MAINTENANCE MANUAL

EDACS® REDUNDANT POWER SUPPLY SYSTEM
350A1441P1 and P2 POWER MODULE CHASSIS
350A1441P3, P4, AND P5 POWER MODULES

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ERICSSON

SPECIFICATIONS*

POWER MODULE CHASSIS		350A1441P1	350A1441P2
	Dimensions (HxWxD) - cm. (in.)	13.34 x 48.26 x 47 (5.25 x 19 x 18.5)	13.34 x 48.26 x 41.3 (5.25 x 19 x 16.25)
	Weight kg (lbs.)	3.22 (7.1)	3.08 (6.8)

POWER MODULES		350A1441P3	350A1441P4	350A1441P5
INPUT SPECIFICATION	Input voltage	110-120/220-230 Vac	110-120/220-230 Vac	110-120/220-230 Vac
	Input Current	6.0/3.0 Amperes	6.0/3.0 Amperes	6.0/3.0 Amperes
	Input Frequency	50/60 Hz	50/60 Hz	50/60 Hz
	Peak Input Current (maximum)	Less than 68 Amperes during first 1/2 cycle		
	Input Undervoltage	Any input voltage below 90 Vac can be applied continuously without damage to the RPS.		
OUTPUT RATINGS	Output Power	380 Watts continuous per Module	380 Watts continuous per Module	360 Watts continuous per Module
	Output Voltage	+5V, +12V, & -12V	+5V, +15V, & -15V	24V
	Output Current	+5V - 0 to 68A +12V - 0 to 8A -12V - 0 to 5A	+5V - 0 to 68A +15V - 0 to 8A -15V - 0 to 5A	0 to 15A
	Output Regulation Limits	+5V - 4.90 to 5.10V +12V - 11.50 to 12.50V -12V - -11.50 to -12.50V	+5V - 4.90 to 5.15V +15V - 14.40 to 15.60V -15V - -14.40 to -15.60V	23.5 to 24.5V
	Output Ripple	Less than 1% of the nominal voltage at full load.		
	Hold-up Time	20 ms	20 ms	20 ms
PHYSICAL SPECIFICATIONS	RPS Chassis Required	350A1441P1	350A1441P1	350A1441P2
	Dimensions (HxWxD) - cm. (in.)	13x21x35 (5.1x8.3x13.8)	13x21x35 (5.1x8.3x13.8)	13x21x35 (5.1x8.3x13.8)
	Weight kg (lbs.)	3.63 (8.0)	3.63 (8.0)	3.54 (7.8)
ENVIRONMENTAL	Temperature Range (Operating)	°0 C to 40° C. (32°F to 104° F)		
	Temperature Range (Storage)	°-20 C to 85° C. (-4°F to 185° F)		
	Humidity	0-95% Non-condensing		
REGULATORY COMPLIANCE	Agency	Listed to UL 1950; certified to CSA 1402C Level 5; conforms to TUV EN60 950.		
	EMI/RFI Rqmts.	Complies with FCC Part 15 Class A; VDE 0871 Level A; IEC 555-2 and 801-3		

* These specifications are intended for use during servicing. Refer to appropriate Specification Sheet for the complete specification.

INTRODUCTION

The EDACS® **R**edundant **P**ower **S**upply (**RPS**) System is the recommended power supply system for use with EDACS Simulcast, Voted, and CEC/IMC equipment. The system is available as an N+1 RPS (for 350A1441P1 with P3 or P4 modules) or a 1+1 RPS (350A1441P2 with P5 module).

The N+1 RPS is configured as an active load sharing system capable of providing up to 380 Watts per module. In this configuration, "N" supplies are required to supply the system load, and an additional supply is added to provide redundancy thereby forming an "N+1" system.

The 3501441P5 modules are used in a 1+1 configuration. In this configuration, the modules are connected in parallel with each module capable of supplying up to 360 Watts.

