

*Operating Manual*  
**LDS LPA600 and LPA1000**  
**Amplifiers**

*Manual 3005430*

*Issue 5*

**Brüel & Kjær**   
BEYOND MEASURE

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## Associated publications

	<b>No.</b>
Operating Manual, V400 Series Vibrators .....	3005360
Operating Manual, V450 Series Vibrators .....	3005370

## LDS MANUALS

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*LDS manuals are continually updated to suit different configurations and applications. For certain products and systems some information in this manual may not be relevant; where it does not apply it should be ignored.*

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## ISSUE HISTORY

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### Operating Manual, LDS LPA600 and LPA1000 Amplifiers

Published August 2017

#### Amendments

<i>Date</i>	<i>Issue</i>	<i>Sections Affected</i>	<i>Brief Details</i>	<i>ECO</i>
12.9.17	2	Chapters 1-3	Added LPA1000 without FPS	–
16.11.17	3	2.3, 6.4	Weight, fuses (including LPA1000); warnings	–
9.1.18	4	Chapter 1, 2.1	Schematic, frequency range	–
5.4.18	5	Figure 1, 2.2, 3.3, 4.3, 4.5, Table 5	Fan interlock	VTS10101



## HEALTH AND SAFETY NOTICES

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### DEFINITIONS

For the purposes of this manual:

**Danger Zone** means a zone extending 2 m (6 ft) 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. The information contained in these notices and elsewhere in Brüel & Kjaer technical publications should be considered as part of provision and use of work equipment (PUWER or equivalent) assessments. Where risks and hazards are identified, appropriate warning signs should be displayed and exclusion zones defined.

#### 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 Brüel & Kjaer 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.



### 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.**

### Magnetic Fields

Electromagnetic vibrators and associated power products produce DC and low-frequency magnetic fields. In the light of medical research on the effect of electromagnetic fields on the human body, Brüel & Kjaer recommend that wearers of electromedical implants take especial care not to enter the danger zone while the vibrator is operational.

Brüel & Kjaer 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 Brüel & Kjaer 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 Brüel & Kjaer 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. Brüel & Kjaer 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 Brüel & Kjaer 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.

### VISUAL SYMBOLS

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

### CONFORMITY

LDS equipment is designed specifically for vibration testing and should not be used for any other purpose except by agreement with Brüel & Kjaer.

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

Low Voltage	2014/35/EU
EMC	2014/30/EU
Restriction of Hazardous Substances	2011/65/EU

For installation, use and maintenance of this equipment the responsibilities of employer and employee are specified in Work Equipment Directive 2009/104/EC 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 1998' 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.

BRÜEL & KJAER DOES NOT ACCEPT RESPONSIBILITY FOR RISKS  
INTRODUCED BY JIGS, FIXTURES AND PAYLOADS.

FOR LDS JIGS AND FIXTURES SEE THE APPROPRIATE MANUAL.

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



## Chapter 1 Introduction

The LDS LPA600 and LPA1000 amplifiers are air-cooled linear amplifiers designed to drive reactive loads such as LDS V400 and V450 Series vibrators. They can be used more generally as voltage generators with low output impedance and a flat voltage frequency response.

The amplifiers are functionally identical, differing only in power output and related characteristics.

When used as part of a vibration test system this manual should be read in conjunction with the relevant vibrator manual.

