



Instruction Manual

800 SERIES

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USA

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IMPORTANT SAFETY PRECAUTIONS

SAFETY

THIS POWER SUPPLY GENERATES VOLTAGES THAT ARE DANGEROUS AND MAY BE FATAL.
OBSERVE EXTREME CAUTION WHEN WORKING WITH THIS EQUIPMENT.

High voltage power supplies must always be grounded.

Do not touch connections unless the equipment is off and the Capacitance of both the load and power supply is discharged.

Allow five minutes for discharge of internal capacitance of the power supply.

Do not ground yourself or work under wet or damp conditions.

SERVICING SAFETY

Maintenance may require removing the instrument cover with the power on.

Servicing should be done by qualified personnel aware of the electrical hazards.

WARNING note in the text call attention to hazards in operation of these units that could lead to possible injury or death.

CAUTION notes in the text indicate procedures to be followed to avoid possible damage to equipment.

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This information contained in this publication is derived in part from proprietary and patent data. This information has been prepared for the express purpose of assisting operating and maintenance personnel in the efficient use of the model described herein, and publication of this information does not convey any right to reproduce it or to use it for any purpose other than in connection with installation, operation, and maintenance of the equipment described.

WICHTIGE SICHERHEITSHINWEISE

SICHERHEIT

DIESES HOCHSPANNUNGSNETZTEIL ERZEUGT LEBENSGEFÄHRLICHE HOCHSPANNUNG.
SEIN SIE SEHR VORSICHTIG BEI DER ARBEIT MIT DIESEM GERÄT.

Das Hochspannungsnetzteil muß immer geerdet sein.

Berühren Sie die Stecker des Netzteiles nur, wenn das Gerät ausgeschaltet ist und die elektrischen Kapazitäten des Netzteiles und der angeschlossenen Last entladen sind.

Die internen Kapazitäten des Hochspannungsnetzteiles benötigen ca. 5 Minuten, um sich zu entladen.

Erden Sie sich nicht, und arbeiten Sie nicht in feuchter oder nasser Umgebung.

SERVICESICHERHEIT

Notwendige Reparaturen können es erforderlich machen, den Gehäusedeckel während des Betriebes zu entfernen.

Reparaturen dürfen nur von qualifiziertem, eingewiesenem Personal ausgeführt werden.

“WARNING” im folgenden Text weist auf gefährliche Operationen hin, die zu Verletzungen oder zum Tod führen können.

“CAUTION” im folgenden Text weist auf Prozeduren hin, die genauestens befolgt werden müssen, um eventuelle Beschädigungen des Gerätes zu vermeiden.

PRECAUTIONS IMPORTANTES POUR VOTRE SECURITE

CONSIGNES DE SÉCURITÉ

CETTE ALIMENTATION GÉNÈRE DES TENSIONS QUI SONT DANGEUREUSES ET PEUVENT ÊTRE FATALES.
SOYEZ EXTRÊMEMENT VIGILANTS LORSQUE VOUS UTILISEZ CET ÉQUIPEMENT.

Les alimentations haute tension doivent toujours être mises à la masse.

Ne touchez pas les connectiques sans que l'équipement soit éteint et que la capacité à la fois de la charge et de l'alimentation soient déchargées.

Prévoyez 5 minutes pour la décharge de la capacité interne de l'alimentation.

Ne vous mettez pas à la masse, ou ne travaillez pas sous conditions mouillées ou humides.

CONSIGNES DE SÉCURITÉ EN CAS DE REPARATION

La maintenance peut nécessiter l'enlèvement du couvercle lorsque l'alimentation est encore allumée.

Les réparations doivent être effectuées par une personne qualifiée et connaissant les risques électriques.

Dans le manuel, les notes marquées « **WARNING** » attire l'attention sur les risques lors de la manipulation de ces équipements, qui peuvent entraîner de possibles blessures voire la mort.

Dans le manuel, les notes marquées « **CAUTION** » indiquent les procédures qui doivent être suivies afin d'éviter d'éventuels dommages sur l'équipement.

