

**TENMA**<sup>®</sup>

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**72-6854**

*DUAL 35V 10A POWER FLEX POWER SUPPLY*

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**INSTRUCTION MANUAL**

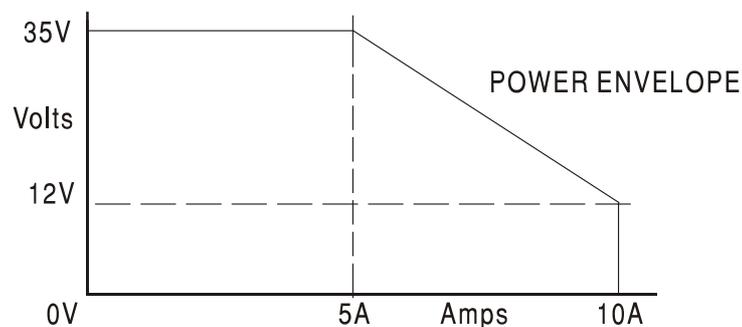
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## Specification

### OUTPUT SPECIFICATIONS

Voltage Range:	0V to 35V
Current Range:	0A to 10A
Power Range:	Up to 175W
Output Voltage Setting:	By coarse and fine controls.
Output Current Setting:	By single logarithmic control.
Operating Mode:	Constant voltage or constant current with automatic cross-over provided that the power demanded stays within the power envelope, see graph. Outside of this envelope the output becomes unregulated.



Output Switch:	Electronic. Preset voltage and current displayed when off.
Output Terminals:	4mm terminals on 19mm (0.75") pitch. 30A max.
Sensing:	Switchable between local and remote. Spring-loaded push terminals for remote connection.
Output Impedance:	Typically <math><5\text{m}\Omega</math> in constant voltage mode. Typically >math>>5\text{k}\Omega</math> 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.
Line & Load Regulation:	<0.01% of maximum output for a 10% line change; <0.05% of maximum output for a 90% load change.
Ripple & Noise (20MHz bandwidth):	5mVrms max; typically <2mVrms, <20mV pk-pk, both outputs fully loaded (7A @ 25V), CV mode.
Transient Load Response:	<2ms to within 100mV of set level for 90% load change.
Temperature Coefficient:	Typically <100ppm/°C
Status Indication:	Output on lamp. Constant voltage mode lamp. Constant current mode lamp. Unregulated (power limit) lamp. Trip message on display.

## METER SPECIFICATIONS

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

## GENERAL

AC Input:	110V-120V AC or 220V-240V $\pm$ 10%, 50/60Hz. Installation Category II.
Power Consumption:	600VA 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.
Safety:	Complies with EN61010-1
EMC:	Complies with EN61326
Size:	210 x 130 x 375mm (W x H x D) half rack width x 3U height (optional rack mounting kit available).
Weight:	5kg

# Safety

This power supply is a Safety Class I instrument according to IEC classification and has been designed to meet the requirements of EN61010-1 (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)

This instrument has been designed to meet the requirements of the EMC Directive 2004/108/EC. Compliance was demonstrated by meeting the test limits of the following standards:

### Emissions

EN61326 (1998) EMC product standard for Electrical Equipment for Measurement, Control and Laboratory Use. Test limits used were:

- a) Radiated: Class B
- b) Conducted: Class B
- c) Harmonics: EN61000-3-2 (2000) Class A; the instrument is Class A by product category.

### Immunity

EN61326 (1998) EMC product standard for Electrical Equipment for Measurement, Control and Laboratory Use.

Test methods, limits and performance achieved were:

- a) EN61000-4-2 (1995) Electrostatic Discharge : 4kV air, 4kV contact, Performance A.
- b) EN61000-4-3 (1997) Electromagnetic Field, 3V/m, 80% AM at 1kHz, Performance A.
- c) EN61000-4-11 (1994) Voltage Interrupt, 1 cycle, 100%, Performance B.
- d) EN61000-4-4 (1995) Fast Transient, 1kV peak (AC line), 0.5kV peak (DC Outputs), Performance A.
- e) EN61000-4-5 (1995) Surge, 0.5kV (line to line), 1kV (line to ground), Performance A.
- f) EN61000-4-6 (1996) Conducted RF, 3V, 80% AM at 1kHz (AC line only; DC Output connections <3m not tested), Performance A.

