Power Reliability in a Critical Data Center

PowerLogic/ION Users Group Conference 2010

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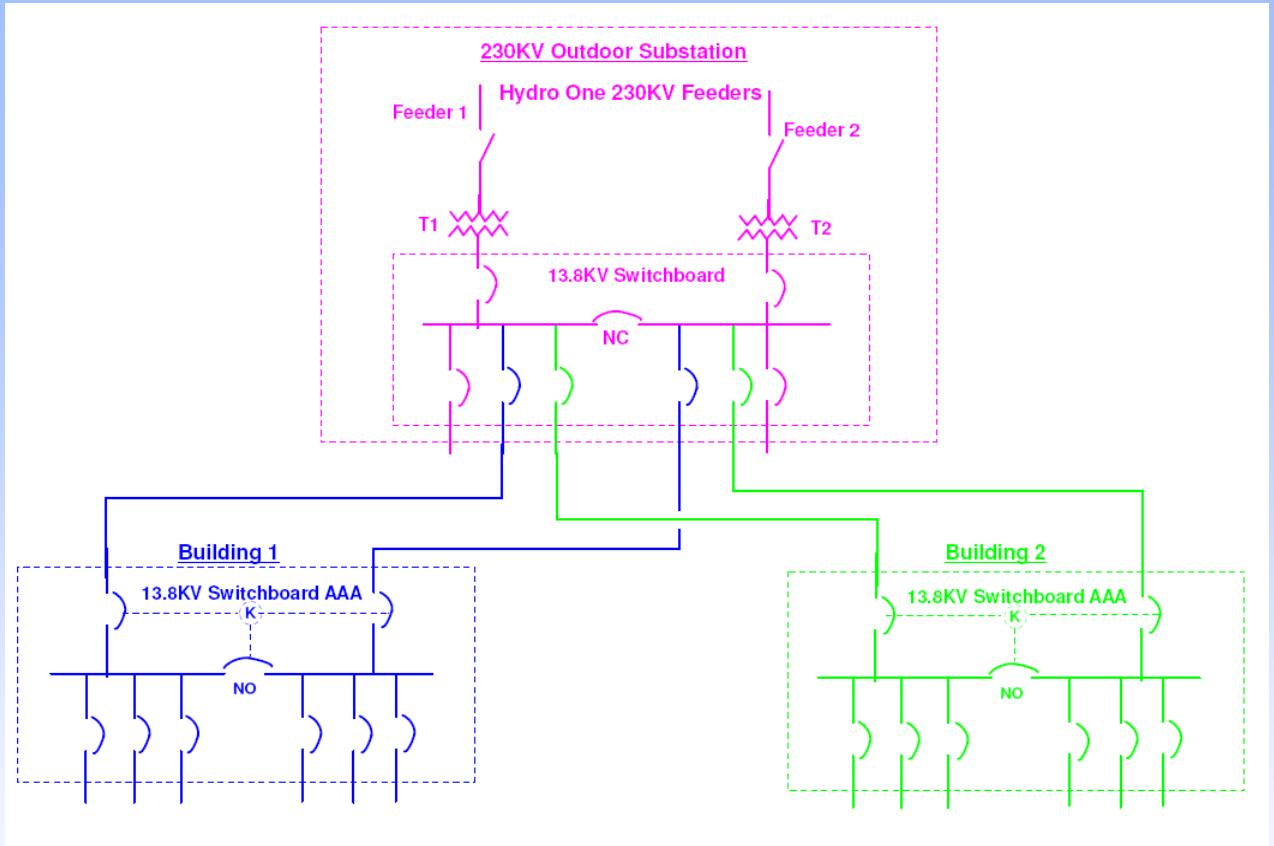
Two Buildings

- **Two buildings fed from one Customer Transformer Station:**
  - **Building 1:**
    - **Class A Multi-tenant Office and Data Center**
    - **1980 technology with Analog Meters**
  - **Building 2:**
    - **Education, Office and Data Center**
    - **1990 technology with First Generation Digital Metering**

Two buildings fed from one Customer Transformer Station



Building 1:

- **Multi-tenant Office and Data Center**
- **1980 technology with Analog Meters**

Building 2:

- **Office and Data Center**
- **1990 technology with First Generation Digital Meters**

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Reliability

- **Today's Critical Data Centers must run continuously.**
- **Any power interruption will disrupt business operations and result in significant financial losses.**
- **Most Data Centers today are designed and built redundant systems to minimize the loss of power.**
- **No less important to Data Center operations , however, is the quality of power.**
- **Power quality problems don't make headlines the way power supply problems do.**
- **Power quality problems can be more difficult to identify, analyze, understand and resolve than any power supply problem.**
- **Power quality problems were always present in electrical distribution systems.**
- **Power quality problems became more understandable in the last 20-25 years, as more sophisticated power monitoring tools are available to Engineers and Facility Operators.**
- **Types of Power Quality problems:**
  - **Transients**
  - **Voltage Fluctuations (Sag/Swell, flicker)**
  - **Voltage Unbalance**
  - **Frequency Fluctuations**
  - **Waveform Distortions (noise, harmonics, notches)**

Reliability

- **Continuity of Power Supply**
  - **Cause of downtime:**
    - **UPS battery failure (65%)**
    - **UPS Overloading (53%)**
    - **Human Error (51%)**
    - **UPS failure (49%)**

- **Power Quality**
  - **Causes:**
    - **Harmonics**
    - **Voltage/Frequency Fluctuations**
    - **Transients**
    - **Ground Faults**
    - **Ground Loops**

Reliability

- **Mitigate Equipment Failures:**
  - **Better Equipment**
  - **Better Maintenance**
  - **Redundancy/A&B circuits**
  - **System Capacity Management**

- **Mitigate Human Error:**
  - **Training**
  - **Better Testing Procedures**
  - **Change Process Management**
  - **Emergency Procedures**
  - **Event Reporting**
  - **Documents Library**

What you don't know can't hurt you….

