

Instruction Manual

MP SERIES

High Voltage Power Supply

MODEL :
SERIAL# :
DATE :

SPELLMAN
HIGH VOLTAGE ELECTRONICS
CORPORATION
475 Wireless Blvd.
Hauppauge, New York, 11788

+1(631) 630-3000*FAX: +1(631) 435-1620*
E-mail: sales@spellmanhv.com
Website: www.spellmanhv.com



- **ARC AND SHORT-CIRCUIT PROTECTION**
- **LOW OUTPUT RIPPLE - 0.001% P-P**
- **LOCAL AND REMOTE VOLTAGE PROGRAMMING**
- **10V REFERENCE OUTPUT FOR EXTERNAL CONTROL**
- **HIGH STABILITY 0.001% LINE AND LOAD REGULATION**
- **MODELS UP TO 40KV OUTPUT**
- **CE MARK FOR EMC DIRECTIVE**
- **OEM CUSTOMIZATION AVAILABLE**

www.spellmanhv.com/manuals/MP

The MP Series has been designed as high performance dc to dc converters with output voltages up to 40kV.

Each module provides well regulated, low ripple and high stability high voltage in a highly versatile compact design, combining linear and switched mode techniques to minimize internal dissipation and generated EMI/RFI interference. The higher voltage modules are vacuum encapsulated to ensure corona free operation.

Specialist cell manufacture of the MP Series ensures prompt delivery.

TYPICAL APPLICATIONS

Photomultiplier Tubes
Scintillators
Electron Guns
Ion Guns
Nuclear Instruments
Electrostatic lenses
Spectroscopy
Microchannel Plates

OPTIONS

F Flange Mounting
P Positive Output Polarity
N Negative Output Polarity
LL Optional Lead Length

SPECIFICATIONS

Input Voltage:

+24Vdc±2V. Other input voltages available on special order.

Input Current:

Less than 1A at full output.

Output Voltage:

Continuously adjustable over entire output range. Available in either positive or negative output polarity. See table for voltage ranges.

Output Voltage Control:

- 1) Internal ten-turn potentiometer
- 2) External potentiometer 5k to 100k (set internal pot. to max.)
- 3) Remote differential voltage programming (0 to +10V gives 0 to full output).
Accuracy 0.1%.

Remote Control:

Remote programming Common Mode Range: -5VDC to +15VDC

Line Regulation:

0.001% for input change of 1V.

Load Regulation:

0.001% for 100µA to full load change
(at maximum voltage).

Temperature Coefficient:

Better than 25ppm/°C.

Stability:

<0.007%/hr at constant operating conditions
after 1 hour warm-up.

Output Voltage and Current Monitors:

Voltage: 0 to +10V represents zero to full output ±1%.
Current: 0 to +10V represents zero to full output ±2%.

Temperature:

Operating: 0°C to +50°C.
Storage: -35°C to +85°C.

Connectors:

Input: 10 pin connector (mating connector supplied).
Output: Output voltage 1-20kV: 500mm screened cable URM76
Output voltage 30kV: 500mm screened cable RG59
Output voltage 40kV: 500mm silicone rubber cable

Dimensions:

Stud mounted case

MP1 to MP5: 1.65"H x 3.86"W x 5.83"D (42mm x 98mm x 148mm)
MP10 to MP15: 1.65"H x 3.86"W x 7.48"D (42mm x 98mm x 190mm)
MP20 to MP30: 1.65"H x 3.86"W x 9.45"D (42mm x 98mm x 240mm)

Two M3 metric studs on case as standard
(mating hardware supplied)

Flange case

- MP1 to MP5: 1.65"H x 3.86"W x 6.61" (42mm x 98mm x 168mm)
Fixing center: 6.14" (156mm)
- MP10 to MP15: 1.65"H x 3.86"W x 8.27" (42mm x 98mm x 210mm)
Fixing center: 7.80" (198mm)
- MP20 to MP30: 1.65"H x 3.86"W x 10.2" (42mm x 98mm x 260mm)
Fixing center: 9.77" (248mm)
- MP40: 1.81"H x 3.86"W x 13.0" (46mm x 98mm x 330mm)
Fixing center: 12.5" (318mm) (4 x 3.3mm mounting holes)

