 and F2 on IPFAN11/12, fuse F1 on IPFAN13/14)
1949240A6301	SU6.3A/250V	6.3 A, 250 VAC fuse (fuses F5 and F6 on all power modules)
1948182A24001	217004	4 A, 250 VAC fast acting fuse

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

Table 3-5. Fasteners

Part Number	Description
NBJAC16010	10-32 × 5/8 self-lock bolt
NBZHA16020	10-32 × 1-1/4 Sems screw
NIDHA16008	10-32 × 1/2 Sems screw
NMPCC16002	10-32 clip nut

Table 3-6. Miscellaneous

Nomenclature/ Part Number	Description
IPBLK01	Power blank faceplate
1948506?8	System power bus bar

Table 3-6. Miscellaneous *(continued)*

Nomenclature/ Part Number	Description
6641490?03	Protective cover for terminal blocks
6641569?1	Protective cover for bus bars

Power System Installation

WARNING	**Verify the main power and power entry panel circuit breakers are turned off before starting installation, retrofit, upgrade, or wiring procedures. Failure to do so could result in severe or fatal shock. Do not turn the power on until the installation, retrofit, upgrade, or wiring procedures are complete.**

Always install the system components in the following order:

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

2. Mount the fan chassis (IPFCH01).

3. Mount the power module chassis (IPCHS01 or IPCHS02).

4. Install the fan cables.

5. Install fans.

6. Mount the power entry circuit breakers (IPECB11 or IPECB13) or switches (IPESW11 or IPESW13).

7. Complete the installation of system wiring, including customer wiring for 48 VDC or 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 or DC feeder lines to the power entry circuit breakers or switches.

10. Install the power monitor module (IPMON01), power modules (IPSYS01, IPBLC01, IPFLD01, IPFLD24, IPFLD48, and IPFLD125), and blank faceplates (IPBLK01).

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 Figure A-2 for a wiring diagram of the system power bus bar. Refer to Table 3-3 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. Use a No. ¼-28 × 0.5-inch brass cap screw and nut with two external tooth lockwashers provided with the power system. There should be a lockwasher used on each side of the system bus bar (Fig. 3-1).

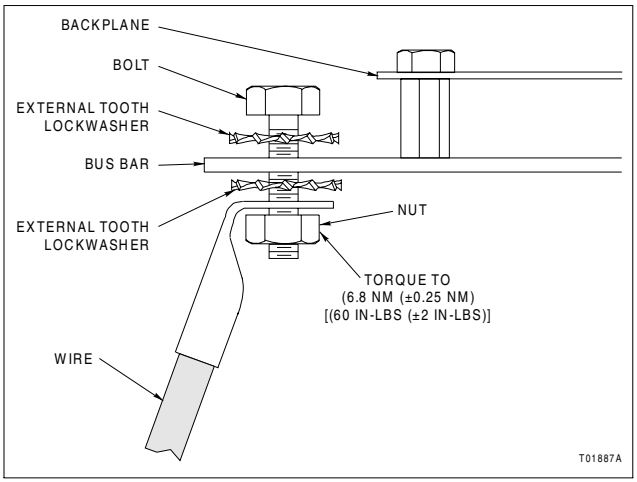

Figure 3-1. System Power Cable Connection

2. Connect the straight ring lug end of the MCOM cable to the MCOM bus bar. Use a No. ¼-28 × 0.5-inch brass cap screw and nut with two external tooth lockwashers provided with the power system. 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. Use a No. ¼-28 × 0.5-inch brass cap screw and nut with two external tooth lockwashers provided with the power system. 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. Use a No. ¼-28 × 0.5-inch brass cap screw and nut with two external tooth lockwashers provided with the power system. 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.

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.

Chassis Mounting

There are two chassis to mount: Power fan chassis (IPFCH01) and power module chassis (IPCHS01 or IPCHS02). 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

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

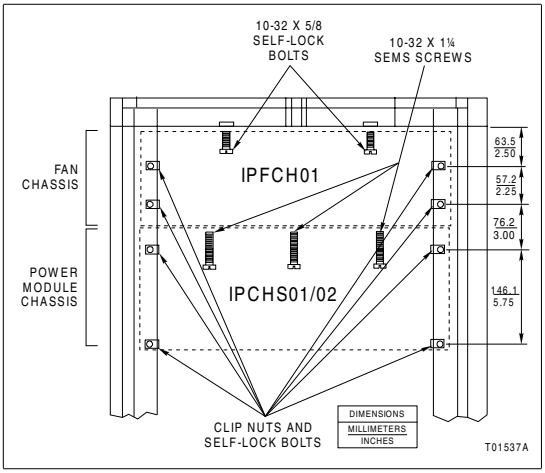

Figure 3-2. Chassis Clip Nut Spacing

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.

IPCHS01 or IPCHS02 Power Module Chassis

Mount the power module chassis to the top side rails inside the 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 cabi-

net 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 × 1-¼ Sems screws (supplied with chassis) to secure the front edge of the IPCHS01 or IPCHS02 chassis to the front edge of the IPFCH01 chassis (Fig. 3-2).

Installing the Fan Assembly

The fan assemblies (IPFAN11, IPFAN12, or IPFAN13) 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.

Each fan assembly includes a unique power cable. Table 3-7 lists the input voltage for each fan type. Two labels showing the required voltage are included with each cable.

Table 3-7. Fan Operating Voltages

Nomenclature	Operating Voltage
IPFAN11	120 VAC
IPFAN12	240 VAC
IPFAN13	125 VDC

NOTE:
1. Refer to Table 3-3 for cable part numbers.

Figures 3-3 and 3-4 show the fan assembly and power entry circuit breaker or switch installation. 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 A-1 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 backplane (P2 or P3). Refer to Figure 3-4.

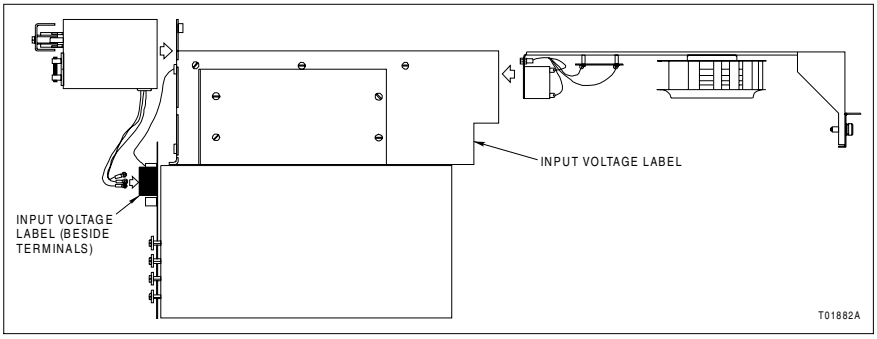

Figure 3-3. Fan Assembly and Power Entry Circuit Breaker or Switch Installation (Side View)

