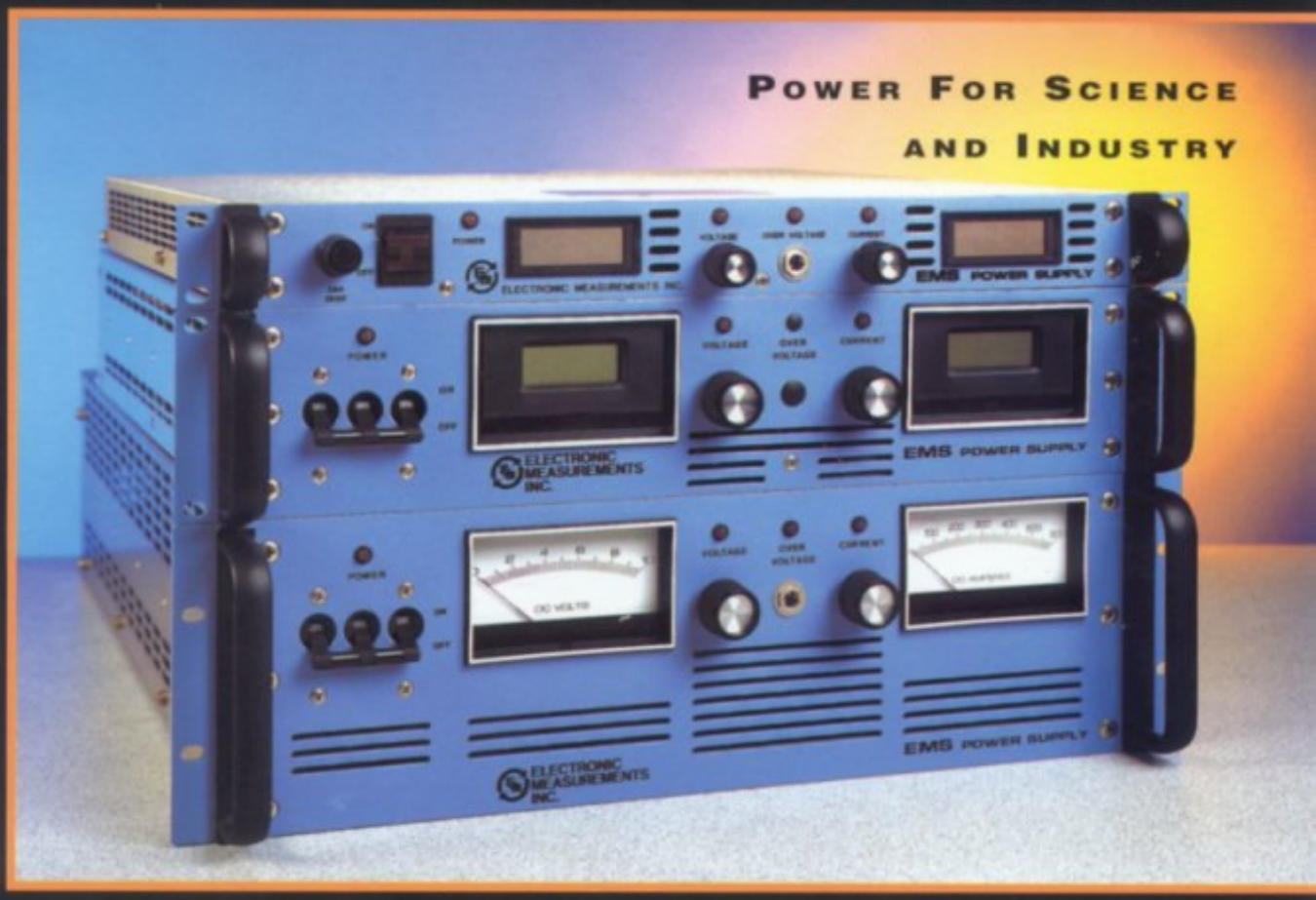
EMS Series Switch Mode DC Power Supplies



LAMBDA EMI

a.l.e. systems

EMS Series DC Power Supplies

CE

CV/CC Auto Crossover

EMS Power Supplies are high power switch mode AC to DC power supplies for single and three phase input applications where high efficiency, precise regulation and a high degree of packaging density and light weight are required.

