How to Choose Power Supplies

Which is better, Linear or Switcher Supplies?

Because servo motors are inductive, they may run highly dynamic motion profiles. As a result, their current demand can vary widely. Surge currents from stand-still to maximum load may be extremely high, yet steady state current demand over time may be relatively mild. As a result, proper care should be taken when selecting power supplies.

Moog Animatics offers two basic types of power supplies.

The chart to the right gives a brief comparison of the two types of supplies.

	Linear	Switcher
AC Input	Field selectable (120/240VAC)	Universal 90- 240VAC
Power Factor Corrected	No	Yes
Relative Size	Big and bulky	Lightweight
Cooling	Ambient convection	Fan cooled
Surge Capacity	400%	5%
Voltage Regulation	15% Drop over range	0%, Fixed
Shunt Required ? 1	Occasionally, but not typically	In most cases, highly recommended!

¹ See shunt section for more information!



As seen in the graph to the right, linear (unregulated) supplies can handle large surge current loads. This is because linear supplies typically contain large output capacitors to handle those surges well.

Voltage regulation: switchers are highly regulated supplies. They will maintain fixed voltage until they reach maximum load and then will "crowbar" to zero volts to protect the output stages. Linear supplies will slowly drop in output voltage while supplying more and more current.

This is the most fundamental difference between switchers and unregulated supplies.

Even though a switcher cannot handle the higher current surges, if it can output as much current as you would expect for a given servo application, then they will actually help the servo accelerate much faster because system voltage will be maintained at maximum level.

However, if your servo application requires surge currents in excess of 50 Amps or more, the switchers may not be cost effective. Getting 50 amps from a Moog Animatics 20 Amp supply is easy. Getting 50 Amps from Moog Animatics switchers would require placing multiple units in parallel, so it may not be cost effective to do so.





Open Frame Linear Unregulated DC Power Supplies

Power Supplies:

- Linear Unregulated
- AC Input, DC output
- Screw Terminal Access
- Toroid Transformer for lower EMI







Part Number	Input Voltage and	No Load Output Voltage	Full Load Output		Nominal	Shunt	Weight(Nom)
Fait Number	Frequency		Voltage	Current	Wattage		inergin (nemi)
PS42V20AF110	120VAC 50/60Hz	44VDC	35VDC	20 Amps	680 W		16.5 lbs (7.5kg)
PS42V20AF220	240VAC 50/60Hz	44VDC	35VDC	20 Amps	680 W		16.5 lbs (7.5kg)
PS42V20AF110-S1	120VAC 50/60Hz	44VDC	35VDC	20 Amps	680 W	100 W	17 lbs (7.7kg)
PS42V20AF220-S1	240VAC 50/60Hz	44VDC	35VDC	20 Amps	680 W	100 W	17 lbs (7.7kg)
PS42V20AF110-S2	120VAC 50/60Hz	44VDC	35VDC	20 Amps	680 W	200 W	17 lbs (7.7kg)
PS42V20AF220-S2	240VAC 50/60Hz	44VDC	35VDC	20 Amps	680 W	200 W	17 lbs (7.7kg)

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WARNING: Improper Power Supply Sizing may result in Motor Position Error Faults, Motor Resets, and Machine Faults



D-STYLE CONNECTIVITY



D-STYLE CON

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M-STYLE

M-STYLE CON

LINEAR

Enclosed Switch Mode DC Power Supply



PFC500W-48 Features

- Universal AC input / Full range
- Built-in active PFC function, PF>0.95
- Protections: Short circuit / Overload / Overvoltage / Overtemperature
- Forced air cooling by built-in DC fan with ON/OFF control
- Built-in remote ON/OFF control
- Built-in remote sense function

