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[FE-2000-48-RA](#)

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## LAMBDA ELECTRONICS

## INSTRUCTION MANUAL

## FE2000 SERIES

Thank you for purchasing a Lambda FE Series power module. The FE Series represents the most power dense front-end power modules currently available and offers many advantages that abet use in telecommunication, process control, photonics and computer applications.

Electrical specifications pertaining to FE power modules are included in the following matrices as well as sense and signaling connection information. *Please note that for the FE power module to function properly, the proper connections must be made on the 25-pin connector.* These connections are described in the Sense and Signaling matrices for both stand-alone module use and for modules assembled in a standard FE Series racking system.

In order to function optimally, the following mating connectors should be used for modules utilized in a stand-alone configuration:

FE Power Module AC Input Power Interface

FE0500 and FE1000 modules utilize a 15 ampere IEC 320 male receptacle and FE1500 and FE2000 modules utilize a 20 ampere IEC 320 male receptacle. Mating connectors can, respectively, be obtained from the following sources:

Panel Components Corporation  
P.O. Box 6626  
Santa Rosa, CA 95406  
800-662-2290 (telephone)

FE0500, FE1000 — PCC Model No. 86525032

Qualteck Electronics Corporation  
7676 Jenthers Drive  
Mentor, OH 44060  
216-951-3300 (telephone)

FE1500 — Qualteck Model No. 227003-01  
FE2000 — Qualteck Model No. 225003-01

FE Power Module DC Output Power Interface

FE Series power modules utilize Iconn-style connectors as an output interface. For stand-alone use, Lambda recommends the following board-mount pin mating connectors be used:

Elcon Products  
P. O. Box 1885  
Fremont, CA 94538  
510-490-4200 (telephone)

FE0500, FE1000 — require two Elcon Model No. 259-16-00100 per module  
FE1500, FE2000 — require four Elcon Model No. 259-16-00100 per module

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FE Power Module Signals Connector Interface

FE power modules utilize a standard 25-pin D-type connector for sense and signaling terminations. The proper interface should include a complimentary mate and guide-pins to ensure proper insertion alignment. Lambda recommends the following mating interface

Amp Incorporated  
Harrisburg, PA 17105  
717-564-0100 (telephone)

Amp Model Nos. 745886-1 (connector) and 750103-3 (guide-pins)

Applications Notes, applications assistance and technical support are also available. Please feel free to contact Lambda at 1-800-Lambda-4 if you have any questions regarding your FE Series power modules and thank you for your purchase.

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**RATINGS AND SPECIFICATIONS FOR LAMBDA MODEL NO. FE2000:**
**I. MAXIMUM RATINGS AT  $V_{OUT}$  NOMINAL**

SPECIFICATION	UNITS	FE2000-24	FE2000-48
OUTPUT VOLTAGE RANGE	V	20-29	40-58
OUTPUT CURRENT (POWER) AT 50°C (AT $V_{OUTMIN}$ )	A (W)	84.00 (2000)	42.00 (2000)
OUTPUT CURRENT (POWER) AT 60°C (AT $V_{OUTMIN}$ )	A (W)	63.00 (1500)	31.50 (1500)
OUTPUT CURRENT (POWER) AT 70°C (AT $V_{OUTMIN}$ )	A (W)	42.00 (1000)	21.00 (1000)
OPERATING TEMPERATURE	°C	CONTINUOUS DUTY FROM -40°C TO +70°C THIRTY MINUTE WARM-UP REQUIRED AT -40°C	

