INSTALLATION AND OPERATION MANUAL

BIAS DECOUPLER

BD2 / BD3

ELECTROGRIP

BIAS DECOUPLER

BD2 / BD3

This manual refers to Electrogrip Model BD2 Bias Decoupler

for use with
Electrostatic Drivers versions DR3, DR4
Gas Controller version GC1, GC2, GC3
and Electrogrip Electrostatic Chucks and End Effectors.

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WARRANTY

LIABILITY. Although all care is taken to ensure stated, safe, and reliable performance, Electrogrip can not be held liable for any direct or consequential damages arising from the use or abuse of this equipment. Detailed descriptive, hazard and use data is provided with each unit. Proper operating and safety procedures must be followed and reasonable care must be taken by the user to avoid hazards.

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Except as stated herein, Electrogrip makes no warranty, expressed or implied (either in fact or by operation of law), statutory or otherwise:

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Service contracts are available for Electrogrip products.

For additional assistance, contact Electrogrip or its authorised agent.

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OPERATIONAL SAFETY

INTERLOCKS, MOUNTING

Before connecting high voltage cables ensure that an interlock switch closure or signal from a control computer is provided to enable the Electrostatic Driver DR4 (or equivalent) output. This interlock must be arranged to cut high voltage output when driver output terminals may be exposed. For example, any high-voltage access plate requires a microswitch.

It is recommended that the bias decoupler be mounted on a match network enclosure on a fixed metal wall which forms a good rf ground connection. There should be an access plate or door near the bias decoupler to allow connections to be made to the rf (pinjack) side of the bias decoupler. This is recommended due to the need for careful positioning of wiring in the rf enclosure to avoid unwanted shunting of rf power to a grounded surface with consequent overheating of wire insulation.
If such an access plate and rigid decoupler mounting cannot be achieved, minimal wire length on the rf side can help to reduce the chance of such rf shunting.

HIGH VOLTAGE CAUTIONS

Operation must be in accordance with instructions given here and with normal safety practices for high voltage systems.

VOLTAGES of up to 14,000VDC ACROSS THE OUTPUT TERMINALS are present.

Maintenance and servicing must be done by qualified personnel only.

The DR4 driver generates high voltages when its drive power switch and interlock are enabled. These high voltages are present on the outputs during wafer grip and **after** wafer release.

HIGH DC BIAS VOLTAGES ARE PRESENT ON THE
..... • OUTPUT CONNECTOR SHIELDS.
.....and on the • DC BIAS OUTPUT CONNECTOR, with rf plasma operation.

GENERAL INFORMATION

INTRODUCTION

This section gives a description of the instrument and its specifications.

DESCRIPTION

The Electrogrip BD2 Bias Decoupler is a triple high voltage radio-frequency filter. This Bias Decoupler filters 13.56MHz rf power from drive signals between the Electrogrip DR4 Electrostatic Driver and rf-excited electrostatic chucks. The BD3 filters two frequencies, for systems using dual-frequency ICP reactors etc.

The BD series Bias Decoupler minimises rf leakage and interference with external devices. However it also permits electrostatic chuck electrodes to attain full rf potential, thus assuring rf coupling uniformity and uniform plasma processing across semiconductor wafers. In addition the low dc resistance of this bias decoupler permits accurate control of electrostatic electrode voltage, even in chucks with high electrical leakage.

The BD series Bias Decoupler provides a dc bias output which can be used to monitor the plasma-induced dc bias attained by the chuck metal baseplate. To ensure a bias reading of the highest accuracy, a high impedance metering circuit is required due to the indirect plasma contact normally present between wafer and chuck metal.

The dc bias output is used as an internal reference by the DR4 Electrostatic Driver for its electrode drive outputs, which float upon the dc bias voltage value. The bias voltage input impedance of the DR4 unit is 68MΩ. Note the shielded cables between the Bias Decoupler and Driver have floating shields at the rf bias potential, hence require insulating boots to assure safe handling.