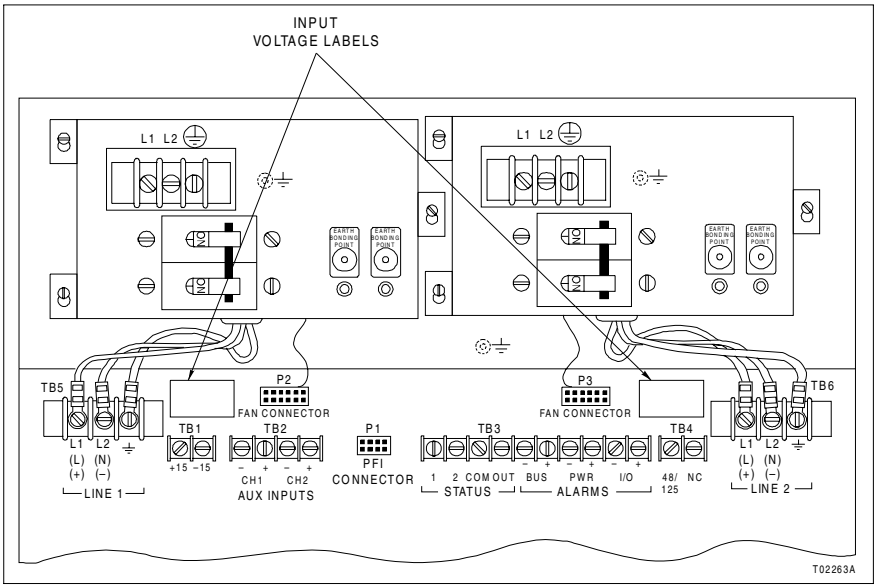

Figure 3-4. Fan Assembly and Power Entry Circuit Breaker or Switch Installation (Rear View)

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

4. Place one of the labels (included with the fan cable) indicating the operating voltage on the front of the fan chassis (Figs. 3-5 and 3-6). Place the other label beside the terminal

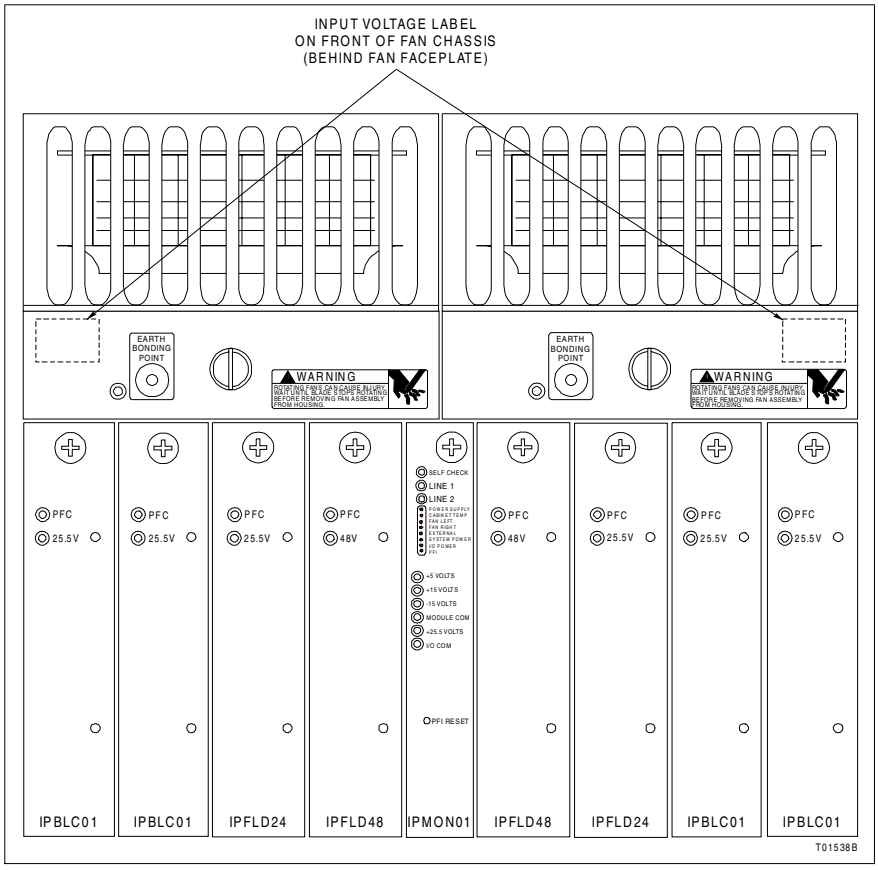

Figure 3-5. Example Mounting Sequence (for Harmony Input/Output System)

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.

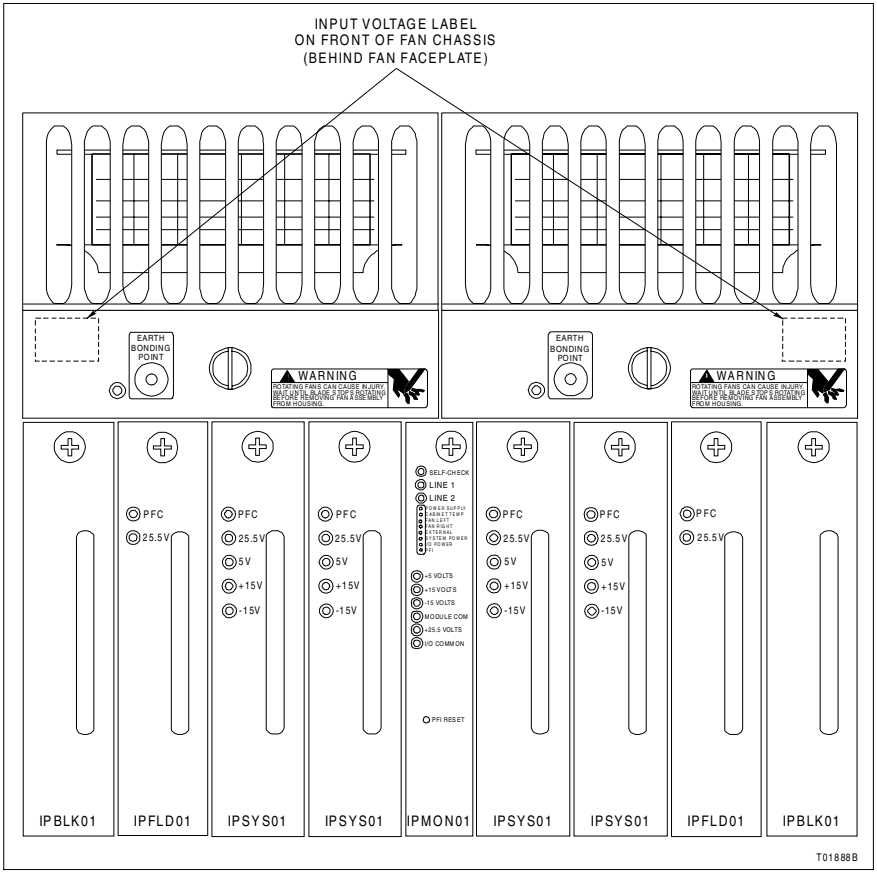

Figure 3-6. Example Mounting Sequence (for Harmony Rack I/O)

7. Repeat the procedure for the other fan assembly.

Power Entry Circuit Breaker or Switch

Mount the appropriate power entry circuit breaker or switch to the back of the fan chassis (Figs. 3-3 and 3-4). 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.**

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 (Fig. 3-4). The terminal screws on the power module chassis backplane should be tightened to 2.3 Newton meters (20 inch-pounds).

