



# ION Enterprise: Implementation Overview, Set-up, and Operation (Power Quality)

## ION User's Group 2008

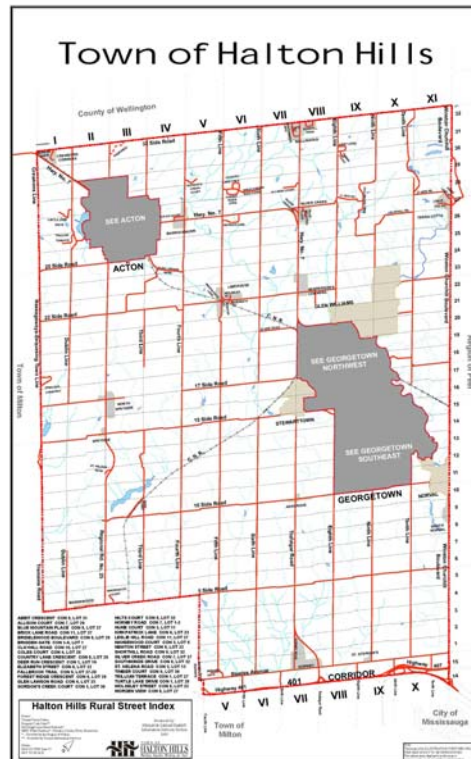
Christopher Hale, C.E.T.  
Senior Engineering Technologist





## Halton Hills Hydro Inc:

- Local Distribution Company servicing the Town of Halton Hills (Georgetown, Acton, and surrounding rural areas).
  - Head office is in Acton, Ontario.
- Employs approximately 45 full time staff.
- 21,000 customers of which 18,000 are residential and 3,000 are commercial/ industrial.
- Total service area of approx. 280 sq. km., of which about 255 sq. km. are rural.

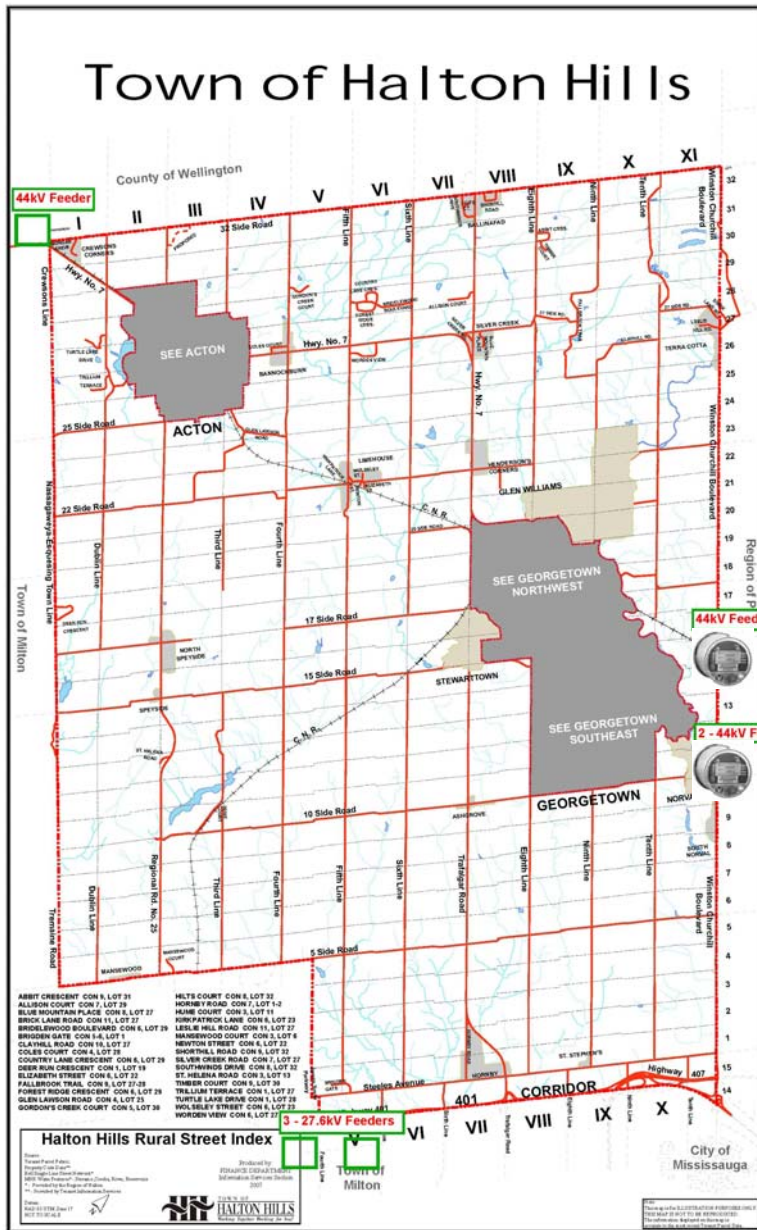


## My Role (primary functions):

- Started with Halton Hills Hydro in March 2003
- Capital project design and budgeting
- Customer service design
- Power Quality monitoring & reporting (ION)
  - Thermal Scanning (Level 1 Certification)
- Engineering & Construction Standards
- Mapping and System Modeling
- Distributed Generation Connection



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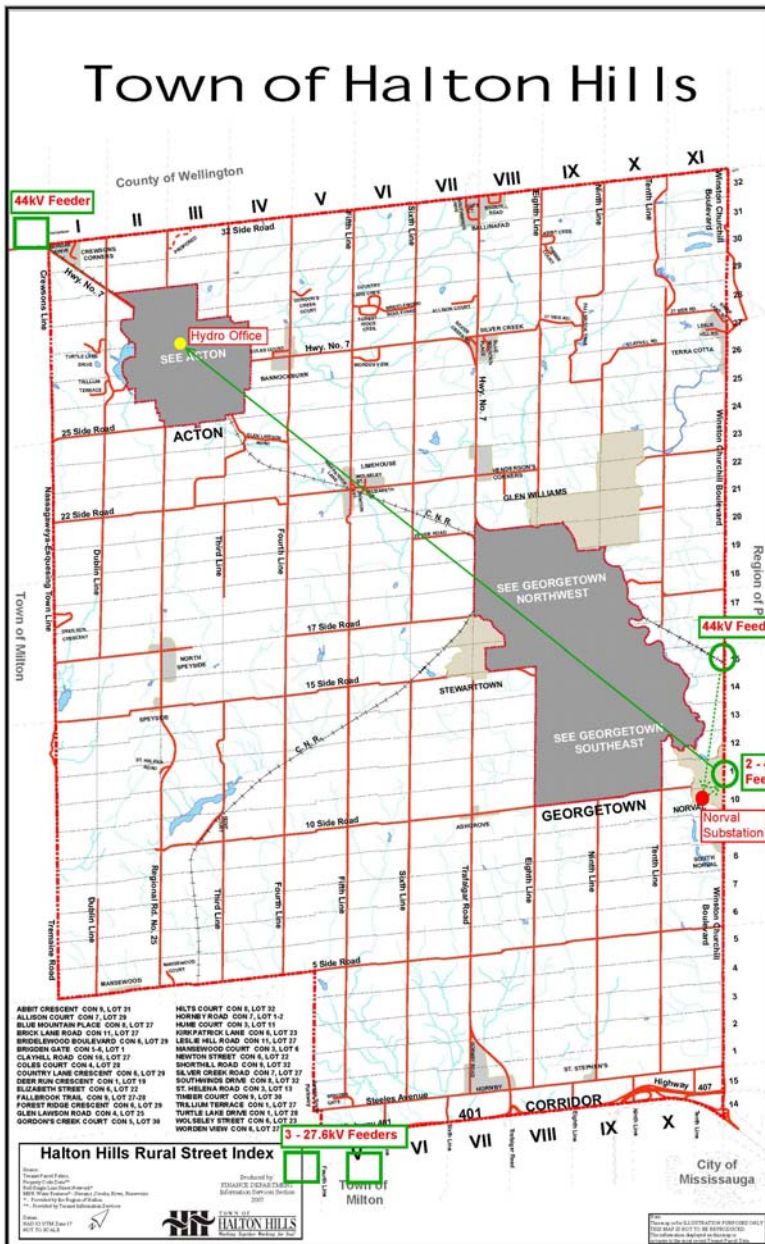


