peco SM
AN EXELON COMPANY

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Automated Tie Blocking Scheme for Duplex Unit Substations

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Agenda

- Terms and Definition
- PECO Unit Substation Configuration (Normal/Abnormal Condition)
- Background
- Solution
- Auto Tie Blocking Scheme architecture
- Additional Benefits
- Questions

Terms and Definitions

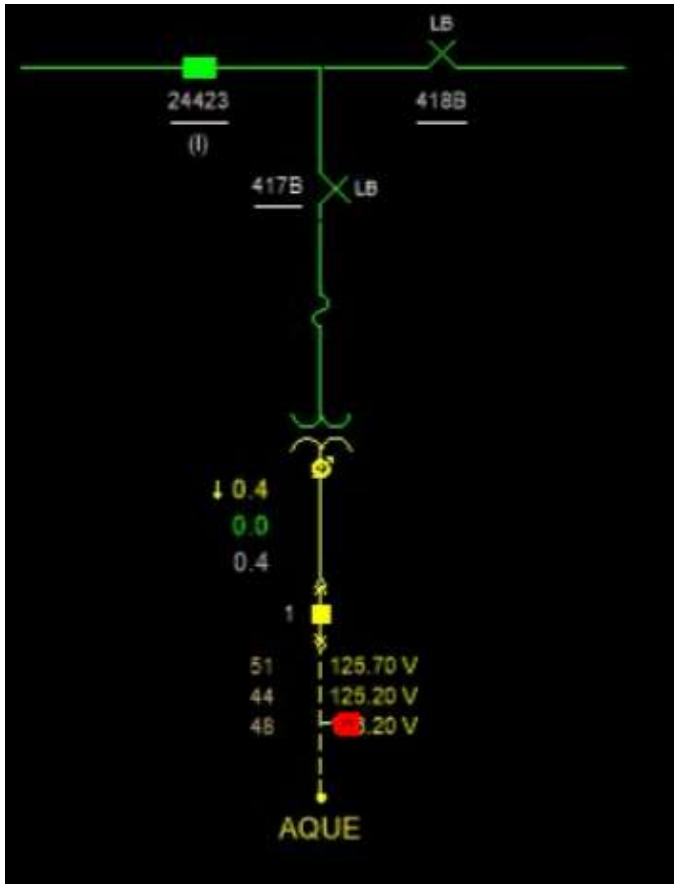
Unit Transformer – Transformer with integrated low side breaker, relaying, control power, and breaker controls (34KV high side, 4KV Low Side)

Terms and Definitions

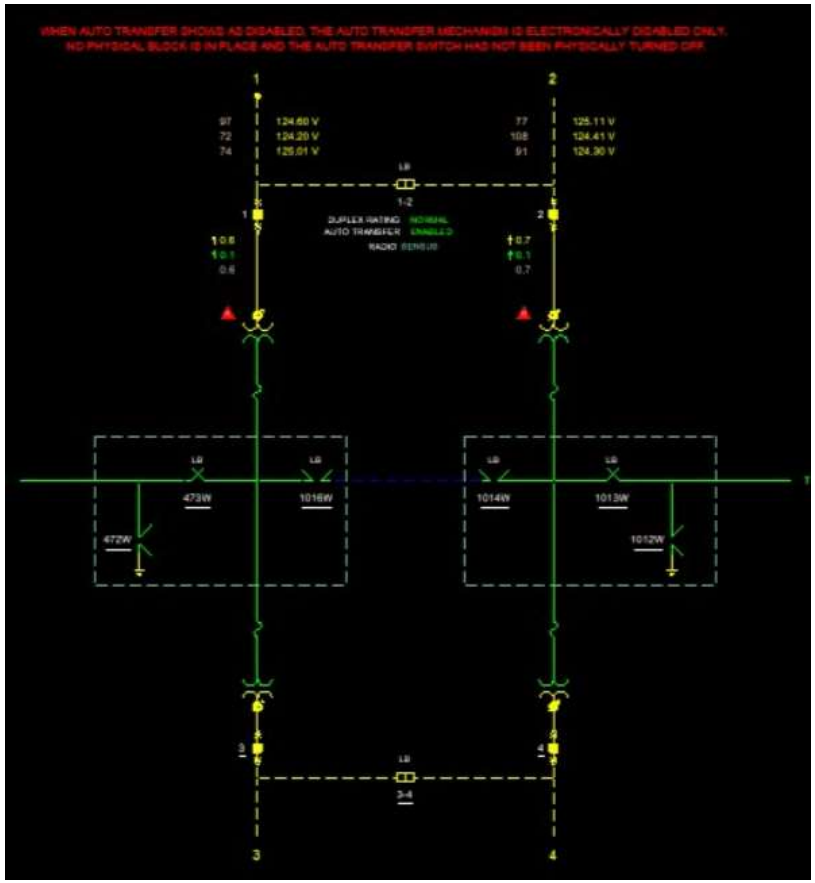
Duplexed Unit Transformer with breaker – Transformer with integrated low side breaker, relaying, control power, and breaker controls with a separate low side tie switch to associated Unit Transformer.