According to EN61326 the definitions of performance criteria are:

**Performance criterion A:** 'During test normal performance within the specification limits.'

**Performance criterion B:** 'During test, temporary degradation, or loss of function or performance which is self-recovering'.

**Performance criterion C:** 'During test, temporary degradation, or loss of function or performance which requires operator intervention or system reset occurs.'

Where Performance B is stated it is because DC Output regulation may deviate beyond Specification limits under the test conditions. However, the possible deviations are still small and unlikely to be a problem in practice.

Note that if operation in a high RF field is unavoidable it is good practice to connect the PSU to the target system using screened leads which have been passed (together) through an absorbing ferrite sleeve fitted close to the PSU terminals.

### Cautions

To ensure continued compliance with the EMC directive observe the following precautions:

- a) after opening the case for any reason ensure that all signal and ground connections are remade correctly and that 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.

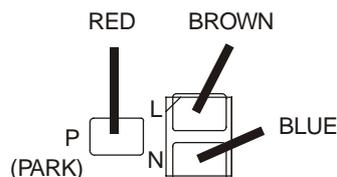
# Installation

## Mains Operating Voltage

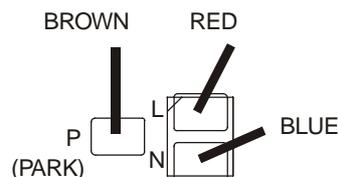
Check that the instrument operating voltage marked on the rear panel is suitable for the local supply. Should it be necessary to change the operating voltage, proceed as follows:

1. Ensure that the instrument is disconnected from the AC supply.
2. Remove the 6 screws holding the case upper and lift off the cover.
3. Change the plug-in connections between the transformer and main board following the diagram below:

**230V OPERATION**  
(VIEW FROM ABOVE)



**115V OPERATION**  
(VIEW FROM ABOVE)



4. Re-assemble in the reverse order.
5. To comply with safety standard requirements the operating voltage on the rear panel must be changed to clearly show the new voltage setting.

## Mains Lead

When a three core mains lead with bare ends is provided this should be connected as follows:

BROWN	-	MAINS LIVE
BLUE	-	MAINS NEUTRAL
GREEN/YELLOW	-	EARTH



When fitting a fused plug a 5 amp fuse should be fitted inside the plug. As the colours of the wires in the mains lead of this apparatus may not correspond with the coloured markings identifying the terminals in your plug proceed as follows:

The wire which is coloured green-and-yellow must be connected to the terminal in the plug which is marked with the letter E or by the safety earth symbol shown above or coloured green or green-and-yellow.

The wire which is coloured blue must be connected to the terminal which is marked with the letter N or coloured black.

The wire which is coloured brown must be connected to the terminal which is marked with the letter L or coloured red.

### **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.

## 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 or their overseas agents.

## Ventilation

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

# Connections

All connections are made from the front panel.

The load should be connected to the positive (red) and negative (black) terminals marked OUTPUT. The OUTPUT terminals are rated at 30A.

Remote sense connections to the load, if required, are made from the positive (+) and negative (-) SENSE terminals. Switch the LOCAL/REMOTE switch to REMOTE when remote sensing is required. Switch back to LOCAL when remote sensing is not in use.

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

# Operation

The operation of both outputs is identical; the following description applies to both.

## Setting Up the Output

With the POWER switch on (I) and the OUTPUT switch off the output voltage and current limit can be accurately preset using the VOLTAGE and CURRENT controls; the upper meter shows the set voltage and the lower meter shows the set maximum current.

When the OUTPUT switch is switched on, the OUTPUT ON lamp and the CV (constant voltage) lamp light; the upper meter continues to show the set voltage but the lower meter now shows the actual load current.

## Constant Voltage

The output voltage is adjusted using the coarse and fine VOLTAGE control; the CURRENT control sets the maximum current that can be supplied.

The CV lamp lights to show constant voltage mode.

## Constant Current

If the load resistance is low enough such that, at the output voltage set, a current greater than the current limit setting would flow, the power supply will automatically move into constant current operation. The current output is adjusted by the CURRENT control and the VOLTAGE controls set the maximum voltage that can be generated.

