Fume Hood Operation:

Fume hoods are designed to protect against toxic and dangerous material by dragging airflow away from the user and thus preventing harmful vapours being inhaled or ingested. The aim of this guide is to provide a description of the fume cupboard systems in the School of Chemistry in **Science South (CSCB) and in Science South (A1)** and to describe how to use them safely and efficiently.

Extraction of Air:

The design of the fume hoods and the air handling systems in Science South (CSCB) differ from those in Science South (A1). Both are of the built-in ducted type that vent to the outside *via* outlets on the roof. However those in Science South (CSCB) have individual fans whereas those in Science South (A1) are arranged in a manifold style with one constant speed extraction fan per laboratory (i.e. all fume cupboards in a lab are served by the same fan).

The manifold arrangement is energy efficient. However, any malfunction of the fan will affect all fume hoods in any one laboratory. Each fan has a back-up motor that will automatically take over in the unlikely event of a malfunction.

The fume hoods are equipped with a VAV (Variable Air Volume) controller which maintains a constant velocity in each fume hood regardless of the sash position. This controller operates by means of an individual damper for each fume cupboard which adjusts in accordance to the sash position. Extract volume is at a minimum (reduced to 80 % of maximum extract volume) when the sash is in the lowered position.

The extraction fan for each laboratory operates continuously, and so, there is no local on/off control at each fume hood. During night-time/weekends/holidays, the fume hood system is set to adjust accordingly thus maintaining energy efficiency. Nevertheless, out of hours use is always possible as the system is set to maintain airflow at these times, albeit in a reduced number of fume hoods.

Air Handling Units (AHU):

The air extracted by the fume hoods is replaced by air provided by an Air Handling Unit (AHU) in such a way that a negative pressure is maintained throughout the laboratory. There is a separate AHU for each laboratory and the amount of air provided is determined by the amount of air extracted by the fume hoods. Fume hoods not only extract air but also heat and so the AHU provides heated air in order to maintain a constant temperature. Air and heat extraction from the laboratory is at a minimum when all sashes are in the lowered position. Thus, chemical containment and laboratory energy are at maximum efficiency level when all sashes are in the lowered position.

Fume Hood Alarms:

Each fume hood is equipped with an alarm that will sound if there is insufficient airflow for a safe working environment (this will sound if the height of the sash exceeds the maximum height for a safe working environment). If this alarm sounds, the user must investigate the cause. If the sash is above the maximum height (indicated by the stop mechanism) for a safe working environment, the user must lower the sash.

Automatic Sash Closure:

The fume hoods are equipped with an "Automatic Sash Closing" device. This device ensures that no fume hood sash is inadvertently left open for any significant length of time when the fume hood is not in active use. This device is set so that if there is no movement detected at a fume hood during a period of 5 mins the sash will automatically close. The advantage to this is that chemical containment will be maintained as much as possible and also the fume hood system will run at maximum energy efficiency. A hazard related to this automatic device is that any apparatus left protruding from the fume hood will obstruct the sash when it closes. Hence, no apparatus should ever be left obstructing the sash area. For special cases where a piece of equipment (e.g. an immersion cooler) obstructs the sash area, the automatic closure may be disabled temporarily.

Operational Instructions for Automatic Sash Closure

a) The auto sash may be operated manually.

b) The auto sash can be electrically operated by use of the **up / stop / down** switch fitted to the LHS of the fume hood.

c) The **up** switch: Sash opens and stops at the maximum working height (500mm above worktop), unless the **stop** switch is pressed.

d) The **down** switch: Sash closes to the low level stop position (just above the front airfoil).

e) Automatic closure: Sash closes automatically to the low level stop position after 5 mins of no activity. The front sash movement stops immediately as soon as a person is detected via the PIR (passive infrared sensor) within the working area of the sash.

f) Detecting obstruction: In addition to the PIR, an additional safety stop is fitted. This low level light barrier will immediately stop the sash moving up or down if the light beam is broken by user operation or by an object protruding from the fume hood at this height. Auto closure is deactivated and requires the sash to be manually moved by 30 mm or the **up / down** switch utilised to reinstate auto closure.

Servicing:

The fume hoods are serviced annually by an external certified company.

General Safety Guidelines For Fume Hood Use:

As stated throughout this document, fume hood sashes must be lowered as far as possible at all times for maximum efficiency in coping with the removal of vapours. Proper safe work practices for fume hood users include:

- All apparatus should be set up at least 15 cm behind the plane of the sash.
- Never put your head inside an operating fume hood to check an experiment.
- Always work with the sash in the lowest position possible.
- Do not clutter your hood with bottles or equipment as this can interfere with the smooth flow of air.
- Keep your fume hood clean. Only materials actively in use should be present. Be especially attentive to the presence of acids.
- Do not obstruct the glass with paper of writing - white boards will be provided at the ends of each bank of fume hoods.
- No apparatus should protrude from the fume hood as this will obstruct the automatic closing sash (and also hinder sash closure in the event of an emergency).
- Do not use fume hoods as storage cabinets for chemicals as these represent potential additional hazards in the event of an accident.
- If airflow fails for any reason, work must stop in all fume hoods (in any one laboratory) and the sashes must be closed until airflow is restored.
- Clean-up spills immediately.
- When using extremely hazardous chemicals, always prepare a plan of action in case of an emergency, such as a power failure.
- Waste bottles held in the fume hood should be kept closed. It is illegal to use fume hoods (especially manifolded ones) for the evaporation of volatile organic compounds.