## Service Area Points of Supply

- Presently have 4 – 44kV Feeders:
  - 3 feeders originate at Pleasant TS in Brampton.
  - 1 feeder originates at Fergus TS in Fergus.
  - These 4 feeders supply power to Acton, most of Georgetown and the rural areas.
- Presently have 3 – 27.6kV Feeders all originating from Halton TS in Milton.
  - These 3 feeders supply power to the southern end of Georgetown and parts of the southern rural areas.
- At present, only the 3 – 44kV feeders from Pleasant TS are being monitored using ION Enterprise.
- Future plans to have all feeders monitored using ION Enterprise (within the next year).

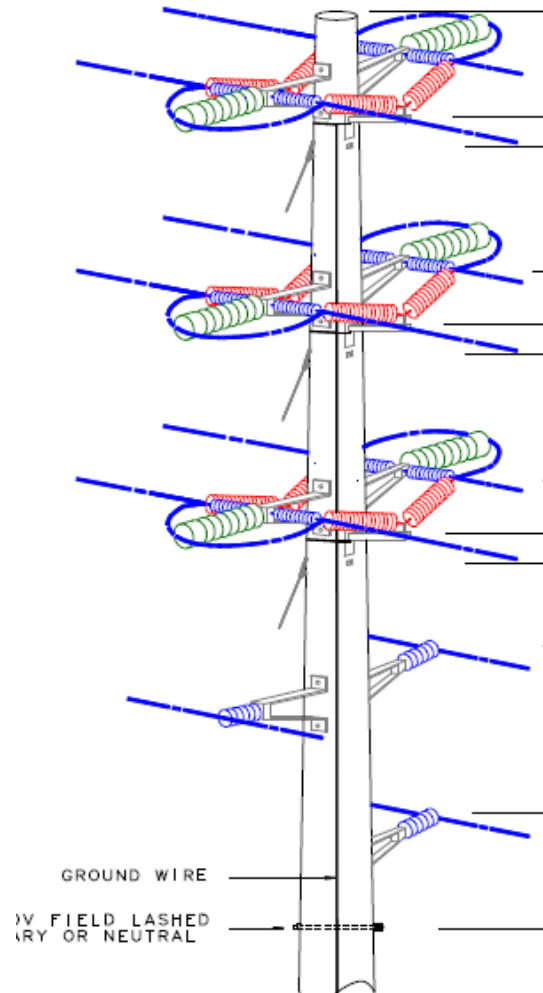


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## Communications:

- ION Enterprise and SCADA communicates via Ethernet over Fibre backhaul to the pole top unit on Hwy 7 in Norval.
- The M23 and M28 meters are directly connected to the fibre in this pole top via a switch.
- An MDS radio (IP radio, unlicensed 900 MHz, spread spectrum) is also connected to this switch.
  - The radio communicates to an access point located at Norval Substation which acts as a repeater.
  - From Norval Substation, the radio link connects to the pole top yagi-uda antenna on Winston Churchill Blvd. where the M25 meter is located. Data from the M25 meter is sent over the radio/repeater network back to the MDS radio at Highway 7 and sent via fibre backhaul to the office.
- Ion Enterprise is using the ION protocol over Ethernet, SCADA is using the DNP3.0 protocol over Ethernet
- To sum up, the M23 and M28 communicate with ION Enterprise via Ethernet directly over fiber. The M25 is the only meter that uses the radios and fibre for backhaul.

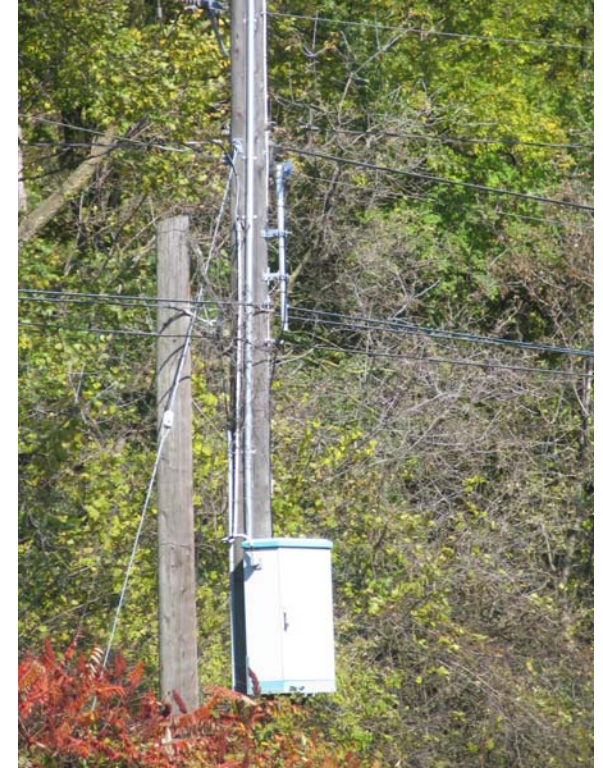


Pole Framing (Lindsey VT/ CT) & Lighting Arresters

## Implementation:

- Installation and connections were made in June/ July 2003.
- Lindsey VT/ CT combination insulators (green) were used to obtain voltage and currents for the ION 8500 meters.
- Lighting arresters (red) installed on both sides of VT/ CT's to protect them.
- Shortly after meters were setup in ION Management Console and connection achieved.
- Vista set-up followed:
  - Initial training on ION Enterprise was done by Langford and Associates (July 2003).
  - Set-up basic Vista network diagram with a few parameters displayed (voltage, current, kW, kVA).
  - Later expansion of network diagram to display additional parameters, data logging, how the information was displayed, graphics, a totaling kW and kVA (Later Summer 2003).
- ION Enterprise was set-up on a dedicated stand alone tower (network connected).
  - Presently only ION and DESS run on this computer.

## Pictures



### Primary Metering Point

#### Highway 7 (Norval, Ontario)

- Two (2) ION 8500 meters are located inside locked NEMA weatherproof enclosure mounted on utility pole. Ladder required to access meter.
- Lindsey VT/ CT combination insulators are used to obtain voltage and current for meters.
- Lighting Arresters are installed to protect Lindsey units.
- Yagi-Uda antenna installed above meter cabinet to receive signal from Norval Substation repeater.
- Signal sent to IP switch and sent back to hydro office via fibre network.