**II. INPUT SPECIFICATIONS**

SPECIFICATION	UNITS	FE2000-24	FE2000-48
INPUT VOLTAGE RANGE	VAC	170-265 (47-63 Hz.)	
INPUT CURRENT (RMS)	A	12.0 AT 220VAC	
INPUT CURRENT (PEAK, AT COLD START)	A	40 AT 220VAC <sub>IN</sub>	
INPUT POWER (MAX)	W	2450 AT 170 VAC <sub>IN</sub>	
INPUT SURGE PROTECTION	—	COMPLIANT TO IEC1000-4-5, LEVEL 3 STANDARDS	
INPUT EMI, CONDUCTED EMISSIONS	—	FCC CFR PART 15, SUBPART J CLASS B STANDARDS EN55022 CLASS A STANDARDS	
EFFICIENCY AT $P_{OUTMAX}$ (-NA VERSIONS)	%	82 MIN AT 170VAC <sub>IN</sub>	
POWER FACTOR CORRECTION AT $P_{OUTMAX}$	%	95 MIN, PER IEC1000-3-2 STANDARDS	
INPUT CURRENT HARMONICS	—	COMPLIANT WITH EN60555-2 ABOVE TEN PERCENT RATED POWER	
FUSING (CUSTOMER SUPPLIED)	—	20 A, 250 VAC FOR 110 VAC INSTALLATIONS 10 A, 250 VAC FOR 220 VAC INSTALLATIONS	

**III. OUTPUT SPECIFICATIONS**

SPECIFICATION	UNITS	FE2000-24	FE2000-48
LINE AND LOAD REGULATION	%	±1 FROM NO LOAD TO FULL LOAD, 170-265VAC	
RIPPLE AND NOISE AT 20 MHz MEASUREMENT BANDWIDTH	mV	250 <sub>PEAK TO PEAK</sub>	500 <sub>PEAK TO PEAK</sub>
TEMPERATURE AND DRIFT	%	±2 OVER TEMPERATURE RANGE AND LIFE	
HOLD-UP TIME	ms	OUTPUT REMAINS ABOVE $V_{OUTMIN}$ LIMIT FOR 16ms UPON REMOVAL OF INPUT	
LOAD TRANSIENT RESPONSE (10% TO 100% LOAD CHANGE)	—	RECOVERY TO WITHIN THREE PERCENT OF OUTPUT WITHIN 10ms.	
CONDUCTED BATTERY NOISE	—	GR-1089-CORE, prETS30013-2 PSOPHOMETRIC NOISE REQUIREMENTS.	
ESD SUSCEPTIBILITY	—	GR-1089-CORE, IEC1000-4-2 LEVEL 4 (8kV DIRECT DISCHARGE) STANDARDS	

**IV. OPERATING MODES**

DESCRIPTION	OPERATIONAL DEFINITION
PARALLEL OPERATION (ACTIVE CURRENT SHARE CONFIGURATION)	REFER TO FE SERIES APPLICATION NOTES

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**FEATURES:**

**I. DC OUTPUT, CONTROLS AND INDICATORS**

DESCRIPTION	OPERATIONAL DEFINITION
OUTPUT VOLTAGE ADJUST	FACTORY SET AT 24VDC OR 48VDC. CONSULT FACTORY FOR ADJUSTMENT.
OVERVOLTAGE PROTECTION ADJUST	FACTORY SET AT 30VAC OR 60VDC. CONSULT FACTORY FOR ADJUSTMENT.
OUTPUT-INVERTER GOOD INDICATOR	GREEN-COLORED LED ILLUMINATES WHEN THE OUTPUT IS WITHIN THE SPECIFIED OPERATING RANGE AND THE INVERTER IS PROPERLY FUNCTIONING.
AC GOOD INDICATOR	GREEN-COLORED LED ILLUMINATES TO INDICATE AC POWER IS APPLIED.
OVERTEMPERATURE FAULT INDICATOR	RED-COLORED LED ILLUMINATES IF OVERTEMPERATURE SHUTDOWN OCCURS.
LOAD CURRENT INDICATOR	FIVE GREEN-COLORED LEDs INDICATE APPROXIMATE PERCENTAGE OF OUTPUT CURRENT VALUE.

**II. REMOTE CONTROL FEATURES**

DESCRIPTION	OPERATIONAL DEFINITION
REMOTE VOLTAGE SENSING	PROVIDES PRECISE REGULATION DIRECTLY AT LOAD. THE MAXIMUM TOTAL DC VOLTAGE DROP BETWEEN THE OUTPUT TERMINALS AND THE LOAD MUST BE LIMITED TO LESS THAN 1.0 VOLT FOR -NA MODELS AND 0.5 VOLTS FOR -RA MODELS.)
REMOTE ON-OFF CONTROL	DC OUTPUT IS ENABLED VIA A CONNECTION BETWEEN PINS 6 AND 19 OF 25-PIN, D CONNECTOR.
SIGNAL ISOLATION	REMOTE ON-OFF PINS ARE REFERENCED TO THE -V <sub>OUT</sub> TERMINAL.

