



Wind and Solar Farm Applications

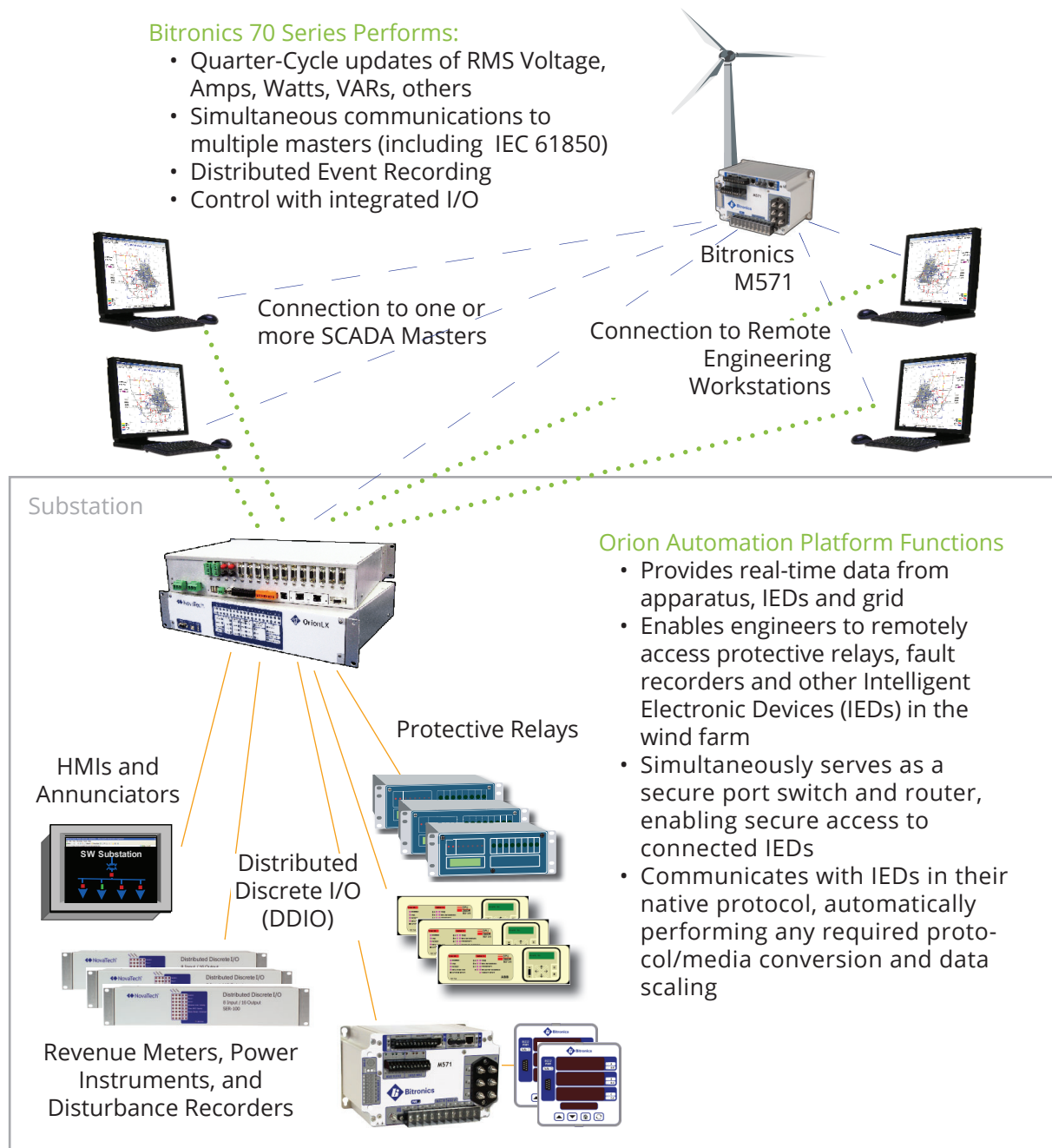
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Overview of Orion and Bitronics

Application in Wind Farms and Solar Farms

The Orion Automation Platform is widely applied in electric substations to perform secure monitoring, data processing and control functions. The Orion physical structure, flexible software architecture and powerful configuration software make it an ideal solution for integration and automation in wind farm and solar farm applications.

The Bitronics 70 Series is seeing early adopter use in monitoring and controlling wind turbines in high speed frequency and phase matching applications. The diagram below shows connections to SCADA, remote workstations, and IEDs in a typical wind farm substation.



