34kV Automation

Utilizing ALRS switches and IntelliTEAM™

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Reliability Programs

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ComEd Service Territory

- More than 3.7 million customers
- 11,400 square miles
- 1.4 million distribution poles
- Distribution Circuits
  » 44,000 miles of overhead circuits
  » 46,000 miles of underground circuits
- 5,182 circuits
  » 4,912 4/12kV Circuits
  » 270 34kV Circuits
- 1,042 substations
Why 34kv?

- 34kV is “Subtransmission”
  - Serves substations-not individual customers
- Can isolate blocks of load
- Biggest Bang for the Buck
34kv Automated Switches
Installed at Comed Since 1992

Presently over 850 switches
34kV SECTIONALIZING

How Automatic Sectionalizers Operate

GENERAL INFORMATION
• They do not interrupt fault current
• They do not interrupt fault current

• They operate while the source circuit breaker is open
• They do not interrupt fault current
• They operate while the source circuit breaker is open
• They are load break switches
• They do not interrupt fault current

• They operate while the source circuit breaker is open

• They are load break switches

• They use voltage and current sensing to determine if a fault is present
• They use local intelligence preprogrammed into the control to determine when to operate
EQUIPMENT

- SCADAMate Switch
- Intelliteam Controller
- Utilinet Radio
Switch

- Integrated Distribution Automation Switch
  - Completely Assembled, ready to install on pole
  - Totally Sealed Load Break Interrupters (SF6)
  - Integral Current Transformers and Voltage Sensors
  - Full Load Break Interruption to 600+ Amps.
  - Visible Break For Line Work
Control

- Designed to Operate with SCADAMate Switch
- Battery Backed-up to Allow Dead Line Operation
- Radio Communications for Team and SCADA Communications
- Team Logic for Fault Isolation and Automatic Line Reconfiguration.
- SCADA Control/Data Acquisition with Unlicensed Spread Spectrum Radios
Communications
• Switches Communicate Amongst Themselves and to SCADA through the Utilinet radio / fiber to System Dispatching (LD’s office)

System Dispatching

SUB 1

ALRS

SUB 2

ALRS

ALRS

ALRS

R

R

R

R
FIG

Looped Fiber Network

32 Head End Radio Sites Around ComEd

DNP Encapsulated in LPP Protocol

( Remote SCADA Computer )

Microwave Link

Head End Radio

SCADA Console Dispatching Center
Utilinet Repeater Radio
SCADA

- Only For Reporting Switch Operations and Dispatcher Control
- Automatic Control Does Not Require a Central SCADA Computer
- If Communications is Lost
  - Only a Portion of the Network is Out
  - Switches Will Still operate Automatically
Standard Intelliteam (ITI) Commonly referred as ALRS Switches

Automatic Line Reconfiguration Sectionalizer
Switches are Arranged in Groups Called “Teams” in a Linear Arrangement of 2 to 7 switches.

SAMPLE LCD PANEL FOR A SWITCH TEAM

-----X----X----X----|----X----X----X----
9901 9902 9903 9900 9803 9802 9801

----X---- CLOSED SWITCH
----| |---- OPEN SWITCH
9901 RTU ADDRESS & SWITCH NUMBER
POINTS TO LOCAL SWITCH LOCATION
RDY TEAM IS READY FOR AUTOMATIC TRANSFER
Switches are installed to provide an alternate source of power for small substations (DC’s) serving multiple customers.

