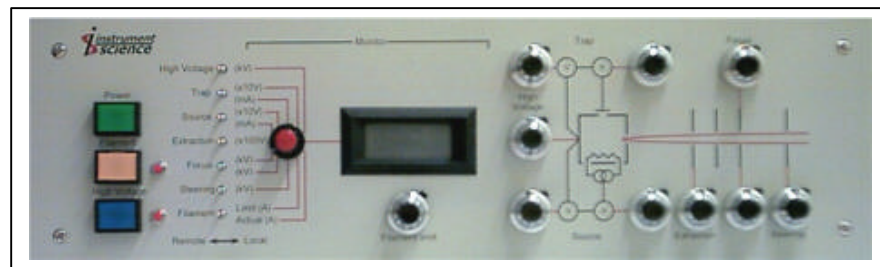


## IS1020 Source Electronics



## Technical Manual

## Overview

The IS1020 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 10,000 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 IS1020 does this electronically, which means that complete sets of source parameters can be readily programmed under remote control.

Many scientists like manual control of the source parameters, so the IS1020 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
- Gives details of the internal settings
- Lists the rear panel connections

## 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 mains 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 filament and high voltage functions operate via interlocks. To turn these functions on, the interlock pins on rear panel connector 14 must be connected, the small red button to the right of the front panel switch must be depressed and the switch momentarily pressed.

Pressing the switch again will trip the function 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 11 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. (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 10kV

Control	Function	Range
Extraction	Voltage from source to extractor	0 to -300V
Focus (two controls)	Voltage from source to focus plate	0 to -1500V
Z lens	Voltage from ground to Z plate	0 to 4kV

The filament, trap current and source current controls work together to influence the filament current.

Assuming the filament is switched on, the filament current will be regulated at the value set by the limit control, unless either the trap or source current has reached its control setting, in which case, the filament current will settle at whatever value is necessary to achieve this setting.

## Internal settings

Settings for additional source stack electrodes are made using jumpers within the unit. These are accessed by removing the four screws holding the underside panel to expose the focus PCB. Note: Remove the unit from any instrument and disconnect it from the mains supply before removing the cover.



Two rows of connections are exposed. Those labelled 9000 to 9800 are used for the internal connection to the shield output (shown at 9400 in the above picture). The numbers relate to the output voltage assuming that the main high voltage is set to 10,000V.

The connectors on the right of the picture are used for the flying leads which connect to the fixed Z plate, R plate and lens 1 and 2 outputs on the rear panel.

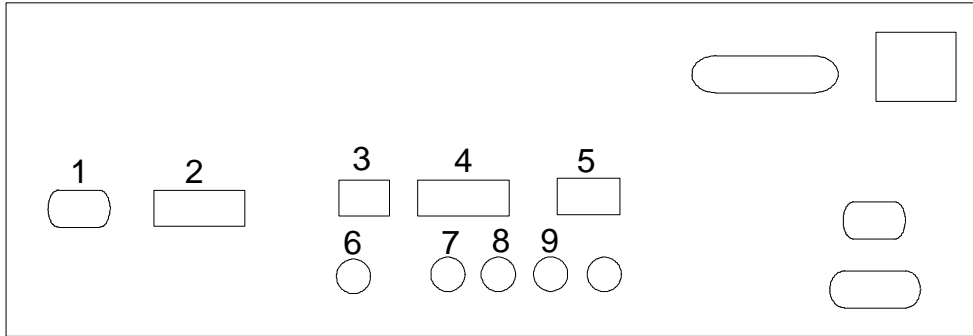
A final flying lead connects the variable Z plate output to its power supply at the bottom of the board.

If multiple electrodes must be connected to the same setting, this can be done by attaching leads to the patch areas at the high voltage end of the board.

If the unit is being used to replace an existing supply, it is worth noting the existing settings and configuring the new unit appropriately.

## Rear panel connections

The layout of the rear panel is shown below:



Connector	Function
1	Auxiliary power outputs
2	System ground
3	* Shield
4	* Source and filament
5	* Focus plates
6	* Adjustable Z plate
7	* Fixed Z plate
8	* R plate
9	* Lens 2
10	* Lens 1
11	Remote control interface
12	Mains input
13	Electromagnet control
14	Interlock and monitor select

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

The function of the individual pins within the multi-way connectors is listed below:

### Connector 1: 9 way 'D' socket - Auxiliary power outputs

This connector provides auxiliary outputs referenced to the system ground rail. The 15Volt outputs (if fitted) may be used to power devices such as head amplifiers. The suppressor output provides a negative voltage which may be connected to a collector secondary emissions suppressor.

Pin	Function
1	+15V (if fitted)
2	-15V (if fitted)
5	0V for suppressor output
6	0V for 15V supplies
9	Suppressor output

### Connector 2: 6 way box – System ground

All six terminals are connected to the ground rail within the unit. One or more of these terminals must be connected to the instrument's source metalwork. This is to ensure that the path for any source flashover current is minimised.

### Connector 3: 2 way box – Shield

Both pins on this connector are connected to the source shield output. One of these should be connected to the source shield using wiring capable of sustaining at least 10,000 Volts.

### Connector 4: 6 way box – Source and filament

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 10,000 Volts. Note also that the filament connections can source 8 Ampere, and must be wired in appropriate low resistance cable.

Pin (from left)	Function
1	Electron trap
2	Extractor
3	Filament negative
4	Filament positive
5	Source
6	Source

### Connector 5: 2 way box – Focus plates

The source stack focus plates should be connected using wiring capable of sustaining at least 10,000 Volts.

Pin (from left)	Function
1	Focus plate
2	Focus plate

### Connector 11: 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 11: 37 way 'D' - Remote control interface (continued)**

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	Extractor setpoint
15	0V
16	Z plate setpoint
18	0V
19	HT setpoint
20	Magnet field setpoint
21	0V
22	Magnet fine setpoint
24	0V

**Connector 11: 37 way 'D' - Remote control interface (continued)**

Connector	Function
25	HT monitor
26	Trap current monitor
27	0V
28	Source current monitor
29	Filament current monitor
30	0V
31	Magnet field monitor
32	General monitor 1 - (Electron energy default)
33	0V
34	General monitor 2 - (Extractor default)
35	Magnet current monitor
36	0V
37	0V

**Connector 12: 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.

### Connector 13: 9 way 'D' socket – Electromagnet control

This connector provides an interface to an Instrument Science*Vector* electromagnet control unit.

Pin	Function
3	Field monitor input
4	Current monitor input
5	0V
6	Field setpoint output
7	Fine setpoint
8	0V

### Connector 14: 15 way 'D' plug – Interlock and monitor select

Interlocks allow the high voltage and filament to be remotely enabled and disabled. A normally closed switch connected between a pair of interlock connections (e.g. pins 8 and 15 for the HT interlock) will allow the corresponding function to operate normally. Opening the switch will cause the function to drop out. The function can then be re-enabled by closing the switch and pressing the manual interlock and on buttons on the front panel or momentarily bridging the appropriate pair of trip override pins.

Pin	Function
1	0V
2	Monitor select 1
3	Monitor select 2
5	Filament trip override
6	HT trip override
7	Filament interlock
8	HT interlock
12	Filament trip override
13	HT trip override
14	Filament interlock
15	HT interlock

A standard arrangement would be to connect the filament interlock to a voltage free contact on a vacuum gauge, and the HT interlock to a microswitch on cabinet housing the unit.

Note that the HT interlock does not disable the focus lens or z plate outputs.