Customer Installation and Testimonials

“The wind farm was a complex project, with many different devices, connections and services...and the Orion was able to handle everything.”

- David Moraes, PE, Senior Electrical Engineer, TRC

Customers

2006

Babcock and Brown (NM Wind Farm)
NextEra (FL)
PPM Energy (OR)
Signal Energy (Alberta, CN)
Sweetwater Wind Farm (TX)

2007

BP/Greenlight Energy (US Wind Farms)
Edison Mission Energy (US Wind Farms)
FPLE (NextEra) (US Wind Farms)
Goat Mountain, LLC (Wind Farms, TX)
Tenaska Power Services (TX)
Ventus Energy Systems (MN)

2008

Babcock and Brown (Wind Farm – SD)
Duke Energy – Happy Jack Wind Farm (WY)
Padoma Wind
RES Americas (Wind Farm, TX)

2009

AES (Armenia Mountain Wind Farm)
Buena Vista Energy (Wind Farm, N. CA)
Cielo Wind Power (Wildorado Wind Ranch)
Milford Valley Wind (UT)
Third Planet (Wind Farm, CA)
Topaz Power Group (TX)

2010

Alta Wind Energy (through Power Engrs)
EnXco (CA), through P&E Engineering in IA
First Wind (HI)
Gestamp Solar
Grasslands Renewable Energy
Haleakala Solar (HI)
Lone Star Transmission (W. TX Renewables)
Pattern Energy Group (Spring Valley Wind)
Ridgeline Energy (ID)
Sun Power (through Ausenco PSI)

2011

Bloom Energy (PA)
Green Futures Innovation (Philippines)
Idaho Power (Wind Power)
Keystone Solar (PA)
NaturEnergy (MT)
Renewable Energy Systems (MT)
Rising Sun Solar (HI)
Solon Energy (CA)
Terra-Gen Operating Company (CA)
Walnut Creek (CA)

2013

Altenergy (Philippines)
Brookfield Renewable Energy (BC Canada)
Catalina Solar - EDF Renewable Energy (CA)
Everpower Wind (IL)
Garnet Solar PV Project (CA)
ImMODO Solar (CA)
Infigen
Lakeswind Wind Power Partners (MN)
Last Mile Electric Coop (WA, White Creek Wind)
Maibarara Geothermal (Philippines)
North Wind Power (Philippines)
Recurrent Energy (CA)
Rising Tree Wind (CA)
Waneta Dam Project (British Columbia, CN)
Wintec Energy (CA)

2014

HNU Energy (HI)
Montalban Methane Power Corp. (Philippines)
Monte Solar (Philippines)
Virelec Solar (Ontario, CN)

2015

Aseagas Corp. (Aboitiz) (Philippines)
Astro Energy Solar (Philippines)
.ON Climate and Renewables (TX, HQ in IL)
Invenergy (IL)
Mariah Acquisition (TX)
RRC Power (OR) and Energy/ EDF Ren.(CA)
Renewable Power Generation (Ireland)
Silicon Ranch (GA)

2016

Fluvanna Wind (TX)

2018

Blattner Wind (TX)

2019

Imperial Valley Solar
Silicon Ranch (GA)

2020

AC Energy (Philippines, Rizal Solar Power Plant)
Altamont Wind (CA)
BayWa Renewables (CA)
CELEC Hidroazoguesz (Ecuador, through Elsystemec)
CELEC Hidropaute (Ecuador, through Elsystemec)
Deltatec (Spain)
Labayat 1 Hydropower Corporation (Philippines)
San Miguel (Battery Energy Storage System)
Ventura Energy (Battery storage)
Wapello Solar (IA)

“The Bitronics M571 is an ideal measurement and control node for integrating distributed intermittent renewables like wind. Its 4ms measurement response time, integrated I/O, and simultaneous communications to multiple masters are uniquely suited to the high-speed control of wind turbines, feeders, and other smart microgrid components.”

