

ORION AUTOMATION PLATFORM in  
**PROCESS PLANTS**  
ORION APPLICATION NOTE

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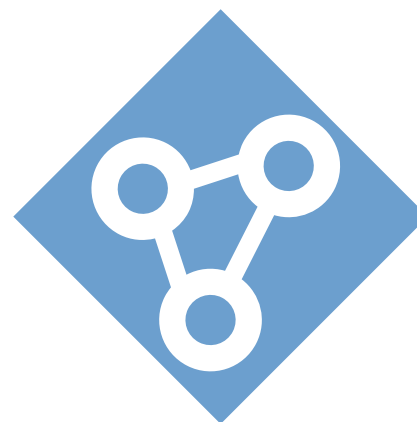
The Orion Automation Platform from NovaTech is being applied in process plants to reduce cost and complexity in the following applications:

1. Protocol conversion and media conversion, primarily conversion from uncommon or proprietary serial protocols to Modbus TCP
2. Integration of large large numbers of IEDs (Intelligent Electronics Devices) from substations and load centers
3. 1ms Sequence of Events (SOE) Recording
4. Lower-cost web-based HMI (Human-Machine Interface) and SCADA systems for portions of the plant

This document describes Orion applications in each of these area and summarizes key Orion features and benefits.

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Orion polls real-time data from attached IEDs using the native IED protocol and presents data to the DCS in a different protocol.	
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# ORION OVERVIEW

## What is the Orion Automation Platform?

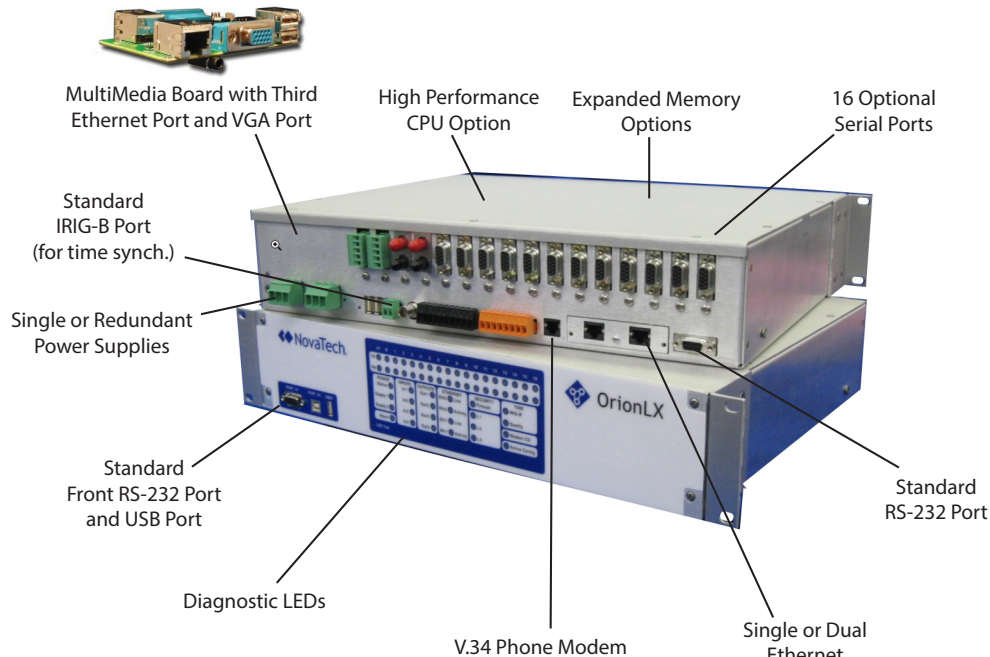


The Orion Automation Platform is a family of modular hardware platforms and software designed to perform a range of monitoring and control applications.

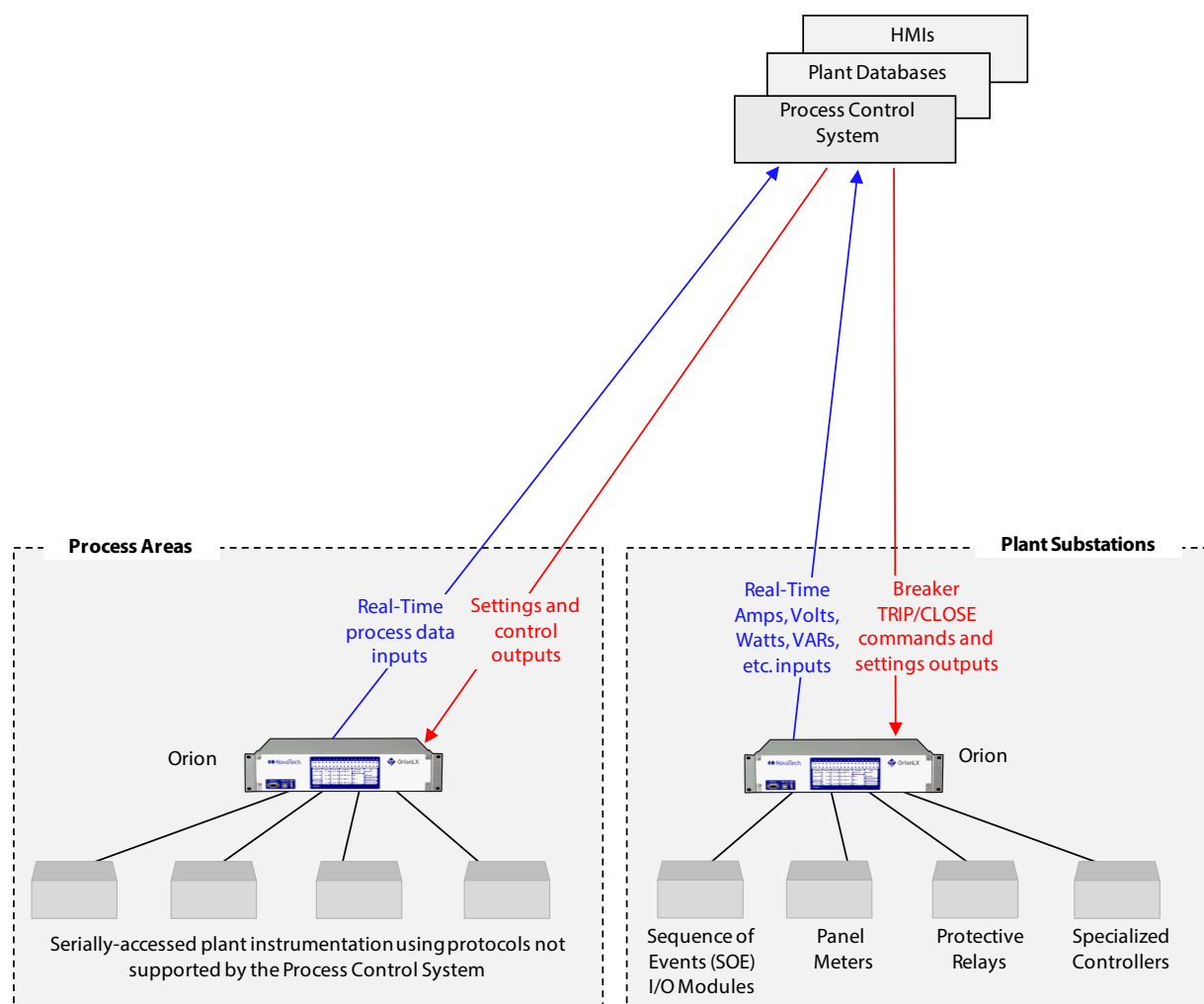
Originally designed for accessing data from IEDs (Intelligent Electronic Devices) in unconditioned

and noisy electrical substations, Orion provides a rugged solution for accessing data from nearly any intelligent serial or Ethernet plant device, plus options to present these data where and how the user desires: to plant control systems, to plant databases, to HMI's (Human-Machine-Interfaces), etc.

