

Enabling the Intelligent Substation with Optical Current Transducers

UCLA WINSmart Grid Connection
Thought Leadership Forum
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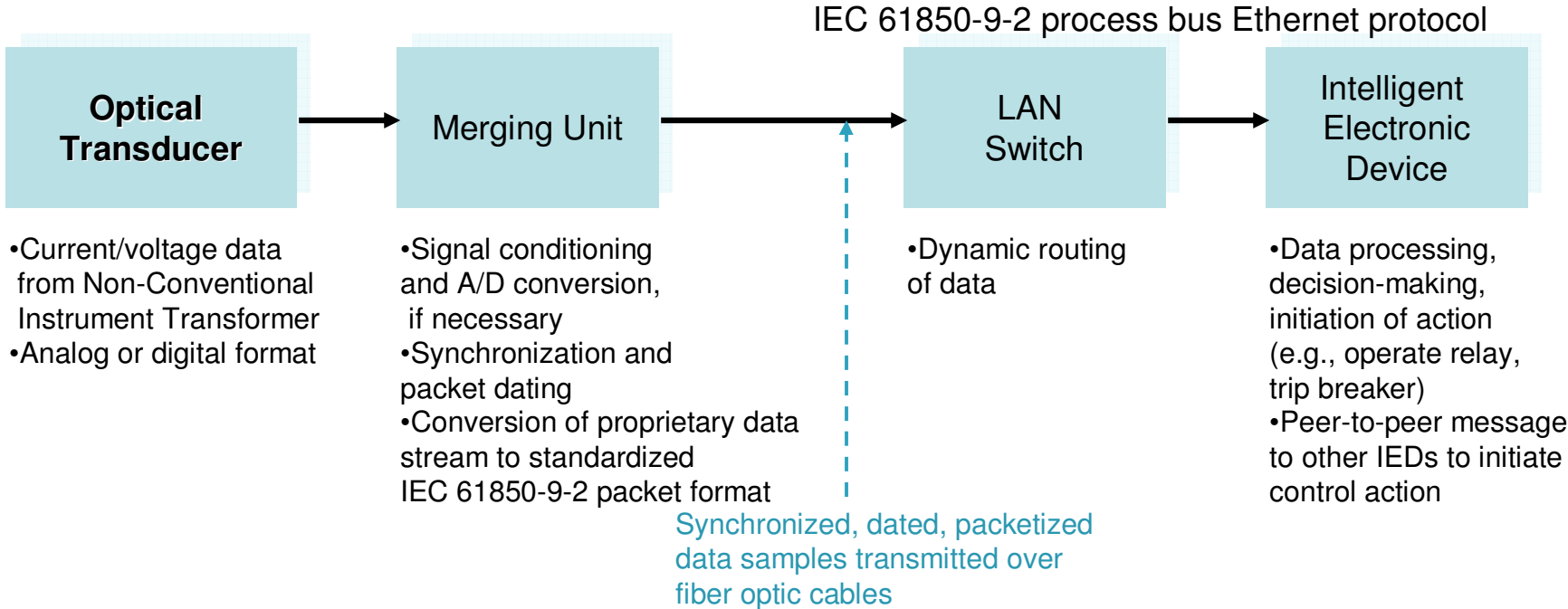
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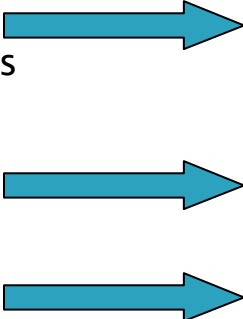
(in collaboration with JDSU Corporation)

Elements of the Intelligent Substation



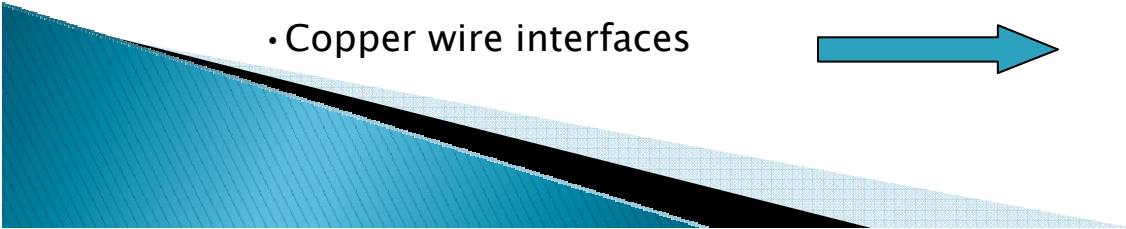
Traditional Substation

- Electromechanical relays, programmable logic controllers and microprocessors
- Master-slave protocols
- Copper wire interfaces



