DRANETZ
BMI

Series 5500 InfoNode®
User's Guide

WARNING

Death, serious injury, or fire hazard could result from improper connection of this instrument. Read and understand this manual before connecting this instrument. Follow all installation and operating instructions while using this instrument.

Connection of this instrument must be performed in compliance with the National Electrical Code (ANSI/NFPA 70-2002) of USA and any additional safety requirements applicable to your installation.

Installation, operation, and maintenance of this instrument must be performed by qualified personnel only. The National Electrical Code defines a qualified person as "one who has the skills and knowledge related to the construction and operation of the electrical equipment and installations, and who has received safety training on the hazards involved."

Qualified personnel who work on or near exposed energized electrical conductors must follow applicable safety related work practices and procedures including appropriate personal protective equipment in compliance with the Standard for Electrical Safety Requirements for Employee Workplaces (ANSI/NFPA 70E-2004) of USA and any additional workplace safety requirements applicable to your installation.

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Safety Summary

ADVERTENCIA

Una conexión incorrecta de este instrumento puede producir la muerte, lesiones graves y riesgo de incendio. Lea y entienda este manual antes de conectar. Observe todas las instrucciones de instalación y operación durante el uso de este instrumento.

La conexión de este instrumento debe ser hecha de acuerdo con las normas del Código Eléctrico Nacional (ANSI/NFPA 70-2002) de EE. UU., además de cualquier otra norma de seguridad correspondiente a su establecimiento.

La instalación, operación y mantenimiento de este instrumento debe ser realizada por personal calificado solamente. El Código Eléctrico Nacional define a una persona calificada como "una que esté familiarizada con la construcción y operación del equipo y con los riesgos involucrados."

AVERTISSEMENT

Si l'instrument est mal connecté, la mort, des blessures graves, ou un danger d'incendie peuvent s'en suivre. Lisez attentivement ce manuel avant de connecter l'instrument. Lorsque vous utilisez l'instrument, suivez toutes les instructions d'installation et de service.

Cet instrument doit être connecté conformément au National Electrical Code (ANSI/NFPA 70-2002) des Etats-Unis et à toutes les exigences de sécurité applicables à votre installation.

Cet instrument doit être installé, utilisé et entretenu uniquement par un personnel qualifié. Selon le National Electrical Code, une personne est qualifiée si "elle connaît bien la construction et l'utilisation de l'équipement, ainsi que les dangers que cela implique."

WARNUNG

Der falsche Anschluss dieses Gerätes kann Tod, schwere Verletzungen oder Feuer verursachen. Bevor Sie dieses Instrument anschliessen, müssen Sie die Anleitung lesen und verstanden haben. Bei der Verwendung dieses Instruments müssen alle Installation- und Betriebsanweisungen beachtet werden.

Der Anschluss dieses Instruments muss in Übereinstimmung mit den nationalen Bestimmungen für Elektrizität (ANSI/NFPA 70-2002) der Vereinigten Staaten, sowie allen weiteren, in Ihrem Fall anwendbaren Sicherheitsbestimmungen, vorgenommen werden.

Installation, Betrieb und Wartung dieses Instruments dürfen nur von Fachpersonal durchgeführt werden. In dem nationalen Bestimmungen für Elektrizität wird ein Fachmann als eine Person bezeichnet, welche "mit der Bauweise und dem Betrieb des Gerätes sowie den dazugehörigen Gefahren vertraut ist."

Safety Summary

Definitions

WARNING statements inform the user that certain conditions or practices could result in loss of life or physical harm.

CAUTION statements identify conditions or practices that could harm the Series 5500, its data, other equipment, or property.

NOTE statements call attention to specific information.

Symbols

The following International Electrotechnical Commission (IEC) symbols are marked on the top and rear panel in the immediate vicinity of the referenced terminal or device:


Caution, refer to accompanying documents (this manual).


Alternating current (ac) operation of the terminal or device.


Direct current (DC) operation of the terminal or device.


Protective conductor terminal.

Definiciones

Las ADVERTENCIAS informan al usuario de ciertas condiciones o prácticas que podrían producir lesiones mortales o daño físico.

Las PRECAUCIONES identifican condiciones o prácticas que podrían dañar la Series 5500, sus datos, otros equipos o propiedad.

Las NOTAS llaman la atención hacia la información específica.

Símbolos

Los siguientes símbolos de la Comisión Internacional Electrotécnica (IEC) aparecen marcados en el panel superior y el posterior inmediatos al terminal o dispositivo en referencia:


Precaución, consulte los documentos adjuntos (este manual).


Operación de corriente alterna (ca) del terminal o dispositivo.


Operación de corriente continua (CC) del terminal o dispositivo.


Terminal de protección del conductor.

Safety Summary

Définitions

Les messages d'AVERTISSEMENT préviennent l'utilisateur que certaines conditions ou pratiques pourraient entraîner la mort ou des lésions corporelles.

Les messages de MISE EN GARDE signalent des conditions ou pratiques susceptibles d'endommager "Series 5500", ses données, d'autres équipements ou biens matériels.

Les messages NOTA attirent l'attention sur certains renseignements spécifiques.

Symboles

Les symboles suivants de la Commission électrotechnique internationale (CEI) figurent sur le panneau arrière supérieur situé à proximité du terminal ou de l'unité cité:


Mise en garde, consultez les documents d'accompagnement (ce manual).


Fonctionnement du terminal ou du dispositif sur le courant alternatif (c.a.).


Fonctionnement du terminal ou de l'unitécourant continu (CC).


Borne conductrice de protection.

Safety Summary

Definitionen

WARNUNGEN informieren den Benutzer darüber, daá bestimmte Bedingungen oder Vorgehensweisen körperliche oder tödliche Verletzungen zur Folge haben können.

VORSICHTSHINWEISE kennzeichnen Bedingungen oder Vorgehensweisen, die zu einer Beschädigung von Series 5500, seiner Daten oder anderer Geräte bzw. von Eigentum führen können.

HINWEISE machen auf bestimmte Informationen aufmerksam.

Symbole

Die folgenden Symbole der Internationalen Elektrotechnischen Kommission (International Electrotechnical Commission; IEC) befinden sich auf der Abdeck- und Seitenplatte unmittelbar am betreffenden Terminal oder Gerät.


Vorsichtshinweis, siehe Begleitdokumente (dieses Handbuch).


Wechselstrombetrieb des Terminals bzw. Geräts.


Gleichstrombetrieb im Terminal oder Gerät.


Terminal-Schutzleiter.

Safety Summary

Safety Precautions

The following safety precautions must be followed whenever any type of connection is being made to the instrument.

- Connect the green safety (earth) ground first, before making any other connections.
- When connecting to electric circuits or pulse initiating equipment, open their related breakers. DO NOT install any connection of the instrument on live power lines.
- Connections must be made to the instrument first, then connect to the circuit to be monitored.
- Wear proper personal protective equipment, including safety glasses and insulated gloves when making connections to power circuits.
- Hands, shoes and floor must be dry when making any connection to a power line.
- Make sure the unit is turned OFF before connecting probes to the rear panel.
- Before each use, inspect all cables for breaks or cracks in the insulation. Replace immediately if defective.

Medidas de seguridad

Las medidas de seguridad siguientes deberán observarse cuando se realice cualquier tipo de conexión al instrumento.

- Antes de hacer cualquier conexión, deberá enchufarse el conector de seguridad verde a tierra.
- Cuando se haga conexiones a circuitos eléctricos o a equipo de activación por pulso, deberá abrirse sus respectivas cajas de seguridad. NO deberá hacerse ninguna conexión del instrumento en líneas eléctricas bajo tensión.
- Las conexiones deberán hacerse primero al instrumento y, luego, al circuito a ser monitorizado.
- Al hacer conexiones a circuitos eléctricos, deberá utilizar anteojos y guantes protectores.
- Sus manos, zapatos y el piso deberán estar secos en todo momento en que se haga una conexión a un cable eléctrico.
- Verifique que la unidad esté DESACTIVADA antes de conectar sondas en el panel posterior.
- Previo a cada uso, deberá verificarse que los cables no estén rotos y que el material aislante no tenga rajaduras. Reemplace de inmediato cualquier parte defectuosa.

Mesures de Sécurité

Les mesures de sécurité suivantes doivent être prises chaque fois qu'un type de connexion quelconque est effectué sur l'instrument.

- Connecter d'abord la prise de terre de sécurité verte (terre) avant d'effectuer toute autre connexion.
- Ouvrir les disjoncteurs correspondants lors d'une connexion à des circuits électriques ou à des équipement de génération d'impulsions. NE PAS effectuer de connexion d'instrument sur des lignes électriques sous tension.
- Une fois toutes les connexions de l'instrument effectuées, connecter au circuit à contrôler.
- Porter des lunettes de protection et des gants isolants pour effectuer des connexions aux circuits électriques.
- S'assurer que les mains, les chaussures et le sol soient secs lors de connexions à une ligne électrique.
- S'assurer que l'unité est ÉTEINTE avant de connecter les sondes au panneau arrière.
- Inspecter tous les câbles, avant chaque utilisation, pour s'assurer que les isolants ne sont pas coupés ou fendus. Remplacer immédiatement tous les équipements défectueux.

Sicherheitsvorkehrungen

Die folgenden Sicherheitsvorkehrungen sind immer dann zu befolgen, wenn eine Verbindung zum Instrument hergestellt wird.

- Schließen Sie zuerst die grüne Sicherheits-/Erdleitung an, bevor Sie eine andere Verbindung herstellen.
- Öffnen Sie beim Anschluß an elektrische Stromkreise oder Impulsauslösungseinrichtungen die entsprechenden Unterbrecher. Es dürfen KEINE Anschlüsse an das Instrument unter stromführenden Spannungsleitungen montiert werden.
- Die Verbindungen müssen zuerst am Instrument und danach an der zu überwachenden Schaltung hergestellt werden.
- Tragen Sie Schutzbrillen und Isolierhandschuhe, wenn Sie Anschlüsse an den Stromkreisen vornehmen.
- Hände, Schuhe und Fußboden müssen trocken sein, wenn Sie Anschlüsse an den Stromkreisen durchführen.
- Stellen Sie sicher, daß das Gerät AUSgeschaltet ist, bevor Sie an der rückwärtigen Konsole Meßfühler anschließen.
- Prüfen Sie vor jedem Gebrauch alle Kabel auf Bruchstellen und Risse in der Isolierung. Wechseln Sie schadhafte Kabel sofort aus.

FCC Statement

This device has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his/her own expense.

Warranty

Dranetz-BMI warrants that the Series 5500 will be free from defects in workmanship and materials for a period of one year from the date of purchase. Dranetz-BMI will, without charge, replace or repair, at its option, any warranted product returned to the Dranetz-BMI factory service department.

Dranetz-BMI shall not be held liable for any consequential damages, including without limitation, damages resulting from loss of use, or damages resulting from the use or misuse of this product. Some states do not allow limitations of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific rights and you may also have rights which vary from state to state.

Exclusions: *This warranty does not apply in the event of misuse or abuse of the product or as a result of unauthorized repairs or alterations.*

Need Help?

How to Contact Dranetz-BMI

Regardless of your location, Dranetz-BMI sales and product support are within easy reach through an established network of representatives and distributors worldwide.

For Sales, Technical Support, or the name of a Dranetz-BMI Sales Representative in your area, call:

1-800-372-6832 or 732-287-3680

Fax: 732-248-1834

Web site: www.dranetz-bmi.com

Welcome to the Series 5500

Congratulations on your purchase of the Series 5500 InfoNode.

The InfoNode, the central component of the unique Dranetz-BMI power quality and energy monitoring system, can now be integrated into a computer's Windows® operating system. By providing a centralized connection point for remote devices, the InfoNode acts as the server for a user designed power monitoring network. The user interface is a conventional Internet browser, with access restricted only to users with the correct password.

The optional DataNodes serve as the data and information gathering devices, connected to the InfoNode on PC via RS-485/422/232 or Ethernet. By logging onto the InfoNode service from any PC having Internet access (or access to the network in which the system operates) or via modem, users can obtain extensive monitoring data, information and answers from all the connected DataNodes.

More DataNodes can be added at any time, increasing the size and capabilities of the monitoring network. The individual capabilities and features of each different type of DataNode are covered in their own separate user's guides.

Please read this and all user's guides carefully to obtain the greatest value from your power monitoring equipment and to avoid damage and injury that can occur from misuse and improper connection.

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Signature System Setup

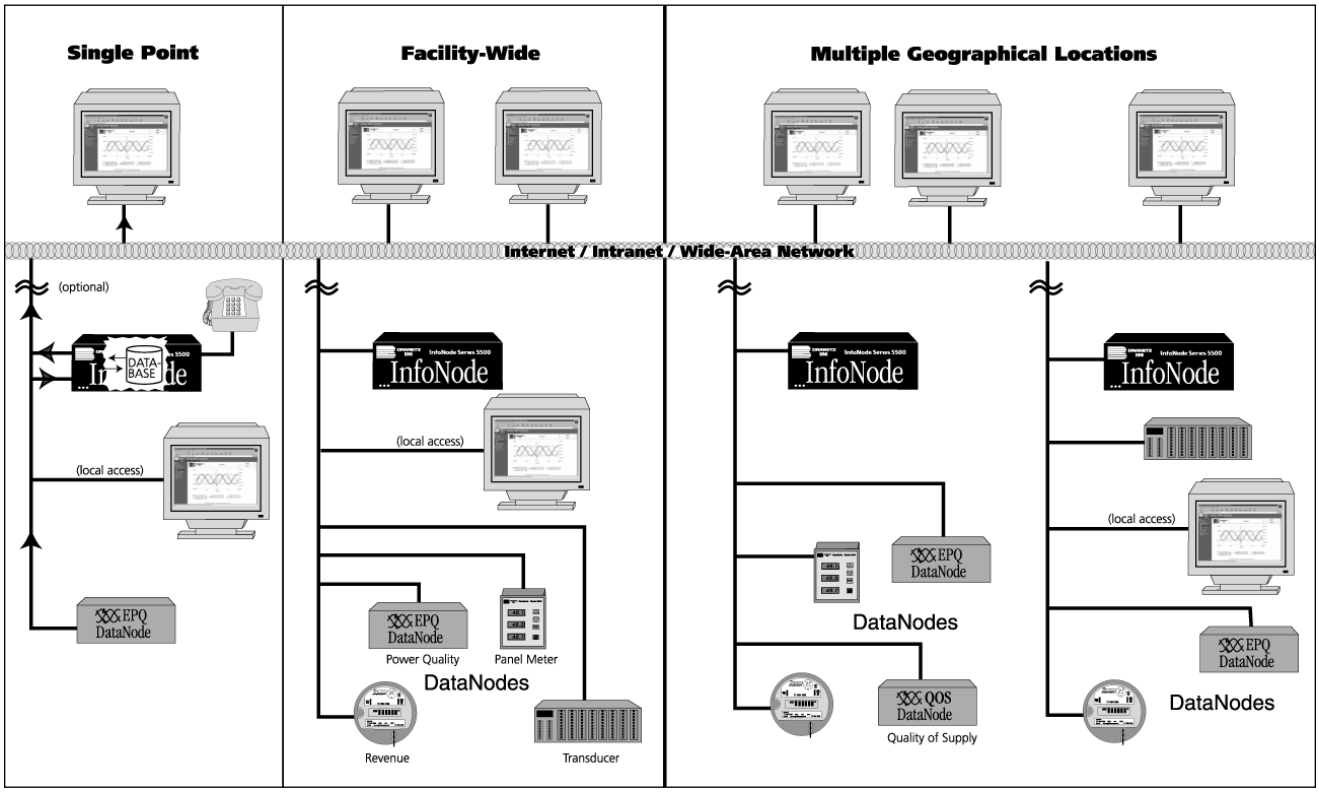
The Signature System is a new vision for distributed electric power information systems.