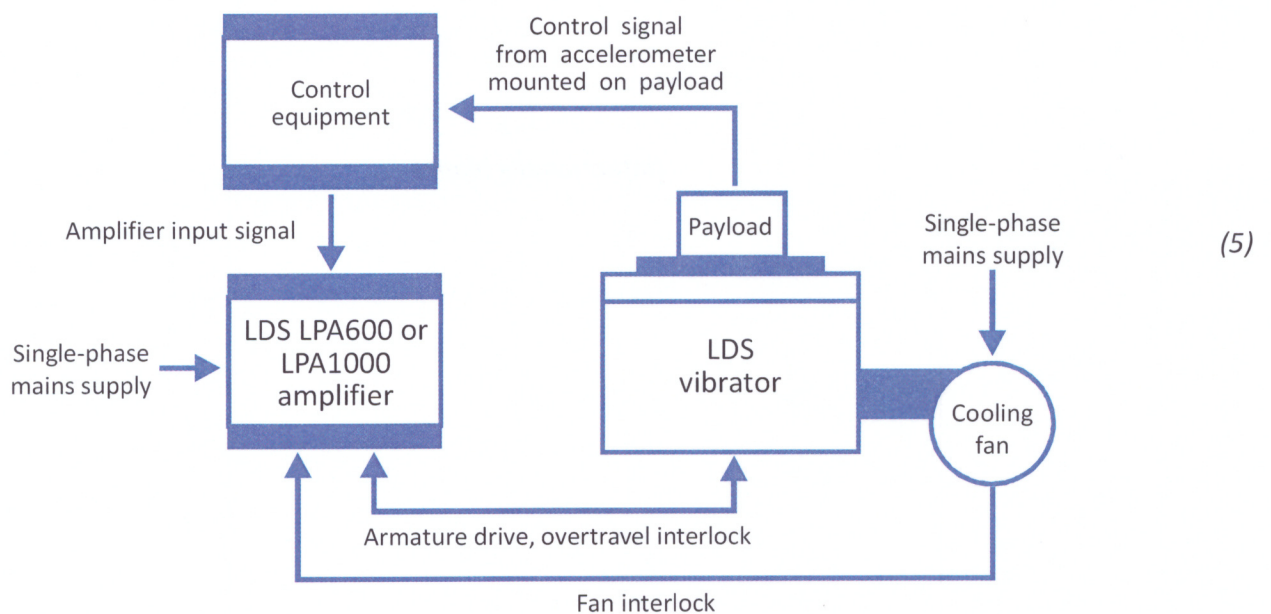


Figure 1 Vibration test system with LPA600 or LPA1000 amplifier



## Chapter 2 Technical Data

### 2.1 Performance

(4)

	LPA600	LPA1000
<b>Classification</b>	Class B linear amplifier, air-cooled	
<b>Rated output</b>		
Power	656 VA into 2.5 $\Omega$ load	961 VA into 4 $\Omega$ load
Current	16.2 A rms	15.5 A rms
<b>Maximum output (<math>\leq 30</math> min)</b>		
Power	810 VA into 2.5 $\Omega$ load	1296 VA into 4 $\Omega$ load
Current		17.75 A rms
<b>Frequency range</b>		
<i>Usable range</i>	<i>DC to 15 kHz</i>	
<i>At rated power</i>	<i>(output current availability reduced below 40 Hz)</i>	
<i>At maximum power</i>	<i>40 Hz to 15 kHz</i>	
	<i>40 Hz to 10 kHz</i>	
<b>Harmonic distortion at rated output</b>	<0.2% 40 Hz to 5 kHz, <0.3% 5 kHz to 10 kHz	
<b>Maximum output voltage</b>	45 V rms	72 V rms
<b>Gain</b>	45 V/V $\pm 2$ dB	72 V/V $\pm 2$ dB
<b>Signal to noise ratio</b>		>95 dB
<b>Efficiency</b>	57%	64%
<b>Monitoring outputs, 5 Hz to 15 kHz</b>		
Voltage		0.05 V/V $\pm 3\%$
Current		0.1 V/A $\pm 3\%$

## 2.2 Features

### Outputs

- Vibrator drive
- Voltage and current monitoring signals
- interlock interface (with provision for operation with FPS )

### Controls and displays

- Amplifier on/off pushbutton
- Gain control with reset
- Current limit control
- LED function indicators
- LCD display of voltage, current and error messages

### Interlocks

The following internal or external fault conditions will cause the amplifier to shut down:

- Output current exceeds limit set
- Output transistors overheating
- Vibrator overtravel
- External interlock (where connected)
- Error indicated by LDS FPS (where connected)
- Loss of power to vibrator cooling fan

(5)

### Cooling

Forced air cooling using internal fans.