Terms and Definitions

DMS – Distribution Management System used by PECO to monitor and operate distribution equipment (34KV & below)



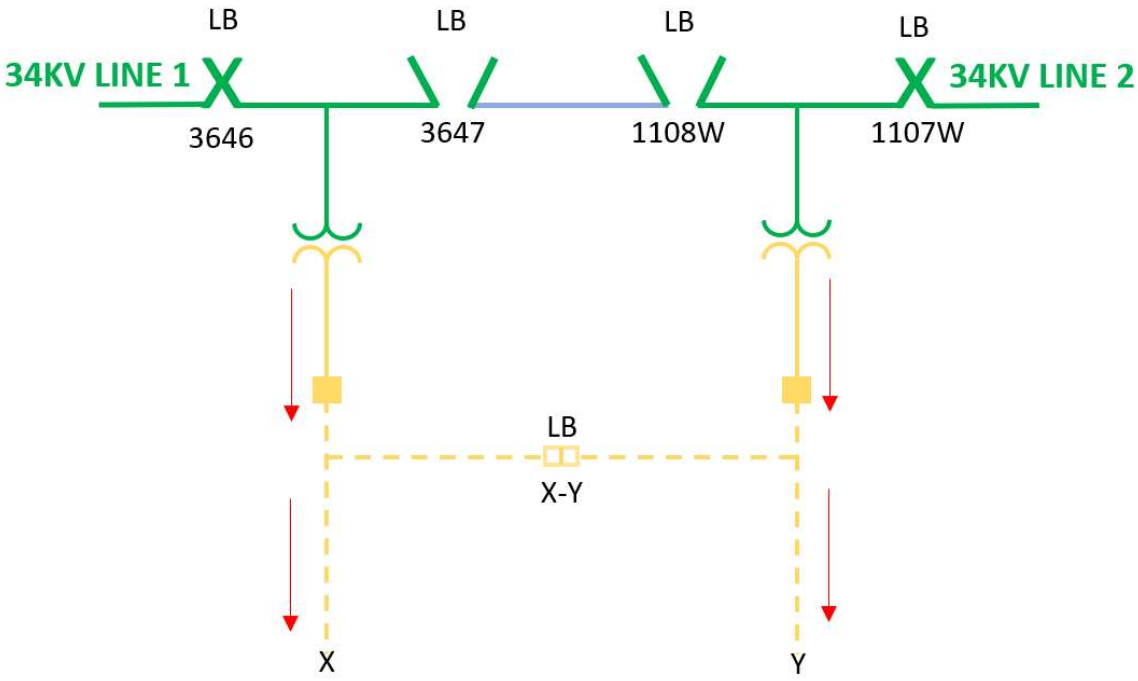
Single Unit



Duplex Unit

Configuration Under Normal Condition

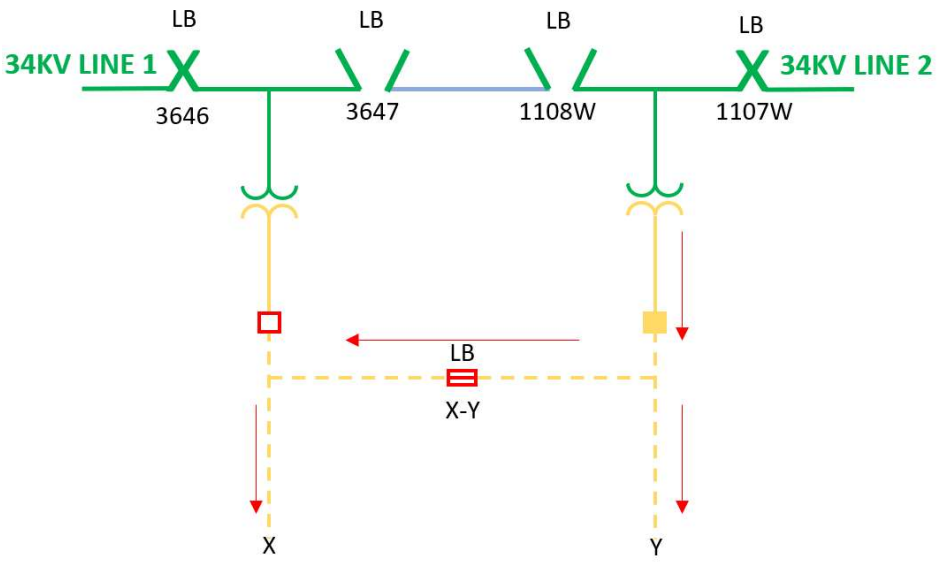
- 34KV high side from two separate sources
- 4KV low side (XFMR X & Y)
- Low side breaker closed feeding the load
- Tie breaker open