- **Power Quality problems cannot always (most of the time) be seen by the naked eye (harmonics, noise, transients, ground loops).**

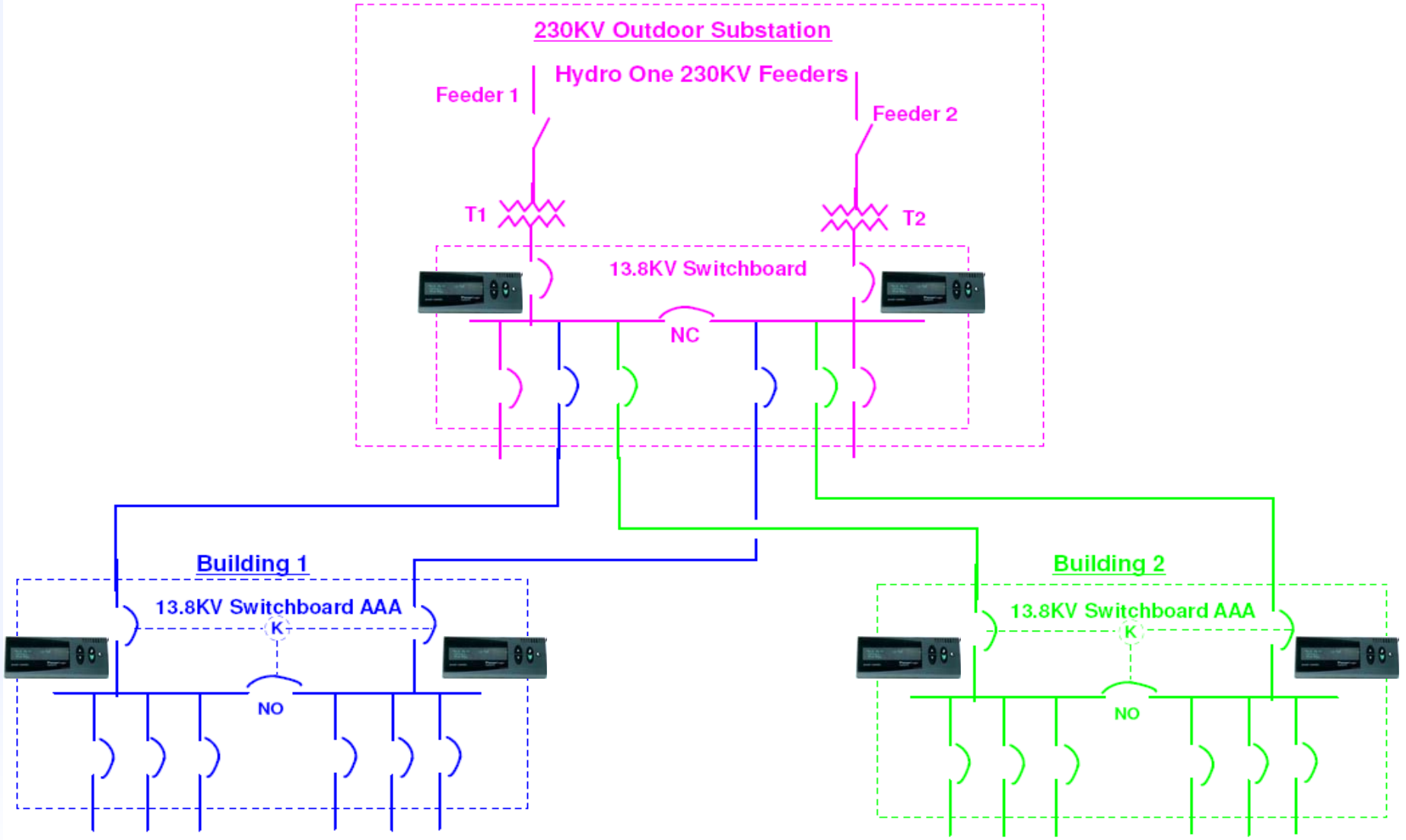
But, what you don't know, you will soon find out, so what you don't know you should know, because you'll find out sooner or later and it will hurt you.

- **However, the result of almost all these problems could be seen by the naked eye (overheating, damaged equipment, unwanted breaker trips).**
- **Therefore, the need for Power Monitoring equipment in Data Center design, operation and maintenance is more than ever a hot topic.**

A journey of a thousand miles begins with a single step

- **First step** - **open the door for modern Digital Metering**
- **Second step** - **build the Network**
- **Third step** - **expand the system to Data Center**
- **Fourth step** - **demonstrate performance and benefits to Owner**
- **Fifth step** - **Digital Metering becomes part of Data Center design**
- **Next step** - **use the full capabilities of the Digital Metering System to:**
  - **ensure, maintain and improve the quality and reliability of power supply**
  - **better manage energy consumption**
  - **identify areas of concern**
  - **sub-metering at circuit level (Branch Circuit Monitoring)**