Guidelines on Fume Hood Manifold Issues. The UCD Safety Office (SIRC) has supplied the following guidelines on issues related to manifolded fume hoods:

Where fume hood extracts are linked together in a single manifold extract system then some additional precautions need to be taken. Whilst manifolded systems offer an additional degree of protection to the user over single flue units due to the increased dilution in the extract flues and the presence of a backup extract fan, the indiscriminate mixing of exhausts from different fume hoods could lead to the generation of an unstable / dangerous atmosphere in the common extract flue. To prevent this happening the following materials must not be used in a manifolded extract system: radioactive materials; fuming acids; any concentrated acid including, hydrofluoric, perchloric, nitric, etc; any biological material of Class 2 or above.

If in doubt do not use a manifolded fume hood until advice has been obtained.

Operational Notes:

The following are useful notes in relation to the general operation of the fume hoods in the Science South (A1) Laboratories of the School of Chemistry:

- There are 2 types of nitrogen gas taps (house supply); one being classified as "normal" control and the other classified as "fine" control. The "fine" control taps allow very fine control of the amount of gas and are suitable for use with gas bubblers, etc. Fume hoods with a total of 3 nitrogen taps possess 1x"normal" and 2x"fine" control. Fume hoods with 4 nitrogen taps possess 2x"normal" and 2x"fine" control.

- All vacuum taps must be fitted with a suitable trap at all times to protect the house vacuum system from solvent ingress.

- All fume hoods are fitted with a cabinet underneath to house a vacuum pump for reduced pressure distillations and/or Schlenk line connection (if required). This cabinet is connected to the lab venting system, and so, airflow in this cabinet should be sufficient to alleviate any exhaust fumes or heat from the pump. Attached tubing to the pump exhaust to lead the exhaust fumes into the venting system.

- The cabinet should accommodate the most common types of pump used in chemistry laboratories (e.g Edwards RV-5). If your pump does not fit, do not force it in. It is good practice to have oil mist filters on such pumps to reduce contamination of the cabinet.

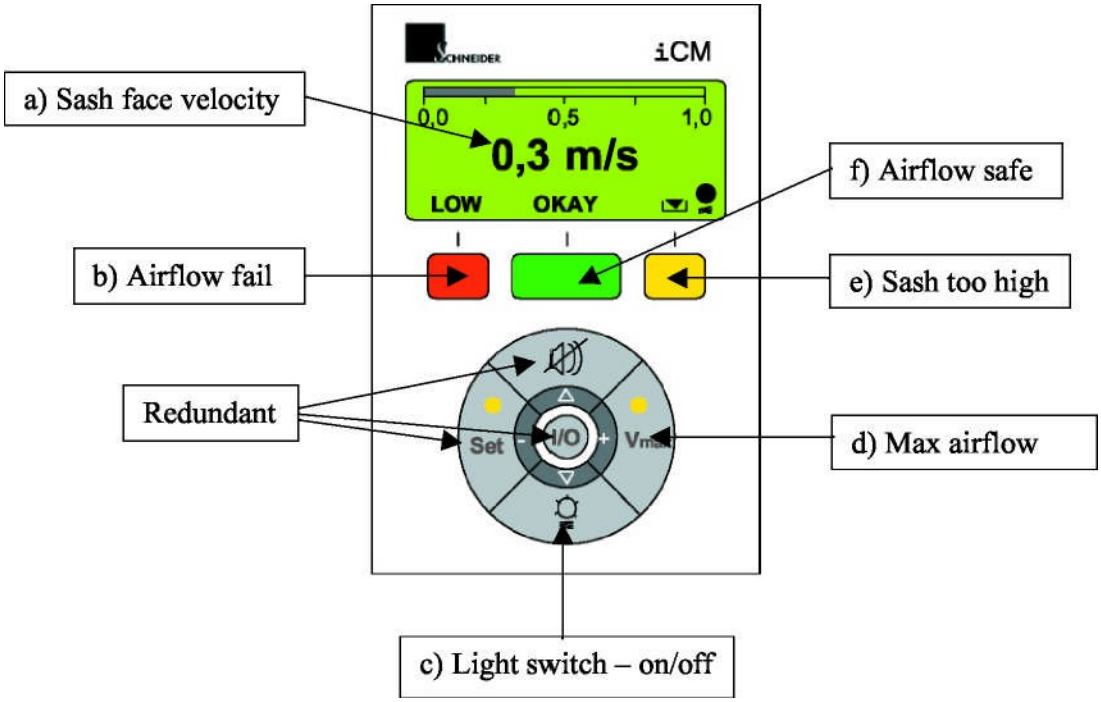
- Schlenk lines may be connected to the vacuum pump in the cabinet below the fume hood by means of the pass through conduit provided. Once the tubing has been passed through this (some lubrication may be required), the hatch at the back of the pump cabinet may be temporarily removed (with a screwdriver) to allow access to the tubing.