Configuration Under Abnormal Condition

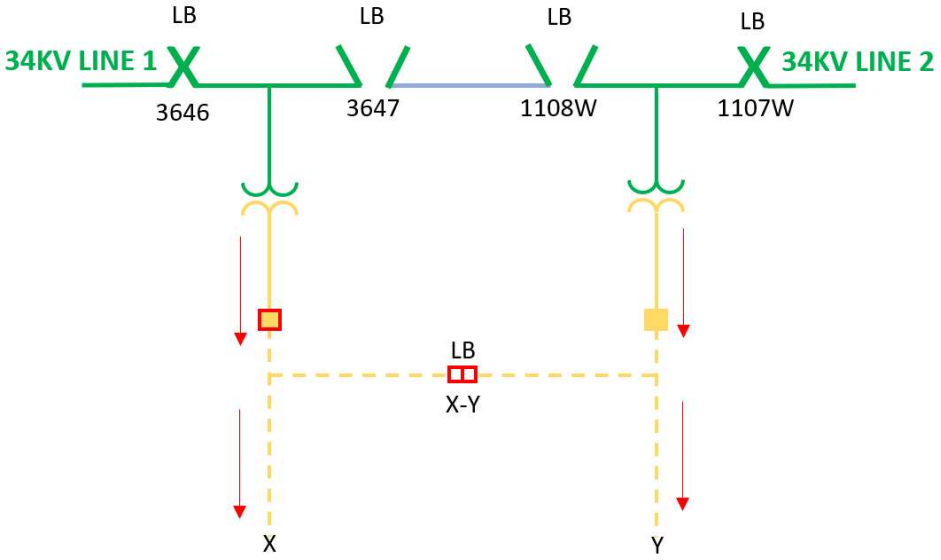
Loss of High Side

- Loss of Potential on X Unit
- Low Side Breaker on X Unit Opens
- Tie Breaker Closes to Pick Up Load



High Side Restored

- High Side Restored
- Low Side Breaker on X Unit Closes
- Tie Breaker Opens to Return to Normal Configuration