## OrionLX Physical Overview



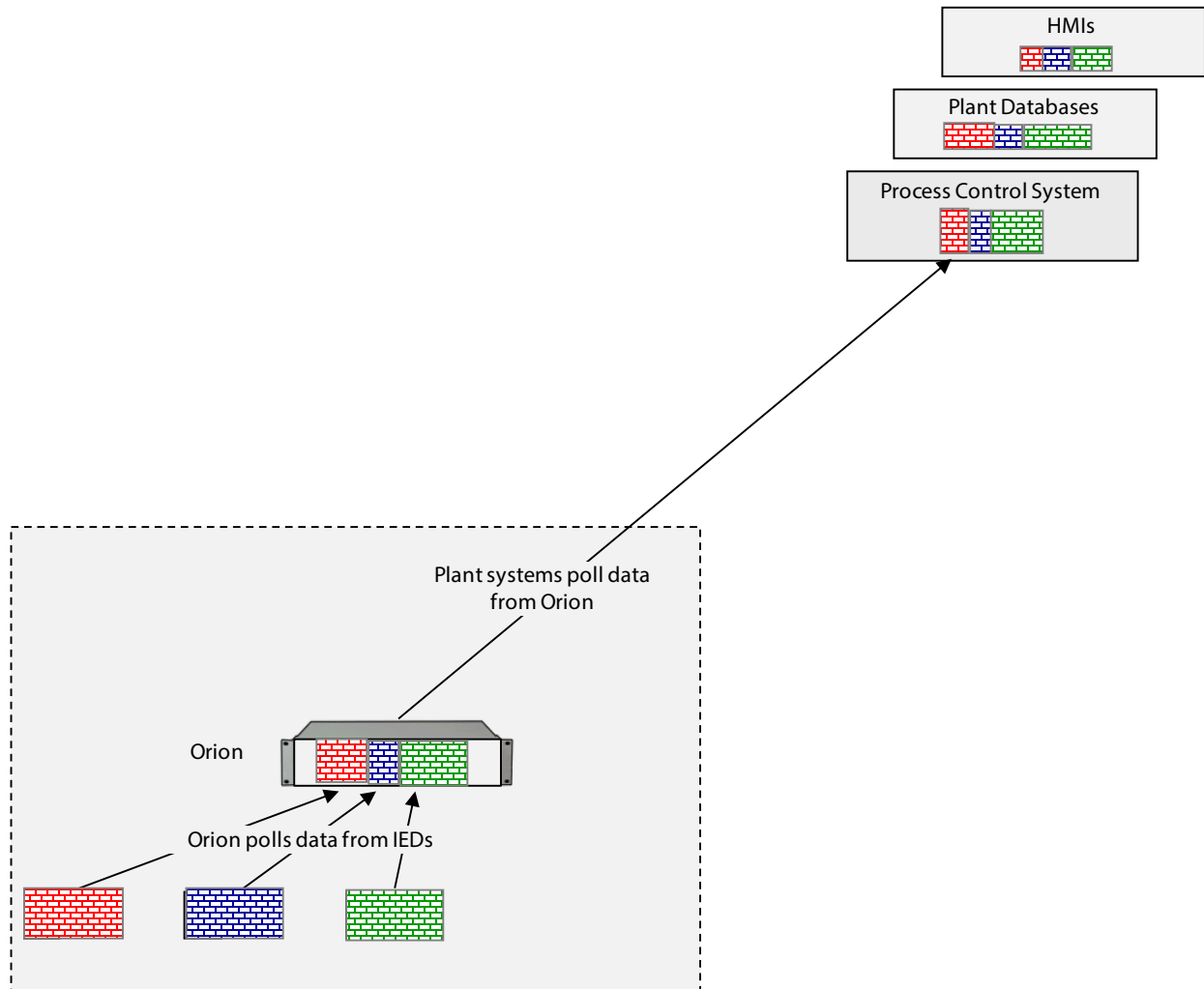
## How is Orion Applied in Process Plants?



Orion provides real-time data to process control systems and plant databases. These data are accessed from the IEDs in plant process areas and plant substations.

Control commands, such as circuit breaker TRIP/CLOSE, can be sent through Orion either to I/O modules or to the microprocessor protective relay on the breaker.

## How Does Orion Access Data?



In this diagram, data flow, from IEDs to plant systems, is represented by bricks. Orion polls a subset of the data available from the IEDs. Plant systems poll all or a portion of the data from Orion.

Note Orion polls data asynchronously to how it is polled (e.g. Orion could poll IEDs every second, while the DCS could poll Orion every two seconds).

## Summary of Typical Orion Applications

### Protocol Conversion

- ◆ Modbus TCP to DNP3 (common utility protocol)
- ◆ Modbus TCP to SEL<sup>®</sup> Protocol (for Schweitzer Relays)
- ◆ Modbus TCP to ABB 10-byte (for ABB DPU2000 relays)
- ◆ Modbus TCP to Modbus serial (PLCs, most GE motor relays, many starters and drives)
- ◆ Modbus TCP to proprietary instrumentation protocols (e.g. SCPI)

### Media Conversion

- ◆ Serial RS-232 to Ethernet
- ◆ Serial RS-485 to Ethernet
- ◆ Serial Fiber Optic to Ethernet

### “Remote Terminal Unit”

- ◆ Report real-time data to SCADA or to DCS
- ◆ Accept control commands from SCADA or from DCS
- ◆ Can obtain data from IEDs or from Orion I/O modules

### Security Gateway

- ◆ Secure connections between DCS and IEDs
- ◆ Strong password and password rules
- ◆ Firewall
- ◆ Encryption
- ◆ Logging

### Human-Machine-Interface (HMI)

- ◆ Serve out customized webpages to browsing PC locally or remotely
- ◆ Local control and tagging supported
- ◆ Direct Video monitor connections to Orion supported (to eliminate browsing PC)

### Math and Logic Control

- ◆ IEC 61131-3 available for local control tasks
- ◆ Rugged Orion I/O modules available

### Alarm Annunciation

- ◆ Serve out webpages with alarms status
- ◆ Acknowledge alarms locally or remotely
- ◆ Tile Annunciator available

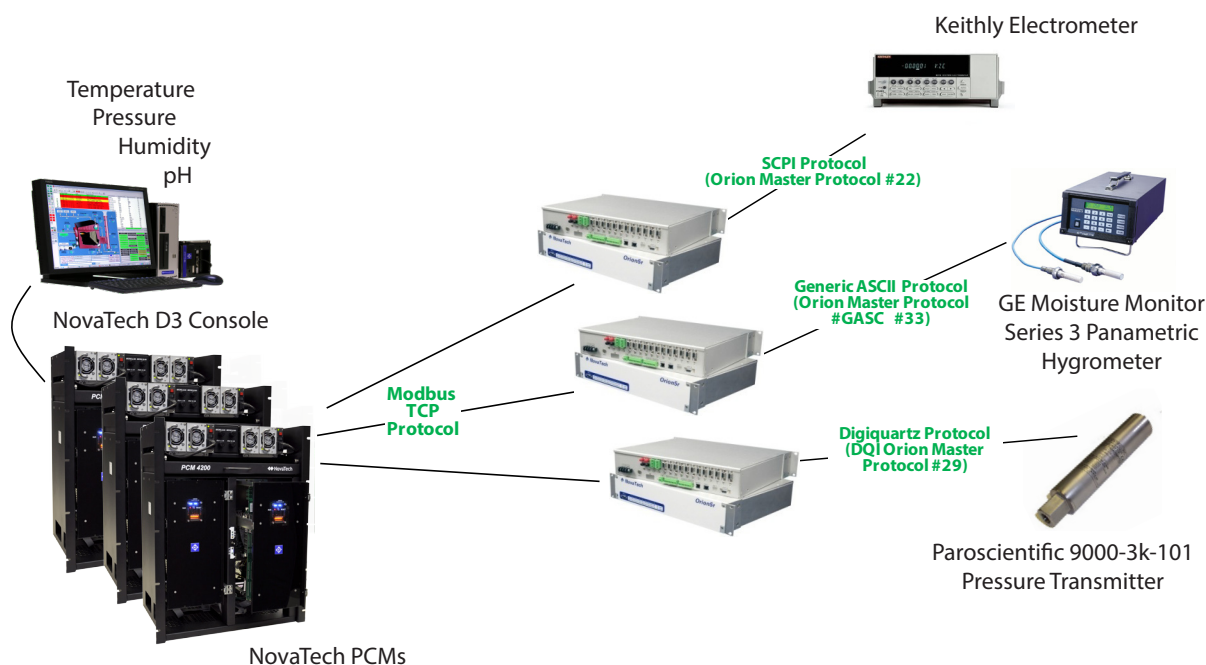
### Sequence of Events (SOE) Recording

- ◆ 1ms accuracy
- ◆ Works with Orion Distributed I/O

# PROTOCOL CONVERSION AND MEDIA CONVERSION

## Protocol Conversion and Media Conversion at Southeast US Nuclear Fuel Processing Plant

In a Southeast US nuclear fuel processing plant, Orion Automation Platforms convert data from specialty instruments in their native protocols to the plant NovaTech DCS in Modbus TCP protocol.



