

**INSTALLATION AND OPERATING  
MANUAL**

**PA100E-CE Amplifier**

**Manual 936221**

**Amendment 3**



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## LDS MANUALS

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*LDS Test & Measurement,  
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**AMENDMENT RECORD PAGE**

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**PA100E-CE Amplifier**

Publication Date of this Edition: February 1996

Amendments:

<i>Date</i>	<i>Amendment Number</i>	<i>Serial Nos Affected</i>	<i>Pages Affected</i>	<i>Brief Details</i>	<i>LDS ECO</i>
29.1.97	1	All	All	General update related to Low Voltage Directive and 200 V tap settings.	7142
30.3.98	2	All	i, v, 9.	Cable colours and linking updated	7472
15.2.8	3	All	i-xii	Company name, notices, China-RoHS	5/675

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**DEFINITIONS**

For the purpose of this manual:

**Danger Zone** means a zone extending 2 metres from the periphery of the vibrator and cabling.

*Note: Outside this zone noise may still be a risk to health and safety.*

**Exposed Person** means any person either wholly or partially in the danger zone.

**Operator** means any person transporting, installing, adjusting, operating, cleaning, maintaining or repairing the vibration system.

**Main control position** is next to the vibration control unit.

**Payload** means the test piece, part or assembly under test including any jigs, fixtures, accelerometers and fastenings used to mount it to the vibrator moving element.

**SELV** means Safe Extra Low Voltage

**RISKS & HAZARDS**

When planning, installing, operating or maintaining a vibration test system, careful consideration must be given to the potential hazards inherent in the use of such equipment.

**Noise**

Exposure of the human body to high noise levels can damage health. Electrodynamical vibration test equipment can generate significant noise levels and ideally should be sited within a soundproof cell. The operator control position, together with signal generation, control and monitoring equipment should be located outside the soundproof cell. Power amplifiers, cooling units and other ancillary equipment can also generate significant noise levels and should be located away from the operator control position. If the ideal situation is impractical, all personnel at risk must be made aware of the hazards involved and a directive issued that ear defenders should be worn.

**Mechanical**

It must be remembered that vibrators can be used to test equipment to destruction and that the forces available can be considerably amplified by local resonances. Precautions must be taken to ensure that any parts of the payload which may become detached cannot cause injury to personnel.

Payloads must be designed and mounted such that they cannot overturn the vibrator either statically or under

test. Further, they must not exceed the rated load of the vibrator bearings.

In so far as their purpose allows, payloads should have no sharp edges, no sharp angles and no rough surfaces likely to cause injury. Payloads should also have no trapping points, e.g. where fingers or hands might be trapped during test.

It is recommended that all persons entering the danger zone, whether the vibrator is energised or not, are aware of the risks and that appropriate protective clothing is worn. Other risks specific to siting and operation of the vibrator are identified in the relevant sections of this manual.

**Electrical**

All equipment constituting a vibration test system contains voltages above SELV and is potentially lethal. During normal operation it is not necessary for an operator to access areas containing voltages above SELV. Access to high voltage areas can only be gained by removing panels or covers, or by opening doors with the use of a tool (including a key).

It is the policy of LDS to supply two keys for each lock position. To ensure that access to the interior of equipment is restricted to designated personnel, it is strongly recommended that all keys are held by a responsible person, authorised to issue keys for service/maintenance purposes.

With the exception of calibration or fault diagnosis by qualified personnel, equipment should be completely isolated from the supply before gaining access. Residual hazardous voltages may be present immediately after isolation.

**Pneumatic**

Some vibrators rely on a compressed air supply for armature and body support. Due care and attention must be given when fixing loads to the armature and subsequently setting armature and body positions.

It is recommended that the air supply has a shut-off valve adjacent to the vibrator for use in emergencies or when the vibration system is not being used e.g. overnight. In such cases the payload should be supported by other means e.g. armature lock-out plates or overhead crane.

**Hydraulic**

Some vibrators and all combos use Shell Tellus oil or equivalent. Whilst this oil does not pose a direct health and safety hazard, care should be taken to clean up any spillages which may occur during filling, draining or operating the system. It is also recommended that any oil making skin contact is removed as soon as possible.

## HEALTH AND SAFETY NOTICES

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### Water

Some vibrators are water-cooled with the cooling system self-contained within the vibrator, hoses and cooling unit. Although water can only be released (leak) due to a failure in the system, operators should be made aware of the temperatures attained during normal operation (see below).

### Temperature

The heat generated by all equipment in the vibration test system should be considered before siting. Measures should be taken to ensure that the temperature of the working environment for the system and operating personnel is within allowable limits. Operators should also be made aware that some equipment, particularly water cooled vibrators, can attain high surface temperature during normal operation.

### Blower Outlet (Air-cooled vibrators)

The air outlet port from the cooling blower in air-cooled vibrator systems should be positioned such that an operator cannot stand directly in line with the airflow. This precaution will prevent injury in the event of small objects, e.g. nuts or screws becoming detached in the vibrator and ejected at high velocity from the blower.

### Cables and Hoses

Where practical, all cables and hoses used in the vibration test system should be sited in ducts or trunking to give clear unimpeded access to the vibrator, power amplifier, cooling unit and other ancillary equipment.

### Chemicals

The hazards of chemicals/cleaning agents are dependent not only upon the toxicity of materials but also upon the degree and nature of exposure. Users should adopt procedures conforming to the requirements of the European Directive 90/394/EEC, Protection Of Workers From The Risks Related To Exposure To Carcinogenic Substances At Work, which is implemented in the UK by the COSHH regulations.

**IMPORTANT NOTE:** In special cases where vibrator rolling seals are required to have resistance to fuel oil, the standard white SILICON vibrator seal may be replaced by a black VITON seal. In the event of a fire, anyone handling residues of VITON must wear Neoprene protective gloves to avoid skin contact with possibly highly corrosive residues which are likely to include hydrogen fluoride. **DISCARD GLOVES AFTER USE.**

### Low Frequency Fields

By virtue of their mode of operation, vibrators and associated power products produce DC and low-frequency magnetic fields. While current medical research is inconclusive as to the effect of low-frequency electromagnetic fields on the human body, LDS recommend that personnel, particularly those with medical implants, do not enter the danger zone whilst the vibrator is running.