### Safety

Designed in accordance with EN 61010-1:2010.



## 2.3 Environmental

	LPA600	LPA1000
<b>Electrical supply</b>		
Input kVA	< 1.85	< 2.7
Voltage 1-phase	100, 120, or 230 V ± 10%, 50/60 Hz (factory preset)	
Line current	See Note 3	
<b>Environmental</b>		
Working ambient temperature	+5° to +40° C (+41° to +104° F)	
Airflow inlet temperature range	+1° to +30° C (+34° to +86° F)	
Working ambient pressure	900 to 1100 mbar (27 to 33 in Hg)	
Relative humidity (non-condensing)	80% up to 31° C, linear decrease to 50% at 40° C	
Heat rejected to air	0.8 kW	1.6 kW
Acoustic noise	45 dBA	49 dBA
<b>Weight and dimensions</b>		
Weight	27 kg (60 lb)	33 kg (73 lb)
Width	483 mm (19.0 in), with flanges for rack mounting	
Height	132 mm (5.2 in) excluding feet	
Depth (excluding 2 mm front plate)	450 mm (17.7 in)	550 mm (21.6 in)

(3)

### Notes

1. Electrical supply input figures are worst case demands. Average power under swept sine or random test conditions will be lower.
2. The customer is responsible for: mains supply and fuses, all trunking or conduit, air conditioning, ventilation and soundproofing, system emergency stop where required.
3. Line current A =  $\frac{\text{Input kVA} \times 1000}{\text{line voltage}}$
4. An RFI earth may be fitted by the customer if required; the cable should be independently connected to the input supply earth, or connected to a local isolated earth plate adjacent to the vibration system. RFI earth impedance must be as low as possible, preferably not greater than 0.1 Ω.
5. The vibrator earth connection is via the drive cable assembly.
6. The determination of noise levels is a varied and complex procedure. Figure 2 shows the conditions under which the values stated were obtained.

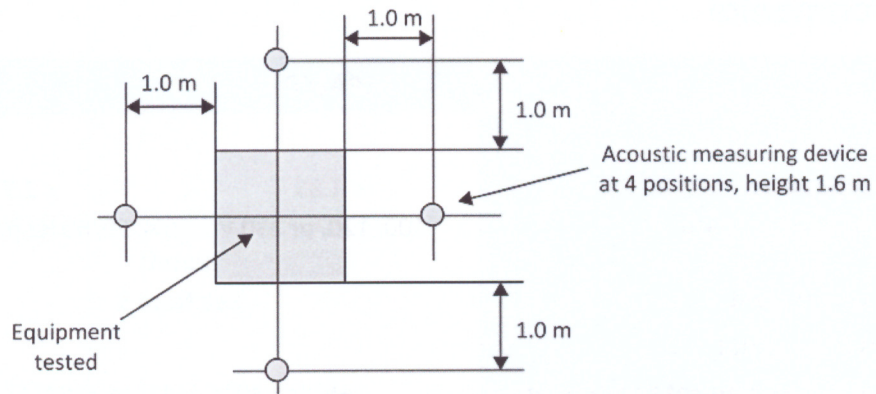




Figure 2 Noise measurement – plan view

## 2.4 Labelling

The following textual labels are affixed to the amplifiers:

<b>LDS LPA600</b>			
MADE IN GERMANY		S/N: B0603E1A17K0001	
P/N: 2035790-X03 REV: 01		A B	
MAINS POWER		C	
<1850VA ~50-60Hz 230V ± 10%		Ⓢ	
FS1	T10A H 250V		

- a) “Model no; made in Germany; part and serial no; mains power”

<b>LDS LPA1000</b>			
MADE IN GERMANY		S/N: B1003E1A17K0001	
P/N: 2035800-X03 REV: 01		A B	
MAINS POWER		C	
<2700VA ~50-60Hz 230V ± 10%		Ⓢ	
FS1	T16A H 250V		