Weight:

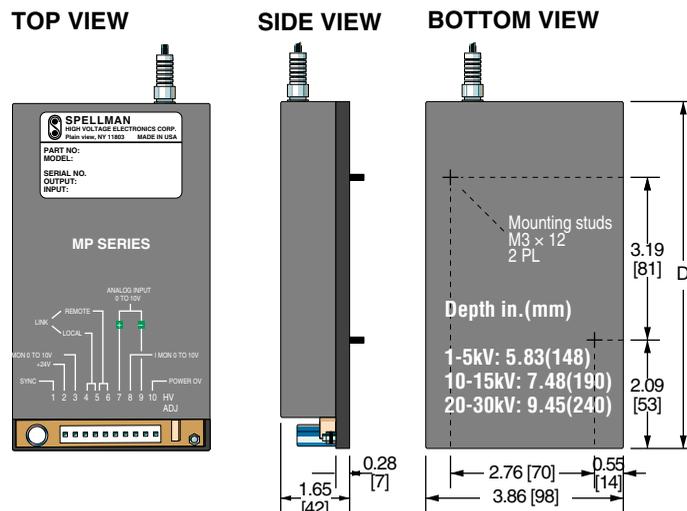
- MP1 to MP5: 21.18 oz. (600g)
- MP10 to MP15: 35.3 oz. (1000g)
- MP20 to MP30: 51.18 oz. (1450g)
- MP40: 76.24 oz. (2160g)

Regulatory Approvals:

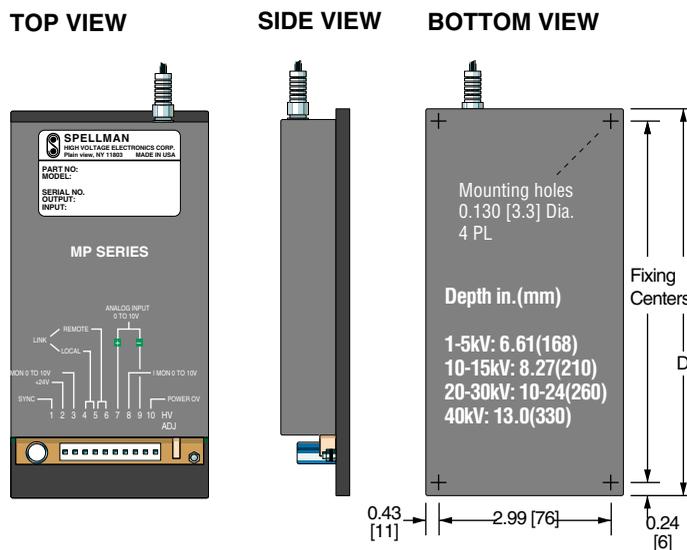
Compliant to 2004/108/EC, the EMC Directive and 2006/95/EC, the Low Voltage Directive.

DIMENSIONS: in.[mm]

STUD MOUNTING (standard)



FLANGE MOUNTING (optional)



MP SELECTION TABLE

OUTPUT VOLTAGE kV	MAX. CURRENT mA	RIPPLE (full load) mV	MODEL
0 to 1	10	10mV p-p	MP1*
0 to 1.5	6	10mV p-p	MP1.5*
0 to 2	5	10mV p-p	MP2*
0 to 2.5	4	10mV p-p	MP2.5*
0 to 3	3	10mV p-p	MP3*
0 to 5	2	20mV p-p	MP5*
0 to 10	1	100mV p-p	MP10*
0 to 15	0.60	150mV p-p	MP15*
0 to 20	0.50	200mV p-p	MP20*
0 to 30	0.33	300mV p-p	MP30*
0 to 40	0.2	400mV p-p	MP40*

*Specify "P" for positive polarity or "N" for negative polarity.