DECOUPLER AND ASSOCIATED EQUIPMENT

Fig. 1 Bias Decoupler. View of mounting side facing rf enclosure.

Fig. 2 Connection cables, Bias Decoupler - DR4 Driver. Normally provided with Driver.

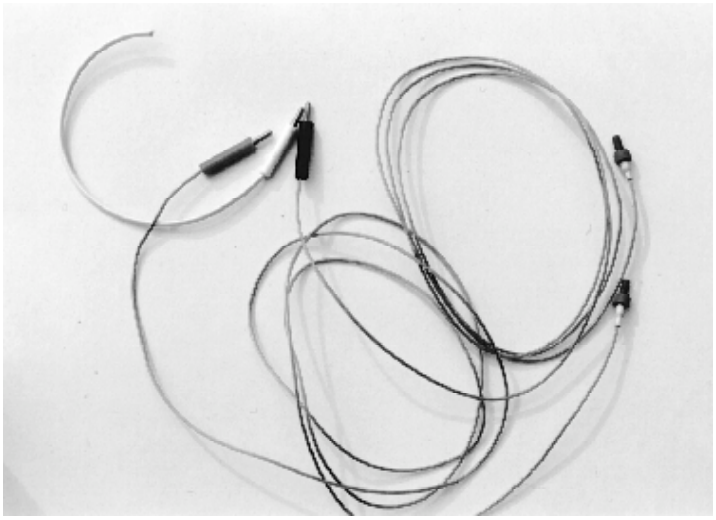

Fig. 3 Connection cables, Bias Decoupler - rf chuck. Normally provided with Decoupler.

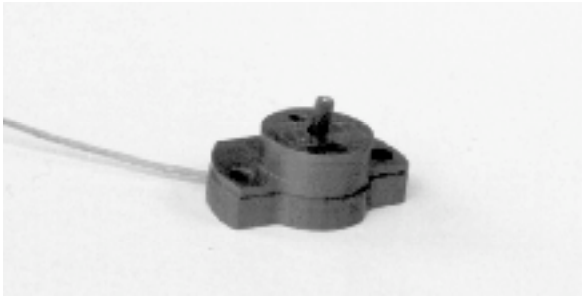

Fig. 4 Connection cable end. Sample plug housing for removable chuck puck mounting.

SPECIFICATIONS

BIAS DECOUPLER BD2 SPECIFICATIONS

MAXIMUM RATINGS

DC DRIVE VOLTAGE ON A, B CHANNELS:	8 kV (max. 16kV between the A, B outputs)
CURRENT:	60mA
RF VOLTAGE (13.56MHz):	6000 Vpeak-to-peak
DC BIAS VOLTAGE:	3 kV internal limit ~1.5kV BNC connector limit

ISOLATION

rf OUTPUTS - dc DRIVE INPUTS	>120 dB at 13.56MHz

INSTALLATION

INTRODUCTION

This section describes initial setup and operation of the BD2 bias decoupler.
Additional information required for setup will be found in the chuck / end effector and electrostatic driver instructions.

UNPACKING

In your package you should find:

(i) Bias Decoupler BD2
(ii) Connection cables Bias Decoupler - Chuck
(iii) Connection pin plugs for Bias Decoupler (qty. 3)
(iv) #6-32 screws for mounting Bias Decoupler (qty. 2, mounted on BD2 case)

INSTALLATION TOOLS

You will require the following items for installation:

(i) Enclosure for mounting Bias Decoupler with slot, screw holes, and access panel.

(ii) Soldering iron for attaching cables {Bias Decoupler - Chuck} to pin plugs.

(iii) Phillips screwdriver for #6-32 mounting screws.

(iv) Interlock cable from • microswitch on high voltage wiring enclosure;
OR • computer interlock line (hi for safe, lo for open / unsafe).
This cable connects to the interlock pin(s) on the driver DR4 DB15 connector.

