

Reliable Process Control for Hurricane Prone Areas With FOUNDATION Fieldbus

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Abstract

Hurricanes, often followed by severe flooding are one of the most damaging natural disasters that can run havoc to a process control system. Process plants, factories, and refineries located in and around hurricane prone areas are always at a higher risk of being flooded or damaged by hurricane. In this paper we highlight the value of FOUNDATION Fieldbus, an all-digital industrial network protocol for intelligent instruments and controllers for its data reliability, enhanced diagnostics, and control distribution smart instruments and controllers producing a more available process control system.

1. Introduction

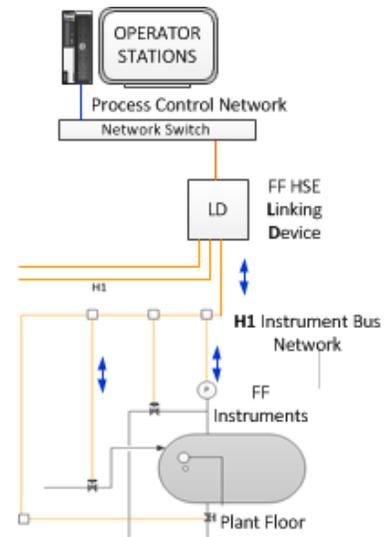
Typical Process Control System deals with a large volume of data generated by hundreds if not thousands of sensors and measurement devices (generally known as IOs) distributed across a plant floor. Reliability of that data from various input/output devices is absolutely paramount to the production process. Modern factories use state of the art automation technologies to reduce downtime and increase profitability, but vast majority of the systems still use conventional IOs where process value (instrument measurement data) is transmitted in the form of a 4 to 20 mA current signal across a pair of wire. 4 to 20 mA represents the range of the measured process variable, and this current signal can be severely compromised when instruments and associated wirings get wet through flooding. During perfect conditions a current signal from an IO may represent pressure in a vessel accurately, but if the signal is compromised, it will provide wrong pressure value of the vessel to control system and the operator. Ambiguous or wrong process data could eventually lead to plant shutdown and other safety or environmental hazards. Replacing 4-20mA technology with FOUNDATION Fieldbus for plants in hurricane prone areas will not only increase reliability of the system by removing ambiguity from process data, but also increase diagnostics and system availability.

2. Technology

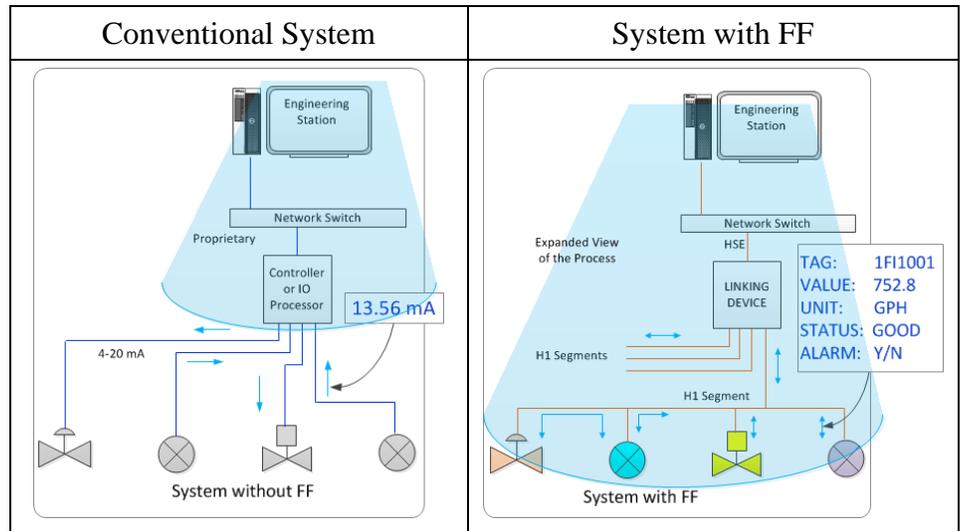
FOUNDATION Fieldbus (FF) is a digital 2-way industrial network protocol for intelligent instruments and controllers in process automation systems. FF technology emerged during the late nineties out of a necessity to improve control system reliability through data reliability, enhanced diagnostics, distributed control, interoperability, and single-loop integrity. FF protocol has two standards:

- a. **H1 (31.25 Kbit/s)** interconnects field equipment such as sensors, actuators, and I/O at plant-floor level. Also H1 SIF for safety systems.
- b. **HSE (100 Mbit/s) or High Speed Ethernet** to provide integration of high speed controllers, H1 networks, Data Servers, and Workstations. HSE provides the supervisory control network backbone.

In this paper our focus is on the H1 networks that interconnect smart instruments at plant floor providing digital process data to the supervisory control system. Advanced Diagnostics from instruments expands the view of the process with more information for instrument health that leads to a more reliable system for flood or hurricane prone areas.



Process data is made more meaningful with quality and status with FF. There is no room for ambiguity, thus even when instrument's wiring is compromised, operator will receive measurement with good or bad status associated with it. In contrast, a 13.56mA signal from a conventional IO channel has no way to validate if this is truly the instrument's measurement.



3. Methodology

Key to make automation systems hurricane resilient is two folds – first selecting technology that produces reliable data, and second is to make the instrument networks flood resistant with appropriate physical network peripherals. Physical network of an H1 segments are constructed using several peripherals which includes power supply conditioner, device couplers, H1 instrument wire, and bus terminators. Power supply conditioners are typically housed closed to the controller in a rack room, while device couplers are distributed outside on the plant floor. Special Device Couplers and cable systems with water-tight fasteners are required to construct hurricane resilient instrument networks. Some of the early FF installations gave real-world proof to this concept. FF installation at an Effluent Treater in a Shell Deer Park facility was located in a low area immediately beside the ship channel; it was constructed using TURCK device couplers and cables. Not long after the installation was complete the whole area was flooded and all of the Fieldbus segments operated while under water.



Hurricane resilient FF Device Couplers and wirings

4. Conclusion

Despite best efforts instrument networks can get wet and give trouble. Operator will end up with incorrect signal without any error indication with traditional analog IO. One of the worst conditions operations can encounter is an instrument that appears to be working but is really lying to you. When FF wiring gets wet the transmissions can have errors – operator gets error indications or good signals from the FF technology with no ambiguity.

5. Acknowledgement

This paper received special consultations from Herman Storey, Herman Storey Consulting, LLC, Kingwood, TX and Stephen Mitschke, Fieldbus Foundation, Austin, TX.

6. References

[1] “Wiring and Installation 31.25 kbit/s, Voltage Mode, Wire Medium” Application Guide –Fieldbus Foundation, www.fieldbus.org