**III. AUXILIARY MONITORING AND ALARM SIGNALS — OPTICALLY COUPLED, CONDUCTANCE OUTPUTS.**  
 (CONDUCT UP TO 5mA AT A VOLTAGE OF LESS THAN 1.0VDC WHEN ACTIVE.)

DESCRIPTION	OPERATIONAL DEFINITION
AC FAIL SIGNAL	CONDUCTANCE SIGNAL WHICH INDICATES SUFFICIENT AC INPUT IS PRESENT TO PROVIDE A MINIMUM OF FIVE MILLISECONDS OF HOLD-UP TIME AFTER THE REMOVAL OF INPUT.
OUTPUT-INVERTER GOOD SIGNAL	CONDUCTANCE SIGNAL WHICH INDICATES THAT DELIVERED OUTPUT VOLTAGE, AS MEASURED AT THE +V AND -V TERMINALS, IS PRESENT AND THE INVERTER IS OPERATIONAL.
OUTPUT CURRENT MONITOR SIGNAL	ZERO TO ONE VOLT SIGNAL PROPORTIONAL TO OUTPUT CURRENT AVAILABLE FOR MONITORING. ONE VOLT CORRESPONDS TO 100 PERCENT RATED CURRENT.
SIGNAL ISOLATION	SIGNALS ARE ISOLATED FROM POWER SUPPLY OUTPUT AND EACH OTHER FOR VOLTAGES UP TO 500VDC MAXIMUM AND 3000VAC ISOLATION FROM AC INPUT TO AUXILIARY SIGNALS. THE CURRENT MONITOR SIGNAL IS REFERENCED TO THE -IMON TERMINAL (THE CATHODE OF THE INTERNAL OR-ING DIODE.)

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FEATURES (CONT'D)

IV. PROTECTION FEATURES

DESCRIPTION	OPERATIONAL DEFINITION
OVERCURRENT PROTECTION	OUTPUT CURRENT IS LIMITED TO APPROXIMATELY 110 PERCENT OF 50°C RATED POWER FROM $V_{OUTMAX}$ TO $V_{OUTMIN}$ . CURRENT LIMIT CHARACTERISTICS WILL PROVIDE FOLDBACK TO APPROXIMATELY 80 PERCENT OF RATED CURRENT BELOW $V_{OUTMIN}$ .
OVERVOLTAGE PROTECTION	INVERTER SHUTDOWN, NON-LATCHING. CONSULT FACTORY FOR ADJUSTMENT.
THERMAL PROTECTION (OVERTEMPERATURE PROTECTION)	SELF-RESETTING INVERTER SHUTDOWN.
ISOLATION VOLTAGES	3000VAC, INPUT TO OUTPUT 500VDC, OUTPUT TO CHASSIS GROUND 1500VAC, INPUT TO CHASSIS GROUND
LEAKAGE CURRENT (AC LINE TO CHASSIS GROUND)	LESS THAN 3.5mA WHEN OPERATED AT 250VAC (47-63Hz) OR LOWER VOLTAGES.
REGULATORY AGENCY COMPLIANCE	FE SERIES POWER MODULES ARE COMPLAINT TO THE FOLLOWING STANDARDS: <ul style="list-style-type: none"> <li>• UL1950</li> <li>• CSA 22.2-234</li> <li>• EN60950</li> <li>• CE MARKED FOR EUROPEAN COMMUNITY COMPLIANCE</li> </ul>

V. MECHANICAL FEATURES

SPECIFICATION	UNITS	FE2000-24	FE2000-48
STORAGE TEMPERATURE (NON-OPERATING)	°C	-40 TO +85	
OPERATING TEMPERATURE	°C	-40 TO +70 WITH DERATING ABOVE +50 (-40 OPERATION REQUIRES A THIRTY MINUTE WARM-UP PERIOD)	
WEIGHT (NET)	LBS	9.00	
WEIGHT (SHIP)	LBS	10.00	
SIZE (L x W x H)	INCHES	11.97 x 4.87 x 5.50	
FINISH	—	BLACK	
MOUNTING	—	EITHER STAND-ALONE OR ASSEMBLED INTO A STANDARD LAMBDA MODEL NO. FE6K RACKING SYSTEM.	