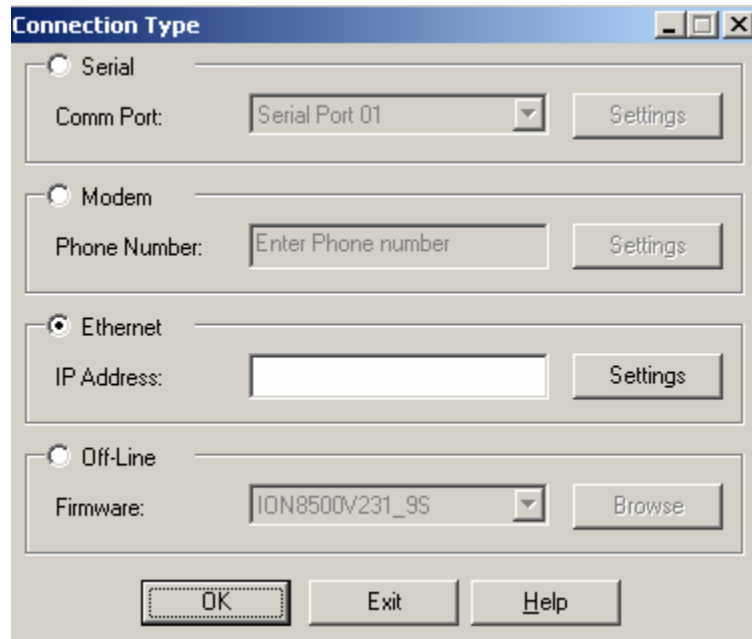
## Pictures



### Primary Metering Point

#### Winston Churchill Blvd. (Norval, Ontario)

- One (1) ION 8500 meter located inside locked NEMA weatherproof enclosure mounted on utility pole. Ladder required to access meter.
- Lindsey VT/ CT combination insulators are used to obtain voltage and current for meter.
- Lighting Arresters are installed to protect Lindsey units.
- Meter data sent to Norval Substation via wireless 900MHz network, then sent back to Norval metering point as shown previously.



## ION Set-up:

- Used to test initial communications and set-up (2003).
- Typically use ION Set-up to check connection to meters when Vista is not showing active connection.
- Used to test TCP/ IP connection when we switched to Cisco firewall (2007).
- Used for testing communications set-up of new meter connections with HHH's MSP.
- Used to test dial-in connection to meter at customer site. Typically a slower connection time than Ethernet.
  - Once connected, not much difference in retrieving data (Vista).

Devices - supervisor (Supervisor) - Management Console

File Edit View Tools Help

System Setup

Servers

Sites

Devices

Dialout Modems

Connection Schedules

Devices

Name	Type	Address	Site	Site Status	Enabled	Description
hhh.M23	8500 ION		<Ethernet/MIKEM-CF28>	Connected	YES	
hhh.	8500 ION			Port Blocked	YES	
hhh.M25	8500 ION		<Ethernet/MIKEM-CF28>	Connecting...	YES	
hhh.M28	8500 ION		<Ethernet/MIKEM-CF28>	Connected	YES	
hhh.M29_TRIAL	8500 ION		<Ethernet/MIKEM-CF28>	Connecting...	YES	METER FOR TRIAL PURPOSES

Properties Events

## Management Console and Back-up:

- Currently we have 4 ION 8500 meters set-up in ION Enterprise.
- Three meters are connected through the Cisco firewall and TCP/ IP addresses are assigned to each meter.
  - Connection made using Ethernet protocols.
- Remote connection via phone line to 1 meter at customer site.
- One meter licence presently used for testing connections.
  - Tested communications set-up with HHH's MSP for new ION meters monitoring HHH feeders from Halton TS (Not yet connected into ION Enterprise)
- Perform full weekly backup's and daily incremental backups.
  - Store backup on server and offsite.
- Perform quarterly archiving of data.

Database Manager Settings

Archive Options Trimming Options **Backup Options** Advanced Options

Enable Database Backups Help

Daily incremental backup and weekly full backup  
 Weekly full backup  
 Daily full backup

Perform backups at: 5 : 00 AM If weekly, on: Fridays

Save 2 week(s) of backups.

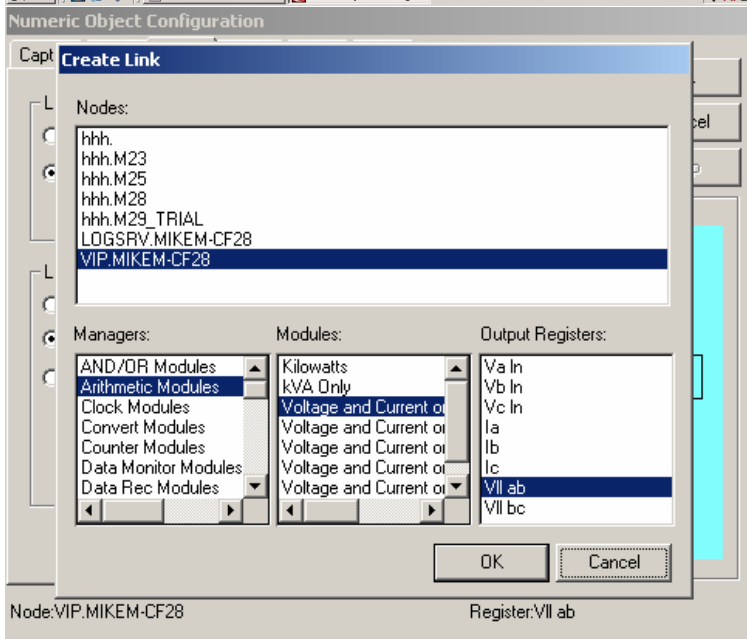
Save my backups in:  Browse

Save Cancel



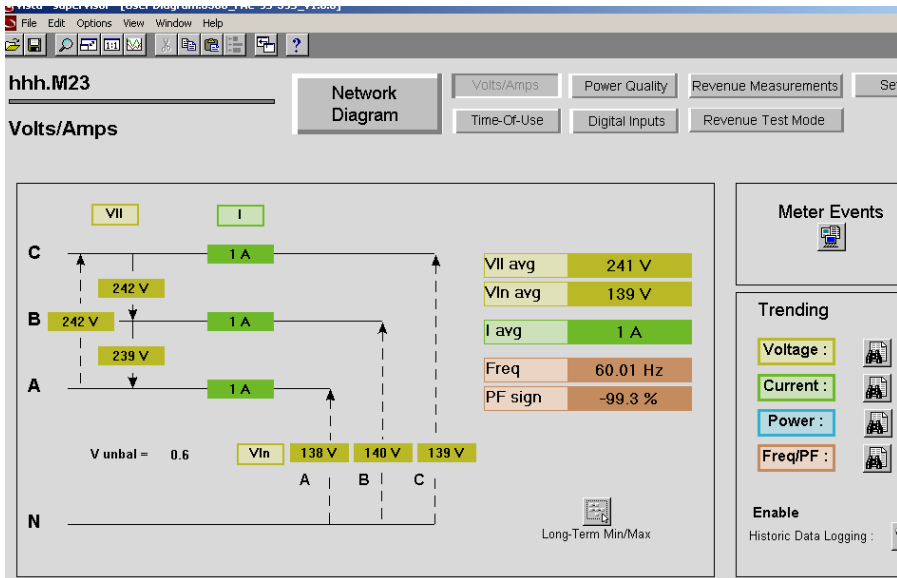
## Vista Set-up:

- Currently we have 4 ION 8500 meters set-up in ION Vista.
- Continuous live update of data.
- We monitor and record a variety of values:
  - kW & kVA (individual and summation)
  - Feeder current
  - Line-to-Line voltage (44kV nominal)
  - Power factor
  - Frequency
- Values displayed on Vista network diagram are set-up using ION Designer and Arithmetic Modules.
- Have remote connection via phone line to 1 ION 8500 meter at customer site.



