TOTALFLOW
Technical Bulletin 95

Static Pressure Correction (Explanation and Troubleshooting Guide)

Totalflow Technical Bulletin

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Static Pressure Effect (SPE) on Differential Pressure Explanation and Troubleshooting Guidelines

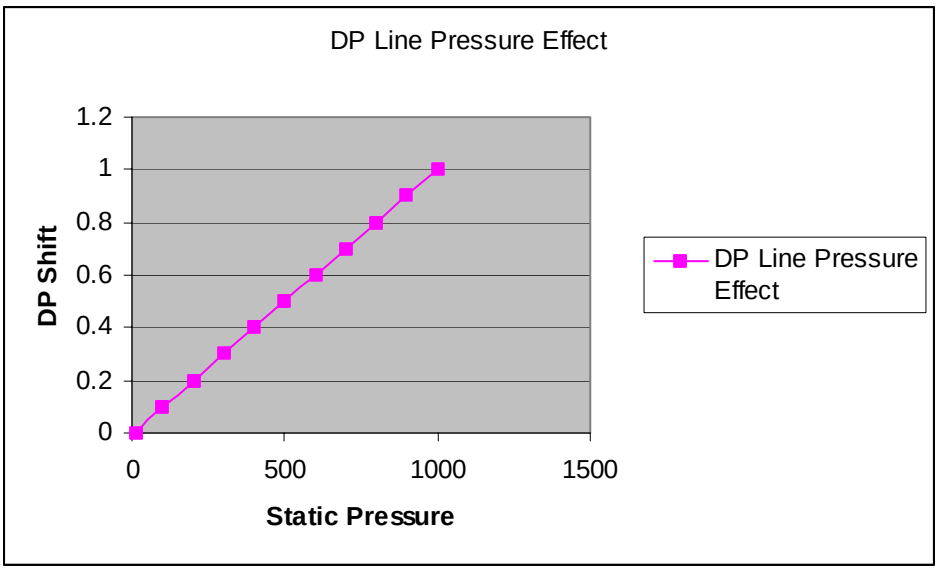
The output of a differential transducer changes slightly as a result of operating in the presence of static pressure above ambient (barometric pressure). This effect is named *static pressure effect (SPE)* and it can affect both the zero and span of a differential pressure transducer, effectively shifting the calibration of the differential pressure device.

A DP cell normally operates in the presence of static pressure, thus it is desirable to compensate for these effects, in order to maintain calibration of the DP cell. Totalflow flow computers perform compensation calculations to correct for *static pressure effect* on the DP transducer that is a component in our AMU (Analog Measurement Unit).

How the Software eliminates DP line pressure effects

Static Pressure Effect, is quantified *as a part of the* AMU characterization process at our factory. Our characterization system looks at the DP offset at both atmospheric (vented) pressure and at the static pressure's span (calibrated range). A typical SPE can be illustrated in the "DP Line Pressure Effect" chart below. From this data our characterization system computes the slope using the two SP and DP offset points gathered during the calibration process.

The chart below represents how a raw DP cell's output is affected by line pressure being applied equally to both the high and low side of the DP cell. The shift indicated below is typical of a DP cell that hasn't been compensated for *static pressure effect*. Since every AMU is characterized at our factory, then compensation for the *static pressure effect is performed on all AMU's (DP Cells) supplied by Totalflow.*



By knowing the offset at each Static pressure point the AMU can correct for SPE at any given static pressure. This correction is continually applied to the DP's output to compute a corrected DP output. The graph below is an illustration of the DP cell's output after SPE compensation is performed. The correction algorithm has an accuracy of +/- .1% of DP span (i.e. +/- .1"H2O based on a 100" DP cell).

It is **not** recommended to zero the DP cell under line pressure conditions as this action can offset the DP's zero at other line pressure points.

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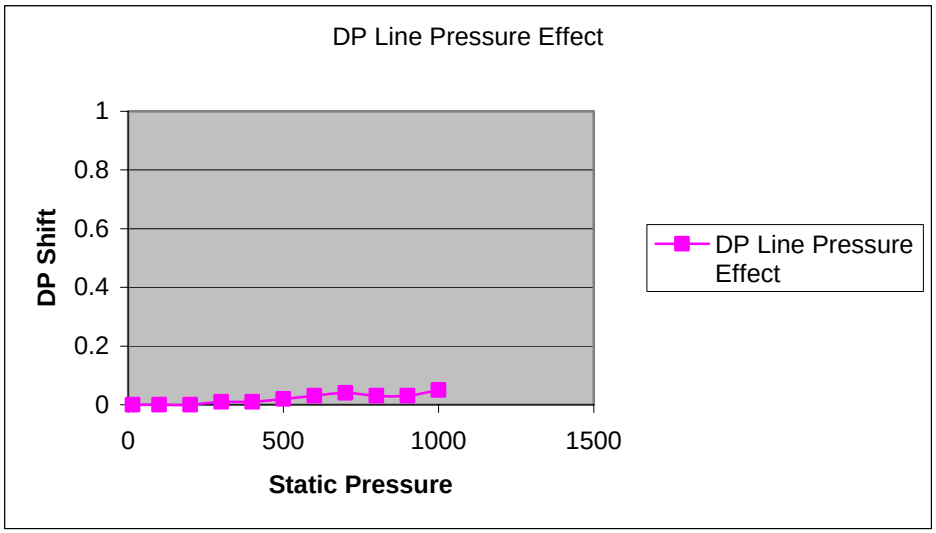


Question – Does this correction get re-computed whenever I calibrate static pressure in the field?