VI. OTHER FEATURES

DESCRIPTION	DEFINITION
COOLING	FORCED AIR, FAN COOLED FROM THE FRONT OF THE MODULE EXITING THE REAR.
FUNGUS INERT	ALL FE POWER MODULES ARE INHERENTLY FUNGUS INERT.
AUXILIARY-BIAS POWER SUPPLY	12VDC AT 50mA SOURCE REFERENCED TO $-V_{OUT}$ TERMINAL FOR EXTERNAL HOUSEKEEPING CIRCUITRY.
ISOLATION DIODES	AVAILABLE SOLELY ON -RA MODULES. BUILT IN OR-ING DIODES IN THE $-V_{OUT}$ TERMINAL PROVIDE A SINGLE POINT FAILURE RIDE-THROUGH FOR THE DC BUSS IN THE CASE OF POWER SUPPLY FAILURE. REVERSE LEAKAGE CURRENT IS LESS THAN 8mA.
GUARANTEE	TWO YEARS FROM THE TIME OF DELIVERY, PARTS AND LABOR.

VII. CONNECTOR INFORMATION — SIGNALING AND DIAGNOSTICS

PIN NO.	DESIGNATION	DESCRIPTION
1	+S	+SENSE CONNECTION. CONNECT TO +V TERMINAL OF LOAD FOR REMOTE-SENSING. CONNECT TO +LS FOR LOCAL SENSING.
2	-LS	-LOCAL SENSE CONNECTION.
3	PROG	JUMPER TO PIN 15 (-S) FOR FRONT-PANEL PROGRAMMING. ALLOWS FOR REMOTE, EXTERNAL PROGRAMMING VIA INSERTION OF RESISTOR BETWEEN THE PROGRAMMING PIN AND PIN 15 (-S.)
4	+IMON	OUTPUT CURRENT MONITORING TERMINAL. CONSISTS OF A ZERO TO ONE VOLT SIGNAL WITH RESPECT TO THE -IMON THAT IS PROPORTIONAL TO THE OUTPUT CURRENT. ONE VOLT CORRESPONDS TO 100 PERCENT, FULL LOAD.
5	+VAUX	POSITIVE TERMINAL OF THE 12VDC AUXILIARY-BIAS POWER SUPPLY.
6	INTLK 1	FUNCTIONS TO ENABLE AND DISABLE THE INVERTER OF THE POWER SUPPLY. A LOGIC LEVEL LOW FROM ZERO TO 1.5 VOLTS OR A DIRECT SHORT TO INTERLOCK 2 (PIN 19) THROUGH A CONTACT CLOSURE WILL ENABLE THE UNIT. A LOGIC LEVEL HIGH FROM A MINIMUM 3.8 VOLTS OR HIGHER OR AN OPEN CIRCUIT TO INTERLOCK 2 WILL DISABLE THE POWER SUPPLY.
7	N/C	NO CONNECTION
8	N/C	NO CONNECTION
9	N/C	NO CONNECTION
10	N/C	NO CONNECTION
11	AC FAIL 2	REPRESENTS THE EMITTER OF THE INTERNAL OPTO-TRANSISTOR CAPABLE OF SINKING UP TO 5mA WITH 20 VOLTS MAXIMUM APPLIED FROM COLLECTOR TO EMITTER.)
12	DC GD 2	REPRESENTS THE EMITTER OF THE INTERNAL OPTO-TRANSISTOR CAPABLE OF SINKING UP TO 5mA WITH 20 VOLTS MAXIMUM APPLIED FROM COLLECTOR TO EMITTER.)
13	OT 2	REPRESENTS THE EMITTER OF THE INTERNAL OPTO-TRANSISTOR CAPABLE OF SINKING UP TO 5mA WITH 20 VOLTS MAXIMUM APPLIED FROM COLLECTOR TO EMITTER.
14	+LS	+LOCAL SENSE CONNECTION.
15	-S	-SENSE CONNECTION. CONNECT TO -V TERMINAL OF LOAD FOR REMOTE SENSING. CONNECT TO -LS FOR LOCAL SENSING.
16	ISHARE	CURRENT SHARE BUSS.
17	-IMON	RETURN PIN FOR THE IMON FUNCTION.
18	-VAUX	RETURN PIN FOR AUXILIARY-BIAS POWER SUPPLY.
19	INTLK 2	(SEE DESCRIPTION, PIN 6)
20	CH GND	REPRESENTS THE CHASSIS GROUND TERMINAL.
21	N/C	NO CONNECTION
22	N/C	NO CONNECTION
23	AC FAIL 1	OPEN COLLECTOR SIGNAL INDICATING THAT A FAULT CONDITION HAS OCCURRED ON THE AC LINE. THIS PIN REPRESENTS THE COLLECTOR OF THE INTERNAL OPTO-TRANSISTOR CAPABLE OF SINKING UP TO 5mA WITH 20 VOLTS MAXIMUM APPLIED FROM COLLECTOR TO EMITTER.
24	DC GD 1	OPEN COLLECTOR SIGNAL INDICATING THE OUTPUT IS PRESENT AND THE INVERTER IS OPERATIONAL. THIS PIN REPRESENTS THE COLLECTOR OF THE INTERNAL OPTO-TRANSISTOR CAPABLE OF SINKING UP TO 5mA WITH 20 VOLTS MAXIMUM APPLIED FROM COLLECTOR TO EMITTER.
25	OT 1	OPEN COLLECTOR SIGNAL INDICATING THAT AN OVERTEMPERATURE CONDITION HAS OCCURRED. THIS PIN REPRESENTS THE COLLECTOR OF THE INTERNAL OPTO-TRANSISTOR CAPABLE OF SINKING UP TO 5mA WITH 20 VOLTS MAXIMUM APPLIED FROM COLLECTOR TO EMITTER.