DESCRIPTION

The RPS Power Module Chassis' mount into a standard 19-inch rack, and are 5.25 inches high (three Rack Units) and a maximum of 18.5 inches deep (350A1441P1) or 16.25 inches deep (350A1441P2). Each RPS Power Module Chassis accepts two slide-in Power Modules as shown in Figure 1.

The Power Modules are available in three different output ratings:

350A1441P3	+5 Vdc and ±12 Vdc.
350A1441P4	+5 Vdc and ±15 Vdc.
350A1441P5	+24 Vdc.

When one of the module slots is vacant, a blank panel (350A1441P6) is installed.

The RPS operates from 120 or 230 Vac, 50/60 Hz source and is fully operational over the voltage range of 90 to 132 Vac or from 180 to 264 Vac @ 47 to 63 Hz. Any input voltage below 90 Vac can be applied continuously without damage to the RPS.

RPS POWER MODULE CHASSIS

The Power Module Chassis is available in two configurations:

350A1441P1	For P3 or P4 Power Modules.
350A1441P2	For P5 Power Modules only.

Each Power Module Chassis has a "Voltage Rating Label" attached to the front and rear of the chassis. Only Power Modules with the matching voltage rating should be installed in the chassis.

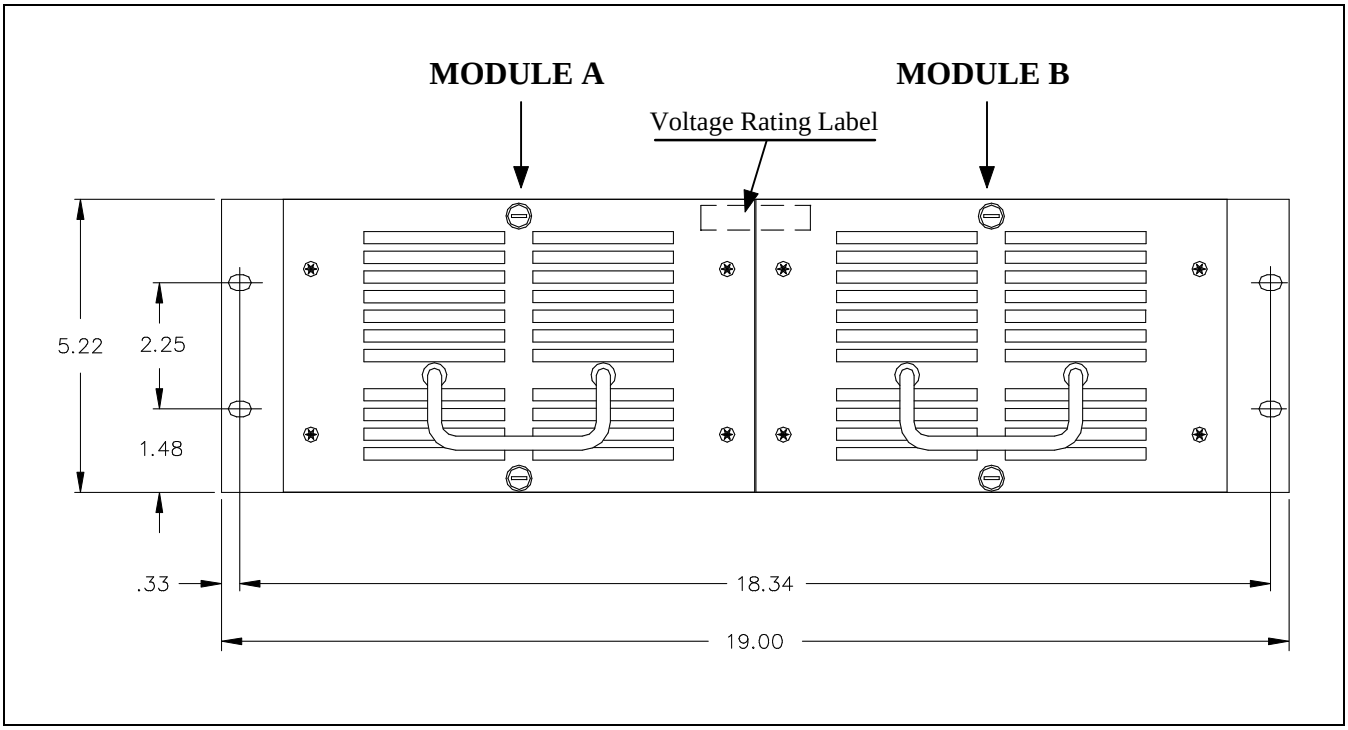


Figure 1 - 350A1441P1 & P2 Power Module Chassis (Front View)