LDS cannot accept responsibility for any effects on health of electromagnetic fields but strongly advise that all precautions as defined in this notice and product manuals are followed.

## INSTALLATION

### Line of Sight

From the main control position it must be possible to ensure that there are no exposed persons in the danger zone. For vibration systems in which there is no direct line of sight or video link between the control position and the vibrator, it is recommended that an audible warning device is fitted at the vibrator location to give notice of impending operation. This will give personnel in the danger zone opportunity to vacate the area, or actuate the emergency stop to prevent vibrator operation.

### Emergency Stop

For most vibration test systems, the vibrator is fitted with a minimum of one locking emergency stop pushbutton, and includes the facility for additional emergency stop pushbuttons at other locations. It is recommended that on large systems (with the vibrator in the horizontal mode) or with combos, the additional emergency stop(s) are located adjacent to the payload position, in easy reach of an operator working in that area.

Additional emergency stop switches must comply with BS EN418-1992.

## OPERATION

LDS systems are designed to provide a controlled vibration testing environment for quality and reliability testing of components and assemblies, within the limits stated in the specifications. Any other use, e.g. in an explosive or corrosive environment, unusual loading, etc, may invalidate contractual agreements. Any doubts regarding the fitness for purpose of the equipment should be referred to LDS Technical Department before the equipment is used.



### Before-use Checks

Before operating any vibration system, check that:

- the vibration test area is clear of unnecessary obstructions.
- all terminal covers are correctly fitted.
- all equipment doors are correctly closed and secure.
- the supply of cooling medium (if applicable) is sufficient.
- the hydraulic oil supply (if applicable) is correctly topped-up.
- the item under test is correctly secured to the vibrator or slip table.
- all personnel are clear of the danger zone

### Emergency Stop

If an emergency arises, the emergency stop should be activated immediately.

### Remote Control Operation

For systems including a remote control panel (RCP), operation is only permitted from one control position (amplifier or RCP). This protection is provided either by software selection or by keyswitch operation, the key being common for both positions. Although LDS provide more than one key, it is strongly recommended that only one is issued and its use restricted to the authorised operator. This will provide added protection against system mal-operation or misuse.

### TRAINING

Vibration test systems encompass a wide variety of technological disciplines and it is essential that personnel are properly qualified and trained before being authorized to work on such a system. Access to areas where vibration test systems are located should be restricted to authorised personnel. LDS offers short training courses providing a practical introduction for technicians/engineers new to vibration testing.

### MAINTENANCE

A programme of planned maintenance, carried out by fully trained and qualified personnel, is essential to maintain the safety of the equipment. Safety interlocks must be frequently checked for correct operation. Under no circumstances should protective earth conductors be left disconnected; these should be frequently checked to ensure good earth bonding of all equipment. Frequent checks on armature and field coil insulation should be carried out in accordance with the detailed vibrator maintenance section of this manual.






### CUSTOMER RESPONSIBILITIES

When specifying, siting, installing and operating a vibration system the customer is responsible for the following:

1. Off-loading, unpacking and siting the equipment at its designated position.
2. Ensuring that the floor surface where the equipment is to be located is suitable for the equipment.
3. Ensuring that access to the equipment is adequate.
4. Providing all service requirements such as water, air lines, electrical power etc. to the point of entry to the equipment and ensuring that such supplies conform to company specifications.
5. Supplying all test equipment necessary to complete acceptance testing.
6. Making available consumable materials such as distilled water, oil, cleaning material etc.
7. Any special tools required for commissioning the system such as lifting equipment etc.
8. Completion of pre-installation check list prior to commencement of installation
9. To validate warranty, return to LDS on completion of all installations or commissioning of the signed commissioning certificate.
10. PAYLOADS AND THEIR EFFECT ON THE VIBRATOR ARE THE RESPONSIBILITY OF THE CUSTOMER.

### VISUALSYMBOLS

The following visual symbols may be used on the equipment:

Symbol	Description
	Alternating current
	Earth (ground) terminal
	Protective conductor terminal
	Caution - risk of electric shock
	Caution - risk of danger

## HEALTH AND SAFETY NOTICES

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### CONFORMITY

This equipment has been designed specifically for vibration testing and should not be used for any other purpose except by agreement with LDS Test & Measurement (LDS).

The equipment complies where applicable with the following European Union (EU) directives:

Machinery	98/37/EC
Low Voltage	73/23/EEC (Amended 93/68/EEC)
EMC	89/336/EEC (Amended 93/68/EEC)

For installation, use and maintenance of this equipment the responsibilities of employer and employee are specified in EU Work Equipment Directive 89/655/EEC which refers to suitability of work equipment, maintenance, specific risks, information & instructions and training. The directive is implemented in the United Kingdom by statutory regulations 'Provision and Use of Work Equipment Regulations 1992' and by similar regulations in other EU countries.

LDS product design provides personal protection in accordance with the applicable directives listed above, and care has been taken to minimise the risks associated with all equipment constituting a vibration test system. Since however the vibrator and other equipment contains moving parts and can exert large forces on jigs, fixtures and payloads, the area surrounding such equipment should be declared a Danger Zone (see Definitions) and suitable precautions taken by operators working there.

**LDS DOES NOT ACCEPT RESPONSIBILITY FOR RISKS  
INTRODUCED BY JIGS, FIXTURES AND PAYLOADS.**

**FOR JIGS AND FIXTURES DESIGNED BY LDS SEE THE  
APPROPRIATE MANUAL.**

This equipment as supplied by LDS meets the essential requirements of all applicable EU directives. To maintain compliance the equipment must be maintained and serviced by personnel certified by LDS as having successfully completed an LDS approved training course relating to the equipment. Only parts and components supplied under an LDS part number or otherwise specifically approved by LDS shall be used in the maintenance and servicing of the equipment.

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**DRAWING AND DOCUMENT - (bound at end of manual):**

PA100E-CE Outline Drawing .....	Drawing No. 995400	
China-RoHS Compliance .....	Document 3002390	(3)

# 1. INTRODUCTION

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## 1.1 General

The Ling Dynamic Systems (LDS) PA100E is a nominal 147 VA dc coupled, fan cooled, linear, FET power amplifier using Class B circuit techniques. It has been designed primarily to drive the LDS 400 series vibration generators.