First step - open the door for modern Digital Metering



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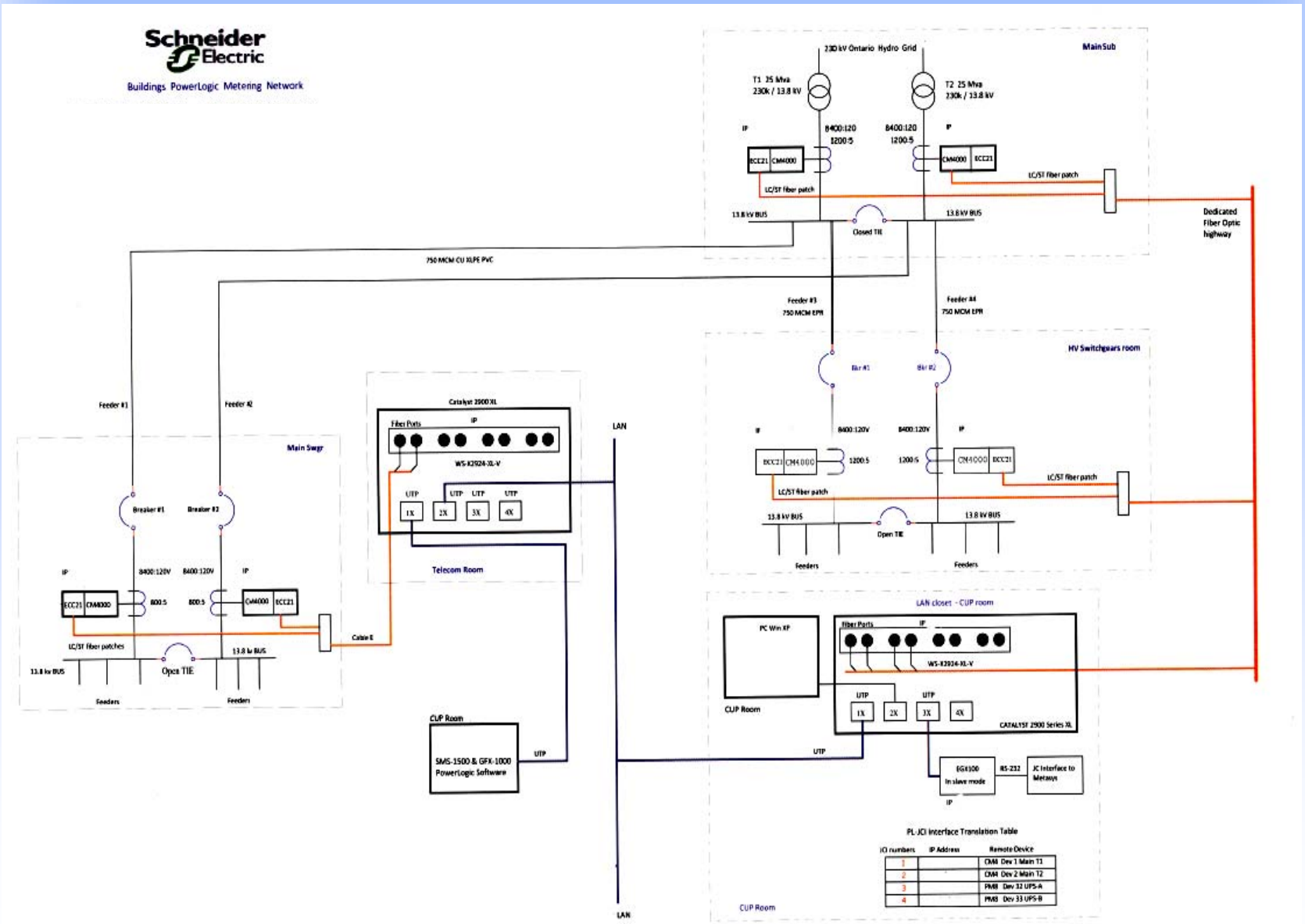
Second step - build the Network



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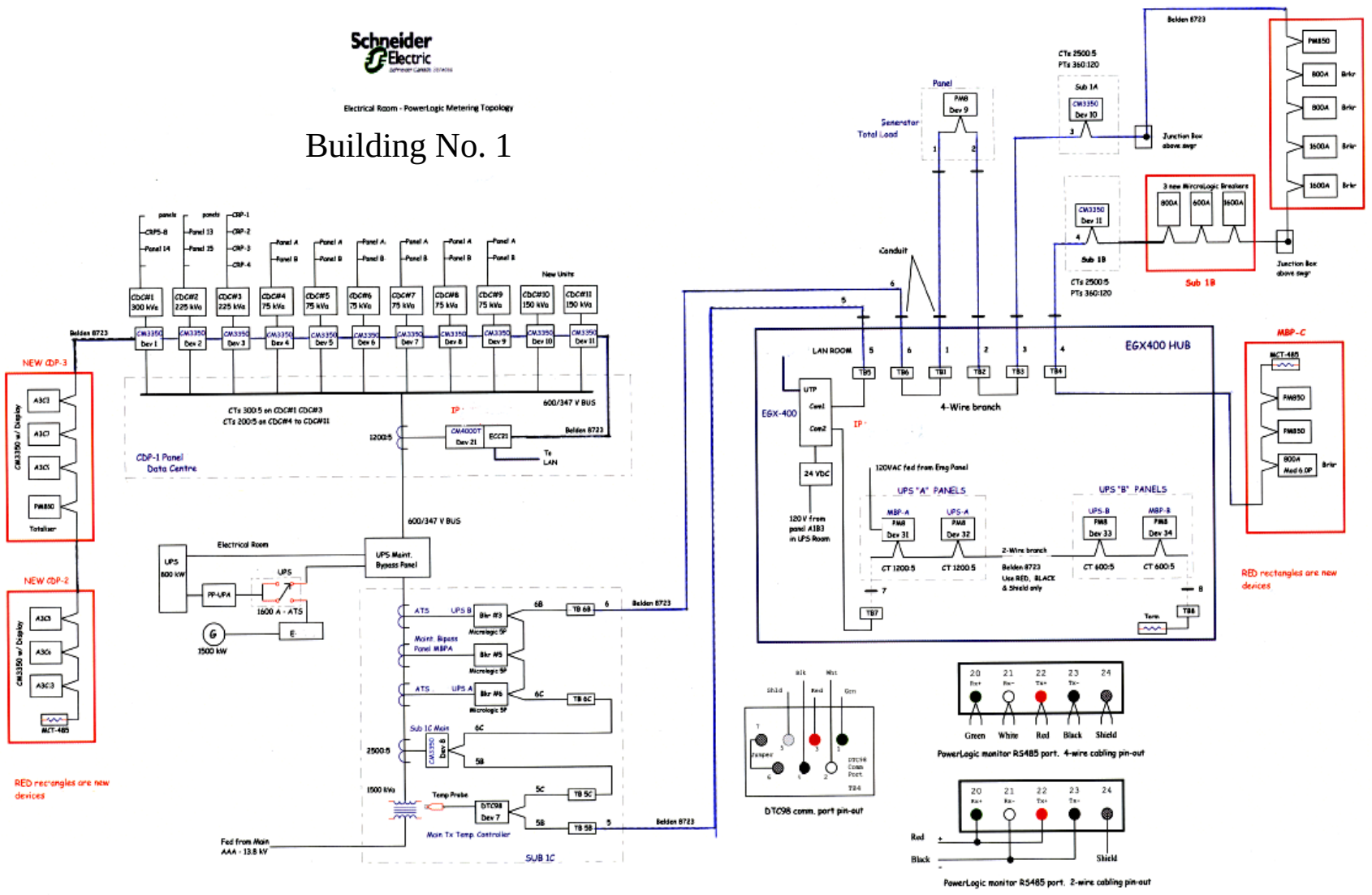
Third step - expand the system to Data Center