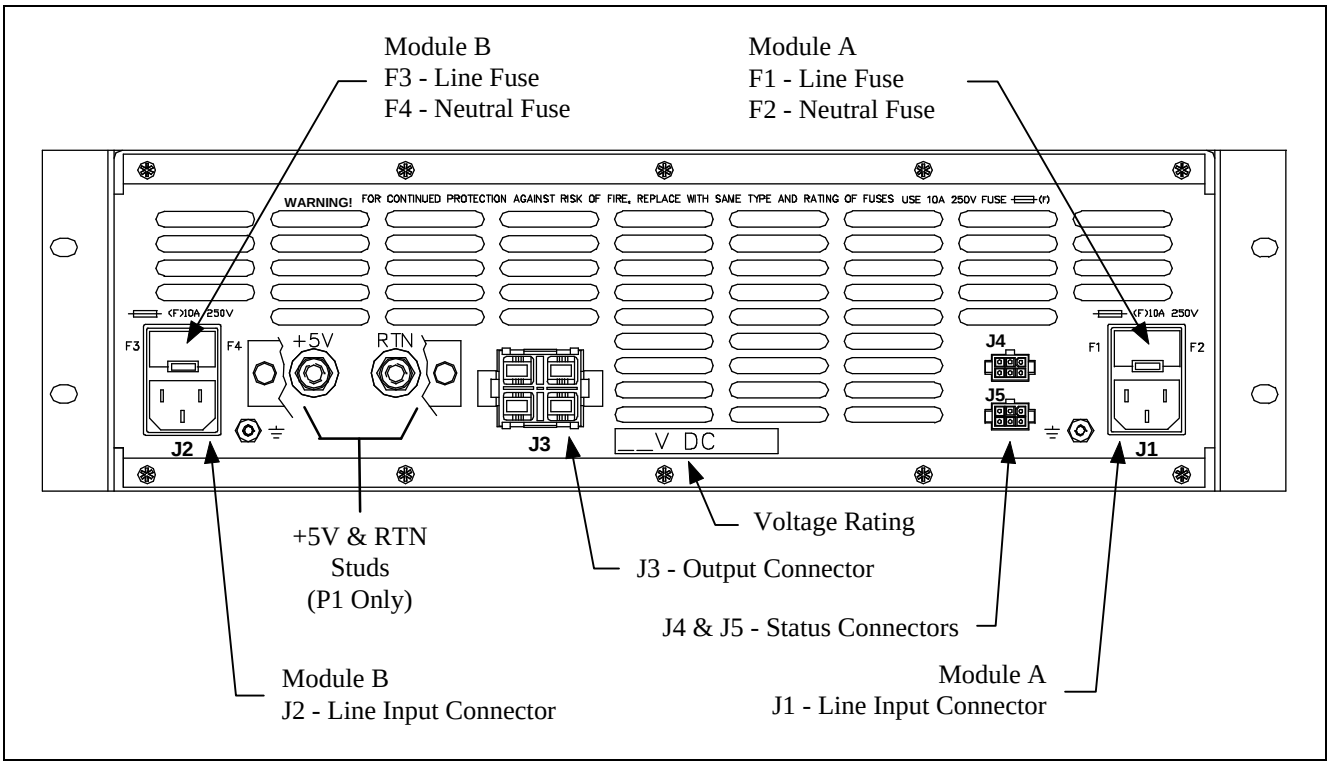


Figure 3 - 350A1441P1 & P2 Power Module Chassis (Rear View)

The rear panel of the RPS Power Module Chassis, shown in Figure 3, contains the following items:

- Two AC Power Entry modules (J1 and J2) with self-contained fuses. J1 contains fuses F1 and F2, J2 contains fuses F3 and F4.
- Paralleled Status Connectors (J4 and J5).
- An Output connector (J3).
- Power Module Chassis 350A1441P1 also has 5 Vdc and RTN studs with protective cover.

