How to select a Transducer ?

In a measurement system the transducer is the input element with critical function of transforming some physical quantity to a proportional electrical signal. Selection of the appropriate transducer is therefore the first and perhaps most important step in obtaining accurate results in every instrumentation and control system. A number of elementary questions should be asked before a transducer can be selected, for example,

- What is the physical quantity to be measured?
- Which transducer principle can be used to measure this quantity?
- What accuracy is required for this measurement?

The first question can be answered by determining the type and range of the measurand. An appropriate answer to the second question requires that the input and output characteristics of the transducer be compatible with the recording or measurement system. In most cases, these two questions can be answered readily, implying that the proper transducer is selected simply by the addition of an accuracy tolerance. In practice, this is rarely possible due to the complexity of the various transducer parameters that affects the accuracy. The accuracy requirements of the total system determine the degree to which individual factors contributing to accuracy must be considered. Some of these factors are:

1. Fundamental transducer parameters: type and range of measurand, sensitivity, excitation
2. Physical conditions: mechanical and electrical connections, mounting provisions, corrosion resistance.

3. Ambient conditions: nonlinearity effects, hysteresis effects, frequency response, resolutions
4. Environmental conditions: temperature effects, acceleration, shock and vibration
5. Compatibility of the associated equipment: zero balance provisions, sensitivity tolerance, impedance matching, insulation resistance.

Categories 1 and 2 are basic electrical and mechanical characteristics of the transducer. Transducer accuracy, as an independent component, is contained in categories 3 and 4. Category 5 considers the transducer's compatibility with its associated system equipment.

The total measurement error in a transducer-activated system may be reduced to fall within the required accuracy range by the following techniques:

1. Using in-place system calibration with corrections performed in the data reduction
2. Simultaneously monitoring the environment and correcting the data accordingly.
3. Artificially controlling the environment to minimize possible errors.

Some individual errors are predictable and can be calibrated out of the system. When the entire system is calibrated, these calibration date may then be used to correct the recorded data. Environmental errors can be corrected by data reduction if the environmental effects are recorded simultaneously with the actual data. Then the data are corrected by using the known environmental characteristics of the transducers. These two techniques can provide a significant increase in system accuracy.

Another method to improve overall system accuracy is to control artificially the environment of the transducer. If the environment of the transducer can be kept unchanged, these errors are reduced to zero. This type of control may require either physically moving the transducer to a more favorable position or providing the required isolation from the environment by heater enclosure, vibration isolation, or similar means.

Source:

http://instrumentationandcontrollers.blogspot.in/2011/07/how-to-select-transducer.html