



25A BIAS UNIT

3265A

User Manual

Part N° 9H3265A

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1. SAFETY

1.1 General



This equipment has been designed to meet the requirements of EN61010-1 'Safety requirements for electrical equipment for measurement, control and laboratory use' and has left the factory in a safe condition.

The following definitions in EN61010-1 are applicable:

OPERATOR	Person operating equipment for its intended purpose. Note: The OPERATOR should have received training appropriate for this purpose.
RESPONSIBLE BODY	Individual or group responsible for the use and maintenance of equipment and for ensuring that operators are adequately trained.

The RESPONSIBLE BODY must ensure that this equipment is only used in the manner specified. If it is not used in such a manner, the protection provided by the equipment may be impaired.

The equipment is intended for use by suitably trained and competent persons.

The equipment can cause hazards if not used in accordance with these instructions. Read them carefully and follow them in all respects.

Do not use the equipment if it is damaged. In such circumstances the equipment must be made inoperative and secured against any unintentional operation.

WARNING Back EMF!

Lethal back EMF potentials can be generated if an inductor under test is disconnected whilst current is still flowing in it. The energy is proportional to the square of the current and back EMFs can reach several kilovolts.

NEVER touch the test connections while the direct current is flowing.

USE the Safety Interlock, see section 6.2.6, 'SAFETY Interlock'.

1.2 AC Power Supply

Power cable and connector requirements vary between countries. Always use a cable that conforms to local regulations, terminated in an IEC320 connector at the instrument end.

If it is necessary to fit a suitable AC. power plug to the power cable, the user must observe the following colour codes:

WIRE	EUROPEAN	N. AMERICAN
LIVE	BROWN	BLACK
NEUTRAL	BLUE	WHITE
EARTH	GREEN/YELLOW	GREEN

The user must also ensure that the protective earth lead would be the last to break should the cable be subjected to excessive strain.

If the plug is fused, a 13-amp fuse should be fitted.

If the power cable electrical connection to the AC power plug is through screw terminals, any solder tinning of the cable wires must be removed before fitting the plug to ensure reliable connections.

WARNING Earth Conductor!

Any interruption of the protective earth conductor inside or outside the equipment, or disconnection of the protective earth terminal, is likely to make the equipment dangerous. Intentional interruption is prohibited.

1.3 Adjustment, Maintenance and Repair

When the equipment is connected to the local AC power supply, internal terminals may be live. Opening of the covers, or removal of parts (except those to which access can be gained by hand), is likely to expose live parts. The equipment must be disconnected from all voltage sources before it is opened for any adjustments, maintenance or repair.

Capacitors inside the equipment may still be charged even if the equipment has been disconnected from all voltage sources.

Any adjustment, maintenance or repair of the opened equipment under voltage must be carried out by a skilled person who is aware of the hazards involved.

Ensure that only fuses of the specified type and correct current rating are used for replacement. The use of makeshift fuses and short circuiting of fuse holders is prohibited.

1.4 Static Electricity

The unit supplied may use static sensitive devices. Service personnel should be alerted to components which require handling precautions to avoid damage by static electrical discharge.

Before handling circuit board assemblies containing these components, personnel should observe the following precautions:

- 1) The work surface should be a conductive grounded mat.
- 2) Soldering irons must be grounded and tools must be in contact with a conductive surface to ground when not in use.
- 3) Any person handling static sensitive parts must wear a wrist strap which provides a leaky path to ground, impedance not greater than $1M\Omega$.
- 4) Components or circuit board assemblies must be stored in or on conductive foam or mat while work is in progress.

New components should be kept in the suppliers packaging until required for use.

WAYNE KERR ELECTRONICS LTD and the associated sales organizations accept no responsibility for personal or material damage, nor for any consequential damage that results from irresponsible or unspecified operation or misuse of this equipment.

2. SCHEDULE OF EQUIPMENT

The instrument has been carefully packed to prevent damage in transit. When removing the unit from the packing box, ensure that all parts are removed from the packing material. Retain the packing box and material.

The complete equipment, WK Part Number 1J3265, comprises:

Description	WK Part Number	Qty
3265A 25A Bias Unit	1J3265	1
Detachable AC Power Lead	HC22V2	1
User Manual	9H3265A	1
PMA3260A to 3265A Coaxial Link Cables	5-324-2015	4
Control Link Cable	5-324-2020	1
Spare Fuses: 1.6A Fast-Acting HRC, 5mm x 20mm	FF1A605X20HRC	2

Accessories (optional)	WK Part Number	Qty
Rack Mounting Kit	7SM5593	4
Kelvin clip leads (fine jaws)	1EVA40100	
Kelvin clip leads ((large jaws)	1EVA40180	
Power transfer bus bars (2 each per unit in parallel)	4-324-6009	
Filter pad (washable)	Contact Wayne Kerr	

NOTE: In the event of damage in transit or shortage in delivery, separate notices in writing should be given to both carriers and WAYNE KERR Electronics Limited, or local agent if outside the UK, within three days of receipt of goods, followed by a complete claim within five days. All goods which are the subject of any claim for damage in transit or missing items should be preserved intact as delivered for a period of seven days after making the claim, pending inspection or instructions from WAYNE KERR Electronics Limited, or any agent of this company.

3. INTRODUCTION

3.1 Description

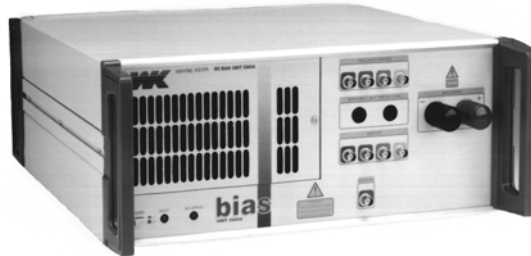


fig 3-1 3265A Bias Unit

The 3265A can be used on the bench-top or rack-mounted. It is intended to be used with a PMA3260A or PMA3260P, extending the DC bias capability from 1A to 25A. Up to five 3265A bias units, with the outputs connected in parallel, may be connected to a single PMA3260A to give a maximum of 125A DC bias capability.

Bias currents of less than 1A may be applied using the PMA3260A BNC terminals when a 3265A is connected. Fuses are incorporated on the front panel of the 3265A to protect low current cables. Alternatively, bias currents from 25mA to 25A may be applied from the 3265A heavy current terminals.



fig 3-2 PMA3260A Precision Magnetics Analyzer



fig 3-3 PMA3260P Precision Magnetics Analyzer

The host PMA3260A has full control of the 3265A, output current being set via a menu from the PMA3260A or by GPIB statements. Warning messages and the status of the 3265A are displayed on the PMA3260A. A warning LED on the PMA3260A and 3265A indicates when dc bias is being applied. The 3265A will go into standby mode if the PMA3260A mains power is removed.