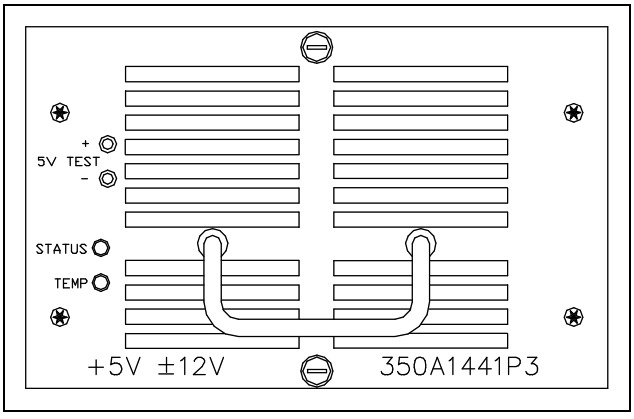


Figure 2 - 350A1441P3, +5V and ±12V Power Module (Front View)

The polarized AC input lines are double fused with a 10 ampere 250 Volt fuse (Buss® Type ABC-10). The fuses are located in either side of the AC input line. Auto switching between 120 and 230 Vac operation requires only that the power plug be changed.

POWER MODULES

Each Power Module contains a status board, EMI board, fans, and "ORing" diodes. The output "ORing" diodes within each module enable redundant operation and prevent catastrophic failures if a short develops in the output stage of a single module. Remote sensing built into each module compensates for the diode and cable voltage drops.

Input/output connectors automatically connect all lines to the Power Modules when the modules are slid into place and secured. The ground pins on the Power Module's input/output connectors are lengthened so that these pins connect first upon installation and disconnect last when removing a power supply module. This permits hot change-out of Power Modules without interrupting system operation.

Front Panel

The front panel of each 350A1441P3 and P4 Power Module (shown in Figures 2 and 4, respectively) contains a

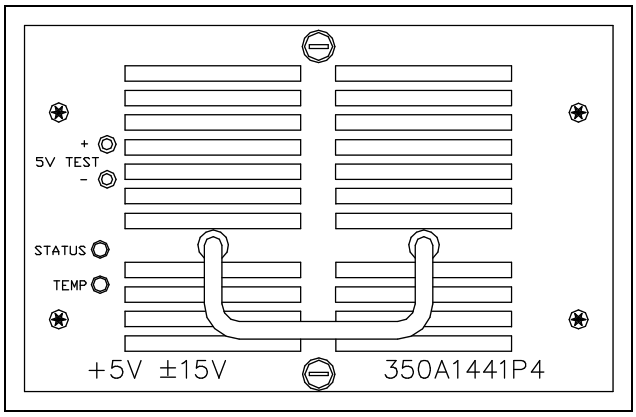


Figure 4 - 350A1441P4, +5V and ±15V Power Module (Front View)

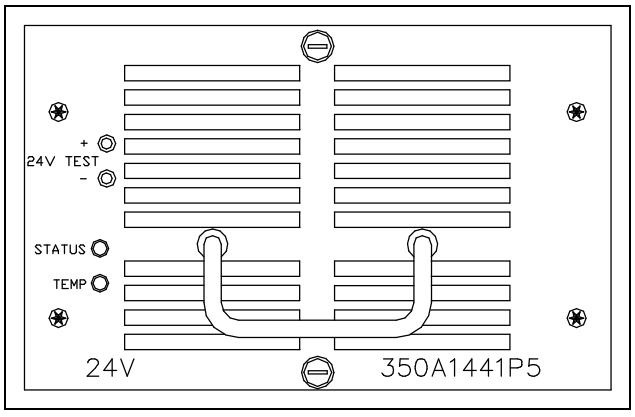


Figure 5 - 350A1441P5, ±24V Power Module (Front View)

+5 Vdc output voltage test point labeled 5V TEST with (+) and (-) jacks and two bi-colored LED's to provide visual information on the DC output voltage (STATUS) and operating temperature (TEMP) of the Power Module.

