

# Impact Source Electronics

Model IS10202



## Technical Manual

## Overview

The IS10202 unit has been designed to power and control high performance Neir type electron-impact ion sources, of the type commonly found in magnetic sector mass spectrometers.

It will work with sources which operate at up to 5,000 Volts from ground potential and require filament currents of up to 8 Amps.

Controlling low level voltages and currents on a source at this potential has always presented a problem. Traditionally, this has been done by coupling mechanical control dials through plastic shafts to the vulnerable circuitry at high voltage. The IS10202 does this electronically.

Many scientists like manual control of the source parameters, so the IS10202 also allows this via ten-turn dials on the front panel.

Being able to 'see' the source settings has always been advantageous, so the unit has a monitor section which allows all of the critical control parameters to be measured. This also allows dependant parameters, such as the source, trap and filament current to be observed.

The remainder of this document:

- Describes the function of each of the controls
- Lists the rear panel connections

## Power requirements and safety precautions

The unit has a 'universal' power supply which will operate from 100V to 240V AC at 50/60Hz. Mains power is applied when the switch on the rear panel is on. This establishes the internal supply of 24V

High voltages can be present on the rear panel source connector whenever the front panel power switch is on.

Voltages up to 5,000V can be present within the unit. Do not remove the covers and refer to the supplier for any service requirements.

Note that the front panel power switch will only operate if the external interlock is present.

## Front panel controls

All of the controls are labelled on the front of the unit. To the left are the main power switches:

Control	Function
Power	Turns on the dc power, enabling all of the functions other than the high voltage output and filament drive.
Filament	Switches on the filament output.
HT	Switches on the main high voltage output.

The power function operates via an interlock. To turn this on, the interlock pins on rear panel connector 5 must be connected, the small button to the right of the power switch must be depressed and the switch momentarily pressed.

Pressing the switch again will trip the power off.

### Remote / local control selection

A bank of toggle switches allow the individual control functions to be set for remote or local (i.e. front panel) control.

If a switch is set to the left, the function will be under remote control provided the appropriate pin of connector 3 on the rear panel is connected to a control voltage. If this is not the case, it will default to local control.

Setting a switch to the right will force the control to be via the appropriate front panel knob.

### Monitor

A rotary switch allows various functions to be monitored via the meter on the front panel of the unit. (some of these can also be monitored via the remote control interface). The meter scaling is shown alongside the switch.

### Source and lens control knobs

These knobs allow the source and lens voltages and currents to be adjusted. All are 10-turn. Their functions are shown below:

Control	Function	Range
Filament limit	Maximum current through filament	0 to 8A
Trap voltage	Voltage between filament and electron trap	0 to 200V
Trap current	Maximum current between filament and trap	0 to 3mA
Source voltage	Voltage between filament and source	0 to 200V
Source current	Maximum current between filament and source	0 to 10mA
Acceleration	Voltage from ground to source	0 to 5kV

Control	Function	Range
Repeller	Voltage from filament to repeller	0 to 200V
Focus (two controls)	Voltage from the focus plate to ground as a proportion of the acceleration voltage. (Note that the meter displays the actual voltage from the source).	70% to 100%

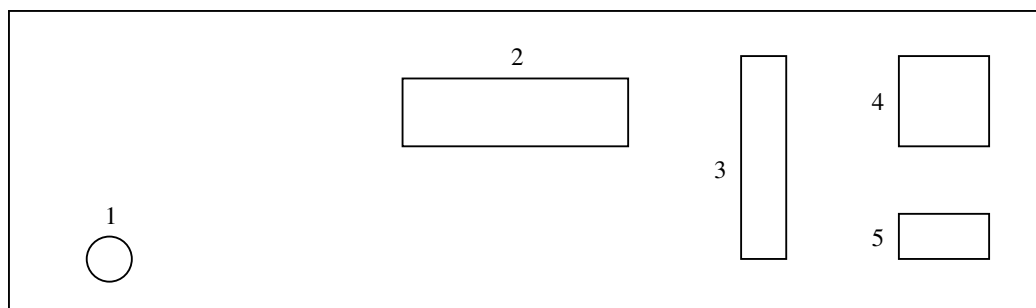
Note that the majority of the source voltages are expressed with respect to the filament. A typical start up sequence would be:

- Switch on the power only.
- Set the desired electron energy (e.g. 80V). This is the voltage between the filament and source.
- Set a trap voltage higher than the electron energy. The trap voltage is the voltage between the filament and trap, i.e. setting 105V would give a trap to source voltage of 25V when the electron energy is set at 80V. (25V is a typical value pre-set in older control units).
- Set a repeller voltage. This is the voltage between the filament and repeller, so setting 80V when the electron energy is at 80V will give a zero repeller to source voltage.
- Turn the filament limit control to zero (i.e. fully anticlockwise).
- Set a low value for the trap current. (1 turn on the control is 300uA).
- Turn the source current control to half way (equivalent to 5mA). This sets the maximum allowable source current.
- Set the monitor to measure the filament current.
- Turn the filament on.
- Gradually increase the filament limit setting to about 3A. The displayed filament current should track this.
- Set the monitor to measure the trap current. It should show a low value. Gradually increase the filament limit to the point that the trap current climbs and then stabilises. This should take no more than two more turns (i.e. to 4.6A).
- The trap current control should now dominate and hold the filament current fairly constant (the value will change gradually as the source warms up). Increase the filament limit by about 0.1A.
- Set the focus controls half way (i.e. to 85%).
- Set the ion energy (high voltage) to zero.
- Switch on the high voltage.
- Slowly raise the ion energy to the desired value.

Note: course focus is achieved by operating both focus controls together. Differential focus (sometimes called delta f, or delta half plates) is achieved by setting slightly different values on the two focus controls.

## Rear panel connections

The layout of the rear panel is shown below:



Connector	Function
1	Suppressor
2	* Source
3	Remote control interface
4	Mains input
5	Interlock

**WARNING:** Connectors with a \* are at high voltage when the system is operating.

### Connector 1: BNC socket - Suppressor

The core pin on this connector provides a negative voltage which may be connected to a collector secondary emission suppressor. The outer is at ground.

### Connector 2: High voltage connector – Source

This connector provides the main terminals for connection to the instrument's source electrodes. The connections should be made using wiring capable of sustaining at least 5,000 Volts. Note also that the filament connections can source 8 Ampere, and must be wired in appropriate low resistance cable.

Pin	Function
c	Filament
d	Filament
k,m	Half plate
f	Trap
l	Half plate
b	Repeller
e	Source
s	Analyser 0V

### Connector 3: 37 way 'D' - Remote control interface

Remote control is accomplished by connecting DC signals in the range 0 to +10 Volts to the appropriate terminals of connector 11. When left unconnected, the unit will automatically default to local manual control.

Similarly, monitor signals in the range 0 to +10 Volts which reflect the actual state of the source electrodes are provided on this connector.

Connector	Function
1	Electron energy setpoint
2	Trap voltage setpoint
3	0V
4	Filament limit setpoint
5	Trap current setpoint
6	0V
7	Source current setpoint
8	Focus 2 setpoint
9	0V
10	Focus 1 setpoint
12	0V
13	Repeller setpoint
15	0V
16	Z plate setpoint (optional)
18	0V
19	HT setpoint
20	Magnet field setpoint (optional)
21	0V
22	Magnet fine setpoint (optional)
24	0V
25	HT monitor
26	Trap current monitor
27	0V
28	Source current monitor
29	Filament current monitor
30	0V
31	Magnet field monitor (optional)
32	General monitor 1 - (Electron energy default)
33	0V
34	General monitor 2 - (Repeller default)
35	Magnet current monitor (optional)
36	0V
37	0V

**Connector 4: IEC Power inlet**

This is a fused connector which accepts mains power. The fuse, and an optional spare, is held in a box at the bottom of the connector. The switch on this connector applies mains power to the unit.

**Connector 5: 9 way 'D' – Interlock**

The interlock allows the unit's power to be remotely enabled and disabled. A normally closed switch connected between the pair of interlock connections will allow the power to be applied. Opening the switch will cause the power to drop out. The function can then be re-enabled by closing the switch and pressing the manual interlock and power buttons on the front panel.

Pin	Function
1	Interlock
5	Interlock

A standard arrangement would be to connect interlock to a voltage free contact on a vacuum gauge. The unit will trip off when there is no connection between pins 1 and 5, and remain off until the connection is re-established and the power and interlock switches are depressed.