Fixtures must be designed using the safety interlock with a suitable screen or cover on the PMA3260A to protect an operator when bias current is applied. Bias current will only be applied when the contacts on the safety interlock socket are shorted together.

Please read section 1 ‘SAFETY’, before using the instrument.

4. SPECIFICATION

4.1 PMA3260A Measurement Facilities

For a full description of facilities and specification see the PMA3260A user manual.

All the measurement facilities of the PMA3260A/P are available with the following exception.

Rdc Transformer Measurements	Not available when DC bias current is applied.
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4.2 3265A Facilities

DC Bias Current	25mA to 25A in 0.025A steps. Up to five 3265A units can be connected in parallel, to give a maximum bias current of up to 125A, provided that the maximum voltage drop does not exceed the compliance voltage.	
DC Bias Current Accuracy	±1% of set bias current.	
Compliance Voltage	10V DC max at 1V AC drive level (f < 12kHz) 11V DC max at 0.25V AC drive level (f < 12kHz) Where f > 12kHz, deduct 0.5V	
Frequency Range	PMA3260A or PMA3260P	20Hz to 500kHz
	PMA3260A/Q or PMA3260P/Q	20Hz to 1MHz

4.3 General Data

4.3.1 Input Specification

Input Voltage	90 to 255V AC
Frequency	47 to 63Hz
Input Current	9A RMS max
Power Factor	> 0.9
Input fuse rating	10A 'T' type, 5 x 20mm HRC The input fuse is the fuseholder drawer integral to the IEC input connector.
Power-up	3265A powers up automatically when connected to a powered PMA3260A or PMA3260P. Isolating switch provided.

4.3.2 Measurement Connections

4 BNC terminals to connect to the PMA3260A with coaxial cable.

4 BNC terminals to connect with the Unit Under Test with Kelvin Leads.

DC bias current to connect to the UUT via two M8 studs. Use heavy duty cable (twisted) compatible with the maximum current applied.

Two Terminal Measurement	Via M8 studs
Four Terminal Measurement	Via Kelvin Leads and M8 studs
Measurement terminals are internally protected against normal inductor back-EMF or accidental disconnection of inductor by two 1.6A fuses. These are easily accessible from the front panel.	

4.3.3 Control Connections

I²C bus link controls application of DC current and monitors status of 3265A. Status data includes 'Excessive Voltage Drop' and 'Overtemperature'.

4.3.4 Environmental Conditions

Altitude	Altitude up to 2000m
Relative Humidity	up to 80% non conducting.
Installation category	II (in accordance with IEC664)
Pollution degree	2 (mainly non-conductive)
This equipment is intended for indoor use only in a non-explosive, non corrosive atmosphere.	

4.3.4.1 Temperature

Storage	-40°C to +70°C (-40°F to +158°F)
Operation	0°C to +40°C (32°F to +104°F) (20A max)
Full accuracy	+15°C to +30°C (59°F to +86°F) (25A max)

4.3.5 Safety

Bias safety interlock on rear panel of measuring instrument provides door lock and closed control lines.

Designed to meet the requirements of EN61010-1.

4.3.6 EMC

Complies with EN50081-1, EN50082-1 generic emissions and immunity standards by meeting with the requirements of EN55022, EN61000-4-2, EN61000-4-3, EN61000-4-4.

Note:

When subjected to a significant electrostatic discharge (in accordance with EN61000-4-2), the PMA3260A may reset itself. If a bias current is being applied (either from the 3265A or the PMA3260A), this will be removed as part of the reset procedure. This ensures the safety of the operator under normal and test conditions. Please read section 1 ‘Safety’ before using this instrument.

4.3.7 Mechanical

Height	190mm (7 ¹ / ₂ "
Width	440mm (17 ³ / ₈ "
Depth	520mm (20 ¹ / ₂ "
Weight	15kg (33lb)
Cooling	Fan cooled: intake front, exhaust rear. Fan filter accessible on front panel. Overtemperature trip provided.

4.4 Panel Symbols Used







	Refer to handbook.
	Alternating current
	Earth (ground) terminal
	CAUTION - Risk of electric shock.
	On
	Off

fig 4-1 Panel Symbols

5. INSTALLATION

IMPORTANT NOTE:

PMA3260A units purchased before November 1997 require an upgrade. Please contact the Wayne Kerr Service Department at:

The Service Department,
Wayne Kerr Electronics Ltd.
Durban Road,
Bognor Regis,
West Sussex
PO22 9RL

Tel 01243 825811

Fax 01243 824698

5.1 AC Line Connections

This unit is provided with a mains lead capable of carrying the input current for both 115V and 230V operation. This lead should be connected via a suitable connector to the local AC mains supply. The colour code employed is as follows:

WIRE	EUROPEAN	N. AMERICAN
LIVE	BROWN	BLACK
NEUTRAL	BLUE	WHITE
EARTH	GREEN/YELLOW	GREEN

No adjustment is required for variation of supply frequency or supply voltage*.

Before connecting the AC power, read the precautions listed under section 1.2, 'AC Power Supply'.

The instrument is not suitable for battery operation.

The power switch is located on the left of the front panel.

* The PMA3260A requires setting to the correct operating voltage.

5.2 Safety Interlock

WARNING!

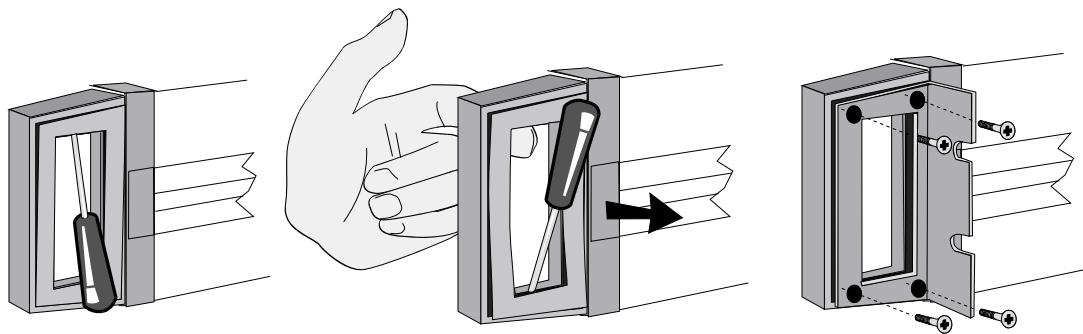
Improper use of this instrument could be fatal

To protect the user against lethal back EMF potentials, there is a facility to inhibit the operation of a DC bias current function by removing the 'BIAS SAFETY INTERLOCK' plug on the PMA3260A rear panel. Details of this feature can be found in section 6.2.6, 'SAFETY Interlock'. The safety interlock plug is supplied with the unit and must be inserted to use the bias current feature.