It is based on a few simple premises: Capture all data. Convert the data to information. Manage the information while saving the data. Move the information to those who need it, when they need it. Share the information. Provide answers, not just data. Eliminate installed software. And use the Internet.

A typical Signature System is built from several DataNodes, plus one or more InfoNodes equipped with a selection of Answer Modules. Large Signature Systems may also include NodeLink or NodeCenter, a powerful suite of server-based management analysis tools for enterprise-wide systems.

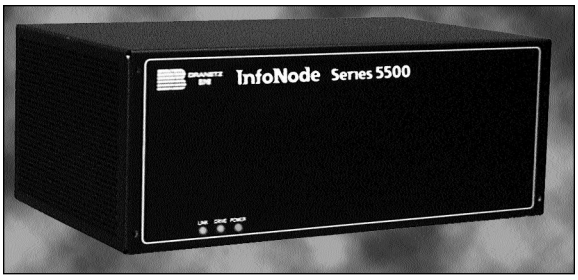
DataNodes gather readings from circuits and processes. Inexpensive, small and easy to install, DataNodes have the intelligence to convert raw readings into useful data. They communicate their data to InfoNodes through RS-485 or Ethernet links.

InfoNodes gather DataNode data, convert the data to information, manage and present the information. They form the central component of the whole Signature System. InfoNodes are equipped with Answer Modules which convert information into application-specific answers using patented and proprietary expertise developed by Electrotek Concepts, Electric Power Research Institute (EPRI) and Dranetz-BMI. These plug-in application-specific answers will cover applications from identifying power disturbance origins, to reporting based on evolving standards, to predicting maintenance schedules at substations.



Signature System Architecture: A Conceptual Illustration

1 Series 5500 Overview



The Series 5500 InfoNode

InfoNode: The Central Component

The InfoNode is the central component of the Signature System, "the System that Learns from the Past, to Inform You in the Present, and Prevents Problems in the Future." The Signature System consists of one or more DataNodes (the data acquisition modules), connected to an InfoNode (the data storage and analysis module). Optionally, the data and information from multiple InfoNodes can be combined at the enterprise level using the NodeLink or NodeCenter software. InfoNodes can be accessed through either LAN or modem connections. See Chapter 14 *Specifications* for a detailed description of the InfoNode hardware.

The InfoNode provides the user interface through a self-contained web server. This frees the user from having to load software onto the user's PC or laptop. Access is possible from anywhere in the world, through the Intranet, Internet, or via a modem, with only a standard web browser (Microsoft® Internet Explorer V5.5 or higher or Netscape® Navigator 6.x or higher running the Sun Java Virtual Machine 1.3.x or higher (Sun Java VM 1.4.x is recommended)). Earlier versions of Netscape that use the Netscape Java VM are no longer supported. Access time is dependent primarily on the communication media, with a direct network connection being the fastest.

The InfoNode can also provide GPS time synchronization to the DataNodes with the optional GPS module.

Some of the most important options are the software Answer Modules. These options can be part of the initial purchase or easily added later. Data from one or more DataNodes is analyzed to provide such answers as the direction of the PF cap switching transient (upstream or downstream), sag directivity, location of faults on radial feeders, reliability-benchmark indices for power quality, and different characterizations of data, such as QOS (Quality of Supply), IEEE 1159, EPRI DPQ.

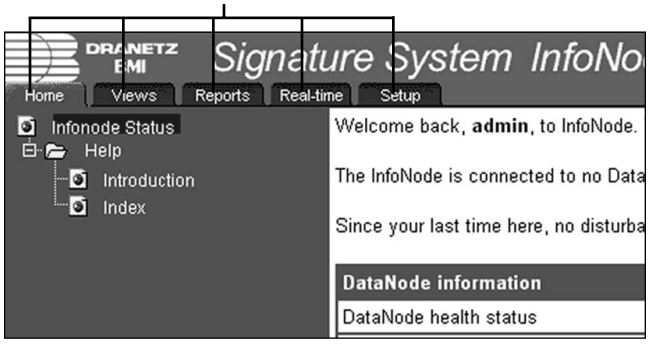
Signature System InfoNode Graphical User Interface

The InfoNode user interface consists of a series of tab pages. The pages are labelled as follows: Home, Views, Reports, Real-time, and Setup.

Each tab page has its own tree directory located in the left window pane. The tree can be expanded or collapsed. Click on the plus (+) sign to expand the tree and show more options available. Click on the minus (-) sign to collapse the tree one level backward.

All detailed tab page information is found in the right window pane. The InfoNode system provides a direct, no-fuss interface which displays information called out in tab, hyperlink and button format. Each tab is provided with a Help option to provide users with immediate, onscreen assistance. Below is a sample screen showing the five main tab pages of the Signature System InfoNode.

main menu tabs of the InfoNode System



The Home page provides basic status information about the InfoNode and DataNodes connected, along with easy access to the first, last, and most recent events in memory.

The Views page provides access to three interactive sections: the QOS (Quality of Supply) Status, Timeline, and Smart Views. The QOS module is designed to monitor and report quality of supply compliance as specified by European Standard EN50160. QOS Status will appear in InfoNode systems that have QOS data acquisition modules (5560 DataNode) in it. The Timeline is a two pane browser, with the timeplot of selected parameters and channels in the top pane, and the event list and details (waveshapes) in the lower pane. The Smart Views include: 3D RMS Mag/Dur (Magnitude/ Duration), RMS Mag/Dur, Smart Trends, Event Summary, RMS Variations, Snapshots, and Transients.

The Reports page is used to generate reports formatted for direct printing, through Smart Reports and Standard Reports. Smart Reports have pre-selected output formats and include: DataNode Summary, Voltage Quality, Energy & Demand, Event Summary, and Top 10 Events. Standard Reports have output formats that can be customized by the user and include: Event Summaries, Top 10 Events, Event Statistics, Quality of Supply, Waveform Distortion, Energy & Demand, and InfoNode Summary. The Answer Module is a customized facility which enables you to identify the source, cause and time of faults or disturbances like sags and swells. The system is able to record and document the source of the problem, whether coming from inside your facility or in the supply from your power supplier.

The Real-time page displays real time metered data in one of three formats: Meter Panel, Meter Dial and Scope Mode. Meter Panel shows a textual list of metered parameters for the selected DataNode. Parameters displayed are those configured for logging and trending. Meter Dial shows the same information as Meter Panel but in an analog meter dial format. Scope Mode shows real time waveforms for all enabled channels in an oscilloscope type of display. Note that Scope Mode is not available for all DataNode types.

The Setup page allows the user to configure both the InfoNode and any DataNodes connected to it. Additional users and their access permissions and passwords are programmed on this page. Additional DataNodes connected to the InfoNode are also set up on this page. Other parameters which you can view and/or customize (depending on your user access privilege) are: Notifications, Communications, Answer Module, DataNodes.

InfoNode Access Levels

The InfoNode firmware can function at different security levels: *Guest, Viewer, Operator* and *Administrator.*

Guest: Can view data only. Cannot change any settings or data.

Viewer: Can view data and change their own password and display settings.

Operator: Can change DataNode settings (e.g. instrument thresholds), upload and delete measurements.

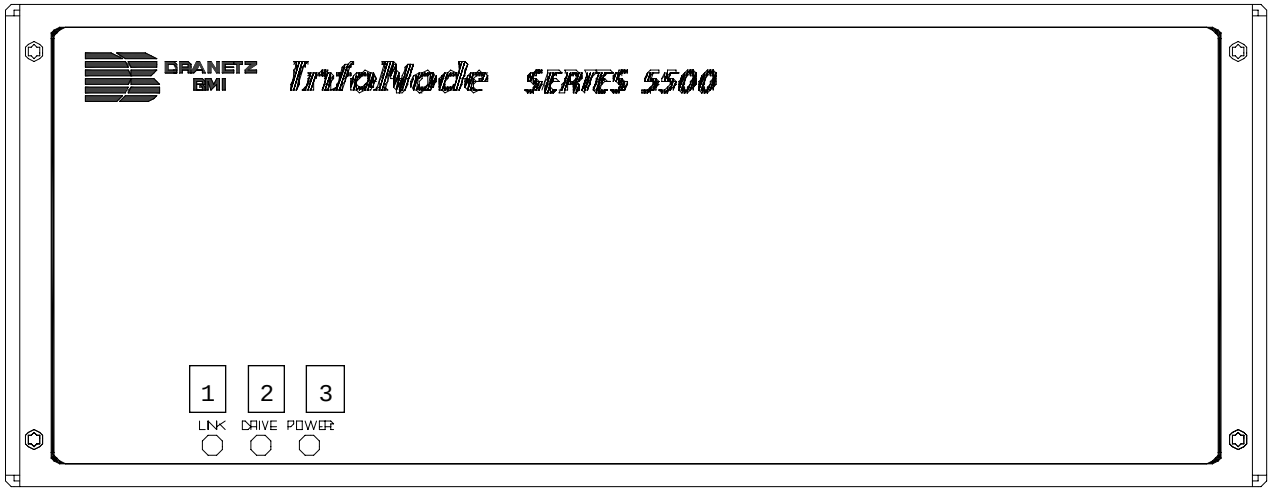
Administrator: Full access to all settings (e.g. Network, Time, Locale, Users).

The Administrator mode is accessible to users with administrative privileges. This mode is not normally used except to initially configure the InfoNode, upload new firmware, or run extensive diagnostic tests on the system.

Standard and Optional Accessories

A power cord (P/N 900744) and this User's Guide (P/N UG-INODE5500) are included with the Series 5500 InfoNode as standard accessories. A variety of optional equipment is available. See Chapter 13 *Optional Equipment* for details.

Series 5500 Overview

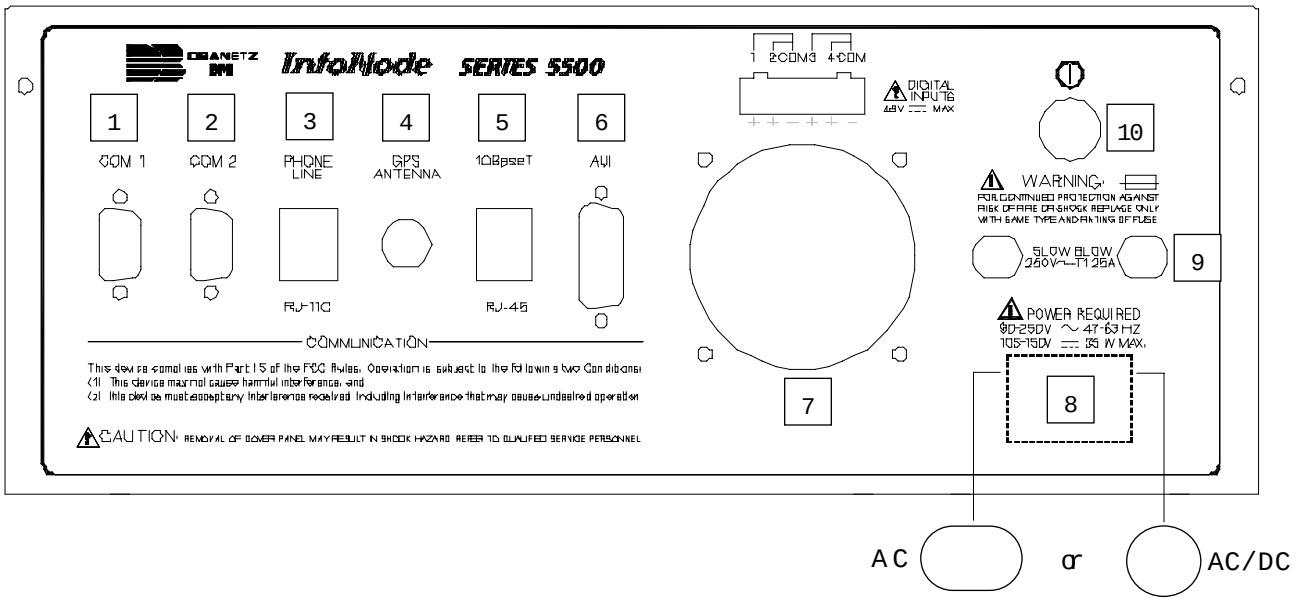


Series 5500 Front Panel

1 **LINK** - Indicator lamp will flash when the unit is responding to network requests.

2 **DRIVE** - Indicator lamp will flash when the unit's database is being read or written to.

3 **POWER** - Indicator lamp will flash when the unit is operating normally.
NOTE: *All three lamps will flash simultaneously when the unit is in Administrator mode.*



Series 5500 Rear Panel

1 **COM 1** - Serial communications port 1. Use for connection with DataNodes (7100 or 5540) or with PC serial port for administrative tasks.

2 **COM 2**- Serial communications port 2. Use for connection with DataNodes (7100 or 5540).

3 **Phone Line (RJ-11C)** - Allows modem communication via telephone line.

4 **GPS Antenna** - Allows connection of GPS antenna.

5 **10BaseT (RJ-45)** - Allows connection to Ethernet.
NOTE: *Normal factory unit setting is with the AUI port disabled.*
Only one network connection media type may be active at a time.
Choosing to enable the AUI port results in disabling the 10BaseT port.
The AUI port may be enabled "Only by a Qualified Person" by installing a shunt jumper at location J35 pins 1-2. This area is located adjacent to pin 30 of the boot ROM (U23) and near the 4 rectangular LED's on the main CPU board.

6 **AUI** - Auxiliary Universal Interface. For use with fiber optic adapter or other Ethernet transceiver.

7 **Cooling fan** - Runs continuously while unit is on.

8 **Line power**
AC only power version - 90-250V ac, 47-63 Hz.
AC/DC power version - 90-250V ac, 47-63 Hz. and 105-125V dc, 35W max.

9 **Fuses** - Slow blow, 250V ac T 1.25A.

10 **Power switch** - Press to turn unit power on or off. Power indicator lamp on front panel will glow while unit is on.
NOTE: *Power indicator lamp will glow for approximately 5 seconds after unit is powered off.*

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Initial Setup and Configuration

NOTE: The following procedures are for first time set up and configuration of an InfoNode. If the unit is already set up and configured, proceed directly to the section entitled *Communicating with the InfoNode* on page 2-4.

The Series 5500 InfoNode should be handled with care. After unpacking the unit, verify that all items ordered have been accounted for. Contact Dranetz-BMI if any items are missing or damaged.

