You Can’t Manage What You Don’t Monitor
SEL Integrated Systems and Information Management

Making Electric Power Safer, More Reliable, and More Economical®
Integrated Systems Efficiently, Securely Replace Dedicated SCADA, Metering and Equipment Monitoring Devices

- Calculations and Operator Interfaces Are Tailored to Meet the Needs of Operators, Protection Engineers, Asset Managers, Technicians etc.
SEL Information Management Saves Lives, Saves Money, and Saves Equipment

- Saving Lives and Equipment via Fewer Failures
  - Maintenance when needed as predicted by IEDs, fewer blackouts/failures, less expensive repairs

- Proactive Asset Management Improves Apparatus Health and Reduces Maintenance Costs
  - Better productivity, better maintenance scheduling, less maintenance effort
  - Savings Due to SEL Integrated System data quickly pays for the system
Integration of Dynamic I&C System Data Supports Automation and Information Management

- Addition of Time Allows Trending and Integrating

Gas Pressure: 85 psi
Gas Temperature: 20°C

Instantaneous Measurements

![Trend Chart]

- Measured Gas Density
- Minimum Acceptable Gas Density
Duke Power Actual and Projected Reduction in O&M Costs Due to Intelligent Management
SCADA Practices Strand Asset Management Data

- SCADA Protocols Serve SCADA Data Needs Only and Only Serve One Client
  - SCADA protocols used at the IED level collect a small subset of available data
  - No reports, settings, historical references, diagnostics, equipment monitoring, performance measures
It All Starts With the IED Connections

- Report Collection and SER Host
- Equipment Monitoring Host
- EMS Host
- SCADA Host
- Local HMI Substation Automation
- Engineering Dial In
- Asset Management
- Revenue Metering
- Distribution Automation Host
- Integrated or SCADA Communications
- Peer-to-Peer Communications
Where RTU and SCADA Methodology Cannot do the Job, SEL Can

- SEL-2032 Designed to Serve Many Clients Separately – SCADA, PI, EMS, Engineering

- All data types are collected, stored and sent to many connections
Where SCADA Practices Strand Asset Management Data, SEL Rescues the Data

- Talk to Virtually any IED via Native Protocol
  - Created by vendors to access all IED data for test, commissioning, engineering access etc.
- Integrate Devices Designed for Manual Data Retrieval via Laptop and Software
  - Equipment monitors, weather station etc.
Engineers and Technicians Need to Directly Retrieve and Receive IED Data
What Does SEL Offer?

- Direct Access to Equipment Diagnostic Data in SEL and Other IEDs
  - Breaker, transformer, generator, motor etc.
  - Serial or Ethernet
**Ethernet Transceiver Makes Create Web Pages at Each Device**

![Screen Shot of SEL-2890 Ethernet Transceiver - Microsoft Internet Explorer](http://10.11.1.233/)

**SEL-311L**

**EXAMPLE: BUS B, BREAKER 3**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Max</th>
<th>Date</th>
<th>Time</th>
<th>Min</th>
<th>Date</th>
<th>Time</th>
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<td>IA(A)</td>
<td>997.0</td>
<td>05/07/01</td>
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<td>05/09/01</td>
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<td>23:03:20.889</td>
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<td>12/24/01</td>
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<td>100.0</td>
<td>09/07/01</td>
<td>23:03:21.060</td>
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<tr>
<td>IP(A)</td>
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<tr>
<td>IG(A)</td>
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<td>12/24/01</td>
<td>21:35:27.174</td>
<td>132.0</td>
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<td>06:42:46.395</td>
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<td>RESET</td>
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</table>

**LAST RESET 05/03/01 08:35:48.735**
Also... Unsolicited email of Reports
Go Direct to Experts

```
Subject: Breaker 865, SEL-421

Date: 10/29/2001  Time: 15:42:22.850
Serial Number: 2001242085

Relay 1
Station A

Event: AG T
Event Number: 10344
Shot 1P: 0  Shot 3P: 0
Location: 50.42
Time Source: OTHER
Freq: 60.00  Group: 1

Targets: INST ZONE_1 A-PHASE GROUND
Breaker 1: OPEN  Trip Time: 15:42:22.850

Prefault:
IA  IB  IC  IG  3I2  VA  VB  VC  V1mem
MAG(A/kV)  248  251  248  3  2  134.001  134.049  134.140  134.062
ANG(DEG)  -0.3  -120.0  119.7  -95.9  142.9  0.0  -120.0  120.0  0.0

Fault:
MAG(A/kV)  1669  251  247  1644  1637  111.984  138.054  138.141  132.054
ANG(DEG)  -79.4  -120.0  119.7  -87.9  -88.0  0.0  -120.0  120.0  -0.1

MB: 8->1  RMBA  TMBA  RMBB  TMBB
TRIG  00000000  00000000  00000000  00000000  0 1 1 0  0 0 0 0
TRIP  00000000  00000000  00000000  00000000  0 1 1 0  0 0 0 0
```
FTP Access to Serial Devices From Any Vendor