- Oliver Pacific, CTO, Spirae

Orion Key Features for Wind Farms and Solar Farms

Cyber Security

- Reduce chances for unauthorized or malicious access
- Address emerging NERC CIP requirements
- User groups with varying access privileges
- Firewall, encryption and key management
- Security event and alarm logging

Interface to multiple SCADA Masters simultaneously

- Independent buffers
- Different protocols, including DNP3, Modbus, FTP, telnet, SNTP and IRIG-B
- One Orion Smart RTU can serve the role of multiple RTUs

Pre-engineered Point Pick Lists

- Reduced engineering time
- No tedious register entry required
- Protective Relays: Over 10 vendors with 200 models
- Electrical Revenue and Display Meters: Most vendors and models

Math and Logic Functions

- Eliminate need for specialized controllers
- Fewer nuisance alarms
- Can be used for control actions and to condition data
- Complete suite of Math and Logic function with Syntax Checker and Logic Simulator
- Examples: Filter alarms, invert sign (as in power flow), convert phase-to-phase to phase-to-ground

Orion physical structure is modular and offers many communication options

- Individual communication modules for RS-232, RS-485 and fiber
- Individual Ethernet modules for copper or fiber (redundant copper available)
- Eliminate expensive physical conversion modules

Rugged Like a Relay

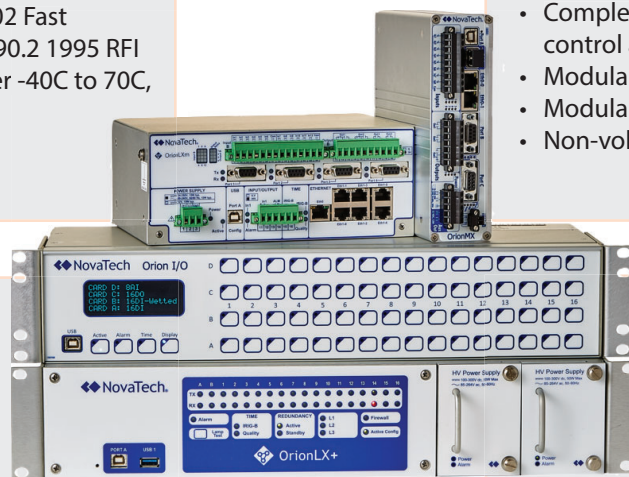
- Meets ANSI C37.90.1 2002 Fast Transient and ANSI C37.90.2 1995 RFI
- Designed to operate over -40C to 70C, without heaters or fans

Flexible and Modular Like a PLC

- Complete logic suite for local control and intelligent alarming
- Modular and expandable I/O
- Modular and expandable ports
- Non-volatile memory

Standard PC Tools

- Large, expandable solid state memory
- Built-in 10/100/1000MB Ethernet
- A variety of communication options such as HTTPS, SSH and Email



Utility-Specific

- Complete Cyber Security Package
- Built in breaker control, counter and accumulator functions
- Momentary-Change-Detect function
- Full suite of utility protocols

Bitronics 70 Series Key Features for Wind Farms

Distributed Disturbance Recording

- Multiple 70 Series instruments work together to capture a power system event on multiple feeders or generators
- Software consolidates individual records into one “substation event” for analysis
- “Sequence of Events” functions quickly highlight sources of disturbances

Simultaneous support of multiple protocols via serial and Network media

- IEC 61850 via TCP/IP network
- DNP3 via network and serial
- Modbus serial and TCP
- FTP, Telnet, SNMP, and IRIG-B

Quarter cycle (4ms) measurement updates

- Volts, amps, power, energy
- Frequency, phase angle
- Harmonic spectrum through the 63rd harmonic on all phases, current and voltage

Automation Functions

- Voltage control, power factor control, and loadshedding
- Front-end for synchro-check and synchronizing between two power sources and lines
- Binary status and control points available to remote SCADA Masters

Event Recording and Analysis

- Two independent Oscillographic Recorders
- 256 samples per cycle resolution
- Two independent Slow Disturbance Recorders with one cycle resolution
- Seasonal Trend recorder captures months of data with up to one minute resolution
- Sequence of Events recorder

Relay-Like Functionality

- Distance to fault measurements
- Enterprise-wide access to important event files without jeopardizing the security of the protection system
- Can set triggers without requiring re-commissioning