## Key Orion Features for Protocol Conversion

- Large Orion library of communications protocols – over 50 total including many for Process applications
- NovaTech Engineering can add protocols to Orion for a small one-time fee
- NovaTech “Generic ASCII” protocol enables users to create interfaces to ASCII devices

### Serial Protocols for Process Applications

DNP3 Level 2	Master / Slave
Modbus RTU	Master / Slave
SEL® ASCII Protocols	Master
SEL2030 Protocol	Master
TransData DTO	Master
Alstom KITZ (Courier)	Master
GE DLP	Master
ABB DPU and 10-byte	Master
DF1 (Allen Bradley)	Master
SCPI (Std. Commands for Programmable Inst.)	Master
Generic ASCII	Master
IEC60870-5-103	Master
DQI (Digiquartz)	Master

### Network Protocols for Process Applications

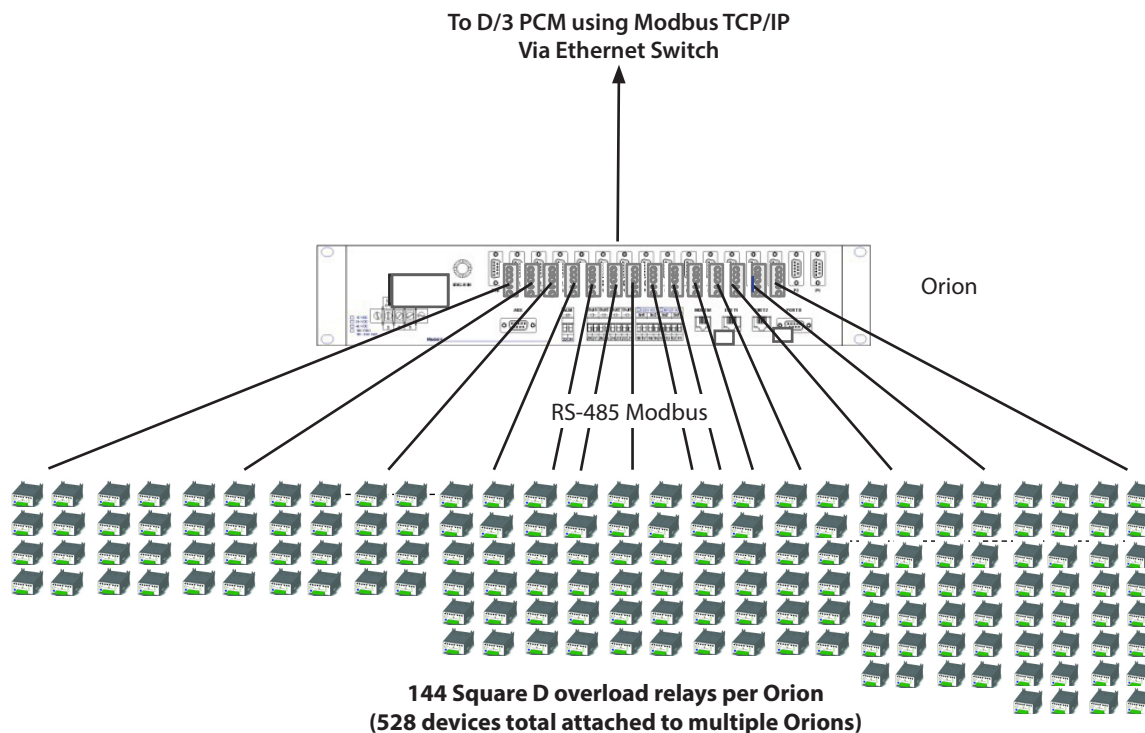
DNP3 TCP/UDP	Master / Slave
Modbus TCP RTU	Master / Slave
NTP	Client / Server
SNMP	Client
FTP / sFTP	Server
HTTP / HTTPS	Server
telnet / SSH	Server
PassThru	Server



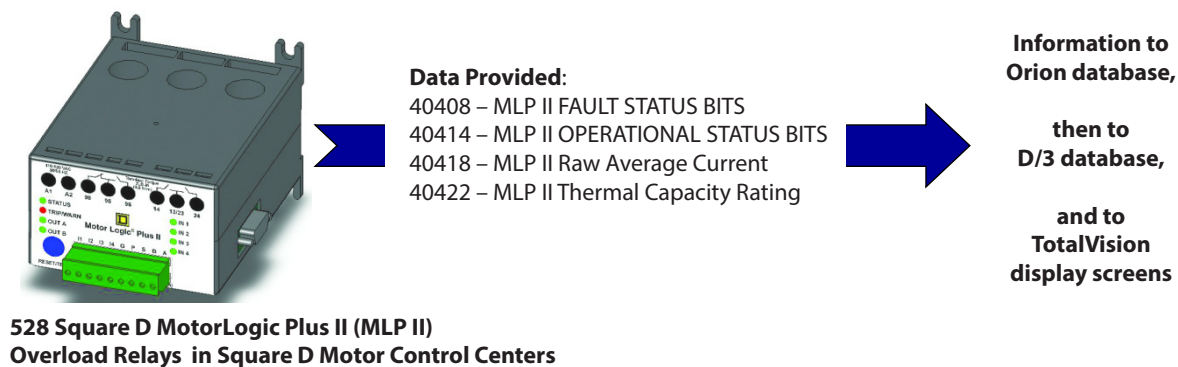
# INTEGRATION OF LARGE NUMBERS OF INTELLIGENT ELECTRONIC DEVICES

## Integration of Intelligent Electronic Devices at a Northeast US Cocoa Processing Plant

In a US cocoa processing plant, multiple Orion platforms integrate over 600 motor overload relays, drives and softstarts. Real time data values, including operation status, fault status and measured values, are presented to the plant NovaTech D/3® DCS.



## Summary of Cocoa Plant Application



Orion also accesses data from these IEDs:

### Altivar Drives – 64 Devices

- ◆ 4 read registers, 1 analog write register for speed
- ◆ 4 registers to be remapped to contiguous Modbus registers to simplify reading by DCS
- ◆ TCP/IP connection to PCM ports via Modbus TCP/IP

### Square D SoftStarts – 13 Devices

- ◆ 4 registers read
- ◆ 1 write for settings connections
- ◆ TCP/IP connection to PCM ports via Modbus TCP/IP

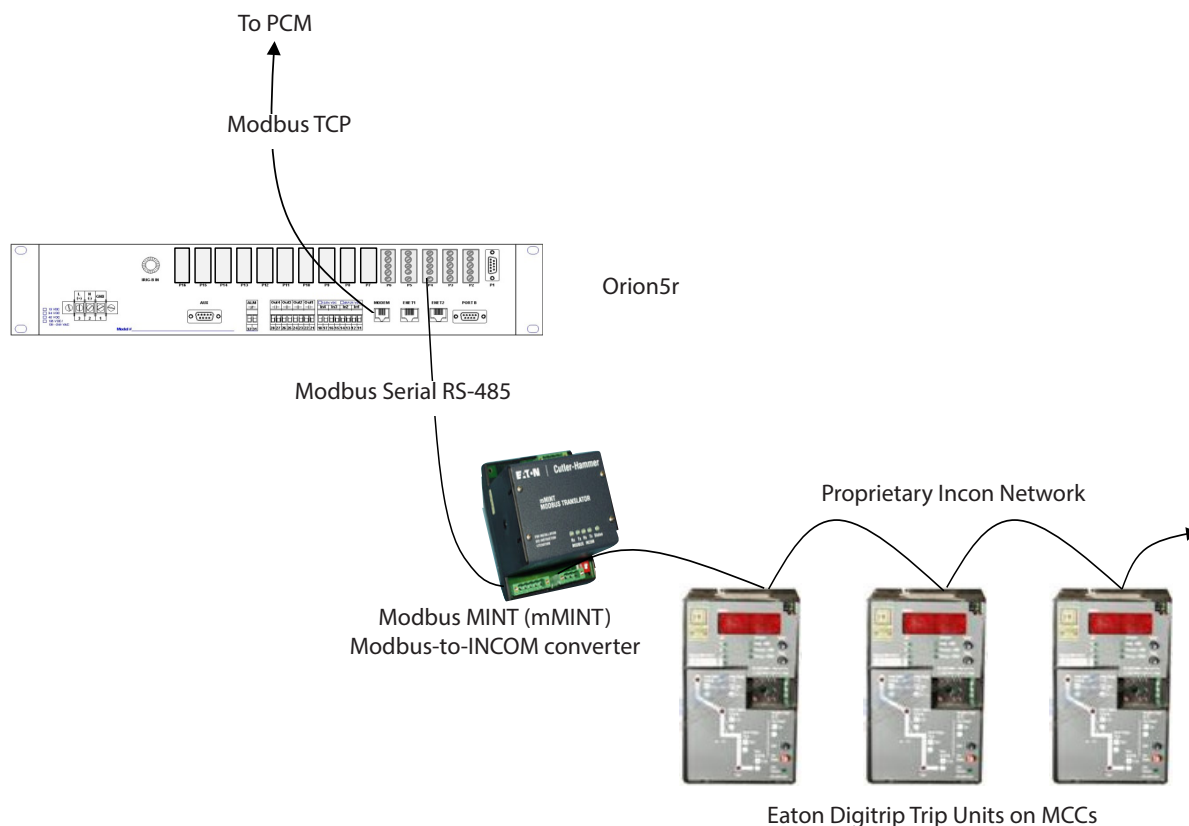
## Integration of Intelligent Electronic Devices at Midwest US Agricultural Product Processing Plant