It is possible to communicate with the InfoNode using either or both of the following methods: modem or Ethernet (10BaseT). The InfoNode has an optional built-in modem. Each communication method requires a specific configuration procedure, detailed below. For initial setup, follow the appropriate *Getting Started* section (modem or Ethernet) for your installation.

Position the InfoNode on a dry, flat surface in the desired mounting area. The unit is designed for use inside an appropriate enclosure. Access to the appropriate power and communication connections is necessary.

Refer to the illustration on page 1-5 of Chapter 1, *Series 5500 Overview* for location of the various connectors on the rear panel of the unit.

Getting Started (modem users)

NOTE: If the default modem IP address will not be used or to change the modem IP address, proceed directly to the section entitled *Changing the Modem IP Address* on page 2-3. If using the default modem IP address, continue with the following procedure.

1. Unpack the unit and set up on an appropriate indoor surface. Allow the unit to reach ambient temperature before use. This assures proper operation within design specifications.

2. Connect the supplied AC power cord to the unit and to an appropriate outlet. Observe the power ratings marked on the rear panel. *Do not turn the unit on until instructed to do so by this procedure.*

3. Connect the telephone communications cable (user supplied) to the appropriate connector on the rear panel of the InfoNode, labeled Phone Line (RJ-11C).

4. Turn the InfoNode on by pressing the Power button on the rear panel. The Power light on the front panel should illuminate. It takes approximately two minutes for the unit to go through the initialization sequence.

5. To communicate with the InfoNode, use a computer running Microsoft® Internet Explorer V5.5 or newer or Netscape® Navigator V4.75 with Windows 95/NT or higher.

6. From the desktop, double click on the *My Computer* icon, then double click on *Dial-up Networking*.

NOTE: Some operating systems may require you to log in as the local administrator to make these changes. Consult your MIS Administrator for details.

7. Create a new connection site by double clicking on the *Make New Connection* icon.

8. Follow the screen prompts in the dialog boxes and enter the appropriate information for your location.

9. Once the new connection site has been created, the new icon representing the information you have entered will appear in the *Dial-up Networking* folder.

10. Click once on the new icon to highlight it. Select *File>Properties.* A general dialog box will appear. In the *Connect using* section, click on *Server Type*.

11. Enable *only* the following settings:
    Type of Dial-Up Server:
    - •PPP: Windows 95, Windows NT, Internet...

    Advanced options:
    - •Log on to network
    - •Enable software compression

    Allowed Network protocols:
    - •TCP/IP

12. Click on *TCP/IP Settings.* Select *Specify an IP address.* Enter the default IP address for your computer's modem interface in this connection profile: **192.168.1.5**. Contact your MIS Administrator if you need to use a different IP address.

NOTE: The first three groups of numbers in the TCP/IP address must be the same for dial-up networking and the InfoNode's internal modem. The default address is 192.168.1.X, where X is "5" for dial-up networking and "10" for the InfoNode's internal modem.

Enable the *Server assigned name server addresses* and select *Use IP header compression*. Click on *OK* when done. Click on *OK* on both the *Server Types* screen and the *General* screen.

13. The web browser must also be configured for dial-up networking. Disable the *Proxy server* in the Internet Explorer or Navigator connection configuration. Contact your MIS administrator for information if you are not sure how to do this.

14. Double click on the new icon to launch the connection to the InfoNode.

15. When the *Connect to* screen appears, enter the proper user name and password.
Default user name: **viewer**
Default password: **password**
Press *Enter* or click on *OK.*

16. During the connection process, various screen messages will appear indicating connection status. Finally, the message "Connected at..." will be displayed.

17. Once connection has been established, launch Internet Explorer or Navigator. This is typically done by double clicking on *The Internet* icon located on the desktop.

18. Proceed to the section entitled *Communicating with the InfoNode* on page 2-4*.*

Getting Started (ethernet users)

1. Unpack the unit and set up on an appropriate indoor surface. Allow the unit to reach ambient temperature before use. This assures proper operation within design specifications.

2. Connect the supplied AC power cord to the unit and to an appropriate outlet. Observe the power ratings marked on the rear panel. *Do not turn the unit on until instructed to do so by this procedure.*

3. Connect the Ethernet communications cable (user supplied) to the appropriate connector on the rear panel of the InfoNode, labeled 10BaseT (RJ-45).

4. Connect the female end of a 9-pin null modem cable (user supplied) to the connector labeled COM1 on the rear panel of the InfoNode. Connect the other end of this cable to the COM1 or COM2 port of the computer being used for this installation.

5. **Configuring the HyperTerminal**. From the desktop, click *Start>Programs>Accessories>HyperTerminal.*

6. Locate the file named "Hypertrm.exe" and double click on this file to launch it.

7. The *Connection Description* screen will appear. Enter the desired name for this connection and select the desired icon for it. When done, click on *OK*.

8. The *Phone Number* screen will appear. Do not enter a phone number. Go to the *Connect Using* section of this screen. Use the scroll button to find the computer port being used for connection with the InfoNode (e.g. Direct to COM1). Select the correct port by clicking on it. The screen should now display the proper information in the *Connect Using* box. Click on *OK*. (Contact your MIS Administrator if you are not sure how to configure the HyperTerminal)

9. The *Port Settings* screen for the selected port will appear. Enter or verify the following settings:
Bits per second: 9600
Data bits: 8
Parity: None
Stop bits: 1
Flow control: None
When done, click on *OK*.

10. Turn the InfoNode on by pressing the Power button on the rear panel. The Power light on the front panel should illuminate.

11. Wait approximately 30 seconds until the HyperTerminal screen displays a connection message from the InfoNode. Press the *Enter* key within 5 seconds of the appearance of this message to place the unit into Console mode (A countdown message will appear on the screen during this period, i.e. 5..4..3..2..1..0). If the unit does not

enter Console mode it will continue with the boot sequence. Should this occur, turn the InfoNode off, wait 30 seconds and return to Step 10.

12. At the Login prompt, type **admin**
At the Password prompt, type **password**
Press *Enter.*

13. The screen should now display the DMM> prompt. At the prompt, type **showip** and press *Enter*. The current IP parameters will be displayed. You may wish to make a note of the current settings before making any changes.

NOTE: The unit will automatically exit Console mode if no command is received after ten minutes. For a list of commands, type **help** at the prompt and press *Enter*.

14. **Configuring the The Ethernet IP address, Gateway and DNS.** These settings may need to be changed to allow the InfoNode to operate on your network. Consult your MIS Administrator if you are not sure of the correct information. After you have determined the proper IP address and settings, proceed as follows.

15. **To set your Ethernet IP address:** At the DMM> prompt, type **setipe** *your Ethernet IP address* (e.g. **setipe 192.168.0.10**) and press *Enter*.

16. **To set your Gateway:** At the DMM> prompt, type **setgw** *your Gateway* (e.g. **setgw 192.168.0.1**) and press *Enter*.

17. **To set your DNS:** At the DMM> prompt, type **setdns** *your DNS* (e.g. **setdns 192.168.0.16**) and press *Enter*.

NOTE: The Ethernet Subnet Mask may also need to be changed in some installations. Consult your MIS Administrator for information.

18. **To set your Ethernet Subnet Mask:** At the DMM> prompt, type **setmaske** *your Ethernet Subnet Mask* (e.g. **setmaske 255.255.255.0**) and press *Enter*.

19. **Verify if the desired information has been entered:** At the DMM> prompt, type **showip** and press *Enter*. The current settings will be displayed. If changes are needed, repeat steps 15-18.

20. **When finished entering settings:** At the DMM> prompt, type **reboot** and press *Enter*. The InfoNode will re-boot. Exit the HyperTerminal screen and save the file for future use (e.g. to configure other InfoNodes using the same settings).

21. After the InfoNode has re-booted (approximately two minutes) launch Internet Explorer or Navigator. This is typically done by double clicking *The Internet* icon located on the desktop.

22. Proceed to the section entitled *Communicating with the InfoNode* on page 2-4.

Changing the Modem IP Address

NOTE: The first three groups of numbers in the TCP/IP address must be the same for dial-up networking and the InfoNode's internal modem. The default address is 192.168.1.X, where X is "5" for dial-up networking and "10" for the InfoNode's internal modem.

1. Unpack the unit and set up on an appropriate indoor surface. Allow the unit to reach ambient temperature before use. This assures proper operation within design specifications.

2. Connect the supplied AC power cord to the unit and to an appropriate outlet. Observe the power ratings marked on the rear panel. *Do not turn the unit on until instructed to do so.*

3. Connect the telephone communications cable (user supplied) to the appropriate connector on the rear panel of the InfoNode, labeled Phone Line (RJ-11C).

4. Connect the female end of a 9-pin null modem cable (user supplied) to the connector labeled COM1 on the rear panel of the InfoNode. Connect the other end of this cable to the COM 1 or COM 2 port of the personal computer being used for this installation.

5. **Configuring the HyperTerminal**. From the desktop, click on *Start>Programs>Accessories>HyperTerminal.*

6. Locate the file named "Hypertrm.exe" and double click on this file to launch it.

7. The *Connection Description* screen will appear. Enter the desired name for this connection and select the desired icon for it. When done, click on *OK*.

8. The *Phone Number* screen will appear. Do not enter a phone number. Go to the *Connect Using* section of this screen. Use the scroll button to find the computer port being used for connection with the InfoNode (e.g. Direct to COM1). Select the correct port by clicking on it. The screen should now display the proper information in the *Connect Using* box. Click on *OK*. (Contact your MIS Administrator if you are not sure how to configure the HyperTerminal)

9. The *Port Settings* screen for the selected port will appear. Enter or verify the following settings:
Bits per second: 9600
Data bits: 8
Parity: None
Stop bits: 1
Flow control: None
When done, click on *OK*.

10. Turn the InfoNode on by pressing the Power button on the rear panel. The Power light on the front panel should illuminate.

11. Wait approximately 30 seconds until the HyperTerminal screen displays a connection message from the InfoNode. Press the *Enter* key within 5 seconds of the appearance of this message to place the unit into Console mode (A countdown message will appear on the screen during this period, i.e. 5..4..3..2.. 1..0). If the unit does not enter Console mode it will continue with the boot sequence. Should this occur, turn the InfoNode off, wait 30 seconds and return to Step 10.

12. At the Login prompt, type **admin**
At the Password prompt, type **password**
Press *Enter.*

13. The screen should now display the DMM> prompt. At the prompt, type **showip** and press *Enter*. The current IP parameters will be displayed. You may wish to make a note of the current settings before making any changes.

NOTE: The unit will automatically exit Console mode if no command is received after ten minutes. For a list of commands, type **help** at the prompt and press *Enter*.

14. **To set your Modem IP address:** At the DMM> prompt, type **setipm** *your modem IP address* (e.g. **setipm 192.168.1.10**) and press *Enter*.

NOTE: The Modem Subnet Mask may also need to be changed in some installations. Consult your MIS Administrator for information.

15. **To set your Modem Subnet Mask:** At the DMM> prompt, type **setmaskm** *your Modem Subnet Mask* (e.g. **setmaske 255.255.255.0**) and specify the number of bits (e.g. 24), then press *Enter*.

16. **Verify if the desired information has been entered:** At the DMM> prompt, type **showip** and press *Enter*. The current settings will be displayed. If changes are needed, repeat steps 14-15.

17. **When finished entering settings:** At the DMM> prompt, type **reboot** and press *Enter*. The InfoNode will re-boot. Exit the HyperTerminal screen and save the file for future use (e.g. to configure other InfoNodes using the same settings).

18. Continue with *Getting Started (modem users)*, step 6.

Communicating with the InfoNode

NOTE: If you are using a modem, you must dial into the InfoNode prior to the procedure below.

1. Enter the IP address for the InfoNode in the Internet Explorer or Navigator *Address* box (Default address: **192.168.1.10**). Press *Enter*.

2. The *Enter Network Password* dialog box will appear. Enter the proper user name and password.
Default user name: **admin**
Default password: **password**
Press *Enter* or click on *OK*.

3. Connection with the InfoNode will now be established and the Series 5500 InfoNode home page will appear on screen. The following main menu tabs are available: *Home, Views, Reports, Real-Time, Setup*.

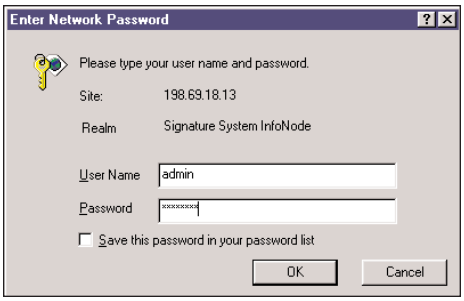
NOTE: Detailed information about the menu tab selections is contained in the next Chapters of this manual and in the on-screen Help. General information required to begin operation is provided in the next section. Administrative privilege is required to perform the operations described next.

This chapter explains how authorized users log in and access the InfoNode system.

Log-in

Before gaining access to the Home page, the user must first log-in using a proper user name and password. If the user name or password is not correct, the Enter Network Password dialog box shown below will re-appear. Setting up the names, passwords, and privilege level require administrative permission (see Chapter 7 *Setup Page*, *Users* section).

Contact your InfoNode Administrator (someone with Admin privileges) to set up your user account in order to access the system. Only the Administrator can create accounts for other people and change Security Levels. The system is shipped with a default Admin account, which the Administrator should customize with your own user name and password.



Enter Network Password dialog box

NOTE: When you upgrade your operating InfoNode firmware version, the Signature System Java Classes will automatically be installed in your computer upon log-in. The Java wizard program will install the setup files necessary for your computer to support the Signature System interactive controls. If you do not allow installation of the Java program, then some InfoNode screens will not be visible and you will not be able to take advantage of some features of the Signature System. The setup program will not change any system configuration. It just stores a small number of Java files on your computer. Once installation is done, the program will prompt you to click on Finish to complete setup. You may have to restart your web browser once setup is complete.

Home Page

The Home page provides basic system status information, and links to events that occurred since you last logged on. The Home page is automatically displayed after successfully logging on, or by selecting the Home tab.

In the left-hand frame of the page, you will see the InfoNode Status and Help options. The InfoNode Status displays general information on both the DataNode and InfoNode (see sample screen display next page). Click on one of the underscored links or hyperlinks on the right-hand screen display to go directly to the event detail or status information.

You may log out of the InfoNode at any time by closing your browser.

Note that some pages may take longer than usual to download when viewed for the first time, or after a firmware revision has been uploaded to the InfoNode.

The standard home page can be modified or replaced with a custom HTML page at extra cost. Please contact the Dranetz-BMI Customer Service Department:
Phone: (732) 287-3680 or 1-800-DRANTEC
Web: http://www.dranetz-bmi.com

InfoNode Status

The InfoNode Status table provides general information about the InfoNode and the data that it retrieved from the connected DataNodes, including the following:

DataNode Information

DataNode health status is based on continual checks of the communication links and internal processes.

Database usage shows the amount (%) of memory used. As a reference, the total available memory is shown.