(v) Attachment means to baseplate of chuck (rf strap) for provision of dc bias reference.

(vi) *[Optional]* BNC plug and coaxial cable to dc bias voltage meter. Such a meter should be capable of measuring the expected maximum dc bias (typically not more than 1kV) and have an input impedance of 100MΩ or greater.

INSTALLATION

(i) Mount BD2 on enclosure into metalworking cutout as shown in Fig. 5.

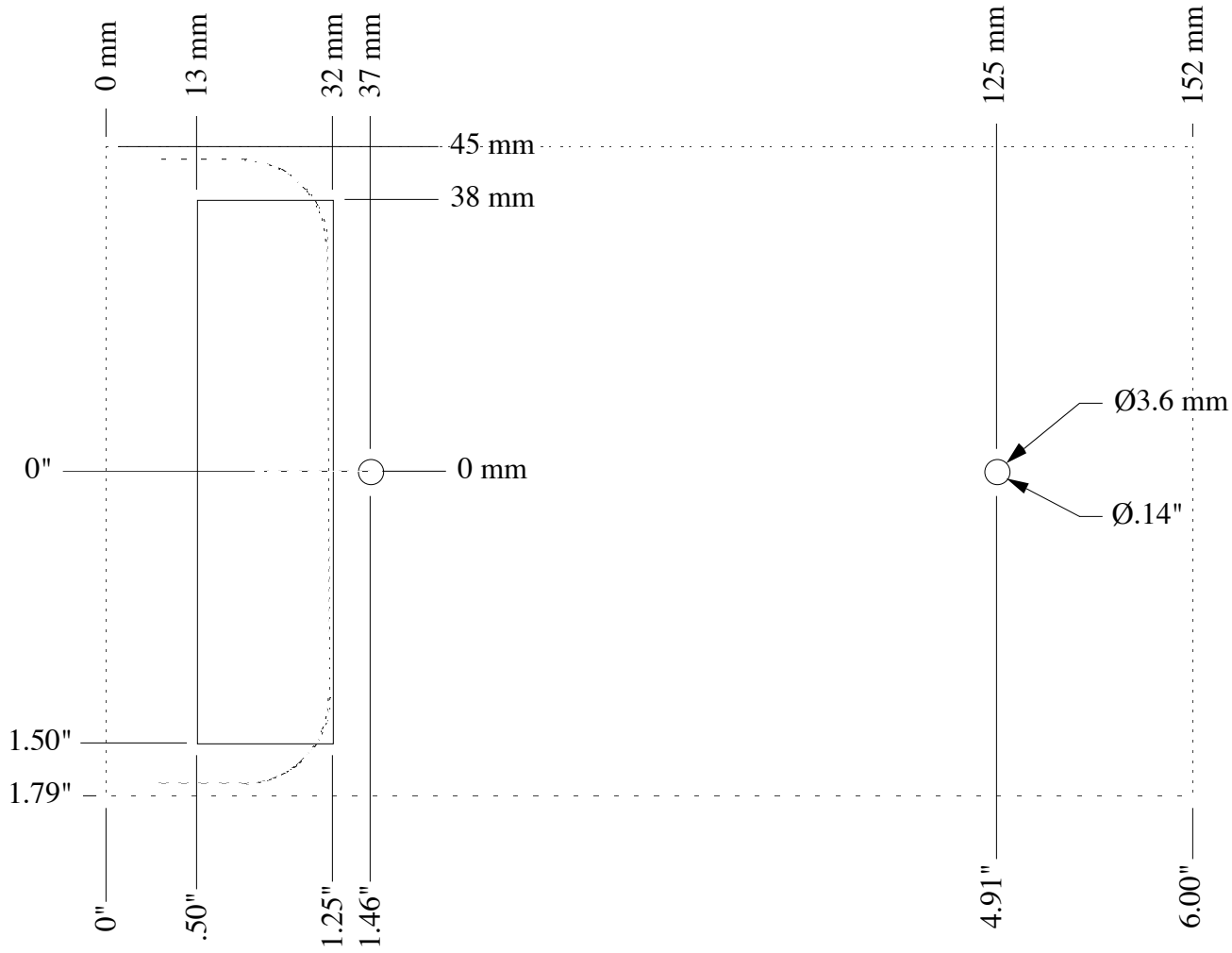

Fig. 5 Cutout for Bias Decoupler mounting

(ii) Attach Driver cables to Bias Decoupler to sockets 5 and 7 in Fig. 6.

(iii) Attach two Chuck-Decoupler cables to high-voltage sockets at chuck rear. Cut to length and solder to red / black pin plugs. Plug these into pinjacks 4 and 6 in Fig. 6.

(iv) Attach [Chuck Base / Rf Strap] - Decoupler wire to a convenient point on chuck baseplate or its rf feed. Cut to length and solder to white pin plug for pinjack 2 in Fig. 6.

(v) (If desired) Plug dc bias monitoring meter into BNC socket 3 of Fig. 6.

COMPONENT DESCRIPTION

INTRODUCTION