Eleven Orion Automation Platforms are installed in two substations and nine motor control centers to access real-time data from trip units and protective relays:

- (2) New Substation at Dry Grind Facility
- (1) Dry Grind Medium Voltage
- (1) Mill Motor Control Center
- (1) Feedhouse Motor Control Center
- (1) D/D Motor Control Center
- (1) Utility Motor Control Center
- (1) Elevator Motor Control Center
- (1) DDGS Loadout Motor Control Center
- (1) Alcohol Loadout Motor Control Center
- (1) Waste Treatment Motor Control Center

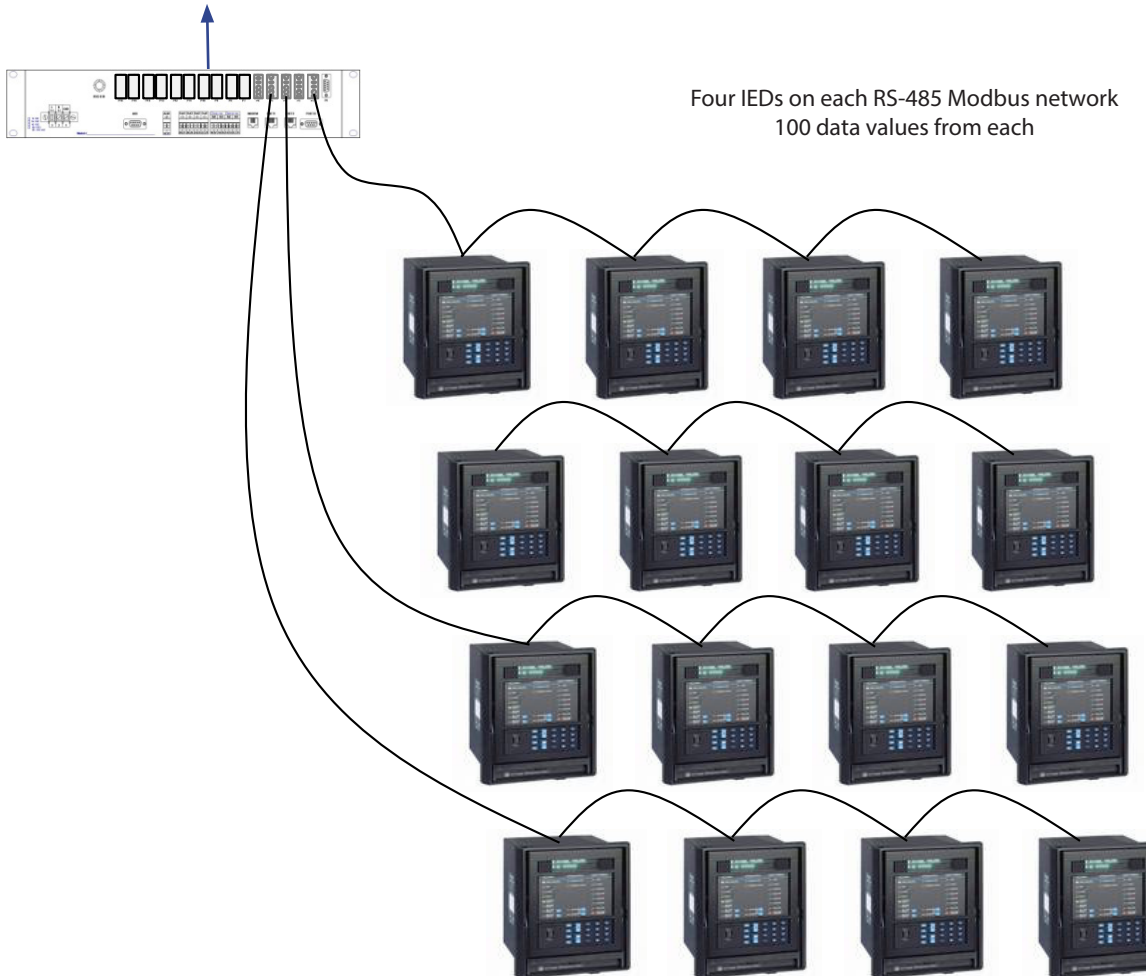
These data are made available to the plant NovaTech D/3® DCS.

### Interface to Eaton MCCs



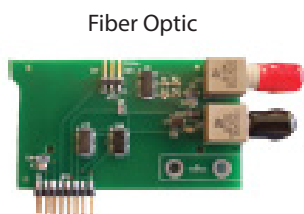
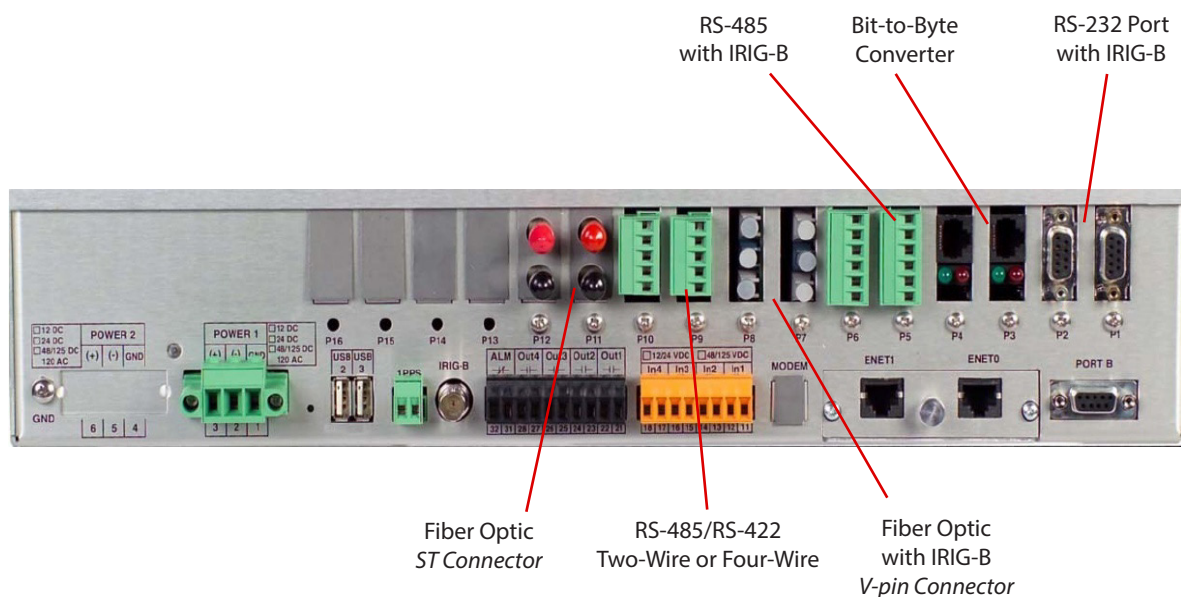
## Performance Guidelines: RS-485 Multidrop

Updates from each of the points from each IED  
can be obtained every 1 to 2 seconds



## Key Orion Features for IED Integration

- ◆ Up to 16 RS-485 serial ports per Orion; each port able to accommodate up to 31 IEDs
- ◆ Large point processing capabilities; up to 20,000 points able to be accessed and presented to DCS
- ◆ IED “Point Pick Lists”
- ◆ Simple mapping of points from the ports where data is polled by Orion to ports where the DCS will poll data from Orion (no typing)