# of Disturbances *(Total disturbances, First disturbance, Last disturbance)* is defined by the type of DataNode connected. For a power quality-type DataNode, these include events triggered by limit or threshold crossings.

# of Disturbances (*Since your last logon, In the last 48 hours*) is the amount of events that have occurred since the user last logged on and in the last 48 hours. *#Disturbances* is linked to the Event SummaryView.

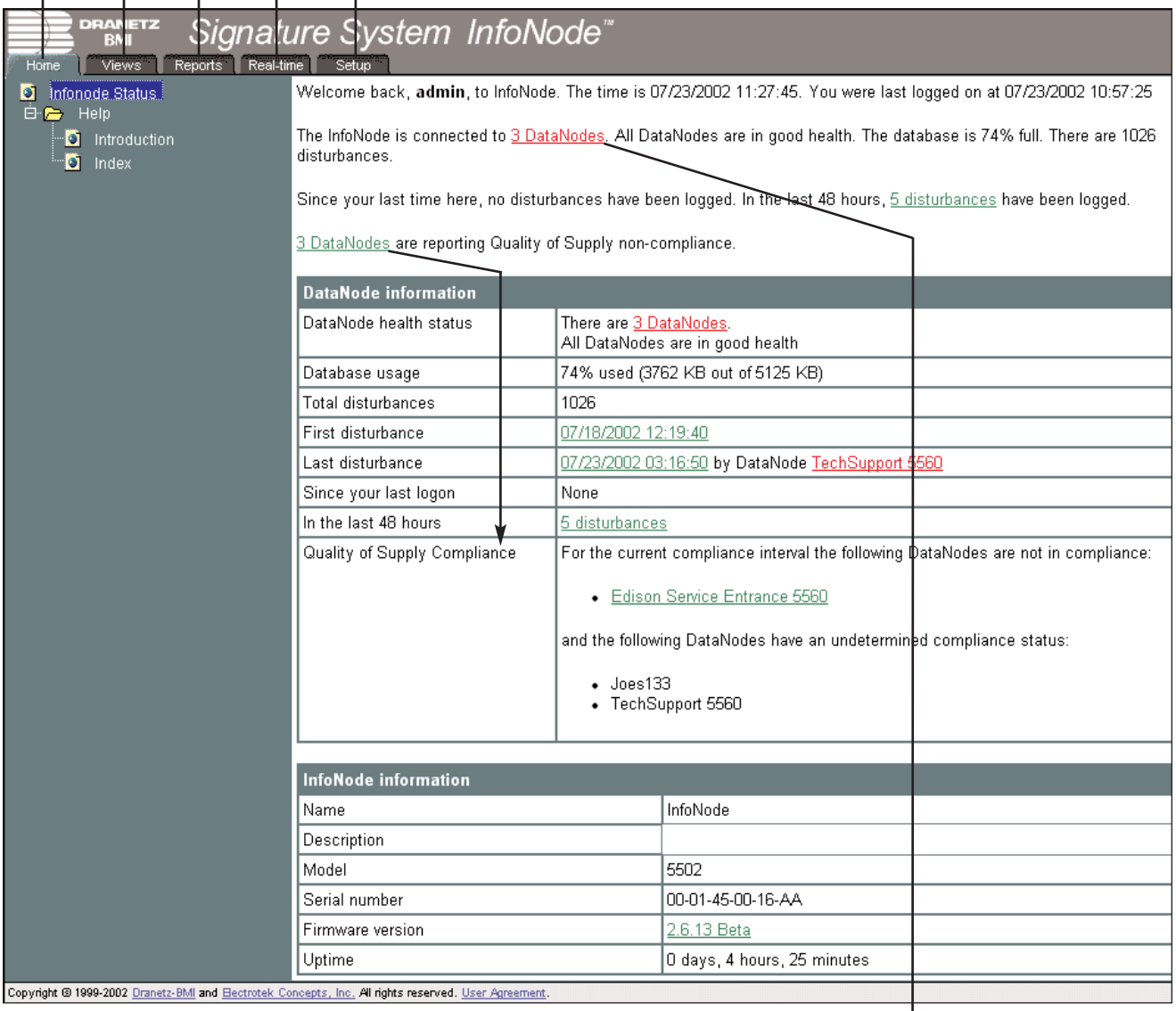
DataNode Status

You can select the DataNode Status from either the linked text on the Home Page, or by selecting the Setup tab and clicking on the desired DataNode site in the tree directory. This page provides information about specific DataNodes connected to the InfoNode. This includes DataNode *Description*, the *Last Connection* made, DataNode site *Health* status, DataNode *Model* type, *Serial number*, and software *Version*.

Home Page

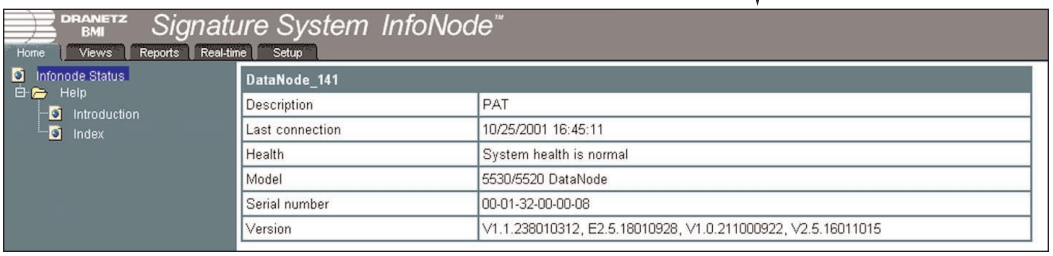
Home, Views, Reports, Real-time: where DataNode settings are displayed in meaningful format

Setup: where users view and/or customize the Datanode settings



InfoNode Home page

click any DataNode hyperlink to view specific DataNode information



Quality of Supply (QOS) Compliance
NOTE: Information on QOS Compliance only appears when the 5560 DataNode support package (SW-IAP60) is installed.

The Home page reports Quality of Supply compliance status for the latest complete evaluation period of each DataNode. Information about QOS compliance appears in two parts of the Home page: the DataNode status paragraph and the DataNode status table.

Compliance Message on DataNode Status Paragraph
An additional message on QOS compliance is appended to the DataNode Status. Sample messages include “3 DataNodes are reporting Quality of Supply non-compliance" or “One DataNode is having problems. 2 DataNodes are inactive." Like other DataNode messages in the status paragraph, the compliance message is hyperlinked to the Quality of Supply Compliance section in the DataNode status table.

Compliance Message on DataNode Status Table
An additional section showing the compliance status of DataNodes is added to the DataNode status table. The table indicates which DataNodes are in compliance, not in compliance, or have undetermined compliance status for the specified interval. DataNodes that are non-compliant are hyperlinked to the QOS Status view.

InfoNode Information
This table provides the following information about the InfoNode: *Name*, *Description*, *Model*, *Serial number*, *Firmware version* containing the different support packages installed in the InfoNode, and *Uptime* duration.

Help
Much of what is written in this manual can be found in the Help option onscreen. Expanding the Help tree will produce Introduction and Index links.

Introduction
The Introduction page orients users that they are currently viewing the Home page. Four active buttons are found in this page: Contents, Index, <<, and >>. These buttons present different ways to access the same Help information. The differences lay only in the way each button organizes and lists information.
The >> button brings the user forward to the next linked page. It covers information across pages in all tabs, not just the Home tab. Some pages have hyperlinks which contain further detailed information on the topic.
The << button brings the user backward to the previously linked page. It helps the user scan for information quickly and easily through the linked pages.

Index
The Index page operates exactly like the Index portion of a book. Information is listed and categorized in alphabetical order. Click any button from A to Z to show various related topics under each letter. The topics are featured as hyperlinks.

The Contents button operates exactly like the Table of Contents in books. Information is listed and organized under different headings. The headings normally used here are the menu tab names. Sub-topics per heading appear as hyperlinks.

This page intentionally left blank.

This chapter describes the various interactive graphical display screens formatted primarily for viewing data through the browser, as opposed to printing out. If you want to generate reports in print format, please select the Reports tab and turn to Chapter 5 *Reports Page*.

General Procedures In Making Queries
The Views and Reports tabs both use a common Query section where you select whether to display graphs or reports in a new window or an existing window, select which DataNodes are to be included in the presentation, and over what time period to select the data from. To arrive at your desired information, follow the designated procedures below:

To Select Multiple DataNodes - keep the Control key depressed while using the mouse and its left button to select the DataNodes of choice.
NOTE: This option functions for all Views and Reports except the Timeline.

To Select the Time Range - select one of eight pre-formatted time-range radio buttons, or enter any valid starting and ending time/date range. Pre-filtered Time Ranges and their definitions include:

All Time - first event in memory to last event
Last Hour - previous hour from present time
Today - from 00:00 midnight of the present day until the present time
Yesterday - the 24 hour period ending at 00:00 midnight of present day
Last 48 Hours - previous 48 hours from present time
This Week - from 00:00 of Sunday of the present week until the present time
Last 7 Days - previous 7 days ending with 00:00 of today
Last 14 Days - previous 14 days ending with 00:00 of today
Last 30 days - previous 30 days ending with 00:00 of today
This month - from 00:00 of the first day of the month until present day
This year - from January 1 of the present year until the present day
Last year - from January 1 to December 31 of the previous year

To Customize Time/Date Ranges - enter the starting and ending month/day/year as well as hour/minute/second in the format selected in the Setup page (i.e. European date format, 24 hour military time, etc.)

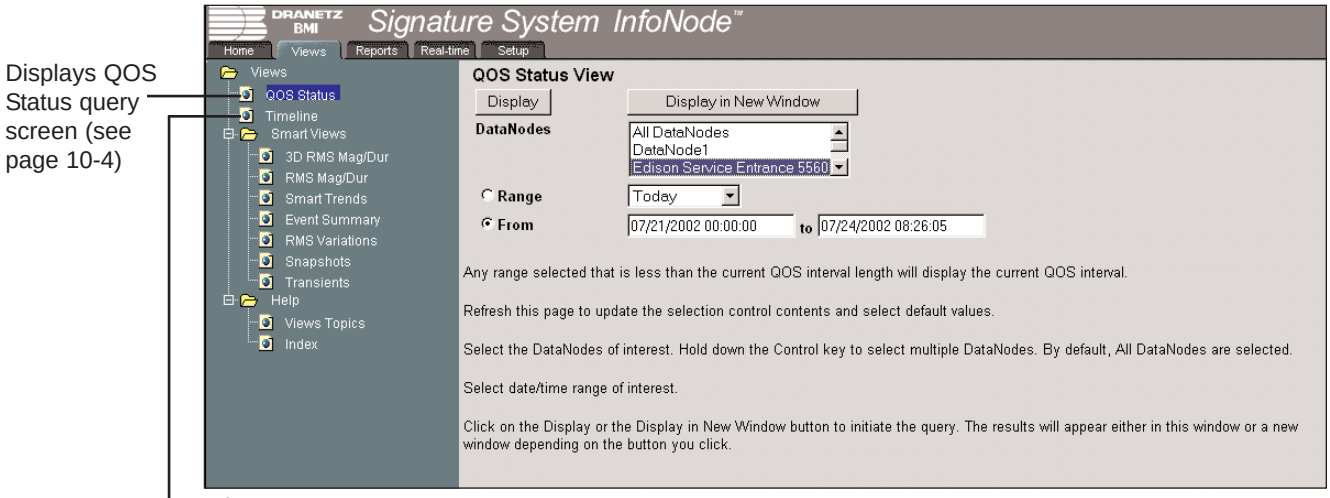
Views Page

The Views page offers three ways to display data sourced from the DataNode settings. First is through the QOS Status which displays data relative to quality of supply compliance. QOS Status appears in InfoNode systems that have 5560 DataNode in use. See page 10-4 for information on QOS Status. Second is through Timeline, featuring graphs of user-selected parameters over user-selected time periods. Third is through the Smart Views featuring different views of data that have been pre-filtered or specified based on typical uses of other Dranetz-BMI products. These include magnitude-versus-duration graphs, lists of all events or only those events that are classified by IEEE 1159 as RMS variations or transients.

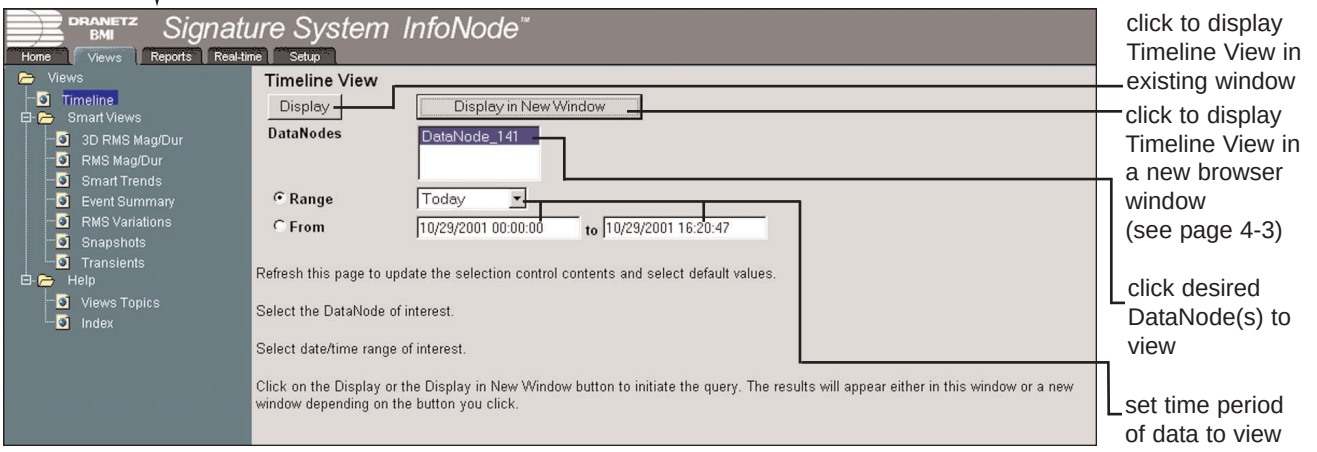
The left window pane contains the tree directory which presents the QOS Status (if 5560 DataNode is in use, see page 10-4), Timeline, Smart Views and Help options. Clicking on any Timeline or Smart View option will direct you to a common Query Section screen. The Query section is used to select which specific DataNode you want to view as well as the Time/Date Range when that particular DataNode information was captured. Once you have made those selections, click on either the *Display* or *Display in New Window* button to view the information that you are interested in.

The Timeline option displays a graph of user-selected parameters over a user-selected time period. For some parameters, the minimum, maximum and average values are plotted, along with event markers that indicate detailed waveform information also available at that specific time. The lower portion of the screen displays a list of events recorded over that time period.

Smart Views are similar to Reports of the same name, except that they are designed to be viewed onscreen instead of printed out. Smart Views selections include: 3D RMS Mag/Dur (Magnitude-and-Duration), RMS Mag/Dur, Smart Trends, Event Summary, RMS Variations, Snapshots, Transients.