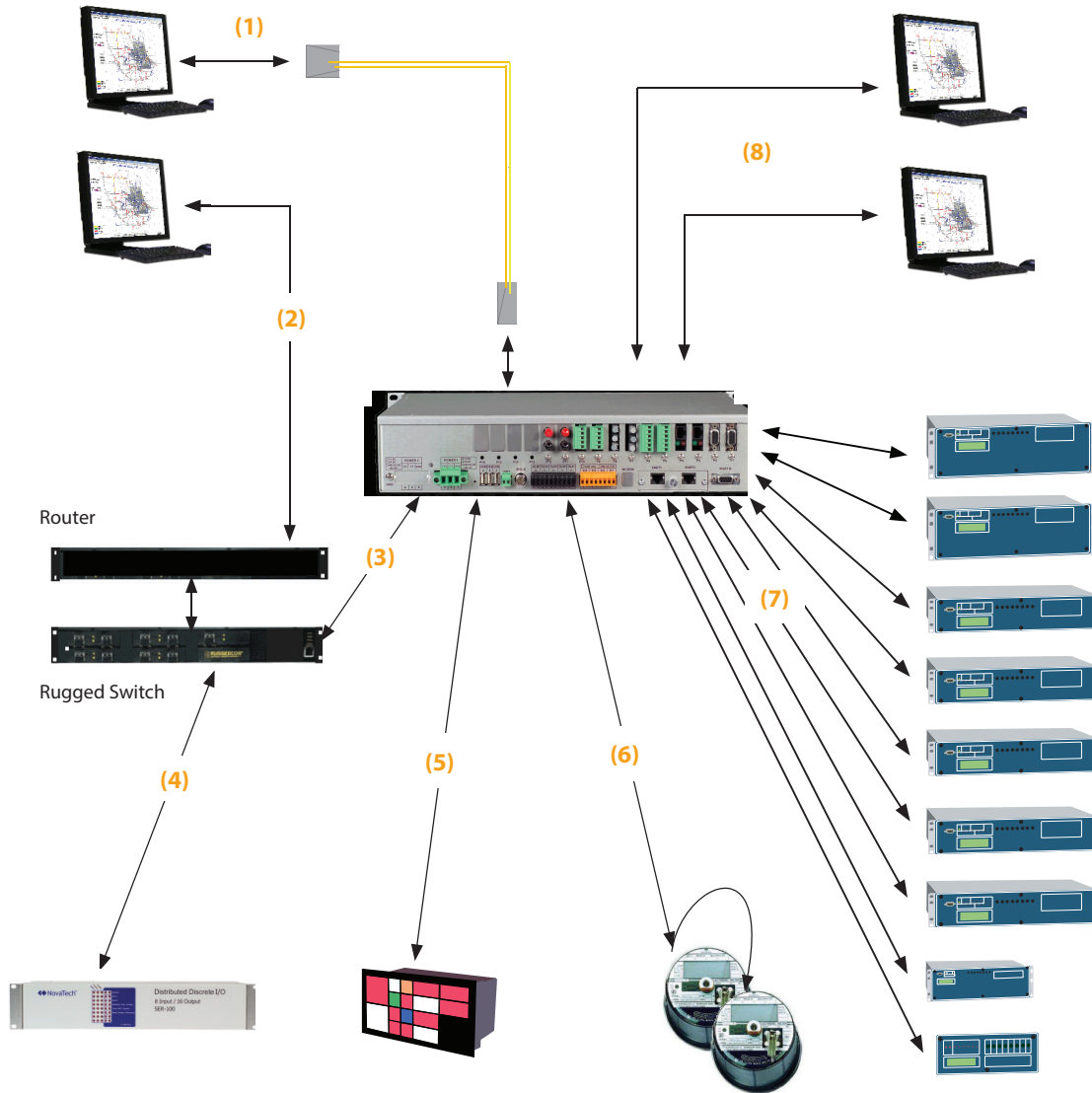


Utility-Grade

- Bright, easy-to-read LED panel meters
- Compliant to IEC 60687 and ANSI C12-30-1998
- Over 2000 measurements including frequency, demand, individual and total harmonics, Kfactor, current & voltage unbalance, flicker, impedance and symmetrical components