5.3 Rack Mountings

This instrument is intended for use either on the bench or in a rack. The power modules are convection cooled and care must be taken not to restrict any of the air paths.

There is a rack mounting kit available as an optional extra to fit a standard 19' rack. This kit contains the mounting 'ears' and screws required for the conversion. To fit these 'ears' carefully remove the insert in the outer face of both front handles, see fig 5-1 below. Fit each 'ear' into the recess formed by the removal of the insert and secure using the bolts provided (M4 x 10mm CSK). It is important that some provision is made to support the rear of the unit when using the rack mounting ears.



Insert small screwdriver into the gap between insert and handle body. Prise away one end slightly and hold in position with finger. Note operation of insert with styling cut-out opposite cut out in handle.

Insert screwdriver into other end and repeat procedure. This will relieve the small tapered pins of the insert from the threaded holes in the handle. Remove insert in the direction of arrow.

Insert rack mounting bracket into recess in handle in attitude shown and secure firmly with 4 M4x10 C'SK HD screws supplied.

fig 5-1 Procedure for Attachment of Rack mounting brackets

5.4 PMA3260A/3265A Interconnection

To perform measurements with the PMA3260A/3265A system, the units must be linked together as follows:

- 1) Position the PMA3260A on top of the 3265A.

Front Panel Connections

- 2) Link the PMA3260A ‘Primary’ BNCs to the top four BNCs on the 3265A using short coaxial leads.

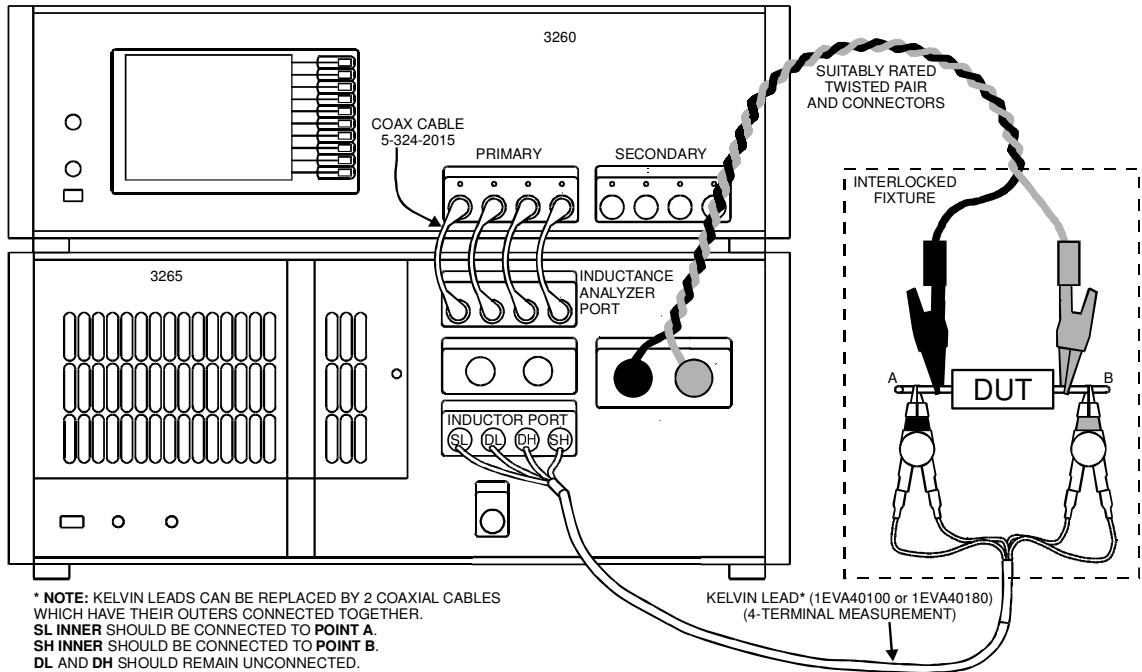


fig 5-2 Front Panel Connections for 4-Terminal Measurement

Rear Panel Connection

- 3) Connect the PMA3260A ‘Auxiliary Control Out’ 9-way ‘D’ connector to the 3265A ‘Aux Control In’ 9-way ‘D’ connector using the control link cable supplied.

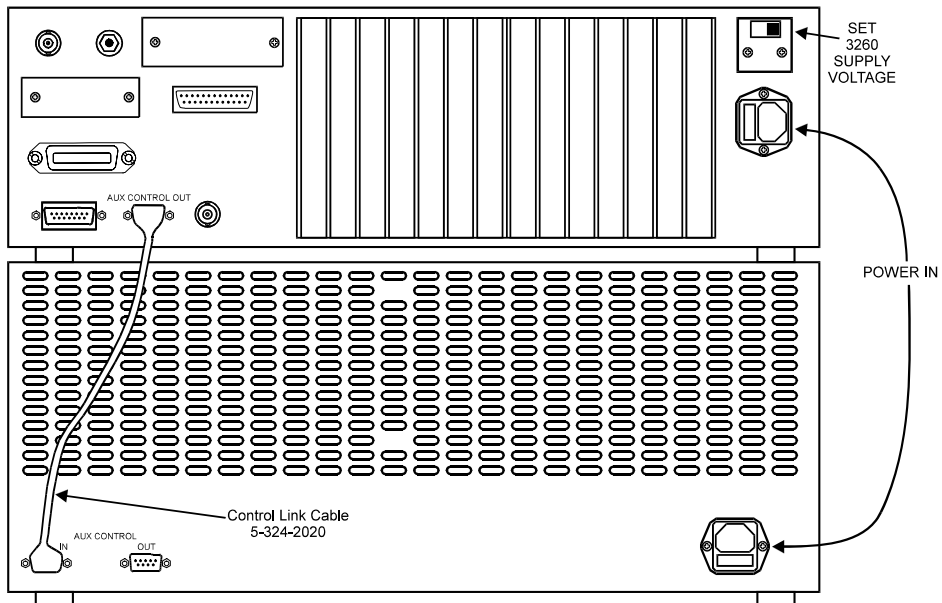


fig 5-3 Rear Panel Connection

5.5 Using Multiple 3265s

Up to five 3265A units can be connected in parallel as follows:

- 1) Position the PMA3260A on top of the 3265A units (see section 5.5.1—Maximum Stacking Height).
- 2) Connect the PMA3260A to the first 3265A as described in section 5.4 above.

Front Panel Connections

- 3) Link the 'Bias Current' terminals of each 3265A to the 3265A below it with the power transfer bus bars supplied (+ to +, - to -).
- 4) Connect the 'Bias Unit Link' terminal of each 3265A to the 'Inductance Analyzer Port' RED terminal of the 3265A below it.