The 350A1441P5 Power Module (shown in Figure 5) contains a +24V output voltage test point labeled 24V TEST with (+) and (-) jacks and bi-color STATUS and TEMP LEDs.

Remote Sensing

Remote sensing is provided for the +5 (350A1441P3 and 350A1441P4). The output voltage is sensed after the "ORing" diode, the Power Module will compensate for up to a 0.7 Volt cable drop. No remote sensing is provided for the +24 Vdc (350A1441P5) output.

Overload Protection

An overload or short circuit on any output will result in either a primary power or a primary current limit. A primary limit results in all outputs phasing back and shutting down.

The outputs will periodically cycle on and off until the fault condition is removed. After an overload or short circuit is removed from the outputs, the Power Module will automatically recover. All outputs can withstand a continuous short with no damage to the Power Module.

Overvoltage Protection

Overvoltage protection is provided for the 5 Vdc output (350A1441P3 and P4 only). An overvoltage condition results in the Power Module latching off. The AC input must be cycled off and back on to reset the Power Module. The 5 Vdc overvoltage trip point is +6.5 ±0.75V. The AC input must be removed for several seconds to properly reset the Power Module.

Reverse Voltage Protection

All outputs on the Power Modules are reverse voltage protected. The maximum reverse voltage will not exceed 1 Volt.

Thermal Protection

If the Power module's heat sink exceeds 90°C, a thermal shutdown will occur. The Power Module will automatically recover when the heat sink temperature returns to its normal operating temperature range.

N+1 Load Share

Active load sharing is available for the +5 Vdc output (P3 and P4 Power Modules). The +24 Vdc output (P5 Power Modules) is intended for 1+1 redundancy without active current sharing.

For the +5 Vdc (P3 & P4) supplies, the **C**urrent **S**hare Control (CS) and Sync signal outputs allow N+1 sharing between additional RPS Power Module Chassis'. The CS Bus and Sync signals are internally connected between Power Modules within the same chassis and externally cabled via redundant J4 & J5 connectors between chassis. This cable also provides a connector for remote voltage sense. The cable is only required when more than two power modules are bussed together.

OPERATION

In an "N+1" RPS system, "N" supplies are required to supply the system load. An additional supply is added to provide redundancy thereby forming an "N+1" system. Since the system requires "N" supplies to support the load,

current sharing is necessary to prevent any one supply from being overloaded.

Active sharing is achieved by signaling between the individual supplies on a **C**urrent **S**hare Control (CS) Bus. In a system the CS Bus signals are connected together. The Power Module with the highest output voltage, will have the highest output current, and will act as the master to drive the CS Bus. The other Power Modules use the CS Bus as a reference and increase their output to match the CS Bus level. If the master fails, the Power Module with the next highest output voltage becomes the master.

A 50 mV fixed offset is built into the CS Bus between the master and the slave Power Modules. Since the Power Modules' output voltages can be set very close to each other, the offset allows the Power Modules to easily determine a master. This prevents the system from becoming unstable while determining a master.

Once the master has been established, each of the slave modules regulate their load share bus at 50 mV less than the master. This fixed offset always results in the master delivering 1.4A more current than the slave modules throughout the operating range.

In addition, the RPS system can start-up glitch free with any output load. This is accomplished by synchronizing the start-up of the Power Modules. The modules provide the synchronized start-up via the Remote Inhibit signal (SYNC). Since the modules current share during start-up, no one module provides excessive output current. This prevents false current limit trips and allows the system to start under any load condition.

STATUS INDICATOR

The bi-colored (green/amber) **STATUS** LED, also referred to as the "DC OK Indicator," is green when all DC outputs are above the specified minimum limits. The LED changes to amber if any output falls below the specified minimum limits.