Lambda FE Series Safety and Installation Instructions for Lambda Model FE2000

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To comply with published safety standards, the following instructions must be used in conjunction with the Lambda FE Series:

For earth fault protection, the unit must be protected in the final installation by suitable overcurrent protection means. If protection relies upon building wiring, the end product installation must ensure that the necessary protection is provided.

The internal fuse (F601) may only be replaced with a Littelfuse, type 324015, rated at 15A, 250V.

The power supply is intended for use as a component of other equipment. When installing the power supply, the relevant safety standards (EN60950, IEC950, UL1950 or CSA-22.2-950) must be complied with.

In particular, creepage and clearance distances and distances through insulation between primary and earth or primary and secondary must be maintained.

The power supply output is SELV in accordance with requirements IEC-950. The output available has power greater than 240VA.

The CE mark on the product is applied to show conformance with the requirements outlined in the European Union's Low Voltage Directive [72/23/EEC] as amended by the CE Mark Directive [93/68/EEC].

The maximum ambient temperature of the operating environment must not exceed 50°C at 2000W, 60°C at 1500W or 70°C at 1000W.

This unit is protected by an approved fuse rated at a maximum of 20A, 250VAC for 220VAC installations and is to be placed in the ungrounded supply conductor.



Sicherheits und Installationsanleitung für Lambda Modell FE2000

Die folgende Sicherheitshinweise müssen bei der Verwendung der Netzteile beachtet werden:

Gegen Isolationsfehler zum Schutzleiter muß in der Endanwendung eine angemessene Absicherung vorgenommen werden. Falls die Absicherung durch die Gebäudeinstallation erfolgt, muß beim Einbau in das Endgerät entsprechend darauf hingewiesen werden.

Die interne Sicherung (F601) darf nur gegen gleichen Typ und gleiche Werte ausgetauscht werden. Es ist die Sicherung Littelfuse Typ 324015, mit 15A und 250V zu verwenden.

Das Netzteil ist nur als Baugruppe zum Einbau in Endgeräte vorgesehen und nicht zur eigenständigen Verwendung. Beim Einbau in Endgeräte sind die entsprechenden Sicherheitsbestimmungen (z. B. EN 60950, IEC-950, UL-1950, CSA 22.2-950) zu beachten.

Im speziellen ist auf das Einhalten ausreichender Kriech- und Luftstrecken sowie Isolationsdicken zwischen dem Primär- und Sekundärkreis sowie zum Schutzleiter zu achten.