## Chapter 3 Description

---

### 3.1 Function of amplifier

The LDS LPA600 and LPA1000 amplifiers are designed for use in an electrodynamic vibration test system (shown schematically in Figure 1) comprising:

- A vibration generator ('the vibrator') with associated cooling fan
- The amplifier
- An external signal source/controller

The basic functions of the amplifier are:

- To amplify the external signal so as to drive the vibrator armature.
- To monitor system operation and shut down drive to the vibrator if a fault condition is sensed. (5)

System monitoring is provided by amplifier control circuitry as described later in this chapter. If certain parameters of the vibrator or amplifier are exceeded or fail, the amplifier is shut down as quickly as possible and an interlock indication presented to the user.

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

#### Use with field power supply

Both amplifiers have provision for operation with an LDS field power supply, enabling operation of the LPA600 with LDS V555, V650 and V721 Series vibrators in low power applications. For further details contact Brüel & Kjær VTS.



Figure 3 Front view

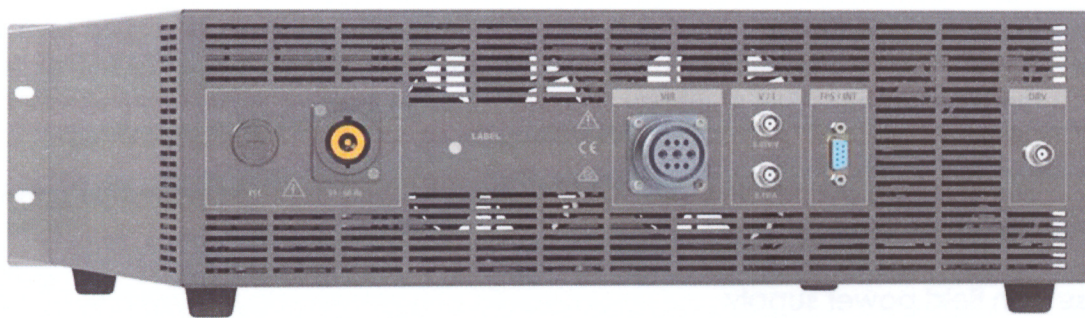


Figure 4 Rear view

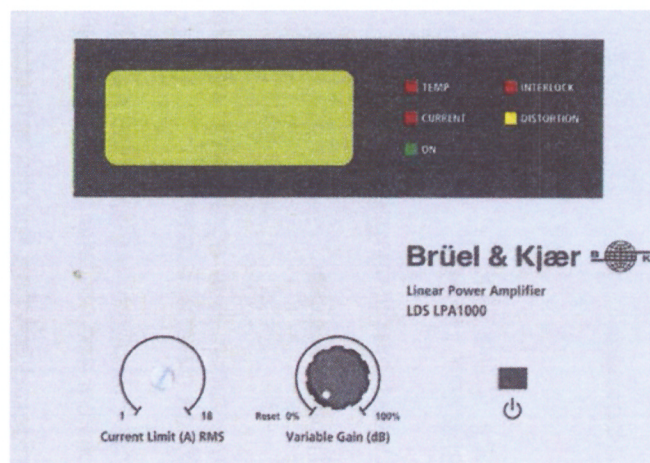


Figure 5 Front panel controls and indicators



## 3.2 Controls and indicators

The amplifier front panel contains the following controls (see Figure 5):

<b>Power</b>	Mains on/off button.
<b>Current Limit</b>	Factory set (see also Chapter 4, 'Current limit')
<b>Variable Gain / Reset</b>	Single-turn, logarithmic potentiometer for continuous adjustment of input signal level. Turning the control anticlockwise past the click and back again resets the amplifier.
<b>LCD display</b>	Described below.
<b>LED indicators</b>	Described below.