Intelligent Substation

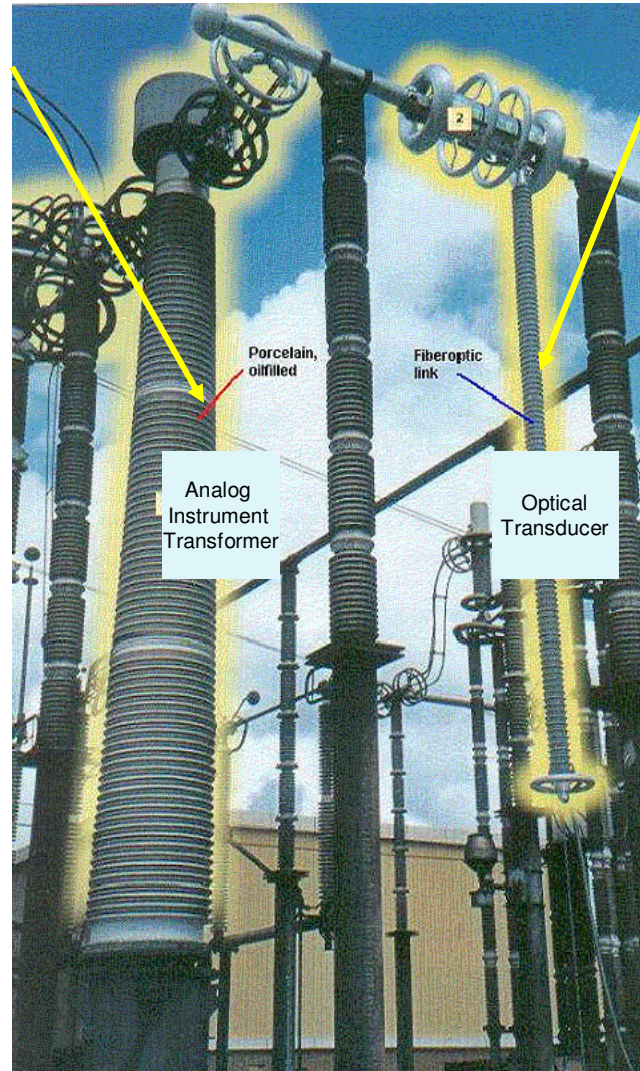
- Digital input from optical transducer; Ethernet communications between interchangeable IEDs
- Peer-to-peer messages over process bus
- Small numbers of fiber optic cables replace large bundles of copper wire



Why Use Optical Transducers?

Conventional Instrument Transformer

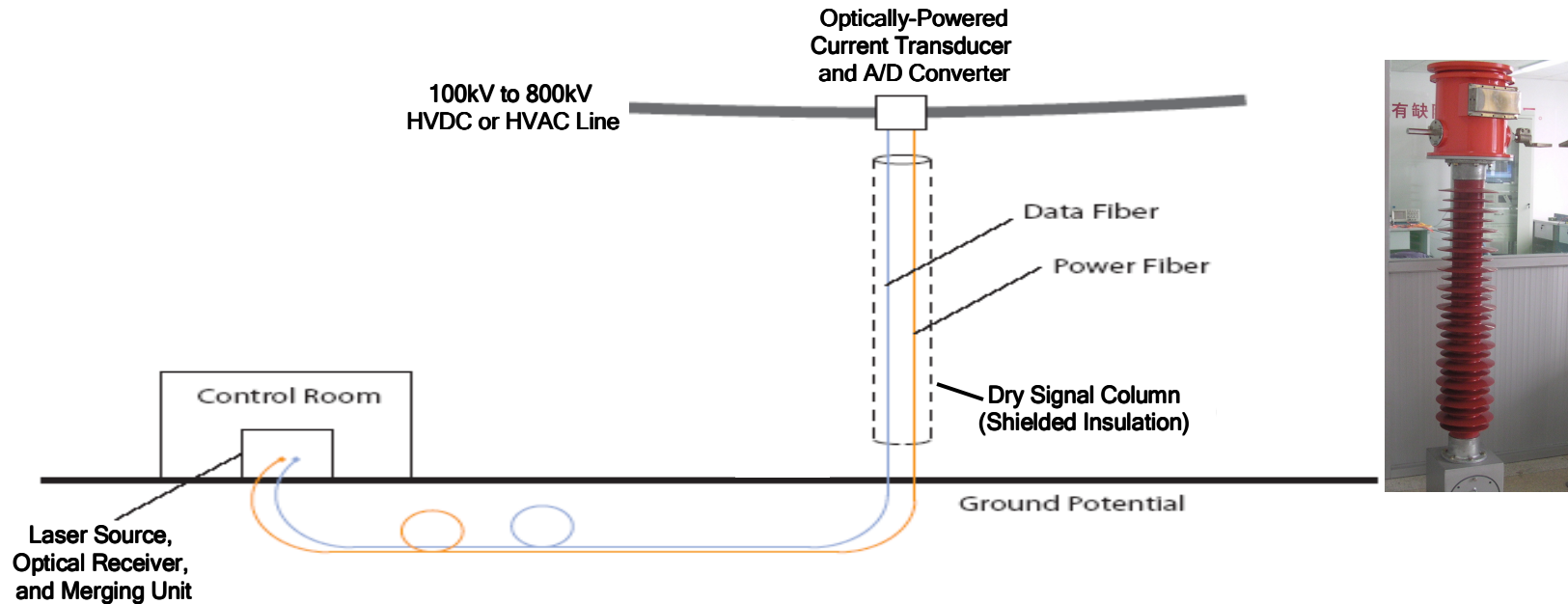
- Proven
- Heavy and challenging to install higher voltage units
- Subject to open current circuit conditions
- Potential for explosion or leak
- Must convert analog measurement to digital format