Example of Weather Station on Roof of 2390

Port 15, Data Region USER Data

TEMP_IN = 72.50  TEMP_OUT = 70.40  WIND_SP = 6  WIND_DIR = 338
BAR_RD = 27.46  HUM_IN = 33  HUM_OUT = 46  RAIN_RD = 0.91
SCRATCH1 = 91  SCRATCH2 = 91
Innovative Communication Paths and Protocols Integrate Data With Applications

- Equipment Monitoring Host
- EMS Host
- SCADA Host
- Asset Management
- Revenue Metering
- Historian
- Engineering Dial-In / Dial-Out
- LAN
- WAN
- WAN Access Point
- Report Collection and SER Host
- Communications Processor (Port Switch)
- Peer-to-Peer Connections
- Subsystem
- Peer-to-Peer Connections
- Relays, Meters, Controllers, Monitors, RTUs, PLCs
- Local HMI Substation Automation
- Distribution Automation Host
- WAP
Integrated Systems Efficiently Collect and Calculate Information

- IEDs and Communications Processors Perform Data Acquisition and Processing
- Communications Processors Share Data With Local and Remote Data Users
Integration of Equipment Diagnostic Data in SEL IEDs

Breaker, Transformer, Generator, Motor, etc

| % Wear X: 7 | 100% Wear X | NO |
| % Wear Y: 7 | 100% Wear Y | NO |
| % Wear Z: 7 | 100% Wear Z | NO |
| 4 MWH OUT | BP |
| 558 MWH IN |
| 32767 MVARH OUT |
| 653 MVARH IN |

Winding Temperature

Oil Temperature
Integration of Other Equipment

Monitors

Dissolved gas analyzers, load tap changers, breaker monitors
Integration of Other Important Devices

Clocks, weather stations, battery systems
Substation Automation

Control, alarm, notification, swap-over etc.
HMI Operator Displays Made Better
With Apparatus Health Information
Automatic Event Collection Software and Web Viewer

Master Enterprise SEL-5040 Application Summary

At an engineering or enterprise-wide master PC, the SEL-5040 communicates with remote sites to collect and summarize reports, and select and collect long event reports. The software provides management and analysis tools to help you quickly analyze and use power system reports.
Substation Wide Database to Store and Forward Data for all Purposes Including Asset Management

SEL-2032
EIA-232
Relays, Controllers, and Equipment Monitors

SEL-3032
SEL-3351
System Computing Platform

SOE CSV Log
SQL 2000 DB
Wonderware HMI
PI
SEL-3300 Series Computing Platform and SEL-3021 Serial Encryption Tranceiver
Connections to Common Database Interfaces
DDE and OPC

SEL Fast Message I/O Server
ver 2.20
Supports Win XP, 2000
www.trafficwerks.com

SEL OPC Server
Version 1.0
For Microsoft Windows 2000 / XP
www.ClearControls.com
Station Wide Sequence of Events, SER

Viewer relates time stamped data to user-friendly states and descriptions

<table>
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<tr>
<th>Date/Time</th>
<th>Event Type</th>
<th>Status</th>
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<td>fgh</td>
<td>Compressor</td>
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<tr>
<td>10/22/2002 17:51:41.156</td>
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<tr>
<td>10/22/2002 17:53:13.041</td>
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<tr>
<td>10/22/2002 17:53:32.413</td>
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<td>Overcurrent</td>
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<td>10/22/2002 18:02:36.746</td>
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Absolute Time

Relative Time
Annunciation and Alarming Immediate and Direct to Those who can fix the Problems

Event Messenger Voice Messages
Remote Monitoring and Data Storage

Customer Sites

- System
- System
- Controller
- Meter

Internet

Data Collection, Storage, and Management Application Server

Customer Web Based Clients

Vendor Web Based Clients

Internet
Data Available Via Web Browser

Synchrophasor Voltage Angle Measurement  Real-Time Updates
SEL-734 Meters Report Phase Angles in Western Hemisphere

SEL-734 Meters report high accuracy phase angle measurement from across power grids in the Western hemisphere.

Select check box under individual meter gauge to view phasor measurements on main display.

Click inside individual meter face to establish that meter as the reference in the main display.
Engineering Design, Installation, and Support

Remote Monitoring, SEL-7000, Control House, Tailored Design
What’s Different With SEL Integrated Power System Data?

- Monitor Asset ROI
- Monitor and Understand Apparatus Health
- Perform Fact Based Risk Assessment
- Schedule Periodic Equipment Exercise to Avoid, Predictive Maintenance
- Provide Migration Path to Future Technologies
What’s the Benefit of Using an SEL Integrated System?

- Increased Device and System Productivity
- Reduced Expenses, Lower Total Ownership Cost
- Justified, Defendable Business Planning Based on Actual Power System Data
- Increased Health, Availability, Reliability, Revenue, Performance
- Documented Resolutions to NERC/FERC Recommendations