



72-6850 & 72-6852

HIGH CURRENT DC POWER SUPPLIES

INSTRUCTION MANUAL

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Introduction

This series of bench power supplies offer high power outputs (in excess of 350 Watts) in a casing which is both compact and lightweight when compared with conventional designs. Their high performance is derived from a regulator design which combines switch-mode and linear techniques to achieve high efficiency with excellent regulation, transient response and very low noise.

The supplies feature high accuracy voltage and current metering on bright 0.5" LEDs, overvoltage and thermal protection, and remote sense terminals. The output operates in constant voltage or constant current mode with automatic crossover and mode indication. Coarse and fine controls permit the output voltage to be set within 10 mV and the current limit control is logarithmic to give good resolution at low current settings.

The supplies have a robust steel case which is half-rack width (3U height). They are Safety Class I, Installation Category II instruments which meet IEC 1010-1 safety requirements and EN50081-1 and EN50082-1 EMC standards.

Specification

OUTPUT SPECIFICATIONS

Voltage Range:	Nominally 0-35V (35V/10A) Nominally 0-18V (18V/20A)
Current Range:	Nominally 0-10A (35V/10A) Nominally 0-20A (18V/20A)
Output Voltage Setting:	By coarse and fine controls; 10mV setting resolution.
Output Current Setting:	By single semi-logarithmic control; 10mA setting resolution.
Output Mode:	Constant voltage or constant current with automatic crossover.
Output Switch:	Electronic. Preset voltage and current displayed when off.
Output Terminals:	4mm terminals on front panel, screw terminals at rear.
Sensing:	Remote via rear panel screw terminals or direct via shorting strip (supplied).
Output Impedance:	<1m Ω in constant voltage mode. >5k Ω in constant current mode (voltage limit at max.).
Output Protection:	Forward protection by Over-Voltage-Protection (OVP) trip; maximum voltage that should be applied to the terminals is 50V. Reverse protection by diode clamp for reverse currents up to 3A.
OVP Range:	10% to 110% of maximum output voltage set by front panel screwdriver adjustment.
OVP Delay:	<200 μ s
Load & Line Regulation:	<0.01% of maximum output for 90% load change or 10% line change.
Ripple & Noise:	<1mV rms typical in constant voltage <3mA rms typical in constant current.
HF Common Mode Noise:	Typically <3mV rms, <10mV peak.
Transient Response:	20 μ s to within 50mV of setting for 90% load change.
Temperature Coefficient:	Typically <100 ppm/ $^{\circ}$ C.

Protection Functions:	Overvoltage trip. Regulator overtemperature. Sense miswiring.
Status Indication:	Output off lamp Constant voltage mode lamp Constant current mode lamp Trip message on display.

METER SPECIFICATIONS

Meter Types:	Dual 4 digit meters with 12.5mm (0.5") LEDs. Reading rate 4Hz.
Meter Resolution:	10mV, 10mA
Meter Accuracy:	Voltage 0.2% of reading \pm 1 digit, current 0.5% of reading \pm 1 digit.

GENERAL

AC Input Voltage:	115VAC \pm 14%, 50/60Hz. Installation Category II.
Power Consumption:	700VA max.
Operating Range:	5°C to +40°C, 20% to 80% RH.
Storage Range:	-40°C to +70°C.
Environmental:	Indoor use at altitudes up to 2000m, Pollution Degree 2.
Size:	210 x 140 x 385mm (W x H x D), half rack width x 3U height (optional rack mounting kit available)
Weight:	5kg.
Safety:	Complies with IEC 1010-1
EMC:	Complies with EN50081-1 and EN50082-1.

Safety

This power supply is a Safety Class I instrument according to IEC classification and has been designed to meet the requirements of IEC 1010-1 (Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use). It is an Installation Category II instrument intended for operation from a normal single phase supply.

This instrument has been tested in accordance with IEC 1010-1 and has been supplied in a safe condition. This instruction manual contains some information and warnings which have to be followed by the user to ensure safe operation and to retain the instrument in a safe condition.

This instrument has been designed for indoor use in a Pollution Degree 2 environment in the temperature range 5°C to 40°C, 20% - 80% RH (non-condensing). It may occasionally be subjected to temperatures between +5°C and -10°C without degradation of its safety. Do not operate while condensation is present.