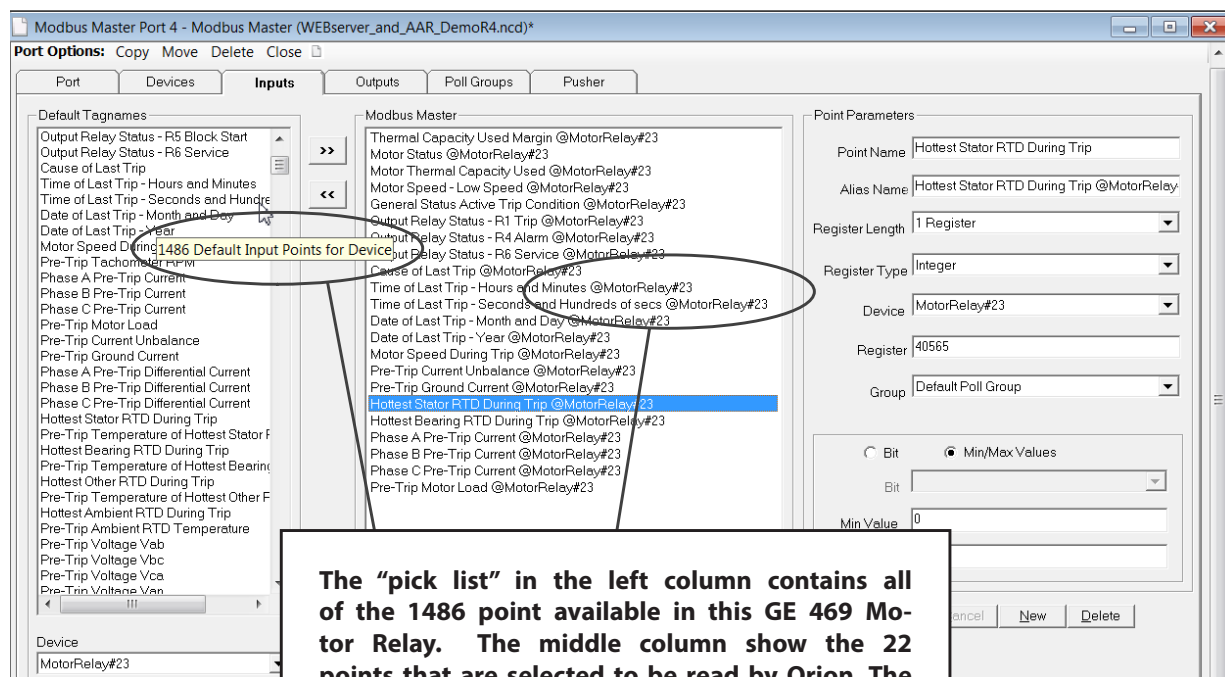
Serial communication cards are modular and field-upgradable

## Orion “Point Pick Lists”

Orion is supplied with over 300 “point pick lists.” These point pick lists contains the names and addresses of all of the points that can be read, or controlled, by Orion. These preformatted lists make configuration possible with minimal typing and scripting

Point pick lists for many process plant IEDs are provided including:

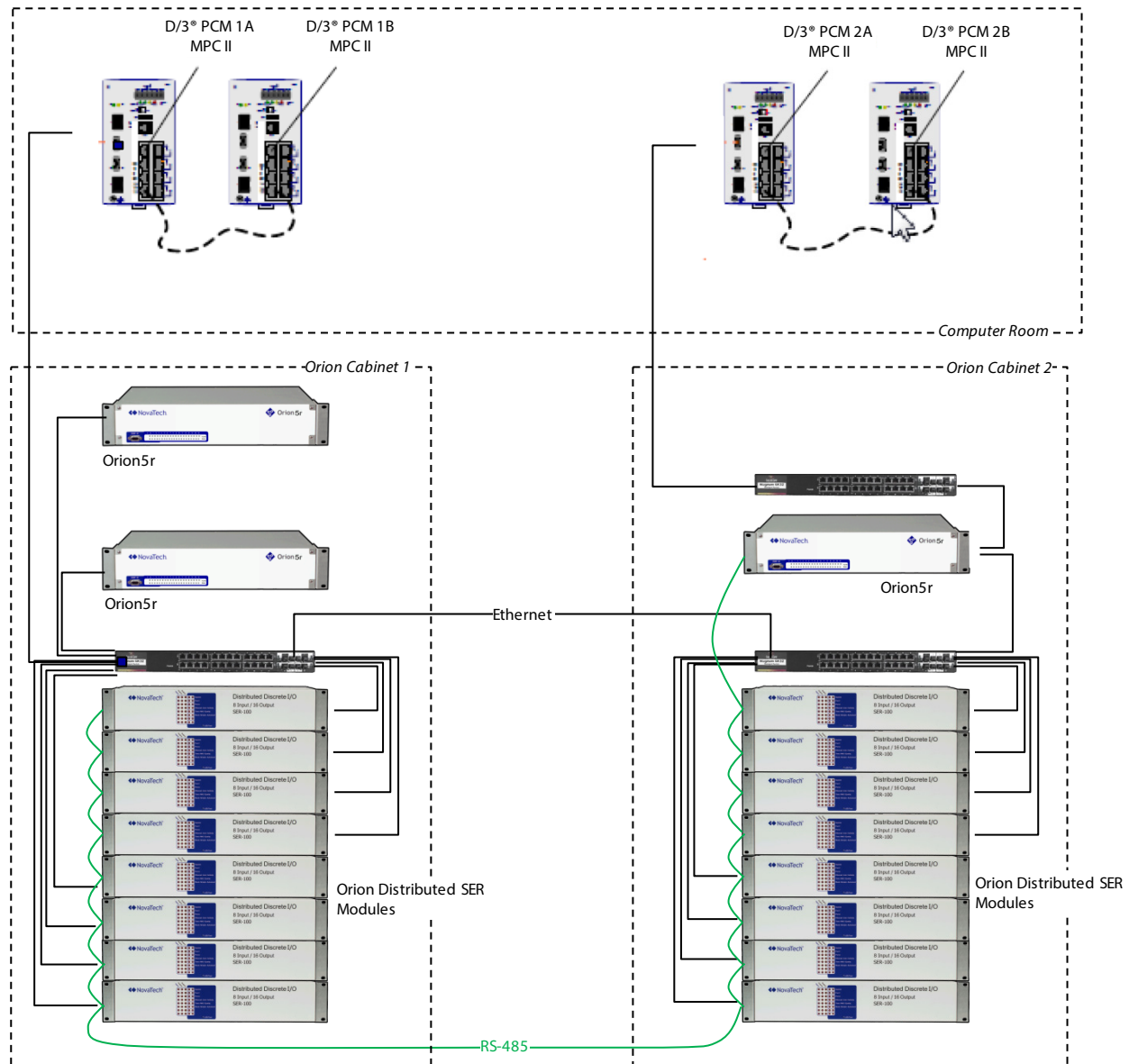
- ◆ Bitronics Meters and Recording IEDs; all models
- ◆ GE Protective Relays; “UR” Series, DLP Series, 7xx Series, 469 Series, 269 Series
- ◆ GE Meters; PQM Series
- ◆ Schweitzer Protective Relays; all models
- ◆ Basler and Beckwith Protective Relays; most models
- ◆ Square D MLPII Motor Relays
- ◆ Eaton DigiTrip IEDs
- ◆ Satec, Power Measurement, and Electro- Industries Meters
- ◆ Ametek GenStar Meters



