

RadioRANGER® Wind Farm Application

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INTRODUCTION

The RadioRANGER Wireless Fault Indication System improves fault-finding time over that of typical fault indicators installed inside equipment enclosures. The RadioRANGER offers the ability to remotely monitor the status of fault indicators mounted inside equipment. SEL offers a wide range of faulted circuit indicators (FCIs) that are compatible with the RadioRANGER Wireless Interface and can be used for a variety of applications. A magnetic RadioRANGER Interface Probe from the fault indicator communicates both the tripped and reset status of the indicator to the Wireless Interface. The device communicates via a frequency-hopping scheme transmitted in the unlicensed 900 MHz ISM band. The Wireless Interface offers many power-saving features and is designed to be installed in harsh environments. For details and specifications, refer to the RadioRANGER product literature and manual.

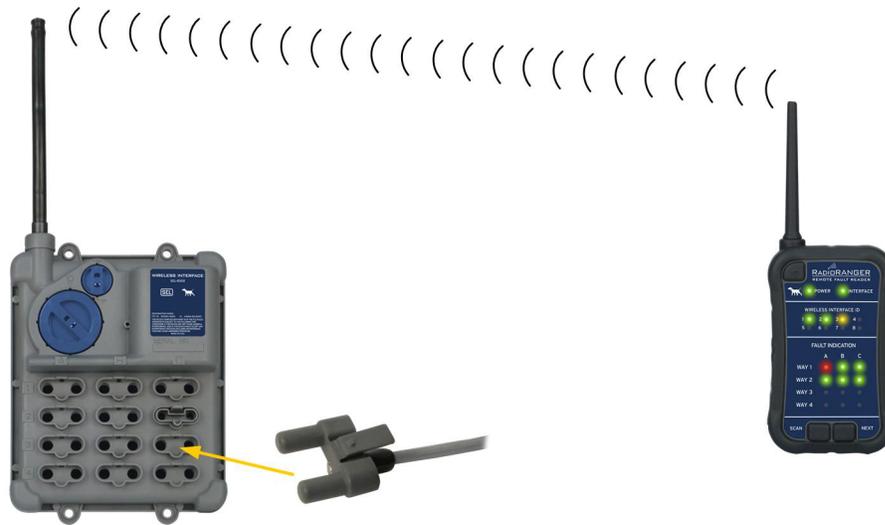


Figure 1 RadioRANGER Wireless Interface, Interface Probe, and Remote Fault Reader

PROBLEM

Troubleshooting wind farm collector system faults can be a time-consuming and potentially dangerous process. In earlier system designs, the step-up transformers were located outside, near the base of the turbine tower. The transformer was connected to cables routed up the tower to the turbine generator. However, modern wind farms can use much larger turbines. To reduce cable losses, the step-up transformers are now located at the top of the tower, in the nacelle. To facilitate this design, the medium-voltage cables are routed up the tower and the switchgear is located at the base of the tower. Fault indicators are typically installed in the switchgear and in the junction enclosures to aid in the fault-finding process. Entering the secure wind turbine towers or opening junction enclosures to check the status of fault indicators exposes personnel to the risk

of arc flash. The rapid release of energy during an arc flash can cause costly damage to equipment and harm to personnel.

Entering the confined space of each wind turbine tower and checking every junction enclosure for faults can be not only risky but also very time-consuming. A single cable fault at a wind farm can cause significant downtime, resulting in lost revenue. It is cost-effective to find the quickest and safest way to determine faulted cable sections.

SEL SOLUTION

Using the Wireless Interface in junction enclosures and inside the switchgear of a wind turbine tower reduces the risk of arc flash by avoiding unnecessary opening of high-voltage cabinets. Personnel can easily check the state of fault indicators installed inside the switchgear and junction enclosure with the easy-to-use wireless RadioRANGER Remote Fault Reader.

Typical transmitting distances from a Wireless Interface installed in the tower switchgear are represented in Figure 2. Operating personnel can wirelessly receive fault indicator status anywhere within the dashed line.

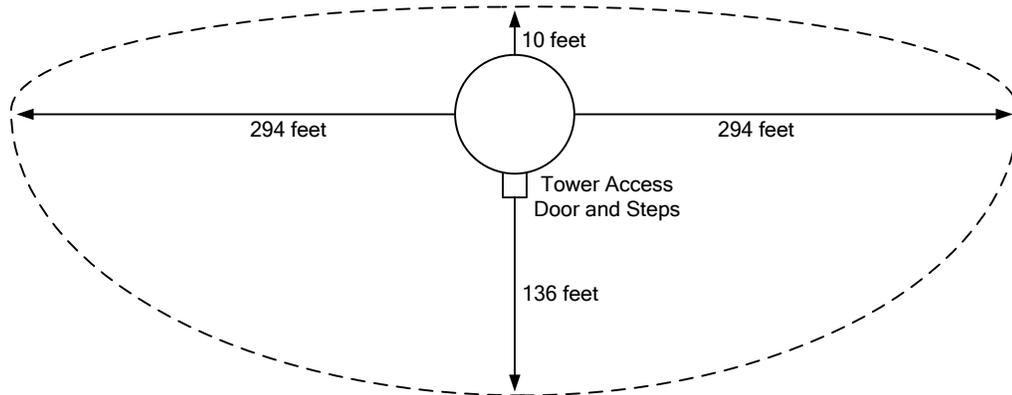


Figure 2 Typical Transmitting Distances From Inside Turbine Switchgear

Figure 3 depicts a typical installation of the Wireless Interface in a junction enclosure. Operating personnel can stay up to 600 feet away from the junction enclosure and still wirelessly receive fault indicator status with the Remote Fault Reader.