This series of high frequency switching power supplies is designed to operate as a source of constant current/constant voltage power with automatic crossover. All EMS Power Supplies are fully programmable via analog programming or (optional) RSTL digital interface, allowing for systems integration to meet your specific requirements.

Continuous Development

The EMS series represents an important element in our broad line of switching power supplies. Beginning in 1969 with multiple patents awarded, Electronic Measurements has continued to invest in the development and engineering of the EMS series. Successful applications include semiconductor processing, medical, scientific and research laboratories. The EMS series offers the best of customer tested and application proven features, while incorporating the latest advancements in technology for the user of power conversion systems.

Major Features

- Highest power per cubic inch for wide range, rack mount, CV/CC power supplies in the industry
  1.0 kW—2.0 Watts per cubic inch—506 cu. in.
  2.5 kW—2.3 Watts per cubic inch—1071 cu. in.
  5.0 kW—3.1 Watts per cubic inch—1606 cu. in.
- CE mark available upon request on selected models
- 650 microsecond transient response time (models to 20 V output)
- Built in OVP with front panel adjust (models up to 300 V output)
- Built in thermal protection
- Constant Current/Constant Voltage with automatic crossover
- Soft Start
- Series or parallel, master-slave operation
- Common programming with TCR, EMHP and ESS series
- True zero voltage and current adjustability
- U/L Recognized

Product Changes - product information published in this brochure was current at time of printing, however, Electronic Measurements Inc. reserves the right to change specifications, designs and models without prior notice.

Operational Ratings @ 50°C & 60 Hz

1Ø Single Phase 1Ø

Output Ratings (1)			Regulation		(2) Ripple (mV) P-P Carrier	Model Number
Watts	Volts (DC)	Amps	Line	Load		
600	7.5	75	0.1%	0.1%	100	EMS 7.5-75
1000	7.5	130	0.1%	0.1%	75	EMS 7.5-130
2000	7.5	250	0.1%	0.1%	75	EMS 7.5-250
2500	7.5	300	0.1%	0.1%	75	EMS 7.5-300
600	10	60	0.1%	0.1%	100	EMS 10-60
1000	10	100	0.1%	0.1%	75	EMS 10-100
2000	10	200	0.1%	0.1%	75	EMS 10-200
2500	10	250	0.1%	0.1%	75	EMS 10-250
600	20	30	0.1%	0.1%	100	EMS 20-30
1000	20	50	0.1%	0.1%	75	EMS 20-50
2000	20	100	0.1%	0.1%	75	EMS 20-100
2500	20	125	0.1%	0.1%	75	EMS 20-125
600	30	20	0.1%	0.1%	100	EMS 30-20
1000	30	33	0.1%	0.1%	75	EMS 30-33
2000	30	65	0.1%	0.1%	75	EMS 30-65
2500	30	80	0.1%	0.1%	75	EMS 30-80
600	40	15	0.1%	0.1%	100	EMS 40-15
1000	40	25	0.1%	0.1%	75	EMS 40-25
2000	40	50	0.1%	0.1%	75	EMS 40-50
2500	40	60	0.1%	0.1%	75	EMS 40-60
600	60	10	0.1%	0.1%	100	EMS 60-10
1000	60	18	0.1%	0.1%	75	EMS 60-18
2000	60	33	0.1%	0.1%	75	EMS 60-33
2500	60	40	0.1%	0.1%	75	EMS 60-40
600	80	7.5	0.1%	0.1%	100	EMS 80-7.5
1000	80	13	0.1%	0.1%	100	EMS 80-13
2000	80	25	0.1%	0.1%	100	EMS 80-25
2500	80	30	0.1%	0.1%	100	EMS 80-30
1000	100	10	0.1%	0.1%	100	EMS 100-10
2000	100	20	0.1%	0.1%	100	EMS 100-20
2500	100	25	0.1%	0.1%	100	EMS 100-25
1000	150	7	0.1%	0.1%	120	EMS 150-7
2000	150	13	0.1%	0.1%	120	EMS 150-13
2500	150	16	0.1%	0.1%	120	EMS 150-16
1000	300	3.5	0.1%	0.1%	150	EMS 300-3.5
2000	300	6	0.1%	0.1%	150	EMS 300-6
2500	300	8	0.1%	0.1%	150	EMS 300-8
1000	600 (3)	1.6	0.1%	0.1%	250	EMS 600-1.6
2000	600	3.3	0.1%	0.1%	250	EMS 600-3.3
2500	600	4	0.1%	0.1%	250	EMS 600-4