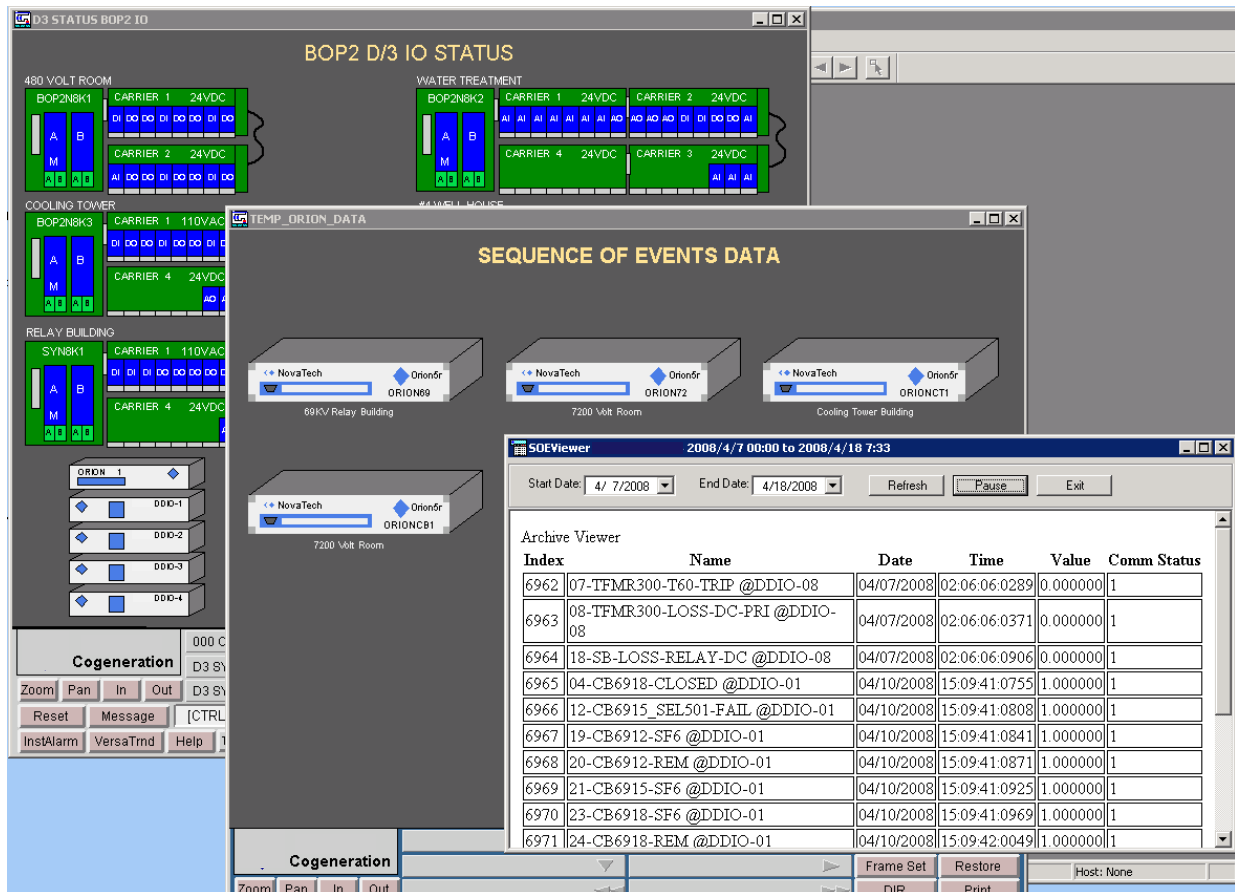
# 1ms SEQUENCE OF EVENTS (SOE) RECORDING

## 1ms Sequence of Events (SOE) Recording at Midwest Cogeneration Plant

Orions and Distributed SER I/O Modules are applied to place 1ms time stamps on power system events. A redundant architecture, including dual D/3® PCs and dual RS-485 and Ethernet connections to the I/O modules, assures higher availability.



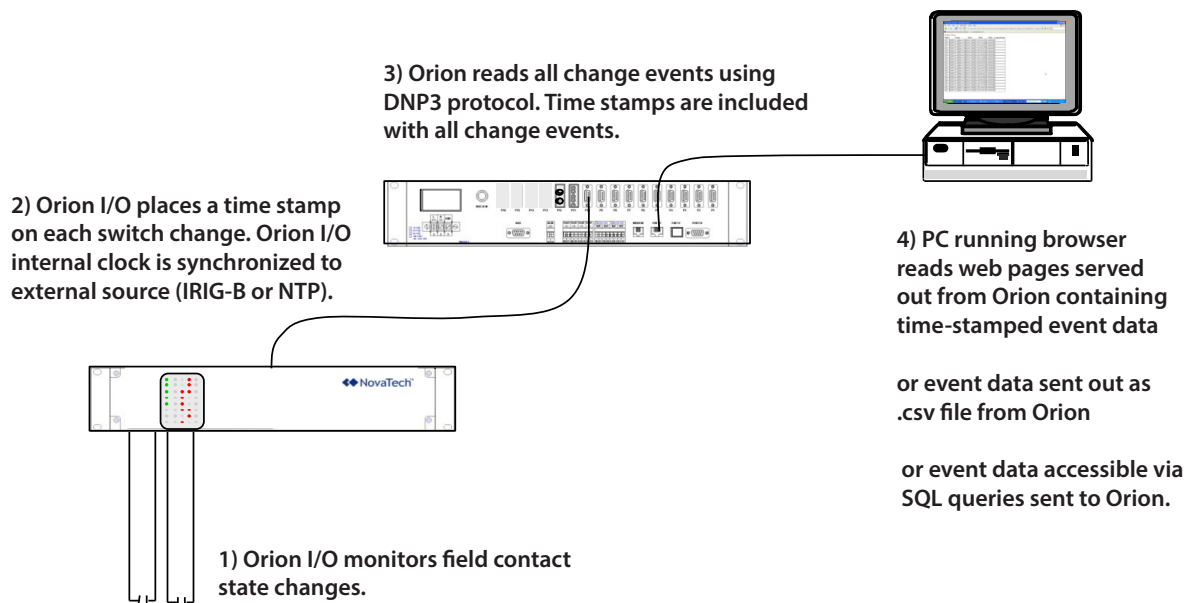
Equipment Layout - Cogeneration Plant



Typical D/3 TotalVision screen depicting integration of Orion Sequence of Events system with D/3 PCMs. Also shown: web-based HTML table of 1mS time-stamped SOE data from substation IEDs and Orion I/O modules.

## Sequence of Events Recording with Orion and Distributed I/O

The connections and data flow between Orion and I/O modules in this SOE system are summarized below:





## Sequence of Events Recording with Orion and Distributed I/O

### Physical Features

**Operates with 48V dc or 125V dc battery-powered systems**

- ◆ No converters or interposing relays required

**All input circuits independent and isolated**

- ◆ Simplifies retrofits

**Both Ethernet and serial options supported**

**Rugged design to survive in harsh environments**

- ◆ -25°C to 70°C (156°F)
- ◆ Meets stringent IEEE C37.90 standards for Fast Transients, Electrostatic Discharge and RFI

### Software Features

**Internal clock can be synchronized to a precise IRIG-B time signal**

- ◆ Facilitates time stamping to an accuracy of one millisecond
- ◆ Network Time Protocol (NTP) also supported when access to NTP server is available

**Individual filters on all discrete input channels to reduce nuisance data**

- ◆ ON-state filter
- ◆ De-bounce filter
- ◆ Chattering contact filter

**DNP3 Protocol**

- ◆ Supports transfer of timed events *in the protocol*

**When combined with Orion, presents SOE data in multiple forms to meet specific user requirements**

- ◆ Table of SOE events presented on a web page
- ◆ Exported .csv file
- ◆ SQL queries from other databases



Distributed Combination I/O Module (DCIO) 19" rack-mount model, front and rear view. This model offers eight discrete 1mS inputs, eight discrete contact outputs and eight analog inputs (each selectable for 4-20mA, -2mA to +2mA or 0-10V). Panel mount and DIN-rail mount models are also available.



