

**LEVEL VI**  
EFFICIENCY  
EMI & EMC



 **RoHS**

 **VI**

 **CE**



### Features

- Meets DoE Efficiency Level VI Requirements
  - No load input power
  - Average Efficiency
- Up to 90W of AC-DC Power
- Universal Input 90-264Vac Input Range
- IP22 Rated Enclosure
- Meets “Heavy Industrial” Levels of EN61000 EMC Requirements
- Meets EN55011/CISPR11, FCC Part 15.109 Class B Conducted & Radiated Emissions, with 6db margin
- Approved to EN/IEC/UL60950-1, 2<sup>nd</sup> Edition, Am. 2
- E-cap life of >7 years
- 3 Year Warranty
- RoHS/REACH Compliant

### Description

A high performance AC to DC external power supply family designed for test & measurement and industrial applications. Fully compliant with Efficiency Level VI requirements per U.S. Dept. of Energy, and also compliant to the Heavy Industrial levels of various EN61000-4-x standards for EMC. The TE90 series models also meet Class B conducted and radiated EMI per FCC Part 15, EN55022, CISPR22, with margin. Designed to allow easy integration with test and measurement equipment and other industrial applications.

### Model Selection

Model Number	Volts	Output Current	Output Power	Ripple & Noise <sup>1</sup>	Line Regulation	Load Regulation	Output Cable & Connector	Input Configuration
TE90A1251F01	12.0V	7.50A	90W	120mV pk-pk	±1%	±5%	6 pin Molex Type <sup>2</sup>	Class I Desktop, IEC60320 C14 Receptacle
TE90A1503F01	15.0V	6.00A	90W	150mV pk-pk	±1%	±5%	2.5 x 5.5 x 9.5mm Straight Barrel Type, center positive	
TE90A1803F01	18.0V	5.00A	90W	180mV pk-pk	±1%	±5%	2.5 x 5.5 x 9.5mm Straight Barrel Type, center positive	
TE90A2403F01	24.0V	3.75A	90W	240mV pk-pk	±1%	±5%	2.5 x 5.5 x 9.5mm Straight Barrel Type, center positive	Class II Desktop, IEC60320 C8 Receptacle
TE90A1251N01	12.0V	7.50A	90W	120mV pk-pk	±1%	±5%	6 pin Molex Type <sup>2</sup>	
TE90A1503N01	15.0V	6.00A	90W	150mV pk-pk	±1%	±5%	2.5 x 5.5 x 9.5mm Straight Barrel Type, center positive	
TE90A1803N01	18.0V	5.00A	90W	180mV pk-pk	±1%	±5%	2.5 x 5.5 x 9.5mm Straight Barrel Type, center positive	Class II Desktop, IEC60320 C18 Receptacle
TE90A2403N01	24.0V	3.75A	90W	240mV pk-pk	±1%	±5%	2.5 x 5.5 x 9.5mm Straight Barrel Type, center positive	
TE90A1251Q01	12.0V	7.50A	90W	120mV pk-pk	±1%	±5%	6 pin Molex Type <sup>2</sup>	
TE90A1503Q01	15.0V	6.00A	90W	150mV pk-pk	±1%	±5%	2.5 x 5.5 x 9.5mm Straight Barrel Type, center positive	
TE90A1803Q01	18.0V	5.00A	90W	180mV pk-pk	±1%	±5%	2.5 x 5.5 x 9.5mm Straight Barrel Type, center positive	
TE90A2403Q01	24.0V	3.75A	90W	240mV pk-pk	±1%	±5%	2.5 x 5.5 x 9.5mm Straight Barrel Type, center positive	

Notes: 1. Measured at the output connector, with noise probe directly across output and load, terminated with 0.1µF ceramic and 47µF low ESR capacitors.  
 2. Molex p/n 39-01-2060 or equivalent. See outline drawing for pinout information.  
 3. For Input Class I models: For AC GND connected to output common (-), insert a “B” in the part number where the “A” is located (TE90B1251F01).  
 4. All specifications are typical at nominal input, full load, at 25°C ambient unless noted.

