



# Measurement and Control of Compressed Air Systems

## Background

Many manufacturing processes require a constant supply of compressed air. The air may be used for many different reasons - for example the actuation and control of pneumatic valves, cylinders and controllers; operation of process machinery or tooling; as a transport medium for bulk materials; or as a purge gas. The compressed air supply will contain some moisture which, if uncontrolled, could potentially cause damage to the process, pneumatic controls, tooling, finished product, or indeed the components of the air distribution system itself.

To reduce the likelihood of these problems occurring, compressed air supplies are often conditioned to remove or significantly reduce the moisture content, before the air is consumed by the process.

Refrigerant dryers are commonly used to reduce the moisture content of compressed air. In principle the compressed air is cooled in a heat exchanger to a temperature just above the freezing point of water, causing much of the moisture in the air to condense out to liquid, which can then be drained off. Efficient operation of the dryer is dependent on maintaining good temperature control at close to 0 °C in the heat exchanger and upon the design of the heat exchanger itself. If the temperature drops below 0 °C ice will form on internal surfaces and dryer performance will be reduced. Refrigerant dryers are normally

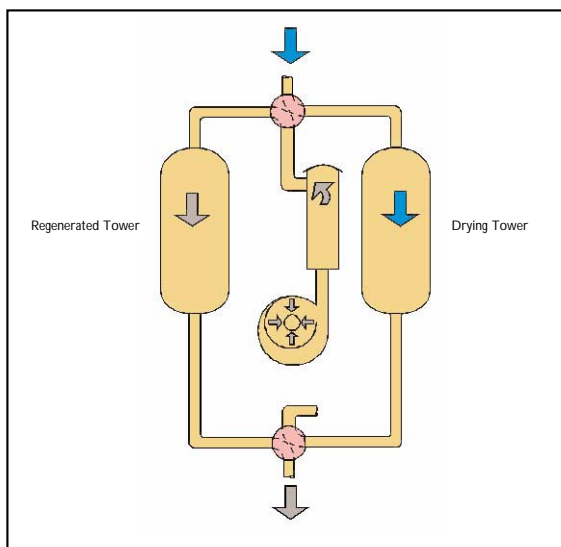


Diagram of a drying cycle in a twin column regenerative dryer



Robots on a car plant production line

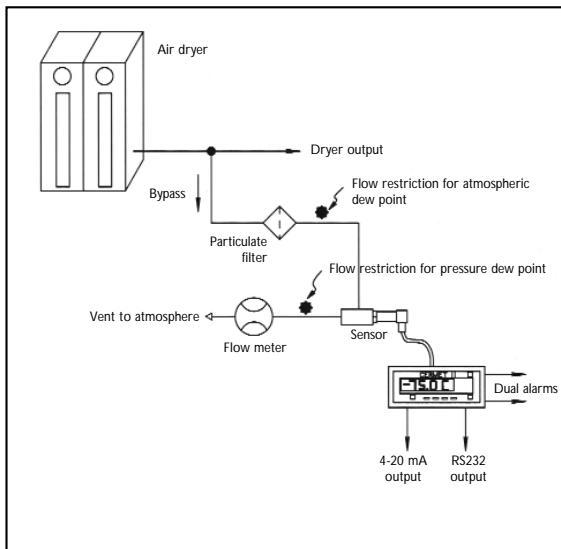
equipped with temperature sensing devices to monitor the outlet air temperature. This measurement will give a first indication of the operation of the dryer, but does not guarantee the quality of the air at the dryer output. The only way to be certain that the dryer is functioning correctly is to measure the moisture content of the outlet air directly using a suitable hygrometer.

Regenerative desiccant column dryers can offer a very efficient method of air drying. These dryers are normally configured in twin columns, allowing one column of desiccant to be regenerated whilst the other is performing the air drying process. There are two common types - pressure swing and heat-regenerative. A pressure swing dryer uses a sudden drop in pressure of the column under generation to evaporate moisture from the desiccant, which is then flushed out of the column to atmosphere by a back purge of air from the column under load. In the case of heat-regenerative dryers, large electrical or steam heaters are used to regenerate columns of saturated desiccant material and in such cases energy efficiency is of prime importance. As the demand made on the dryer can be variable, it follows that it would be advantageous to control the dryer cycle period according to the output performance required - rather than simply on a fixed time interval, as is often the case. By monitoring the moisture content of the common dryer outlet using a hygrometer, this information can be used, not only as a quantitative measurement, but also to initiate the dryer cycle change-over point at a pre-determined moisture level. This system is often referred to as "dew point dependant switching" or-DDS and it provides the user with significant energy savings as well as providing a consistent quality of dry air output.



## Measurement Technique

Michell Instruments can offer instruments which are ideally suited to the measurement or control of compressed air systems. The Michell Cermet II Hygrometer, utilising the Michell Advanced Ceramic Moisture Sensor, is ideal for providing continuous on-line measurement and control of dew point levels within air drying systems. Sensors can be installed at the dry gas source and at strategic points along the air supply lines or directly at the point of usage. In all cases, installation involves sampling from the air line at a point of interest and measuring at line pressure (up to 30 MPa(g)) or vented to atmosphere. A pre-filter is always recommended as a precaution against contamination by solid particles or condensates which may be present in the air supply lines.



Picture Caption

Annual recalibration of the sensor (traceable to international standards) provides compliance with the most vigorous quality requirements. Cermet II sensors are interchangeable without the need for any electrical adjustment to the monitor, allowing the user to exchange sensors for re-calibration with minimum system downtime. Cermet II offers all the flexibility needed for this application, with multiple supply voltages, dual alarms, voltage current analogue outputs, RS232/485 digital outputs and a display which is configurable to read in a variety of humidity units.

Michell's Transmet Dewpoint Transmitter offers a low cost alternative to Cermet II. Utilising the same Michell Advanced Ceramic Moisture Sensor and installed in exactly the same way as Cermet II, Transmet provides remote measurement of the compressed air supply line with either an analogue or digital signal to a central monitoring location. When operated in the RS485 digital mode, up to 32 Transmets can be daisy chained to give continuous on-line measurement at strategic points across the whole compressed air distribution system, monitored by a PC, DCS or SCADA system. An optional monitor unit can be added to Transmet to provide local display, output and alarm functions if control of the air dryer is required. Michell's portable dew-point hygrometer, Cermax, can be used as a spot check tool. Fast response and ease of use (with data logging facility) enables the user to make a quick gas analysis.

## Reference Users

Domnick Hunter, Atlas Copco, Hamworthy, Walker Filtration, Peak Scientific, Colortronic, and many more ...