Use of this instrument in a manner not specified by these instructions may impair the safety protection provided. Do not operate the instrument outside its rated supply voltages or environmental range.

WARNING! THIS INSTRUMENT MUST BE EARTHED

Any interruption of the mains earth conductor inside or outside the instrument will make the instrument dangerous. Intentional interruption is prohibited. The protective action must not be negated by the use of an extension cord without a protective conductor.






When the instrument is connected to its supply, terminals may be live and opening the covers or removal of parts (except those to which access can be gained by hand) is likely to expose live parts. The apparatus shall be disconnected from all voltage sources before it is opened for any adjustment, replacement, maintenance or repair. Capacitors inside the power supply may still be charged even if the power supply has been disconnected from all voltage sources but will be safely discharged about 10 minutes after switching off power.

Any adjustment, maintenance and repair of the opened instrument under voltage shall be avoided as far as possible and, if inevitable, shall be carried out only by a skilled person who is aware of the hazard involved.

If the instrument is clearly defective, has been subject to mechanical damage, excessive moisture or chemical corrosion the safety protection may be impaired and the apparatus should be withdrawn from use and returned for checking and repair.

Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of makeshift fuses and the short-circuiting of fuse holders is prohibited. Do not wet the instrument when cleaning it.

The following symbols are used on the instrument and in this manual:-

	Earth (ground) terminal.
	mains supply OFF.
	mains supply ON.
	alternating current (ac)
	direct current (dc)

This power supply has been designed to meet the requirements of the European EMC Directive 89/336/EEC.

Compliance was demonstrated by meeting the test limits of the following standards:

Emissions

EN50081-1 (1992) Generic emission standard for residential commercial and light industry.

Test methods and limits used were:

- a) EN55022 Conducted, Class B
- b) EN55022 Radiated, Class B

Immunity

EN50082-1 (1992) Generic immunity standard for residential, commercial and light industry.

Test methods and limits used were:

- a) EN60801-2 (1993) Electrostatic Discharge, 8kV air discharge.
- b) IEC801-3 (1984) RF Field, 3V/m.
- c) IEC801-4 (1988) Fast Transient, 1kV peak (AC line) and 0.5kV peak (DC output).

Cautions

To ensure continued compliance with the EMC directive the following precautions should be observed:

- a) after opening the case for any reason ensure that all signal and ground connections are remade correctly before replacing the cover. Always ensure all case screws are correctly refitted and tightened.
- b) In the event of part replacement becoming necessary, only use components of an identical type, see the Service Manual.

Installation

Mains Operating Voltage

This instrument operates from a nominal 115V mains. Check that the local supply meets the AC Input requirement given in the Specification.

Mains Lead

WARNING! THIS APPARATUS MUST BE EARTHED.

Any interruption of the mains earth conductor inside or outside the instrument will make the instrument dangerous. Intentional interruption is prohibited.

Mounting

This instrument is suitable both for bench use and rack mounting. It is delivered with feet for bench mounting. The front feet include a tilt mechanism for optimal panel angle.

A rack kit for mounting one or two of these Half-width 3U high units in a 19" rack is available from the Manufacturers.


Ventilation

These instruments are very efficient but nevertheless can generate significant heat at full power. The supplies rely on convection cooling only and it is therefore important that ventilation is never restricted if performance and safety are to be maintained. If the supplies are mounted in a restricted space, eg. a 19 inch rack, then adequate ventilation must be ensured by using, for example, a fan tray.

Connections

The load should be connected to the positive (red) and negative (black) front panel OUTPUT terminals. These safety terminals will accept 4mm plugs, bare-ended wires or spade terminals without exposing any metal parts and are rated to 30A.

The load can alternatively be connected to the rear panel OUTPUT screw terminals where the SENSE connections are also located. Refer to the Connection to the Load section in the Operation chapter for full details.

The terminal marked  is connected to the chassis and safety earth ground.

Output Setting

With the POWER switch on (I) and the OUTPUT push-button switch off (out) the output voltage and current limit can be accurately set using the three output controls; the left-hand meter indicates set voltage and the right-hand meter set current.