Table 1 - 350A1441P3 DC OK Status Limits

OUTPUT	DC OK Minimum Limit
+5 Vdc	+4.75 Vdc
+12 Vdc	+11.30 Vdc
-12 Vdc	-11.30 Vdc

Table 2 - 350A1441P4 DC OK Status Limits

OUTPUT	DC OK Minimum Limit
+5 Vdc	+4.75 Vdc
+15 Vdc	+14.20 Vdc
-15 Vdc	-14.20 Vdc

Table 3 - 350A1441P5 DC OK Status Limits

OUTPUT	DC OK Minimum Limit
+24 Vdc	+22.6 Vdc

TEMPERATURE INDICATOR

The bi-colored (green/amber) **TEMP** LED, also referred as the "Thermal Alarm," is green when the Power Module is operating below its maximum operating temperature. The LED changes to amber to indicate an impending thermal shutdown. This thermal alarm indication occurs 5°C prior to shutdown. If the Power Module's heat sink exceeds 90°C, a thermal shutdown occurs. The Power Module automatically recovers when the temperature of the heat sink returns within the operating temperature range. When the Power Module has recovered and returned to normal service the amber LED may remain illuminated for several minutes.

TTL STATUS OUTPUTS

A logic level high is provided to indicate all outputs and the operating temperature are normal. If the output voltage drops below the DC OK limits or the maximum operating temperature is exceeded, the TTL status output switches to a logic low.

The status output is open collector TTL compatible and has a maximum sink current of 10 mA. These outputs may be used to drive a remote alarm indicator.

INSTALLATION

Each N+1 RPS Power Module Chassis may contain two identical Power Modules. **These modules must be of the same type**. For example, a 350A1441P1 RPS Power Module Chassis may contain either two 350A1441P3 Power Modules or two 350A1441P4 Power Modules, but no P5 Power Modules. A 350A1441P2 RPS Power Module

Chassis may only contain up to two 350A1441P5 Power Modules.

CAUTION

When installing Power Modules into the RPS Power Module Chassis, observe chassis and Power Module voltage rating labels. **Do not** attempt to install dissimilar Power Modules in the same chassis, a 12 or 15 Volt Power Module into a P2 chassis, or a 24 Volt Power Module into a P1 chassis. Damage to associated equipment or the RPS Power Modules may result.

INPUT CONNECTIONS

WARNING

Observe all standard safety procedures for handling dangerous voltages.

WARNING

For continued protection against risk of fire, replace the fuses only with fuses of the same type and rating.

CAUTION

Each Power Module is wired for Double-Pole - Neutral fusing via the AC Power Entry module located on the rear of the RPS Power Module Chassis.

The two power cords supplied with the unit should be connected to a 120 or 230 Vac, 50/60 Hz source.

NOTE

The AC source is normally a power strip in the same equipment rack. Typically, the power strip is hardwired to an independent circuit breaker.

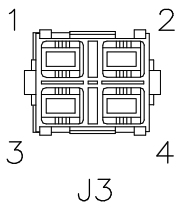
SYSTEM CONNECTIONS

Load connections are made from Output connector J3. For P3 and P4 Power Modules, high current applications are connected to the +5 Vdc studs via bus bars. Normally, the output of each Power Module is connected in parallel through an "ORing "diode to the load. Each of the (+) and (-) remote sense lines are tied together and connected to the load at the desired sense points. The CS Bus from each chassis are wired together as are the Sync lines. The lines are internally connected together inside each Power Module Chassis.

Output Connections

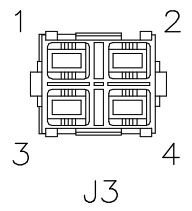
In systems using the 350A1441P1 Power Module Chassis, high current output connections are made to the +5 Vdc and RTN studs. Normally, bus bars are used to connect between the studs on each chassis and the appropriate power distribution panel. Outputs from connector J3 (as shown in Table 4) are +12 Vdc output (pin 1), +5 Vdc output (pin 2), ±12 Vdc Return (pin 3), and a -12 Vdc output (pin 4) for 350A1441P3 Power Modules. For 350A1441P4 Power Modules, the P1 Power Module Chassis provides a +15 Vdc output (pin 1), +5 Vdc output (pin 2), ±15 Vdc Return (pin 3), and a -15 Vdc output (pin 4).