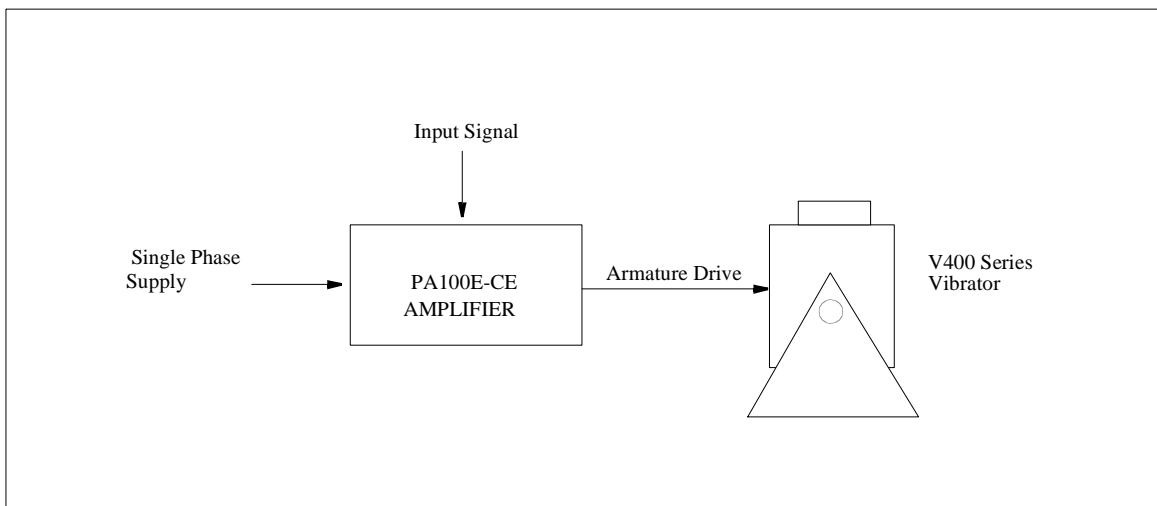
**Note: If the equipment is used for any other purposes the protection provided to the user may be impaired.**

The amplifier is driven from an external signal source via a triaxial socket located on the rear panel.

The output is protected primarily by an overcurrent circuit, set to operate at 7.5 amps. Backup protection is also provided by an output fuse in series with the 'high' output connection.

The amplifier incorporates a signal clamp circuit to operate during power-up and overcurrent conditions. This prevents potentially transients being applied to the vibration generator armature circuit. Reset of the signal clamp is performed by a RESET switch located on the front panel.

The unit is supplied as standard for bench or 19 in rack mounted.



**Figure 1.1 PA100E-CE Amplifier - System Connections**

## 2. SPECIFICATION

### 2.1 Amplifier Performance

	Metric Units	American Units
Amplifier	PA100E-CE	PA100E-CE
Classification	Class B linear amplifier, air cooled	
<b>Input supply:</b>  Single phase, 50/60 Hz	100, 110, 120, 200, 220, 240 V +/- 6%	100, 110, 120, 200, 220, 240 V +/- 6%
<b>Amplifier performance:</b>  Rated sinusoidal power output into a resistive load of 2.9 ohms	147 W	147 W
Maximum continuous sinusoidal VA output into any reactive load, 0.5 pf leading or lagging at $t_{amb} = 25^{\circ}C$	147 VA	147 VA
Frequency range of rated power output	10 Hz to 10 kHz	10 Hz to 10 kHz
Total harmonic distortion at rated output 10 Hz to 10 kHz	Typically < 0.5% ,	Typically < 0.5%
Maximum output voltage	20 V rms	20 V rms
Maximum no load voltage at the nominal ac power supply voltage	32 Vrms	32 Vrms
Voltage regulation for a step change of current 0 - 3 amps	97%	97%
Output current at rated VA output	7 A rms	7 A rms
Maximum output current	7 A rms	7 A rms
Input sensitivity for maximum output (400 Hz)	1.0 V rms	1.0 V rms
Signal to noise ratio at maximum sinusoidal output, measured across the rated resistive load with input short circuited	>75 dB	>75 dB
Amplifier efficiency(maximum output) at 400 Hz	58%	58%

## 2. SPECIFICATION (cont.)

### 2.2 Environmental Data

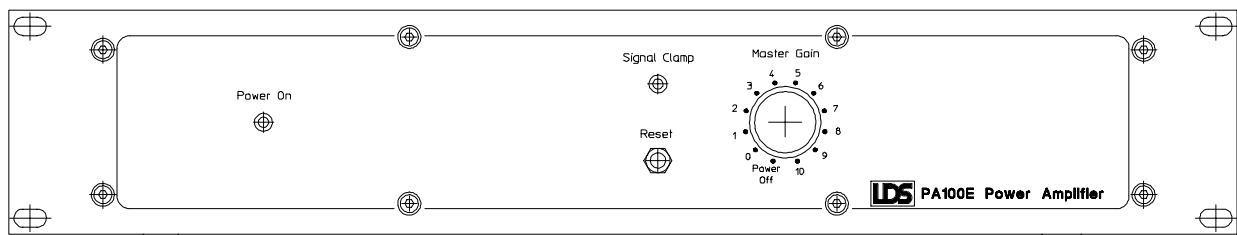
	Metric Units	American Units
Amplifier	PA100E-CE	PA100E-CE
Heat rejected to environment at maximum power output	150 W	150 W
Generated sound power level at maximum power output. Measured at 2 metres with signal frequency = 1000 Hz	2 dBA	2 dBA
Ambient temperature range at maximum power output	0 <sup>0</sup> to 35 <sup>0</sup> C (above 35 <sup>0</sup> C derate by 2% per <sup>0</sup> C)	32 <sup>0</sup> to 95 <sup>0</sup> F (above 95 <sup>0</sup> F derate by 2% per <sup>0</sup> F)
Working ambient pressure	900 - 1100 mbar	27 - 33 in Hg
Relative humidity (non-condensing)	0 - 95%	0 - 95%
<b>Amplifier cooling</b>	Forced air cooling via rear mounted, high density, aluminium dissipator.	
<b>Electrical Power Requirement</b>		
AC input power will not exceed	270 VA	270 VA
Input fuse (20 mm antisurge) 200-240 V 100-110-120 V	3.15 A 6.3 A	3.15 A 6.3 A
Input voltage (single phase supply)	100, 110, 120, 200, 220, 240 V - 50/60 Hz	
Power connection	Rear panel mounted 3 pin IEC filter connector with integral fuse	
<b>Dimensions and Weight</b>		
Height	92 mm	3.6 in
Width	488 mm	19.2 in
Depth	337 mm	13.3 in
Weight (packed)	15 kg	33 lb