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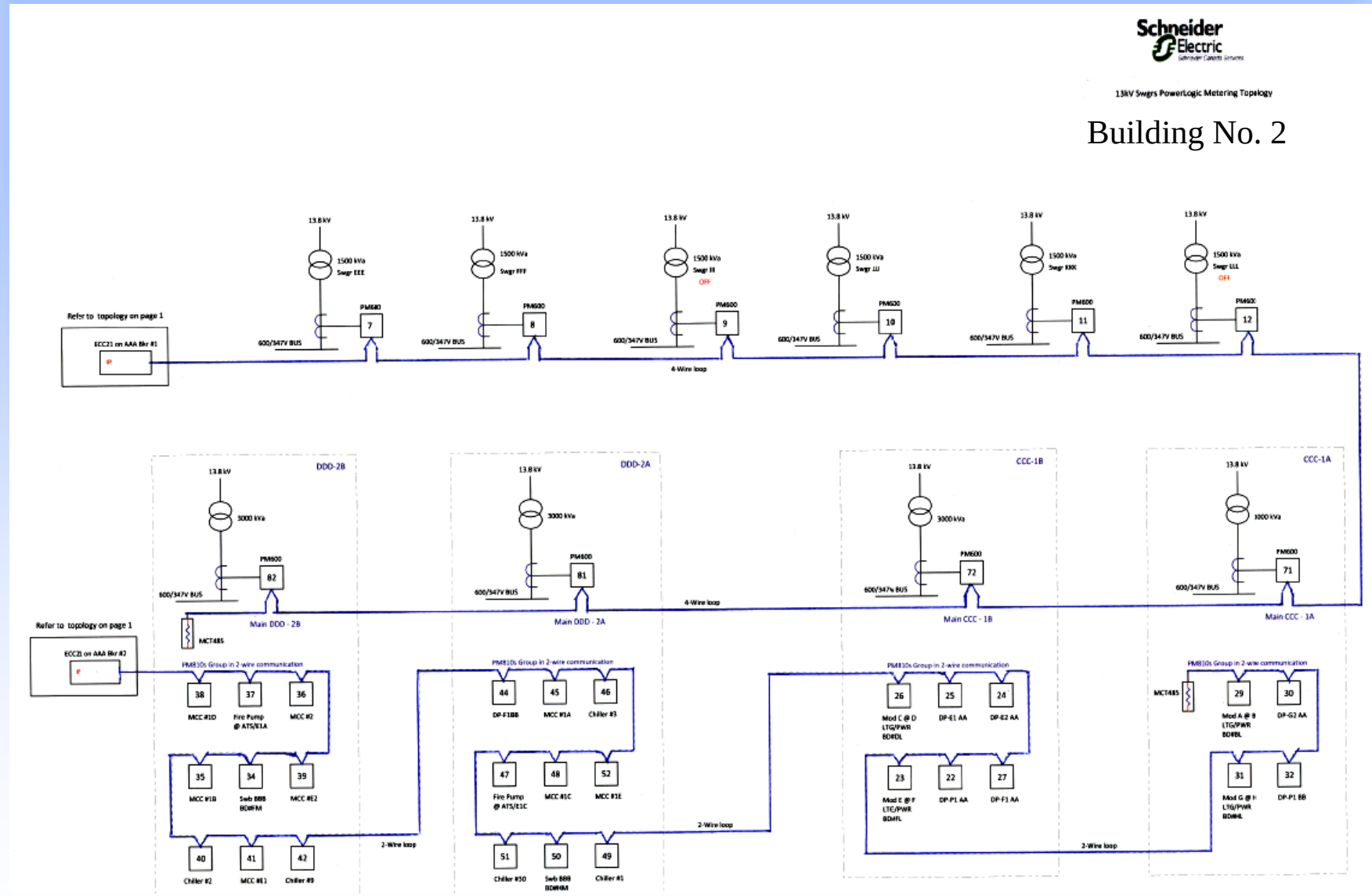
Third step - expand the system to Data Center



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Summary of Power Logic devices

- **Building 1**
  - **Total of 60 meters** — **- 12 for Base Building**; **- 48 for Data Center**
  - **Meter Types** — **- 2 CM4000**; **- 25 CM3350**; **- 12 PM850**; **- 20 Micrologic 6.0P/H**; **- 1 Temp. Model 98**
- **Building 2**
  - **Total of 40 meters** — **- 34 for Base Building**; **- 6 for Data Center**
  - **Meter Types** — **- 2 CM4000**; **- 38 PM810**
- **Transformer Station**
  - **Total of 2 meters** — **- 2 CM4000**