   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 Figure A-3 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 ABB 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 3-3 for a list of cable part numbers. Refer to Appendix A for wiring diagrams of the Modular Power System II.

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

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.**

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 × 0.5 brass cap screw and nut with two external tooth lockwashers provided with the power system. 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 × 0.5-inch brass cap screw and nut with two external tooth lockwashers provided with the power system. 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 × 0.5-inch brass cap screw and nut with two external tooth lockwashers provided with the power system. 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 × 0.5-inch brass cap screw and nut with two external tooth lockwashers provided with the power system. 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 Figure A-2 for correct wiring).

9. If the cabinet contains Harmony mounting columns for I/O blocks, connect each mounting column power cable to the connectors on the power distribution assembly circuit board of the IPCHS02 chassis (Fig. A-4).

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

11. 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 (PSS1) on the NTCL01 termination unit.

12. 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.

13. For cabinets with multiple Cnet or INFI-NET 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.

14. Steps 14a through 14c are optional. These terminals provide a connection for external alarms, monitoring external sources, and status inputs Refer to Figure A-7 for a wiring diagram.

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 VDC, 48 VDC, or 125 VDC sources. 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 (NO) or normally closed (NC) logic inputs. Refer to ***Installing the Power Monitor Module*** for information on setting up these inputs.

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.**

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.

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 inch-pounds (±2 inch-pounds)].

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.**

To attach the 120/240 VAC or 125 VDC feeder lines to the power system:

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 several dipswitches on the power monitor module that set up how various bus voltage status alarms and power fail interrupts (PFI) operate. Additionally, there are several jumpers on the module that select options such as input voltage, high and low trip points, and temperature trip points. Figure 3-7 shows the IPMON01 circuit board layout.

To install the power monitor module:

1. Select the monitoring options and set the module dipswitch and jumpers appropriately. Refer to the sections that follow for a description of the dipswitch and jumper settings, and to

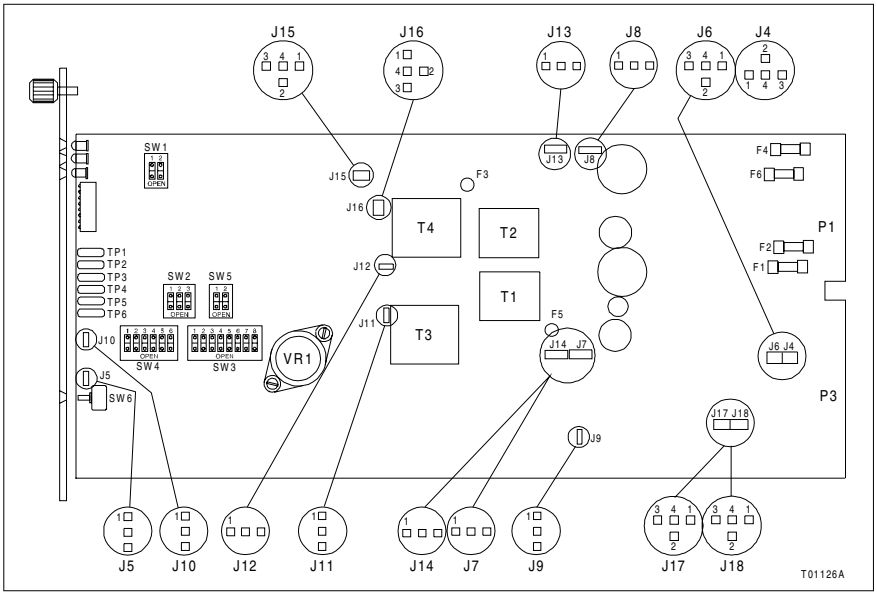

Figure 3-7. IPMON01 Circuit Board Layout

Tables 3-8 through 3-12 for the dipswitch settings and Tables 3-13 through 3-17 for the jumper settings.

2. Verify the fuses are installed and in good condition. Replace any fuses that are missing or damaged. Refer to Table 3-4 for a list of 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 Section 5 for assistance in locating and correcting the problem.

9. Proceed to the power module installation procedure described in ***Installing the Power Modules*** in this section.

Dipswitch SW1

Dipswitch SW1 is a two-pole dipswitch that sets up input power line two monitoring and 5, 15, or –15 VDC monitoring options.

Pole one determines if the power monitor module monitors 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 module faceplate.

If a fault occurs, the power monitor module generates a power alarm and a power system status. The power alarm is an opto-isolated open collector output that is available at terminal strip TB3, ALARMS PWR terminals on the power module chassis backplane. The power system status is an internal system status signal that is available at terminal strip TB3, STATUS OUT terminals. This status signal is sent to consoles on the communication network.

Pole two determines if the power monitor module monitors 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 opto-isolated open collector outputs available at terminal strip TB3, ALARMS PWR, and ALARMS BUS terminals respectively on the power module chassis backplane. The power system status is an internal system status signal that is available at terminal strip TB3, STATUS OUT terminals. This status signal is sent to consoles on the Cnet or INFI-NET communication network.

Table 3-8 lists dipswitch SW1 settings.

Table 3-8. IPMON01 Dipswitch SW1 Settings

Option	Enabled	Dipswitch Pole 1	Dipswitch Pole 2	User Setting
Monitor power source line 2	Yes	0		
	No	1		
Monitor 5, 15, –15 VDC system bus	Yes		0	
	No		1	

NOTE: 0 = closed or on; 1 = open or off.

Dipswitch SW2

Dipswitch SW2 is a three-pole dipswitch that determines the fault conditions that will cause the power monitor module to generate a PFI signal. The PFI LED on the module faceplate indicates when a PFI signal has been generated. This dipswitch sets up PFI indications for the STATUS 1 input, 25.5 VDC I/O bus, and the Harmony BLP A and BLP B (25.5 VDC) buses.

Pole one determines if the power monitor module generates a PFI signal for the STATUS 1 input. Jumper J10 must be set in conjunction with pole one on dipswitch SW2 to set up a NO or NC contact input. Refer to Table 3-16 for jumper settings.

Pole two determines if the power monitor module generates a PFI signal for a 25.5 VDC I/O bus fault.

Pole three determines if the power monitor module generates a PFI signal for a Harmony BLP A or BLP B bus fault.

Table 3-9 lists dipswitch SW2 settings

Table 3-9. IPMON01 Dipswitch SW2 Settings

PFI Option	Enabled	Dipswitch Pole 1	Dipswitch Pole 2	Dipswitch Pole 3	User Setting
Generate PFI for STATUS 1 input	Yes	0			
	No	1			
Generate PFI for 25.5 VDC I/O bus	Yes		0		
	No		1		

Table 3-9. IPMON01 Dipswitch SW2 Settings *(continued)*

PFI Option	Enabled	Dipswitch Pole 1	2	3	User Setting
Generate PFI for Harmony BLP A and BLP B (25.5 VDC) bus	Yes			0	
	No			1	

NOTE: 0 = closed or on; 1 = open or off.

Dipswitch SW3

Dipswitch SW3 is an eight-pole dipswitch that determines the signals the power monitor module will monitor to drive the I/O power LED on the module and the opto-isolated open collector output available at terminal strip TB3, ALARMS I/O terminals on the power module chassis backplane. The signals that can be monitored include the STATUS 1 and STATUS 2 inputs, AUX CH1 and AUX CH2 status inputs, 25.5 VDC I/O bus, Harmony BLP A and BLP B (25.5 VDC) bus, and 49.1 VDC or 125.6 VDC status inputs.