Transformers are typically 6250kVA or 9375kVA.
Team Operation

Two Radial Lines With One or More ALRS’s & One Normally Open ALRS at Tie (EMC)

ALRS’s Open to Isolate the fault on Stand Alone
Sectionalizing Logic (2-Counts)
Radio Communicate to Determine the Faulted Segment
The Switch Downstream From the Fault Opens to Isolate the Fault & Other Upstream Switches Not Isolating the Fault Close
The Tie Switch Closes to Pick Up Load
Radial Line Team (ALRS) Operation

Typical Two Line Set-up of Sectionalizing Switches
A Fault Occurs between ALRS 11 and ALRS12
CB Opens to Clear the Fault. ALRS11 Stays Close as it is Set for “2” Counts to Open (Loadbreak Not Fault Break Device)
Circuit Breaker Closes (after Std. 15 Sec. Open time). CB Closes Into Permanent Fault
CB Opens a 2nd Time to Clear the Fault. ALRS 11 Counts 2 (Overcurrent and Loss of Voltage) Breaker Operations
ALRS 11 Count to Open (2) Has been Satisfied and Opens While the CB is Opens (ALRS11 Cannot Break Fault Current)
CB Recloses (After std. 30 Sec Open Time). DC 1 Back in Service. Team Starts Talking to Locate the Fault.
Radios for ALRS11, ALRS12 & ALRS10 Exchange Fault Information & Determine Fault is between ALRS11 & ALRS12
From the Information Received From ALRS11 & ALRS10, ALRS12 Opens to Isolate the Upstream Fault.
From the Information Received From ALRS12, ALRS10 Knows, the Fault was Isolated By ALRS12, and Closes
Load Transfer Inhibits

- Teams/Switches Are Preprogrammed With A Maximum Allowable Transfer.
- The Team Will Only Pick-up Load That Will Not Overload The Alternate Line.
Summary

- Local Intelligence on Fault Isolation (No Block)
- Permissive on Load Reconfiguration
  - Automatic Block of Reconfiguration if Alternate Line Will Overload
  - Will Not Allow a Transfer if Any Control Abnormal
    » Any Control In Manual
    » Any Communication Problem
    » Control Failure (Not Responding to Team)
    » Low Battery on any Control
- Full SCADA Control of Switches
34kV Automation

Utilizing ALRS switches and IntelliTEAM II ™
Line 7347 with Intelliteam I
Only 1 team with 7 switches;
Line L7065 and Switch 4700 not included

TSS 73

CB

DC F36

4735 4737

DC F16

4715 4716

DC K44

L7065

4700

NOT AUTOMATED

DC K18

4717 4739

L7066

4738

NOT AUTOMATED

4716
Line 7347 with Intelliteam I
(System reconfigured – after fault)

TSS 73

Fault

DC F36

DC F16

DC K18

DC K44

L7066

NOT AUTOMATED

DC F36 Restored
F16 & K44 Dropped
IntelliTEAM II Rules:

- A team is now a line segment bounded by switches
- Teams can include up to 8 switches
- Teams can have up to 8 separate sources of supply
- After reconfiguration, the remaining teams can reconfigure again if another fault occurs
- If multiple sources are available, a preferred source can be programmed into the scheme
- Teams can have zero, one or many N.O. switches
- Switches can belong to multiple teams
- Software Agents (coaches) circulate among the teams and “call the plays” to keep customers in service
- Note: IT2 not usable on network lines
Line 7347 with Intelliteam II
Eight Switches in Six Teams
Line L7065 and Switch 4700 now included
Line 7347 with Intelliteam II
(System reconfigured – after fault)

TSS 73

CB

DC F36

Fault

DC K18

DC K44

L7065

DC F16

L7066

R

NOT AUTOMATED

4735 4737 4715

4700 4738 4716

4700 4738 4716

All DC’s Restored
Requires 6 teams to include all SW

- All 2 switch teams except SW14-15-16 team
- Transfer capability can be affected by line config.
Fault on Line out of TSS 1
Which switch to close??

Fault
Can specify to always restore via SW 16
...or not
Intelliteam II

TSS 1

Fault

SW 12

SW 13

SW 14

SW 15

SW 21

TSS 2

DC 1

DC 2

DC 3

DC 4

SW 11

SW 16

SW 31

Line reconfigured after fault
Second fault occurs
Line reconfigures after second fault - assuming loading capability available
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ComEd
An Exelon Company