An engineer makes five "identical" pressure measurements in an experiment. The computer display on which the pressure measurement is displayed has a least count of 0.01 psi; however, the pressure values fluctuate over a wider range of values as indicated in the following table containing the pressure measurement readings.

Measurement	1	2	3	4	5
Reading [psi]	16.21 – 17.32	15.84 – 16.74	16.12 – 17.20	15.92 – 16.73	16.19 – 17.33

What pressure and uncertainty should the engineer report?

SOLUTION:

Even though the transducer's least count is 0.01 psi, the uncertainty per measurement is much larger than this based on the range over which the pressures fluctuate.

Measurement	1	2	3	4	5
Reading [psi]	16.21 – 17.32	15.84 – 16.74	16.12 – 17.20	15.92 – 16.73	16.19 – 17.33
Mean [psi]	16.77	16.29	16.66	16.33	16.76
Range [psi]	1.11	0.90	1.08	0.81	1.14

The mean value for the measurements is 16.56 psi and the standard deviation is 0.23 psi. With five Since the number of measurements is small, a Student's t-distribution should be used to give a 95% confidence level in the measurement. With $n = 5$, $t_{0.95} = 2.78$. Hence, the measurement with uncertainty is:

$$\bar{x} \pm t_{95\%}\sigma = 16.56 \pm (2.78)(0.23) \text{ psi}$$

$$\therefore \bar{x} \pm t_{95\%}\sigma = 16.56 \pm 0.65 \text{ psi}$$