Non-Conventional Optical Transducer

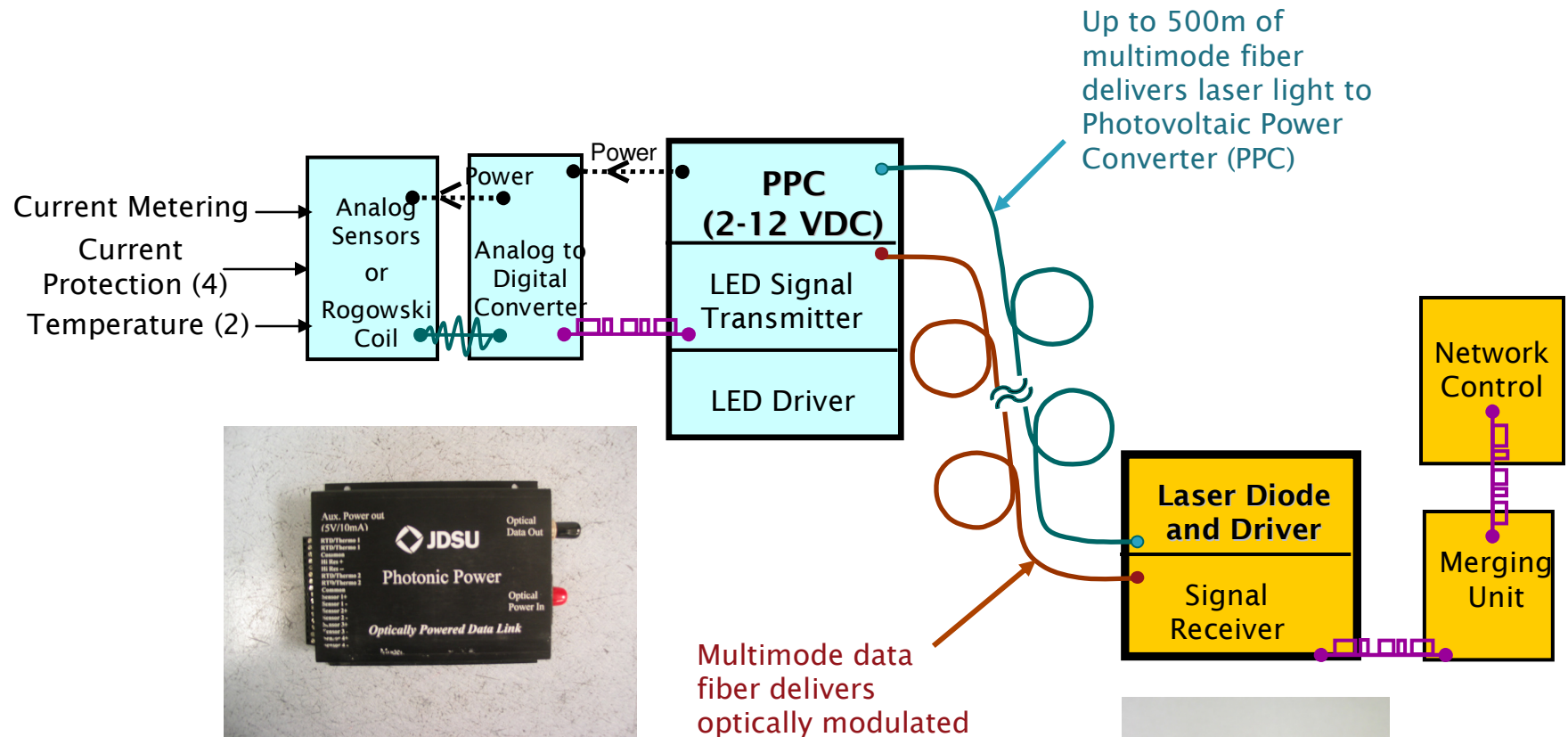
- Unaffected by high voltage, lightning or electromagnetic effects
- Small size conserves substation space
- Not subject to open circuit conditions
- Dry signal column eliminates possibility of explosion or leak
- Compatible with IEC 61850-9.2 digital process bus requirements