Power Logic devices

CM4000

CM3350

PM850

Breakers Micrologic Trip Units

Temperature Controller Model 98

EGX 100

EGX400

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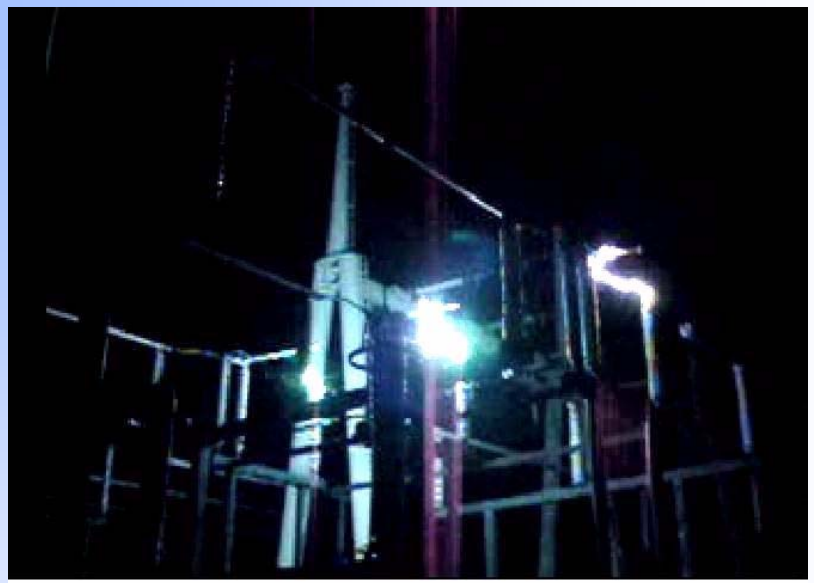
Case Study No. 1

- **What you don’t know can’t hurt you**
- **But, what you don’t know, you will soon find out, so what you don’t know you should know, because you’ll find out sooner or later and it will hurt you.**



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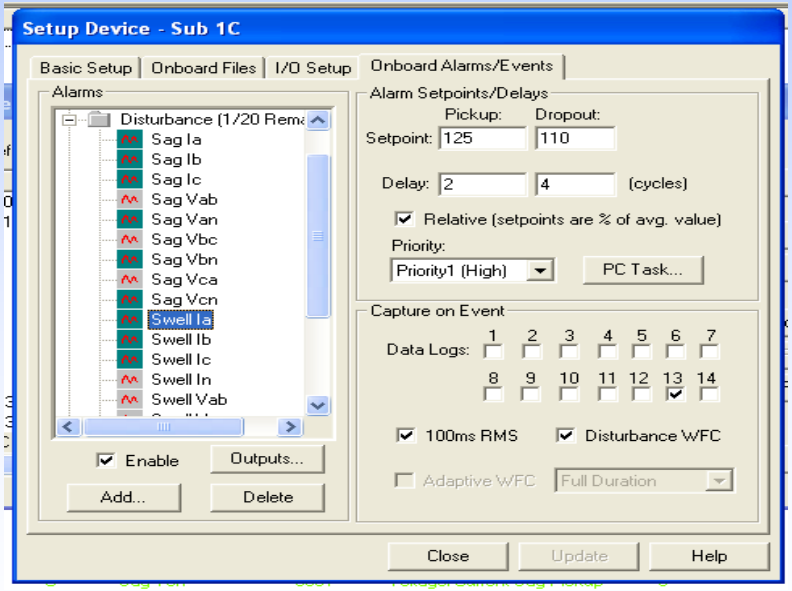
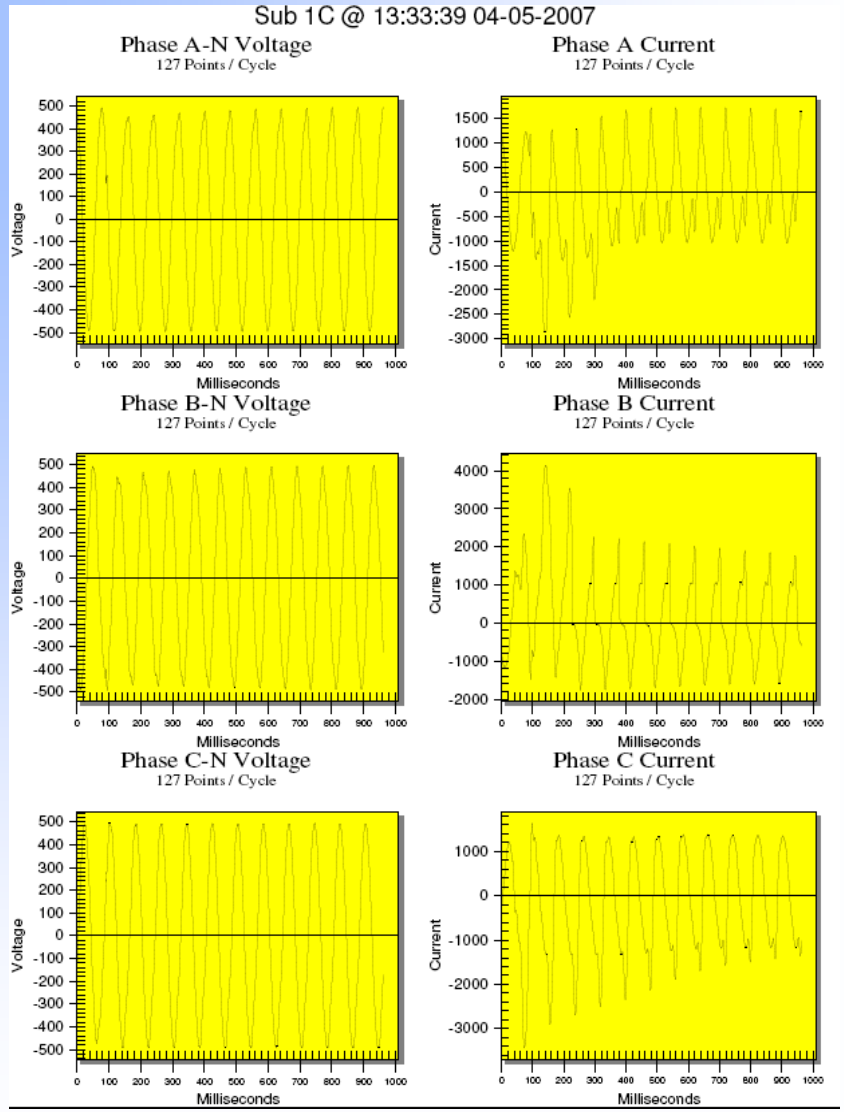
Case Study No. 1

Current Swell recorded by the CM3350 at the secondary of the Transformer feeding the UPS Unit