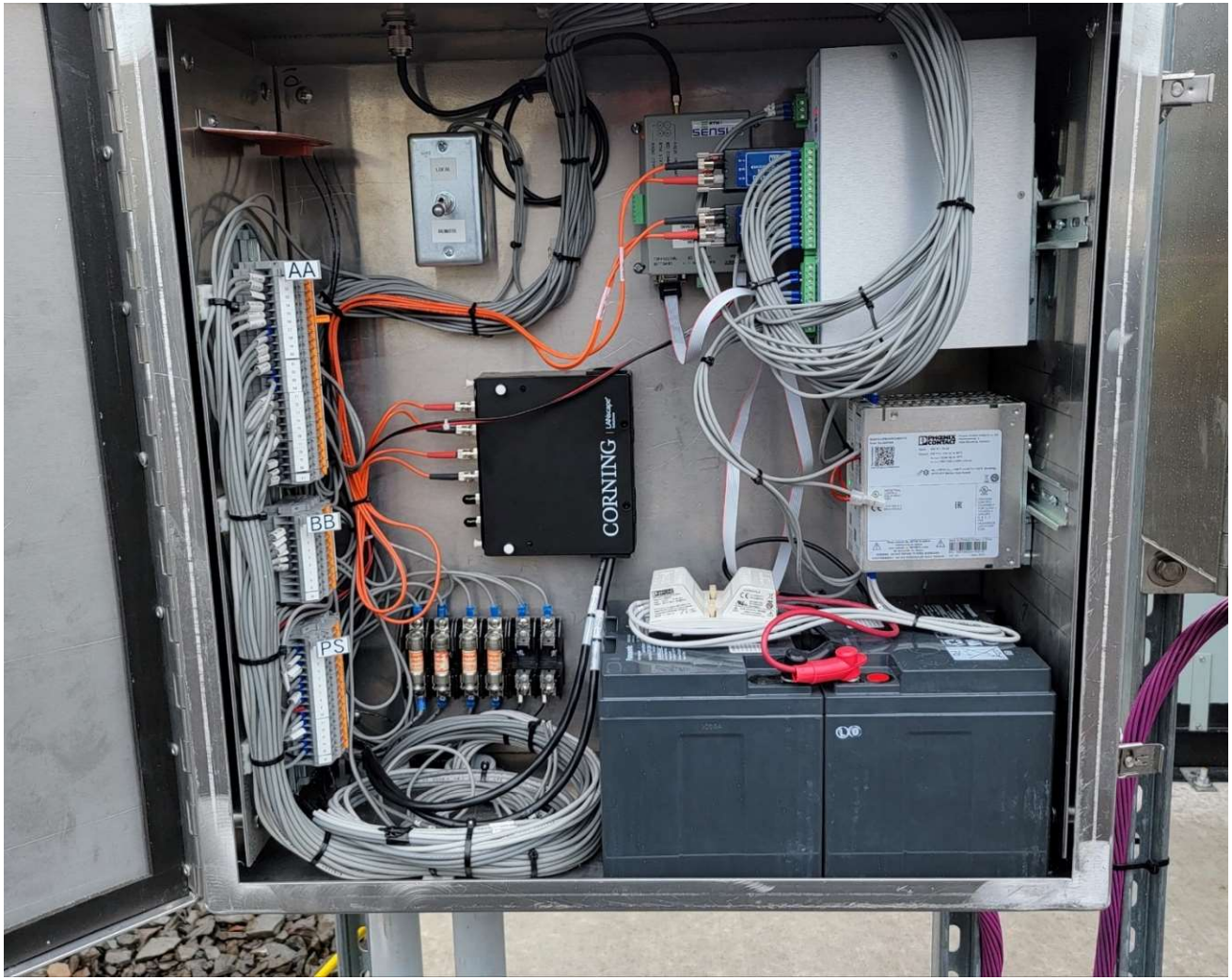
Background

- Distribution Capacity System planning analyzes summer loads on annual basis and if a unit would be overloaded during peak load period due to a transfer, issues a list to block those ties
- Categorization of blocks based on temperature and three blocking list are issued (A, B and C)
- For each block, duplex ties are blocked for set number of months where tie cannot operate and pick up load from another unit transformer starting with A block in the beginning of summer followed by B and C blocks
- This makes the Automatic throwover of the load unavailable while blocked (Upto a few months) at a time which can have a reliability impact
- Additionally, blocking and unblocking is manual process and requires field resources

Solution - Automated Tie Blocking

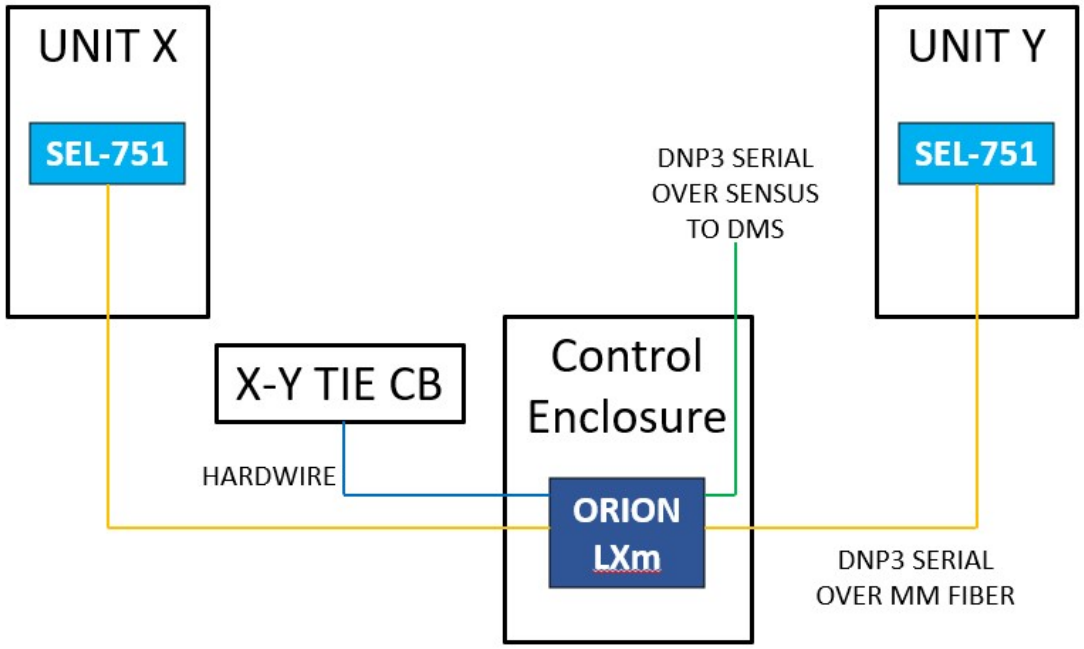
- **PECO "Automated tie blocking scheme"**
  - Monitoring of real-time load data from the units
  - Local logic control of availability of tie control
  - Allows for dynamic blocking of duplex unit tie breakers during high loading condition
  - Allows for ties to only be blocked when required (potential overload condition) as opposed to be blocked for set number of months regardless of conditions
- ATS Hardware
  - RTUs installed at individual units for monitoring and control and logic controller/data concentrator
  - Additional Novatech Orion serves as data concentrator for SCADA as well as logic controller to implement blocking algorithm.
    - Blocking remotely through SCADA
    - Automated blocking through Logical parameters per pre-determined limits