MP CONNECTOR 10 PIN

TB1	SIGNAL	TB1	SIGNAL
1	Synchronization	6	Remote Control
2	+24V Input	7	Vprog+
3	Voltage Monitor	8	Current Monitor
4	Local Control	9	Vprog-
5	Remote / Local Link	10	Power Ground



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.

Copyright © 2000, Spellman High Voltage Electronics Corporation. All Rights Reserved.
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.



INSTRUCTION MANUAL

MP SERIES HIGH VOLTAGE POWER SUPPLY MODULES 0-1KV TO 0-40KV UP TO 10 WATTS

This manual is issued to enable users of MP series modules to connect up and use the product confidently. Whilst circuit information is given it is not intended that this manual be used as a repair and service document in the event of serious failure especially in the High Voltage area we recommend return to our factory or our agents and representatives.

The MP series of high voltage dc-dc convertors are complete modules designed to produce a high quality dc output for a very wide range of instrumentation and analytical applications.

The higher voltage units (10kV and above) have their high voltage sections encapsulated with silicone rubber for extra resistance to corona.

Encapsulation provides excellent protection against shock, vibration overvoltage and the possible ingress of moisture. The low voltage area is left unencapsulated and is accessible in the event of future repair needs.

All MP modules are delivered with a flying EHT output cable and mating input connector, molex type 3001-10. Input, control and monitor functions are on a common pin layout for all models in the series.

Stud fixing are standard (M3 x 12mm long) on centres appropriate to the model see sketches on page 4. Flange mounting is available as an option. Either stud fixing or flange mounting are used and denoted by /S and /F respectively.

The module has exposed components and therefore ESD handling precautions should be taken.

CIRCUIT DESCRIPTION

See Block Diagram (Page 3)

MP Series modules have a linear regulated sine wave inverter set for optimum (resonant) operation at a frequency of around 100kHz.

The dc input is filtered by C1 and then passes through a linear regulator to the inverter. This linear regulator is the principle output control circuit performing output voltage control output current limit and input current limit functions.

The inverter is a single ended FET feeding into a resonant high voltage transformer. The pulse width is set to just deliver maximum output when required and the frequency adjusted to suit the high voltage output transformers natural resonance (approx. 100kHz).

The transformer output is fed to a voltage doubler in the case of the lower voltage units or a Cockroft Walton multiplier in the case of the higher output units. The transformer output current is fed to the current monitoring circuit which also drives an over current shutdown circuit.

A sample of the output voltage is fed via a high voltage divider to a differential amplifier, the output of which controls the regulator, forming the closed loop control of output voltage.

SAFETY PROCEDURES

All models in the MP range have a fixed screened high voltage output lead.

This lead **must be terminated safely** before the MP is operated. If the termination is some form of test load in air allowances of one inch (25mm) per 10kV is a normal safe distance.

Before switch on it is advisable to ensure that the ten-turn central potentiometer on the PCB (RV1) is turned fully anti-clockwise (zero set).

All high voltage loads must have a separate ground lead taken to the

chassis stud in the RH corner of the exposed PCB. If the load is through an electronic vacuum system, ie., ion or electron gun, or gas discharge lamp the ground lead must be a low impedance braided cable or tape. On no account should any resistor or impedance be inserted in the HV return. The chassis stud must also be bonded to the system earth.

OPERATION

Local Control (RV1)

Refer to page 3.

Every MP Series unit is supplied with a Molex 10-way connector body, Molex item No. 3001-10 and 10 crimp terminals, Molex item No. 2478 TL. These items must be assembled and connected to appropriate power, monitor and earth points. Pin 2 is power input +ve (normally 24Vdc,) OV is pin 10.

For local control pins 4 and 5 are connected together and control is via the HV ADJ potentiometer (RV1).