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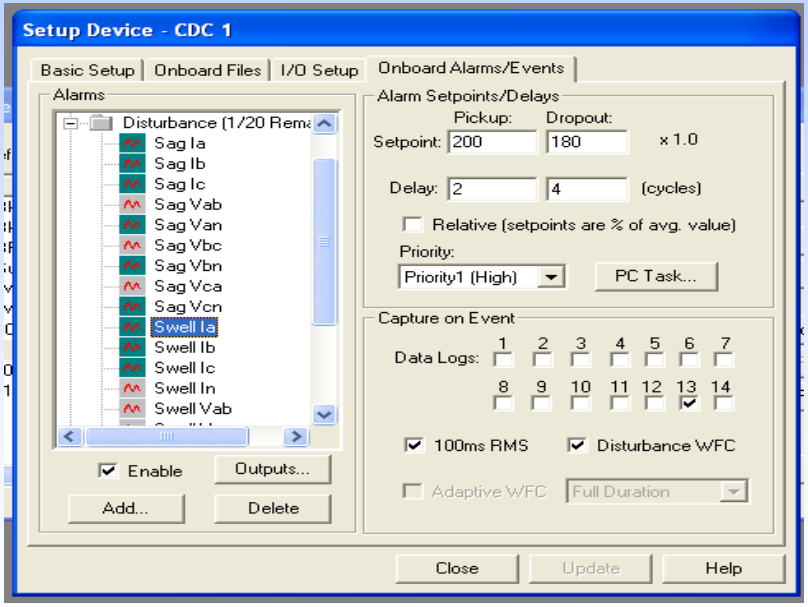
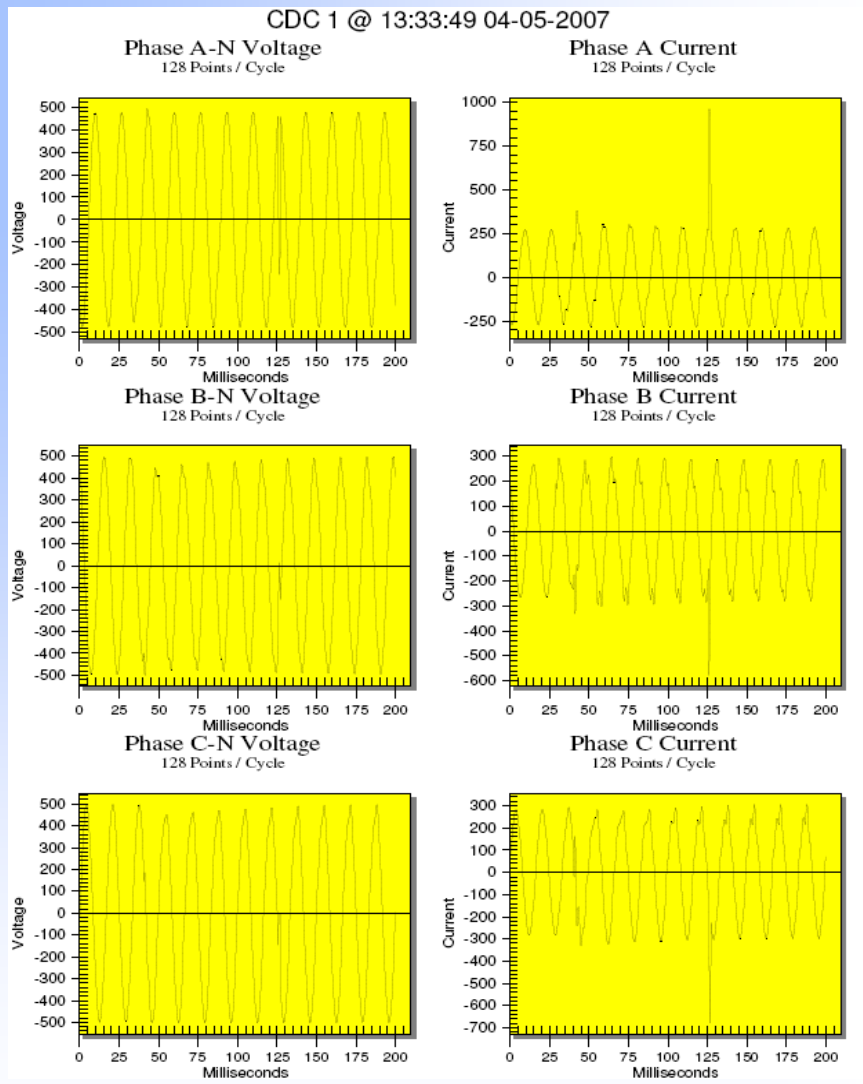
Case Study No. 1