## General Specifications

<b>AC Input</b>	100-240Vac, ±10%, 47-63Hz, 1Ø	<b>Turn On Time</b>	Less than 1 sec @115Vac, full load
<b>Input Current</b>	115Vac: 1.2A, 230Vac: 0.6A	<b>Hold-up Time</b>	20mS min., at full Load, 100Vac input
<b>Inrush Current</b>	264Vac, cold start: will not exceed 60A	<b>Overtemperature Protection</b>	Will shutdown upon an over-temperature condition, auto-recovery.
<b>Input Fuses</b>	F1, F2: 5A, 250Vac fuses (line & neutral lines) provided on all models	<b>Overload Protection</b>	130 to 180% of rating, Hiccup Mode
<b>Earth Leakage Current</b>	Input-GND: <500µA@264Vac, 60Hz, NC Output-GND: <4mA@264Vac, 60Hz, NC	<b>Short Circuit Protection</b>	Hiccup Mode, auto recovery.
<b>Efficiency</b>	Meets US DoE Efficiency Level VI average efficiency levels	<b>Overvoltage Protection</b>	130 to 150% of output voltage (max. 60V on 48V model), hiccup mode
<b>Output Power</b>	90W continuous – See models chart for specific voltage model ratings.	<b>Isolation</b>	Input-Output: 4000Vac Input-Ground: 1500Vac Output-Ground: 1500Vac
<b>No Load Input Power</b>	<0.210W per DoE Efficiency Level VI Requirements	<b>Safety Standards</b>	EN/CSA/UL/IEC 60950-1, 2nd Edition, Am 2
<b>Ripple and Noise</b>	See models chart on pg 1.	<b>Operating Temperature</b>	-20°C to +70°C. Derate above 40°C.
<b>Output Voltage</b>	See models chart on pg 1.	<b>Case Temperature</b>	Case Temperatures are within regulatory guidelines. Care should be taken to avoid prolonged contact with skin or other heat sensitive surfaces.
<b>Transient Response</b>	500µs response time for return to within 0.5% of final value for any 50% load step over the range of 5% to 100% of rated load, $\Delta i/\Delta t < 0.2A/\mu s$ . Max. voltage deviation is +/-3.5%. >7 year life based on calculations at 115Vac/60Hz & 230Vac/50Hz, ambient 25°C at 24 hrs per day, 365 days/year, 6 power up cycles per day. (80% load on 12V model)	<b>Temperature Derating</b>	See Derating Chart
<b>E-Cap Life</b>	115Vac/60Hz & 230Vac/50Hz, ambient 25°C at 24 hrs per day, 365 days/year, 6 power up cycles per day. (80% load on 12V model)	<b>MTBF</b>	>500,000 hours, full load, 110 & 220Vac input, 25°C amb., per Telcordia 332 Issue 6.
<b>Weight</b>	600g	<b>Storage Temperature</b>	-40°C to +85°C
<b>Safety Drop Test</b>	1.4m from table top to wooden platform, 6 faces.	<b>Altitude</b>	Operating: to 5000m (derate to TBD temp. above 3000m). Non-operating: -500 to 40,000 ft.
<b>Dimensions</b>	W: 2.58" x L: 5.9" x H: 1.34" W: 65.5mm x L: 150.5mm x H: 34mm	<b>Relative Humidity</b>	5% to 95%, non-condensing
<b>Vibration</b>	Operating: 0.003g/Hz, 1.5grms overall, 3 axes, 10 min/axis, 1-500Hz. Non-Oper.: random waveform, 3 minutes per axis, 3 axes and Sine waveform, Vib. frequency/acceleration: 10-500Hz/1g, sweep rate of 1 octave / minutes, Vibration time of 10 sweeps / axes, 3 axes	<b>Shock</b>	Operating: Half-sine, 20gpk, 10mS, 3 axes, 6 shocks total Non-Operating: Half-sine waveform, impact acceleration of 100G, Pulse duration of 6 mS, Number of shocks: 3 for each of the three axis

All specifications are typical at nominal input, full load, at 25°C ambient unless noted.