## Future Goals:

- Plan to set-up another 4 ION meters on Vista within the next year:
  - 3 – 27.6kV
  - 1 – 44kV



Main Meter Screen from Network Diagram (above)

	timestamp	Va in	Vb in	Vc in	Ia	Ib	Ic	M2B kW	VII ab	VII bc	VII ca	kVA Total
1	30/09/2008 03:45:00 PM	27,492.727	27,820.859	27,761.453	251.076	260.286	254.723	20,383.57	47,574.619	48,230.637	48,063.181	21,207.607
2	30/09/2008 03:30:00 PM	27,419.034	27,740.25	27,695.825	253.123	263.123	267.028	20,516.629	47,449.625	48,096.32	47,958.789	21,351.877
3	30/09/2008 03:15:00 PM	27,387.43	27,719.876	27,681.799	251.876	261.896	256.015	20,455.11	47,397.195	48,080.417	47,912.845	21,238.697
4	30/09/2008 03:00:00 PM	27,336.478	27,651.712	27,605.807	254.398	262.889	257.998	20,520.131	47,300.128	47,944.687	47,807.626	21,340.758
5	30/09/2008 02:45:00 PM	27,322.034	27,640.198	27,593.466	250.335	259.194	253.334	20,151.585	47,276.508	47,925.204	47,784.375	20,968.44
6	30/09/2008 02:30:00 PM	27,295.997	27,592.151	27,641.183	250.777	259.493	254.485	20,218.118	47,253.85	48,017.59	47,846.952	21,075.407
7	30/09/2008 02:15:00 PM	27,445.691	27,768.344	27,707.39	249.538	257.447	252.467	20,103.714	47,436.878	48,133.54	47,990.076	20,968.527
8	30/09/2008 02:00:00 PM	27,428.589	27,739.853	27,640.089	248.234	256.413	250.522	19,983.3	47,460.593	48,041.544	47,921.561	20,840.418
9	30/09/2008 01:45:00 PM	27,351.74	27,676.361	27,547.403	245.233	253.54	248.415	19,742.861	47,336.542	47,911.554	47,771.844	20,562.631
10	30/09/2008 01:30:00 PM	27,401.962	27,714.189	27,619.528	243.875	252.982	247.762	19,694.744	47,410.635	48,004.938	47,881.857	20,531.483
11	30/09/2008 01:15:00 PM	27,359.851	27,688.657	27,566.73	247.12	256.749	251.147	19,977.746	47,358.008	47,939.288	47,791.672	20,787.725
12	30/09/2008 01:00:00 PM	27,413.449	27,736.639	27,595.496	249.51	260.156	253.962	20,214.4	47,447.168	47,990.289	47,859.68	21,054.98
13	30/09/2008 12:45:00 PM	27,344.879	27,663.773	27,533.06	251.161	261.351	255.528	20,317.298	47,319.647	47,884.509	47,757.153	21,127.128
14	30/09/2008 12:30:00 PM	27,469.781	27,784.137	27,568.848	248.161	256.531	249.828	19,999.127	47,528.519	48,013.69	47,905.203	20,825.666
15	30/09/2008 12:15:00 PM	27,394.739	27,721.78	27,478.021	251.005	259.881	253.861	20,245.654	47,410.11	47,983.817	47,758.142	21,050.111
16	30/09/2008 12:00:00 PM	27,361.838	27,686.966	27,431.924	250.163	258.537	253.064	20,198.354	47,350.616	47,809.958	47,694.199	20,939.465
17	30/09/2008 11:45:00 AM	27,371.344	27,696.285	27,403.748	248.324	256.595	251.801	20,041.745	47,368.17	47,739.039	47,674.704	20,815.76
18	30/09/2008 11:30:00 AM	27,406.372	27,729.77	27,429.596	249.241	255.913	251.425	20,068.913	47,436.121	47,841.898	47,714.163	20,817.595
19	30/09/2008 11:15:00 AM	27,180.795	27,486.62	27,193.556	250.693	259.071	253.806	20,074.263	47,554.865	47,432.544	47,398.025	20,832.364
20	30/09/2008 11:00:00 AM	27,317.929	27,670.047	27,342.487	247.504	256.702	250.824	19,916.558	47,339.591	47,697.62	47,558.347	20,716.557
21	30/09/2008 10:45:00 AM	27,451.038	27,809.818	27,437.509	246.351	254.369	249.075	19,896.844	47,575.323	47,911.401	47,746.1	20,685.2
22	30/09/2008 10:30:00 AM	27,451.089	28,283.926	27,701.251	251.424	259.045	252.737	20,398.056	48,111.203	48,525.687	48,049.161	21,249.32
23	30/09/2008 10:15:00 AM	27,468.79	27,716.202	27,405.383	245.368	252.967	247.039	19,713.075	47,495.502	47,821.408	47,728.494	20,516.304
24	30/09/2008 10:00:00 AM	27,520.825	27,750.333	27,567.709	250.436	257.811	252.205	20,152.521	47,587.076	47,960.068	47,929.318	20,993.666
25	30/09/2008 09:45:00 AM	27,498.724	27,799.689	27,598.825	249.881	256.823	252.182	20,049.448	47,632.382	48,118.851	47,996.985	20,990.969
26	30/09/2008 09:30:00 AM	27,599.393	28,014.542	27,667.673	250.723	256.695	252.58	20,059.064	47,787.808	48,275.732	48,120.013	21,065.861
27	30/09/2008 09:15:00 AM	27,499.121	27,917.798	27,551.965	247.475	254.111	249.624	19,803.094	47,616.302	48,069.363	47,980.408	20,766.95
28	30/09/2008 09:00:00 AM	27,635.303	28,256.738	27,746.809	245.241	251.76	246.848	19,699.702	47,952.188	48,664.185	48,239.638	20,734.464
29	30/09/2008 08:45:00 AM	27,477.49	27,827.842	27,459.716	241.332	249.335	242.906	19,318.686	47,579.208	47,350.14	47,781.897	20,201.679
30	30/09/2008 08:30:00 AM	27,279.919	27,630.927	27,242.352	240.887	247.277	241.536	19,157.495	47,249.045	47,602.109	47,436.472	19,901.562
31	30/09/2008 08:15:00 AM	27,561.655	27,991.302	27,418.661	238.912	245.156	239.541	19,114.334	47,623.111	48,073.257	47,909.641	20,009.919
32	30/09/2008 08:00:00 AM	27,630.646	27,888.959	27,719.69	241.013	248.056	242.05	19,312.705	47,860.016	48,119.061	48,190.549	20,280.873
33	30/09/2008 07:45:00 AM	27,628.333	28,069.006	27,696.414	232.481	239.004	234.496	18,590.675	47,842.627	48,361.761	48,228.406	19,620.017