Field Pictures



Auto Tie Blocking Scheme Architecture

- SEL-751A's are installed in X and Y units replacing the watt-hr meter and provides Analog, Status and Control to the units.
- SEL-751A's communicates with Orion over serial fiber network
- OrionLXm is hard-wired to the Tie Breaker for status, control & Auto/Manual
- OrionLXm is connected to Sensus radio for communication to SCADA over Peco Sensus network (wireless).



Component Function

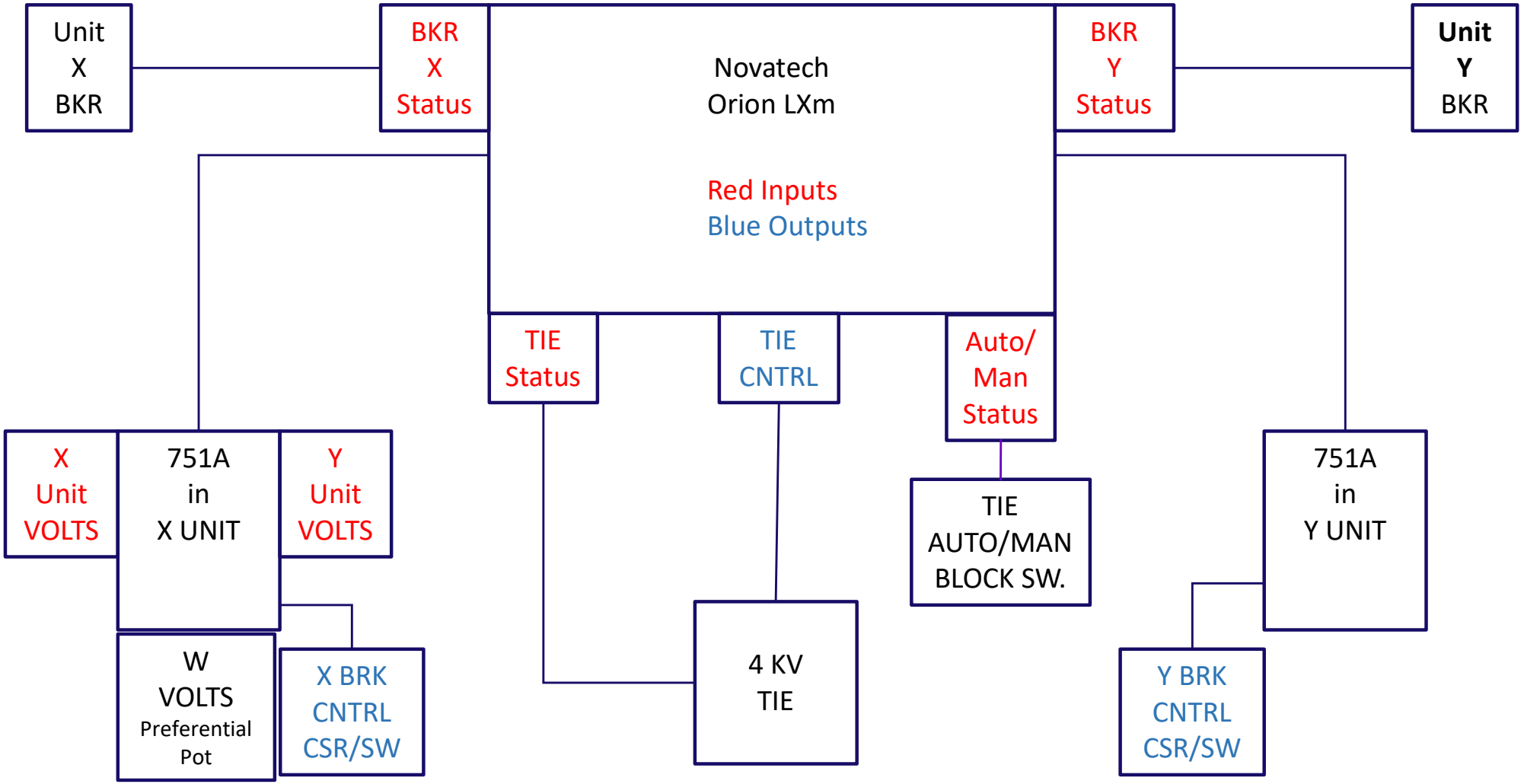
SEL 751 A

- Metering
- Loss of High-side Trip and Restoration
- Breaker Control
- Auto Reclose
- Fast Trip
- LS Reset
- Fault Monitoring - No Trip Output
- Event Reporting
- Sequence of Events on Unit
- Control Voltage Throw-Over
  X Volt / Y volts / W Volts