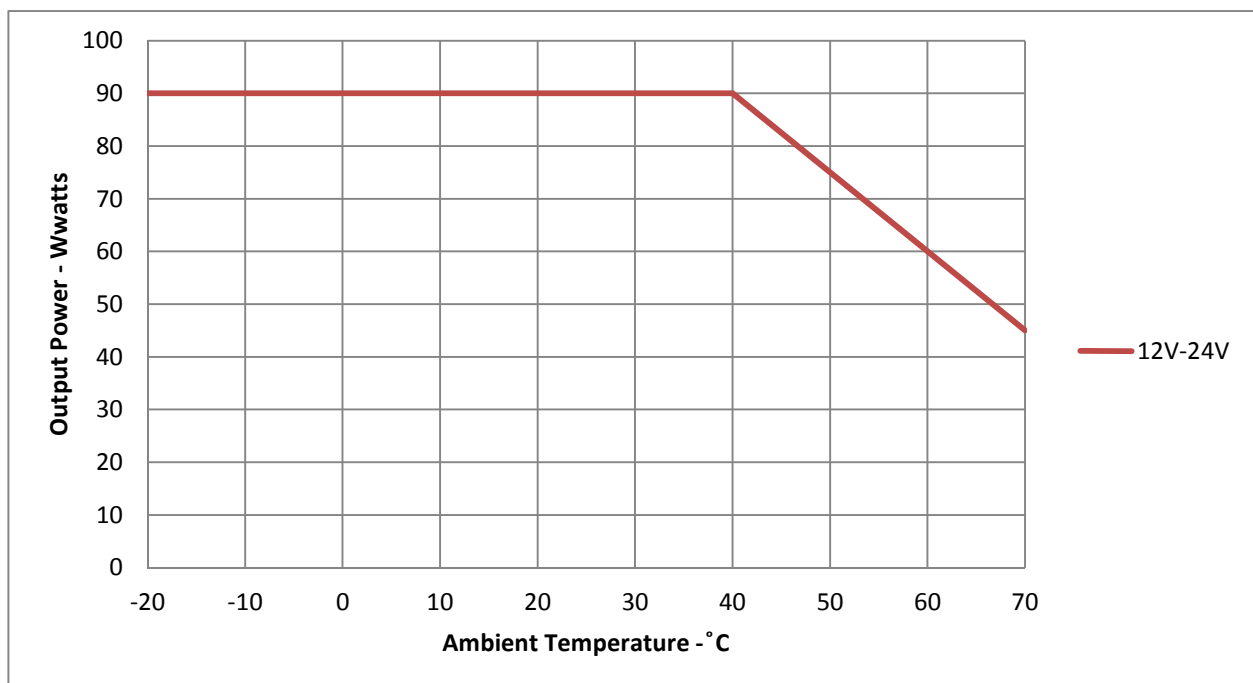
## EMI/EMC Compliance

<b>Conducted Emissions:</b>	EN55011/CISPR22 Class B, FCC Part 15.107, Class B: 6db margin typ, at 115 and 230Vac
<b>Radiated Emissions:</b>	EN55022/CISPR22 Class B, FCC Part 15.109, Class B: 3db margin typ, at 115 and 230Vac
<b>Common Mode Noise:</b>	High Frequency (100kHz-20MHz): <40mA pk-pk
<b>Electro-Static Discharge (ESD) Immunity on Power ports:</b>	EN55024/IEC61000-4-2, Level 4: +/- 8kV contact, +/- 15kV air, Criteria A
<b>Radiated RF EM Fields Susceptibility</b>	EN55022/EN61000-4-3, 10V/m, 80MHz-2.7GHz, 80% AM at 1kHz
<b>Electrical Fast Transients (EFT) /Bursts:</b>	EN55024/IEC61000-4-4, Level 4, +/- 4kV, 100Khz rep rate, 40A, Criteria A
<b>Surges, Line to Line (Diff Mode) and Line to GND (CMN Mode)</b>	EN55024/IEC61000-4-5, Level 4, +/-2kV DM, +/-4kV CM, Criteria A
<b>Conducted Disturbances induced by RF Fields</b>	EN55022/IEC61000-4-6, 10Vrms – Level 4, in ISM and amateur radio bands between 0.15Mhz and 80Mhz, 80% AM at 1KHz
<b>Rated Power frequency magnetic fields</b>	EN55024/IEC1000-4-8, Level 4: 30 A/m, 50/60 Hz
<b>Voltage Interruptions, Dips, Sags &amp; Surges</b>	EN55024/IECEN61000-4-11: --100% dip for 10 mS, at 0, 45, 90, 135, 180, 225, 270 and 315 degrees; 20mS at 0 degrees. Criteria A --100% dip for 5000mS (250/300 cycles), Criteria B --60% dip for 100mS, Criteria B --30% dip for 500mS, Criteria A
<b>Harmonic Current Emissions</b>	EN55011/EN61000-3-2, Class A
<b>Flicker Test</b>	EN61000-3-3