Optical Current Transducer System Approach



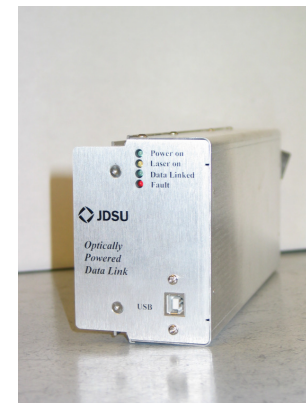
- ▶ **Application:** Current metering and protection and temperature measurement on HVDC or HVAC line
- ▶ **Enabling Technology:** Optical-to-electrical power conversion; analog signals converted to digital format on HV line and transmitted to control room via fiber optic line (or optionally over a wireless connection)
- ▶ **Key Benefit:** Non-conductive nature of fiber optic power cable isolates the electronics from ground permitting measurement electronics to mount in close proximity to the high voltage line

Power by Light Block Diagram (All-Fiber Solution)



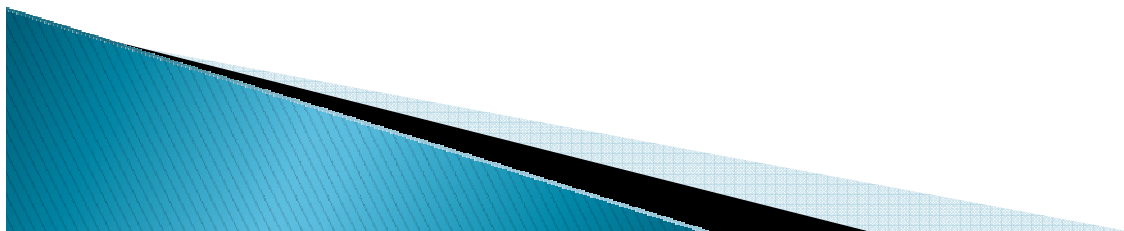
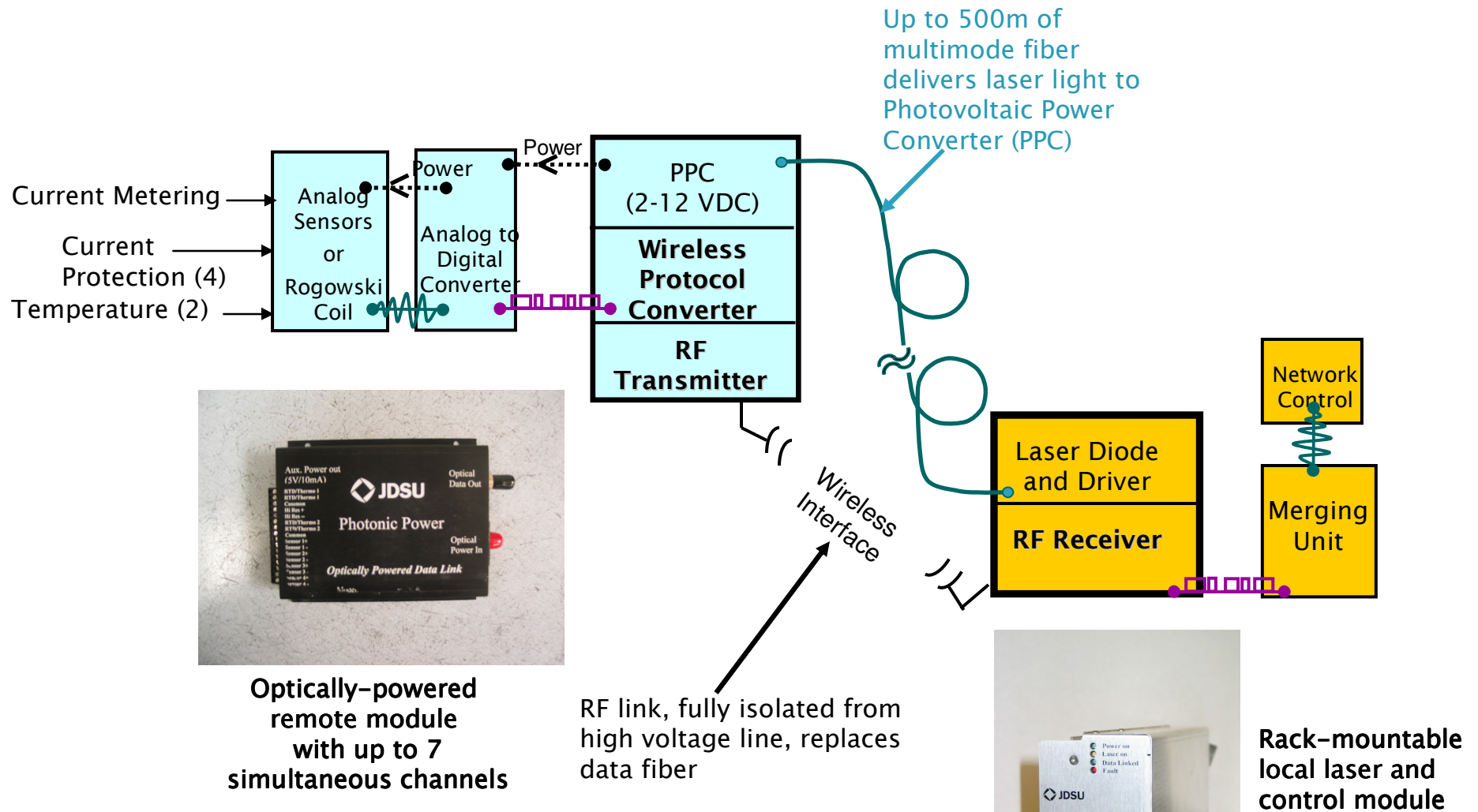
Optically-powered remote module with up to 7 simultaneous channels

Multimode data fiber delivers optically modulated digital data stream to merging unit in control room