This section describes the BD2 Bias Decoupler connections, the rf-side cables used, and gives the decoupler circuit diagram.

BIAS DECOUPLER CONNECTIONS

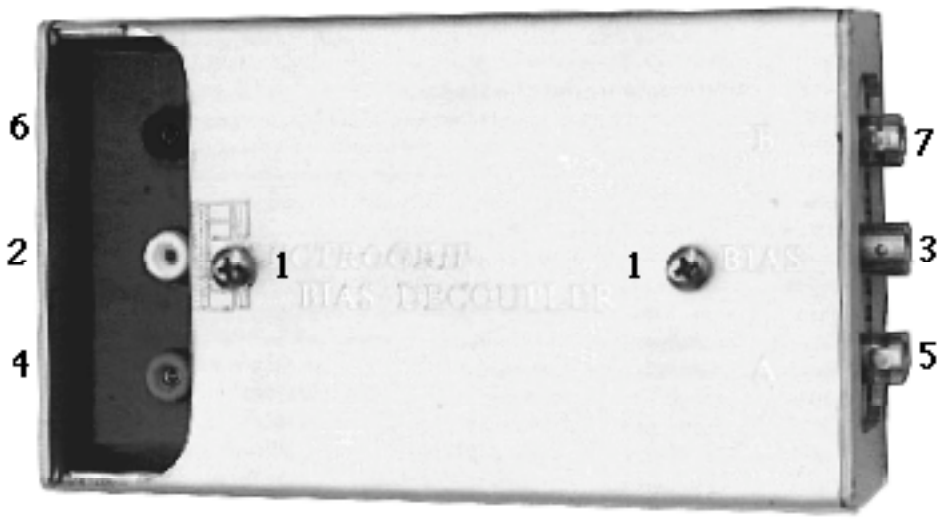

Fig. 6 Bias Decoupler connections

1. MOUNTING SCREWS: #8-32 Stainless steel. Tapped into the Al metal case of BD2. Connect the internal case grounding brass spring tab to the rf enclosure ground for the first filter sections, and provides ground reference for the dc bias voltage output 3.

2. RF CHUCK CONNECTION: Connected to the chuck baseplate rf connection. Filtered to yield the dc bias output 3 which is then used to provide a ground reference for the second filter sections, and as the reference for high voltage drives 5,7 and associated cable shields. Connects to "2" in Fig. 7.

3. BIAS VOLTAGE OUTPUT: Filtered dc bias of the rf voltage applied to the chuck. This terminal may be driven also to provide an electrostatic drive reference, but the current limit of this input must be observed.

4. "A" OUTPUT: Connects to "A" input of chuck using cable "4" in Fig. 7. Filters connect to "A" input 5.