Views Page



Query Section screen

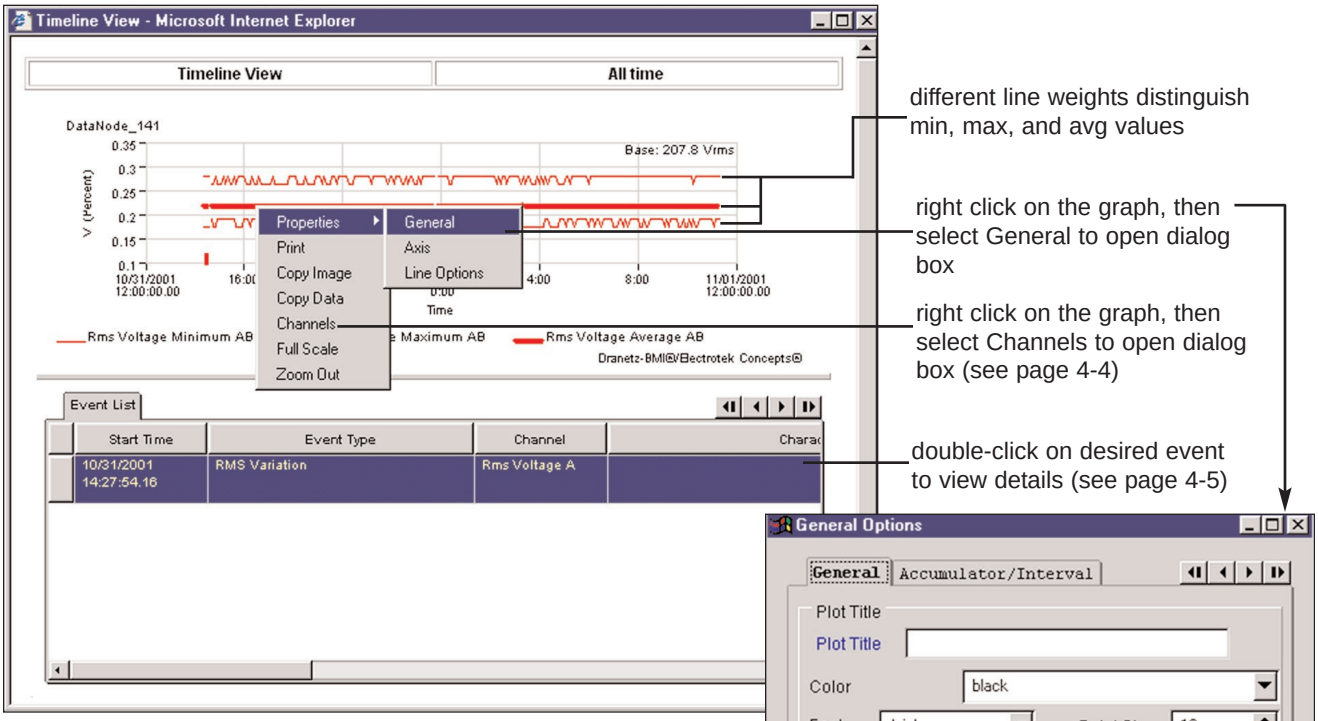
Timeline

Once the DataNodes and time ranges have been selected, you can select the *Display* or *Display in New Window* button to create a plot of one or two specified parameter(s) on the vertical axis and the time range on the horizontal axis. This plot is the Timeline View, which consists of two areas: the Timeline Graph (top) and the Event List/Detail (bottom). Click and drag the horizontal line that separates the two areas to enlarge either of them.

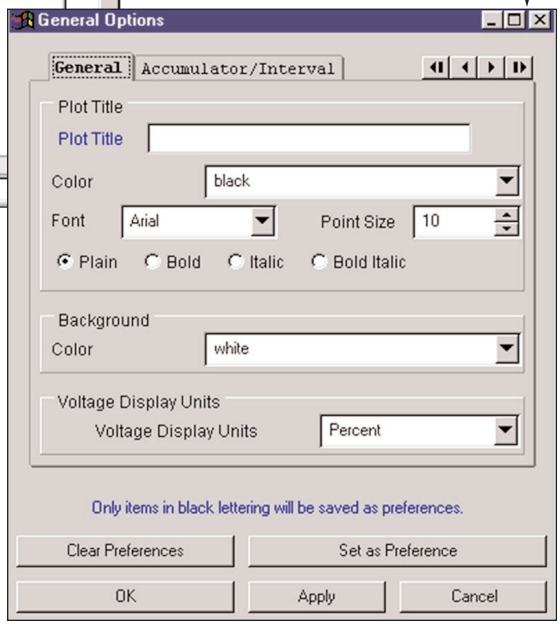
Timeline Graph

The Timeline graph is auto-scaled to use the maximum amount of space for viewing the data. Key features of the timeline graph include:

1. Graphs of the minimum, average and maximum values of the parameter over a user selectable time interval are simultaneously displayed. The default average value has a heavier line weight to distinguish it from the min/max lines.
2. Graphs will show any timed readings, limit crossing or threshold triggered events that occurred during the selected time range. These are indicated by an Event Marker on the horizontal time axis. Click on the event marker to display the Event Detail in the lower portion of the screen.
3. Graphs support zooming via a rectangle drag. Zooming in on specific data can be done in both the horizontal and vertical axis. Position the cursor into the graph area at one of the corners of the area of interest and depress the left mouse button while dragging the cursor towards the opposite corner of the area of interest. A box will appear as the mouse is moved, indicating the area being selected. Once the selection is complete, release the left mouse button. The display will be resized to show the area of interest.



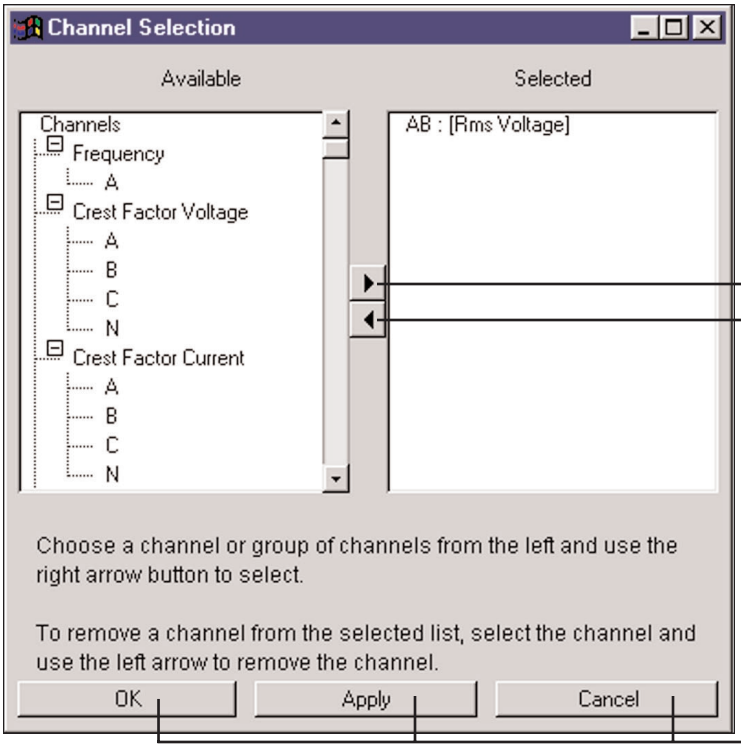
Timeline Graph and Event List display



The General Options dialog box provides additional options for altering the graph. This user preferences command is available only to users assigned the Security Level of Viewer, Operator or Administrator. This option is not available to Guests.

4. Graphs support a right mouse button context menu that displays additional options for altering the graph:
General Properties of the Timeline - will allow you to change the title of the graph, font type, font size, background color, and whether parameters are displayed in units of % or magnitude. In addition, accumulated data such as Energy can be set for display on an internal basis, in accumulated values, or as a normalized accumulated graph.
Axis Properties for the Timeline - will allow you to change the title, fonts, scaling for the horizontal time axis, label characteristics for the vertical axis, and grid color.
Print - will print and save in PQDIF format
Copy Image - will save the displayed timeline to a new window clipboard as a GIF file. This can then be saved to any folder using the standard browser File|Save As... command.
Copy Data - will allow you to copy the data that makes up the graph to the clipboard. Data can then be pasted into applications such as Excel.
Channels - channnels to be displayed can be selected from the expanding tree.
Full Scale - will return to the original, unzoomed data.
Zoom Out - will undo the previous zoom.

To Add/Remove Channel-Parameters: The Channel Selection box below allows the user to add or remove channels/parameters from the graph. If there is a plus sign [+], then you can click on the plus sign to further expand the tree to show more options available. A minus sign [-] shows that the tree directory has already been fully expanded. Clicking on the minus sign will collapse the tree back up one level.



To display an additional parameter for a specific channel, expand the tree to the necessary detail and then click on the item. Click on the right arrow in the middle to move the channel-parameter to the list of displayed data.

To move all channels of a given parameter at once to the display list, highlight the parameter (rather than the individual channel) then click on the right arrow key.

To remove a channel-parameter from the display list, highlight the parameter from the table on the right side then use the left arrow to move it out of the display list.

Once the selections have been made, click on the APPLY button to see the results without exiting the selection window. OK will exit the selection window and apply the changes. CANCEL will exit the window without applying the selection changes.

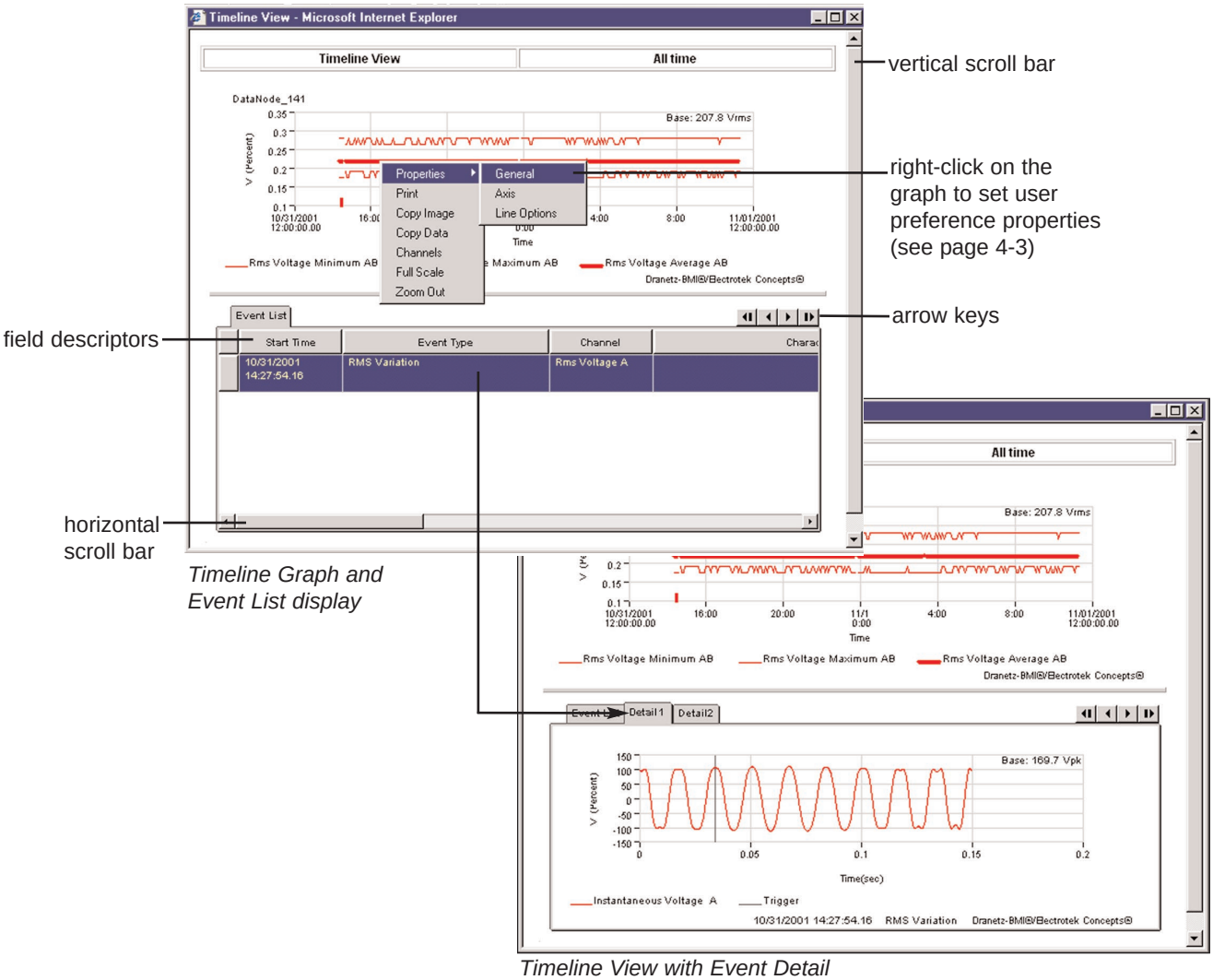
Event List/Detail

The Event List shows a tabular display of the limit crossing or threshold triggered events that are displayed in the timeline (see display screen below). The data associated with an event depends on the type of DataNode and type of event. Key features of the Event List/ Detail include:

1. The Event List table shows the *Time*/date of the event, *Event Type*, *Channel* (phase), and *Characteristic* (description) of the event. The description may contain additional information, such as minimum/maximum values, duration, frequency and category.
2. Events are listed from most recent to oldest.

NOTE: If there are a very large number of events in the range selected, only the most recent 250 events are listed.

3. To step through the events or to jump to the start or end of the list, click on the arrow keys in the upper right hand corner of the list. Use the horizontal and vertical scroll bars to pan through the Event Listing table. Click on the field descriptor on the top of the table to sort by that particular field, instead of chronological order.
4. If there are Event Details or waveforms associated with those events, they can be displayed in additional tabs. Double click on the row containing the event of interest. This will produce additional tabs showing the event details.
5. The event detail viewer supports overlay of multiple channels with left and right axes.
6. You can zoom on the waveform by using the left mouse button as was done in the Timeline Graph section.
7. Click the right mouse button with the cursor in this display area to produce a similar menu to the Timeline Graph section to allow you to change the properties of the graph, as well as save the image.
8. Click on the arrow keys in the upper right corner to step through the available waveforms.