Rack-mountable local laser and control module

Power by Light Block Diagram (Fiber/Wireless Solution)



Enabling the Smart Grid with Optical CT

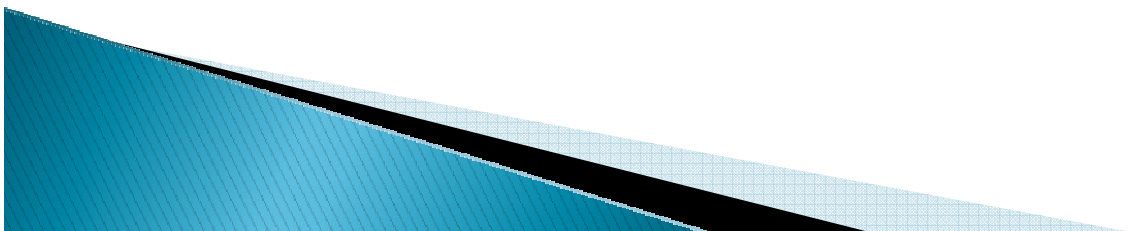
Performance Benefits

- ▶ Precise measurement and synchronization
- ▶ Better protection against current surges and open circuit conditions
- ▶ Enables digital substation process bus per IEC61850-9.2
- ▶ Impervious to electromagnetic effects, high voltages, and lightning

Operational Benefits

- ▶ Potential to reduce outage minutes
- ▶ Potential to allow grid to be run closer to rated capacity
- ▶ Accurate time history of events in digital format
- ▶ Eliminates potential for transformer leaks or explosion

Improved accuracy, control, response, and safety



Thank You!

Visit the RevGen Group Web Site
for more details

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