Current Transient recorded by the CM3350 at the PDU fed from the UPS Unit





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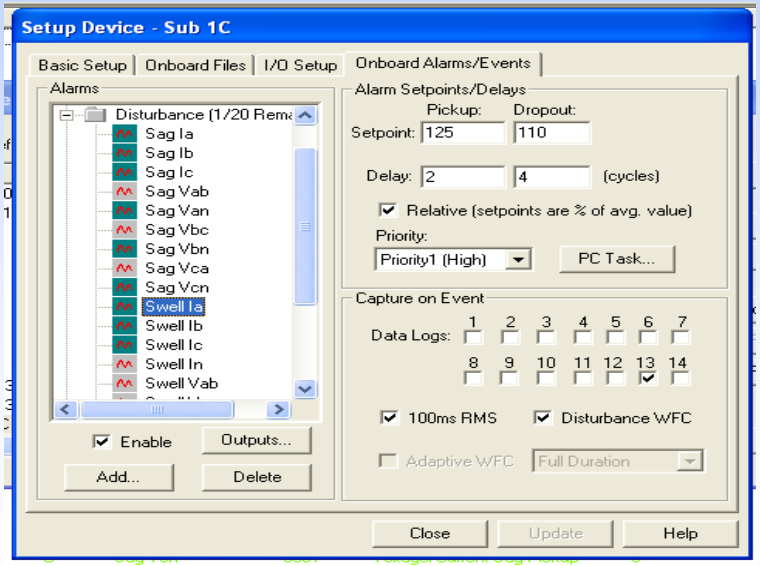
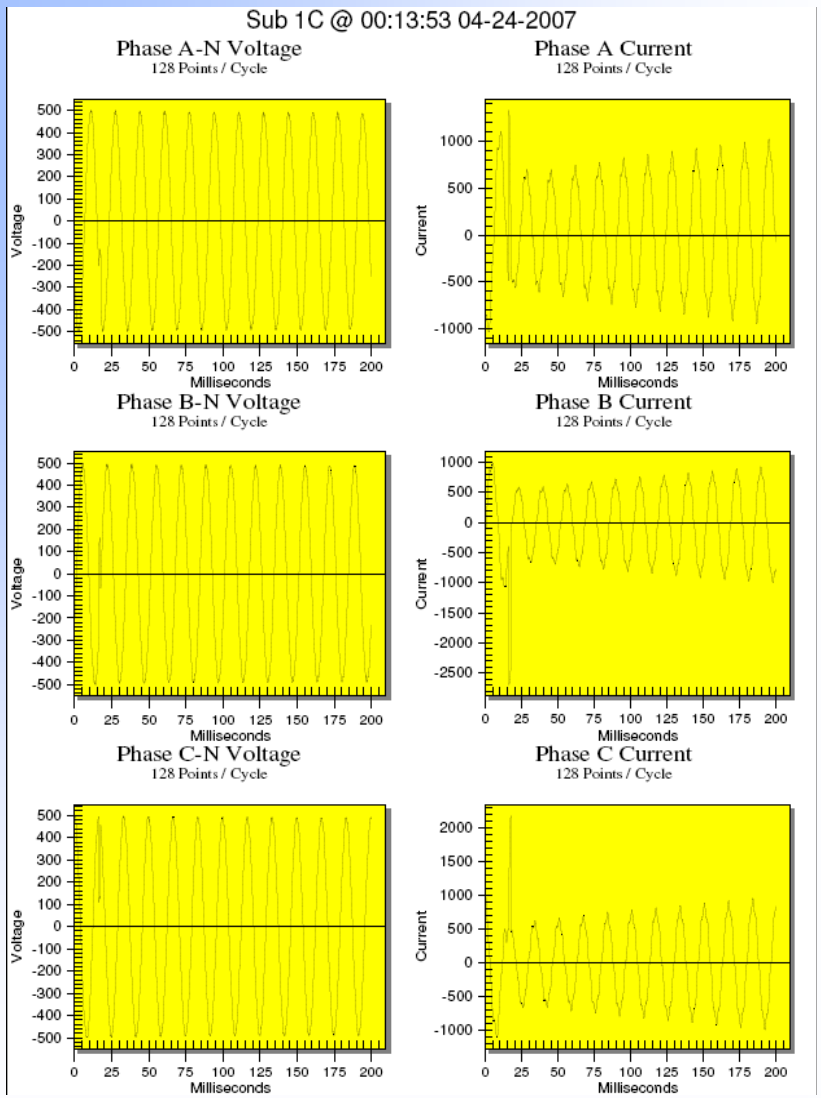
Case Study No. 1

Current Swell and Transient recorded by the CM3350 at the secondary of the Transformer feeding the UPS Unit





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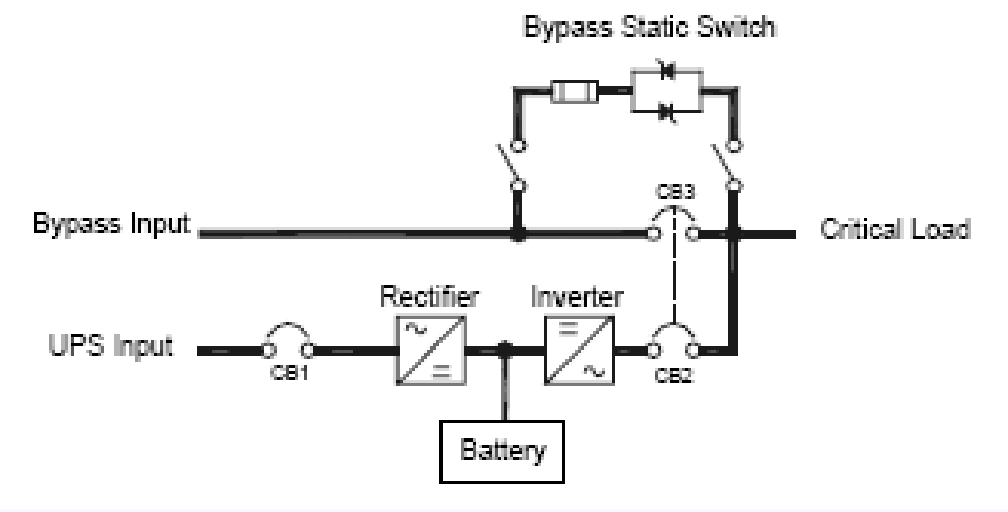
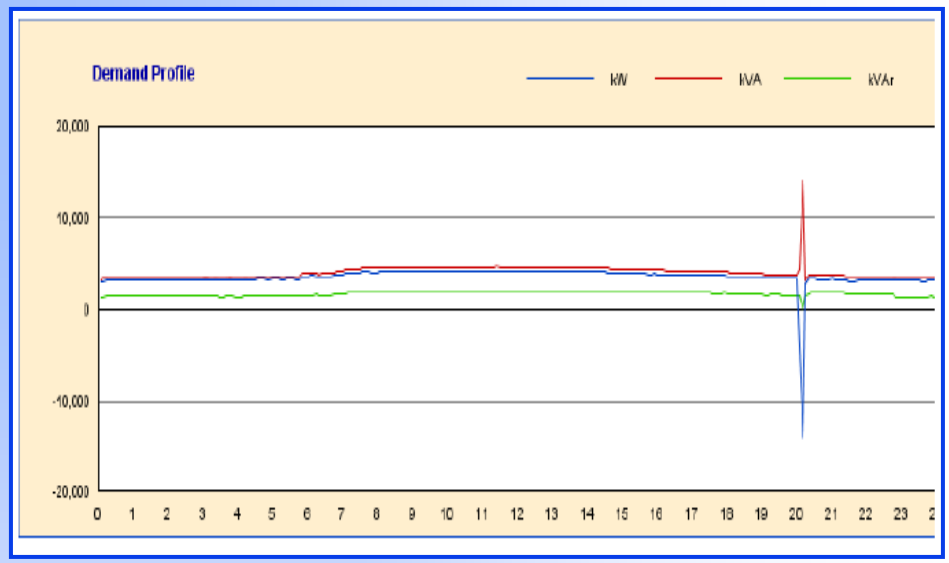
Case Study No. 1