### LCD display:

<b>Voltage RMS</b>	Accuracy $\pm 5\%$ , 40 Hz to 10 kHz
<b>Current RMS</b>	Accuracy $\pm 5\%$ , 40 Hz to 10 kHz
<b>Error outputs</b>	'Reset Gain' 'FPS Error' 'Overtr[avel] Control' 'Interlock 1'

### LED indicators:

<b>ON</b>	Lights green when amplifier is switched on.
<b>TEMP(erature)</b>	Lights red if output transistors overheat. Amplifier must be reset.
<b>CURRENT</b>	Lights red when output current to the load exceeds the Current Limit set. Amplifier must be reset.
<b>INTERLOCK</b>	Lights red when the interlock circuit is activated. Amplifier must be reset.
<b>DISTORTION</b>	Lights yellow when output voltage or current clipping take place.

*Note: Significance of LCD and LED outputs are described further in Chapter 6, 'Fault-finding'.*

### 3.3 System monitoring

Possible faults are monitored as follows:

- Overcurrent
- Overtemperature
- Vibrator overtravel
- External interlock
- Vibrator cooling fan supply

(5)



## Chapter 4 Installation

This chapter provides information on the following topics:

- Physical installation of the amplifier
- Mains supply
- Output and signal connections
- Adjustment of current limit
- External interlock



### WARNING

- Incorrect lifting methods can cause serious personal injury and damage to the equipment.
- Attention is drawn to the safety precautions and hazard warnings contained within the preface to this manual.
- Lethal voltages and high temperature areas are present within the equipment. In no circumstances should covers be removed.

### 4.1 Physical installation

Extreme care must be taken when lifting/moving the equipment (recommended two persons, one taking the two front corners, the other the two back corners) as incorrect lifting methods can cause serious personal injury, and damage to the equipment.

1. Check that all electrical services are available as detailed in Chapter 2, 'Environmental'.
2. Check the equipment received against the packing list. Inspect all equipment for transit damage, and report to Brüel & Kjær within 48 hours.

*Note: It is recommended that the packing carton be retained in case it becomes necessary to return the equipment to Brüel & Kjær.*

3. The equipment has been designed for either 19" rack (with rubber feet removed) or bench mounting.

If fitted in a rack, each unit must be supported by a shelf or equivalent. The side flanges are for location only and will not support the unit weight.

4. To ensure effective cooling it is important to ensure a free flow of air through the input vents in the front panel to the output vents in the back.

## 4.2 Mains supply

### Location



#### WARNING

- The amplifier must be located so that in emergency it can readily be disconnected from the mains supply.
- When rack-mounted, the mains supply must be local to the rack.

### Connection

The rear panel mains connection and fuse are shown in Figure 6.

The mains cable supplied has live, neutral and protective earth cores.

### Input voltage

The input voltage is factory-set as shown on the serial label. If a different voltage is required contact Brüel & Kjær for advice.

Check that the correct mains fuse FS1 is fitted as detailed in Chapter 6, 'Fuses'.

### Mains supply and earth



#### WARNING

- The amplifier must be earthed via the mains supply protective earth.

Use the cable supplied to connect the mains supply to the amplifier mains input socket.

Note the following points:

- The supply must include protective earth.
- The supply should be in close proximity to the equipment (i.e. within easy reach of the operator) and should be marked as the disconnecting point for the equipment.

The installation category for this unit is II (ref. EN61010 - 1 : 2010), pollution degree II.



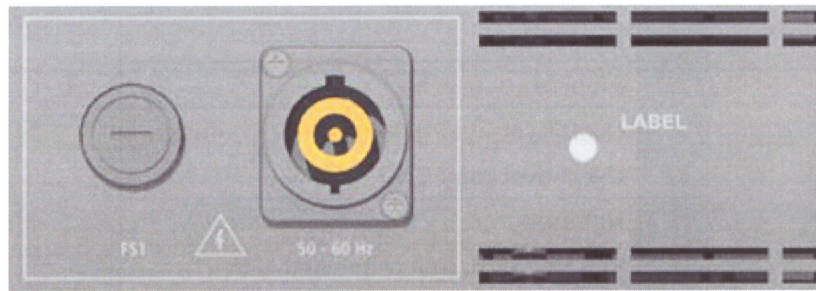


Figure 6 Mains supply and fuse

### 4.3 Output and signal connections

Figure 7 shows the amplifier rear panel connections.