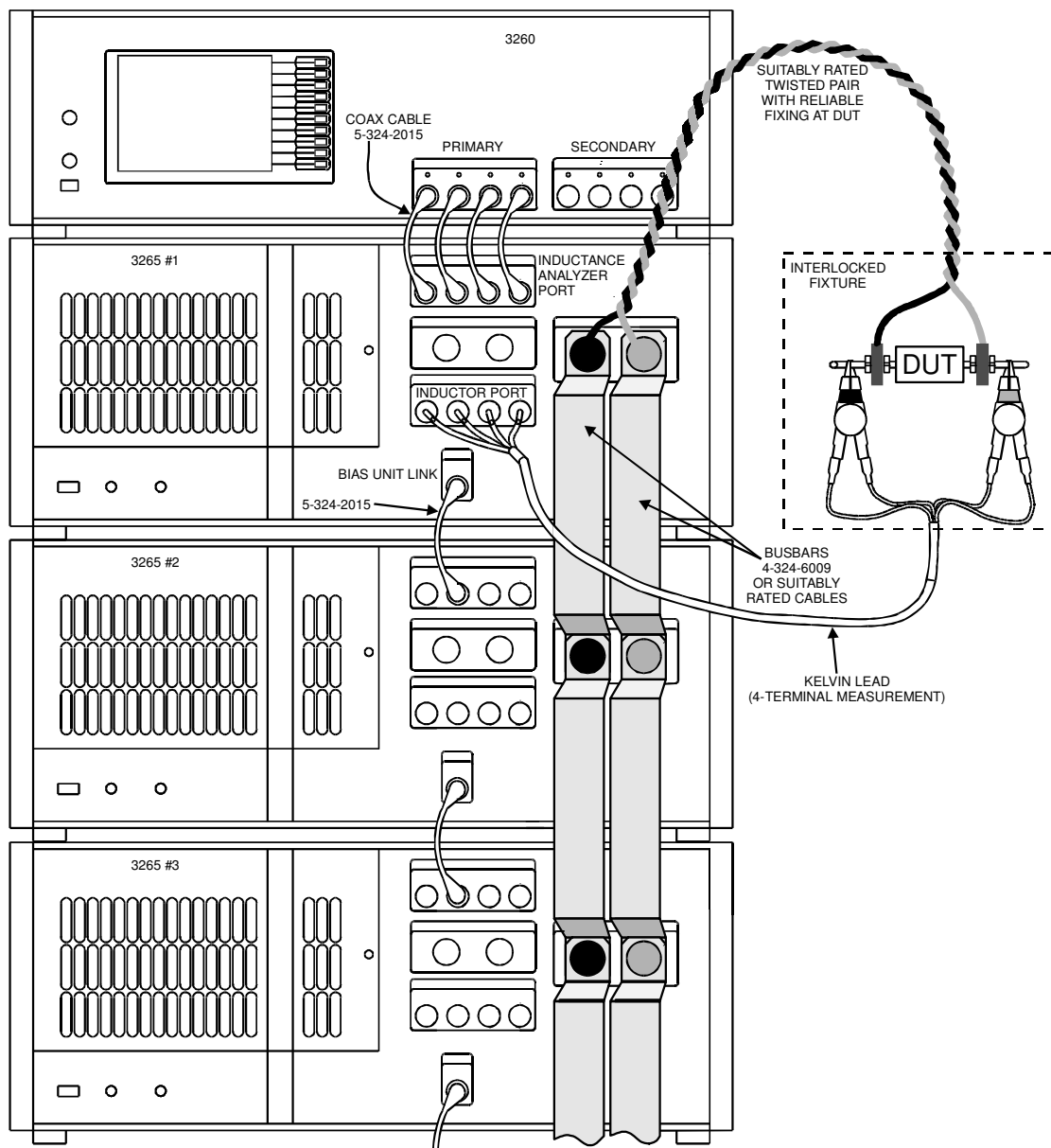


fig 5-4 Front Panel Connections for Multiple 3265 Units

Rear Panel Connections

- 5) Connect the 'Aux Control Out' 9-way 'D' connector of each 3265A to the 'Aux In' 9-way 'D' connector of the 3265A below it.