Timeline Graph and Event List display

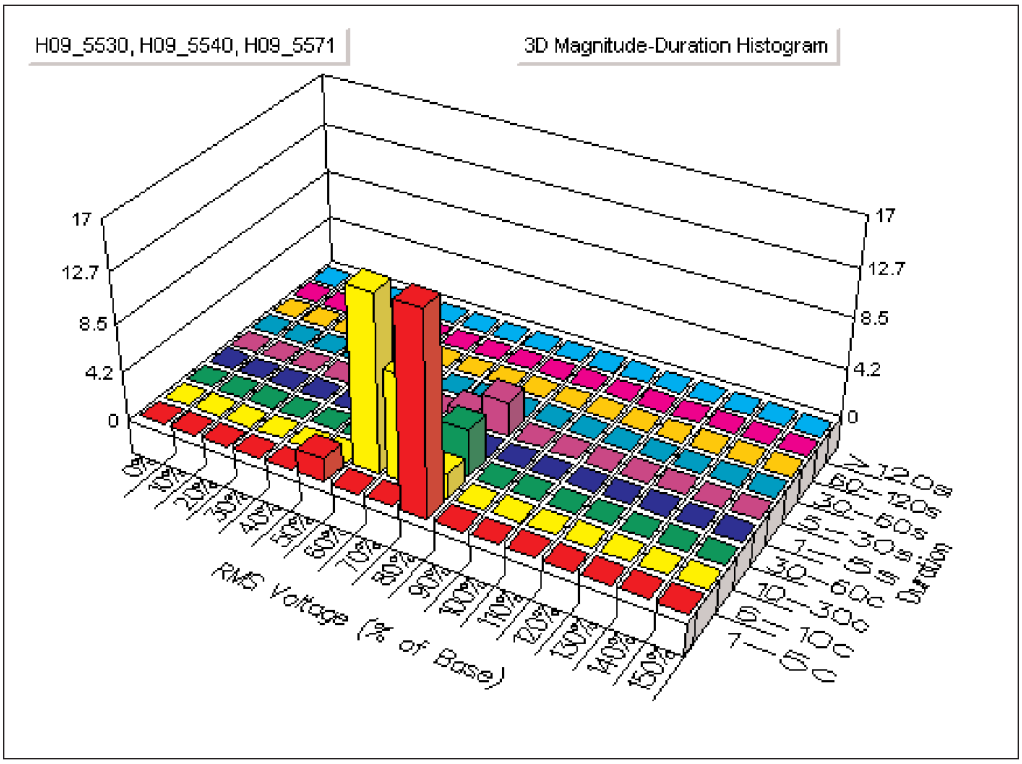
Timeline View with Event Detail

Smart Views

There are a number of different views of the data that have been specified by type. These include magnitude-versus-duration graphs, lists of all of the events, or lists of events that are classified by IEEE 1159 as RMS variations or transients. The same Query Section in the Timeline appears to allow you to select what date/time range and which DataNodes are to be included in the views.

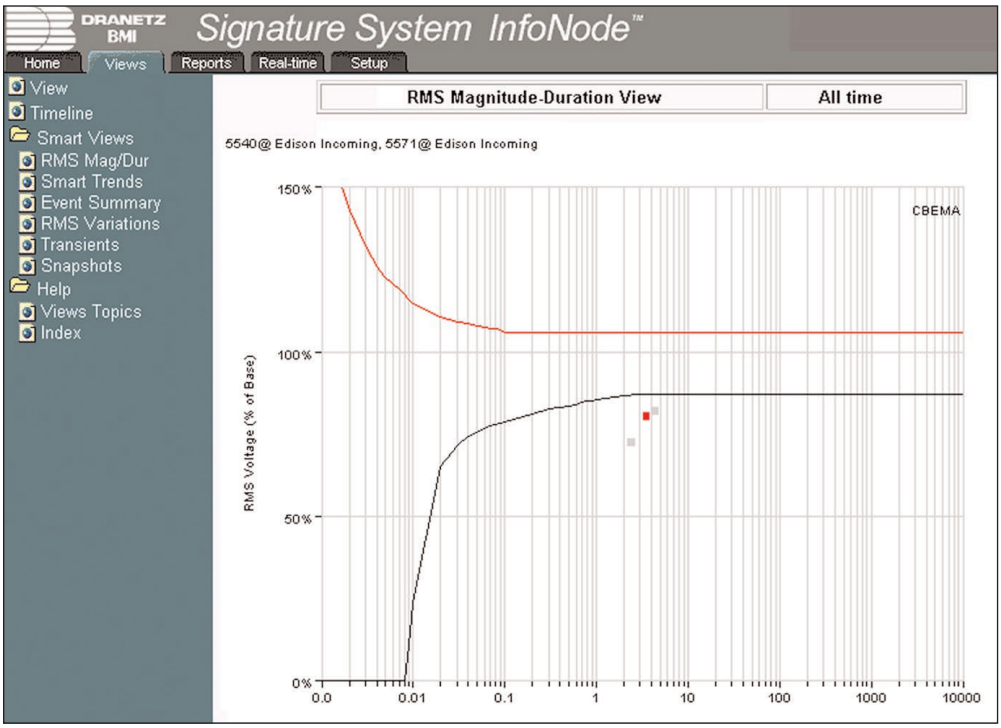
3D RMS Mag/Dur View

3-D Mag-dur graphs show the number of RMS variations of a specified range of magnitude and duration, also called bins. For example, an RMS variation with a magnitude of 80-90% of nominal and 1-5 cycles in duration is one bin, whereas 80-90% and 10-30 cycles is another, 70-80% and 10-30 cycles is another, and so on. Each time that the characteristics of an RMS variation match the criteria of the bin, the counter is incremented. Certain types of phenomena are typically found in certain bin groupings such as: sags cleared by fuses versus sags cleared by breaker operations; versus sags caused by the starting of large horsepower motors; versus the swells caused by loads being turned off and the response time of the automatic tap changer. In the 3-D mag dur graph, it is a quick visual way to see what category most of the disturbances fall into. This helps determine the source of the disturbance.



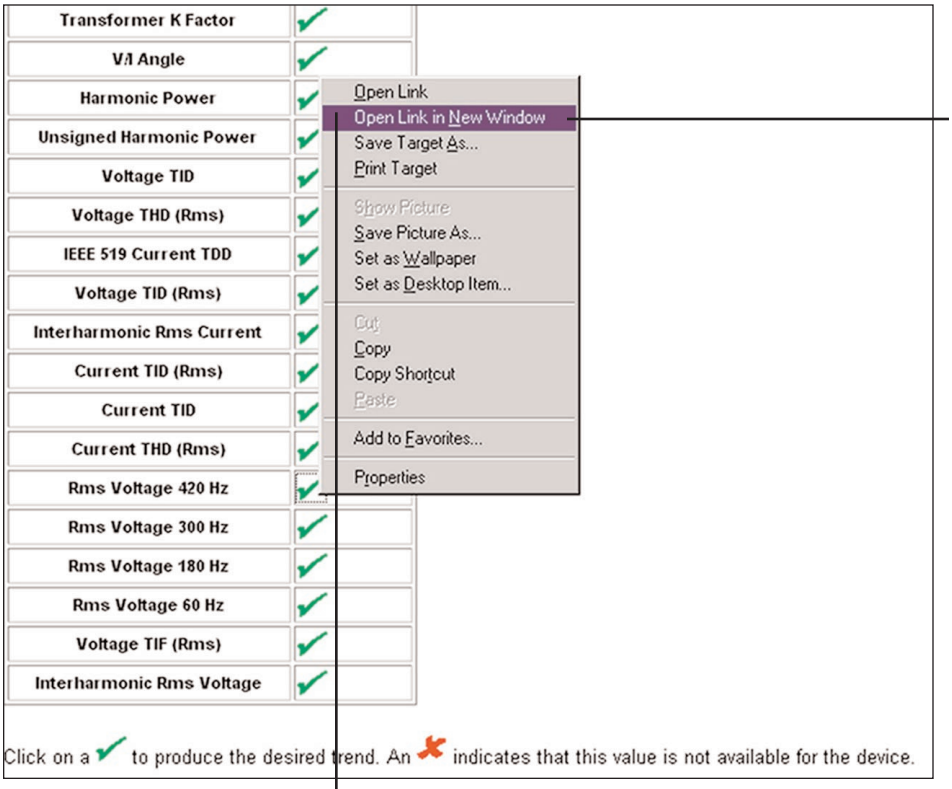
RMS Mag/Dur View

The RMS Magnitude-and-Duration graph is a plot of the magnitude of the event versus duration of the event with the time plotted on a logarithmic scale. A data point is plotted for each event and the graph is overlaid with equipment susceptible or safe-operating type curves, such as the ITIC curve or CBEMA. Events that fall between the two curves will not usually cause equipment to malfunction (equipment with a similar set of susceptibles to those used to develop the curve), whereas those outside the limits are likely to cause problems.

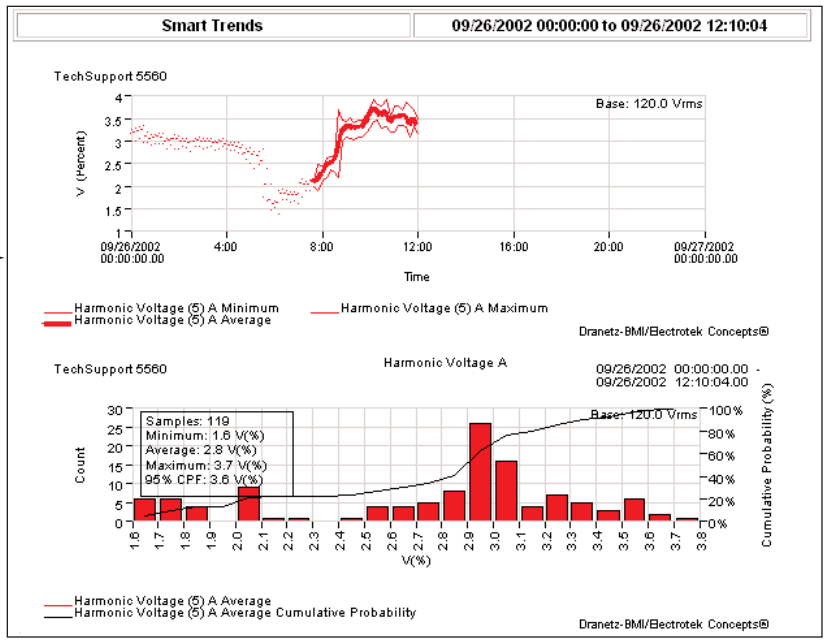


Smart Trend

Smart Trend will display a timeline type graph for a large range of parameters, based on the type of DataNode and which parameters were saved for trending. After using the standard query to select the DataNodes and time/date range, a display of all possible parameters that can be trended is shown. Clicking on a green check mark onscreen will trend that parameter for the selected phase and will also show a histogram of the different values with a cumulative probability line. Red X marks onscreen indicate that the particular parameter is not available for trending. See sample display screens below.

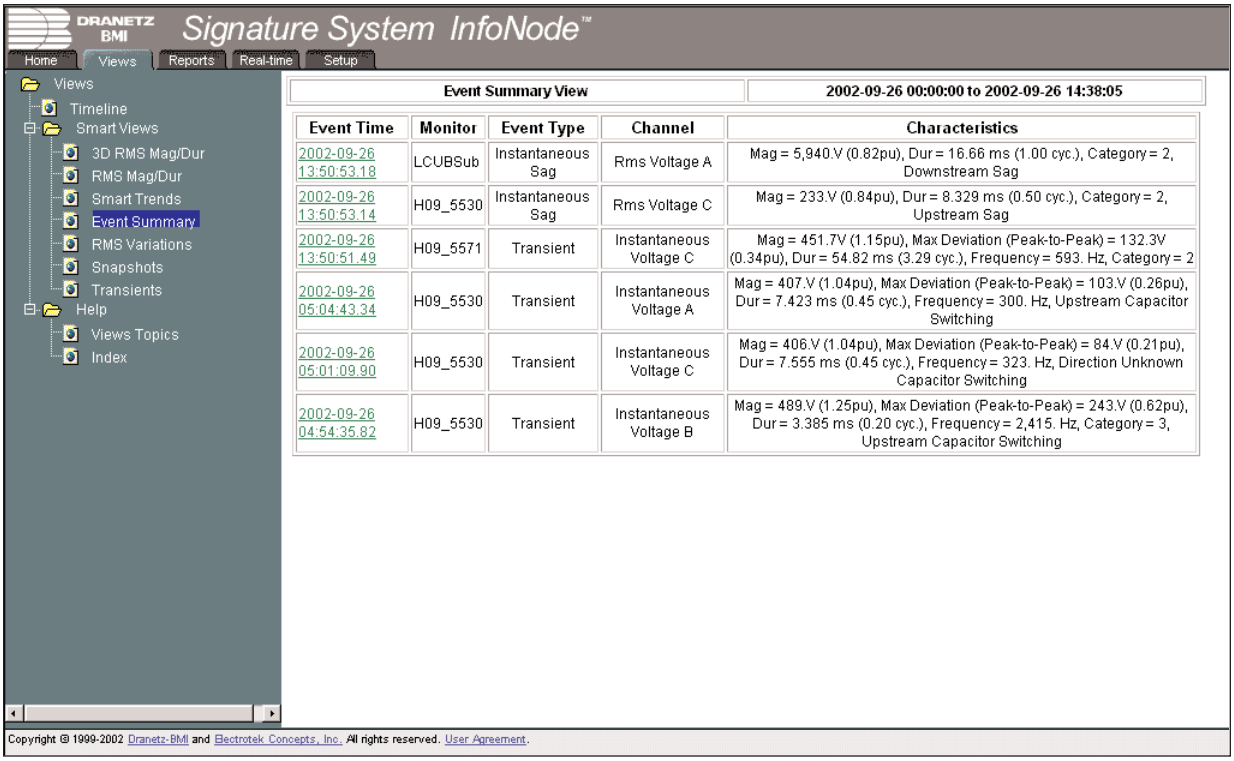


Two ways to view trend displays:
Left-click on the check mark of the parameter you want to trend; OR
Right-click on the check mark to display this drop down menu, then click Open Link/Open Link in New Window to view trend display



Event Summary

The Event Summary table seen below is a listing of the newest to oldest events in memory of the InfoNode for the DataNode selected. The data contained in the table include the: Event Time/Date, Monitor that recorded the event, Event Type, Phase (channel), and event Characteristics as found in the Event List details. Click the Event Time/Date (in hyper-links) to display the Event Details.

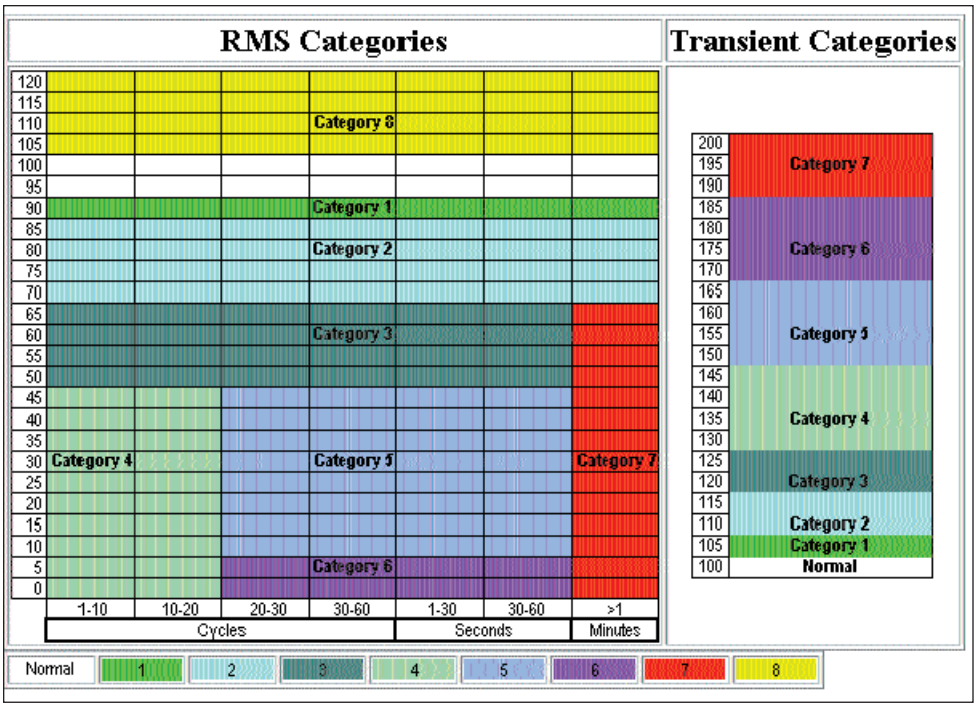


The event Characteristics include magnitude, duration, frequency, and category. The categories are defined according to the graph explained next.