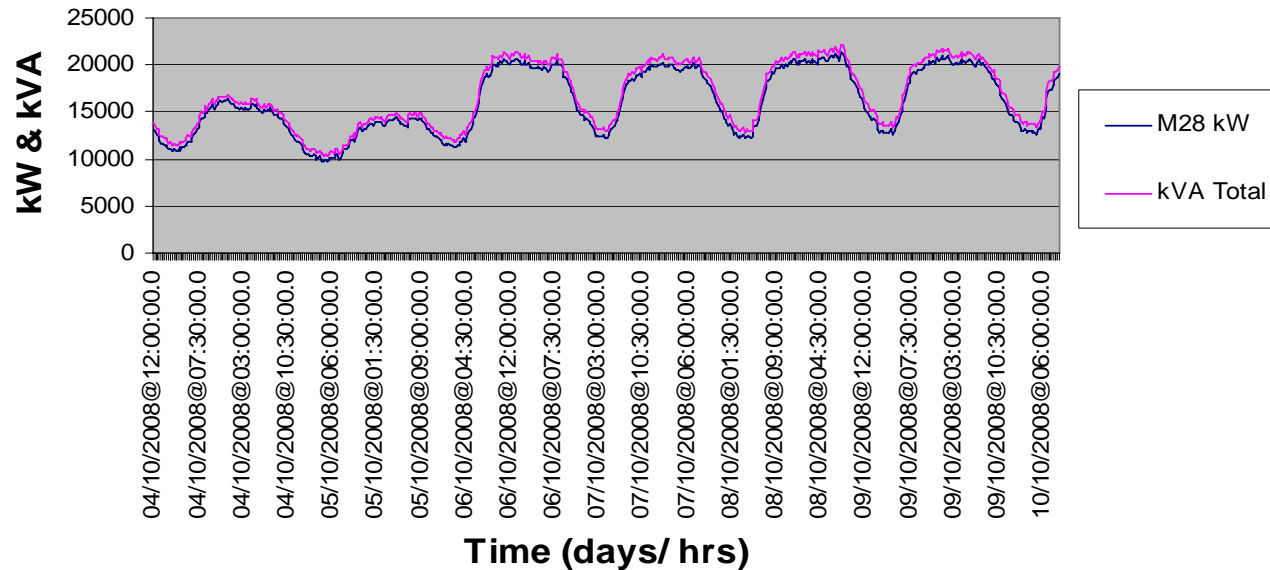
Data Trending Window (above)

## Vista Set-up (continued):

- Record feeder data at 15 minute intervals:
  - Helps to verify 44kV consumption billing from Hydro One (rectify double billing when utility feeders are paralleled).
  - Trend demand patterns over days, weeks, months.
  - Check voltage and current patterns during peak periods.
  - Good aid for system load modeling. Can use peak kW demand or current to analyze system capabilities during peak periods (ie: what happens if a new load is added? Low voltage?).



## 44kV Feeder - 42M28 (Pleaseanet TS) - Loading Oct. 4/08 to Oct. 10/08



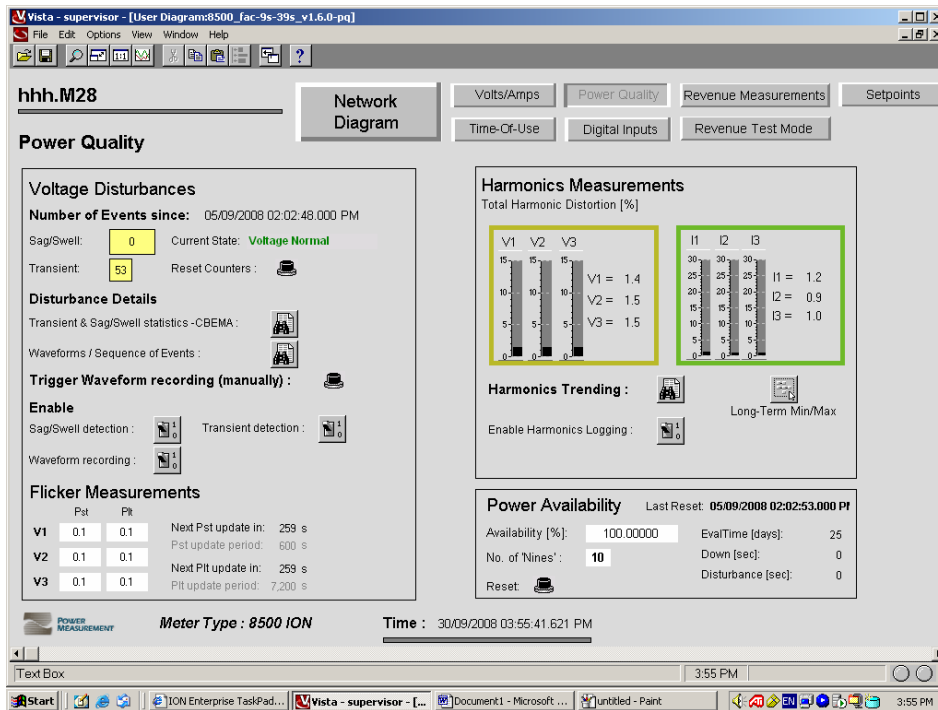
Data Trending

### Data Trending:

- Graphing load trends allows us to see past load growth and assists in forecasting future load growth.
- Record feeder data at 15 minute intervals:
  - Allows us to create custom reports on feeder loading, load cycles and voltage.
  - Very useful for distribution system modeling:
    - Having a load trend allows the user to scale modeling software to match feeder load and achieve a more accurate analysis of current distribution system characteristics and plan for future load.