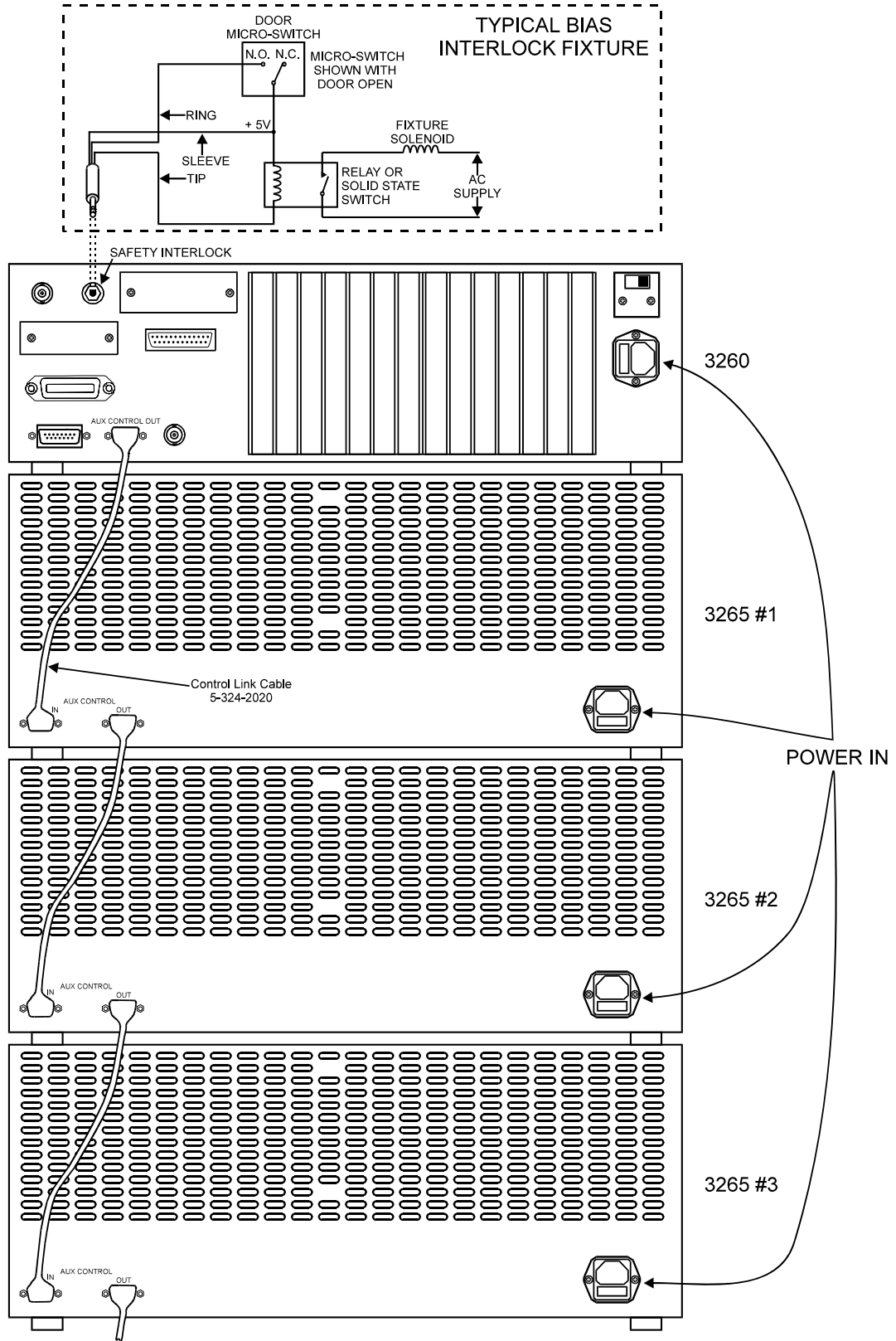


fig 5-5 Rear Panel Connections for Multiple 3265 Units

5.5.1 Maximum Stacking Height

If more than one 3265A is being used, the instruments should be rack-mounted in a suitable ventilated enclosure.

6. OPERATING INSTRUCTIONS

6.1 Basic Features

The 3265A 25A bias unit extends the range of DC bias available when measuring inductance with the Precision Magnetics Analyzer PMA3260A.

One 3265A can provide a bias current in the range 25mA to 25A. Up to five 3265A units can be connected in parallel, to give a maximum bias current of up to 125A, provided that the maximum voltage drop does not exceed the maximum compliance voltage.

Operation of the 3265A is via the PMA3260A. All of the analyzer measurement modes may be used to the full, including the internal 1A bias supply when the high current bias is not required, without disconnecting the 3265A from the PMA3260A.

The safety interlock system on the PMA3260A, designed for use with enclosed fixtures which can reduce the risks associated with high currents and large inductors, is also effective with the 3265A, see section 6.2.6, 'SAFETY Interlock'.

6.2 Operation

The 3265A operations are supported when the PMA3260A is fitted with software version 3.00 or above.

With the PMA3260A and 3265A units connected together, select BOOST mode to allow the high DC bias current to drive the device under test (DUT).

PMA3260A Only

Press ◀ and ▶ keys to move the main cursor (highlighted item) to NORM. Press ▲ or ▼ keys to toggle between NORM and BOOST. Check the cable and power supply on the 3265A if it will not toggle.

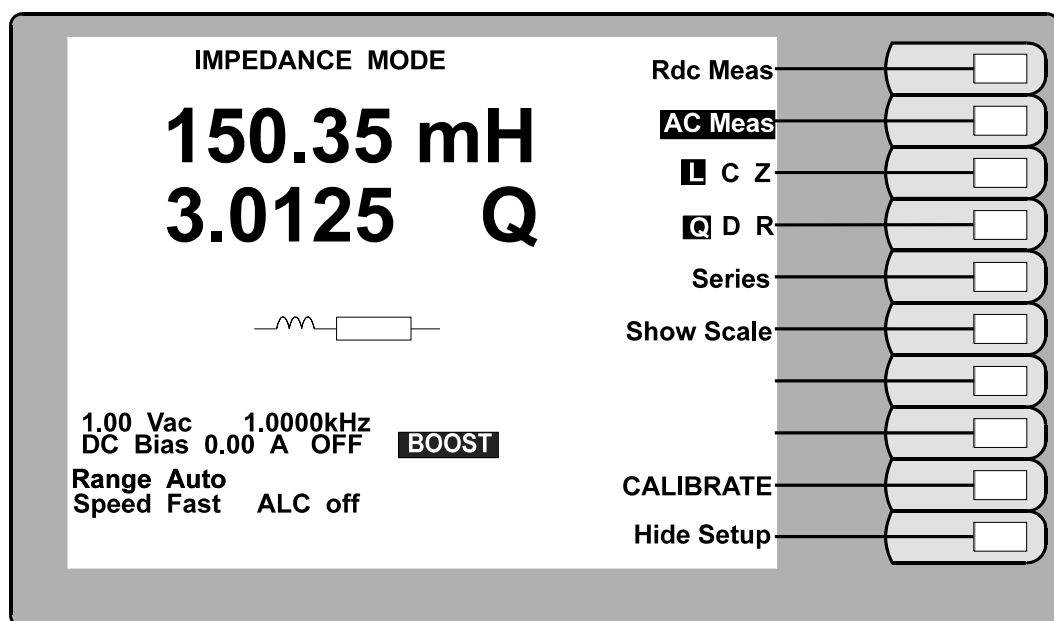


fig 6-1 Impedance Mode with High DC Drive (PMA3260A)

6.2.1 Boost, or High Current Operation

When BOOST mode is selected, the device to be tested should be connected to the two high current stud terminals on the front of the 3265A with cable capable of carrying the required DC bias current. It is important, especially when the inductive energy stored in the DUT exceeds a few Joules, to reduce the risk of the high current leads falling off by using ring crimps at the 3265A, and a reliable fixing arrangement at the DUT.

6.2.1.1 Measurement Restrictions

The drive level chosen on the PMA3260A must not be too high, otherwise the 'excess voltage drop' condition will occur. The maximum DC voltage the 3265A will permit is approximately 11.0V below 12kHz, and 10.0V above 12kHz. This is to allow for the DC voltage drop across the DUT when the bias current is flowing. However, below 12kHz, the AC drive signal from the 3265A must also be taken into account.

For example, if the drive level is 1V rms, below 12kHz, the maximum DC drop is:
 $11 \cdot 0 - (1 \times \sqrt{2}) = 9 \cdot 59\text{V}$

6.2.1.2 Four-Terminal Operation.

Four-terminal operation is required to achieve the specified accuracy at frequencies above 1kHz. For four-terminal operation, ensure the PMA3260A is switched to four-terminal mode.

Connect the two outer BNC connectors on the 3265A inductor port (yellow and brown) via screened coaxial leads to the DUT. It is important to ensure that the YELLOW lead is connected to the same point on the DUT as the RED or '+' high current lead from the 3265A, and that the BROWN lead is connected to the same point as the BLACK or '-' lead from the 3265A. There are no hazards associated with these measurement leads falling off.

