More Straight Talk About Wireless- Wireless ON/OFF Monitoring and Control Basics for Traffic Applications

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This article is the first in a series of Articles on Wireless ON/OFF Monitoring and Control, also known as Wireless Contact Closure. This first article will go over the basics of this proven and popular technology- the basic idea and benefits of Wireless ON/OFF Monitoring and Control will be explained, along with identifying which Traffic Devices and Traffic Applications "fit" with this technology. The second article in this series will examine how Wireless ON/OFF Monitoring and Control is implemented by examining a single deployment example in detail- important Radio Characteristics, Physical IO Requirements, Data Flows, IO Mapping, Network Topologies/Radio Operating Modes, System Constraints (debounce times, delays, latency), Installation/Configuration/Diagnostic Features, Product Selection Criteria Product and Vendor Selection Criteria will be identified and discussed. The third article in this series will "look under the hood" and discuss how a Wireless ON/OFF Monitoring and Control Device really works and what design parameters provide the reliable, robust and fast communications required.

The Best Ideas Are Simple, Yet Powerful

There are some intermediate steps in this process, but the end result is the same. These intermediate steps can be summarized as follows:

- Output signals from the Source Traffic Device are connected to the Inputs of a Wireless Transmitting Device.
- The Wireless Transmitting Device converts and modulates these signals for transmission "over the air".
- The Wireless Receiving Device demodulates and converts these signals back to a form identical to the original Output signals from the Source Traffic Device.
- The Wireless Receiving Device sends these signals to its Outputs.
- These Output signals are available for use at the Destination Traffic Device just as if the Source Traffic Device and Destination Traffic Device were directly connected.

The diagram below illustrates a simple deployment featuring interconnect a Controller (Source Traffic Device), a Wireless Transmitting Device, a Wireless Receiving Device, a Normally Open Relay Two Flashers. When this relay is switched to ground, the relay contacts close and power flows to activate the Flashers. The Relay and Flashers together form the Destination Traffic Device.

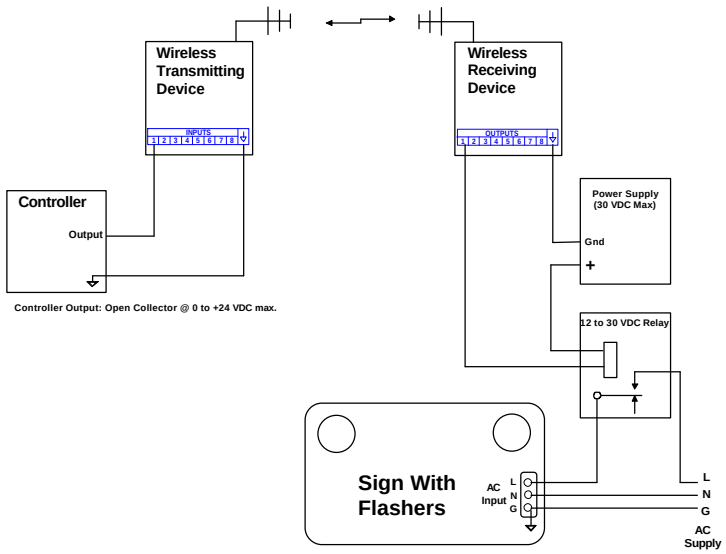

Figure 1- Sample Deployment

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The Best Ideas Provide Clear, Simple Benefits

Monitoring and Controlling ON/OFF signals is at the core of many Traffic Applications. Traditionally, this has been accomplished with "hardwire" communications. This approach has definite disadvantages:

- Costs associated with excavation, conduit installation and cable pulling.
- Traffic disruption associated with excavation, conduit installation and cable pulling.
- Costs for permits, inspections and/or environmental studies.
- Problems with damaged cable (breaks or corrosion).
- Signal degradation over long longer cable lengths.
- Lack of flexibility to locate system components exactly where required.