<b>VIB</b>	Power output accepting 9-pin plug for connection to vibrator. For pin-outs see Table 1.	
<b>V/I – 0.05V/V</b>	BNC output of amplifier voltage waveform (including dc component).	
<b>V/I – 0.1V/A</b>	BNC output of amplifier current waveform (including dc component).	
<b>FPS/INT</b>	9-pin D-Sub socket. See also 'External interlock' later in this chapter.	(5)
<b>DRV</b>	BNC capacitive coupled input.	

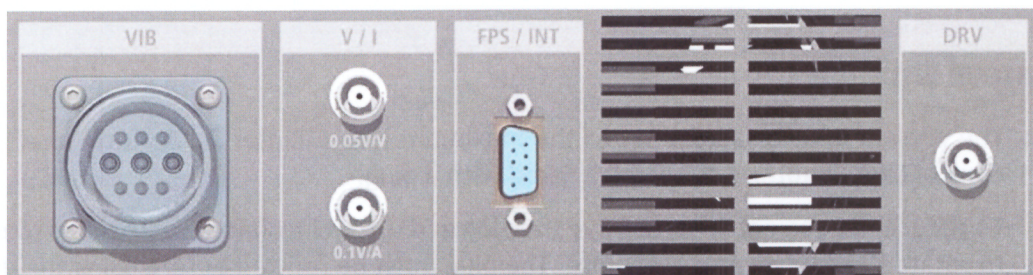


Figure 7 Output and signal connections



Table 1 VIB pin-outs

A	Not used
B	Amplifier output high
C	Overtravel input (potential-free contact)
D	Overtravel input GND
E	Not used
F	Vibrator earth (not connected with vibrator GND)
G	Not used
H	
I	Amplifier output low / GND

Table 2 FPS/INT pin-outs

1	Not used
2	'FPS error' (fan interlock)
3	Not used
4	GROUND
5	
6	Interlock 1*
7	Interlock 1 GROUND*
8	Not used
9	
* Linked out as standard	

(5)

#### 4.4 Current limit

The current limit is factory-set to the maximum (see Chapter 2, 'Performance') and the control (see Chapter 3, 'Controls') fitted with a plug.

To reduce the current limit, remove the plug and use an insulated electrician's screwdriver to rotate the control anti-clockwise. The plug must be refitted before using the unit.

#### 4.5 External interlock

A normally-closed connection is available for the customer to connect an external interlock. Connection is via the FPS/INT socket (see Table 2) and will require a special cable; the interlock is displayed as 'Interlock 1'.

(5)

#### 4.6 Installation with non-LDS vibrator

If the amplifier is required to drive a non-LDS vibrator, a cableset without vibrator connector can be supplied to special order.

Any output cables used with the amplifier must be suitably rated.

## Chapter 5 Operation



### CAUTION

- This equipment should only be operated by persons trained in the techniques of vibration testing.

### WARNING

- Never operate the amplifier without the protective earth connected.

### 5.1 Connection to mains supply

The amplifier must not be connected to the mains supply unless all system cables are connected, and must be isolated from the mains before disconnecting any cables.

### 5.2 System operation

The amplifier is operated using the front panel controls described in Chapter 3.

Operating the amplifier involves:

- switching on and starting up
- switching off normally and in emergency
- recognizing interlock trips

### 5.3 Start-up procedure

1. Prepare the vibrator for operation as described in the appropriate manual. Check that the vibrator is ready to have power applied and all other equipment is ready for operation.
2. Apply single-phase power to the amplifier.
3. Press the Power button on the amplifier.
4. Check that the cooling fans are operating correctly, with sufficient air flow from front to back of the unit.
5. Turn the Gain control fully anticlockwise, then clockwise to the desired level (typically 100%).
6. The LCD display should display voltage and current levels; only the On LED should be lit.
7. The system is now ready for operation.