Check that the Molex connector is pressed fully home.

Check that the EHT connection is mechanically secure and that a good earth is in place, see safety procedures.

Switch on Power Input

The EHT control (RV1) may now be turned clockwise to raise the output voltage to the desired level.

Remote Control Potentiometer

Refer to Page 3.

Turn HV ADJ potentiometer fully clockwise to connect pin 4 to the internal 10v reference. Connect the external potentiometer (good quality 5kR - 20kR) between pin 4 and pin 10, connect its wiper to pin 5 (the voltage programming input). Adjust the external potentiometer to the 0v end pin 10 to keep output to a minimum at switch on. It is essential that all external leads

should be screened and be kept as short as possible. Also they should be routed to avoid close proximity to obvious sources of electrical noise such as electric motors, contactors etc.

Remote Analogue (0-10V) control

Refer to Page 3

Connect pins 5 and 6 together. Connect the +ve line of the 0-10V control source to pin 7 and the -ve line to pin 9.

The external control voltage source now effectively forms the reference for the control of the MP module. Any electrical noise, ripple or spikes that appear on this control voltage source is likely to show itself on the output of the supply. In this configuration the HV output will only be as clean and as stable as its control source.

Sync Pin 1

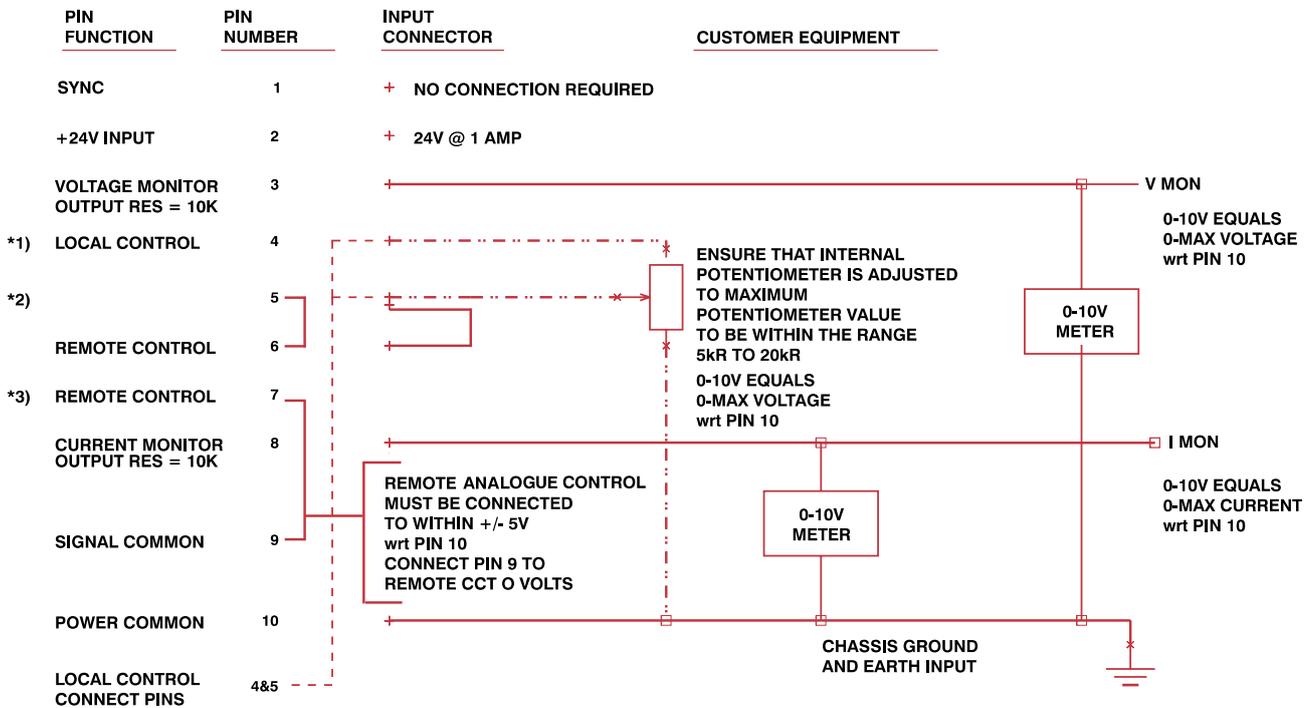
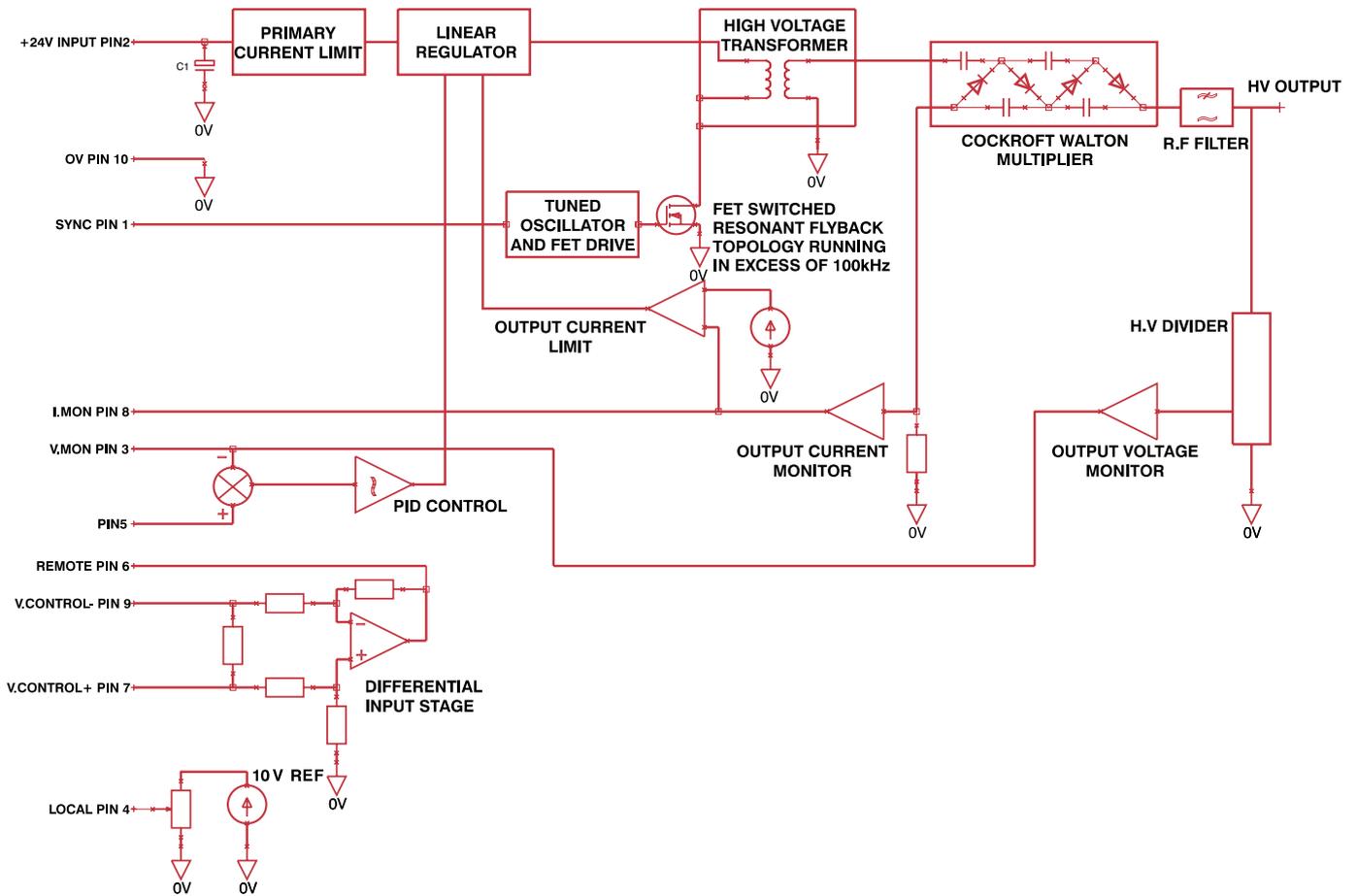
Synchronisation is a feature allowing oscillator frequencies to be synchronised for a number of MP Modules. This feature can only be set by the factory, and is not available as a standard option.