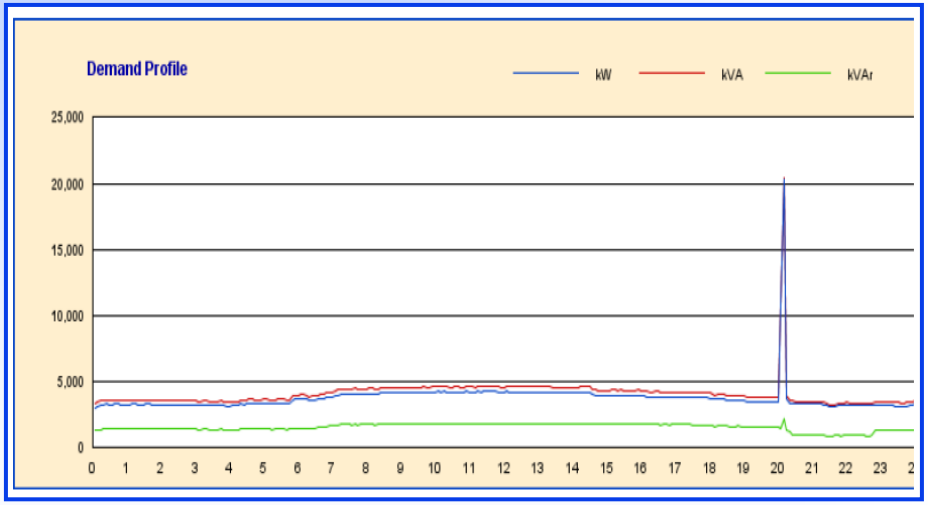
- **Current Swell and Transient recorded by the CM3350 at the secondary of the Transformer feeding the UPS Unit and on downstream equipment.**
- **The cause was found to be the switching of the UPS from UPS to Internal Bypass and vice-versa.**
- **The UPS service was called and the settings for the UPS transfer to Bypass (voltage and phase angle) were found out of range.**
- **Adjustments were made and the Current Transients disappeared.**



Case Study No. 2

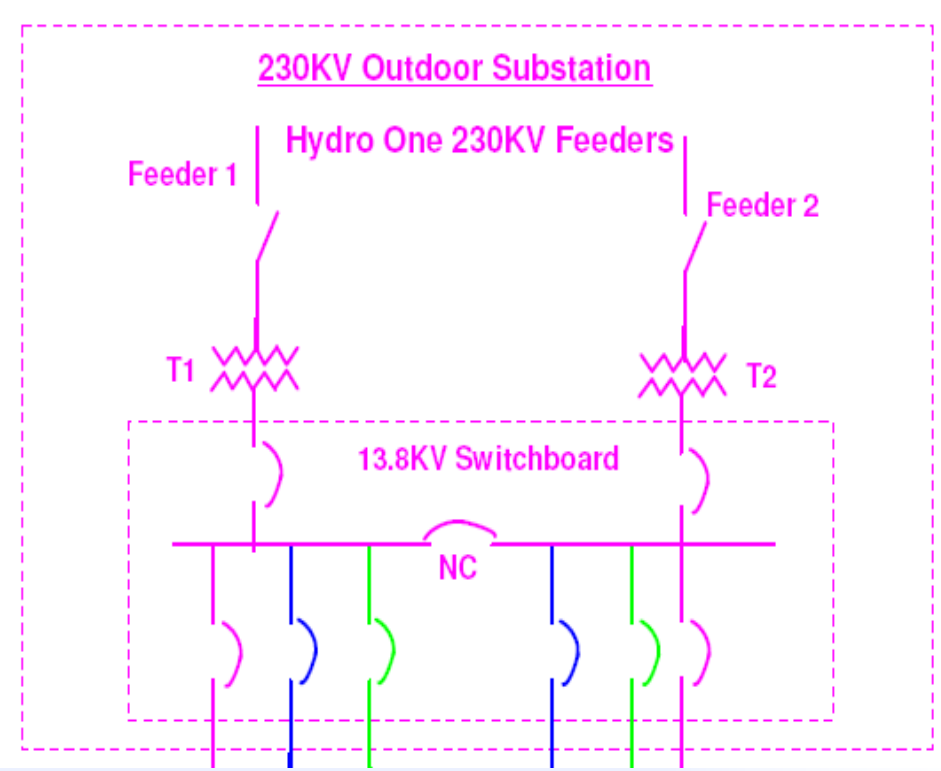
- **Abnormal Peak Loads recorded by CM4000 meters at 230KV Substation**
- **Available data from Power Logic Meters indicated to following scenario:**
  - **Transformer T1 lost the load, but the Voltage was present**
  - **No trip was recorded for Transformer T1 Main Breaker**
  - **Transformer T2 was loaded approx. five (5) times the normal load**





Case Study No. 2

- **Further analysis of the available records from site and Hydro One revealed that Transformer T1 was not isolated from the faulty Line 1 by Hydro One.**
- **As a result and due to the NC Tie Breaker configuration, the Customer Transformer T2 was feeding other Customers still connected to the faulty Line 1 until Hydro One isolated Transformer T1 by opening both Main Breaker and Air Break Switch.**




Questions?

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Notes