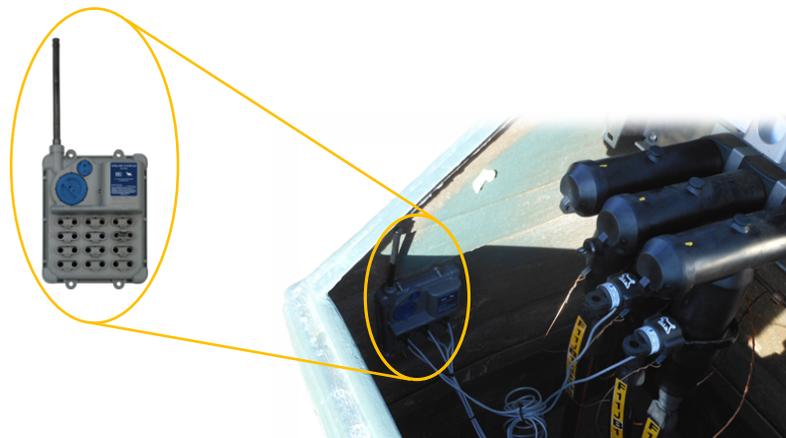


Figure 3 Typical Junction Enclosure Wireless Interface Installation

In addition to providing a safer work environment for operating personnel, the RadioRANGER also significantly reduces fault-finding time. Instead of the time-intensive procedure to check every wind turbine or enclosure for faults, personnel can easily locate the faulted sections of the wind farm and isolate them. Troubleshooters can quickly retrieve FCI status from their truck via the wireless communications link between the Wireless Interface and Remote Fault Reader. Multiple Wireless Interface IDs allow the line crew to easily identify the enclosure, way, and phase on which a fault occurred. A two-way communications link prevents ambiguity by transmitting both tripped and reset fault indicator information to the Remote Fault Reader. Multiple radio channels are selectable for when Wireless Interfaces are installed near each other. As depicted in Figure 4, the ideal installation locations for FCIs and Wireless Interfaces are inside junction enclosures and wind turbine switchgear.

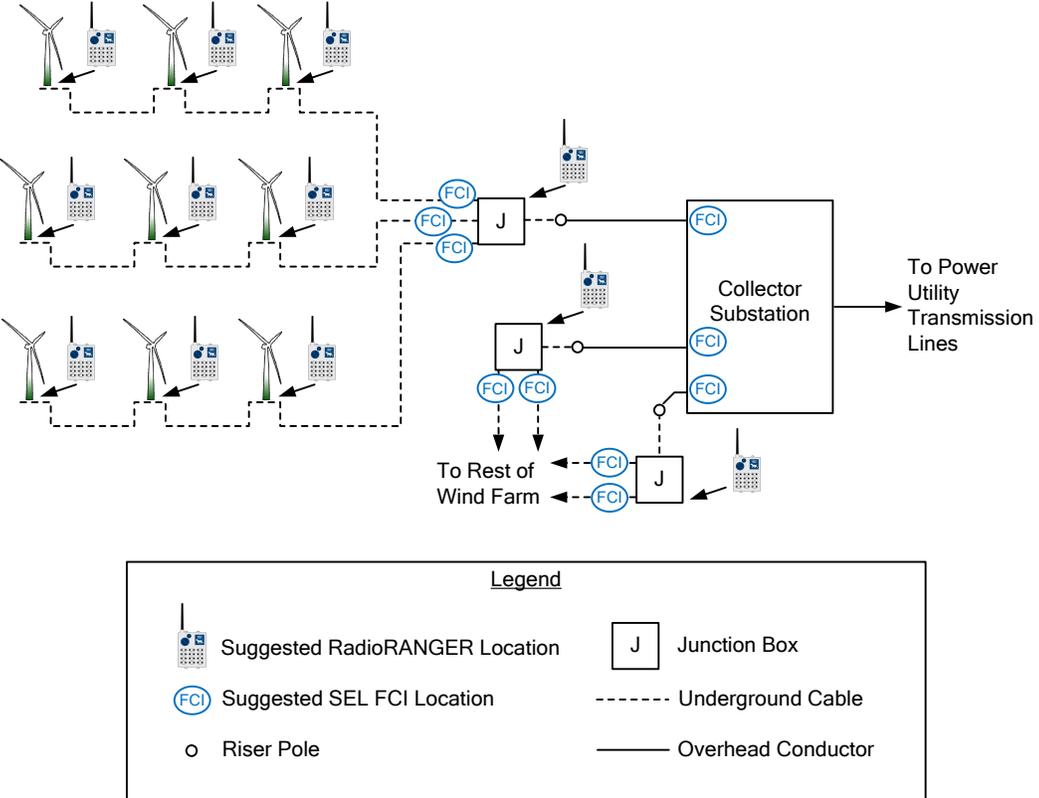


Figure 4 Typical Wind Farm Installation Locations

CONCLUSION

Using the SEL RadioRANGER system with FCIs can significantly reduce the time required for finding electrical faults by eliminating the need to physically enter and inspect every enclosure. RadioRANGER remote technology provides a cost-effective way to quickly and safely locate and troubleshoot electrical faults. The RadioRANGER has been tested in the field and proven to provide years of reliability and safety for a wide range of applications.

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