EMC

MP series modules meet the relevant requirements of EN50081-1 and EN50082-1

The module should be configured as follows:

- Input supply leads over 50mm should be twisted together.
- Remote control, current monitor and sync leads over 50mm should be screened.
- The module should be mounted in an enclosure to protect it from Electro-Static Discharge.



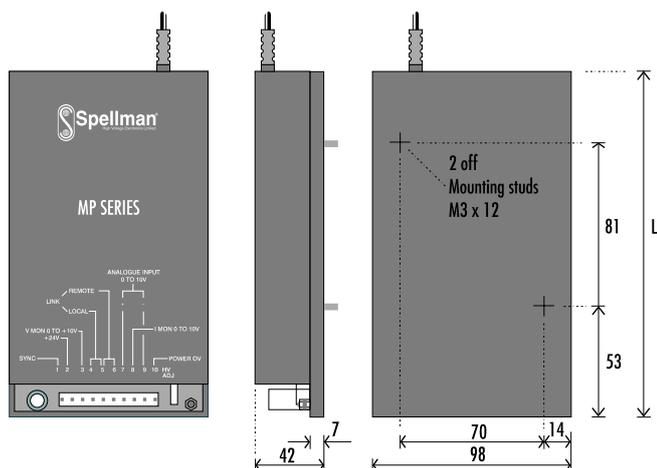
- *1) LOCAL CONTROL CONNECTIONS - - - - -
- *2) REMOTE CONTROL EXTERNAL POTENTIOMETER -
- *3) REMOTE CONTROL 0-10VDC ANALOGUE INPUT - - - - -

MP SERIES

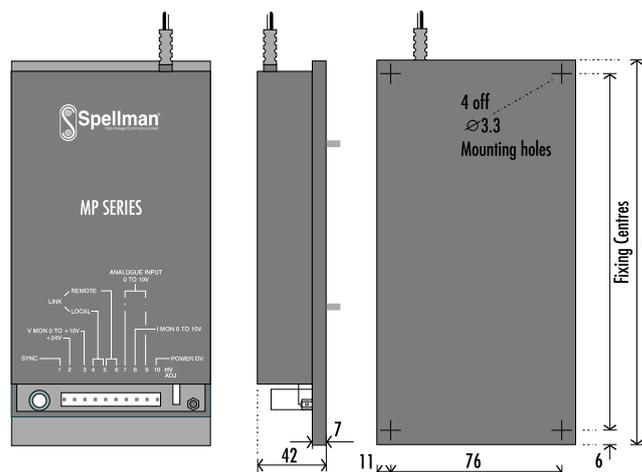
MECHANICAL SPECIFICATION

MODEL NUMBER	CASE	LENGTH (MM)	WIDTH (MM)	HEIGHT (MM)	FIXING CENTRE
MP1 to MP5	STUD	148	98	42	-
MP10 to MP15	STUD	190	98	42	-
MP20 to MP30	STUD	240	98	42	-
MP1 to MP5	FLANGE	168	98	42	156
MP10 to MP15	FLANGE	210	98	42	198
MP20 to MP30	FLANGE	260	98	42	248
MP40	FLANGE	330	98	46	318

STUD MOUNTING



FLANGE MOUNTING

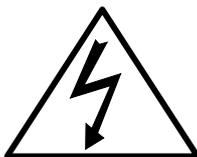


OBSERVE EXTREME CAUTION WHEN WORKING WITH THIS EQUIPMENT

- High voltage power supplies must always be connected to a protective earth
- Do not touch connections unless equipment is turned off and the capacitance of both the load and power supply are earthed
- Allow adequate time 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 only be done by qualified personnel aware of the hazards.