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.

Poles one and two determine if the power monitor module monitors the STATUS 1 and STATUS 2 inputs respectively. Jumper J10 and J5 must be set in conjunction with poles one and two to set up the status one and two inputs as a NO or NC contact inputs. Refer to Table 3-16 for jumper settings.

Poles three and four determine if the power monitor module monitors the AUX CH1 and AUX CH2 inputs respectively. 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 (25.5 VDC, 49.1 VDC, or 125.6 VDC). Refer to Table 3-14 for jumper settings. Refer to Table 1-6 for auxiliary input trip point specifications.

Poles six and eight determine if the power monitor module monitors the Harmony BLP A and BLP B buses respectively.

Pole seven determines if the power monitor module monitors the 49.1 VDC or 125.6 VDC buses.

Table 3-10 lists dipswitch SW3 settings

Table 3-10. IPMON01 Dipswitch SW3 Settings

Option	Enabled	Dipswitch Pole								User Setting
		1	2	3	4	5	6	7	8	
I/O power indication for STATUS 1 input	Yes	0								
	No	1								
I/O power indication for STATUS 2 input	Yes		0							
	No		1							
I/O power indication for AUX CH1 input	Yes			0						
	No			1						
I/O power indication for AUX CH2 input	Yes				0					
	No				1					
I/O power indication for 25.5 VDC I/O bus	Yes					0				
	No					1				
I/O power indication for Harmony BLP A (25.5 VDC) bus	Yes						0			
	No						1			
I/O power indication for 49.1 VDC or 125.6 VDC bus	Yes							0		
	No							1		
I/O power indication for Harmony BLP B (25.5 VDC) bus	Yes								0	
	No								1	

NOTE: 0 = closed or on; 1 = open or off.

Dipswitch SW4

Dipswitch SW4 is a six-pole dipswitch that determines the fault conditions that will cause the power monitor module to generate a PFI signal. The PFI LED on the module faceplate indicates when a PFI signal has been generated. This dipswitch sets up PFI indications for the 5 VDC, 15 VDC, and –15 VDC system power buses and the 49.1 VDC or 125.6 VDC buses.

Pole one determines if the power monitor module generates a PFI signal for a 15 VDC bus fault.

Pole two determines if the power monitor module generates a PFI signal for a –15 VDC bus fault.

Poles three and four are not used and must be set to one.

Pole five determines if the power monitor module generates a PFI signal for a 5 VDC bus fault.

Pole six determines if the power monitor module generates a PFI signal for a 49.1 VDC or 125.6 VDC bus fault.

Table 3-11 lists dipswitch SW4 settings.

Table 3-11. IPMON01 Dipswitch SW4 Settings

Option	Enabled	Dipswitch Pole						User Setting
		1	2	3	4	5	6	
Generate PFI for 15 VDC bus	Yes	0						
	No	1						
Generate PFI for –15 VDC bus	Yes		0					
	No		1					
Not used; must be set to 1	No			1				1
Not used; must be set to 1	No			1				1
Generate PFI for 5 VDC bus	Yes					0		
	No					1		
Generate PFI for 49.1 VDC or 125.6 VDC bus	Yes						0	
	No						1	

NOTE: 0 = closed or on; 1 = open or off.

Dipswitch SW5

Dipswitch SW5 is a two-pole dipswitch that sets up PFI signal latching. When the PFI signal is set to latch, the PFI LED on the module faceplate remains on after the PFI condition returns to a normal state (no PFI). In this case, the PFI reset pushbutton must be pressed to turn off the LED. When the PFI signal is set to not latch, the PFI LED turns off when the PFI condition returns to a normal state.

Table 3-12 lists dipswitch SW5 settings

Table 3-12. IPMON01 Dipswitch SW5 Settings

Option	Enabled	Dipswitch Pole		User Settings
		1	2	
PFI signal latching	Yes	0		
	No	1		

Table 3-12. IPMON01 Dipswitch SW5 Settings *(continued)*

Option	Enabled	Dipswitch Pole 1	Dipswitch Pole 2	User Settings
Not used; must be set to 1	No		1	1

NOTE: 0 = closed or on; 1 = open or off.

Jumpers J7, J8, J11, J12, J13, and J14

There are six jumpers that tell the power monitor module the voltage to expect on input lines one and two: J8, J12, and J13 for input line one and J7, J11, and J14 for input line two. All three of the jumpers for an input line must be set to the same input voltage.

Table 3-13 lists the J7, J8, J11, J12, J13, and J14 settings.

Table 3-13. IPMON01 Jumpers J7, J8, J11, J12, J13, and J14 Settings

Input Line	Jumper	Jumper Setting			User Setting
		120 VAC	240 VAC	125 VDC	
1	J8	1-2	2-3	1-2	
	J12	1-2	2-3	1-2	
	J13	1-2	1-2	2-3	
2	J7	1-2	2-3	1-2	
	J11	1-2	2-3	1-2	
	J14	1-2	1-2	2-3	

Jumpers J4, J6, J17, and J18

There are four jumpers that set up trip points for the auxiliary inputs: J4 and J6 for AUX CH1 input and J17 and J18 for AUX CH2 input. The trip points determine whether an alarm occurs on a high trip point and low trip point for the external voltage being monitored (24 VDC, 48 VDC, or 125 VDC). Trip points for the auxiliary inputs are listed in Table 1-6. 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.

Table 3-14 lists the J4, J6, J17, and J18 settings.

Table 3-14. IPMON01 Jumpers J4, J6, J17, and J18 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	

Jumpers J15 and J16

Jumpers J15 and J16 select the internal cabinet temperature trip points that the power monitor module uses to generate a cabinet over temperature 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 (i.e., jumper installed) for the monitor module to monitor cabinet temperature. Jumpers J15 and J16 should be set the same.

Table 3-15 lists the J15 and J16 settings.

Table 3-15. IPMON01 Jumpers J15 and J16 Settings

Temperature Sensor	Jumper	Jumper Setting			User Setting
		50°C (122°F)	60°C (140°F)	70°C (158°F)	
1	J16	3-4	2-4	1-4	
2	J15	3-4	2-4	1-4	

Jumpers J5 and J10

Jumpers J5 and J10 set up the STATUS 1 and STATUS 2 inputs as either NO or NC contact inputs. When the power monitor module detects that either STATUS 1 or STATUS 2 has changed states from normal operation, it generates an alarm dependent on the setting of dipswitch SW3. It also generates a PFI signal for STATUS 1 dependent on the setting of dipswitch SW2. Refer to ***Dipswitch SW2*** and ***Dipswitch SW3*** for an explanation of the setup choices for module LEDs, alarm outputs, and the PFI signal when using the status inputs.

Table 3-16 lists the J5 and J10 settings.

Table 3-16. IPMON01 Jumpers J5 and J10 Settings

Status Input	Jumper	NO[1]	NC[1]	User Setting
1	J10	1-2	2-3	
2	J5	1-2	2-3	

NOTE:
1. NO = normally open, NC = normally closed.