5. "A" INPUT: Connects to "A" output of driver.

6. "B" OUTPUT: Connects to "B" input of chuck using cable "6" in Fig. 7. Filters connect to "B" input 7.

7. "B" INPUT: Connects to "B" output of driver.

Above A and B inputs interchangeable if chuck and driver outputs are symmetric, as is typical.

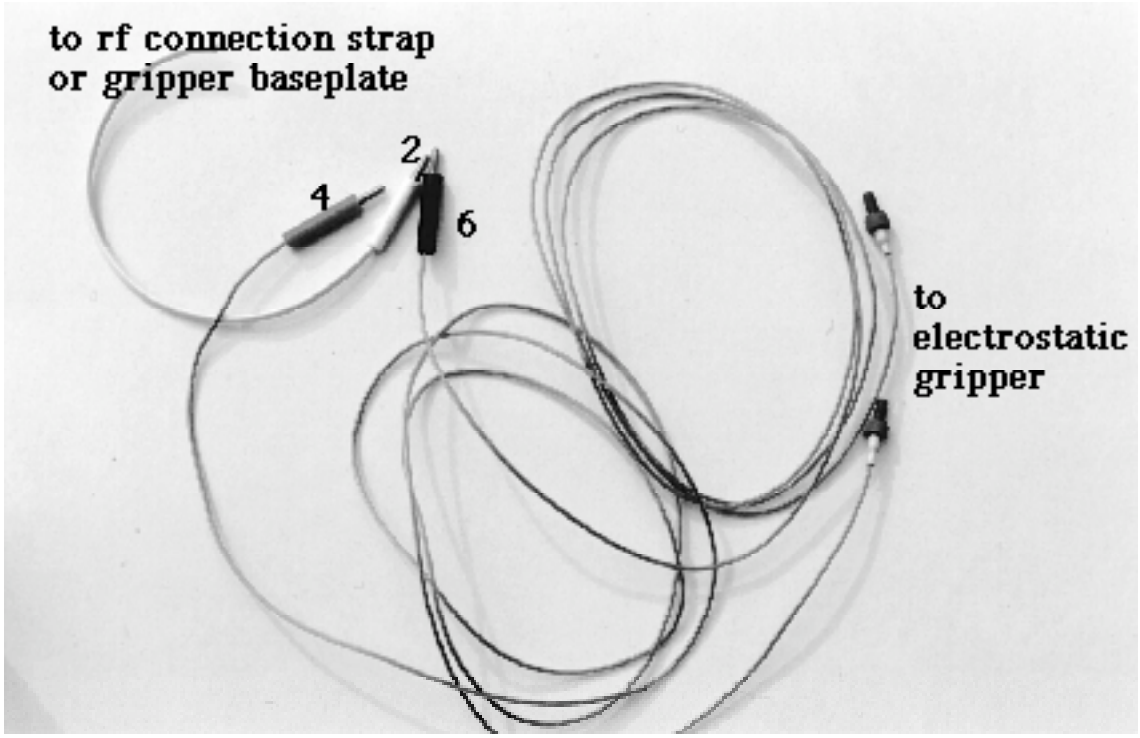

Fig. 7 Rf-side connection cables (typical)

Above rf-side cables are NOT insulated with rf-resistant insulation. Their insulation would melt if a high rf potential is placed between the inner conductor and the insulation exterior. Thus they must not be traced along any path that would result in them coming close to a surface at different potential from the chuck base.

Thus a chuck at rf potential must have these wires at rf potential also. They should be cable-tied to the rf strap and brought to the BD2 Decoupler such that they are more than 1cm from a grounded surface at all places. TFE insulator rings or tubes should be placed to assure such spacing, if necessary.