OUTPUT	DC VOLTAGE	48V		
	RATED CURRENT	10A		
	CURRENT RANGE	0 ~ 10A		
	RATED POWER	480W		
	RIPPLE & NOISE (max) Note.2	3mVp-p		
	VOLTAGE ADJ. RANGE	41 ~ 56V		
	VOLTAGE TOLERANCE Note.3	± 1.0%		
	LINE REGULATION	±0.5%		
	LOAD REGULATION	±0.5%		
	SETUP, RISE TIME	1500 ms, 50 ms at full load		
	HOLD UP TIME (Typ.)	24 ms at full load		
INPUT	VOLTAGE RANGE Note.5	88 ~ 264VAC 124 ~ 370VDC		
	FREQUENCY RANGE	47 ~ 63Hz		
	POWER FACTOR (Typ.)	PF>0.95/230VAC PF>0.95/115VAC at full load		
	EFFICIENCY(Typ.)	87%		
	AC CURRENT (Typ.)	7A/115VAC 3.5A/230VAC		
	INRUSH CURRENT (Typ.)	18A/115VAC 36A/230VAC		
PROTECTION	OVERLOAD	105 – 135% rated power output Protection type: Constant current limiting, recovers automatically after fault condition is removed		
	OVERVOLTAGE	57.6 ~ 67.2V		
	FAN CNTRL., OVERTEMPERATURE	RTH1 or RTH2 ≥50°C FAN ON, ≤45°C FAN OFF, ≥70°C output shutdown		
FUNCTION	REMOTE CONTROL	RC+/RC-: Short = power on ; Open = power off		
	WORKING TEMP.	-10 ~ +50°C (Refer to output load derating curve)		
	WORKING HUMIDITY	20 ~ 90% RH noncondensing		
ENVIRONMENT	STORAGE TEMP., HUMIDITY	-20 ~ +85°C, 10 ~ 95% RH		
SAFETY & EMC	SAFETY STANDARDS	UL60950-1, TUV EN60950-1 approved		
(Note 4)	WITHSTAND VOLTAGE	I/P-O/P:3KVAC I/P-FG:1.5KVAC O/P-FG:0.5KVAC		
	ISOLATION RESISTANCE	I/P-O/P, I/P-FG, O/P-FG:100M Ohms/500VDC		
	EMI CONDUCTION & RADIATION	Compliance to EN55022 (CISPR22) Class B		
	HARMONIC CURRENT	Compliance to EN61000-3-2,-3		
	EMS IMMUNITY	Compliance to EN61000-4-2,3,4,5,6,8,11; ENV50204, light industry level, criteria A		
OTHERS	MTBF	133.4K hrs min. MIL-HDBK-217F (25°C)		
	DIMENSION	170*120*93mm (L*W*H)		
NOTE	 All parameters NOT specially mentioned are measured at 230VAC input, rated load and 25°C of ambient temperature. Ripple & noise are measured at 20MHz of bandwidth by using a 12" twisted pair-wire terminated with a 0.1uf & 47uf parallel capace Tolerance: includes set up tolerance, line regulation and load regulation. The power supply is considered a component which will be installed into a final equipment. The final equipment must be re-confine that it still meets EMC directives. 			
	input voltages. Lieuse ellect the delating ou ve for more details.			

WARNING: Improper Power Supply Sizing may result in Motor Position Error Faults, Motor Resets, and Machine Faults

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PFC500W-48

Enclosed Switch Mode DC Power Supply



Terminal Pin No. Assignment

Pin No.	Assignment	Pin No.	Assignment
1	AC/L	7	R.C.
2	AC/N	8	+S
3	FG ≟	9~11	DC OUTPUT +V
4,5	NC	12~14	DC OUTPUT -V
6	R.C.G	15	-S



WARNING: Improper Power Supply Sizing may result in Motor Position Error Faults, Motor Resets, and Machine Faults



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Enclosed Switch Mode DC Power Supply

PFC1500W-48



PFC1500W-48 Features:

- Universal AC input / Full range
- AC input active surge current limiting
- Built-in active PFC function, PF>0.95
- Protections: Short circuit / Overload / Overvoltage / Overtemperature
- Forced air cooling by built-in DC fan with ON/OFF control
- Built-in remote ON/OFF control
- · Built-in remote sense function