Jumper J9

Jumper J9 sets the power monitor module to operate with the 48/125 VDC input set to either 49.1 VDC or 125.6 VDC.

Table 3-17 lists the J9 settings.

Table 3-17. IPMON01 Jumper J9 Settings

Voltage	Setting	User Setting
49.1 VDC	1-2	
125.6 VDC	2-3	

Installing the Power Modules

IPSYS01 System Power modules; IPBLC01 Harmony Power modules; and IPFLD01, IPFLD24, IPFLD48, and IPFLD125 Field Power modules mount in the power module chassis slots (four on each side of the power monitor module).

The Harmony I/O system uses redundant block logic power (25.5 VDC). At a minimum, two IPBLC01 power modules are required to power a Harmony I/O system. One mounts on the left side of the power monitor module for the BLP A bus bar and the other mounts on the right side for the BLP B bus bar. The same number of IPBLC01 power modules should be installed 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 with the exception of the IPBLC01 power module. One must be installed on the left side of the power monitor module and one must be installed on the right to power the separate BLP A and B bus bars.

CAUTION	**Do not install the IPFLD48 and IPFLD125 field power modules together in the same IPCHS01 or IPCHS02 chassis. Equipment damage will result.**

Figure 3-8 shows the IPSYS01 circuit board layout (the IPBLC01 and IPFLD01, IPFLS24, IPFLD48, and IPFLD125 circuit board layouts are very similar except for the LED and power output points). There are no jumpers or dipswitches on the system and Harmony power modules and the field power modules. Therefore, the modules are ready to install.

To install power modules:

1. Check the fuses (F5 and F6). They should be installed and in good condition before installing the power module. If a fuse is missing or damaged, install or replace it with an equivalent fuse. Refer to Table 3-4 for the 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 power module chassis. 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.

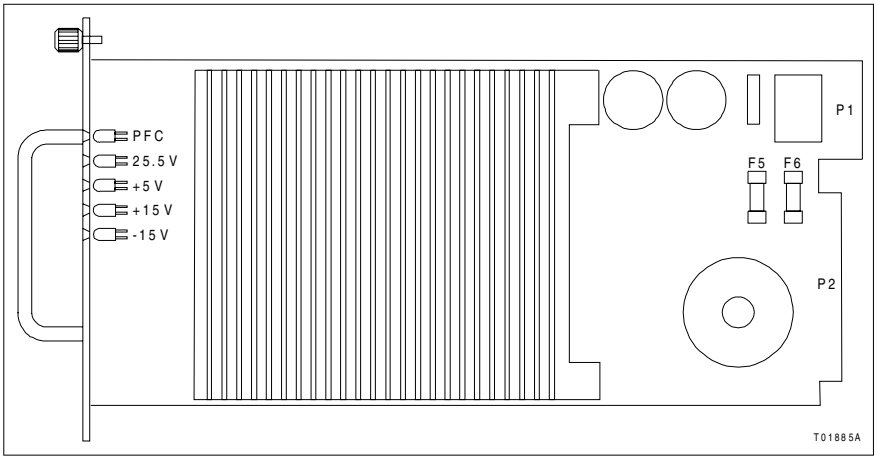

Figure 3-8. IPSYS01 Circuit Board Layout

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).

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 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 power monitor 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.

Operating Procedures

Section 4

Introduction

This section contains information about Modular Power System II operation. It includes information on power module status LEDs, 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; IPBLC01 Harmony Power module; and IPMON01 Power Monitor module that provide information on system bus voltages, power system status, and system operation. The following text explains the LED indications. 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. Figure 4-1 shows the IPMON01 module faceplate. Table 4-1 lists power monitor module LED states.

> **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.

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 onboard 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.

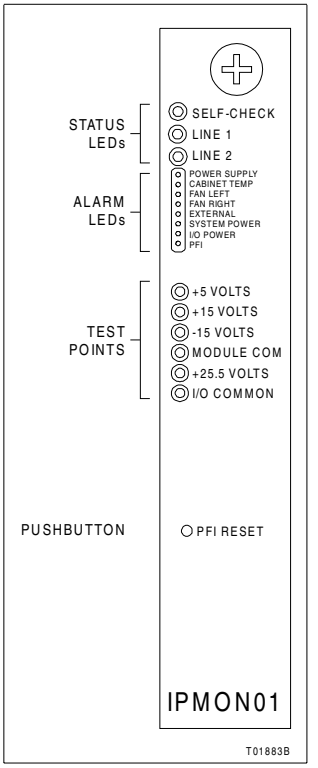

Figure 4-1. Power Monitor Module Faceplate LEDs

Table 4-1. Power Monitor Module LED States

LED	LED State	Meaning
Self-check	Green	Good
	Red	Bad
	Off	Power off
Line 1	Green	Good
	Red	Bad
	Off	Power off

Table 4-1. Power Monitor Module LED States *(continued)*

LED	LED State	Meaning
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

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 VDC, 48 VDC, and 125 VDC external power sources). The external LED can be enabled to indicate the status of line two input power and 5 VDC, 15 VDC, 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 four LEDs. These jumpers select the input power line sensing and operating voltage, high and low trip points for 25.5 VDC, 49.1 VDC, or 125.6 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.

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

Power System and Field Modules

The power system and field module LEDs are always enabled. Table 4-2 lists the IPSYS01, IPFLD01, IPFLD24, IPFLD48, IPFLD125, and IPBLC01 power module LED states. Figure 4-2 shows the power module 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-to-DC converter overcurrent condition.

Table 4-2. Power Module LED States

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

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

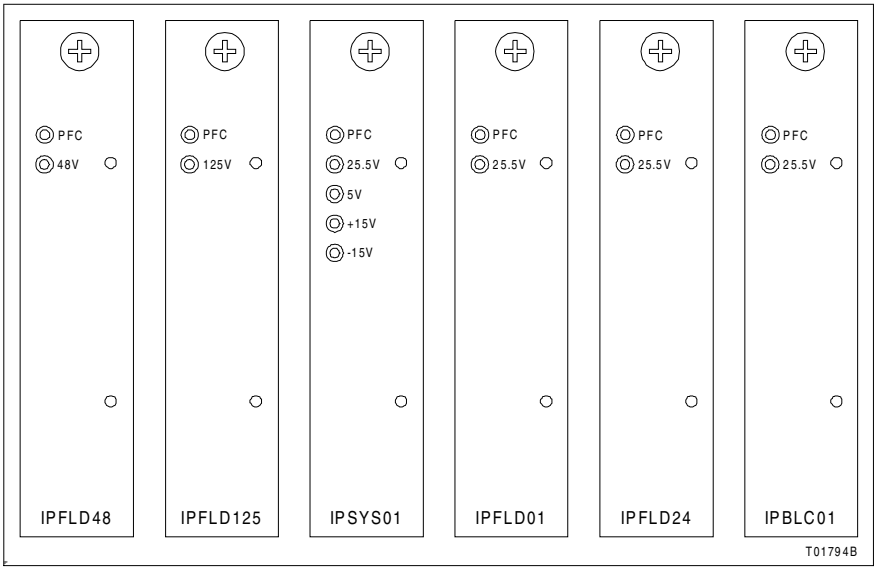

Figure 4-2. Power Module Faceplate LEDs

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.