(1) For non-standard output voltages consult factory.
(2) RMS ripple approx. 30% of P-P carrier ripple. For reduced ripple option (40 mV P-P carrier) on models up to 40 VDC output, specify the prefix EMS II.
(3) OVP standard on models up to 300 VDC output, not available on models over 300 VDC.

AC Inputs

- **600 W**; 105-125 VAC, 11.3A, 1Ø @ 47-63 Hz
  or 190-253 VAC, 6.3A, 1Ø @ 47-63 Hz
- **1 KW**; 105-125 VAC, 18.8A, 1Ø @ 47-63 Hz
  or 190-253 VAC, 10.4A 1Ø @ 47-63 Hz
- **2 KW**; 190-250 VAC, 20.8A 1Ø @ 47-63 Hz
- **2.5 KW**; 190-253 VAC, 28.5A, 1Ø @ 47-63 Hz
  or 190-253 VAC, 16.5A, 3Ø @ 47-63 Hz, user selectable

(Maximum input current is rated at low line input.)

Operational Ratings @ 50°C & 60 Hz

3Ø Three Phase 3Ø

Output Ratings (1)			Regulation		(2) Ripple (mV) P-P Carrier	Model Number
Watts	Volts (DC)	Amps	Line	Load		
2500	7.5	300	0.1%	0.1%	75	EMS 7.5-300
5000	7.5	600	0.1%	0.1%	75	EMS 7.5-600
2500	10	250	0.1%	0.1%	75	EMS 10-250
5000	10	500	0.1%	0.1%	75	EMS 10-500
2500	20	125	0.1%	0.1%	75	EMS 20-125
5000	20	250	0.1%	0.1%	75	EMS 20-250
2500	30	80	0.1%	0.1%	75	EMS 30-80
5000	30	165	0.1%	0.1%	75	EMS 30-165
2500	40	60	0.1%	0.1%	75	EMS 40-60
5000	40	125	0.1%	0.1%	75	EMS 40-125
2500	60	40	0.1%	0.1%	75	EMS 60-40
5000	60	80	0.1%	0.1%	75	EMS 60-80
2500	80	30	0.1%	0.1%	100	EMS 80-30
5000	80	60	0.1%	0.1%	100	EMS 80-60
2500	100	25	0.1%	0.1%	100	EMS 100-25
5000	100	50	0.1%	0.1%	100	EMS 100-50
2500	150	16	0.1%	0.1%	120	EMS 150-16
5000	150	33	0.1%	0.1%	120	EMS 150-33
2500	300	8	0.1%	0.1%	150	EMS 300-8
5000	300	16	0.1%	0.1%	150	EMS 300-16
2500	600 (3)	4	0.1%	0.1%	250	EMS 600-4
5000	600	8	0.1%	0.1%	250	EMS 600-8

(1) For non-standard output voltages consult factory.
(2) RMS ripple approx. 30% of P-P carrier ripple. For reduced ripple option (40 mV P-P carrier) on models up to 40 VDC output, specify the prefix EMS II.
(3) OVP standard on models up to 300 VDC output, not available on models over 300 VDC.

AC Inputs

- **2.5 KW;** 190-253 VAC, 28.5A, 1Ø @ 47-63 Hz
  or 190-253 VAC, 16.5A, 3Ø @ 47-63 Hz,
  user selectable

- **5 KW;** 190-253 VAC, 24A, 3Ø @ 47-63 Hz
  or 342-418 VAC, 13.5A, 3Ø @ 50 Hz

(Maximum input current is rated at low line input.)

EMS Series Specifications

AC Inrush
Soft start is standard on all EMS models. Line current is less than that at full load during turn-on, turn-off, power interruption or reapplication.