NOTE: Multiple units may be paralleled for additional power

OUTPUT	DC VOLTAGE	48V		
	RATED CURRENT	32A		
	CURRENT RANGE	0 ~ 32A		
	RATED POWER	1536W		
	RIPPLE & NOISE (max) Note.2	200mVp-p		
	VOLTAGE ADJ. RANGE	43 ~ 56V		
	VOLTAGE TOLERANCE Note.3	± 1.0%		
	LINE REGULATION	± 0.5%		
	LOAD REGULATION	± 0.5%		
	SETUP, RISE TIME	1500ms, 100ms at full load		
	HOLD UP TIME (Typ.)	16 ms at full load		
INPUT	VOLTAGE RANGE Note.5	88 ~ 264VAC 124 ~ 370VDC		
	FREQUENCY RANGE	47 ~ 63Hz		
	POWER FACTOR (Typ.)	0.95/230VAC 0.98/115VAC at full load		
	EFFICIENCY(Typ.)	91%		
	AC CURRENT (Typ.)	17A/115VAC 8A/230VAC		
	INRUSH CURRENT (Typ.)	30A/115VAC 60A/230VAC		
	LEAKAGE CURRENT	<2.0mA/240VAC		
PROTECTION	OVERLOAD Note 5	105 ~ 135% rated output power		
		Protection type: Constant current limiting unit will shut down o/p voltage after 5 sec. Re-power to recover		
	OVERVOLTAGE	57.6 ~ 67.2V		
		Protection type: Shut down o/p voltage, repower on to recover		
	OVERTEMPERATURE	95°C ± °5C detect on heatsink of power transistor		
		Protection type: Shut down o/p voltage, recovers automatically after temperature goes down		
FUNCTION	AUXILIARY POWER (AUX)	12V@0.1A (Only for Remote ON/OFF control)		
	REMOTE CONTROL	RC+/RC-: Short = power on ; Open = power off		
	WORKING TEMP.	-10 ~ +50°C (Refer to output load derating curve)		
	WORKING HUMIDITY	20 ~ 90% RH noncondensing		
ENVIRON-	WORKING TEMP.	-20 ~ +70°C (Refer to output load derating curve)		
MENT	WORKING HUMIDITY	20 ~ 90% RH noncondensing		
	STORAGE TEMP., HUMIDITY	-40 ~ +85°C, 10 ~ 95% RH		
	TEMP. COEFFICIENT	± 0.5%/°C (0 ~ 50°C)		
	VIBRATION	10 ~ 500Hz, 2G 10min./1cycle, 60min. each along X,Y,Z axis		
SAFETY &	SAFETY STANDARDS	UL60950-1, TUV EN60950-1 approved		
FMC	WITHSTAND VOLTAGE	I/P-O/P:3KVAC I/P-FG:1.5KVAC O/P-FG:0.5KVAC		
(Niete 4)	ISOLATION RESISTANCE	I/P-O/P, I/P-FG, O/P-FG:100M Ohms/500VDC		
(Note 4)	EMI CONDUCTION & RADIATION	Compliance to EN55022 (CISPR22)		
		Compliance to EN61000-4-2,3,4,5,6,8,11; ENV50204, light industry level, criteria A		
OTHERS	MIRE	62.6K nrs min. MIL-HDBK-217F (25°C)		
	DIMENSION	278*127*83.5mm (L*W*H)		
	PACKING	2.0Kg: 0FCS/16.0Kg/1.54CUF1		
NOTE	1. All parameters NOT specially	mentioned are measured at 230VAC input, rated load and 25°C of ambient temperature.		
	2. Ripple & noise are measured a	at 20MHz or bandwidth by using a 12" twisted pair-wire terminated with a 0.1uf & 47uf parallel capacitor.		
	3. Tolerance: includes set up tolerance, line regulation and load regulation.			
	4. The power supply is considere still meets EMC directives.	ed a component which will be installed into a final equipment. The final equipment must be re-confirmed that it		
1	5. Derating may be needed under	r low input voltages. Please check the derating curve for more details.		

WARNING: Improper Power Supply Sizing may result in Motor Position Error Faults, Motor Resets, and Machine Faults

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Enclosed Switch Mode DC Power Supply



The switcher supplies have an adjustable output trim pot. The output voltage MUST BE adjusted to <=48VDC.

Enclosed DC Power Supplies

- · Enclosed linear unregulated power supplies
- PC-type AC power cord
- 4 pin AMP connector on output
- · Internally fused on both primary and secondary side
- Toroid transformer for minimal voltage drop and minimal EMI

Includes AC Power Cord and KITDC1 connector kit



Part Number	Input Voltage	Hz AC	No Load Voltage	Full Load		Nominal	Weight (Nom.)
				Voltage	Current	Wattage	
PS24V8AG-110	110VAC	60	25 VDC	19 VDC	8 Amps	152 W	6.5 lbs (3 kg)
PS42V6AG-110	110VAC	60	46 VDC	38.7 VDC	6.5 Amps	251 W	7 lbs (3.2 kg)
PS42V6A-110CE	110VAC	50-60	46 VDC	38.7 VDC	6.5 Amps	251 W	7 lbs (3.2 kg)
PS42V6A-220CE	220 VAC	50-60	46 VDC	38.7 VDC	6.5 Amps	251 W	7 lbs (3.2 kg)







NOTE: Either pair of Power Pins can handle full load rating

* All sizes are given in inches, sizes in brackets are in mm

PWR116V

Enclosed Laptop Type Power Supply

This Power Supply connects directly to:

- CBLSM1-DEMO
- SmartBox[™]
- SmartBox BCD™

It is ideal for desktop testing of the SmartMotor[™] and will easily run an unloaded SmartMotor for programming and evaluation testing.

Input:100-240VAC 50/60HzOutput:24VDC, 2.5Amps, 60 WattsConnector Type:2.1x5mm coax DC Power ConnectorCable Length:~1meterRoHS/CE Certified

CBLAC1

AC Power Cable for PWR116V Power Supply above.