IMPORTANTI PRECAUZIONI DI SICUREZZA

SICUREZZA

QUESTO ALIMENTATORE GENERA TENSIONI CHE SONO PERICOLOSE E POTREBBERO ESSERE MORTALI.
PONI ESTREMA CAUTELA QUANDO OPERI CON QUESTO APPARECCHIO.

- Gli alimentatori ad alta tensione devono sempre essere collegati ad un impianto di terra.
- Non toccare le connessioni a meno che l'apparecchio sia stato spento e la capacità interna del carico e dell'alimentatore stesso siano scariche.
- Attendere cinque minuti per permettere la scarica della capacità interna dell'alimentatore ad alta tensione.
- Non mettere a terra il proprio corpo oppure operare in ambienti bagnati o saturi d'umidità.

SICUREZZA NELLA MANUTENZIONE.

- Manutenzione potrebbe essere richiesta, rimuovendo la copertura con apparecchio acceso.
- La manutenzione deve essere svolta da personale qualificato, coscio dei rischi elettrici.
- Attenzione alle **AVVERTENZE** contenute nel manuale, che richiamano all'attenzione ai rischi quando si opera con tali unità e che potrebbero causare possibili ferite o morte.
- Le note di **CAUTELA** contenute nel manuale, indicano le procedure da seguire per evitare possibili danni all'apparecchio.

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THE DATA CONTAINED IN THIS MANUAL IS SUBJECT TO CHANGE WITHOUT NOTICE. WRITTEN PERMISSION FROM SPELLMAN HIGH VOLTAGE IS REQUIRED PRIOR TO THE REPRODUCTION OF ANY TECHNICAL DATA CONTAINED IN THIS MANUAL.

SECTION 1 - GENERAL INFORMATION

1.0 SCOPE OF MANUAL

The Series 825 and 835 are regulated precision laboratory high voltage power supplies. These supplies provide high performance and value in many applications including detectors, projection CRT's, X-ray, electrophoresis, microwave and capacitor charging.

1.1 DESCRIPTION

The Series 825 and 835 are three families of high efficiency switchmode, fixed output polarity, modular high voltage power supplies that feature constant voltage and constant current operation with automatic crossover. A wide range of output voltages, up to 50kV, is available. Designed for safety and reliability, all models include a safety interlock, soft start and power interrupt trip, as well as arc, short circuit and open circuit protection. The units are fully enclosed and designed for system or bench top use. They operate off of standard line input of 115/230 Vac (switch selectable) 50-60 Hz. The output voltage and output current are independently controlled by internal multi-turn potentiometers. Remote analog voltage or resistance programming of both the output voltage and current is included in all models. Analog monitor outputs are also provided for remote monitoring of both the high voltage and current outputs. A front panel LED indicator provides power ON status.

1.2 ELECTRICAL SPECIFICATIONS

Input:

90-135Vac @ 2A (815), 5A (825), 6A (835), 50-60Hz.

185 - 265Vac @ 1.5A (815), 2.5A (825), 3A (835), 50-60Hz.

Voltage Regulation: (0.01% of setting + 0.01% of maximum) for 10% input line change. (0.02% of setting + 0.02% of maximum) for FL-NL and NL-FL change

Current Regulation: (0.05% of setting + 0.05% of maximum) for 10% input line change. (0.1% of setting + 0.1% of maximum) for 0 to maximum rated output voltage change.

Output Voltage/Current Capability:

825 / 835		MAXIMUM OUTPUT CURRENT	
MODEL SUFFIX	OUTPUT VOLTAGE	200W SERIES 825	300W SERIES 835
-0.5N, P	0 to 500V	0 to 400mA	0 to 600mA
-1N, P	0 to 1KV	0 to 100mA	0 to 100mA
-1.5N, P	0 to 1.5kV	0 to 133mA	0 to 200mA
-3N, P	0 to 3kV	0 to 66mA	0 to 100mA
-5N, P	0 to 5kV	0 to 40mA	0 to 60mA
-10N, P	0 to 10kV	0 to 20mA	0 to 30mA
-20N, P	0 to 20kV	0 to 10mA	0 to 15mA
-30N, P	0 to 30kV	0 to 6.6mA	0 to 10mA
-50N, P	0 to 50kV	0 to 4mA	0 to 6mA

To obtain appropriate part number, select series, then append model suffix and polarity suffix.

