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# TRANSFORM RELATIVE PRESSURE SENSOR READING INTO ABSOLUTE PRESSURE

HP INC

# Transform Relative Pressure Sensor Reading Into Absolute Pressure

**Abstract:** Relative pressure of an Ink Delivery System of a printer is transformed into absolute pressure using a second pressure from an external sensor.

This disclosure relates to the field of printers.

A technique is disclosed that transforms the relative pressure (fluid pressure compared to a second fluid) into absolute pressure by comparing the relative pressure reading to a second external sensor, which is used as reference point.

Some printer systems use pressure sensors to measure the pressure value of certain fluids e.g. air, ink, etc. In certain applications the sensors are differential ones, which means that they provide a reading of the pressure of one fluid compared to another fluid, being both connected to the same pressure sensor. In many cases, there is only one fluid whose pressure is relevant, while the other one is just a reference used for purposes of comparison.

Differential sensors tend to be affected by noise issues, since the two different fluids can transmit undesired effects and anomalies to the output pressure signal. When using the information retrieved from a differential sensor, it is very important to detect and filter those kinds of events. This typically requires a lot of effort in characterization and testing of systems using a differential sensor. However, unanticipated events may happen which cannot be identified and responded to properly by the printers, which leads to inaccuracies and bad decision making by the systems.

According to the present disclosure, and as understood with reference to the Figure, the relative pressure measure of a Differential Sensor 20 of an Ink Delivery System (IDS) 10 which transports ink to a Printhead 30 is transformed and converted into an absolute pressure value of one of the fluids.

In operation, an Ink Pump 40 moves the ink from an Ink Supply 50 to an Intermediate Tank 60, which acts as reservoir of ink and provides the ink to the Printhead 30. An Air Pressure System applies pressurized air to the Intermediate Tank 60, which pushes the Ink from the Intermediate Tank 60 to the Printhead 30. The Air Pressure System includes an Air Pump 70, and an Air Pressure Sensor 80 to measure the air pressure. The Differential Pressure Sensor 10 returns the delta in pressure between the ink and the Air Pressure System.

On one side, the reading obtained by the Differential Pressure Sensor 10 is the following one:

$$Pressure_{Diff.Sensor} = Pressure_{Ink} - Pressure_{Air} \qquad (1)$$

where $Pressure_{Ink}$ is the absolute pressure of the Ink and $Pressure_{Air}$ is the absolute pressure of the air in the Air Pressure System.

On the other side, there is the pressure reading of the Air Pressure Sensor 80 (PressureAPS), which is the also the absolute pressure of the air in the Air Pressure System (2):

$$Pressure_{APS} = Pressure_{Air} \quad (2)$$

Thus, that equality can be used to derive the absolute pressure of the Ink:

$$Pressure_{Ink} = Pressure_{Diff.Sensor} - Pressure_{APS} \quad (3)$$

Note that in equation (3) both $Pressure_{Diff.Sensor}$ and $Pressure_{APS}$ are sensor readings, hence they are known by the printer and can be used to automatically calculate $Pressure_{Ink}$.

The disclosed technique has numerous advantages:

Versatility: by using readings from a differential sensor to calculate the absolute pressure of a fluid, the printer knows both relative pressure and absolute pressure. This allows the printer to use more advanced and complete algorithms that are not possible if only one of the data sets is available.

Accuracy: because absolute pressure value is obtained, the noise and disturbances coming from the second (reference) fluid are eliminated, making the pressure readings cleaner and more precise.

Robustness: since the Ink pressure is no longer related to the Air pressure, the system is more robust to leakages and pressurization problems in the Air Pressure System. For example, algorithms for controlling Ink flow can be defined independent of the Air pressure, and the different states of the Ink circuit are determined whether the Air circuit works properly or not.

Improved Diagnosticability: both fluid circuits can be diagnosed independently, avoiding undesired effects coming from one of the circuits distorting or masking issues in the other fluid circuit

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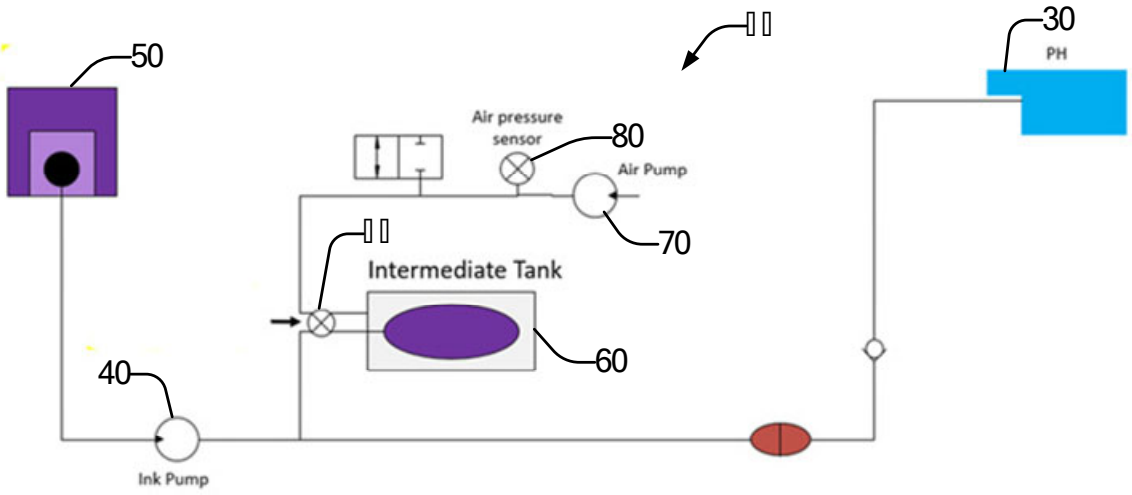
50
30
PH
Air pressure
sensor
80
Air Pump
70
Intermediate Tank
60
40
Ink Pump