Standard 3 prong US AC plug

~1 Meter length







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WARNING: Improper Power Supply Sizing may result in Motor Position Error Faults, Motor Resets, and Machine Faults Moog Animatics offers several shunt options for use with DC input servo motors.

Shunts are needed to protect the servo controller and drive stages from over voltage.

Over voltage sources originate from the following:

- · Back EMF due to back driving the motors
- · Sudden or hard decelerations
- · Hard stop crashes (immediate deceleration to zero speed)
- Vertical load drops

The shunts actually add an additional load to the DC bus automatically when voltage exceeds the trigger level by connecting large load resistors across the bus. Trigger voltage is typically 49.5VDC. As a result, the shunts will work with any of the supplies we offer.

The switcher supplies have an adjustable output trim pot. If used with our shunts, the output voltage MUST BE adjusted to <=48VDC to ensure the shunts do not stay gated on.

The Real Story about Back EMF:

Generally speaking, back EMF is the voltage generated in a motor when it spins. This voltage is typically proportional to speed. However, this is a general rule. The truth is that the back EMF voltage is proportional to the rate of change of magnetic flux in the windings of the stator. As a result, constant speeds produce constant and predictable voltages. However, sudden changes due to decelerations or hard stop crashes cause an immediate change in magnetic flux or even a total instantaneous collapse. As a result, voltages can go 5 to 10 times higher than spinning the motor at its maximum speed.

For this reason alone it is highly recommended to use a shunt in all vertical load applications or any case where the motors could be stopped quickly or back driven suddenly.

We offer both open frame and enclosed shunts in 100Watt and 200Watt capacities. The shunts are all automatic and get their power from the DC bus they are attached to. They simply need to be placed in parallel with the DC bus.

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- 1. Shunts cannot be placed in parallel with each other to increase capacity. The shunt with the slightly lower trigger voltage will trigger first while the other shunt never triggers at all. Please consult factory for information on how to deal with larger shunt requirements.
- 2. Shunts should always be placed between the motor input and any disconnect or e-stop relay to ensure protection of the motor when power is not applied or e-stop relay contacts are open.





SHUNT42V100WOF and SHUNT42V200WOF

- · Can be used with power supplies that have an output of 48VDC or less
- Automatic gate-on when voltage exceeds 49.5VDC
- Easy direct parallel connection to power supply



SHUNT42V100W-OF



Part Number	TRIGGER VOLTAGE	DROP OUT VOLTAGE	CURRENT DRAW WHEN GATED ON	WATTS	EFFECTIVE BUS LOAD
SHUNT42V100WOF	49.5VDC RISING	48.5VDC FALLING	4 AMPS	100W	12.5 OHMS
SHUNT42V200WOF	49.5VDC RISING	48.5VDC FALLING	8 AMPS	200W	6.25 OHMS





BETWEEN 24V/48V AND PVR GND. 6 CONNECTIONS: RED WIRE +DC VOLTAGE INPUT BLACK WIRE -DC VOLTAGE INPUT 7 USE PROPER ELECTRICAL SAFETY PRECAUTIONS. 8 ALL DIREVISIONS ARE NOMINAL, UNLESS OTHERWISE SPECIFIED



SHUNT42V200WOF



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WARNING: If the shunt is connected to an adjustable power supply, the output voltage MUST BE set at or below 48 VDC. If the output voltage is sustained above the trip point of the shunt, overheating and damage may result.

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Enclosed Shunts



- Matching 4 pin AMP connector to enclosed power supply.
- Automatically gate on at >=49.5VDC
- Powered from DC bus
- May be connected in parallel with any supply <=48VDC.



Part Number	TRIGGER VOLT- AGE	DROP OUT VOLT- AGE	CURRENT DRAW WHEN GATED ON	WATTS	EFFECTIVE BUS LOAD
SHUNT42V100W	49.5VDC RISING	48.5VDC FALLING	4 AMPS	100W	12.5 OHMS
SHUNT42V200W	49.5VDC RISING	48.5VDC FALLING	8 AMPS	200W	6.25 OHMS

Includes connector kits

Use with cable CBLDC1 below



* All sizes are given in inches, sizes in brackets are in mm

NOTE: Any time an E-Stop switch is placed on the DC power line to the motor, a shunt MUST BE installed between the E-Stop switch and the motor connector to ensure protection against over voltage!

Connection

CBLDC1

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Power Supply Cables

CBLAC1	AC Line
CBLDC1	DC Cab
CBLSMYPWR-T	Multiple

Part Number

C Line Cord for power supply C Cable for Enclosed Shunt ultiple SM - power supply

Cable Type	Connector Type(s)	Length(s)
Power	N/A	6 ft (1.8m)
DC	4-Pin AMP	1.5ft (0.45M)
Y	4 Pin AMP	2 ft (0.61m)