Troubleshooting

Section 5

Introduction

This section provides troubleshooting tables containing troubleshooting procedures to help locate and correct 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. Power Module 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-to-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.

Table 5-1. Power Module LED Troubleshooting Procedures *(continued)*

LED	LED state	Cause	Corrective Action
5 V, +15 V or –15 V, 25.5 V, 48 V, 125 V *(continued)*	Blinking green	DC-to-DC converter overcurrent	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-to-DC converter failure	Replace the power module.
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.

Table 5-1. Power Module LED Troubleshooting Procedures *(continued)*

LED	LED state	Cause	Corrective Action
5 V, +15 V, –15 V or 25.5 V, 48 V, 125 V *(continued)*	Off	Lost AC/DC input power (on N, N+1 or N+x systems only).	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 A.
		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 A 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 A 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.

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

LED	LED State	Problem	Corrective Action
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 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.
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.

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

LED	LED State	Problem	Corrective Action
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 3-8 through 3-12 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 (NO or NC inputs). Refer to ***Installing the Power Monitor Module*** 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 3-8 through 3-12 for power monitor module dipswitch settings.

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

LED	LED State	Problem	Corrective Action
I/O power *(continued)*	Red	49.1 VDC or 125.6 VDC bus failure.	Check the field power module LEDs for failed power modules. Check the 49.1 VDC or the 125.6 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 A-7 for TB4-1 location. Repair system bus fault if the bus voltages are low and the power modules check good. Refer to Tables 3-8 through 3-12 for power monitor module dipswitch settings.
		25.5 VDC Harmony bus failure.	Check the Harmony power module LEDs for failed power modules. Check the Harmony bus voltages by measuring with a voltmeter from bus bar +24 VDC A to bus bar 24 VDC COM and from bus bar +24 VDC B to bus bar 24 VDC COM. Refer to Figure 2-3 for bus bar locations. Repair system bus fault if the bus voltages are low and the power modules check good. Refer to Tables 3-8 through 3-12 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 3-12 for the power monitor module dipswitch settings.
		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 3-8 through 3-12 for power monitor module dipswitch settings.

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

LED	LED State	Problem	Corrective Action
PFI *(continued)*	Red	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 3-8 through 3-12 for power monitor module dipswitch settings.
		49.1 VDC or 125.6 VDC bus voltage fault	Check the field power module LEDs for failed power modules. Check the 49.1 VDC or 125.6 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 A-7 for TB4-1 location. Repair system bus fault if the bus voltages are low and the power modules check good. Refer to Tables 3-8 through 3-12 for power monitor module dipswitch settings.
		25.5 VDC Harmony bus voltage fault	Check the Harmony power module LEDs for failed power modules. Check the bus voltages by measuring with a voltmeter from bus bar +24 VDC A to bus bar 24 VDC COM and from bus bar +24 VDC B to bus bar 24 VDC COM. Refer to Figure 2-3 for bus bar locations. Repair system bus fault if the bus voltages are low and the power modules check good. Refer to Tables 3-8 through 3-12 for power monitor module dipswitch settings.
		Status input 1	Check the status input option on the power monitor module (SW2-1). Refer to ***Dipswitch SW2*** in Section 3. Check that status input signal(s) are not in their alarm state (NO/NC). Refer to ***Jumpers J5 and J10*** in Section 3.

IPCHS02 Chassis

Refer to Figure 5-1 for connector pin outs for the back of the IPCHS02 chassis.

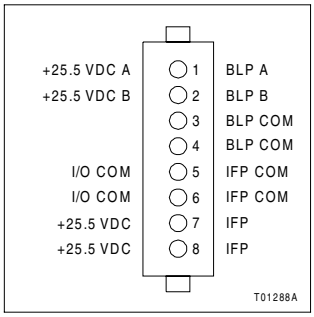

Figure 5-1. IPCHS02 Harmony Power Connector Pins

Maintenance

Section 6

Introduction

This section contains a Modular Power System II preventive maintenance schedule and procedures. Performing 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 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 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.

Equipment Required

Listed are tools and equipment required for maintenance procedures.

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
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 ABB 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

- 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 needlenose 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.

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 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 1-6.

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

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.**

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.

Repair and Replacement

Section 7

Introduction

This section explains how to replace components of the Modular Power System II. It also includes fuse replacement procedures for the IPMON01 Power Monitor module; IPSYS01 System Power module; IPFLD01, IPFDl24, IPFLD48, and IPFLD125 Field Power modules; and IPBLC01 Harmony Power module. The components of the power system 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.

Replacement/Spare Parts

Tables 3-1 through 3-6 list and describe modular power system part numbers and nomenclatures. It is impractical to specify a recommended quantity of spare parts because each system is custom designed. Contact ABB for help determining the quantity of spare parts to keep on hand for a particular system.

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.

Power Monitor 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 so could result in severe or fatal shock.**

3. Set the jumpers and dipswitches on the replacement module the same as the module being replaced. If necessary, refer to Tables 3-8 through 3-12 for dipswitch settings and Tables 3-13 through 3-17 for 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 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 3-4 for a description of the fuses and the 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 ***Power Monitor 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 3-4 for a list of part numbers and descriptions.

Power Modules

The power module replacement procedure and fuse replacement procedures apply to the IPSYS01 System Power module; IPFLD01, IPFLD24, IPFLD48, IPFLD125 Field Power modules; and IPBLC01 Harmony Power module. Power modules can be replaced on-line.

Power 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 so could result in severe or fatal shock.**

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.**

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 thumb-screw 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 power module that can be replaced. Refer to Table 3-4 for a description and the 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 ***Power Module Replacement*** to remove the power 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 3-8 for the power module circuit board layout.

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 3-4 for a list of part numbers and descriptions.

Power System Fan

Power System Fans can be replaced on-line. The IPFAN11 and IPFAN12 Power System Fans have two replaceable fuses. The IPFAN13 and IPFAN14 Power System Fans have 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.**

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.**

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 3-3 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 A-1 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 inch-pounds).

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 inch-pounds).

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 and IPFAN14 fans (F1) that are replaceable. Refer to Table 3-4 for a description and list of 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 3-4 for a list of 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.**

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 inch-pounds).

   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 inch-pounds).

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 or IPCHS02 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.**

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 so could result in severe or fatal shock.**

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. A-1 through A-7). 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.

   h. Disconnect the Harmony power cables.

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 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)].

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 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 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.**

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 needlenose 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 bracket at the cabinet top.

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 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 A-1 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.

Wire and Cable Diagrams

Appendix A

Wiring and Cables

This appendix contains system cabinet wiring diagrams for the Modular Power System II.

Table A-1 and Figure A-1 provide IPFCH01 Power Fan Chassis with IPECB11 or IPECB13 Power Entry Circuit Breakers wiring information. The figure shows N, N+1, N+x, and 2N redundancy wiring.

Table A-2 and Figure A-2 provide system power bus bar wiring information.

Table A-3 provides IPCHS01 and IPCHS02 chassis cable information. Figure A-3 is a wiring diagram for the IPCHS01 Power Module Chassis and Figure A-4 is for the IPCHS02 Power Module Chassis (used with Harmony).

Table A-4 and Figure A-5 provide module mounting unit wiring information.

Figure A-6 shows a Harmony block mounting column.

