THE CONSUMER GUIDE TO NON-CONTACT LEVEL GAUGES
2nd Edition

David W. Spitzer and Walt Boyes

- **0.0 Disclaimer**
- **1.0 Executive Summary**
- **2.0 Level Measurement Systems**
  - **2.1 Material Interfaces**
  - **2.2 Level Measurement Sensors and Transmitters**
  - **2.3 Mechanical Level Measurement Systems**
  - **2.4 Level Measurement Systems With Fluid Contact**
  - **2.5 Level Measurement Systems Without Fluid Contact**
  - **2.6 Externally-Mounted Level Measurement Systems**
  - **2.7 Open Channel Flow Measurement Sytems**
  - **2.8 Measured Quantity**
  - **2.9 Typical Applications**
- **3.0 Non-Contact Level Measurement Technology**
  - **3.1 Laser Level Measurement**
  - **3.2 Non-Contact Radar Level Measurement**
  - **3.3 Ultrasonic Level Measurement**
  - **3.4 Total Beam Angle**
  - **3.5 Sensor Size and Excitation Frequency**
- **4.0 Transmitter Design**
  - **4.1 Analog Transmitters**
  - **4.2 Digital Transmitters**
  - **4.3 Fieldbus Transmitters**
- **5.0 Supplier Data**
  - **5.1 Process Limits**
  - **5.2 Ambient Limits**
  - **5.3 Installation/Maintenance (Sensor)**
  - **5.4 Transmitter**
  - **5.5 Installation/Maintenance (Transmitter)**
  - **5.6 Reference Performance**
  - **5.7 Operating Effects (Sensor and Transmitter)**
- **6.0 Supplier Data Analysis**
  - **6.1 Process Limits**
  - **6.2 Ambient Limits**
  - **6.3 Installation/Maintenance (Sensor)**
  - **6.4 Transmitter**
  - **6.5 Installation/Maintenance (Transmitter)**
  - **6.6 Reference Performance**
  - **6.7 Operating Effects**
- **7.0 Summary of Analysis**
- **8.0 Level Measurement System Performance**
  - **8.1 Accuracy Statements**
  - **8.2 Measurement Range**
  - **8.3 Data Analysis**
- **9.0 Reference Performance**
  - **9.1 Level Sensor**
  - **9.2 Effect of Transmitter Accuracy on Level Measurement**

- **9.3 Digital Output vs. Analog Output Performance**
- **10.0 Actual Performance**
  - **10.1 Ambient Temperature Effects**
  - **10.2 Operating Temperature Effects (Sensor)**
  - **10.3 Process Temperature Effects**
  - **10.4 Process Pressure Effects**
  - **10.5 Composition Effects**
  - **10.6 Speed of Ultrasonic Entery in the Vapor Space**
  - **10.7 Effects of Level Measurement Error**
- **11.0 Supplier Performance Claims**
  - **11.1 High Rangedown**
  - **11.2 High Accuracy**
  - **11.3 Measurement Not Affected by Temperature**
  - **11.4 Measurement Not Affected by Dielectric Constant**
  - **11.5 Measure Large Distances**
- **12.0 Installation Considerations**
  - **12.1 Characteristics of the Material**
  - **12.2 Vapor Considerations**
  - **12.3 Vessel Considerations**
  - **12.4 Sensor Considerations**
  - **12.5 Electrical Installation**
  - **12.6 Level Transmitter Calibration**
  - **12.7 Ambient Conditions**
- **13.0 Accessories**
  - **13.1 Level Sensors**
  - **13.2 Level Transmitters**
  - **13.3 Level Transmitter Signals**
- **14.0 Explanation of Attachments**
- **15.0 Non-Contact Level Gauge Supplier Profiles**
  - **15.1 The Major Suppliers of Non-Contact Level Gauges**
  - **15.2 Other Suppliers of Non-Contact Level Gauges**
-
- **Attachments**
  - **Non-Contact Level Gauge Categories**
  - **Availability of Selected Features**
  - **Reference Accuracy by Various Tank Heights**
    - **2000mm**
    - **5000mm**
    - **10000mm**
  - **Products and Specifications by Supplier**