### 3. DESCRIPTION

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#### 3.1 Front Panel Controls and Indicators

Control/Indicator	Function
POWER ON (LED)	When lit indicates amplifier is switched on (by rotation of the MASTER GAIN control from the fully anticlockwise [ACW] position).
SIGNAL CLAMP (LED)	When lit indicates signal clamp circuit is active and amplifier output is zero irrespective of the position of the MASTER GAIN control.
RESET	When pressed resets the signal clamp to the OFF condition.
MASTER GAIN	Rotary control, with integral power ON/OFF switch. Sets the level of the amplifier output signal.




*Figure 3.1 Front Panel Controls and Indicators*

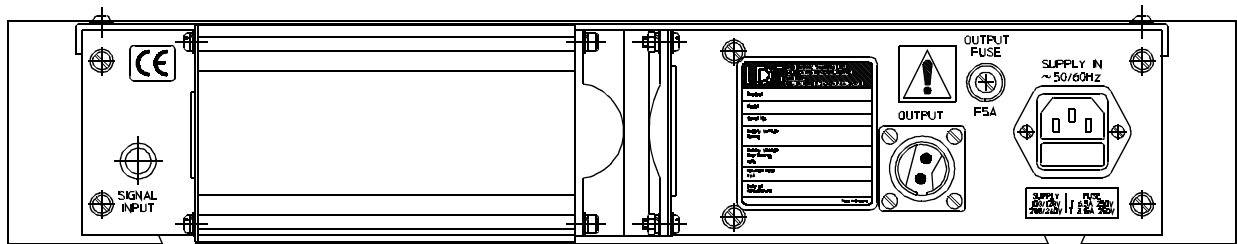


### 3. DESCRIPTION (cont.)

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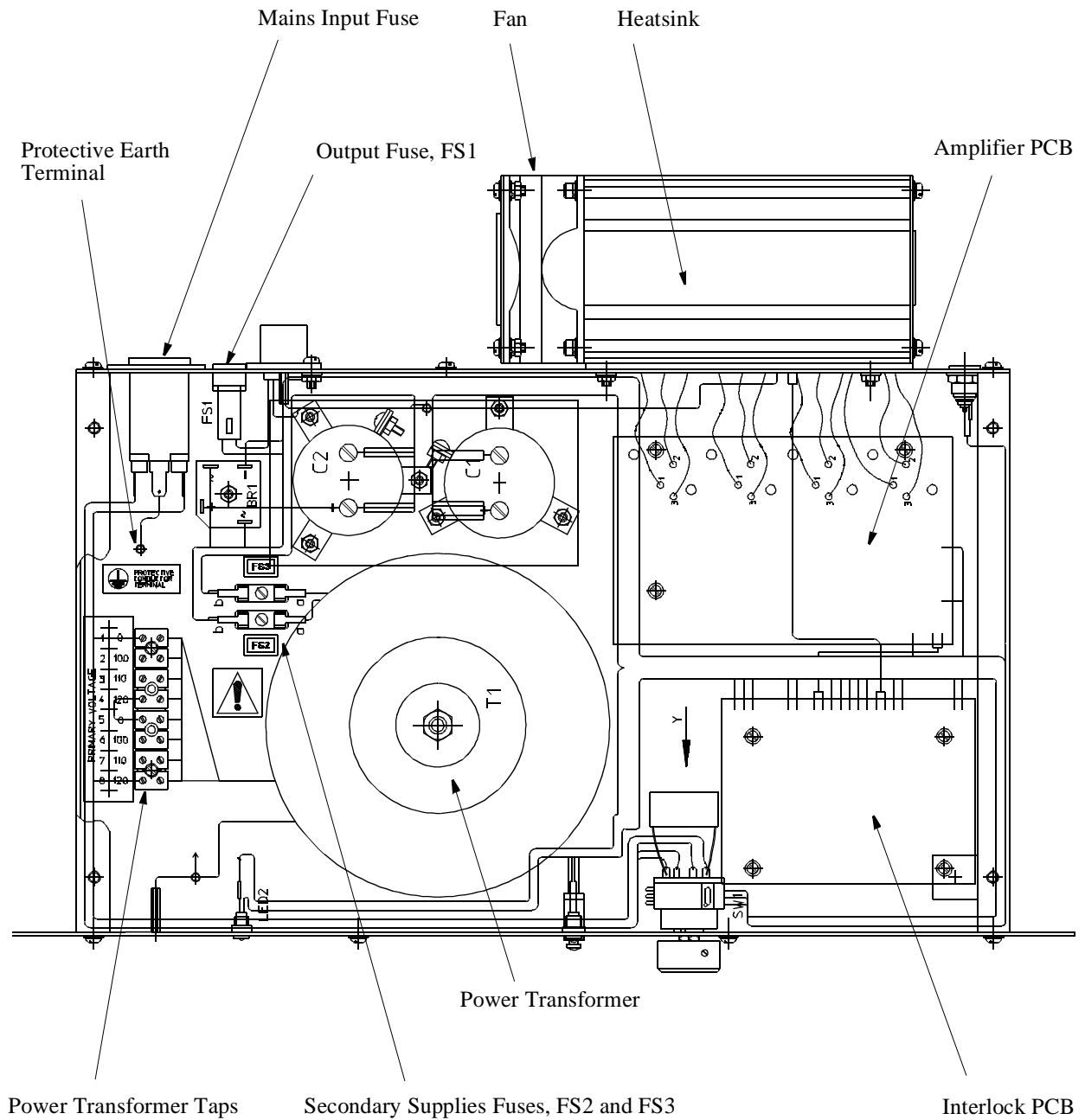
#### 3.2 Rear Panel Connections

Connection	Function
Signal Input	Triaxial socket for input drive signal. Nominal input 1.0 Vrms for full output voltage.
Output Connector	For connection to vibration generator armature 1, 2 and 
Output Fuse	Fuse connected in series with terminal 1 of output connector. Provides backup protection to output from overload conditions.  Fuse rating: 5 amp, 20 mm, fast acting.
Supply In	3 pin I.E.C. filter connector for connection to single phase supply. Contains integral fuse, for rating see Section 2.2



*Figure 3.2 Rear Panel Connections*

### 3. DESCRIPTION (cont.)



*Figure 3.3 Internal Layout*

## 4. INSTALLATION

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### 4.1 General

On receipt of the amplifier the customer should perform a visual check to ensure that no damage has occurred during transportation. It is important that the customer reads the following installation instructions regarding siting and power supply before applying mains power.