Yes, each time the static pressure is calibrated the flow computer goes through a process of quantifying the SPE over the new calibrated pressure range. This newly computed SPE overwrites the Flow Computer's previous SPE (factory SPE or previous field SPE).

Question – Is there anyway for me to cause an inaccurate field SPE?

Yes, ***it is critical to have the same pressure applied to both the high and low side of the DP cell at each of the three (or five) SP calibration points***. This is due to the fact that the Flow Computer is assuming the DP output should be zero (same pressure on both sides of the DP cell) throughout the complete static pressure calibration and looking for any deviation from zero, which is assumed to be due to SPE. Since the software checks for the amount of DP shift at each SP calibration point, shift in the DP output caused by

anything other than SPE will be considered as part of the SPE, which will cause an incorrect DP SPE quantification.

Common reasons for SPE error include:

1) Manifold leak causing a positive or negative differential pressure to be induced while calibrating SP's high point.

2) Using the meter run's line pressure to calibrate the SP high point and forgetting to block in the tap valves. This calibration method often causes flow through the 3 or 5-way manifold and induces a false DP at the high SP calibration point.

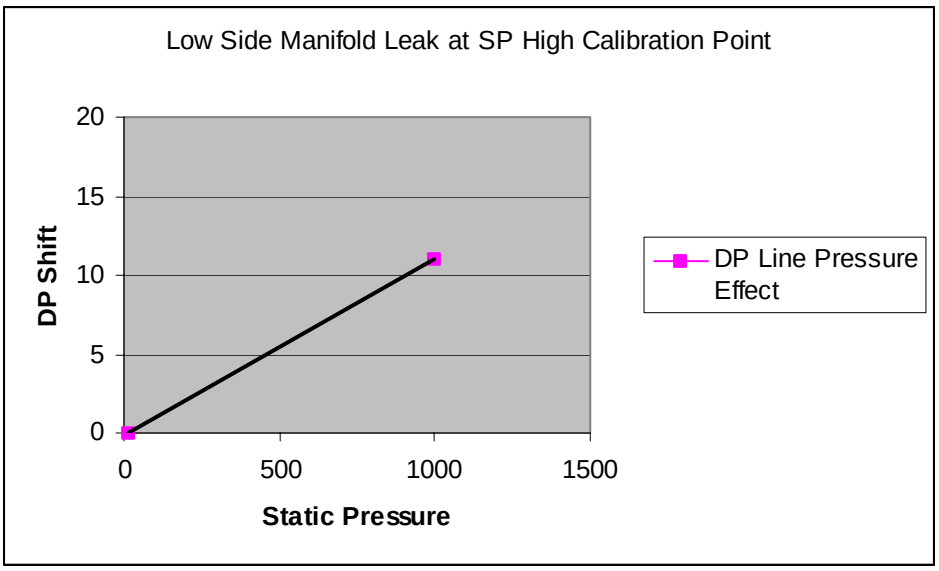
3) Entering the SP high calibration standard using PCCU before the pressure has had time to equalize and stabilize. (TAKE YOUR TIME)

4) High or low side manifold blockage causing a non-equalized condition across the DP cell

Question – Can you give me an example of what I would see if the SPE were incorrectly computed?

In this example assume that the user had a small manifold leak on the low side while calibrating static pressure. This might result in

- DP output equal 0" at low static pressure cal point (atmosphere)
- DP output equal 11" at high static pressure calibration point (1000 psi)



The above DP readings of 0" (at atmospheric pressure) and 11" (at 1000 PSIA) will be inputs for the Flow Computer to compute new SPE data. In this example we will assume the DP would normally shift 1% or 1" H2O when 1000# is applied equally to the DP's high and low side. As a result of this information the Flow Computer would compute the following curve.