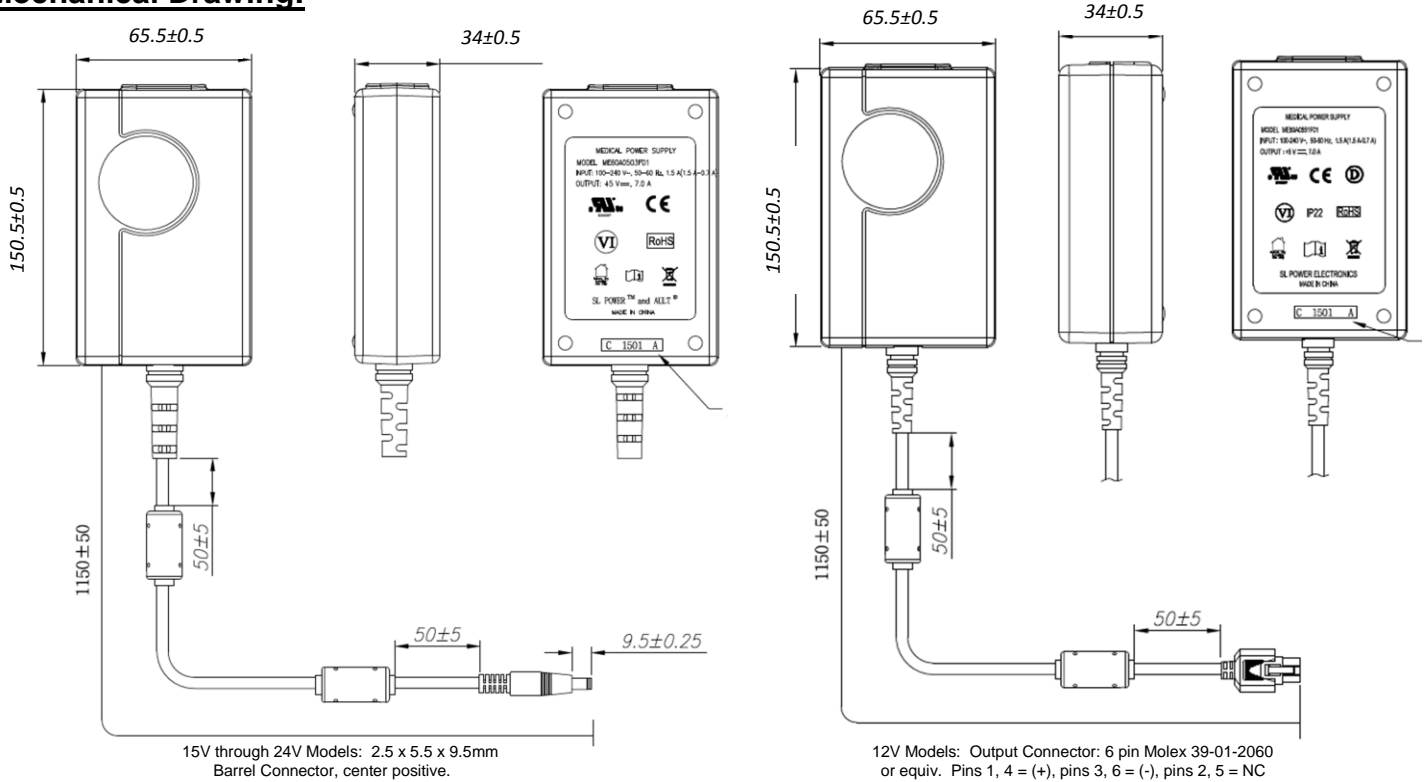
**Notes:** Performance criteria are based on EN55024. According to the standards, performance criteria are defined as following:

- A – Normal performance during and after the test
- B – Temporary degradation, self-recoverable
- C – Temporary degradation, operator intervention required to recover the operation
- D – Permanent damage

## Derating Chart:



## Mechanical Drawing:



- Notes:**
- 1) All dimensions in mm.
  - 2) The unit should not be covered or enclosed to protect against excessive case temperature rise.