It is also recommended that the packing carton is retained in case it is necessary to return the amplifier at any time to Ling Dynamic Systems.

The PA100E has been designed primarily as a rack mounted unit but is provided with feet for bench mounting if required. Amplifiers supplied in racks from LDS will be supported by Z section runners. It is important that amplifiers fitted to customers' own racks should be adequately supported by Z section runners or similar. Under no circumstances should the weight of the amplifier be supported by the front panel, the slots of which are for location and fixing only.

The installation category for this equipment is II, reference EN61010-1:1993, pollution degree II. External equipment connected to the PA100E must have a minimum of basic insulation.

### 4.2 Mains Supply Connection

The mains connection is made via a flexible three core cable. If a fused plug top is used for the supply to the unit the fuse should be rated at 5 A.

*Note: To maintain product safety, the PA100E-CE must never be operated with the earth wire disconnected.*

#### **PORTABLE APPLIANCE TESTERS**

**In order to protect this product from the damaging effects likely to be caused by large transient voltages on the mains supply lines (e.g. during lightning strikes), surge protection devices have been fitted on the mains input socket. These devices will exhibit a low impedance when subjected to voltages above 275 V giving a false earth leakage current indication when the equipment is tested with a portable appliance (PAT) tester.**

**Temporary removal of these protection devices must be undertaken when checking true earth leakage and voltage breakdown characteristics. However, this should only be performed by qualified personnel (LDS engineers).**

**For further information please contact:**

**The Product Safety/EMC Engineer  
Ling Dynamic Systems**

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### 4.3 Input Taps (see Figure 4.1)

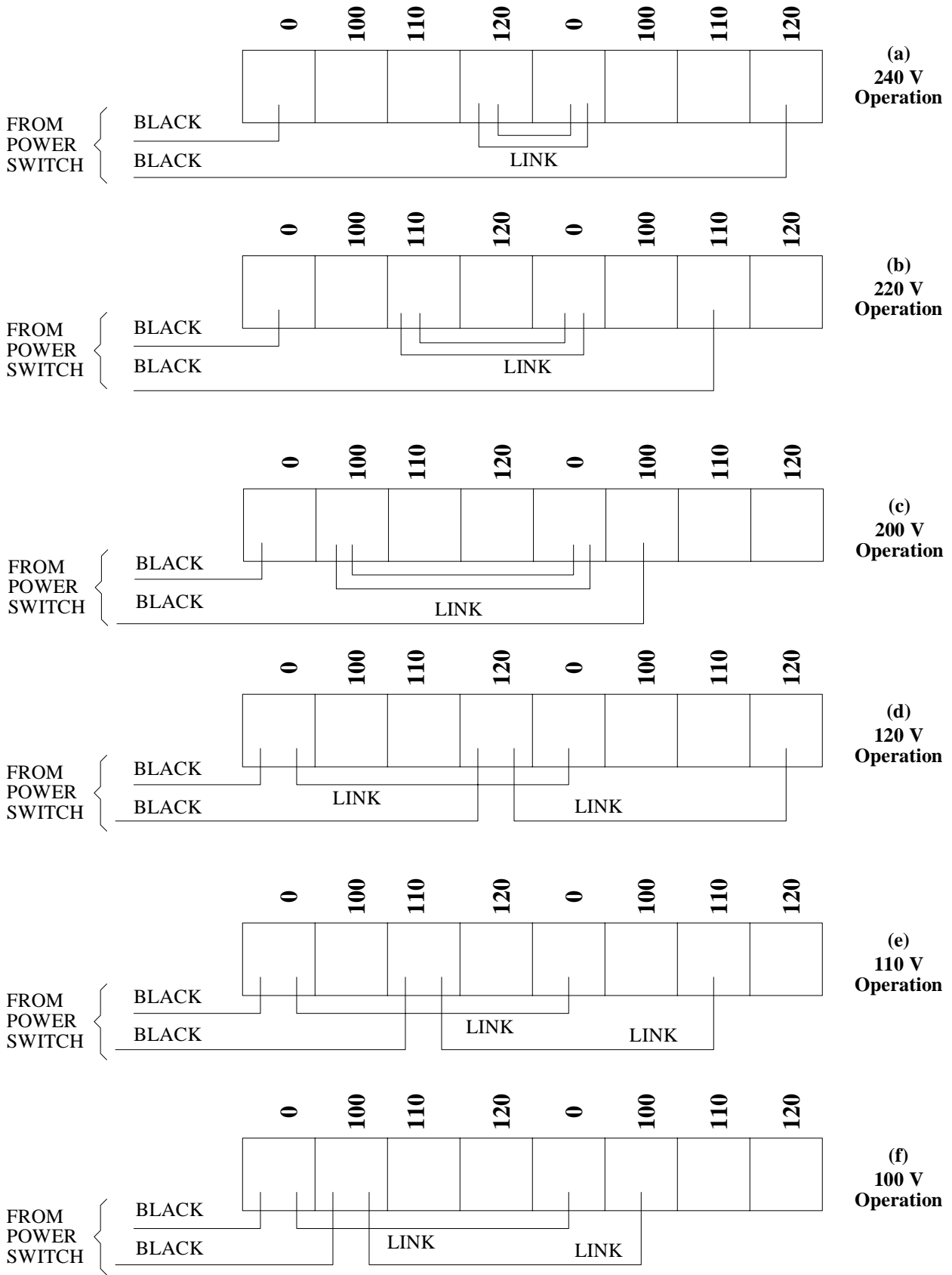
**CAUTION**

**BEFORE POWER IS APPLIED TO THE AMPLIFIER IT IS ESSENTIAL THAT IT IS CONNECTED FOR THE CORRECT POWER SUPPLY VOLTAGE AND THAT THE CORRECT INPUT FUSE IS FITTED.**

Should it be necessary to change the input tap to accommodate a different supply voltage, the following procedure should be adopted:

- (1) Ensure that the amplifier is disconnected from the mains power supply or power source.
- (2) Remove the top cover.
- (3) Check power toroidal transformer tap connection, on the terminal block mounted on the sub-chassis next to the transformer. Links should be arranged according to power supply requirements (see Figure 4.1).