Polarity: The output is fixed polarity, either positive or negative (suffix P or N).

Ripple: 0.1% of setting + 0.1% of maximum, peak to-peak. Lower ripple available on many models. Consult factory for details.

Temperature Coefficient: *Constant voltage operation:* ± (50ppm of setting + 50ppm of maximum)/ °C *Constant current operation:* ± (100ppm of setting + 100ppm of maximum)/ °C.

Stability (after 1/2 hr. warm-up): *Constant Voltage Operation:* ± (0.01% of setting + 0.01 % of maximum)/hr; ±(0.02% of setting + 0.02% of maximum)/8 hrs.

Constant Current Operation: ± (0.02% of setting + 0.02% of maximum)/hr; ±(0.04% of setting + 0.04% of maximum)/8 hrs.

Efficiency: Better than 80%.

Internal Controls: The output voltage and current can be set by the I/V potentiometer controls on the front panel. Two continuous multi-turn precision potentiometers directly dial the voltage and the current. The resolution of each control is 0.05% of maximum.

Voltage Monitor: 0 to 5Vdc proportional to 0 to maximum output high voltage. Accuracy is $\pm(0.2\%$ of reading $+0.2\%$ of maximum). The monitor output impedance is 10 kilohms $\pm 1\%$.

Current Monitor: 0 to +5Vdc proportional to 0 to maximum output current. Accuracy is $\pm(0.5\%$ of reading $+0.2\%$ of maximum). The monitor output impedance is 10 kilohms $\pm 1\%$.

Interlock: TTL compatible remote signal disables (high), enables (low) the high voltage output. The enable input must be pulled low to allow operation of high voltage, regardless of whether supply is in local or remote mode.

Protection: Arc, short-circuit and open circuit protection, self-restoring.

Size:

Series 825: 3.19" H x 10" W x 10.75" D (81 x 254 x 273 mm)

Series 835: 5" H x 10" W x 11" D (127 x 254 x 279 mm)

Weight:

Series 825: 13 lbs (5.9 kg)

Series 835: 18 lbs (8.2 kg)

Power Input Connector: 3-wire IEC line cord receptacle. Detachable line cord for 115 Vac line is included.

Low Voltage I/O Connector: Standard 25 pin "D" type connector for all remote control and monitor functions. The mating connector is provided.

Cooling: Internal fan.

1.3 OPTIONS (OEM APPLICATIONS ONLY)

Additional functions such as programmable overload detection and response. The interface performs the necessary conversions to allow direct user-friendly operation. The operating instructions provide complete set-up and programming information. Software is also available to assist in standard operation environments. Application specific software can also be provided.

10V Programming / Monitoring (OEM APPLICATIONS ONLY): 0 to 10Vdc input for 0 to maximum voltage and current output. 0 to 10Vdc proportional monitors for voltage and current output.

1.4 CUSTOM MODELS (OEM APPLICATIONS ONLY)

The Series 825/835 power supply design can be economically and quickly modified to satisfy custom applications. Other output voltage and/or current ratings, digital programming or special mechanical constraints are some of the varied requirements, which can be satisfied. Multi-output units combining the features of the Series 825/835 and other Spellman high voltage power supplies can be provided. Contact Spellman Sales Engineering for a responsive review of your application.

Specifications subject to change without notice.

1.5 SAFETY TERMS

The **WARNING** used in this manual explains dangers that could result in personal injury or death. The **CAUTION** used in this manual explains hazards that could damage the instrument.

SECTION 2 - INSTALLATION & OPERATION

2.1 INITIAL INSPECTION

Inspect the package exterior for evidence of damage due to handling in transit. Notify the carrier and Spellman immediately if damage is evident. Do not destroy or remove any of the packing material used in a damaged shipment. After unpacking, inspect the panel and chassis for visible damage.

Fill out and mail the Warranty Registration card accompanying the unit. For warranty information refer to the Warranty section of this manual.