NOTE: If there are too many events in the selected range to be displayed in a timely manner, the most recent 500 events will be displayed along with the message “more data is selected than can be displayed”. This also applies to any of the other Views.

RMS Variations

The RMS Variations table is a filtered version of the Event List. It includes only those events of RMS variation type (sags, swells, and interruptions).



Definition of the Category Event Characteristic

Transients

The Transients table is a filtered version of the Event List; only those events of Transient type are included.

Refer to Chapter 7 *Setup Page*, *Answer Module* section, for further discussions on the above topics.

Help

Much of what is written in this manual can be found in the Help option onscreen. Expanding the Help tree will provide Views Topics and Index links.

Views Topics

The Views Topics page simply says that the user is currently in the Views page. Four active buttons are found in this page: Contents, Index, <<, and >>. These buttons present different ways to access the same Help information. The differences lay only in the way each button organizes and lists information.

The >> button brings the user forward to the next linked page.

The << button brings the user backward to the previously linked page.

Index

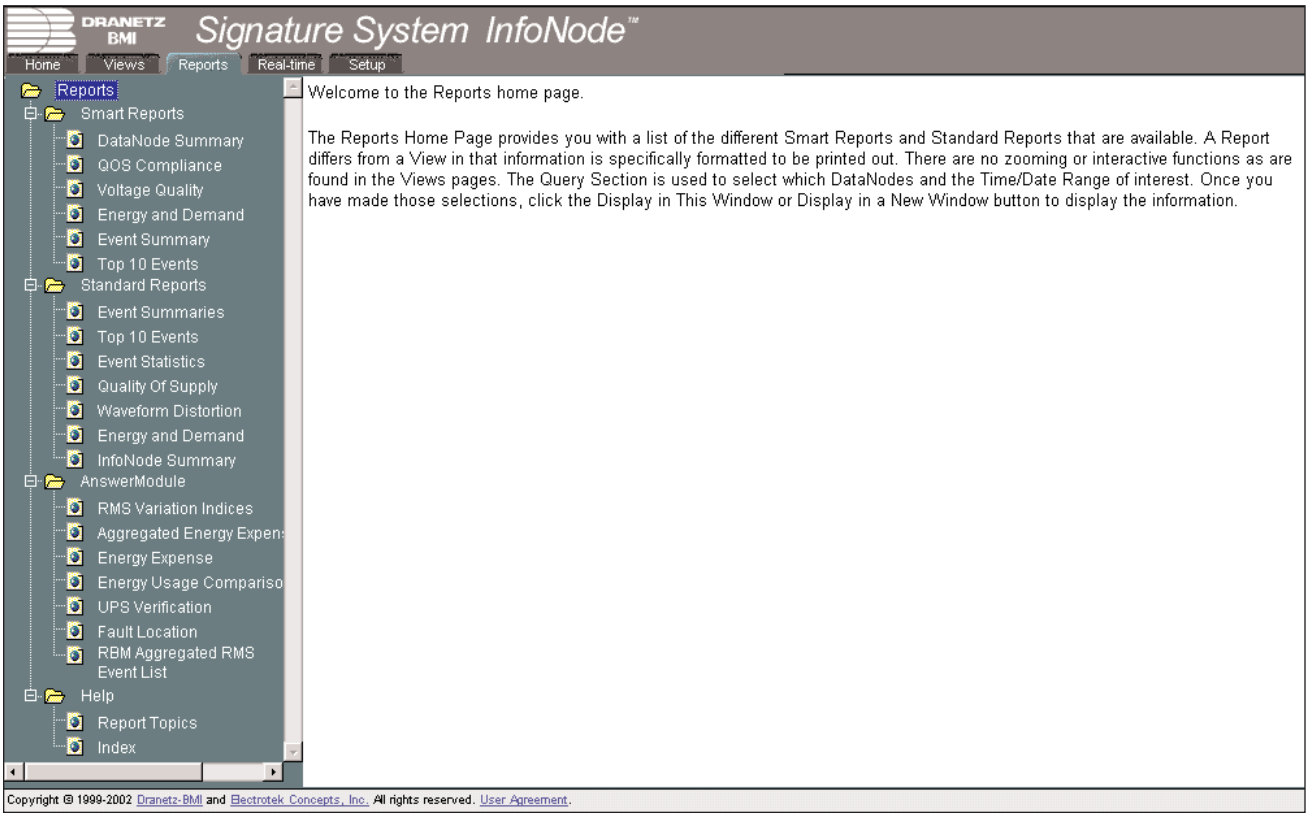
The Index page operates exactly like the Index portion of a book. Information is listed and categorized in alphabetical order. Click any button from A to Z to show various related topics under each letter. The topics are featured as hyperlinks.

The Contents button operates exactly like the Table of Contents in books. Information is listed and organized under different headings. The headings normally used here are the tab names. Sub-topics per heading appear as hyperlinks.

This chapter describes the different types of reports that users can generate using the InfoNode system. It explains how reports can be customized to suit the preference and needs of individual users.

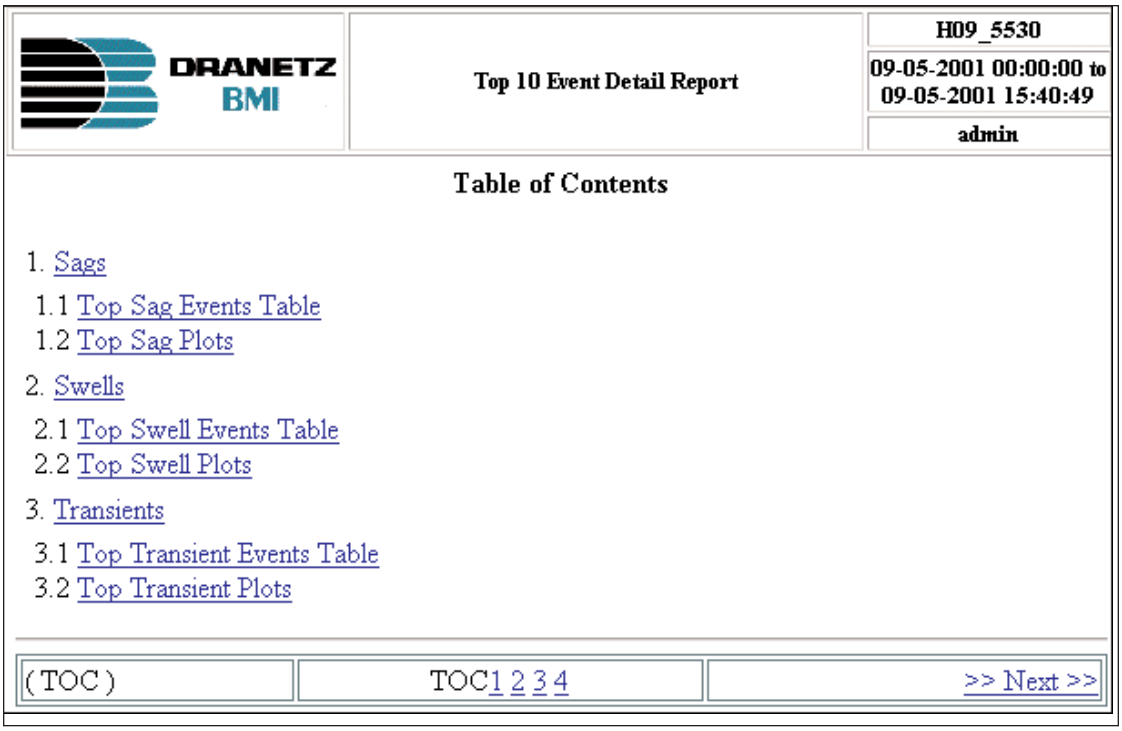
Reports Page

The Reports home page shown below displays a list of the different Smart Reports, Standard Reports, and Answer Module reports that are available. If a 5560 DataNode is in use, the Quality of Supply Compliance smart report will also be included.



Reports home page

A Report differs from a View in couple of ways. If a report contains multiple sections then the report will contain a Table of Contents. The Table of Contents provides a summary of what is in the report, and it provides a quick method for getting to a particular section of the report thru a hyperlink. A sample Table of Contents can be found next page. The Reports do not allow for interactive functions, but they will always be printed in their original form. The Views should be used for interactive functions.



DRANETZ BMI

Top 10 Event Detail Report

H09_5530

09-05-2001 00:00:00 to 09-05-2001 15:40:49

admin

Table of Contents

1. Sags
   1.1 Top Sag Events Table
   1.2 Top Sag Plots
2. Swells
   2.1 Top Swell Events Table
   2.2 Top Swell Plots
3. Transients
   3.1 Top Transient Events Table
   3.2 Top Transient Plots

(TOC) TOC 1 2 3 4 >> Next >>

Sample Table of Contents

Smart Reports
Smart Reports provides several types of reports and allows only minimal pre-filtering. The query setup for all Smart Reports is identical. The only variance between the reports is that some allow the selection of multiple DataNodes. The query setup screen seen next page is similar for all Smart Reports with its respective title.

DataNode Summary
The DataNode Summary Smart Report is a listing of information about a selected DataNode over the specified time period. This report includes RMS Variation Summary, Transient Summary, Monitor Status, DataNode Log, and the DataNode Setup.

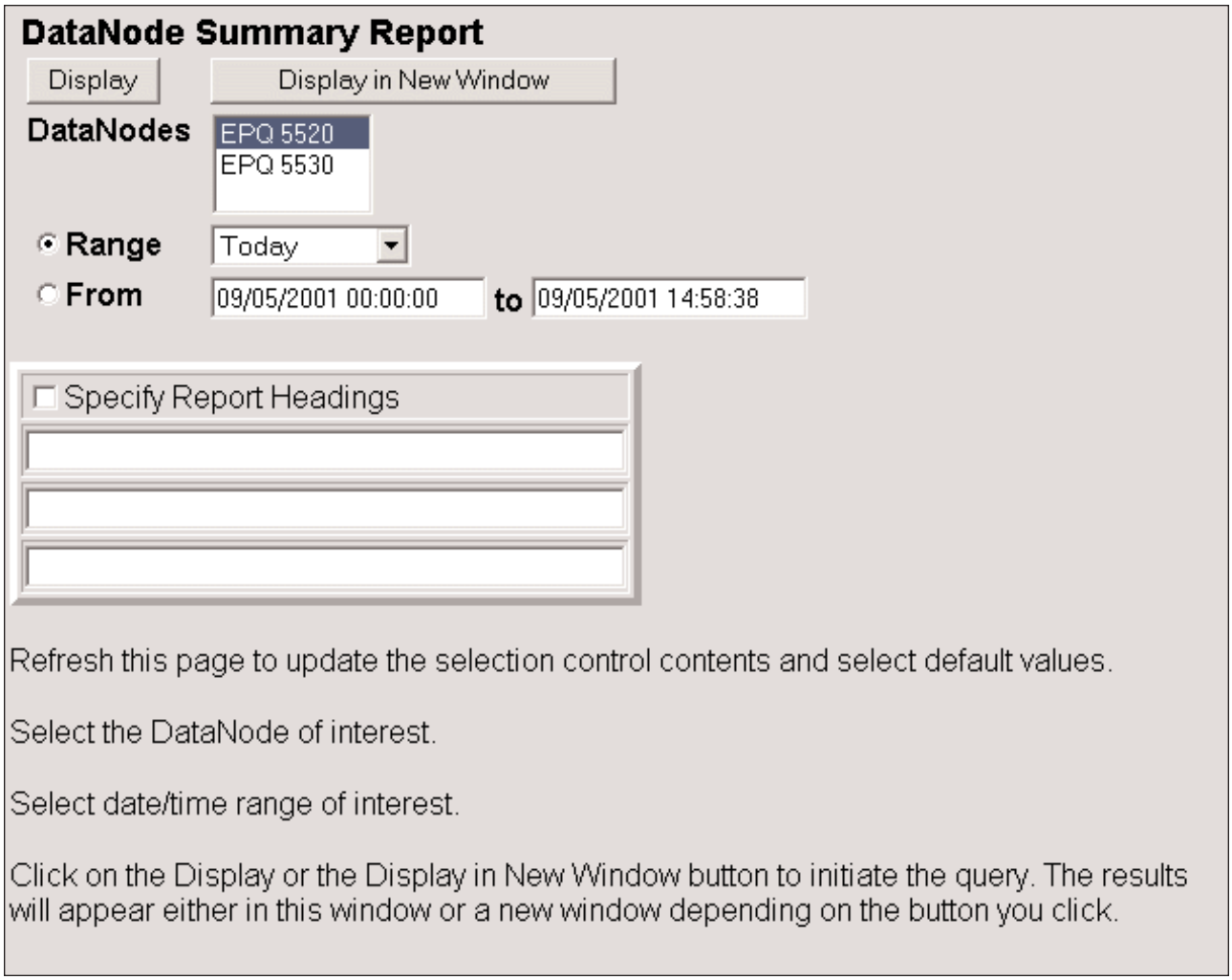
QOS Compliance
The QOS Compliance Smart Report will generate tables and graphs reflecting the compliance of the categories specified in EN50160 for the intervals that were recorded by the DataNodes you selected. The following reports are presented: Compliance Summary, Compliance Graph, Event Statistics, Harmonics Graph, Interharmonics Graph, Power Frequency Graph, and Min/Max Tables. See page 10-11.

Voltage Quality
The Voltage Quality Smart Report consists of a series of timeplots of available voltage phases, along with event summaries, histograms of event magnitudes, a Mag/Dur curve, and a 3D Mag/Dur curve.

Energy and Demand
The Energy and Demand Smart Report consists of trends, tables, and histograms for demand and energy parameters.

Event Summary
The Event Summary Smart Report consists of a table of events that occurred within the date/time that were selected for the query. This report allows for the selection of multiple DataNodes. Events are displayed in chronological order with the most recent event appearing first.

Top 10 Events
The Top 10 Events Smart Report is similar to the Event Summary Smart Report, except that it groups the events by type (sags, swell, interruptions, and transients) and only includes the 10 most severe events of each type. The severity of the events is based on their category. Events of each type are displayed in chronological order with the most recent event appearing first.



