Development and Construction of Manual Polariser Manifold Assembly

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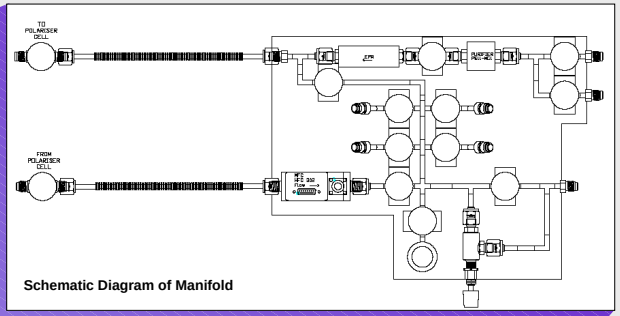
Introduction

One of the objectives of the BTG project was to pool expertise from the different establishments to produce a polarising unit for Nottingham University. The poster showing the progression of the polariser is the work carried out over the last 2 years. This poster shows the final developmental stages of the new manifold system. The gas handling expertise of Chell Instruments Ltd. was employed to assist in construction of the manifold system.

Electronic Pressure Regulator (EPR)

The Horbia STEC UR-7340 is an ultra clean automatic pressure regulator:

- This is an electronic regulator with high-precision pressure sensor
- It is equipped with a high resolution, fast response piezo-actuator valve. Response speed: within 0.5 sec
- There is no fluctuation in pressure accompanying the change in gas flow rate
- The pressure is controlled in accordance with the electric signal (0 to 5 VDC) they received from the THPS-400
- The all metal construction of the gas contact area makes this unit ideal for ultra clean pressure control of ultra pure gas supply systems

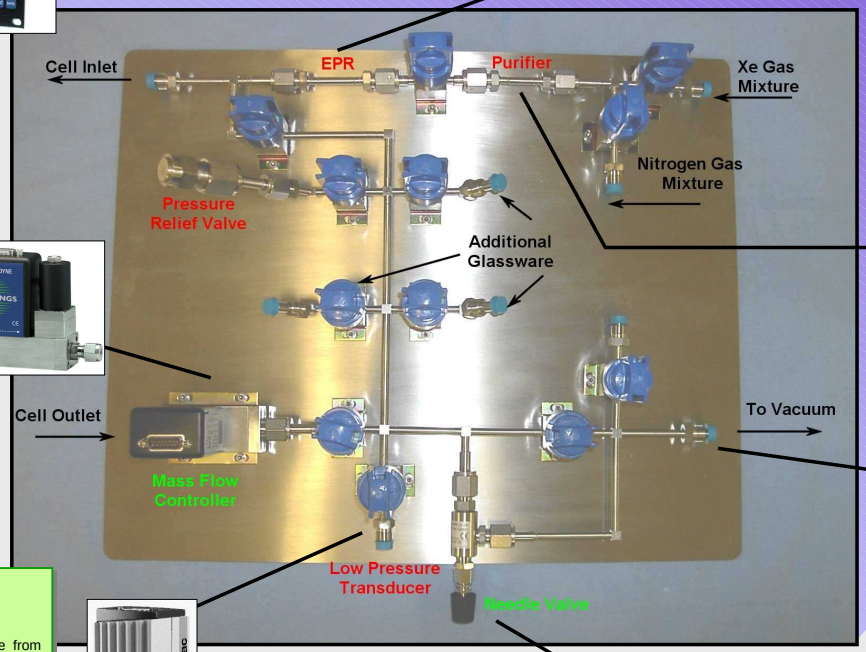


Schematic Diagram of Manifold

Power Controller

Hastings THPS-400 4-channel power supply:

- Can control 4 different electronic pieces of equipment
- It is possible to set the flow rate or pressure remotely via the THPS-400
- The display shows the flow/pressure varying to meet the pre-set requirements
- It allows the components to fully open/close the valves using one button
- It comes equipped with standard RS-232 and RS-485, serial communication
- Most functions, features, signals and alarms are accessible and modifiable via any remote computer
- It provides power to the EPR and MFC



Purifier

The MicroTorr® Getter stabilized zeolite purifier/filter combo:

- Is used to clean the canister gases, by removing moister and dirt, before entering the cell
- The purifier uses a gas-specific purification media to remove impurities to < 1 ppb.
- Analytical testing is performed utilizing APIMS technology to certify maximum performance.
- It is also possible to vacuum through the purifier, which is not possible with some manufactures

Mass Flow Controller (MFC)

The Hastings Metaline Mass Flow Controller (HFC-302):

- Controls the desired pre-set flow rate through the cell
- It can control flow from 0 to 200cm^3/min of Helium.
- Changes in flow rate are detected in less than 250 milliseconds
- The Metaline is constructed of 316 stainless steel, all internal seals are made with Ni 200 gaskets, eliminating the permeation, degradation and out gassing problems of elastomer O-rings.
- The shunt (the flow rate of interest determines the size of the shunt required) is designed to have minimal wetted surface area and no unswept volumes. This will minimize particle generation, trapping and retention
- The sensor is less likely to be clogged due to its large internal diameter (0.026"/ 0.66mm), clogging is the most common cause of failure in the industry

Pump System

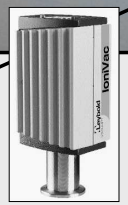
The PT 70-Compact turbomolecular Leybold vacuum:

- Completely oil-free
- Low ultimate pressure free of hydrocarbons (< 10^{-8} mbar)
- High effective pumping speed
- Compact and small unit
- Simple operation (on/off button)
- High level of reliability
- Maintenance-friendly design
- Air cooling

Low Pressure Transducer

IONIVAC Transmitter ITR 90 Leybold vacuum:

- Active sensor measurements of gas in the pressure range from 5x10^{-10} to 1000 mbar
- It uses a combination of a hot cathode ionization sensor after Bayard-Alpert and a Pirani sensor permits vacuum pressure measurement. This provides continuous pressure measurements from 10^{-10} mbar to atmospheric pressure, eliminating the need for two pressure sensors
- Controlled switching on and off sequencing through the integrated double Pirani optimises the service life of the yttrium coated iridium cathodes
- Compact design
- Simple fitting of the sensor using KF vacuum flanges
- With built-in display for stand-alone operation without need for additional display components
- RS 232 C interface



Needle Valve

Chell Instruments Fine gas flow control valve:

- Used to reduce large pressure exiting the system and prevent damage to the turbo-molecular diaphragm pump
- Stainless Steel construction with Perlast seals
- Helium Mass Spec. Leak Test to 10^{-8} mbl/sec
- Smooth opening, 6 turns to 2cm^3/min

Future Outlook

Once the final amendments have been completed by Chell Instruments, the manifold will be transported to Nottingham University, where the glassware will be added. The new laser system will complete the hyperpolarized gas unit for Nottingham University.

Acknowledgements

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Troy Stehr from Chell Instruments Ltd