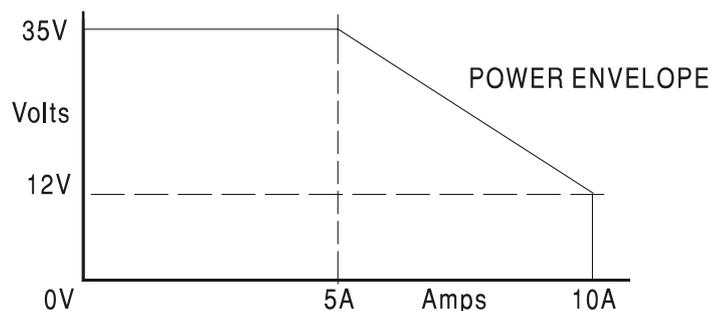
The CI lamp lights to show constant current mode.

## Instantaneous Current Output

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 current pulse as the capacitor discharges which is independent of the current limit setting.

## Power Limit

The maximum output at different voltage settings is limited by the power envelope illustrated below:



The power envelope is set to give 35V/5A and 12V/10A under all supply conditions (both outputs loaded); at lower output voltages the output power is restricted by the 10A current maximum.

When the power limit is exceeded, the status indication will change from CV or CI to UNREG. For example, if the supply is set to 14V, with the current limit at maximum, and is connected to a 3.5Ω load, 4Amps will flow and the supply will be in CV mode. As the voltage across the load is increased, the power into the load increases until, at about 25V, the power limit is exceeded and the supply changes from CV to UNREG.

## Connection to the Load

The load should be connected to the positive (red) and negative (black) OUTPUT terminals. Both are fully floating and either can be connected to ground.

## Remote Sensing

The unit has a very low output impedance, but this is inevitably increased by the resistance of the connecting leads. At high currents this can result in significant differences between the indicated source voltage and the actual load voltage (two 20mΩ connecting leads will drop 0.2V at 5 Amps, for instance). This problem can be minimised by using short, thick, connecting leads, but where necessary it can be completely overcome by using the remote sense facility.

This requires the sense terminals to be connected to the output at the load instead of at the source; insert wires into the spring-loaded SENSE terminals and connect directly to the load. Switch the LOCAL/REMOTE switch to REMOTE. To avoid instability and transient response problems, care must be taken to ensure good coupling between each output and sense lead. This can be done either by twisting the leads together or by using coaxially screened cable (sense through the inner). An electrolytic capacitor directly across the load connection point may also be beneficial.

The voltage drop in each output lead must not exceed 0.5 Volts.

Switch the LOCAL/REMOTE switch back to LOCAL when remote sensing is not in use.

## Series or Parallel connection with other units

The outputs of the power supply are fully floating and may be used in series with other power supply units to generate high DC voltages up to 300V DC.

**WARNING!** Such voltages are exceedingly hazardous and great care should be taken to shield the output terminals for such use. On no account should the output terminals be touched when the unit is switched on under such use. All connections to the terminals must be made with the power switched off on all units.

It should be noted that the unit can only source current and cannot sink it, thus units cannot be series connected in anti-phase.

The unit can be connected in parallel with others to produce higher currents. Where several units are connected in parallel, the output voltage will be equal to that of the unit with the highest output voltage setting until the current drawn exceeds its current limit setting, upon which the output will fall to that of the next highest setting, and so on. In constant current mode, units can be connected in parallel to provide a current equal to the sum of the current limit settings.

Note that the output terminals are rated at 30A maximum; if two or more outputs are operated in parallel to source higher currents than this the junction should be made at a separate point, not one of the terminals.

## 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 user display by pressing the button next to the preset. 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 an attempt is made to draw power from the sense wires.

When the output is tripped the OUTPUT lamp will still be ON but the displays will show 'OP trip' and the UNREG lamp will also light. Turn the output off; the trip message should be replaced with the normal preset V and I readings. When the cause of the trip has been removed the output can be switched on again.

Even with the output off the load is still connected to the power supply output stage. Do not apply external voltages in excess of 50V to the power supply terminals or damage may result.

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.

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## Maintenance

For service repair and calibration please contact your local Tenma distributor or go to [www.tenma.com](http://www.tenma.com)

### Fuse

The correct fuse type is:

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

Make sure that only fuses of the required rated current and 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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