## 5.4 Switch-off procedure

At the conclusion of a test, the system must be switched off as follows:

1. Turn the Gain control fully anti-clockwise.
2. Switch off the amplifier.

### Emergency switch-off

In emergency the system can be switched off by disconnecting the amplifier at the mains supply.

## 5.5 Interlock faults

If at any time during operation an interlock is tripped, the system will shut down and the front panel LCD display will show the relevant fault.

Once the interlock has been cleared, the amplifier must be reset by turning the Gain control fully anti-clockwise.

Possible interlock faults are detailed in Chapter 6, 'Fault-finding'.

## 5.6 Fast cooling of vibrator

At the conclusion of a test, the vibrator can be cooled down more rapidly by leaving the cooling fan on.



## Chapter 6 Maintenance

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### WARNING

- Attention is drawn to the safety precautions and hazard warnings contained within the preface to this manual.
- Lethal voltages and high temperature areas are present within the equipment. In no circumstances should covers be removed.

### 6.1 Maintenance policy

This chapter details the routine maintenance activities recommended by Brüel & Kjær and gives simple fault finding guidance.

It is strongly recommended that a full maintenance contract is taken out with Brüel & Kjær.

### 6.2 Operating log

The equipment history can prove invaluable should advice be required from Brüel & Kjær, so users are strongly advised to keep a daily log recording the following information:

- Number of hours run
- Timetable of interlock trips
- Cause of interlock trips
- Action taken to rectify faults
- Any matters of concern.

### 6.3 Routine maintenance

The amplifier has been designed for minimal maintenance but the following checks are recommended.

#### Daily

1. Ensure the area around the amplifier is
  - clean and free of dust
  - clear of obstructions which could prevent adequate airflow to air intake grilles.
2. Switch on the amplifier and check that the cooling fans are operating. Listen for any noise which suggests a cooling fan is not operating smoothly.

#### Monthly

1. Inspect air intake grilles. Brush off any dust or fluff that has accumulated.
2. Check that all connections to the amplifier are secure.

## 6.4 Fuses

(3)

This section lists the type and value of user-replaceable fuses in the amplifier, mounted in a fuse holder on the rear panel (see Figure 4).



### WARNING

- Before attempting to replace any fuse, ensure that the mains supply is switched off at the isolator.

- Replacement fuses must be as specified in Table 3 below.
- Do not use mended fuses or short-circuit the fuse holder.
- Under no circumstances should fuse replacement be attempted by persons not qualified in the service of electronic instrumentation.

### LPA600

Table 3 Fuses – LPA600

Fuse	Supply voltage	Rating and size	Part No.
Mains input FS1	100V	T, 20A, H, 250V, 6.3 x 32 mm	2036320
	120V	T, 20A, H, 250V, 6.3 x 32 mm	2036320
	230V	T, 10A, H, 250V, 5 x 20 mm	2036330

### LPA1000

Table 4 Fuses – LPA1000

Fuse	Supply voltage	Rating and size	Part No.
Mains input FS1	100V	T, 25A, H, 250V, 6.3 x 32 mm	2036420
	120V	T, 25A, H, 250V, 6.3 x 32 mm	2036420
	230V	T, 16A, H, 250V, 5 x 20 mm	2036310



6.5 Fault-finding

Table 5 Diagnostics

Symptom	LCD display	On	In- terlock	Temp	Current	Distortion	Cause
Cannot run test	Voltage and current	G					Vibrator cable (VIB) not connected to amplifier; or incorrectly connected eg drive signal to monitoring output
Cannot run test	Reset Gain!	G	R				Gain not in reset position when amplifier is switched on
Cannot run test	FPS Error!	G	R				Vibrator cooling fan supply (failed, fuse blown, not switched on).
System shuts down	None						Amplifier fuse blown
System shuts down	Voltage and current	G		R			High temp of amplifier
System shuts down	Voltage and current	G			R		Test draws too much current.
System shuts down	Overtr. Control	G	R				Vibrator overtravel reached during test

(5)