## Connector Information

Standard models include a 2.5 x 5.5 x 9.5mm straight barrel type connector (Ault #3), center positive. (#51 for the 12V models). Other standard options are listed below. The "03" in the standard model number is replaced by the applicable digits below:

Connector No.	Description	Connector No.	Description
02	2.1 x 5.5 x 9.5mm straight barrel plug - Center Positive	44	2.1 x 5.5 x 9.5mm straight barrel plug, locking - Center Positive
03	2.5 x 5.5 x 9.5mm straight barrel plug - Center Positive (Standard Models)	45	2.5 x 5.5 x 9.5mm straight barrel plug, locking - Center Positive
12	5 pin DIN-180 male connector (Pins 3, 5 = (+), pins 1, 2, 4 = (-))	48	3 pin Snap n Lock, Kycon Kpp-3P or equivalent (Pin 1 = (+), pin 2 = (-))
22	6 pin DIN male connector (Pins 1, 2 = (+), pins 4, 5 = (-))	49	4 pin Snap n Lock, Kycon Kpp-4P or equivalent (Pins 1, 3 = (+), pins 2, 4 = (-))
23	8 pin DIN male connector (Pins 3, 7 = (+), pins 1, 4, 6, 8 = (-), shell = FG)	51	6 pin Minifit - Molex 39-01-2060 or equivalent (Pins 1, 4 = (+), pins 3, 6 = (-))
32	9 pin "D" type, female (Pin 8 = (+), pin 5 = (-), all others = NC)	65	Stripped and Tinned Leads
33	2.5 x 5.5 x 12.5mm straight barrel plug - Center Positive	70	2.1 x 5.5 x 11mm right angle barrel plug (high retention) - Center Positive
40	2.1 x 5.5 x 9.5mm right angle barrel plug (high retention) - Center Positive	71	2.5 x 5.5 x 11mm right angle barrel plug (high retention) - Center Positive
41	2.5 x 5.5 x 9.5mm right angle barrel plug (high retention) - Center Positive	72	2.1 x 5.5 x 9.5mm straight barrel plug (high retention, no spark) - Center Positive
42	2.1 x 5.5 x 11mm straight barrel plug (high retention) - Center Positive	73	2.5 x 5.5 x 9.5mm straight barrel plug (high retention, no spark) - Center Positive
43	2.5 x 5.5 x 11mm straight barrel plug (high retention) - Center Positive	74	EIAJ#5 style connector - Center Positive

**Efficiency Level VI Information:**

Single-Voltage External AC-DC Power Supply, Basic-Voltage		
Nameplate Output Power ( $P_{out}$ )	Minimum Average Efficiency in Active Mode (expressed as a decimal)	Maximum Power in No-Load Mode [W]
$P_{out} \leq 1$ W	$\geq 0.5 \times P_{out} + 0.16$	$\leq 0.100$
$1$ W < $P_{out} \leq 49$ W	$\geq 0.071 \times \ln(P_{out}) - 0.0014 \times P_{out} + 0.67$	$\leq 0.100$
$49$ W < $P_{out} \leq 250$ W	$\geq 0.880$	$\leq 0.210$
$P_{out} > 250$ W	$\geq 0.875$	$\leq 0.500$
Single-Voltage External AC-DC Power Supply, Low-Voltage		
Nameplate Output Power ( $P_{out}$ )	Minimum Average Efficiency in Active Mode (expressed as a decimal)	Maximum Power in No-Load Mode [W]
$P_{out} \leq 1$ W	$\geq 0.517 \times P_{out} + 0.087$	$\leq 0.100$
$1$ W < $P_{out} \leq 49$ W	$\geq 0.0834 \times \ln(P_{out}) - 0.0014 \times P_{out} + 0.609$	$\leq 0.100$
$49$ W < $P_{out} \leq 250$ W	$\geq 0.870$	$\leq 0.210$
$P_{out} > 250$ W	$\geq 0.875$	$\leq 0.500$

..... TE90A Series

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Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: [ocean@oceanchips.ru](mailto:ocean@oceanchips.ru)

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А