CIRCUIT DIAGRAM

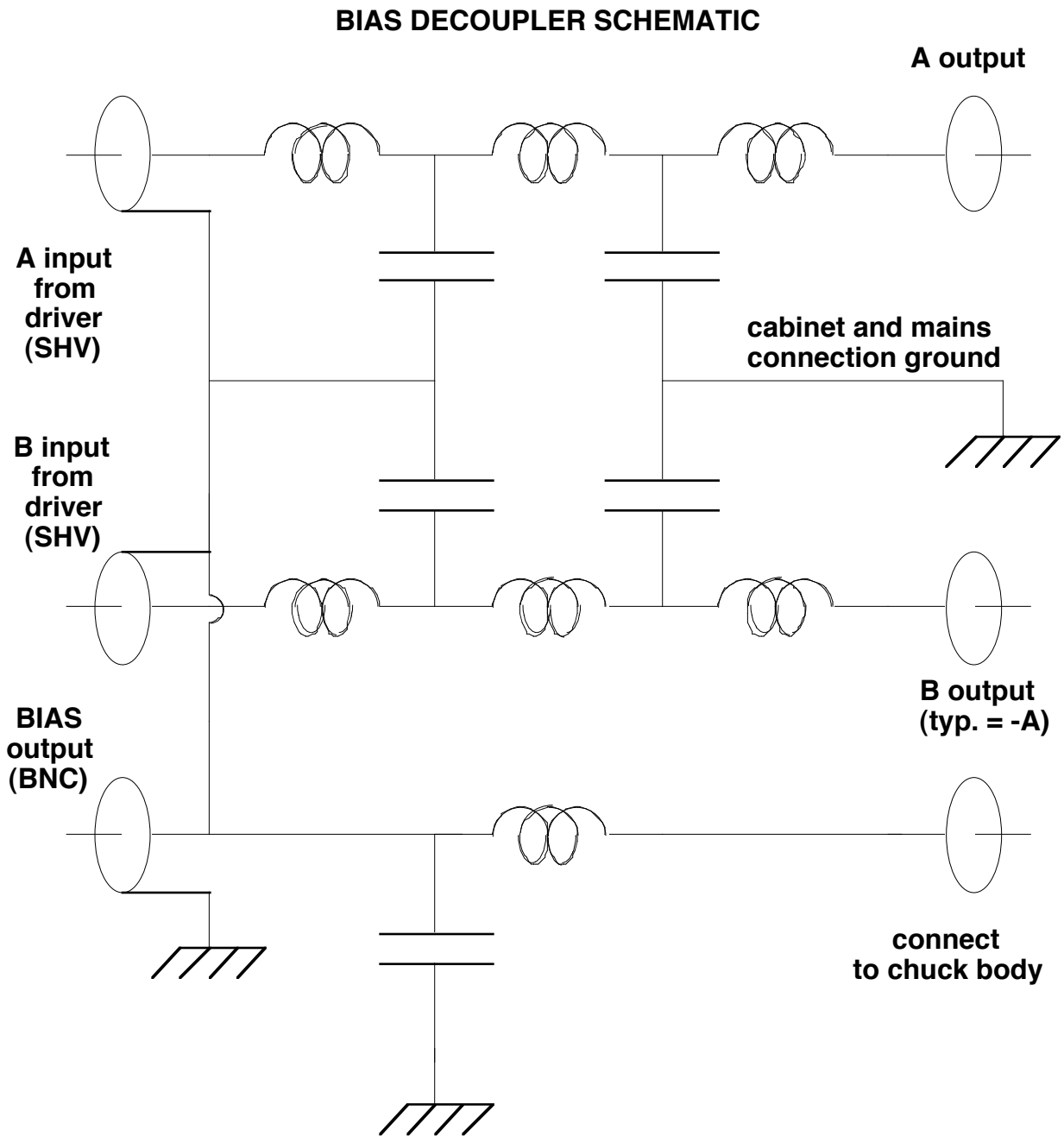

Fig. 8 BD2 Circuit diagram. BD3 diagram has added components for dual-frequency use.