2.2 PREPARATION FOR USE

WARNING! *This unit produces hazardous voltage. Do not apply line voltage input unless adequate ground is connected to the unit and the high voltage output has been properly connected.*

Front Panel Controls:

- a) Check the input voltage rating on the front panel of the supply and make certain that this is the rating of the available power source.
 - b) The chassis of the high voltage power supply must be grounded to earth ground using the lug provided on the front panel of the unit.
 - c) A three wire grounding system is provided for connecting to the AC supply.
 - d) Attach the high voltage output connector / cable to the bulkhead receptacle on the front panel of the power supply.
 - e) Prior to initial turn-on, rotate the high voltage potentiometer (V_o) and the current potentiometer (I_o) fully counter-clockwise to the zero voltage and current positions respectively (Local Mode).
 - f) Check that the DB25 connector (I/O) is wired in accordance with the mode of operation desired.
 - g) The input cable may now be plugged into the AC power source.
 - h) To enable the high voltage output you must apply a low logic signal to Pin 11 of the DB25 connector.
- i) To disable the high voltage output Pin 11 of the DB25 connector must be either open or you must apply a high logic signal.
 - j) For this unit to operate properly the $V_{O/I/O}$ potentiometers MUST be set to something other than zero. This will allow the unit to supply both voltage and current. This unit can operate either as a current source or a voltage source. To operate as a voltage source the unit should be set to the desired voltage and the current setting must be set so that it will not limit the current. To operate the unit as a current source the unit should be set to the desired current and the voltage setting must be set so that it does not limit the voltage.

WARNING! *After turnoff, do not handle the load until the capacitance has been discharged. Load capacitance may be discharged by shorting to ground.*

2.3 MECHANICAL INSTALLATION

Space must be allowed for access to cable connections. Units are fully enclosed and are suitable for bench, tabletop, or OEM operation.

2.4 VOLTAGE AND CURRENT CONTROL

The Series 800 power supplies have three modes of controlling the output voltage and current available to the user. The output voltage and current can be controlled from either an external voltage source, the internal potentiometers. When wired for remote operation the internal controls have no effect on the output voltage or current and therefore need not be turned to zero. When in local mode, the internal controls determine the output voltage and current.

2.5 INTERNAL CONTROLS

The output voltage and current can be set by the I/V potentiometer controls on the front panel. Two continuous multi-turn precision potentiometers directly dial the voltage and the current. The resolution of each control is 0.05% of maximum. The potentiometers are screwdriver adjustable and easily accessed. For local current and voltage control the following pins must be shorted:

Pins 1 to 3, pins 2 to 5, pins 14 to 16, pins 15 to 18

2.6 REMOTE PROGRAMMING

An output voltage and current can be remotely programmed from either an external differential voltage source or with an external potentiometer from the internal reference voltage source. A 0 to 5Vdc differential programming voltage applied to Pins 1 and 2 of the Programming / Monitor connector (I/O) on the front panel will remotely program the high voltage output from zero to maximum output. A 0 to 5Vdc differential programming voltage applied to Pins 14 and 15 of the Programming / Monitor connector on the front panel will remotely program the output current from zero to maximum.

2.7 REMOTE MONITORING

Remote voltage and current monitoring signals are available at Pins 4 and 17 respectively of the Programming / Monitor connector. A 0 to 5Vdc voltmeter may be used to monitor both voltage (Pin 4) and current (Pin 17) for the full output range. Both outputs are positive polarity regardless of the actual polarity of the output voltage.

2.8 CONNECTIONS AND TERMINALS

Ground:

Ground is connected to the case on all models.

Fuse:

The fuse is installed in AC line connector. Refer to the following table for fuse size.

TABLE 2.1
Fuse Specifications

INPUT VOLTAGE	825	835
90-135 Vac	5A	6A
185-265 Vac	2.5A	3A

Line Voltage Selector:

The line voltage selector selects the appropriate line voltage (1 15Vac or 230Vac).

Power Input Connector:

3-wire IEC line cord receptacle. A detachable line cord is included.

HV Output Connector:

The High Voltage output connector is located on the front panel. Refer to the Specifications section for detailed information on the high voltage connector and its mating connector.

Remote Connector:

A 25 pin "D-Type" connector provides remote programming and monitoring of the power supply. A remote enable is also provided and is required to enable high voltage operation. Refer to Table 2.2 for pin designations. When utilizing the remote capabilities of this unit it must be noted that grounding is extremely important.