Table 4 - Output Connector J3 Pin Assignments for 350A1441P1 Power Module Chassis

	Pin	Function
	1	+12/15 Vdc Output
	2	+5 Vdc Output
	3	±12 or ±15 Vdc Return
	4	-12 or -15 Vdc Output

When the 350A1441P2 Power Module Chassis is installed, connector J3 provides a +24 Vdc output (pins 1 and 2) and +24 Vdc Return (pins 3 and 4) as shown in Table 5.

Table 5 - Output Connector J3 Pin Assignments for 350A1441P2 Power Module Chassis

	Pin	Function
	1	24 Vdc Output (+)
	2	24 Vdc Output (+)
	3	24 Vdc Return (-)
	4	24 Vdc Return (-)

Although the output connections for each type of Power Module Chassis are listed in the preceding tables, the interconnection drawings for the specific application must be referred to for connection details.

Status Connectors

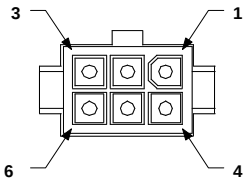
The two Status Connectors (J4 and J5) are internally tied in parallel inside each Power Module Chassis. Externally, J4 and J5 are interconnected between each chassis of the same voltage and the designated sense points.

NOTE

The sense leads must be connected before applying power to the Power Modules.

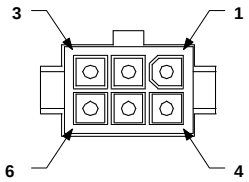
The pin assignments for connectors J4 and J5 are listed in Table 6 for Power Module Chassis 350A1441P1. These assignments are the same for both 350A1441P3 and P4 Power Modules.

Table 6 - Status Connector J4/J5 Pin Assignments for 350A1441P1 Power Module Chassis

	Pin	Function
	1	5 Vdc (+) Sense
	2	5 Vdc (-) Sense
	3	PS Alarm (TTL Output)
	4	CS BUS
	5	SYNC
	6	N/C

For 350A1441P5 Power Modules installed in the 350A1441P2 Power Module Chassis, the pin assignments for connectors J4 and J5 are listed in Table 7.

Table 7 - Status Connector J4/J5 Pin Assignments for 350A1441P2 Power Module Chassis

	Pin	Function
	1	24 Vdc (+) Sense
	2	24 Vdc (-) Sense
	3	PS Alarm (TTL Output)
	4	N/C
	5	N/C
	6	N/C

SERVICE

ADJUSTMENTS

There are no field authorized adjustments in the N+1 RPS System. All adjustments to individual Power Modules must be made at the factory using calibrated equipment under controlled load conditions.

WARNING

Making any adjustments to the individual modules in the field could damage the equipment or degrade the N+1 RPS System's ability to support the total load through current sharing. This could result in one or more Power Modules becoming overloaded.

TROUBLESHOOTING

Most problems encountered with the RPS System will be caused by associated equipment or incorrect cabling or wiring. The information provided in the Troubleshooting Guide may be helpful in isolating a malfunctioning Power Module.

If a Power Module appears to be defective replace the module with a known good Power Module of the same voltage rating. If this resolves the problem, the defective Power Module should be returned to Ericsson Inc. for repair or replacement.

REPAIR

The 350A1441P1 and P2 RPS Power Module Chassis and the 350A1441P3, P4, and P5 Power Modules are not field repairable. If a module or chassis becomes defective, return the defective unit to Ericsson Inc. for repair or replacement. Contact the Ericsson Support Services for specific instructions when returning the unit for repair or replacement.

IN CASE OF DIFFICULTY

If you are unable to resolve a problem to your satisfaction, then contact the Ericsson Technical Assistance Center (TAC) at 1-800-528-7711 (outside the USA, call 804-528-7711).