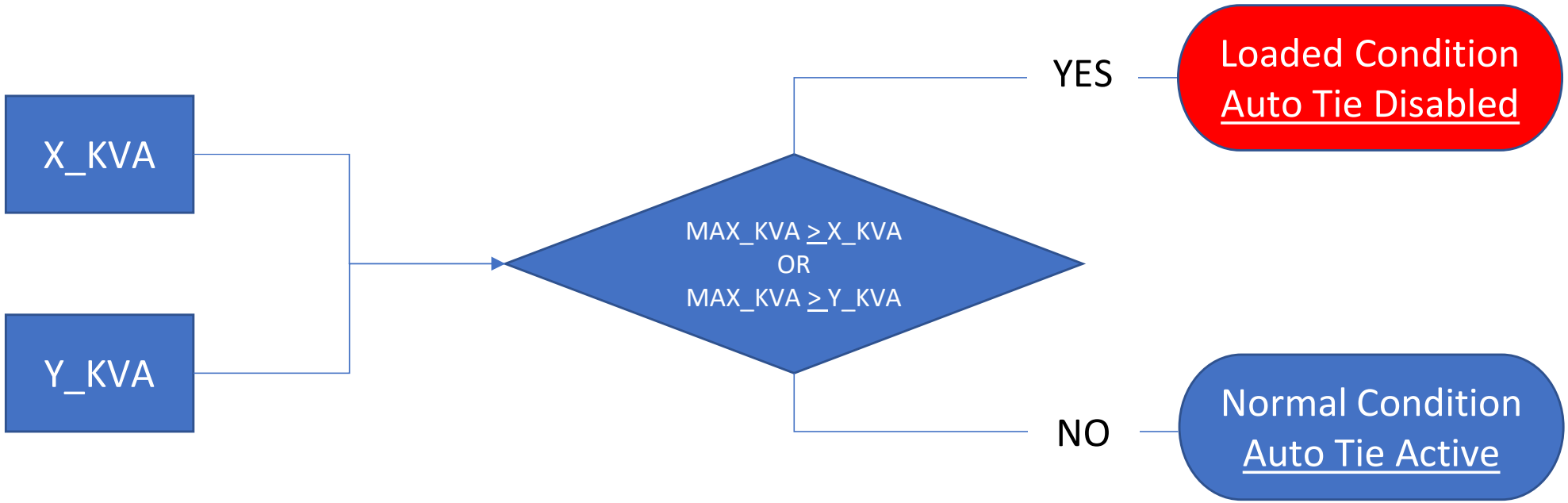
OrionLxM

- Tie Throw-Over Function
- SCADA
- Tie Control
- Unit Overload Protection (Tie Throw-Over Blocking)
- Local / Remote Switch
- Substation Integration HMI
- Sequence of Events on Tie
- Tie Diagnostics
- Communication to Radio
- Remote Tunneling

Details of Logic



ATS Blocking Logic Walkthrough



Max_KVA = X_KVA + Y_KVA
Max_KVA ≥ X_KVA or Y_KVA : **Loaded**
Max_KVA ≤ X_KVA or Y_KVA : **Normal**

Additional Benefits

SCADA Visibility and Control

- 16 Analogs
- 20 Status & Alarms
- 4 Controls
- Total system visibility (Shown Next slide)

Safety

- Remote operation during switching and blocking from DMS
- Controls through HMI at station (Next slide)
- Ability to safely maintain distance

Overload Protection

- Monitor both transformers
- Blocking the tie prevents either of the transformer from overloading