**4. INSTALLATION (cont.)**



**Figure 4.1 Power Transformer Taps**

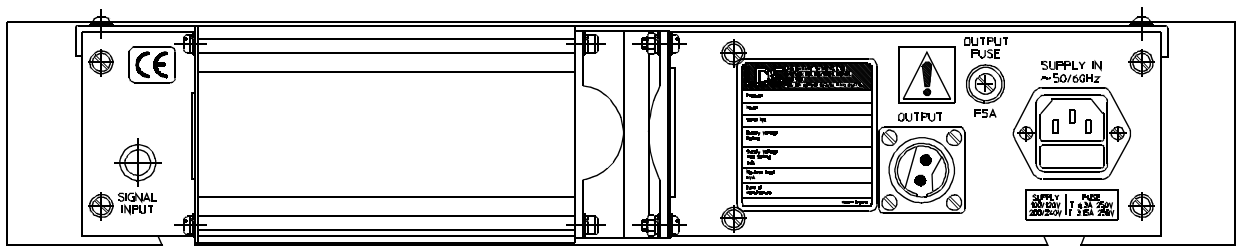
## 4. INSTALLATION (cont.)

### 4.4 Input Fuse Ratings (see Figure 3.3)

200/240 V	Supply:	3.15 amp
100/110/120 V	Supply:	6.3 amp

### 4.5 System Connections

Figure 1.1 shows the system configuration of the PA100E with a Ling Dynamic Systems V400 series vibration generator. Figure 3.2 is repeated below to aid system connection.



*Rear Panel Connections*

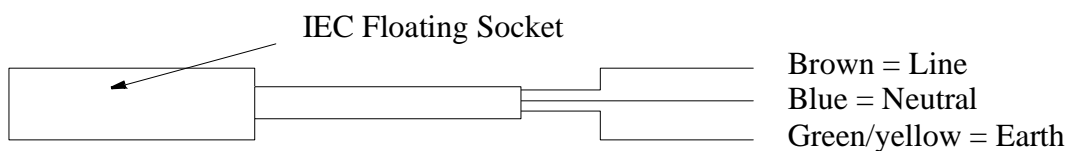
#### 4.5.1 Input

Triax socket. To maintain compliance with the EMC directive, the amplifier signal drive must be supplied via triaxial cable. LDS provide a range of triax cableforms with standard lengths of 3, 6 and 9 metres; with the option of triax-triax or triax-BNC. When using Triax-BNC it is strongly recommended that the outer braid flying lead, at the BNC end, is connected to the chassis (earth) of the signal generator.

#### 4.5.2 Output

Pin 1	:	Output high
Pin 2	:	Output low
Connector shell	⏏	Chassis earth

#### 4.5.3 Mains Lead



*Figure 4.2 IEC Socket Connections*

## 5. OPERATION

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### WARNING

**THE PA100E-CE MUST BE EARTHED. ANY INTERRUPTION OF THE PROTECTION EARTH CONNECTION IS LIKELY TO MAKE THE UNIT DANGEROUS.**

#### 4.6 Siting

When operating the amplifier, either on a bench or in a rack, adequate precautions must be taken to ensure the free flow of cooling air to and from the air cooled heat sink assembly.

**Restriction of airflow will result in a reduction in maximum performance.**

#### 5.1. General

Before applying power to the amplifier, either directly or via a power source, it is essential that all the preliminary precautions are followed (see Section 4).

#### 5.2 Operating Procedure

The following switch-on sequence should be followed irrespective of the type of load, whether a vibration system or otherwise:

- (1) Ensure signal source connected to the SIGNAL INPUT socket is set to zero level.
- (2) Rotate MASTER GAIN control from the fully anticlockwise (ACW) position to fully clockwise (CW) position. Note that the 'POWER ON' LED illuminates.

**Under no circumstances should the covers now be removed and access made to the interior of the amplifier other than by qualified service engineers.**