If desired, the measurement connections can be made using a standard four-wire Kelvin lead set. The inner two coaxial leads are internally disconnected by the 3265A when in BOOST mode.

Note:

- 1) All four, short coaxial linking leads, to the PMA3260A must remain connected.
- 2) The measurement accuracy can only be achieved if these four leads are kept short.

6.2.1.3 Two-Terminal Operation

This measurement mode gives good results at lower frequencies. This is because any wiring from the 3265A terminals to the DUT is included in the measurement. Best results will be obtained by performing the trims at the DUT.

For two-terminal mode, no connections are required to the lower four BNC connectors on the 3265A. For two-terminal operation, ensure the PMA3260A is switched to two-terminal mode.

6.2.1.4 Setting Bias Current.

To determine the maximum DC bias current available, the PMA3260A will automatically detect the presence and number of bias units connected. Select the Instrument Status page to confirm the figure, e.g. three units will indicate 75A.

To set the bias current, highlight the DC Bias measurement condition, key in the required level and the PMA3260A will determine the nearest available DC current. On the PMA3260A, the ▲

or ▼ keys can be pressed and held, to step along the pre-determined steps. Note that the step size is dependent on the number of bias units connected..

High DC BOOST is only available in impedance mode. NORM DC bias must be re-selected before the mode can be changed.

6.2.2 NORM, or NORMAL Operation (No High Current Bias)

When NORM DC bias mode is selected, all functions available to the standalone PMA3260A are supported and the internal 1A bias supply is used. The system design and lead configuration, allow users to maintain the system integrity and to use normal operations without high DC current Bias. Full accuracy is maintained. Two/four-terminal operation is selected from the PMA3260A front panel.

6.2.2.1 Calibration and Trims

It is not necessary to use a calibration coil to calibrate 3265A DC bias units.

If DC bias BOOST mode is selected, pressing the Calibrate soft key will enter 'EXT BIAS CALIBRATE MODE'. O/C Trim and S/C Trim functions are provided to eliminate the effects of stray capacitance or series impedance in the connecting leads or fixture.

The 3265A trim values are stored in non-volatile memory in the PMA3260A and are separate from the internal trim values. Therefore, it is possible to carry out a four-terminal NORMal trim and a two-terminal BOOST trim and then make measurements between these two modes without re-trimming.

The following diagrams show connections for open-circuit and short-circuit trimming in two-terminal and four-terminal configurations.

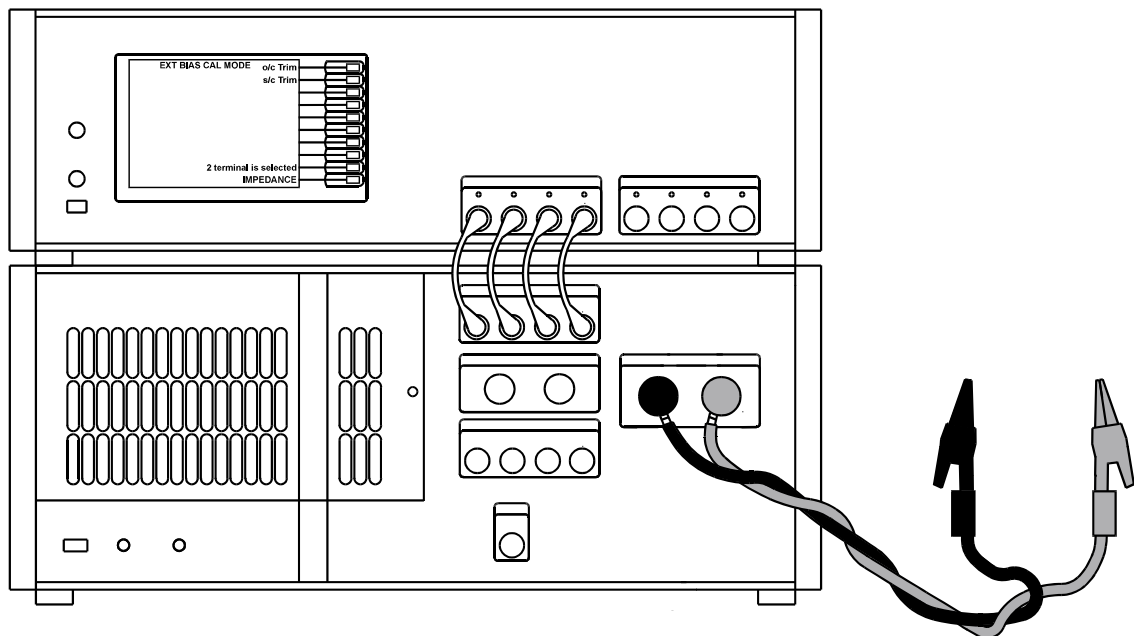


fig 6-2 Connections for Open-Circuit Trimming (Two-Terminal)

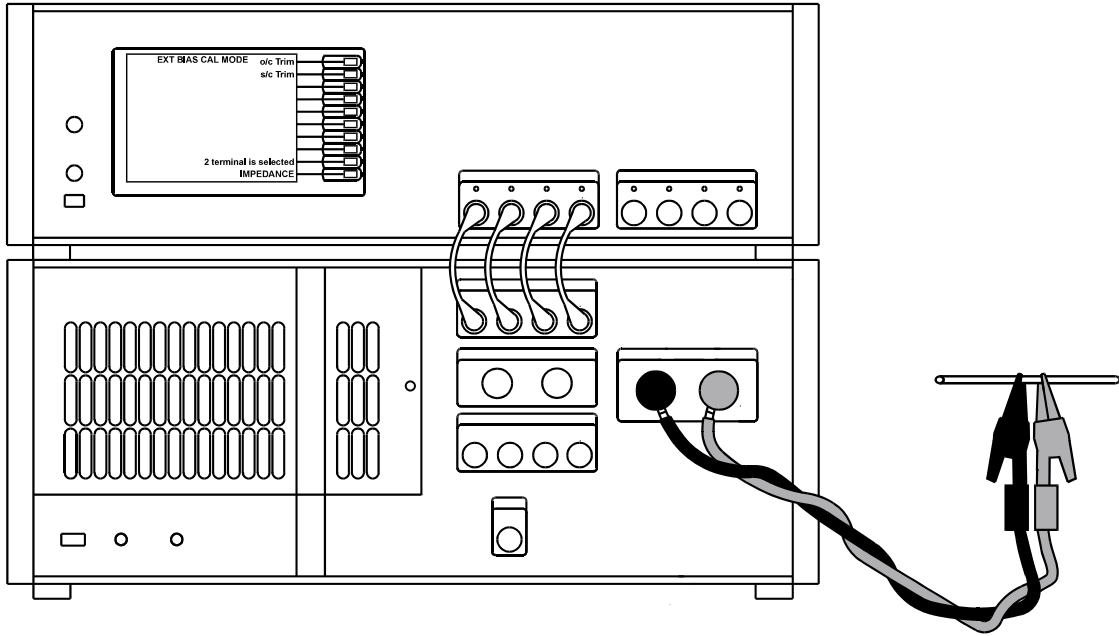


fig 6-3 Connections for Short-Circuit Trimming (Two-Terminal)