Remote Disable Auto Transfer Function

- Eliminate the need for manual Blocking
- Blocking through Logic

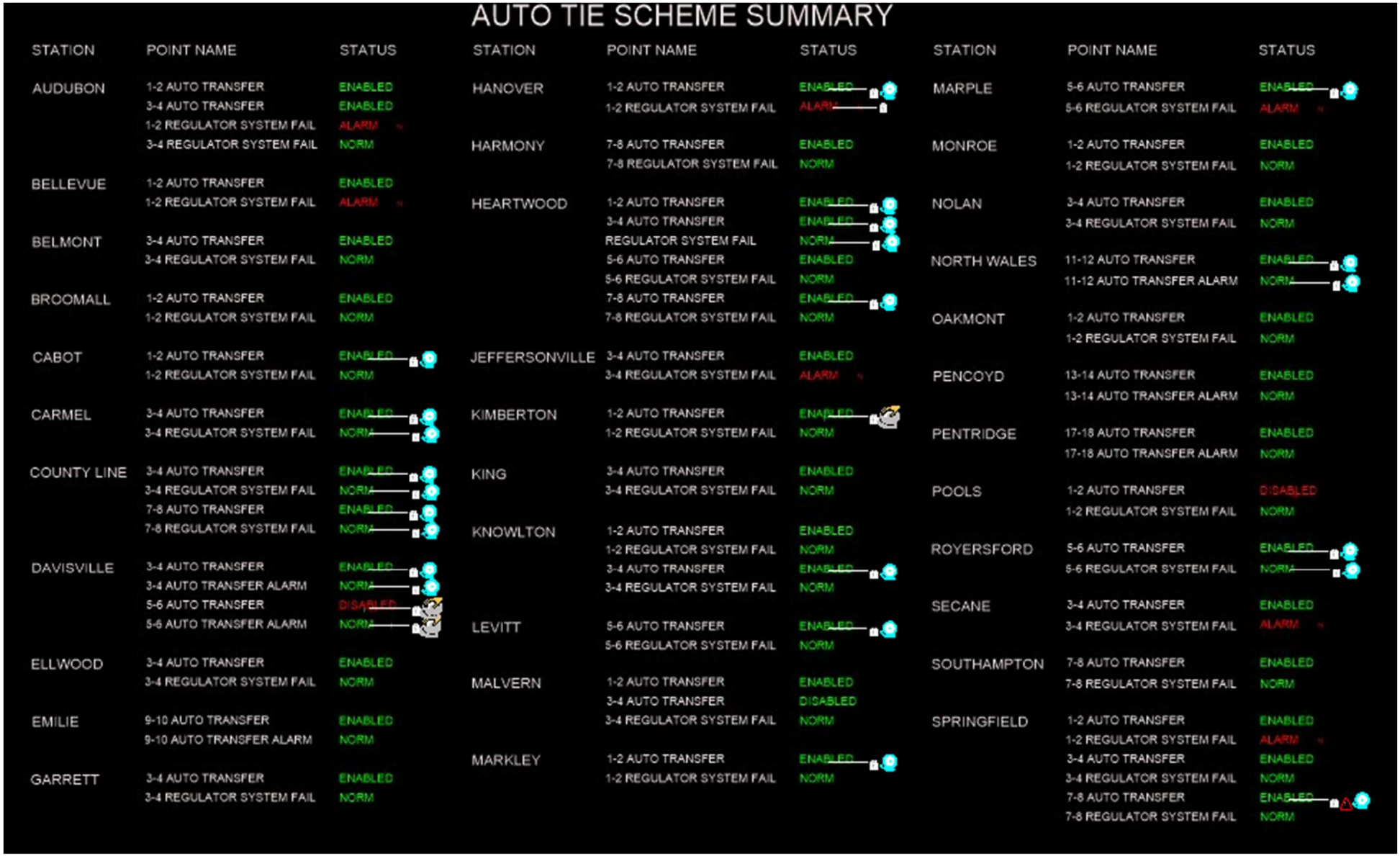
Troubleshooting

- Logs and SOE from both relays and Orion
- Alarm Summary
- Local Remote Switch to isolate controls