## SMALL WEB-BASED SCADA

### OrionLX-Based WEBserver SCADA at Midwest US Agricultural Product Processing Plant

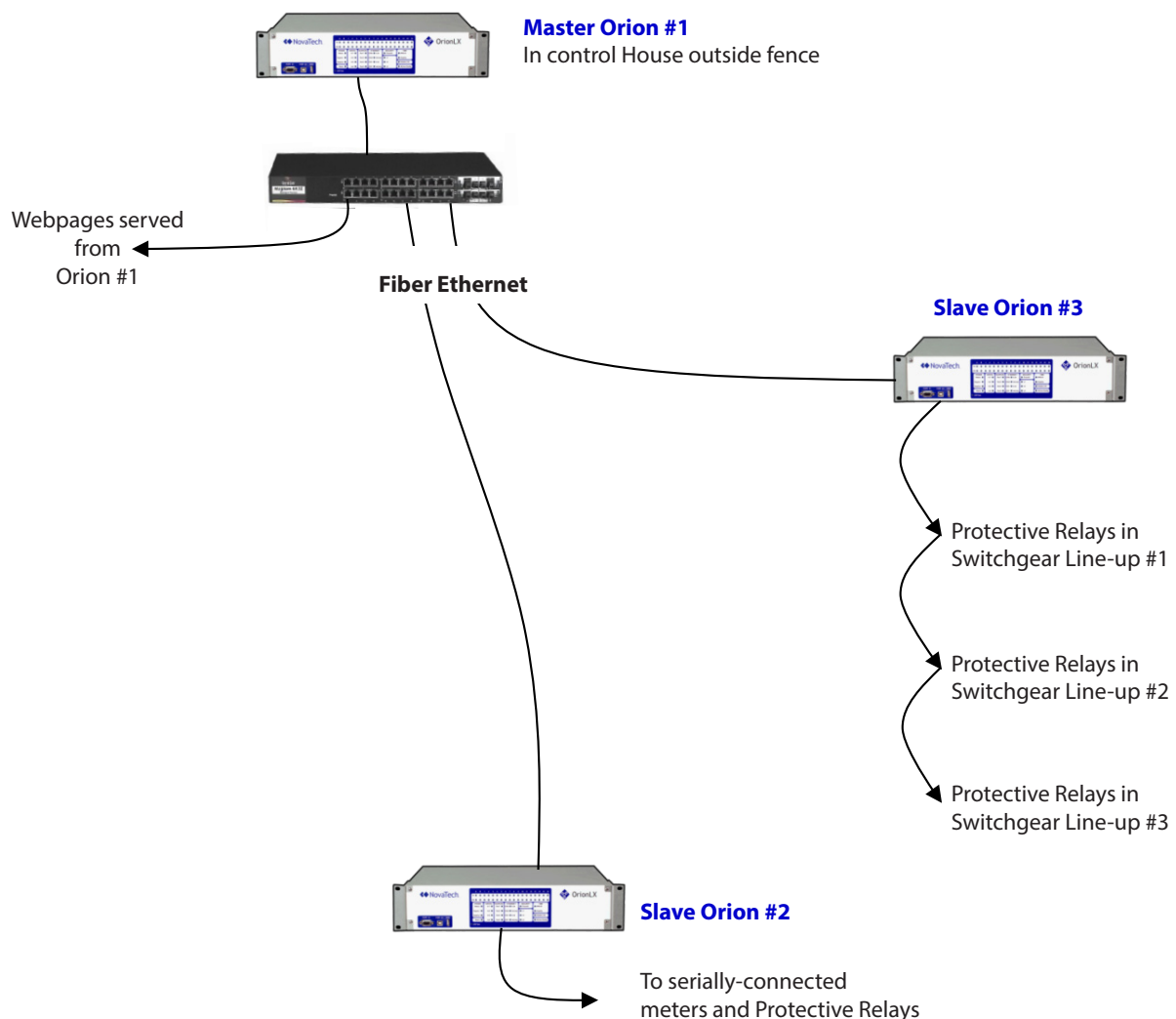
#### Plant Need:

A monitoring system to identify root causes for power system interruptions.

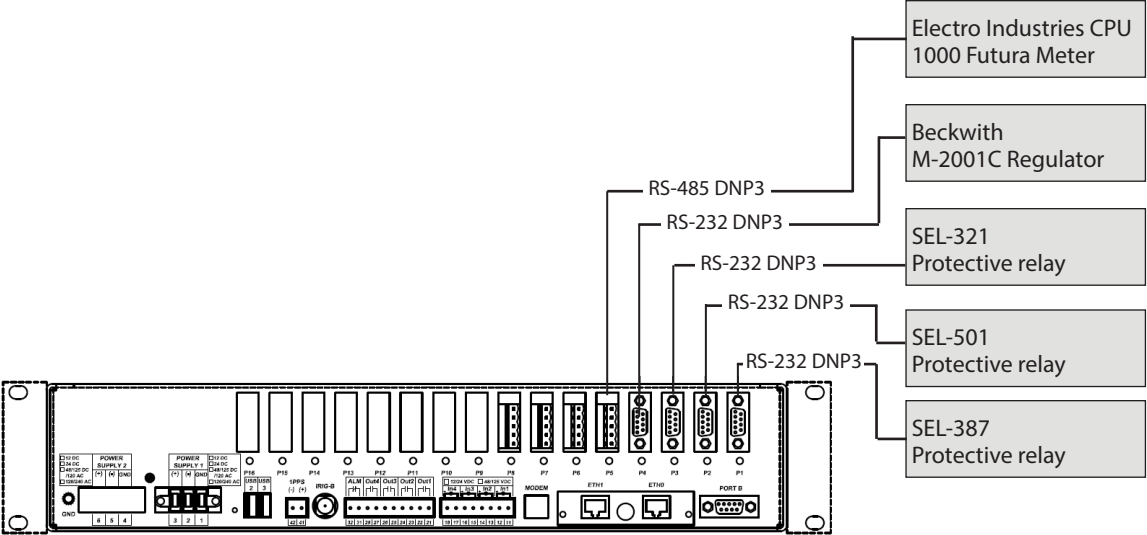
#### Solution:

- ◆ Install Orions and Orion Distributed I/O modules in the substation to access data from IEDs and to capture high-speed (1ms) SOE data
- ◆ Provide simple web-based local visualization of power system operation and power system data
- ◆ Provide SOE data to utility operators via preconfigured web pages in Orion

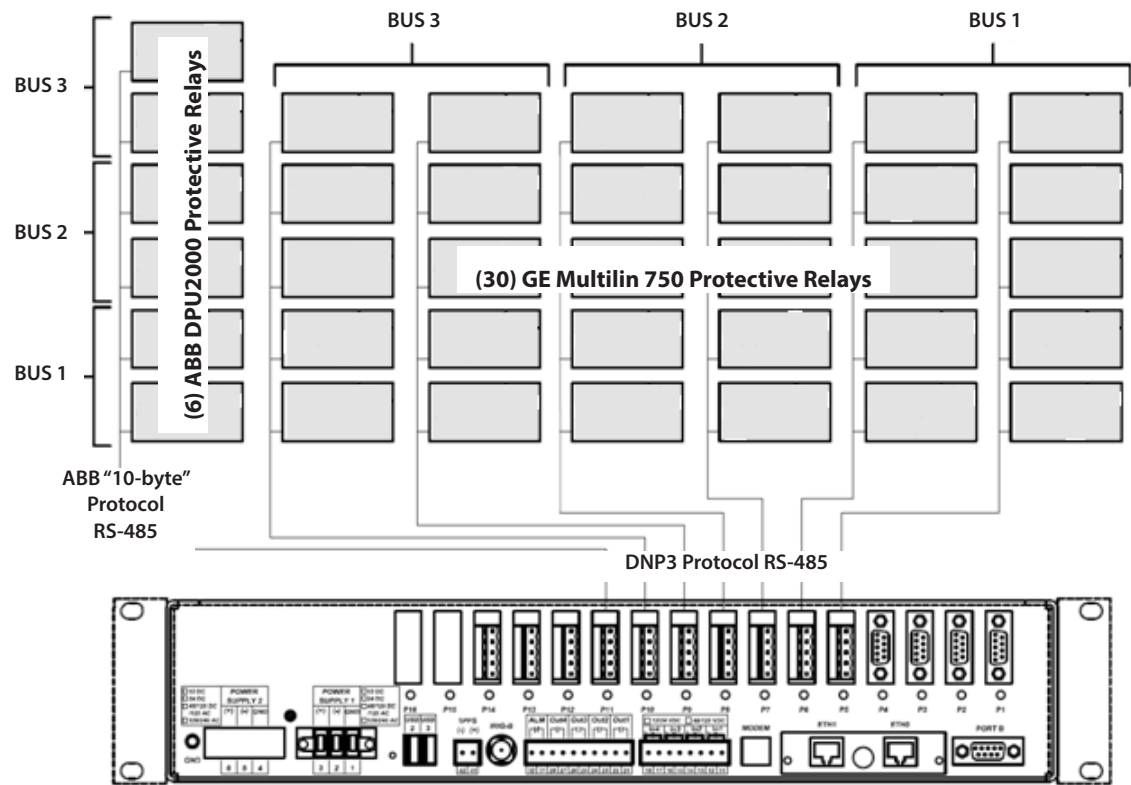
### Automation Equipment Interconnections - WEBserver SCADA Application



Slave OrionLX #2 IED Connections



Slave OrionLX #3 IED Connections



## Webpages (Screens) Provided in System

OrionLX #1 serves out standard and customized webpages providing specific power system data. These data are used by engineers and operators to identify root causes of power interruptions.

### Sequence of Events Screen

user novatech  
hostname orionlx  
ADM\_Master\_Orion\_1.ncd is running.  
This Orion is unlocked. ( [Lock](#) | [Logout](#) )

Home DataValues Devices Alarms **Archive** System Logs Files Settings Contact

**View Trending**

Limit to 1000 most recent records Custom filters

In this mode queries are performed only on the most recent 1000 records. This ensures queries are executed quickly while giving you access to only the most recent data.