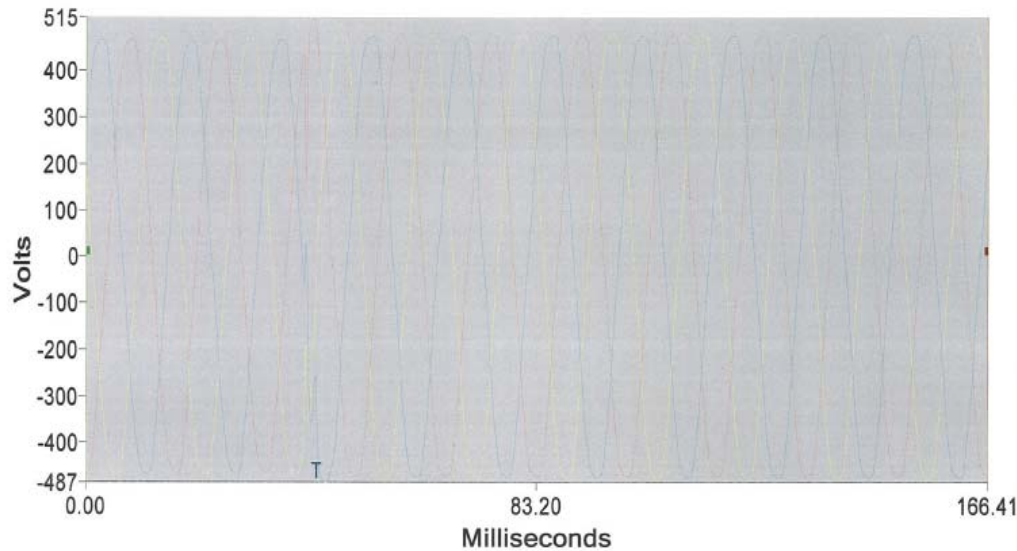
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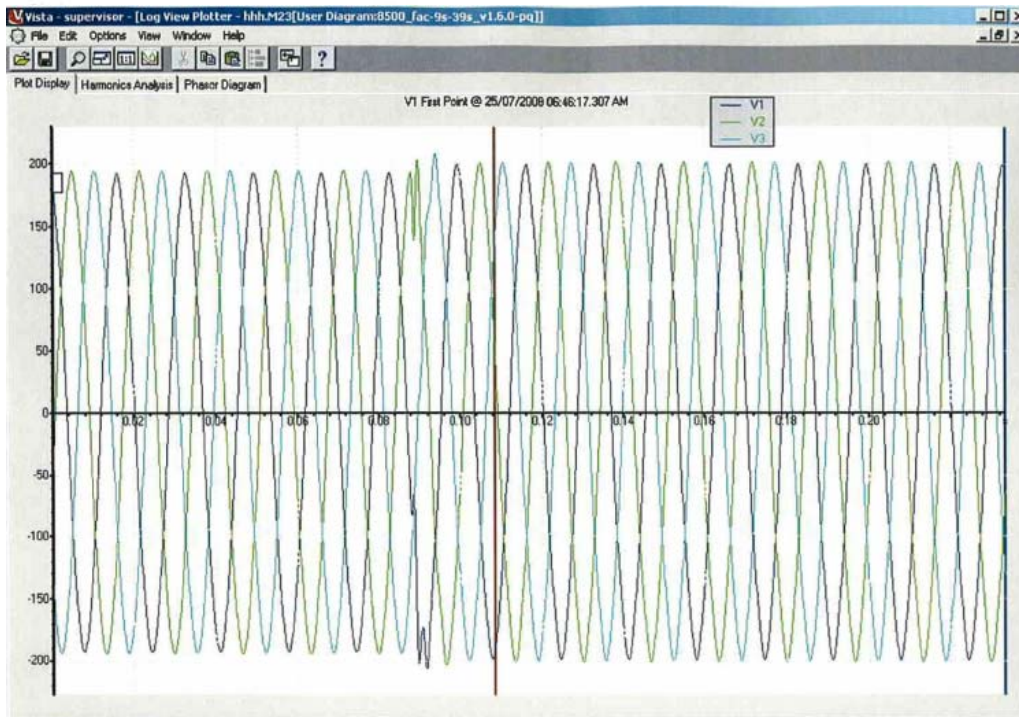
Power Quality Screen

## Vista Power Quality Set-up:

- Primary use of ION Vista is Power Quality.
- In addition to previous slides we monitor:
  - Sag/ Swell
    - Based on “CSA C235-83 Preferred Voltage Levels for AC Systems, 0 to 50,000 V” .
  - Transients
  - Harmonics
  - Power availability (%)
  - Number of Nines
    - Values are typically recorded in an Excel spreadsheet and reset monthly.
- Sag/ Swell thresholds were adjusted in the Sag/ Swell module (via ION Designer) for each meter.
  - Percentage values were adjusted from factory defaults to CSA C235-83 limits.
- Typically check global event log viewer weekday mornings.
- Weekly review of voltage event waveforms (unless SCADA alarms are triggered).



Sinusoidal waveform with transient, data logger above, ION meter below.

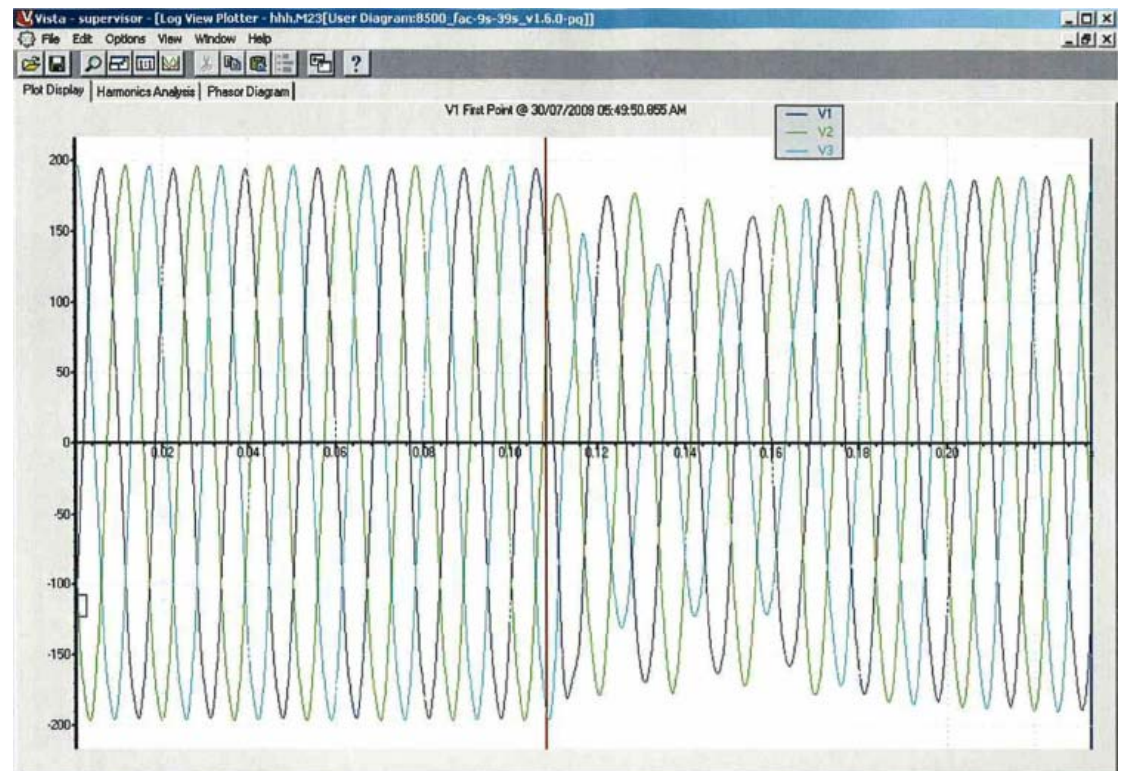


## Power Quality:

- As mention, primary use of ION Vista is Power Quality.
- Install data logger at customer's service entrance and record voltage & current.
  - Capture voltage/ current events.
- Compare those events to feeder events.
- Look for correlation.
- Assists in determining if events at a customer's premises are feeder related or internal.
  - Case at left, event recorded by data logger in top window was also recorded by ION 8500 meter at boundary point.
  - Believe that feeder event caused transient seen at customer's service entrance.
  - Time stamps help to verify.
- 256 samples per cycle rate of ION 8500 captures very fast transients, down to quarter cycle and less in my experience.
  - Excellent when comparing to data loggers with same capture capabilities.
- Key item is to make sure data logger and PML clocks are set to the same time.
  - Verify before each installation of a data logger.