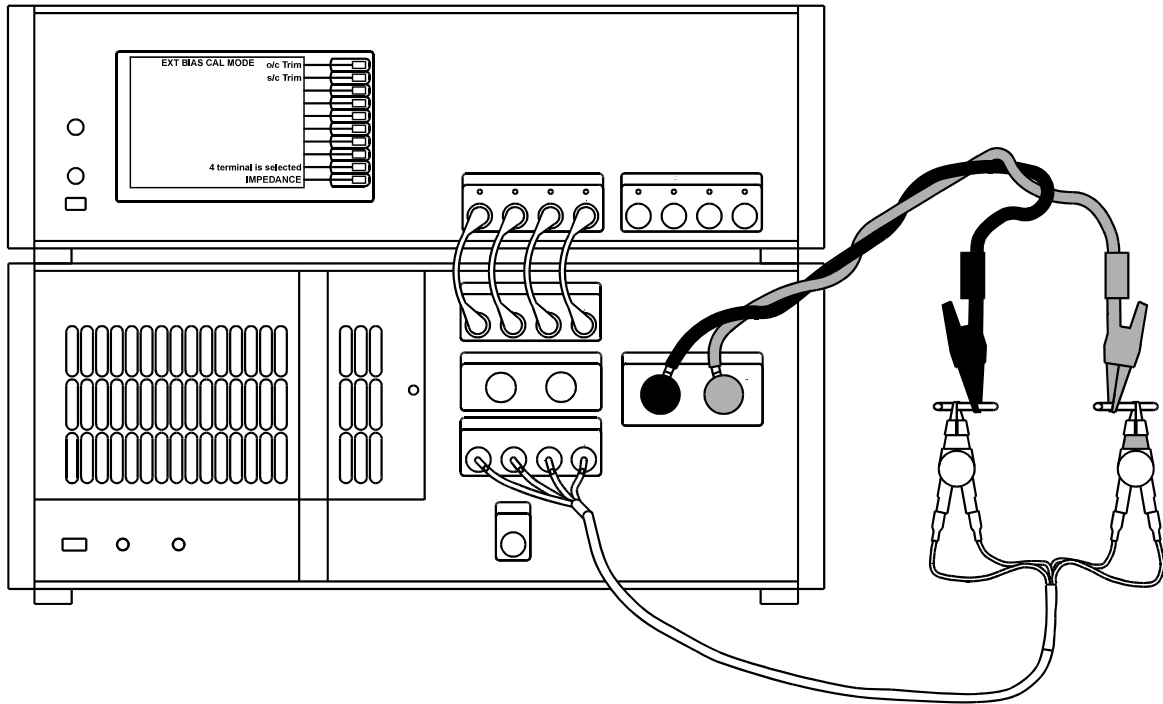


fig 6-4 Connections for Open-Circuit Trimming (Four-Terminal)

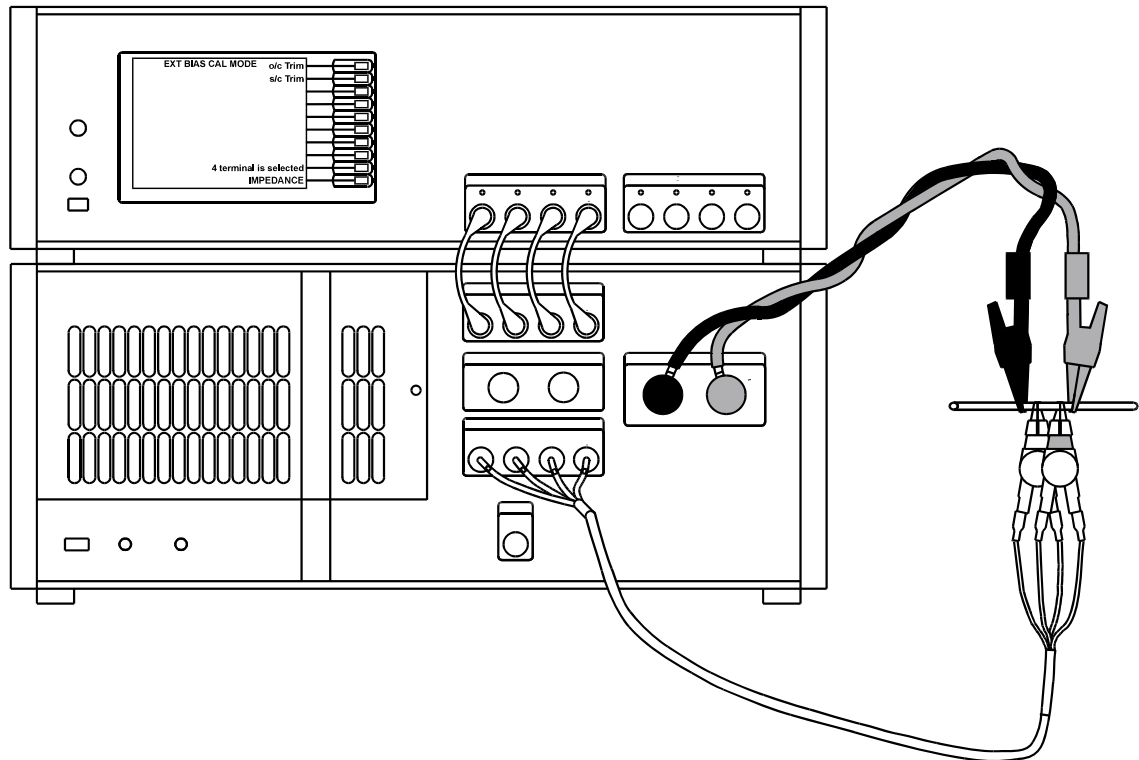


fig 6-5 Connections for Short-Circuit Trimming (Four-Terminal)

6.2.3 Making Measurements

Ensure that Bias is switched OFF. Connect a coil to be measured to the leads, as described in Section 6.2.1.2 or 6.2.1.3, depending on whether four or two-terminal measurement is required. To minimize measurement noise, select maximum AC drive and Slow speed where practical. Switch the Bias ON and then trigger measurements.

Operation of the PMA3260A with one or more 3265As, is similar to that for a stand-alone PMA3260A. Rdc facility is not available with DC bias. However, switching between Rdc and AC measurements is permitted although DC bias will be turned OFF and will not be turned ON automatically.

