

Overview of DC Power Supply Requirements for Popular RF-Sealed CO₂ Lasers

All types of CO₂ lasers require some type of electrical power source to excite the CO₂ gas and energize the laser's integrated electronics. The power source is typically a Switched DC Power Supply, or a Linear DC Power Supply. Switched are more common due to size, weight, and cost. This paper will focus on DC Power Supply requirements, and their adjustability, for RF-Driven Sealed CO₂ lasers offered from popular manufacturers. It will not discuss the DC Power Supply requirements for flowing glass-tube lasers, or other more exotic CO₂ lasers.

Typically, an RF-Sealed CO₂ laser will receive its power from a DC Power Supply and distribute the power internally to electronic circuitry. Usually circuitry are digital controls, RF-Driver, and lastly the RFPA (Radio Frequency Power Amplifier). Internal power regulation is common as the voltage supply for the RFPA is much higher than that to supply the control electronics.

FET's (Field Effect Transistor) are typically used as an RF switch that responds to the fundamental RF-Drive frequency from the RF-Driver circuit. The FET (really 2 push-pull transistors working together in one package), switches the full voltage supplied to the laser at RF frequencies. The waveform at the drain is then transformed to 50Ω from the very low impedance of the FET drain. This RF power then drives the laser plasma. Control of the RF power in any RFPA design is tied to the DC voltage feeding the FET. Therefore lasers sometimes have odd DC power requirements.

Reviewing the laser manufactures requirements for DC Power Supplies shows a wide variety of voltage and current requirements. This can be problematic for users, especially high volume, because with any change of laser manufacturer, you most likely will need to change your power supply. This has a large effect on supply-chain, production, service, etc.

Iradion recommends Cosel power supplies <https://www.cosel.co.jp/en/>. Iradion has done extensive testing on COSEL Power supplies, and it is what we use in the factory. Switched DC power supplies are readily available from other companies as well. One example is Mean Well <http://www.meanwell.com/>.

In general, when choosing a DC Power Supply to drive a CO₂ laser you should consider not only the power that it can supply, but also the supply's rated ripple current under load, and the overall quality of the manufacturer. The best performing lasers can have their performance significantly reduced by a low quality, low cost power supplies with poor regulation. Cheaper power supplies can have voltage regulation problems at certain laser modulation frequencies since these supplies may not consider the nature of a CO₂ laser that draws pulses of current over a wide range of frequencies. Also, keep in mind that the incremental cost between a low quality and high quality DC Power Supply will only increase the total system cost by a few percent.

Fixed voltage DC Power Supplies typically offer some level of voltage adjustability, approximately ±10% for the user. ***Cosel and Meanwell provide a small potentiometer on the supply to make this adjustment.*** Any voltage adjustment should always be done with any laser disconnected, and you must monitor the DC Power Supply's output voltage with a DVM.

When considering long wires between the laser and supply, it is best to install a sense wire so the power supply is regulating the voltage at the laser and not before a long wire that will generate a voltage drop and cause lower laser output power.

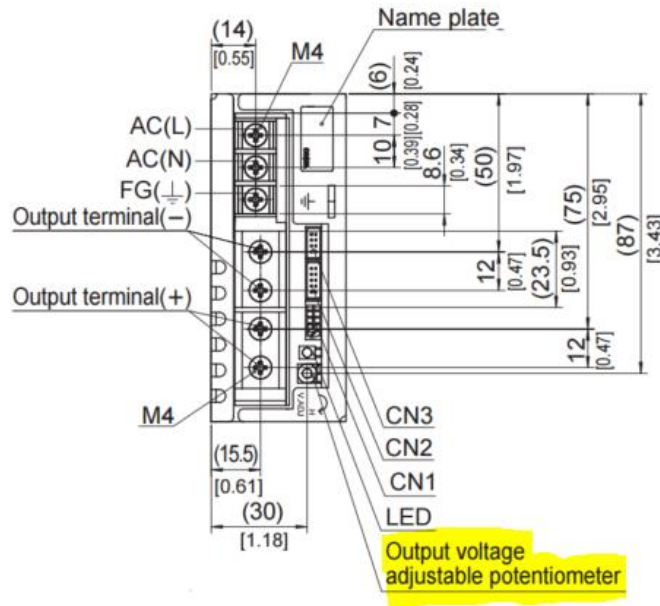


Figure 1 - Rear View, Cosel Power Supply

Table 1 - Iradion Laser Power Requirements and COSEL Power Supply Voltage Adjustment