Figure A-7 describes how to wire the channels for the auxiliary inputs, status inputs, and customer alarms.

Table A-1. Fan Power and Status Cables (Fig. A-1)

Cable Number	Part No.	Description
1	664157?1 6641557?2 664157?3	Fan power and status cable: 120 VAC cable 240 VAC cable 125 VDC cable

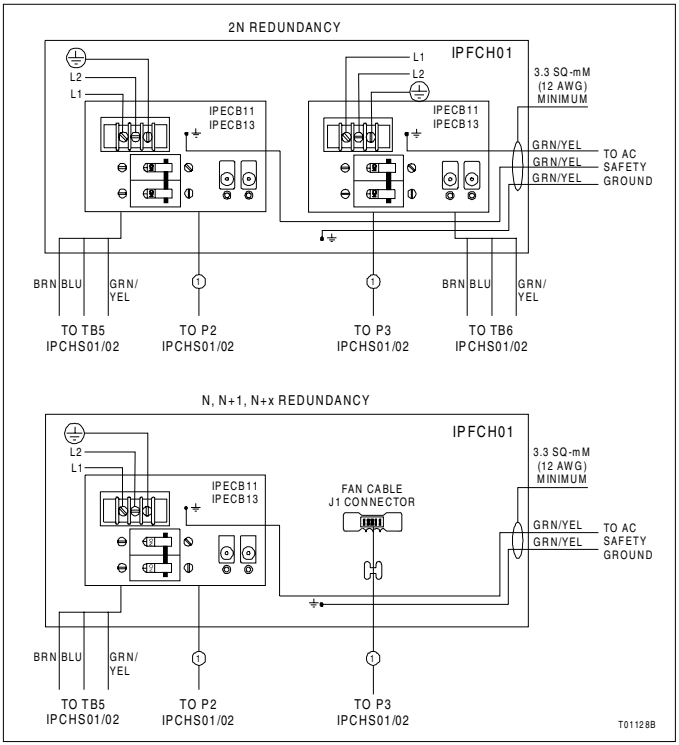

Figure A-1. IPFCH01 Power Fan Chassis Wiring (Table A-1)

Table A-2. System Power Bus Bar Cables (Fig. A-2)

Cable Number	Part No.	Description
1	6641554?1	PFI cable
2	6632285?53	±15 VDC cable
3	6632285?52	25.5 VDC cable
4	6632285?51	MCOM cable
5	6632285?50	5 VDC cable

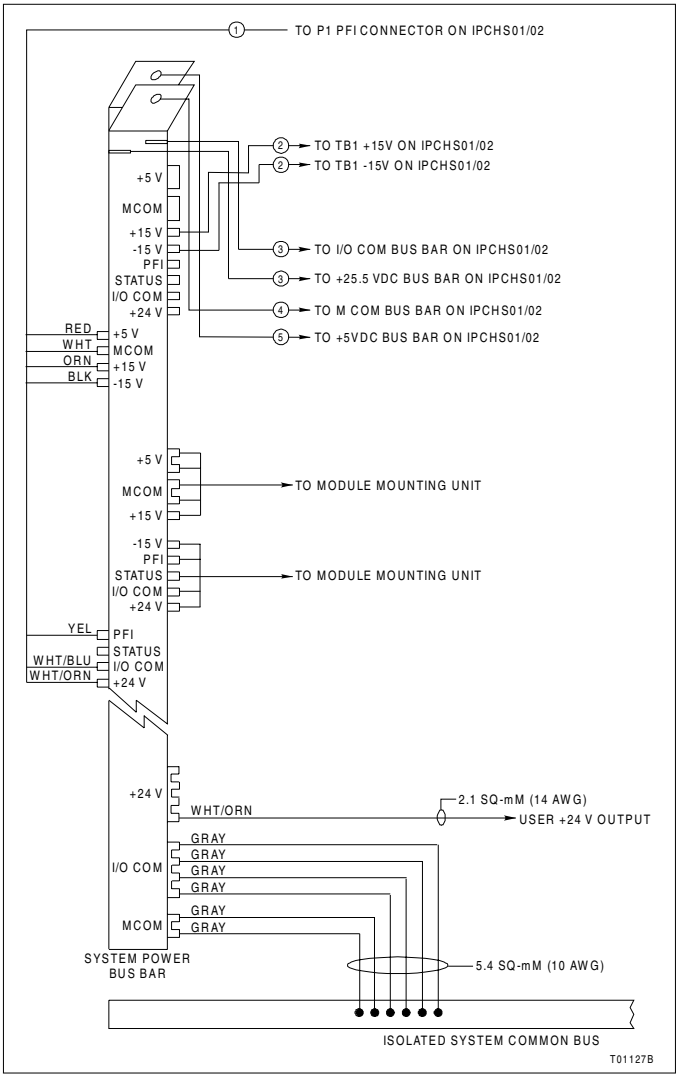

Figure A-2. System Power Bus Bar Wiring (Table A-2)

Table A-3. IPCHS01 or IPCHS02 Cables (Fig. A-3)

Cable Number[1,2]	Part No.	Description
1	663781473	Input power jumper cable

NOTES:
1. Refer to Figure A-2 for system power bus bar cable numbers.
2. The input power jumper cable is used in nonredundant and N+1, and N+x redundant power systems.

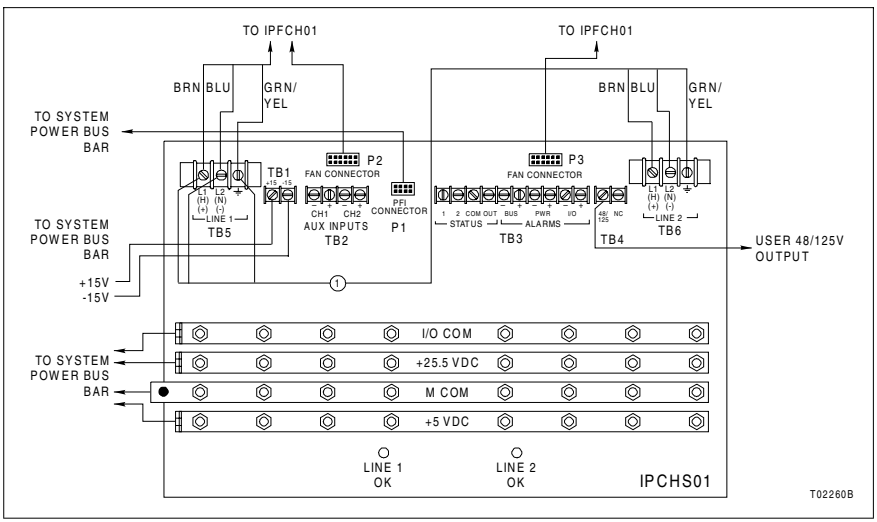

Figure A-3. IPCHS01 Power Module Chassis Wiring (Table A-3)