If the measurement frequency is increased from below 12kHz or decreased from above 12kHz with DC bias applied, the current will be ramped down before the change in frequency and ramped back to the desired value after changing the frequency.

6.2.4 Messages

Message	Condition
Ext Bias Faults	A bias unit has developed a fault, or the power to a bias unit has been switched off.
Ext Bias unplugged	The ribbon cable from the PMA3260A to the bias units has fallen off and disconnected all of the bias units.
Ext Bias Mismatch	One or more (but not all) bias units are disconnected. The message will be extinguished when the fault is cleared.
Setting DC Bias Turning Bias Off	DC bias is being ramped up. DC bias is being ramped down. The message will be extinguished when the correct current level is established.
Excess Voltage Drop	Excessive DC voltage across the DUT. This may be avoided by reducing the bias level and/or reducing the AC drive level.
SAFETY Bias Turned Off	An excess voltage across the DUT has been allowed to persist for 10 seconds The PMA3260A will remove the DC bias current.
Source Failure Load Disconnect Over Temperature Bias Power failure	Critical fault conditions. The PMA3260A will remove the DC bias current.

fig 6-6 Messages

6.2.5 GPIB Operations

Use GPIB Commands for Impedance mode to control the 3265A bias units and make measurements. The following extra commands are described in detail.

Impedance	Description	Query
:IMP:BIAS INT or EEXT	Select INTernal or EXTernal DC bias drive. :IMP:BIAS EEXT command will set the system to DC Bias BOOST mode. Bias status query. Returns bias status in 3 integers delimited with colons. The first integer 0 or 1 are corresponding to OFF, ON respectively. The second integer 0 or 1 are corresponding to INT, EEXT respectively. The third integer is the number of bias units connected in the system.	:IMP:BIAS-STATus?

Impedance	Description	Query
:IMP:BIAS ON or OFF	Turn DC bias ON or OFF. Bias status query. Returns bias status in 3 integers delimited with colons.	:IMP:BIAS-STATus?
:IMP:BIAS <value>	Set DC bias <value> if 'AC Meas' selected. <value> is decimal numeric data. Suffix A is optional. Bias query. Return bias in A as floating point number.	:IMP:BIAS?

fig 6-7 GPIB Operations

6.2.6 SAFETY Interlock

For reasons of safety, an interlock feature is incorporated into the analyzer. This prohibits any DC BIAS current until the safety interlock circuit is complete with the safety jack plug fitted.

For maximum operator safety, particularly on production line testing, it is advisable to place the terminal fixture for the inductor under test, within a housing with an interlocked door. The interlock jack connections are shown below in fig 6-8.

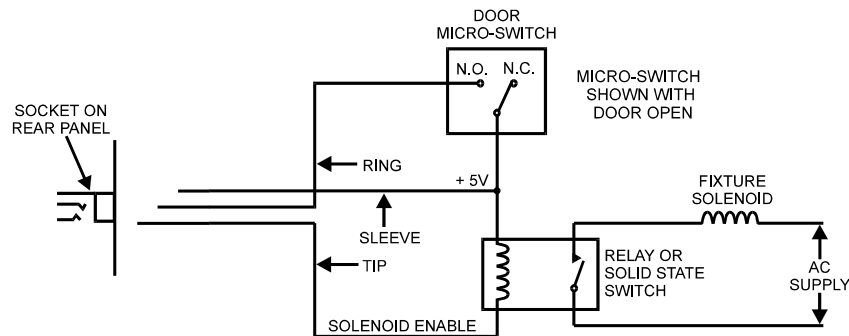


fig 6-8 Typical BIAS interlock fixture

Only when the door is closed and the microswitch therefore made, can the DC BIAS be activated. At this time, the relay is energized, activating an AC supply for a solenoid which can be used to lock the door while the BIAS remains available.

The solenoid drive relay should have a 5V DC coil of resistance not less than 200Ω. Diode coil protection is provided within the BIAS circuitry.

The door lock is activated when BIAS ON is selected on the instrument. If the door switch or interlock lead is broken, the DC bias is inhibited.

IMPORTANT

If the Interlock feature is not required, it is necessary to insert the 3.5mm Audio jack, with the ring and sleeve connections linked, into the socket on the back panel. Failure to do this

will result in the **BIAS** being inhibited, and the message, **Ω Bias Interlock Ω** being displayed.

7. MAINTENANCE

7.1 Cleaning

The outside of the equipment can be wiped with a damp, lint-free cloth. A mild detergent may be used if necessary. No water must enter the instrument.

7.2 Safety Inspection

Each year the equipment should be given a simple safety check.

7.2.1 Equipment Required:

25A earth bond tester, e.g. Megger PAT 2

Insulation tester @ 500V DC, e.g. Megger BM7

7.2.2 Tests:

- 1) **Disconnect the instrument from the mains supply voltage!**
- 2) Inspect the unit and associated wiring for damage e.g. dents or missing parts which might impair the safety or function of the equipment. Look for any signs of overheating or evidence that objects might have entered the unit.
- 3) Earth bond. Ensure that 25A DC can flow from exposed metal parts of the unit (not BNC connector outers) to earth with an impedance of less than 100m Ω .
- 4) Insulation test. Connect the Live and Neutral of the mains cable together and test the insulation between this point and the earth at 500V dc. Readings greater than 1M Ω are acceptable.

7.3 Guarantee

The equipment supplied by Wayne Kerr Electronics Limited is guaranteed against defective material and faulty manufacture for a period of twelve months from the date of dispatch. In the case of material or components employed in the equipment but not manufactured by us, we allow the customer the period of any guarantee extended to us.

The equipment has been carefully inspected and submitted to comprehensive tests at the factory prior to dispatch. If, within the guarantee period, any defect is discovered in the equipment in respect of material or workmanship and reasonably within our control, we undertake to make good the defect at our own expense subject to our standard conditions of sale. In exceptional circumstances and at the discretion of the Service Manager, a charge for labour and carriage costs incurred may be made.

Our responsibility is in all cases limited to the cost of making good the defect in the equipment itself. The guarantee does not extend to third parties, nor does it apply to defects caused by abnormal conditions of working, accident, misuse, neglect or wear and tear.

7.4 Service

In the event of difficulty, or apparent circuit malfunction, it is advisable to telephone (or fax) the Service Department or your local Sales Engineer or Agent (if overseas) for advice before attempting repairs.

For repairs and maintenance it is recommended that the complete instrument be returned to:

The Service Department,
Wayne Kerr Electronics Ltd.
Durban Road,
Bognor Regis,
West Sussex
PO22 9RL

Tel 01243 825811

Fax 01243 824698

Please ensure adequate care is taken with packing and arrange insurance cover against transit damage or loss.