CRITERIA FOR TRANSDUCER SELECTION: GUIDELINES

[Handbook of Transducers, H.N. Norton, Ed. Prentice Hall]

1.- MEASUREMENT CONSIDERATIONS

1. What is the real purpose of the measurement?
2. What is the measurand?
3. What range of measurand values will be displayed in final data?
4. Will the measurand only increase, or only decrease, or both?
5. What overrange conditions may occur before or during the time data are required?
6. With what accuracy must the measurement be presented in the final data?
7. What are the dynamic characteristics (e.g., fluctuation frequency range, step changes) of the measurand?
8. What frequency response or transient response must be visible in the final data?
9. If a fluid is being measured, what are its physical and chemical characteristics?
10. Where and how will the transducer be installed?
11. In what manner, and to what extent, is it permissible for the transducer to modify the measurand while it is being measured?
12. What ambient environmental conditions will the transducer be exposed to?

2.- DATA SYSTEM CONSIDERATIONS

1. What is the general nature of the data system (e.g., radio telemetry, hard-wired telemetry, individual direct display)?
2. Is the data system inherently analog or digital?
3. What is the nature of the major elements in the data system:
    a. Signal conditioning, multiplexing, analog-to digital conversion, pretransmission buffering?
    b. Data transmission link?
    c. Data processing, data storage?
    d. Data display?
4. What are the accuracy and frequency response characteristics of the end-to-end data system, exclusive of those of the transducer?
5. What form of transducer output will the data system accept with minimum additional signal conditioning?

6. What load impedance will be seen by the transducer?
7. Is frequency filtering or amplitude limiting of transducer output required, and can the data system handle this?
8. What transducer excitation voltage is most readily available?
9. How much current may the transducer draw from the excitation supply?
10. Are special transducer-related checking functions (e.g., “ready” check, electrical calibration check) required by the data system, and does the data system provide circuitry for these?

3.- TRANSDUCER DESIGN CRITERIA

1. What constrains are imposed on transducer mass, configuration, excitation, and power consumption?
2. What are the transducer output requirements?
3. Which transduction principle is most suitable?
4. What accuracy and other performance characteristics must the transducer provide: static? Dynamic? Environmental (operating)? Environmental (nonoperating)?
5. What operating or cycling life is required?
6. If a fluid is to be measured, what will be the effects of the measured fluid on the transducer?
7. Will the transducer affect the measurand to the extent that erroneous data will be obtained?
8. What constraints are imposed on the transducer by any applicable governmental standards or industrial codes?
9. What are the failure modes of the transducer? What hazards would a failure present to the system in which it is installed? To adjacent components or systems? To the data system, especially the power supply provided by it? To the area in which the transducer operates? To personnel working in that area?
10. What is the lowest level of technical competence to be possessed by any and all personnel expected to handle, install, and use the transducer? What human-engineering requirements should be incorporated in the transducer design?
11. What testing methods (including calibration) will be used to verify performance? What test will be performed by the manufacturer, and what test will be run by the user? Are those tests adequate? Are the test methods correct? Is the test equipment appropriate? Are the test methods simple and well established?

4.- AVAILABILITY FACTORS

1. Is a transducer that fulfills all the requirements available “off the self”?
2. If the answer to the preceding question is “no”, the following should be considered:
    a. Will minor redesign of an existing transducer be sufficient, or will a major development effort be required?
    b. How many transducer of identical design will be procured at this time and in the future?
    c. What manufacturer has demonstrated the ability to produce a transducer similar to the required item?
    d. What has past experience been like in dealing with a proposed manufacturer?
    e. Can the transducer(s) be delivered in time to meet installation schedules?

5.- COST FACTORS

1. Is the quoted cost of the transducer compatible with the measurement function it will provide?
2. What additional cost will be incurred by required transducer testing, periodic recalibration, handling, and installation?
3. Which requirement imposed on the transducer is the major cost driver?
4. What relatively minor compromises in requirements could lead to substantial savings?
5. What modifications to the data system (including power supplies) could lead towards reduced costs of a number of different transducers used in that system, and what cost trade-offs would be involved?