Output
See Operational Rating Chart. For single phase operation of the 2500 watt units the drop out line voltage will be 200 VAC. However, operation at a line voltage of 190 VAC is possible by derating output voltage by 10%.

Over Temperature Protection
Automatic protection against excessive temperatures is provided by a thermostat mounted on the heat sink. If the heat sink temperature reaches 90°C (195°F) the unit will shut down to prevent damage.

Remote Start/Stop/Interlock
All EMS models are capable of being remotely started or stopped by means of an external AC or DC voltage source. The same circuits provide the ability to interlock the supply via an external contact closure. The start/stop action controls all switching action in the power supply.

Regulation Constant Voltage Mode
An output current load change of 100% will cause an output voltage variation of less than 0.1%.

Regulation Constant Current Mode
An output voltage load change of 100% will cause an output current change variation of less than 0.1%.

Line Effects
When operating in either the constant voltage mode or the constant current mode, variations in the regulated output will not exceed 0.1% of the output for low line to high line AC input changes.

Ripple
The output ripple voltage shown in the table is the guaranteed maximum with resistive load and the power line within the specified range. Maximum ripple typically occurs at 100% of rated power.

Transient Response
A 30% load step is less than 650 micro-seconds for units up to 20 V. Units above 20 V transient response is increased by a factor of Vmax/20.

Stability
Maximum deviation in either voltage or current for an eight (8) hour period is 0.05% under conditions of constant line, load and temperature.

Temperature Coefficient
The output voltage temperature coefficient is 0.02%/°C of the rated output voltage.
The output current temperature coefficient is 0.03%/°C of the rated output current.

Operating Temperature
All EMS power supplies are capable of continuous duty performance within their specifications in ambient temperature between 0°C and 70°C with appropriate derating above 50°C. The derating factor is 1% per degree C. Units may be safely stored at temperatures of -55°C to +85°C.

Cooling
Cooling air, driven by long life fans, enters the enclosure at the front and sides and exits at the rear. Holes in top cover assist cooling, however units may be stacked without air space.

Controls
All EMS models are provided with a U.L. listed circuit breaker or switch and fuse (600 W & 1 KW) which combines primary circuit protection with on/off control. Output voltage is adjusted by the 10 turn, front panel mounted, control. Current adjustment is via a single turn potentiometer located on the front panel.

Simultaneous indication of output current and voltage is provided by front panel meters. The voltmeter is connected across the sense terminals so that the meter will read either the voltage at the load or the voltage at the power supply terminals depending on whether local or remote sense is selected.

Remote Sensing
Separate sense and power terminals are provided to enable specified regulation directly at the terminals of the load. This feature provides automatic compensation for the voltage drop in the power distribution system. (Not operational with RSTL option)

Programming
All EMS series power supplies will respond either to the setting of the front panel controls or to an external control signal. This control signal may be in the form of either a resistance, current or voltage. In the constant voltage mode, full scale output is signaled by 5000 ohms or by 5 VDC or by 1 milliampere. In the constant current mode, full scale output is signaled by 100 ohms, by 1 milliampere or by 100 millivolts. Zero to 10 volt programming available as option.

The RSTL (option) allows the user to program and measure the output voltage and current of an EMS supply via a computer. The RSTL has both IEEE-488 and RS232 capability. The local and remote programming signals are software selectable over the interface. The RSTL has a "shutoff" output flag used to shut off the EMS supply.

The programming resolution is 12-bits (0.024%). There are four 8-bit DACs used to remotely calibrate the programming signals (no pots to adjust). The readback resolution is 16-bits (0.0015%). The readback is calibrated using two "snapshots" at zero and full scale which allow RSTL calculation of the measured value. Remote (analog) programming is not operational with RSTL installed.

Efficiency
70% to 87% depending on output current (higher currents are lower efficiency).