Reset filters Update view

(1 of 1) << first < prev 1 next > last >> Rows per page: 25

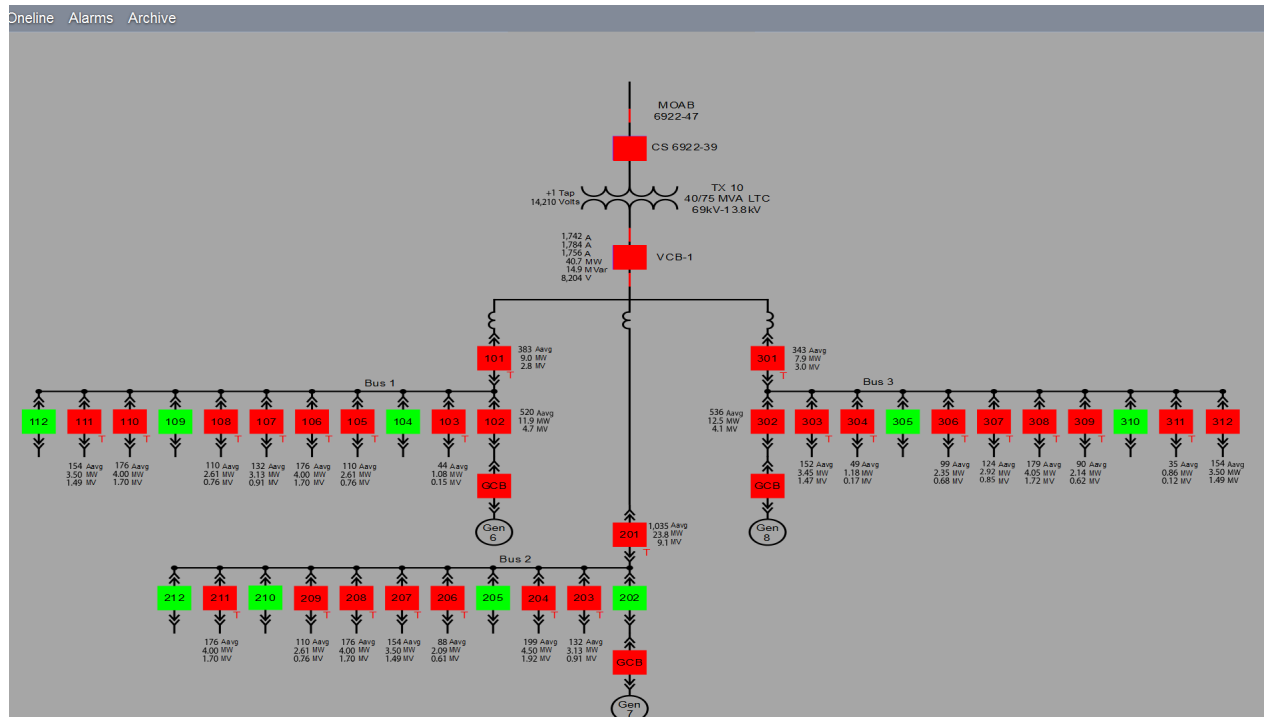
ID	DateTime	Device DateTime	Point Name	Alias	Value	Online	DTime
17	2012-07-11 15:11:57.339-04	2012-07-11 11:10:48.681-04	52-101 Reclosure Locked Out @BUS_Orion		1	online	yes
16	2012-07-11 15:10:00.778-04	2012-07-11 11:08:52.091-04	52-101 Major Internal Failure @BUS_Orion		1	online	yes
15	2012-07-11 15:09:50.637-04	2012-07-11 11:08:41.975-04	52-101 Minor Internal Failure @BUS_Orion		1	online	yes
14	2012-07-11 15:09:40.507-04	2012-07-11 11:08:31.835-04	52-101 Local Mode Active @BUS_Orion		1	online	yes
13	2012-07-11 15:08:52.325-04	2012-07-11 11:07:43.656-04	52-101 Breaker Is Open @BUS_Orion		0	online	yes
12	2012-07-11 15:08:52.324-04	2012-07-11 11:07:43.656-04	52-101 Setpoint Group 2 Active @BUS_Orion		1	online	yes
11	2012-07-11 15:08:52.323-04	2012-07-11 11:07:43.656-04	52-101 Setpoint Group 1 Active @BUS_Orion		1	online	yes
10	2012-07-11 15:08:52.322-04	2012-07-11 11:07:43.656-04	52-101 Protection Picked Up @BUS_Orion		0	online	yes
9	2012-07-11	2012-07-11	52-101 Trip Conditions Active		1	online	yes

**Sequence of Events Screen** summarizes all logged 1mS time-stamped events in a pre-formatted tabular text.

**Alarm Screen** displays power system alarms (*in alarm, not acknowledged, in alarm acknowledged, went out of alarm but not acknowledged*) in a pre-formatted color-coded tabular text summary.

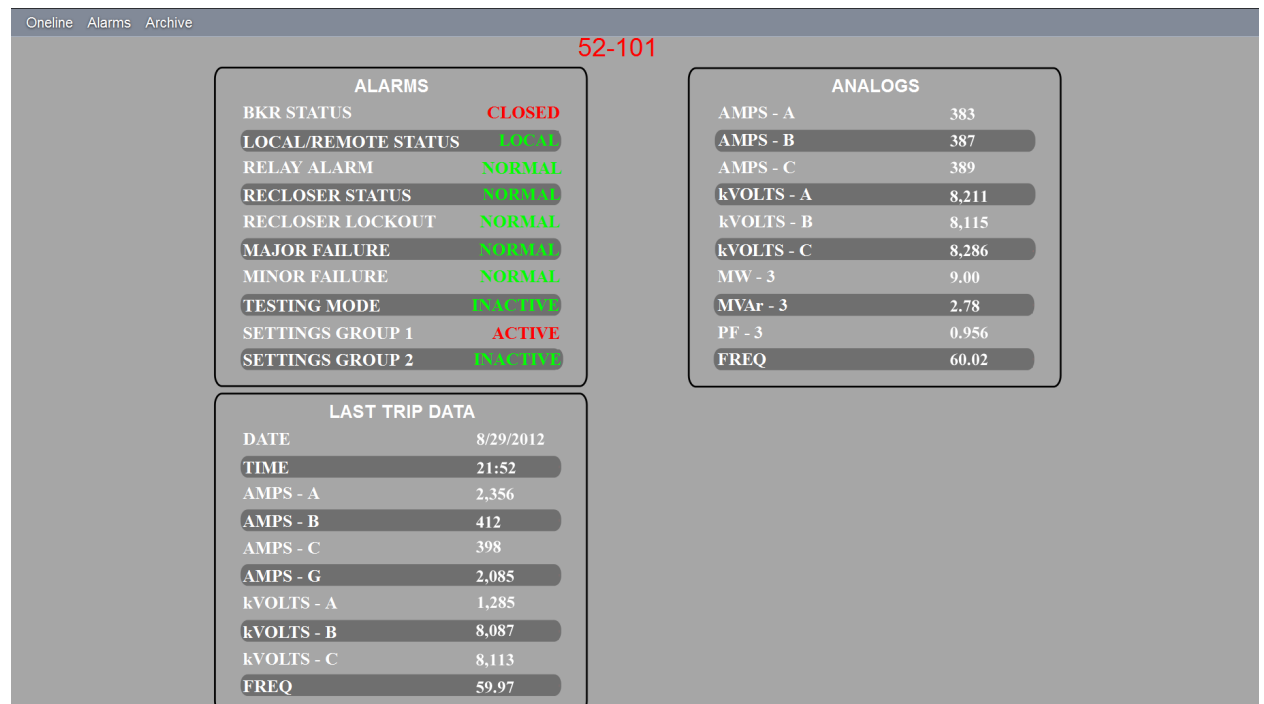
**Communications Screen** depicts communication status to and from all power system IEDs connected to Orion.

## One-line Overview Screen



**Substation One-line Screen** depicts the three phase electrical system showing conductors, breakers, transformers and other power system components with real-time data superimposed.

## IED Zoom Screen



**IED Zoom Screen** provides a detail screen of IED data and power system from specific circuits. Also presents breaker control options to the user.

## OTHER ORION APPLICATIONS IN PROCESS PLANTS

In the electric utility industry, Orion also performs a role in critical cyber security, energy management and fast automatic restoration applications. Process plants with challenges in these areas may benefit from the application of Orion.

### **Security**

Where very high communication security is required, the connection between an OrionLX and a remote server, or between a local OrionLX and a remote OrionLX, can be locked down with a VPN (e.g. OpenVPN). Strong passwords in Orion, and the Orion firewall, provide additional levels of security. An unalterable “syslog” records all user access attempts and processes accessed on Orion.

### **Automatic Restoration**

The combination of high-speed math and logic, substation-grade I/O and access to protective relay data make Orion ideal for tie-breaker control in substations.

### **Energy Management**

Orion can provide the real-time energy data from substation IEDs and load center IEDs required for energy management systems, such as the NovaTech Energy and Asset Management System (EAMS).

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