Is there a better way to accomplish ON/OFF Monitoring and Control? The answer is- "Yes, go wireless." Wireless ON/OFF Monitoring and Control has clear, simple benefits:

- Costs for a Wireless ON/OFF Monitoring and Control deployment are typically 25-50% less than the costs of a "hardwire" communications deployment where excavation, conduit installation and cable pulling would be required (savings estimates vary with distance of communication link).
- Installation of Wireless ON/OFF Monitoring and Control is quick and easy with minimal traffic disruption- little or no work done is done on the road, most work is done at control cabinets or light standards. Wireless installations can take 50-90% less time than "hardwire" installations (savings estimates vary with distance of communication link).
- Practically no costs for permits, inspections and/or environmental studies.
- No problems with damaged cable (breaks or corrosion)- a wireless links rarely fails. If a wireless link fails, it rarely fails completely. Wireless communications also make it very easy and cost-effective to build in system redundancy to mitigate any potential problems.
- Wireless ON/OFF Monitoring and Control signals remain strong over distances where "hardwire" communications have degraded to the point of being rendered useless.
- Wireless ON/OFF Monitoring and Control systems components can be located exactly where required, especially when solar power is used.

Given these clear benefits, let's identify the types of Traffic Devices that can be enabled with Wireless ON/OFF Monitoring and Control.

The Best Ideas Fit Traffic Devices Simply

Wireless ON/OFF Monitoring and Control is a potential fit for any Traffic Device that sends and/or receives ON/OFF signals.

A simple way to determine if Wireless ON/OFF Monitoring and Control potentially fits your Traffic Device(s) is:

- Look at each specific Traffic Device and ask yourself: "Does this Traffic Device (Detector, Controller, Flasher, Signal Light, Pushbutton Switches) send and/or receive ON/OFF signals?"
  - Basic Loop Card Detectors, Video Detectors and Radar Detectors typically send (output) ON/OFF signals when operating in basic Pulse or Presence Mode.
  - By definition, controllers send and receive ON/OFF signals.
  - By definition, Pushbutton switches send ON/OFF signals.
  - By definition, Flashers receive ON/OFF signals (Flashers are typically controlled by ON/OFF signals sent to a relay).
  - By definition, Signal Lights receive ON/OFF signals (Signal Lights are typically controlled by ON/OFF signals set to a relay).

The bottom line is that Wireless ON/OFF Monitoring and Control has excellent potential fit with Loop Card Detectors, Video Detectors, Radar Detectors, Controllers, Pushbutton Switches, Flashers and Signal Lights. We will examine specific Physical IO Requirements in the next article in this series.

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The Best Ideas Fit Traffic Applications Simply

Wireless ON/OFF Monitoring and Control is a practical fit for any Traffic Application with Traffic Devices that send and/or receive ON/OFF signals over distances in excess of 100 feet.

A simple way to determine if Wireless ON/OFF Monitoring and Control is a practical fit for your Traffic Application is:

- Look at your specific Traffic Application and ask yourself: "Do the Traffic Devices (Detector, Controller, Flasher, Signal Light, Pushbutton Switches) in this application send and/or receive ON/OFF signals over distances in excess of 100 feet?"
  - Mainline Traffic Detector (Counting) Stations/ Traffic Monitoring Stations
    - Loop Card Detectors, Video Detectors or Radar Detectors send ON/OFF signals to Controllers at approximate distances of 100^{+} feet.
  - On-Ramp Detector Stations (Demand and Passage Detectors)
    - Loop Card Detectors, Video Detectors or Radar Detectors send ON/OFF signals to Controllers at approximate distances of 100^{+} feet.
  - Queue Detector Stations
    - Loop Card Detectors, Video Detectors or Radar Detectors send ON/OFF signals to Controllers at typical distances of $250\text{-}500^{+}$ feet.
  - Adjacent On-Ramp Detector Stations/ Adjacent Off-Ramp Detector Stations
    - Loop Card Detectors, Video Detectors or Radar Detectors send ON/OFF signals to Controllers at typical distances of $500\text{-}1000^{+}$ feet.
  - Ramp Metering Systems
    - These systems combine Mainline Traffic Detector Stations, On-Ramp Detector Stations, Queue Detector Stations and Traffic Signals. These systems may also include Adjacent On-Ramp Detector Stations and Adjacent Off-Ramp Detector Stations. Distances between these Traffic Devices and the Controller typically range from $100\text{-}500^{+}$ feet.
  - Freeway Traffic Management Systems (FTMS)
    - Traffic Detector Stations and Controllers are important components of these systems. As noted above, Traffic Detector Stations feature Loop Card Detectors, Video Detectors or Radar Detectors which send ON/OFF signals to Controllers at approximate distances of $100\text{-}500^{+}$ feet.
  - Advanced Traveller Information System (ATIS).
    - Traffic Detector Stations and Controllers are important components of these systems. As noted above, Traffic Detector Stations feature Loop Card Detectors, Video Detectors or Radar Detectors which send ON/OFF signals to Controllers at approximate distances of $100\text{-}500^{+}$ feet.
  - Mid-Block Loop Detection
    - Loop Card Detectors, Video Detectors or Radar Detectors send ON/OFF signals to controllers at typical distances of 165-330 feet. This distance is based on 1/16 mile (330 feet) by 1/8 mile (660 feet) grids for city blocks.
  - School Zone Flasher Activation Systems
    - A pushbutton switch activated in the school sends ON/OFF signals to School Zone Safety Flashers at typical distances 100-750 feet. Confirmation of Flasher Activation is a very common optional feature of these systems.
  - Work Zone Flasher Activation Systems
    - A pushbutton switch activated a Flagperson sends ON/OFF signals to Work Zone Safety Flashers at typical distances of $500\text{-}2500^{+}$ feet. Confirmation of Flasher Activation is an optional feature of these systems.
  - Dynamic Work Zone Safety System
    - Detectors (Loop Card Detectors, Video Detectors or Radar Detectors) detect the volumes and speeds at each monitoring site and relay a signal to an upstream unit when congestion is detected. Flashers on the upstream sign are activated when the signal is received to create a no passing zone. Typical distances between Detectors and Flashers in these systems are in the range of $500\text{-}2500^{+}$ feet. Confirmation of Flasher Activation is an optional feature of these systems.

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- Advance Warning Signs
  - A Traffic Signal Controller at an intersection sends ON signals to switch a relay and activate a Flasher in advance of the Signal Light turning red. Typical distances between Traffic Signal Controllers and Flashers in these systems are in the range of 250-500^{+} feet.
- Signal Light Pre-Emption/Priority
  - A pushbutton switch is used to grant authorized vehicles momentary right-of-way at signalized intersections by sending a ON/OFF signals to the Traffic Signal Controller. The Controller sends ON signals to switch a relay and activate a Signal Light. Distances between the Pushbutton Switch and Traffic Signal Controller are typically in the range of 100-750^{+} feet. Confirmation of Flasher Activation is should always be a feature of these systems.

The bottom line is that Wireless ON/OFF Monitoring and Control has an excellent practical fit with all of the Traffic Applications listed above. The next Article in this series will examine Wireless ON/OFF Monitoring and Control for these Applications in more detail by studying a single comprehensive example.

The Next Steps Are Simple

Wireless ON/OFF Monitoring and Control, also known as Wireless Contact Closure is proven and practical for any Traffic Application with Traffic Devices that send and/or receive ON/OFF signals over distances in excess of 100 feet. For more information, go to www.encomwireless.com, call (403) 230-1122 or email info@encomwireless.com. For an advance copy of the next article in this series or for comments/questions on this article, contact gerryb@encomwireless.com

About ENCOM Wireless Data Solutions Inc.

ENCOM products are specifically designed for Traffic Monitoring and Control. ENCOM is proud to work with customers in the Traffic Industry to help them successfully deploy and benefit from wireless technology. Let ENCOM show you that “Wireless Works”.