Iradion Model	Power Requirement	COSEL Model	Qty. Required	Voltage Adjustability
Z30	40V or 48V	PBA600-48-XIRA	1	38.4V – 56V
Infinity 154	30V@20A (640W)	PBA600F-36-XIRA	1	25.2V – 39.6V
Infinity 156	40V@24A (960W)	PBA1500F-48-XIRA	1	38.4V – 56V
Infinity 158	45V@24A (1080W)	PBA1500F-48-XIRA	1	38.4V – 56V
Infinity 1510	50V@28A (1400W)	PBA1500F-48-XIRA	1	38.4V – 56V
Infinity 1512	50V@28A (1400W)	PBA1500F-48-XIRA	1	38.4V – 56V

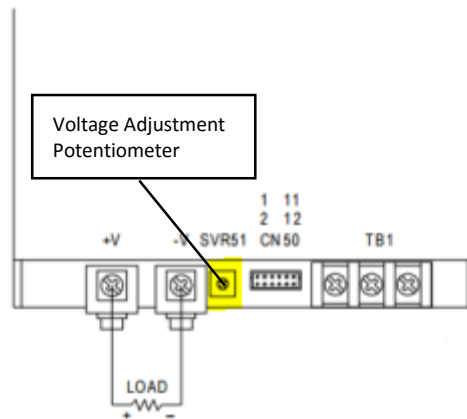


Figure 2 - Rear View, Mean Well Power Supply

Table 2 - Iradion Laser Power Requirements and Mean Well Power Supply Voltage Adjustment

Iradion Model	Power Requirement	Meanwell Model	Qty. Required	Voltage Adjustability
Z30	40V or 48V	RSP-1000-48	1	19.2V-52.8V
Infinity 154	32V@20A (640W)	RSP-1000-48	1	19.2V-52.8V
Infinity 156	40V@24A (960W)	RSP-1000-48	1	33.6V-48V
Infinity 158	45V@24A (1080W)	RSP-1500-48	1	19.2V-52.8V
Infinity 1510	50V@28A (1400W)	RSP-1000-48	2	19.2V-52.8V
Infinity 1512	50V@28A (1400W)	RSP-1000-48	2	19.2V-52.8V

Table 3 - Power Supply Requirements, Iradion Laser

Manufacture Laser Model	Power Supply Voltage (VDC)	Power Supply Current (A) (RMS)
Z30	40/48	13
Infinity 154	31	20
Infinity 156	40	24
Infinity 158	45	24
Infinity 1510	50	28
Infinity 1512	50	28
1625	50	56

Table 4 - Power Supply Requirements, Synrad Laser

Manufacture Laser Model	Power Supply Voltage (VDC)	Power Supply Current (A) (RMS)
48-1	30	7
48-2	30	14
48-5	30	28
V30	30	16
V40	30	18
Vi30	48	10
T60	30	45
T80	36	55
T100	30	75
Ti60	48	18
Ti80	48	22
Ti100	48	35
F100	96	18
F200	96	36
F201	96	36
F400	96	72
P100	48	40
P250	48	90
I401	48	125

Table 5 - Power Supply Requirements, Universal Laser

Manufacture Laser Model	Power Supply Voltage (VDC)	Power Supply Current (A) (RMS)
ULR-10	48	5
ULR-25	48	10
ULR-30	48	10
ULR-40	48	12
ULR-50	48	20
ULR-60	48	20
ULR-75	48	25
ULCR-100	48	36
ULCR-120	48	40
ULCR-150	48	50

Table 6 - Power Supply Requirements, Coherent Laser

Manufacture Laser Model	Power Supply Voltage (VDC)	Power Supply Current (A) (RMS)
C-30	48	11.5
C-40	48	13
C-55	48	20
C-70	48	20
E-400i	48	150
G-100i	48	50
GEM-100	48	50
Diamond E-150	48	55
Diamond E-1000	48	425
Diamond G-100	48	50
Diamond E-400CL2	48	170
Diamond J-2	48	60
Diamond J-3	48	90
Diamond J-5	48	150

Table 7 - Power Supply Requirements, Rofin Laser

Manufacture Laser Model	Power Supply Voltage (VDC)	Power Supply Current (A) (RMS)
OEM 10i X (CW)	96	19
OEM 10i X (PP)	110	19