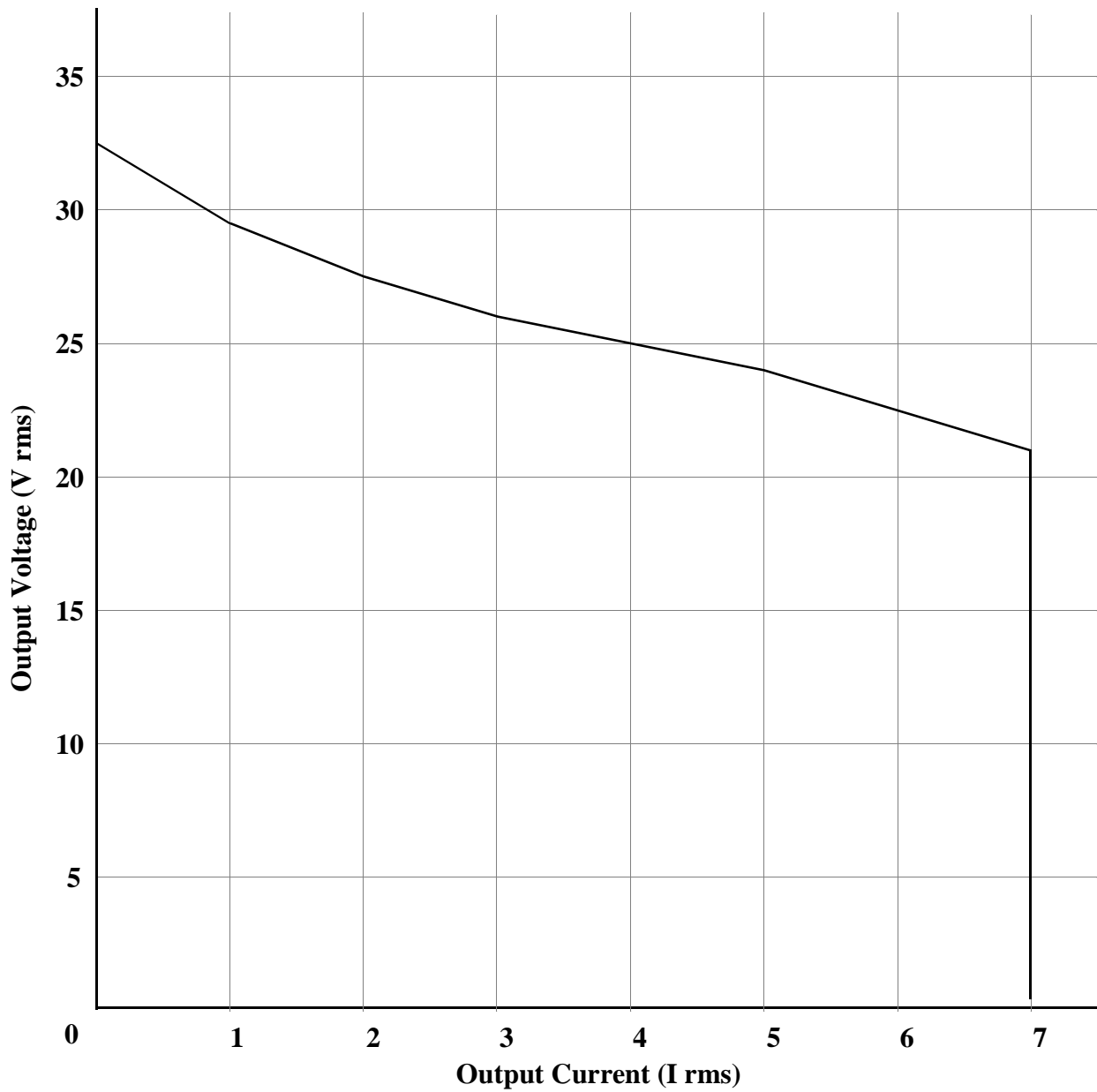
If the 'RESET' LED illuminates, press RESET and note that the RESET LED extinguishes.

- (3) Using the level control on the external signal source in conjunction with the MASTER GAIN control, set the required output level from the amplifier.
- (4) To switch off the amplifier rotate the MASTER GAIN control fully ACW and note that the 'POWER ON' LED extinguishes.
- (5) If at any time the amplifier output current exceeds 7.5 amp, the overcurrent circuit activates and the signal clamp is applied ('SIGNAL CLAMP' LED illuminated). To release the signal clamp press RESET push button. It is advisable, however, to reduce the signal level either externally or by means of the MASTER GAIN control before actuating a signal clamp reset.

A typical load characteristic is shown in Figure 5.1.

## 5. OPERATION (cont.)

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*Figure 5.1 PA100E-CE Typical Load Characteristic (100 Hz Sinewave)*



## 6. MAINTENANCE

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### 6.1 General

Although the PA100E-CE is designed for ease of maintenance it is emphasised that this should be performed by qualified LDS service engineers. Regular maintenance should not be necessary but an occasional visual inspection is recommended as a fault preventive measure.

The equipment should only be cleaned using a damp cloth. **Ensure the equipment is disconnected from the mains supply before performing this operation.**

### 6.2 Fault Diagnosis

If a fault does occur it is recommended that all connections to the amplifier are checked for open/short circuits and that all fuses are checked. If the fault still persists the amplifier should be returned to Ling Dynamic Systems for repair.

### 6.3 Fuses

**Mains Input Fuse** (located in input socket on rear panel)

200-240 V	T3.15A (20 mm antisurge)	Part No. 708940
100 -110-120 V	T6.3 A (20 mm antisurge)	Part No. 711450

**Output Fuse, FS1**, (located on rear panel adjacent to mains input socket)

F5 A (20 mm fast)	Part No. 708190
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**Secondary Supplies Fuses, FS2 and FS3**, (located inside unit on chassis)

200-240 V	FS2, T8 A (20 mm antisurge)	Part No. 629310
100 -110-120 V	FS3, T8 A (20 mm antisurge)	Part No. 629310

## 6. MAINTENANCE (cont.)

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### 6.4 Service and Spares

Various levels of recommended spares holdings, tooling and general service advice are available on request from:

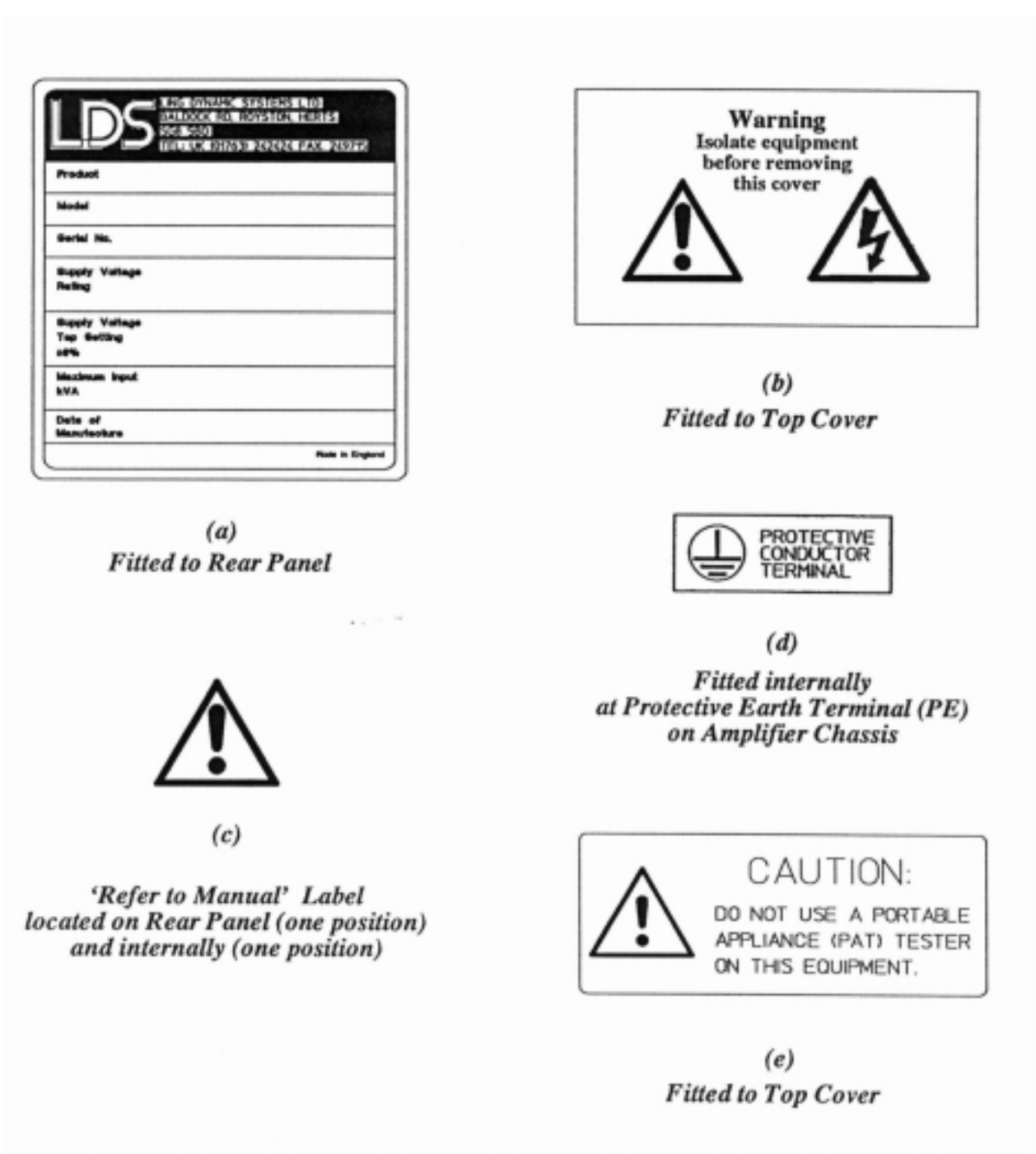
The Service Department  
Ling Dynamic Systems  
Baldock Road  
ROYSTON  
Herts. SG8 5BQ

Telephone: UK (01763) 242424  
Fax: UK (01763) 249715

## 7. WARNING LABELS

### 7.1 General

Warning labels attached to the unit are shown in Figure 7.1. They should be noted together with the relevant text in this manual.



*Figure 7.1 Warning Labels*

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*Intentionally blank*

007566

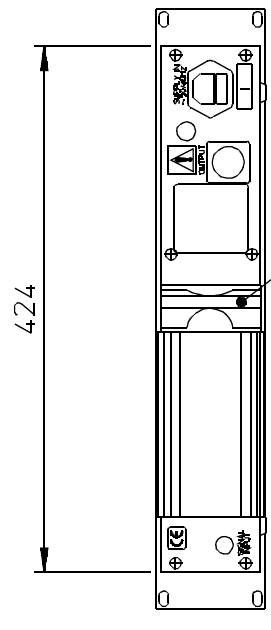
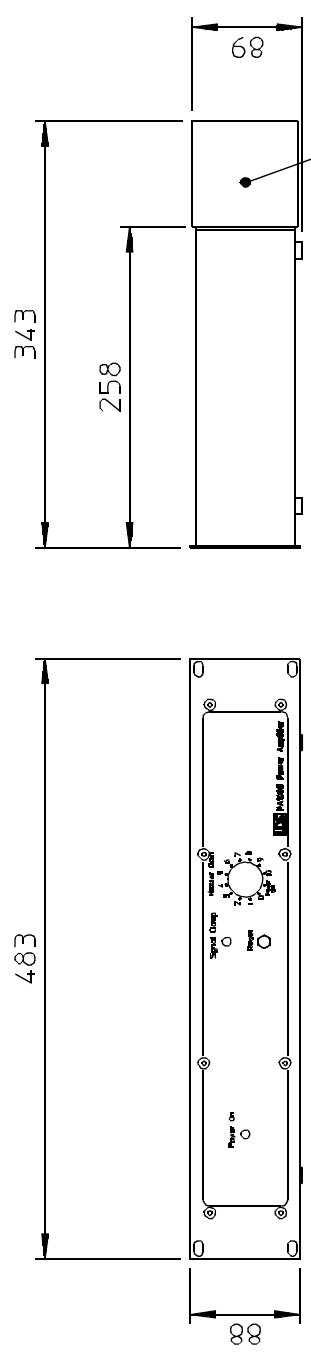
DRG: 007566

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ROYSTON, HERTS. ENGLAND.

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ISSUE

A	24/01/96
1	25/01/96



HEATSINK

AIRFLOW  
COOLING FAN

USED ON  
DATE 24/01/96

FOR EXPLANATION OF DIMENSIONS & NOTES ETC  
SEE BS 308

ALL DIMENSIONS IN MILLIMETRES

Machine where marked  $\nabla$   
Surface texture values in  $\mu\text{m}$   
Threads are isometric  
Coarse Series  
Tolerance Class 6g/6H to  
BS 3643

Tolerances unless otherwise  
Stated  $\pm 1$   
Where one decimal place is shown  
ie. 15 =  $\pm 0.15$   
Where two decimal places are shown  
ie. 150 =  $\pm 0.25$   
Tolerance on drilled holes  
 $\pm 1\%$  OR  $\pm 0.05$  whichever is greater  
Angular tolerance  $\pm 1^\circ$

MATERIAL: \_\_\_\_\_  
FINISH: \_\_\_\_\_

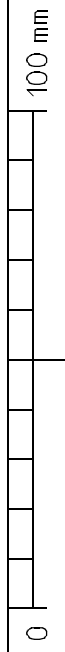
TITLE  
OUTLINE DRAWING,  
PA 100E

DRAWN	CHECKED	SCALE	DRG No.
NJC	RM	NTS	995400

REMOVE ALL BURRS & SHARP EDGES.  
MARK PART NUMBER AND ISSUE NUMBER WHERE SHOWN THIS



DO NOT SCALE



SHT 1 OF 1 SHTS

THIRD ANGLE  
PROJECTION