Customer Application - Orion in Wind Farm

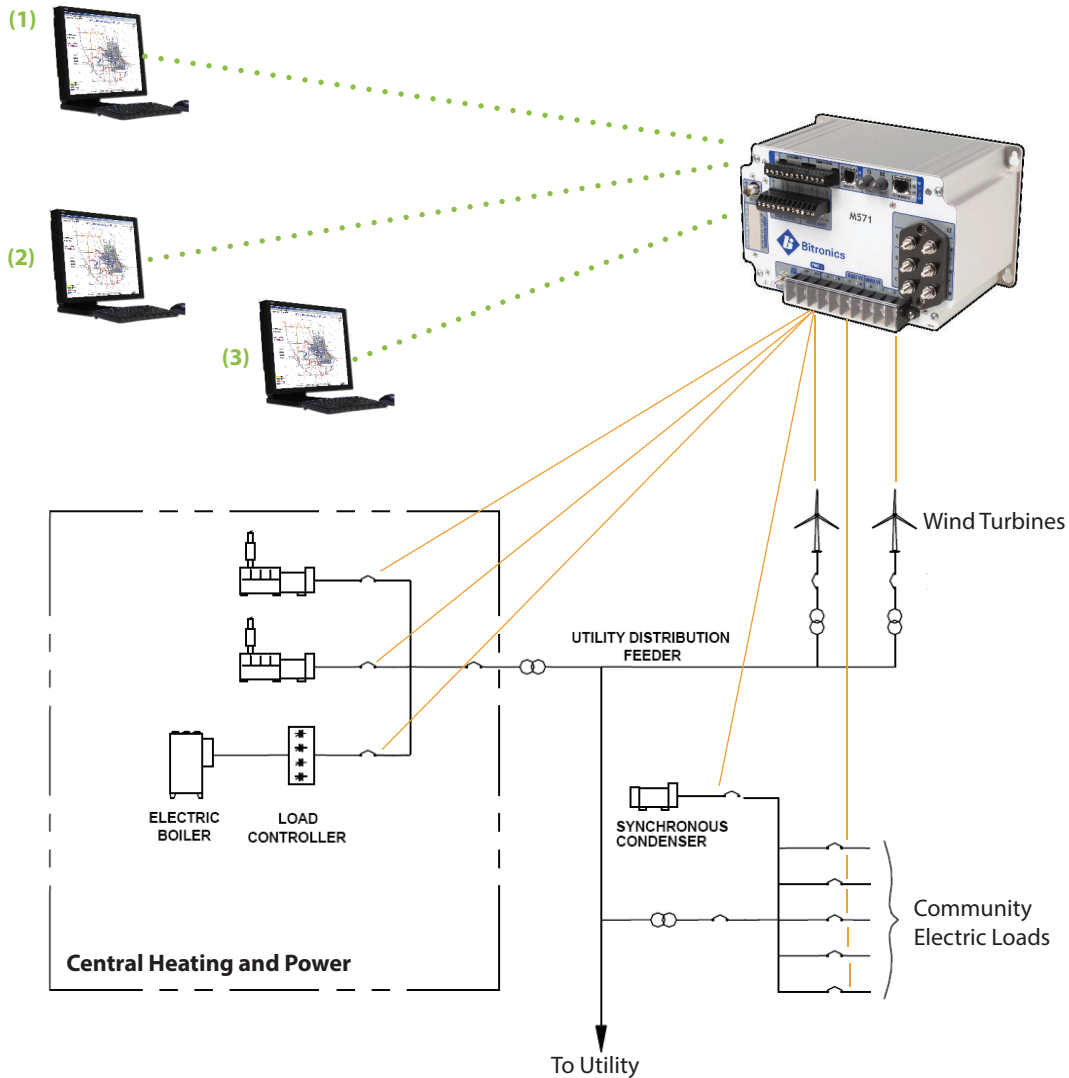
The diagram below details the application of Orion in a wind farm in West Texas, (engineered by TRC, West Palm Beach, FL for Xcel Energy). Support for multiple SCADA Masters and pre-configured point pick lists for all IEDs enable a single Orion to be engineered with less effort than other solutions.



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| <p>(1) To SCADA Master #1
DNP3 protocol over RS-232 converted to 9.3 micrometer single mode fiber optic using SEL-2829 converters</p> <p>(2) To SCADA Master #2 (on turbine)
DNP3 protocol over Ethernet</p> <p>(3) To Ethernet Port on Orion</p> <p>(4) Interface to Orion DDIO
DNP3 protocol</p> | <p>(5) Interface to one Ametek 3100D Annunciator
DNP3 protocol over RS-232</p> <p>(6) Interface to two Revenue Meters
DNP3 protocol over RS-485</p> <p>(7) Interface to nine SEL® Protective Relays
SEL® protocol over RS-232; IRIG-B also sent from Orion to SEL® relays</p> <p>(8) WAN connection to remote engineering workstations</p> |
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Customer Application - Bitronics in Wind Farm

The 70 Series IEDs integrate with controllers running advanced algorithms to demonstrate dynamic stability control in renewable & distributed generation applications.



M571 has remote communication with:

- (1) System Operator's SCADA/EMS**
Serial Leased Line SCADA via DNP
- (2) Distribution Utility's SCADA**
Serial Leased Line SCADA via DNP
- (3) Local Monitoring & Automated Control Systems**
LAN / WAN / VPN via Modbus, DNP, IEC 61850

M571 has local, direct connections to:

- Secondary Load Controllers
- Wind Turbines
- Distribution Feeders
- Community Electric Loads



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