**DANGER
HIGH VOLTAGE
RISK OF ELECTROCUTION**

U.K. and Europe

Broomers Park, Broomers Hill Lane,
Pulborough, West Sussex RH20 2RY, UK
Tel: +44 (0) 1798 877000
Fax: +44 (0) 1798 872479
email: sales@spellmanhv.co.uk

Japan

3-15 Kanayama-cho, Kawaguchi-shi
Saitama-ken Japan, 332-0014
Tel: +81 (0) 48 228 3222
Fax: +81 (0) 48 228 3224

United States of America

475 Wireless Boulevard,
Hauppauge, New York 11788
USA
Tel: +1 - 631 630 3000
Fax: +1 - 631 435 1620
email: sales@spellmanhv.com
www.spellmanhv.com

SPELLMAN HIGH VOLTAGE ELECTRONICS

WARRANTY

Spellman High Voltage Electronics ("**Spellman**") warrants that all power supplies it manufactures will be free from defects in materials and factory workmanship, and agrees to repair or replace, without charge, any power supply that under normal use, operating conditions and maintenance reveals during the warranty period a defect in materials or factory workmanship. The warranty period is twelve (12) months from the date of shipment of the power supply. With respect to standard SL power supplies (not customized) the warranty period is thirty-six (36) months from the date of shipment of the power supply.

This warranty does not apply to any power supply that has been:

- Disassembled, altered, tampered, repaired or worked on by persons unauthorized by **Spellman**;
- subjected to misuse, negligent handling, or accident not caused by the power supply;
- installed, connected, adjusted, or used other than in accordance with the original intended application and/or instructions furnished by **Spellman**.

THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THOSE OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

The buyer's sole remedy for a claimed breach of this warranty, and **Spellman's** sole liability is limited, at **Spellman's** discretion, to a refund of the purchase price or the repair or replacement of the power supply at **Spellman's** cost. The buyer will be responsible for shipping charges to and from **Spellman's** plant. The buyer will not be entitled to make claim for, or recover, any anticipatory profits, or incidental, special or consequential damages resulting from, or in any way relating to, an alleged breach of this warranty.

No modification, amendment, supplement, addition, or other variation of this warranty will be binding unless it is set forth in a written instrument signed by an authorized officer of **Spellman**.

Factory Service Procedures

For an authorization to ship contact **Spellman's** Customer Service Department. Please state the model and serial numbers, which are on the plate on the rear panel of the power supply and the reason for return. A Return Material Authorization Code Number (RMA number) is needed from **Spellman** for all returns. The RMA number should be marked clearly on the outside of the shipping container. Packages received without an RMA Number may delay return of the product. The buyer shall pay shipping costs to and from **Spellman**. Customer Service will provide the Standard Cost for out-of-warranty repairs. A purchase order for this amount is requested upon issuance of the RMA Number (in-warranty returns must also be accompanied by a "zero-value" purchase order). A more detailed estimate may be made when the power supply is received at **Spellman**. In the event that the cost of the actual repair exceeds the estimate, **Spellman** will contact the customer to authorize the repair.

Factory Service Warranty

Spellman will warrant for three (3) months or balance of product warranty, whichever is longer, the repaired assembly/part/unit. If the same problem shall occur within this warranty period **Spellman** shall undertake all the work to rectify the problem with no charge and/or cost to the buyer. Should the cause of the problem be proven to have a source different from the one that has caused the previous problem and/or negligence of the buyer, **Spellman** will be entitled to be paid for the repair.

Spellman Worldwide Service Centers

For a complete listing of **Spellman's** Global Service facilities please go to:
<http://www.spellmanhv.com/customerservice/service.asp>