On-Facility Wireless Control and Monitoring
Wireless: Simple and Reliable Solutions
What is Required in the Municipal Environment?

- Integrate with Existing Equipment
- Scalable Across Large Facilities
- Resistant to Interference and Harsh Environments
- Power Efficient for Remote Deployment
Current Wireless Options

Start with a radio having little or no I/O

Add: DIN Rail Some I/O Terminal strips

Mount all your stuff

Stick it in a box and then install the box

And finally… Wire your I/O
Wireless: Radio, Battery and I/O In One Package
Radio Design
Radio Design: Frequency

- Bidirectional Transceiver Broadcasting in Industrial, Scientific, Medical (ISM) Band:
  - 902-928 MHz ISM Band
  - 2.4 GHz ISM Band
  - No license required (but, it is certified by the FCC)

Mega-Hertz = 1 x 10^6 cycles/sec.
Giga-Hertz = 1 x 10^9 cycles/sec.
Radio Design: Architecture

Frequency Hopping Spread Spectrum (FHSS)

- Allows for many radios to operate in confined spaces

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Radio Design: Architecture

Time Division Multiple Access (TDMA)

- Every Transmitter & Receiver is Guaranteed a time slot
- Minimizes possibility of packet collisions
- Contention Approach – Different? Better?

$125\text{ ms}$
Radio Design: Deterministic Control

Sensor
Node 1
Node 2
Valve Shut-Off
Gateway

Safe Harbor Scenario
Radio Design: Site Survey

For Example...the SureCross method

= # of packets

1GXX ➡️ > -90 dBm
1YXX ➡️ < -100 dBm
1RXX ➡️ < -108 dBm
1MXX ➡️ < -108 dBm

Total = 100

RF signal strength

Sum of **Green, Yellow, Red & Missed** packets will be “100”
Radio Design: Antennas

- Multi-directional
  - Omni or Omni-directional
  - Signal radiates in all directions (low gain)
  - Internal Antenna Option
Radio Design: Antennas

- Directional
  - Yagi
  - Focuses the energy in one specific direction (higher the gain, the more focused)
Power Design
Power Design: *FLEXPower™*

Flexible Power Options

- Line Power
- Battery
- Solar
Banner’s Solution

- Small Battery 3.6V
- Big Punch
- Lots of Endurance
- External Battery Box

Gives Us the Peel-n-Stick Solution

*FlexPower™ BATTERY CONSERVATION*

- **Cycle On**
- **Cycle Off**

**Multi-Year Battery Life**
Power Design: “Peel-n-Stick”

- Flexible and Mobile
- No Hassle Installation
- Unlimited Expandability
- No Software Required
- Access Remote Locations
Wireless Solutions: Various Battery Approaches
I/O Design
I/O Design: Flexible I/O

Multiple Types of I/O

- Digital
- Analog
- Thermal
- Communication
- Transparent Serial
I/O Design: DX80 Off-the-Shelf Options

- **Inputs (example)**
  - 2, 4, 6, or 8 digital
  - 2 or 4 digital, 2 or 4 analog

- **Outputs (example)**
  - 2, 4, 6, or 8 digital
  - 2 or 4 digital, 2 or 4 analog

- **Gateway communication**
  - Serial RS-485 modbus RTU
  - GatewayPro ~ TCP/IP
  - GatewayPro ~ Ethernet IP
Winning With Wireless
Wireless Solutions: Failed Conduit
Wireless Solutions: External/Remote Tank Monitoring
Wireless Solutions: Preventative Maintenance
Wireless Solutions: Video Monitoring (Revenue)
SureCross Solutions: Cost of Wireless

Cost of Implementation

Wiring and Retrofit Costs

Wireless

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