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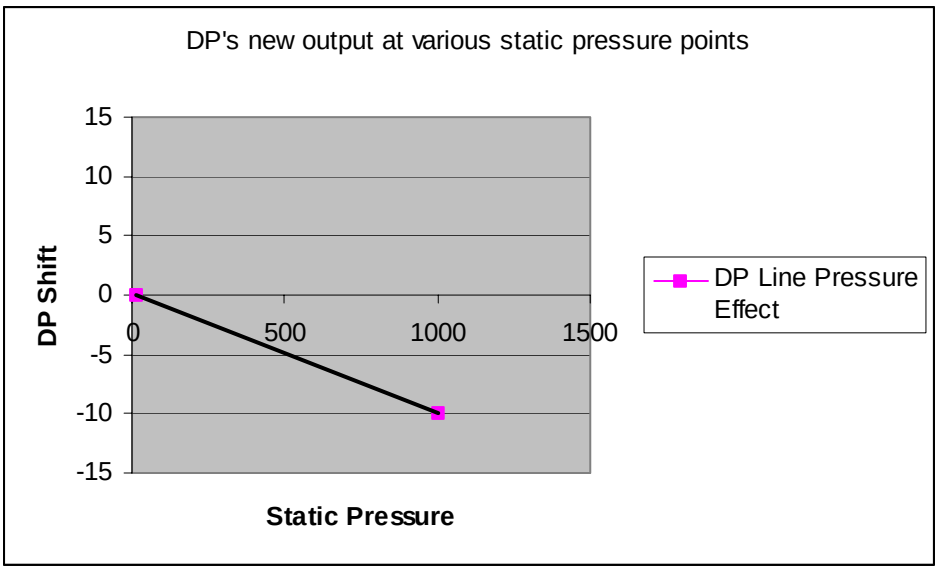

From this example the SPE compensation algorithms would incorrectly shift the DP output negative. The higher the static pressure, the more negative DP would be shifted. At 500# the DP would be reading 5 inches low. At 1000# the DP would be reading 10 inches low, etc.

What tests can be performed to check for an incorrectly computed SPE?

Before putting a meter in service the operator should always check the DP zero at both vented and line pressure conditions. At line pressure, both sides of the DP cell should be equalized (differential pressure of zero across the DP cell) and the cell should be isolated (using tap valves) from the meter run's pressure.

To perform these checks the user must be in "DP Check" within PCCUs "Calibration" menu. These checks cannot be accurately done in monitor, entry mode, or by watching the Flow Computer's scrolling display. "DP check" mode is required because it temporarily removes the DP zero cutoff and allows the user to see negative DP values. This is important because SPE might shift DP either positive or negative. Monitor mode will not allow the user to see any value below the zero cutoff; thus any SPE causing DP to shift negative would look like a good zero, if viewed in monitor mode.

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Step-by-Step Procedure:

1) Perform your normal calibration checks and calibrate SP or DP, if necessary

2) Select “check DP” within the calibration menu

3) Vent the manifold to atmosphere and check DP on the FCU or PCCU’s display. Write down the DP value

4) Using line pressure or another pressure source, apply pressure to both sides of the manifold taking care to equalize and to block in the pressure source. Write down the DP value

5) Compare both DP values by subtracting one from the other... If the difference is +/- .1% of DP range then the SPE correction was performed properly. The two readings may not be zero due to a DP zero shift that will be corrected by following step 6 below.

6) If both values are the same but the zero shift is outside your company’s allowable deviation, re-calibrate or re-zero the DP cell. If both values are the same within the specification above then skip step 7 and 8 below.

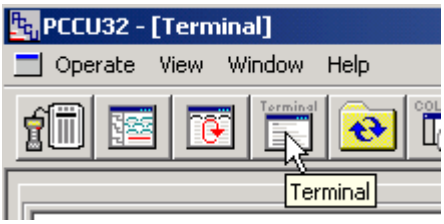
7) If both values are different by more than +/- .1% of DP span then re-calibrate Static pressure (YES STATIC PRESSURE). During the re-calibration of SP, block in the high calibration point and check for leaks before entering the high value using PCCU.

8) Perform steps 2-5 above. If the two DP readings are still different by more than +/- .1% of DP span then re-calibrate Static pressure again. Perform steps 2-5 above.

If you are still unable to get the vented and line pressure DP to match within +/- .1% of DP span then perform one of the following functions.

Begin a Windows Terminal Emulation session on your PC. Since only a few Totalflow handheld PCCU's supported a Terminal Emulator, it is recommended that a PC be used for this. Most PCCU laptop programs include a terminal emulator within the program.

Select Terminal Icon



You will see a cursor blinking waiting for a command. Follow the steps below to reset the factory calibration defaults.

Using terminal mode, enter the following command

RFC=1

You may have to type, "term" without the "" to get a terminal prompt. The prompt will be a "TF" followed by the greater than sign TF>

The RFC (reset factory calibration) command reverts the Flow Computer back to the AMU's factory settings. This includes retrieving the AMU's factory SPE values.

The Reset Factory Calibration command was implemented on 2015494-013 or later EPROMs for the 64xx Flow Computer. Other Flow Computer platforms had this command added around March 2000. If in doubt whether your particular EPROM supports this command enter the following command:

RFC (enter key)

If the flow computer supports the RFC command the following will be returned to the display:

RFC=0 (or some other numeric value)

If the Flow Computer doesn't respond to RFC entry then that particular EPROM doesn't support the Reset Factory Calibration command. In this case you will need to "cold start" the Flow Computer to reset the factory calibration defaults.

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