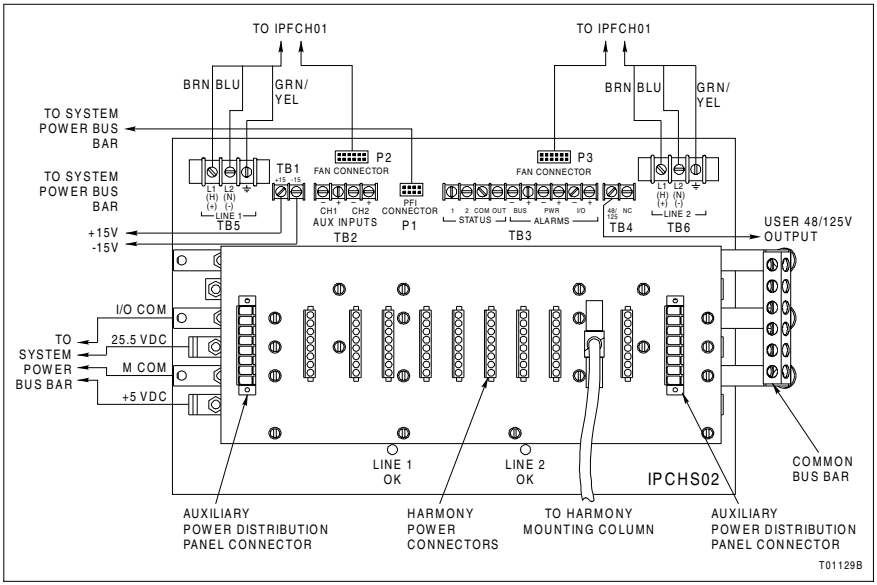

Figure A-4. IPCHS02 Power Module Chassis Wiring (Table A-3)

Table A-4. MMU Cables (Fig. A-5)

Cable Number	Part No.	Description
1	1948509?5	Flat cable - connects power, PFI, and module status signals between MMU and power bus bar
	6632285?54	0.84 sq-mm (18 AWG) wire, faston terminated - connects power, PFI, and module status signals between MMU and system power bus bar
2	6640006?1	Three 0.84 sq-mm (18 AWG) twisted wires, faston terminated for Controlway/module bus interconnection

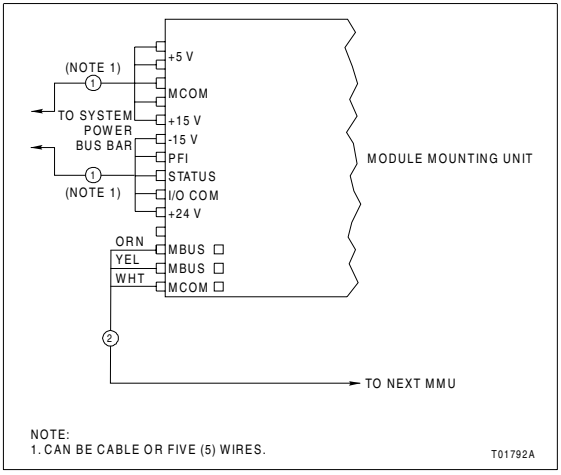

Figure A-5. Module Mounting Unit Wiring (Table A-4)

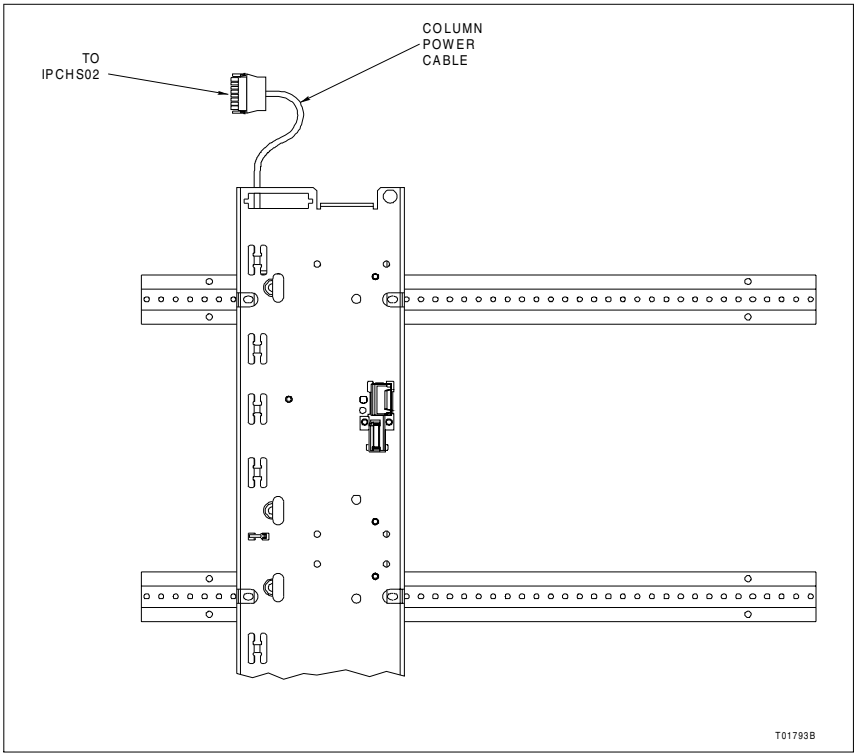

Figure A-6. Harmony Block Mounting Column

Figure A-7 shows a cutaway of the power module chassis. The wiring for the auxiliary input channels, status inputs, and customer alarms is the same for both the IPCHS01 and IPCHS02 power module chassis.

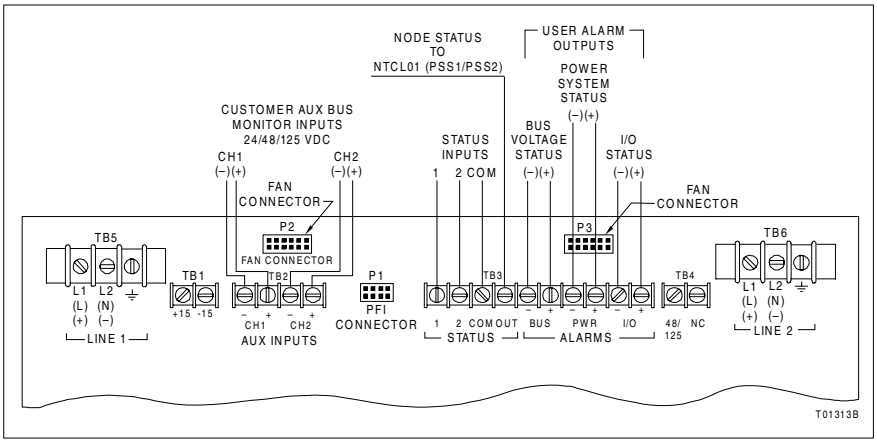

Figure A-7. Alarms and Auxiliary Inputs Wiring

Sizing the Power System

Appendix B

Power System Sizing

Refer to the ***Power System Sizing*** instruction for the Modular Power System II sizing procedures and calculations. The power system is sized by determining and calculating the 5 VDC, 15 VDC, –15 VDC, 24 VDC, 48 VDC, and 125 VDC current requirements for system components installed in a cabinet.

Generally, the procedure to size the Modular Power System II is to:

1. Determine the total current demands for Harmony I/O blocks and the Harmony rack I/O devices in the cabinet. A cabinet may contain only Harmony rack I/O devices, only Harmony I/O blocks, or both.

2. Verify the system and I/O current requirements do not exceed the DC bus bar, Harmony block mounting column, and wiring capacities.

3. Determine the number of power modules required based on the calculated current demands.

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.

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