Protective Circuits

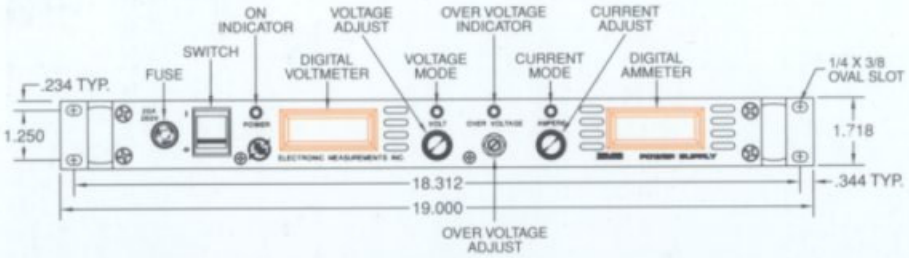
Overvoltage (up to 300 VDC outputs)

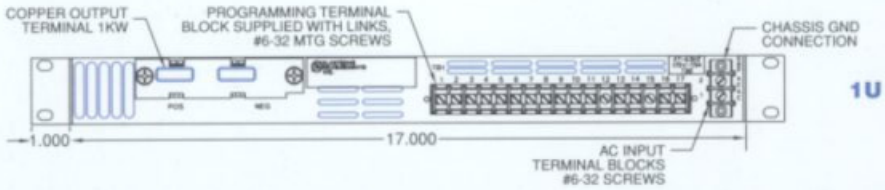
Overvoltage protection, adjustable from the front panel, is standard on all EMS models. This circuit will short circuit the power supply output to protect the load, and turn the primary power off, if the output voltage reaches 110% of the preset value. This protection is effective regardless of the cause of the overvoltage. Events which will trigger OVP include, but are not limited to, knob turned inadvertently, broken remote sense lead, voltage applied from external source and servo failure in the power supply.

Thermal
Excessive temperatures can be caused by a variety of conditions including, but not limited to, fan failure, failure to clean air filters, other obstructions in the air flow path, and high ambient temperatures.

Critical components are thermostatically monitored. If temperature reaches the safety level the unit will shut down to prevent damage. Restart is automatic upon removal of thermal overload.