- Sinusoidal waveform with sag, data logger at left, ION meter below.

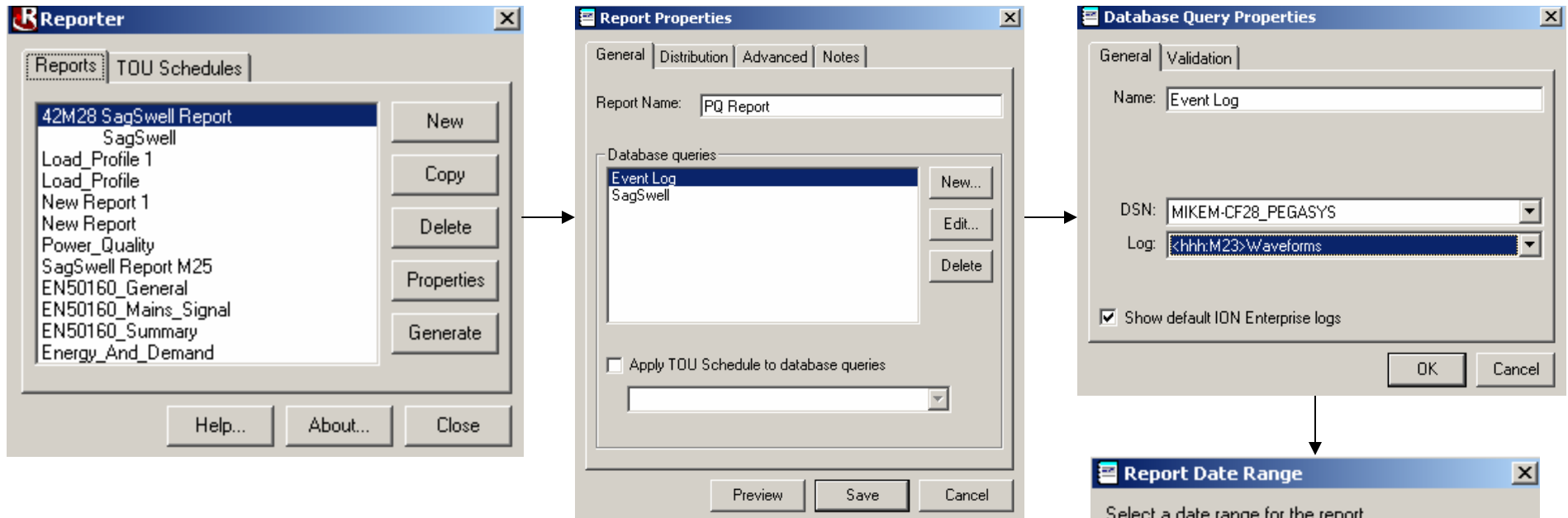


Ch.1

Ch.2

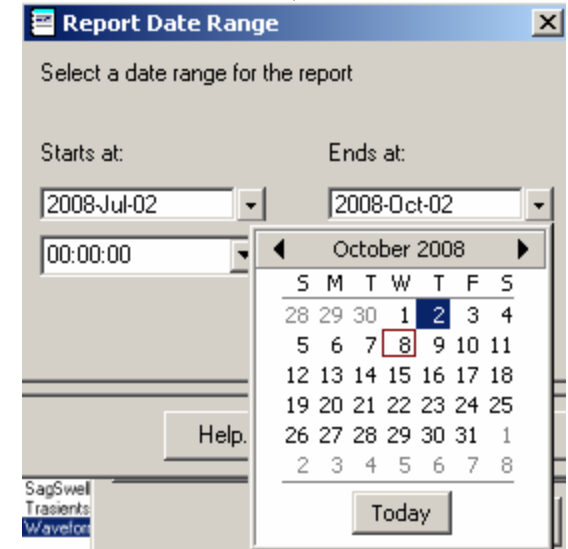
## Power Quality:

- Voltage sag recorded at customer's service entrance also recorded by ION 8500 meter.
- Produce reports for customers that address:
  - where problems are occurring
  - what the cause of the problem is (if external)
  - provide feed back as to utility related events (ex. % of corresponding events)
  - possible utility/ customer work that can help eliminate problem

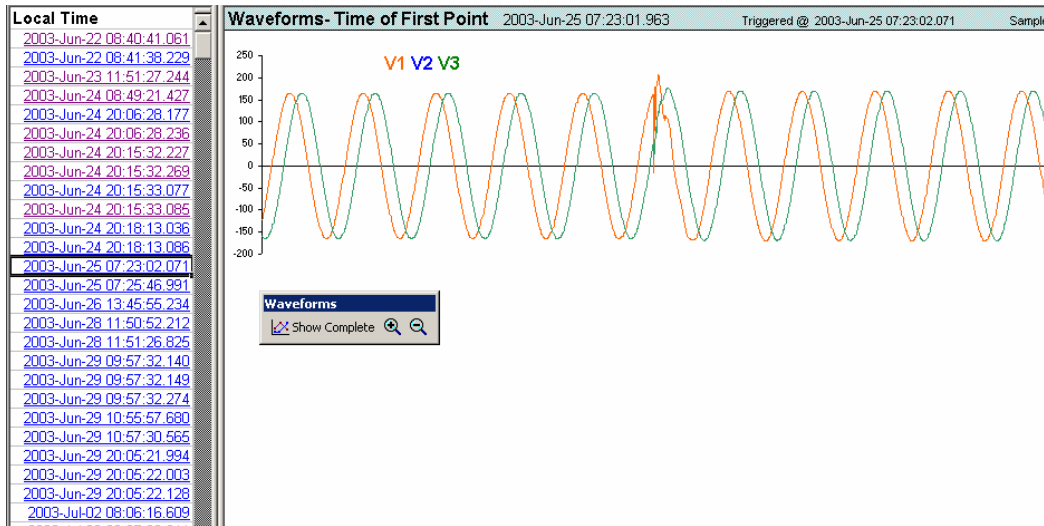


## ION Reporter:

- Typically used to access historical data from customer site meter.
- Microsoft Excel format allows easy access to and navigation of data
- Setup ION Reporter to pull data from the required log and add filters (ie: log) to pull data from database.
  - Use date range to pull data for specific periods.
- Each report is time stamped.
- Can be used to compare to on-site data loggers as discussed previously.