TROUBLESHOOTING GUIDE

SYMPTOM	AREA TO CHECK	POSSIBLE PROBLEM
NO OUTPUT AT +5 & ±15/12 or 24 VOLT LOAD, ALL MODULES HAVE: STATUS LED - green TEMP LED - green	1. Cable connections to load.	1. Power Supply System cables not correctly installed, removed or improperly connected.
NO OUTPUT AT +5 & ±15/12 or 24 VOLT LOAD, ALL MODULES HAVE: STATUS LED - off TEMP LED - off	1. Power Supply System Input power. 2. Sense Cable.	1. Input power incorrect or missing, restore input power. 2. If more than two power modules are bussed together, then the sense cable must be installed.
OUTPUT AT +5 & ±15/12 or 24 VOLT LOAD OK, SOME MODULES HAVE: STATUS LED - off TEMP LED - off	1. Check module fuse. 2. Check module AC input.	1. Module fuse blown, replace with fuse of proper value. Module(s) should return to service. If not replace module. 2. AC input incorrect or missing to that module. Module(s) should return to service with proper AC service. If not, replace module 3. Temperature limit has been exceeded and module(s) has shut down. Wait for module(s) to cool. Module(s) should return to service automatically {note amber LED may persist for a few minutes even though module is fully functional}. If not, replace module.

Continued...

TROUBLESHOOTING GUIDE (Continued)

SYMPTOM	AREA TO CHECK	POSSIBLE PROBLEM
OUTPUT AT +5 & ±15/12 or 24 VOLT LOAD OK, SOME MODULES HAVE: STATUS LED - amber TEMP LED - green	1. Voltage at STATUS test points on front of module(s) should be equal to load voltage. 2. Faulty equipment or condition causing momentary excessive load current(s).	1. Module has shut down due to internal overvoltage condition caused by excessive load current requirements. AC power must be recycled to that module. AC power should remain off for several seconds to recycle module. STATUS LED should go to green, if not, replace module. 2. Power Module defective replace module if recycling power doesn't correct problem.
OUTPUT VOLTAGE CYCLING ON ALL MODULES STATUS LED - cycling green/amber TEMP LED - cycling green/off	1. Check load, wiring and associated equipment for shorts or overload conditions.	1. An N+1 Power Supply Modules current limit or maximum power limit has been exceeded. Modules are bringing up output voltage in an attempt to recover. Output cycles off at over current or power limit point. Rate of cycling indicates the severity of the overload condition. Modules will recover when over current or over power condition is removed.
+5 VOLTS LOW AT LOAD STATUS LED - green TEMP LED - green	1. Measure voltages at load. 2. Measure voltages at 5V TEST on power supply modules. 3. Check loads to insure load current is not excessive, check cabling for excessive temperature rise to locate overload(s).	1. If voltage at 5V TEST low or zero, check for open voltage sense line to that module rack. Voltage sense lines are pins 1 & 2 of J4 or J5. All sense lines should terminate at single point on load. 2. If voltage at load is low and 5V TEST (voltage sense) is correct, check for short or overload causing excessive voltage drops in wiring to load.
NORMAL OUTPUT AT LOAD FOR ANY MODULE WITH STATUS LED - green TEMP LED - amber	1. Check module fans (2) are running and verify air flow from Power Supply Rack. 2. Check for obstructions to air flow from Power Supply Rack(s).	1. Module may be experiencing an over temperature condition insufficient to shut module down. Replace module if this persists. 2. Module may be recovering from an over temperature shut down {i.e.; STATUS & TEMP LEDs were off, module cooled and recovered}. Over temperature LED may be amber for a short period of time after module has recovered. If condition persists, replace module.

Continued...

TROUBLESHOOTING GUIDE (Continued)		
SYMPTOM	AREA TO CHECK	POSSIBLE PROBLEM
NORMAL +5 VOLT OUTPUT AT LOAD, AND ±15/12 VOLTS MISSING STATUS LED - green TEMP LED - green	1. Check for ±15/12 Volts at load.	1. System Power Supply cabling faulty, incorrect or missing.

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