When the OUTPUT is switched on, the ON LED and the CV (constant voltage) LED will light; the left-hand meter continues to show the set voltage but the right-hand meter now shows actual current drawn. Alternate presses of the I METER DAMPING button will switch current meter damping in and out; with damping switched in the DAMPED LED will be lit and the average value of a varying load current will be read.

If the output goes into current limit the CI (constant current) LED will light instead of the CV LED and the left-hand meter will now show the actual voltage at the output terminals; the right-hand meter will continue to show the set current limit.

At any time, the set voltage and set current levels can be reviewed by pressing the CHECK V/I button.

Outputs from several supplies may be connected in series or parallel to produce higher voltages or higher currents respectively. Care must be taken when connecting supplies in series to ensure that the maximum voltage rating of any output terminal (300V peak maximum with respect to true ground) is not exceeded.

Connection to the Load

Connection to the front panel output terminals can be made with 4mm plugs, spade terminals or wire ends. To minimise voltage drop, the connecting leads to the load should be of an adequate wire gauge and be kept short. Load wires should also be twisted together to minimise inductance.

To overcome errors introduced by connecting lead resistance at higher currents the remote sensing facility should be used (10 mΩ of lead resistance will drop 0.2 Volt at 20 Amps). Remove the two shorting links made between the rear output and sense terminals and connect the sense terminals directly to the load; the power connections may be made from either the front or the rear terminals.

To ensure good coupling between the output and sense, the sense wires should be twisted with their corresponding output leads before the output leads are twisted together.

The voltage drop in each output lead must not exceed 1 Volt.

The shorting links should be re-made between the rear sense and output terminals when remote sensing is not being used. However, the sense connection is also made internally through a low value resistor and only a small error between the set and actual voltage will result if the links are left disconnected.

The output is fully floating and either terminal can be connected to ground or raised by up to 300V peak above true ground; however, such voltages are hazardous and great care should be taken.

The current limit control can be set to limit the continuous output current to levels down to 10mA. However, in common with all precision bench power supplies, a capacitor is connected across the output to maintain stability and good transient response. This capacitor charges to the output voltage, and short circuiting of the output will produce a short current pulse as the capacitor discharges which is independent of the current limit setting.

Protection

Overvoltage protection (OVP) is fully variable within the range 10% to 110% of the supply's maximum output level. The OVP limit is set via the screwdriver adjustable SET OVP preset potentiometer, accessible through a hole in the front panel. Rotating the preset clockwise increases the limit, which can be read directly on the left-hand display by pressing the READ OVP button. If the voltage on the output exceeds the set OVP for any reason, including an externally forced voltage, the output will be tripped off.

The output will also be tripped off if the thermal sensing detects overheating of any of the power semiconductors, or if the sense wires are wired to the wrong output or if an attempt is made to draw power from the sense wires.

In all the above cases, the 'TRIP' message will be shown in both displays. Once the cause of the trip has been removed, normal operation can be restored by switching the POWER switch off (O) then on (I) again.

The output is protected from reverse voltages by a diode; the continuous reverse current must not exceed 3 Amps, although transients can be much higher.

Maintenance and Repair

For service repair and calibration please contact your local Tenma distributor or go to www.tenma.com

Fuse

The correct fuse type is:

10 Amp 250V HBC time-lag, 5 x 20 mm

Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of makeshift fuses and the short-circuiting of fuse-holders is prohibited.

To replace the fuse, first disconnect the instrument from the AC supply. Remove the 6 cover securing screws and lift off the cover. Replace the fuse with one of the correct type and refit the cover.

Note that the main function of the fuse is to make the instrument safe and limit damage in the event of failure of one of the switching devices. If a fuse fails it is therefore very likely that the replacement will also blow, because the supply has developed a fault; in such circumstances the instrument will need to be returned to the manufacturer for service.

Cleaning

If the PSU requires cleaning use a cloth that is only lightly dampened with water or a mild detergent. Polish the display window with a soft dry cloth.

WARNING! TO AVOID ELECTRIC SHOCK, OR DAMAGE TO THE PSU, NEVER ALLOW WATER TO GET INSIDE THE CASE. TO AVOID DAMAGE TO THE CASE OR DISPLAY WINDOW NEVER CLEAN WITH SOLVENTS.

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