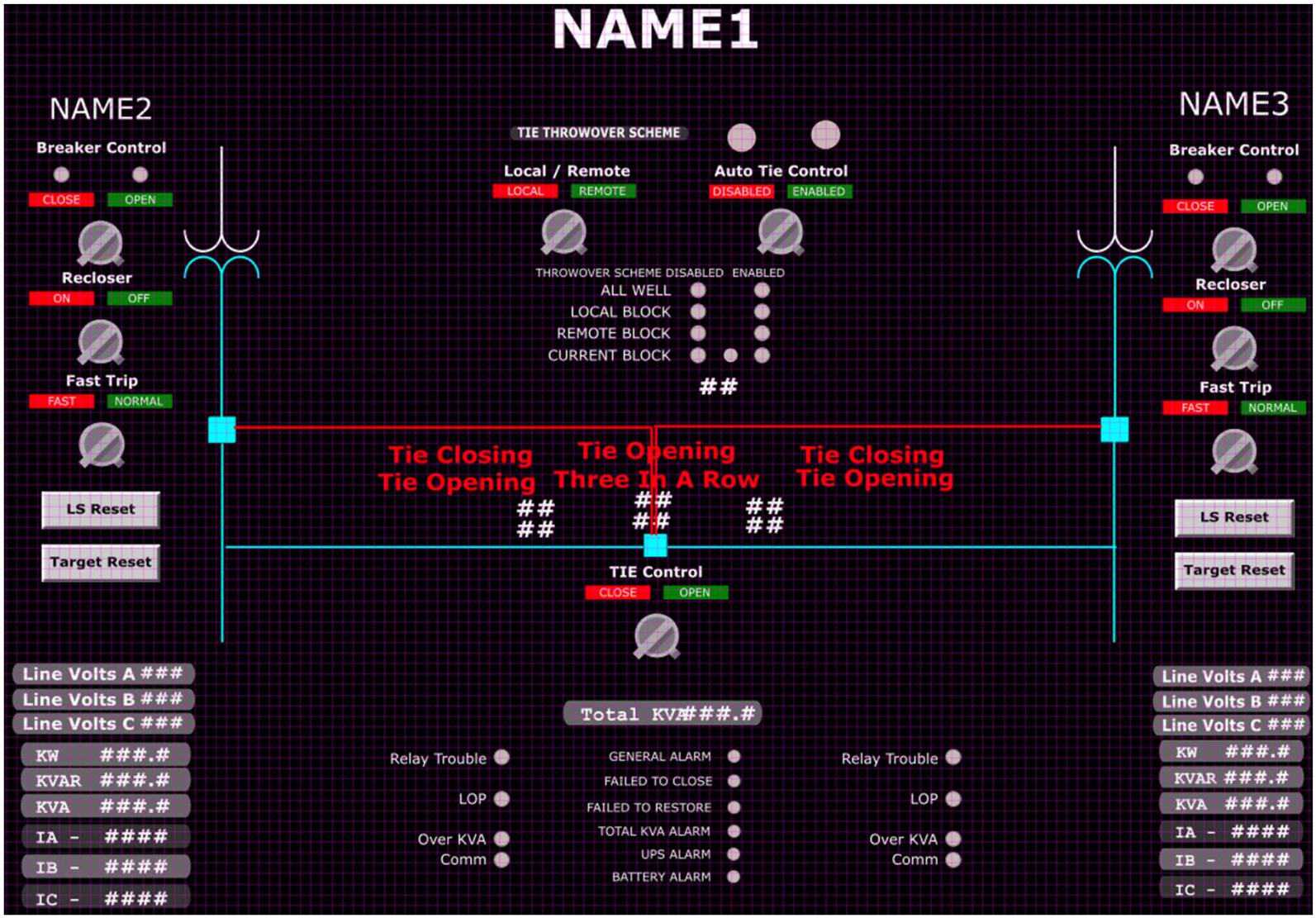
Communication

- Robust communication between relays and Orion
- Leverage built in Sensus monitoring & diagnostic capability

ATS Summary Screen in DMS



HMI Screen


NAME1
NAME2
Breaker Control
CLOSE
OPEN
Recloser
ON
OFF
Fast Trip
FAST
NORMAL
LS Reset
Target Reset
TIE THROWOVER SCHEME
Local / Remote
LOCAL
REMOTE
Auto Tie Control
DISABLED
ENABLED
THROWOVER SCHEME DISABLED ENABLED
ALL WELL
LOCAL BLOCK
REMOTE BLOCK
CURRENT BLOCK
##
Tie Closing
Tie Opening
##
##
Tie Opening
Three In A Row
##
##
Tie Closing
Tie Opening
##
##
TIE Control
CLOSE
OPEN
NAME3
Breaker Control
CLOSE
OPEN
Recloser
ON
OFF
Fast Trip
FAST
NORMAL
LS Reset
Target Reset
Line Volts A ###
Line Volts B ###
Line Volts C ###
KW ###.#
KVAR ###.#
KVA ###.#
IA - ####
IB - ####
IC - ####
Total KVA###.#
Relay Trouble
LOP
Over KVA
Comm
GENERAL ALARM
FAILED TO CLOSE
FAILED TO RESTORE
TOTAL KVA ALARM
UPS ALARM
BATTERY ALARM
Relay Trouble
LOP
Over KVA
Comm
Line Volts A ###
Line Volts B ###
Line Volts C ###
KW ###.#
KVAR ###.#
KVA ###.#
IA - ####
IB - ####
IC - ####

Questions

Appendix

Current Stats

- Number of Units - 718
- Number of Unit Ties - 168
- Number of Unit Ties with Varying Degrees of SCADA - 53
- Number of Units with Micro Processor relays (SCADA) - 286
- Aging Equipment ~ 50 years old
- Unit Retirement Program