TABLE 2.2
Remote Connector Pin Designations

PIN	FUNCTION
1	V_{OUT} Program Input (+)
2	V_{OUT} Program Input (-)
3	V_{OUT} Program Output
4	V_{OUT} Program Monitor
5	Common (V_{MON} & V_{REF} Return)
6	+5Vdc Reference Output
7	N.C.
8	N.C.
9	N.C.
10	Logic Common
11	ENABLE Input
12	ENABLE Remote Output
13	V_{MODE} / I_{MODE} Output
14	I_{OUT} Program Input (+)
15	I_{OUT} Program Input (-)
16	I_{OUT} Program Output
17	I_{OUT} Monitor
18	Common (I_{MON} Return)
19	Analog Common
20	N.C.
21	N.C.
22	N.C.
23	N.C.
24	Polarity Status POS / NEG
25	N.C.

SECTION 3 - THEORY OF OPERATION

3.1 SWITCHING SUPPLY OVERVIEW

Spellman switching supplies use control and monitoring circuits similar to Spellman's line of linear supplies. Differences occur in the techniques used to generate the output power and in the control circuits after the error amplifier. Switching supplies contain additional protection and other ancillary circuits. The techniques Spellman uses for switching supplies allow for control over an extremely wide range of output current and voltage.

3.2 SWITCHING SUPPLY POWER CONVERSION

Spellman uses an off-line configuration where the ac line is rectified and smoothed by a capacitive filter. The rectified voltage is converted to an ac voltage by a half bridge inverter. The inverter output waveform is an approximate 30kHz sinusoid. Average current control mode is used. The main loop controls duty cycle of the inverter as a function of output voltage and current to maintain constant output voltage or current. The inverter is quasi resonant in that switching takes place at approximately zero current to reduce EMI and switching losses. The ac voltage from the inverter is fed to the primary of the step-up transformer. As in the linear supply, the step-up transformer output is rectified or voltage multiplied, and filtered in the high voltage assembly.

3.3 SWITCHING SUPPLY OUTPUT CONTROL

The high voltage dc output is sensed by a high voltage divider, and fed through a sense amplifier to the main error amplifier. The error amplifier compares the programming voltage with the sense voltage, and outputs the necessary signal voltage to maintain the desired constant high voltage output. A second error amplifier then compares the error voltage with a signal that is representative of the output average current. The output of the second error amplifier is fed to the PWM (Pulse Width Modulator) which controls the pulse width of the half bridge inverter.

Any change detected in the output voltage by the sense amplifier is fed to the first error amplifier and in turn, to the second amplifier for correction of pulse width. The second error amplifier maintains constant current in the inverter transformer primary, which is approximately proportional to the high

voltage output current. The power supply can work as a voltage or current source, depending on the programming and load conditions. The crossover from current source to voltage source, or vice versa, is automatic.

SECTION 4 - MAINTENANCE

4.1 GENERAL

The Series 825 and 835 instruments should not require any maintenance. They are designed for reliable, trouble free operation. If any question should arise, contact the Spellman Customer Service Department for assistance or return authorization. It is suggested that the unit be returned to the factory if service should become necessary.

4.2 CLEANING

Cleaning of the power supply should *only* be performed with the supply disconnected from the ac power source. A soft cloth moistened with conventional ammonia-based cleaning agents will suffice for all exposed surfaces. The outer shell of

the HV connector should be cleaned with isopropyl alcohol.

4.3 CALIBRATION SERVICES

Your Spellman high voltage power supply is designed to provide many years of reliable service. For a nominal charge it can be returned to the factory for calibration and certification to its original specification. For traceability, a certificate will be issued, identifying the serial number of the unit calibrated and all test equipment used to perform the calibration. All measurements are traceable to the National Institute of Standards and Technology (NIST). Calibration is guaranteed from 1 year of issuance. Contact the factory at 1-914-686-3600 or your local sales representative for additional details

To obtain information on Spellman's product warranty please visit our website at:

<http://www.spellmanhv.com/en/About/Warranty.aspx>