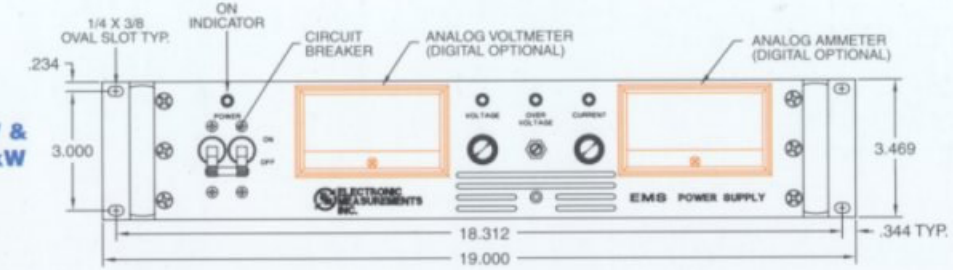
00 W
&
1 kW

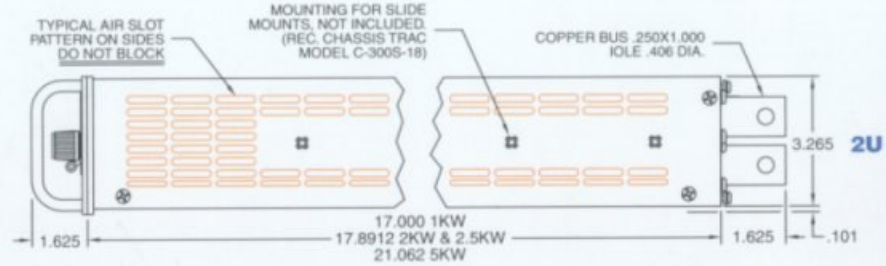




1U

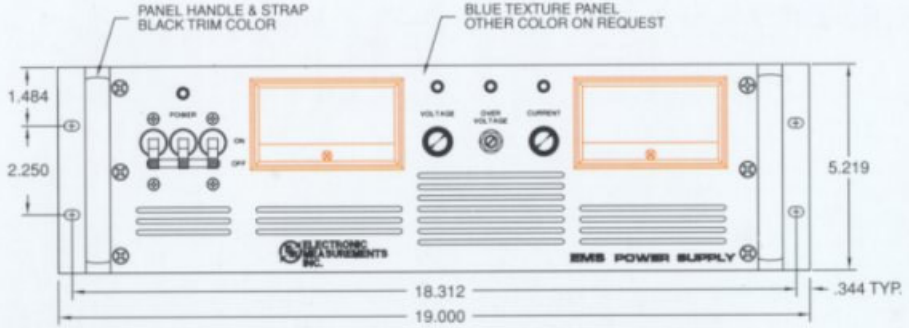
kW &
.5 kW

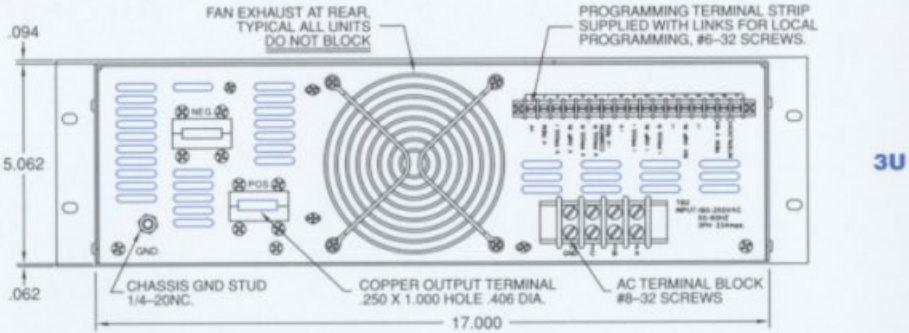




2U

5 kW





3U

Notes: 1. RSTL option increases height by 1 ¾".
2. Output terminal location may vary on EMS II models, consult factory.

Programming Block	
TB1 PIN#	**PIN Description**
1	+ Voltage (+V)
2	+ Voltage Remote (+V REM)
3	Voltage Programming Current (V PROG I)
4	Voltage Amplifier (V AMP IN)
5	Voltage Programming Resistance (V PROG R)
6	Voltage Programming Resistance Common (V PROG R COM)
7	-Voltage Remote (-V REM)
8	-Voltage (-V)
9	Current Programming Current (I PROG I)
10	Current Amplifier (I AMP IN)
11	Current Programming Resistance (I PROG R)
12	-Shunt (-I)
13	Inverted Amplifier (IN AMP IN)
14	+Shunt (+I)
15 & 16	Remote Voltage Turn On (Remote V IN)
16 & 17	Remote Dry Contact Turn On (Remote SW)

3. Consult factory for alternate programming and/or input terminal configurations for CE and special programming options.

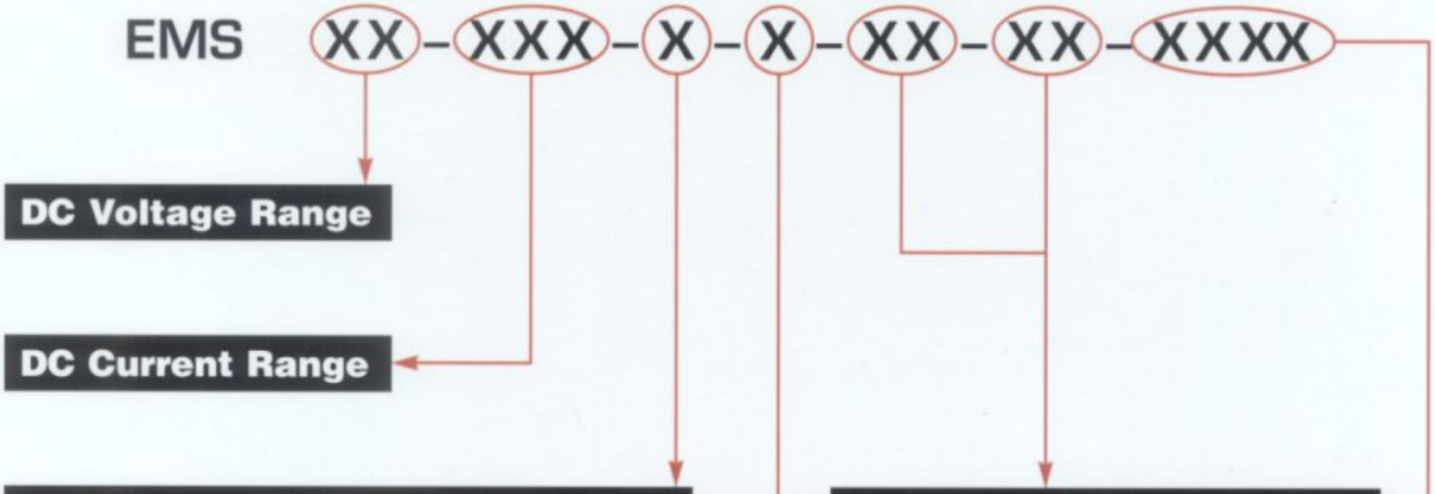
Weight:

600 W @ 15 lbs/7 kg
1 kW@ 17 lbs/7 kg
2 kW @ 30 lbs/13 kg
2.5 kW @ 35 lbs/16 kg
5 kW @ 60 lbs/27 kg

AC Input Block				
TB2	**1Ø 600 W/1 kW**	**1Ø 2000**	**1Ø 2.5 kW**	**3Ø 2.5 & 5 kw**
PIN 1	AC High	Ground	Ground	Ground
2	Neutral	Neutral	Do Not Use	Phase C Input
3	N/A	AC High	Neutral	Phase B Input
4	N/A		AC High	Phase A Input
	600 W 1 kW GND Wire to marked mounting stud.			

How To Order

The following chart describes the model number for the EMS power supply family



AC Input Voltage Selection

For This Output Wattage	With This Input Voltage	Use This Suffix
600 watts & 1 kW	105-125 VAC 47-63 Hz 1Ø	-1
600 watts & 1 kW	190-253 VAC 47-63 Hz 1Ø	-2
600 watts & 1 kW	90-110 VAC 47-63 Hz 1Ø	-6
2 kW	190-250 VAC 47-63 Hz 1Ø	-5
2.5 kW	200-253 VAC 1Ø and 190-253 VAC 3Ø User Selectable, 47-63 Hz	-2
5 kW	190-253 VAC 3Ø 47-63 Hz	-2
5 kW	342-418 VAC 3Ø 47-63 Hz (Five Wire)	-8
5 kW	374-456 VAC 3Ø 47-63 Hz (Five Wire)	-9
600 watts, 1 kW, 2 kW & 2.5 kW	207-253 VAC 47-63 Hz 1Ø	-3
5 kW	360-440 VAC 47-63 Hz (Five Wire)	-13

Refer to AC Input Section for additional information or consult factory

Options

Feature	Suffix
Lock Bushing	LB
10 Turn Current Control	10T
Output Terminal Covers	TC
RS232/IEEE 488 Programmer Consult Factory	RSTL
CE Mark Only On AC Input - 3 & -13	CE

Panel Meters

Analog	OMIT
Digital	D

1. No charge for digital meters
2. 600 W & 1 kW Units - Digital Meters only.

Special Programming Options

Programming		Monitoring		Suffix
Voltage Channel	Current Channel	Voltage Channel	Current Channel	
0-5 V	0-5 V	0-Full Rated Voltage	0-100 mV	-0699
0-10 V	0-10 V	0-Full Rated Voltage	0-100 mV	-0891
0-5 V	0-5 V	0-5 V	0-5 V	-0806-1
0-10 V	0-10 V	0-10 V*	0-10 V	-0806

*for units with rated voltage >10 V

Examples:

EMS 30-30-1-D
EMS 10-500-2-RSTL
EMS II 20-250-2-LB
EMS 10-250-2-LB-10T
EMS 10-500-2-D-0806-1

Quality Policy

Quality excellence is the foundation for management of our business and provides the principal strategy for achievement of our goals as a World Class Manufacturer through customer satisfaction.

Therefore, each of us will:

- Provide products and services that consistently meet or exceed the quality expectations of our customers. This includes both internal and external customers.
- Dedicate ourselves to continuous quality improvement of our products and services by actively pursuing the identification and elimination of non-value-adding activities within all our processes.
- Pride ourselves on the quality of our workmanship by striving to perform all actions right the first time.

The Employees of Lambda EMI

LAMBDA EMI

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