- The airfoil (stainless steel lip at the front of each fume cupboard) is hinged to allow easy access for cleaning.

  All special gas/"X" gas supplies are fitted with "fine" control gas taps.

- There are two power isolation switches on the top left-hand-side of each fume hood which allow the user to isolate electrical supply to the power sockets on the fume hood and also in the under fume hood pump cabinet.

Science South (A1) Fume Hood Control Panel:



a) Continuous digital read out of sash face velocity.

b) Airflow fail (red indicator) with audible alarm.

c) Light switch – on/off.

d) Max airflow option: This option sets airflow to maximum while the sash is in the lowered position (an orange light flashes when this mode is enabled). This mode should only be used in an emergency (e.g. if there is a spill in the fume cupboard) and should be manually disabled (by pressing the button once more) once it is no longer required.

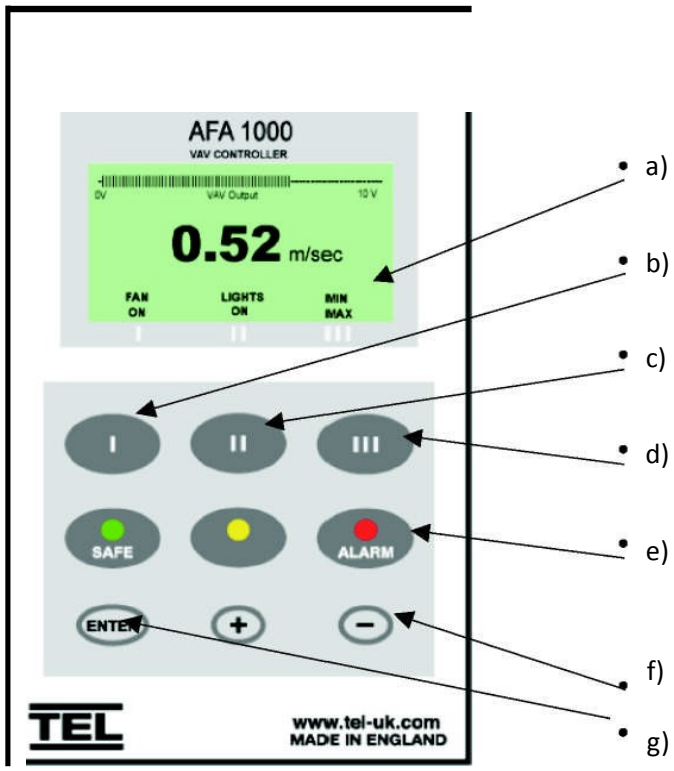
e) Sash too high (flashing yellow indicator).

f) Airflow safe (green indicator).

Emergency Procedures:

The activation of the Fire alarm, causes a set of actions to occur automatically: Fume Hood extraction is turned off, and ventilation is shut down following a 5 minute delay. The hydrogen gas supply is also shut-off. In the case of fire, close all sashes and leave lab. In the case of fan failure for any other reason, again close sashes and report to the Safety Coordinator.

Science South (CSCB) Fume Hood Control Panel:



a) Digital Display with continuous reading of face velocity, alarm condition & pushbutton status
b) Programmable Pushbutton I (Fan Stop/Start)
c) Programmable Pushbutton II (Light On/Off)
d) Programmable Pushbutton III (Spare Function)
e) 3 Alarm Indication Lights (Green– safe, Amber – warning, Red – Alarm)
f) + and – configuration buttons
g) Enter Button

Operation

1. With the sash in closed position, press **Fan On** (pushbutton 1). Fan will start and after it is allowed to get to running speed, green – safe light will illuminate.
2. Raise sash to safe working height sash stop. Safe light will still be illuminated and digital display should give required face velocity reading.
3. If there is a requirement to raise the sash above the safe working height (Bench mounted fume hoods only) please **DO NOT try to force the sash past the stop.**
    - If the sash is raised above the normal working height of 500mm, the audible sash high alarm will activate with the amber light flashing and the digital face velocity will toggle with a SASH HIGH display. The alarm can be muted by pushing enter.
    - Upon air failure (caused by sash being high as well as fan / extract system failures) the amber light will flash for a warning it is getting low and then the audible air fail alarm will activate with the red light flashing and the digital face velocity will toggle with a AIR FAIL display. The alarm can be muted by pushing enter.
4. Lower the sash completely and press **Fan Stop** (pushbutton I). The digital face velocity reading will reduce to zero and toggle with AIR FAIL display, all alarms will be muted and the red alarm indicator will flash. Air Fail status will continue until the fan is re-started