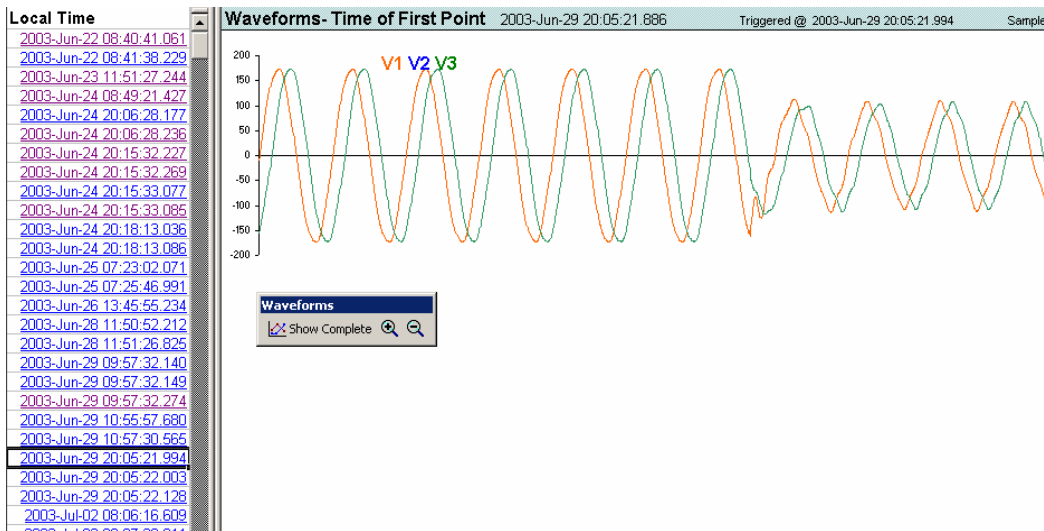


**Report Generated**



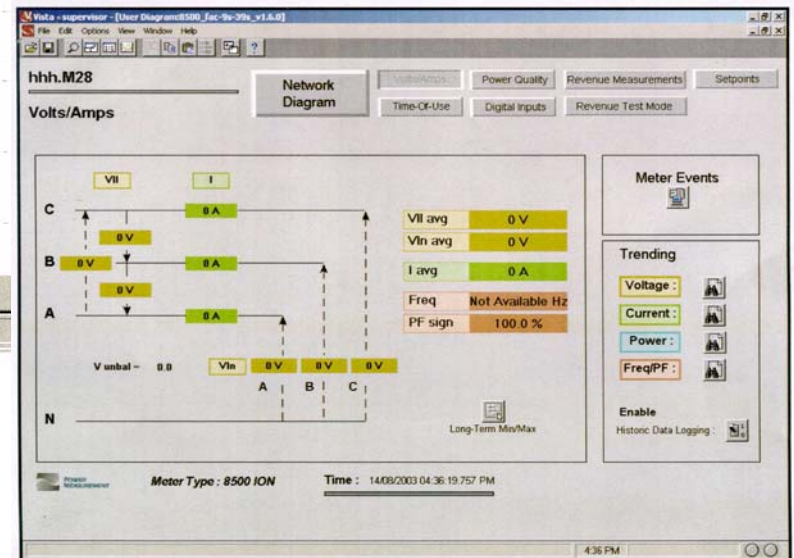
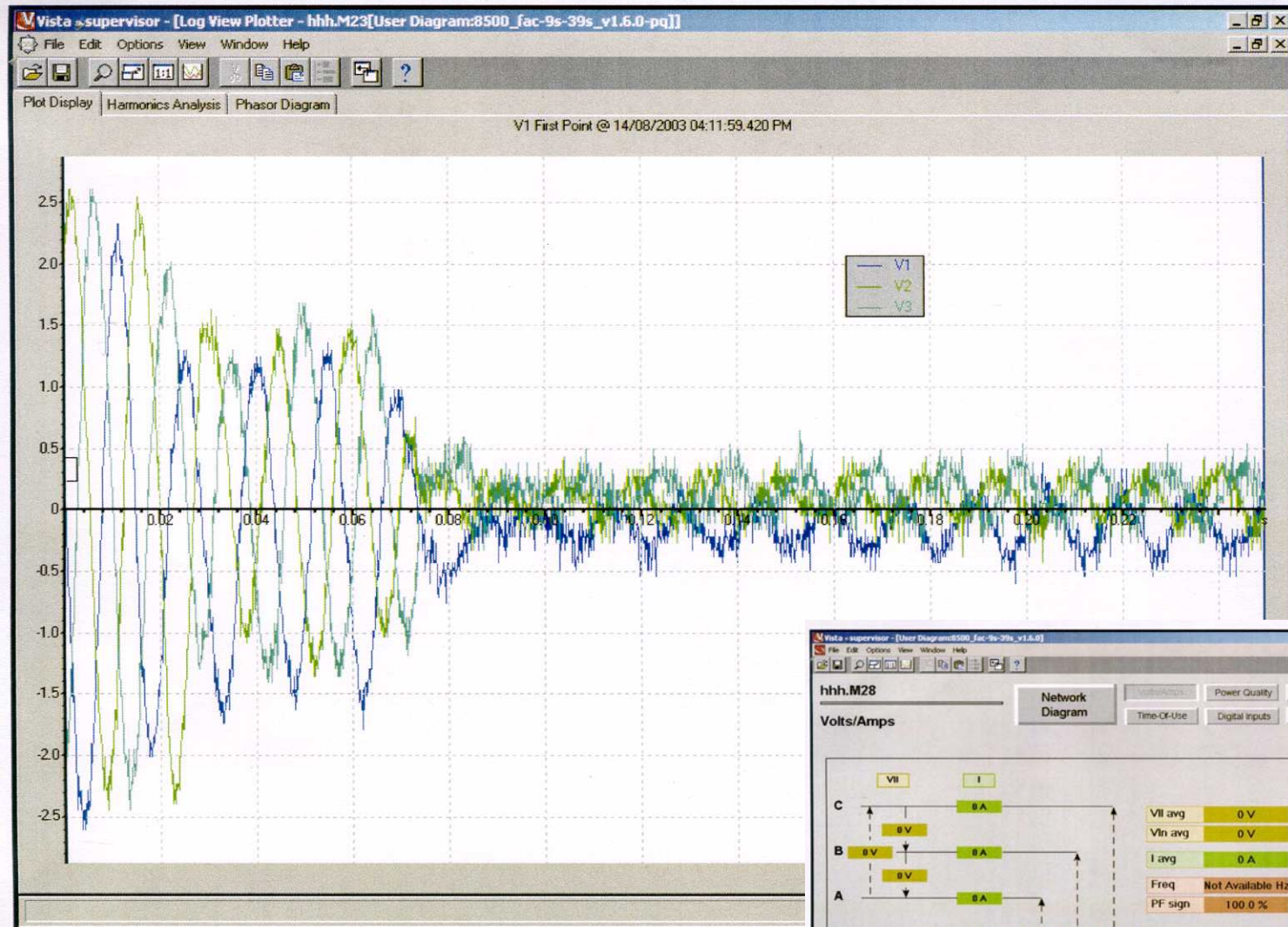
## ION Reporter:

- Waveforms displayed using Reporter.
- Time stamped logs make it easy to follow a sequence of events.
- Use this format of display to present waveforms for customers and management.
  - Typically related to power quality issues.
  - Sometimes general interest of number of similar events occurring in a specified period (ie: how many voltage sags occurred?).



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# August 14, 2003 - Blackout



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# Thank you for your time!

## Questions?

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