Das Netzteil liefert eine SELV-Spannung in Übereinstimmung mit IEC-950. Die verfügbare Ausgangsleistung ist grober 240VA.

Das CE-Konformitätszeichen auf dem produkt zeigt Übereinstimmung mit den anforderungen der EG-neiderspannungs-Richtlinie [72/23/EEC] and siener Ergänzung [93/68/EEC].

Die maximale Arbeitsumgebungstemperatur darf 50C bei 2000W, 60C bei 1500W and 70C bei 1000W nicht überschreiten.

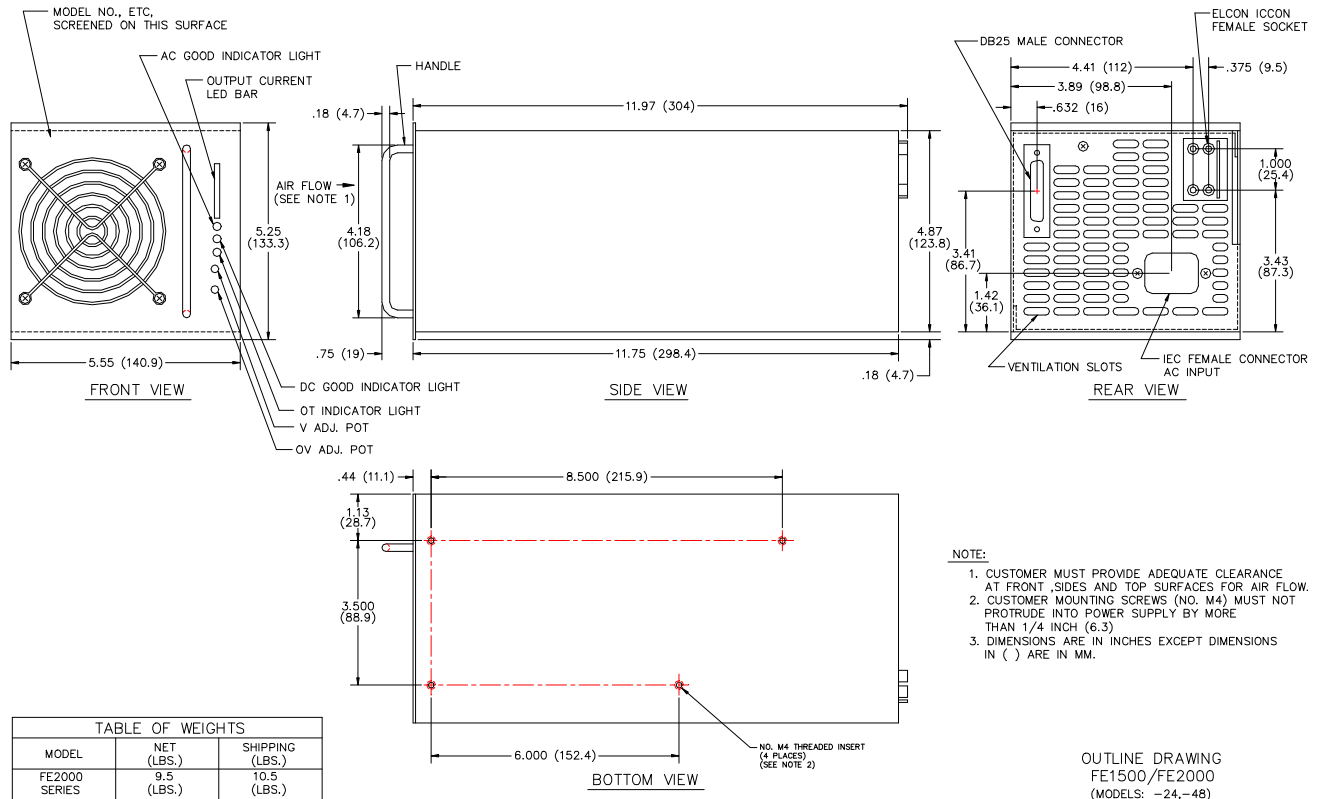
Dieses Gerat mub durch eine geprüfte Sicherung mit Maximalwerten 20A, 250V fur 220V Installationen geschützt werden.

Die Sicherung mub in dem Phasenleiter eingefugt werden.

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Outline Drawing