Smart Reports Query Selection

Standard Reports

Standard Reports provide the user with a greater ability to customize the contents of each report. The Smart Reports Query Setup is also used for the standard reports, with each Standard Report adding query parameters that are specific to its report type.

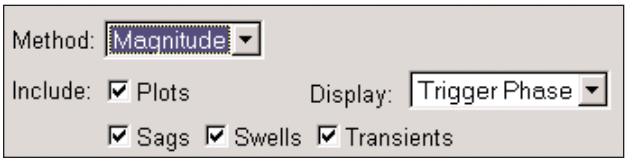
Event Summaries

The Event Summaries Report of the Standard Reports is very similar to that of the Smart Reports. The Standard Report version allows the user to select which event types will be included in the report. The user selects the types of events they want included in the report by checking the box(es) next to the desired event type(s). See figure below.

Event Summaries Specific Query Setup

Top 10 Events

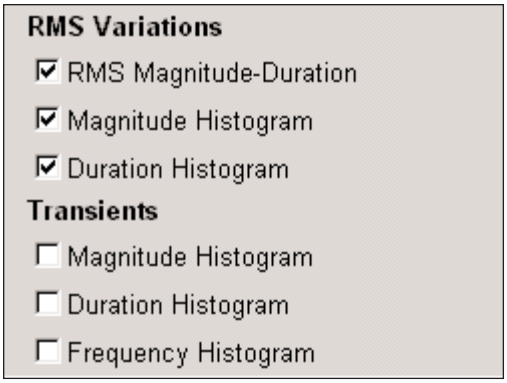
The Top 10 Events Report of the Standard Reports is very similar to that of the Smart Reports. The Standard Report version allows the user to select the method or criteria for determining which events will be included in the report. The method options are magnitude, duration, area, or category. The user may specify whether to include sags, swells, and/or transients. The user may also select to include time plots of only the triggered phase, the worst phase, or all monitored phases. See figure below for the additions to the Query Setup for this report.



Top 10 Events Specific Query Setup

Event Statistics

Event Statistics Report is a series of statistical analysis reports that you select for RMS variations and/or transients. The selections are shown in the following figure.



Event Statistics Specific Query Setup

RMS Variations

RMS Mag-Dur - a plot of the magnitude of the event versus duration of the event. A data point is plotted for each event, and the graph is overlaid with equipment susceptible or safe-operating type curves, such as the ITIC curve or CBEMA.

Duration Histogram - the duration of the variation versus the number of occurrences as a bar chart, with a cumulative frequency of occurrence line graph overlaid.

Transients

Magnitude Histogram - the magnitude of the transient versus the number of occurrences as a bar chart, with a cumulative frequency of occurrence line graph overlaid.

Duration Histogram - the duration of the transient versus the number of occurrences as a bar chart, with a cumulative frequency of occurrence line graph overlaid.

Frequency Histogram - the principal frequency of the transient versus the number of occurrences as a bar chart, with a cumulative frequency of occurrence line graph overlaid.

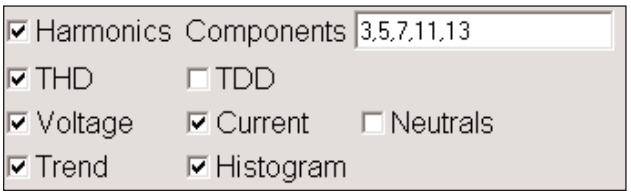
Quality of Supply

The Quality of Supply Report is an analysis of the voltage, similar to the requirements of the European Standard EN50160, which specifies that various parameters must be within a specified percentage for 95% of the time. The user may select from an analysis of the Voltage Regulation, Unbalance, and Frequency. The user may select the presentation of the data in trend and/or histogram form. The selections available are shown below.

Quality Supply Specific Query Setup

Waveform Distortion

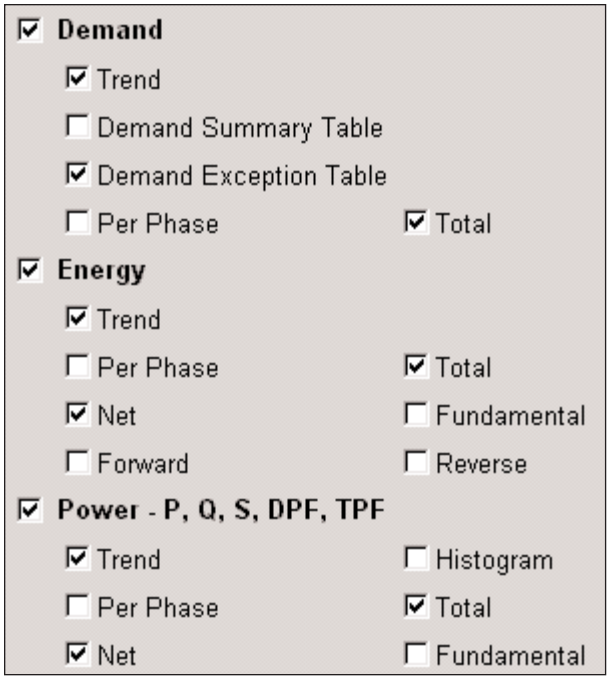
The Waveform Distortion Report is an analysis of harmonics. The user may select which data type at which components they would like to include in the report. The user may select Voltage THD (Total Harmonic Distortion) and/or IEEE 519 Current TDD. The user may select to present the data in trend and/or histogram form. The selections available are shown below.



Waveform Distortion Specific Query Setup

Energy and Demand

The Energy and Demand Report of the Standard Reports is very similar in content to that of the Smart Reports. The Energy and Demand Report will allow you to produce a trend, table and/or histogram for demand and energy. An additional feature of the Standard report version is that the user may include Power data. The user may elect to include real, imaginary, apparent power, displacement power factor and true power factor calculations in a trend and/or histogram form.
The selections available are shown in the next figure.



Energy and Demand Specific Query Setup

InfoNode Summary

The InfoNode Summary table is a listing of the oldest to newest administrative activity recorded by the InfoNode. The table includes the following data:

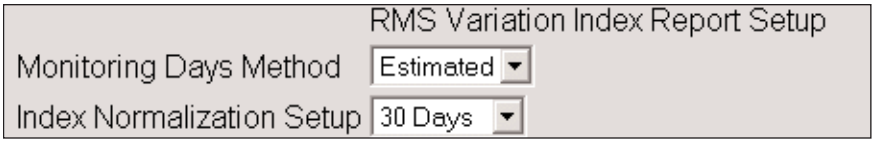
Entry Time - the time that the logged activity occurred.
Entry - a name for the activity, such as "User login" or "DataNode added".
User - identifies who carried out the activity.
Source Name - the part of the system affected by the activity that could be the name of a user or a DataNode.
Description - provides additional information about the entry. For example, if the Entry is "DataNode communication OK", then the Description could be "System health is normal".

Answer Module

Some answer modules provide information via a separate report. Other answer modules may just add characteristics to the events that are displayed in the event summary table, such as direction of disturbance. Answer Modules that create a separate report will be covered in this section.

RMS Variation Indices

The query information required for the RMS Variation Indices is very similar to all other reports. First, select the DataNode of interest and then select the time range. The query setup for this report requires that two additional parameters be set. The query setup specific to this report is shown below.



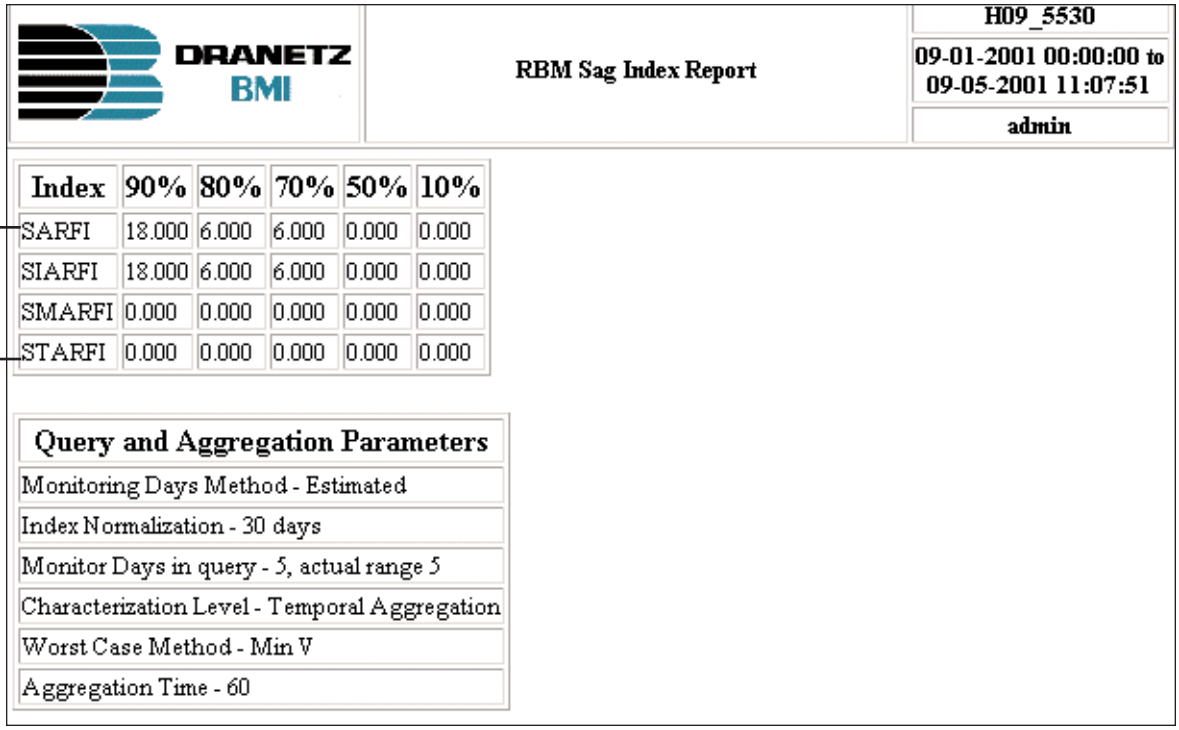
Setup Screen for RMS Variation Indices Report

Monitoring Days Method
Many of the EPRI RBM RMS variation indices provide frequency of occurrence information or rates of occurrence. The EPRI RBM technical report, TR-107938, discusses in detail the necessity of normalizing these rates based on the data upon which the indices are calculated. There are two normalization methods: “Estimated” and “None (No Normalization)”.

Estimated
The "Estimated" normalization method algorithm estimates the number of days a monitor is considered on-line by calculating the number of days between the 'From' and 'To' dates specified on the Date and Time Selection of the report setup.

None (No Normalization)
The "No Normalization" method results in a count rather than a rate. Thus, all frequency of occurrence indices calculated using this normalization method are counts of all aggregate measurements occurring during the specified time period.

Index Normalization Setup
The Normalization Rate control designates the time period (number of day's data) to which the rate indices are normalized. If the Normalization Method control is set to “None”, there is no rate used so the Rate control is disabled.



DRANETZ BMI

RBM Sag Index Report

H09_5530

09-01-2001 00:00:00 to 09-05-2001 11:07:51

admin

see note below

Index	90%	80%	70%	50%	10%
SARFI	18.000	6.000	6.000	0.000	0.000
SIARFI	18.000	6.000	6.000	0.000	0.000
SMARFI	0.000	0.000	0.000	0.000	0.000
STARFI	0.000	0.000	0.000	0.000	0.000

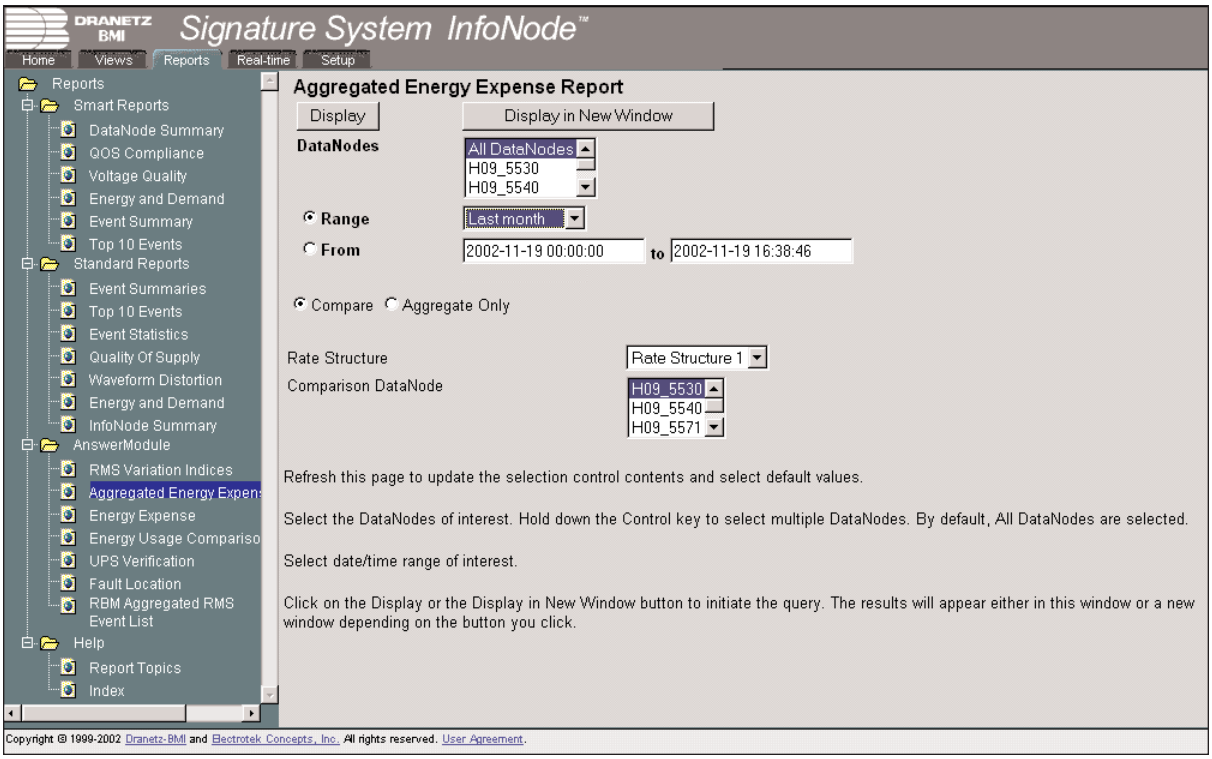
Query and Aggregation Parameters
Monitoring Days Method - Estimated
Index Normalization - 30 days
Monitor Days in query - 5, actual range 5
Characterization Level - Temporal Aggregation
Worst Case Method - Min V
Aggregation Time - 60

Sample RBM Sag Index Report

This report is generated using the RBM Aggregation Parameters and the query information described above. For more information on the RBM Aggregation Parameters see page 7-26 of Chapter 7 *Setup Page*. The RBM Sag Index Report calculates the indices listed below for 90%, 80%, 70%, 50%, and 10% voltage thresholds.

Aggregated Energy Expense

The Aggregated Energy Expense features a query setup to enable users to generate a comparative expense report for different DataNodes. Data is only available when the Energy Usage Answer Module is installed.



Setup screen for Aggregated Energy Expense Report

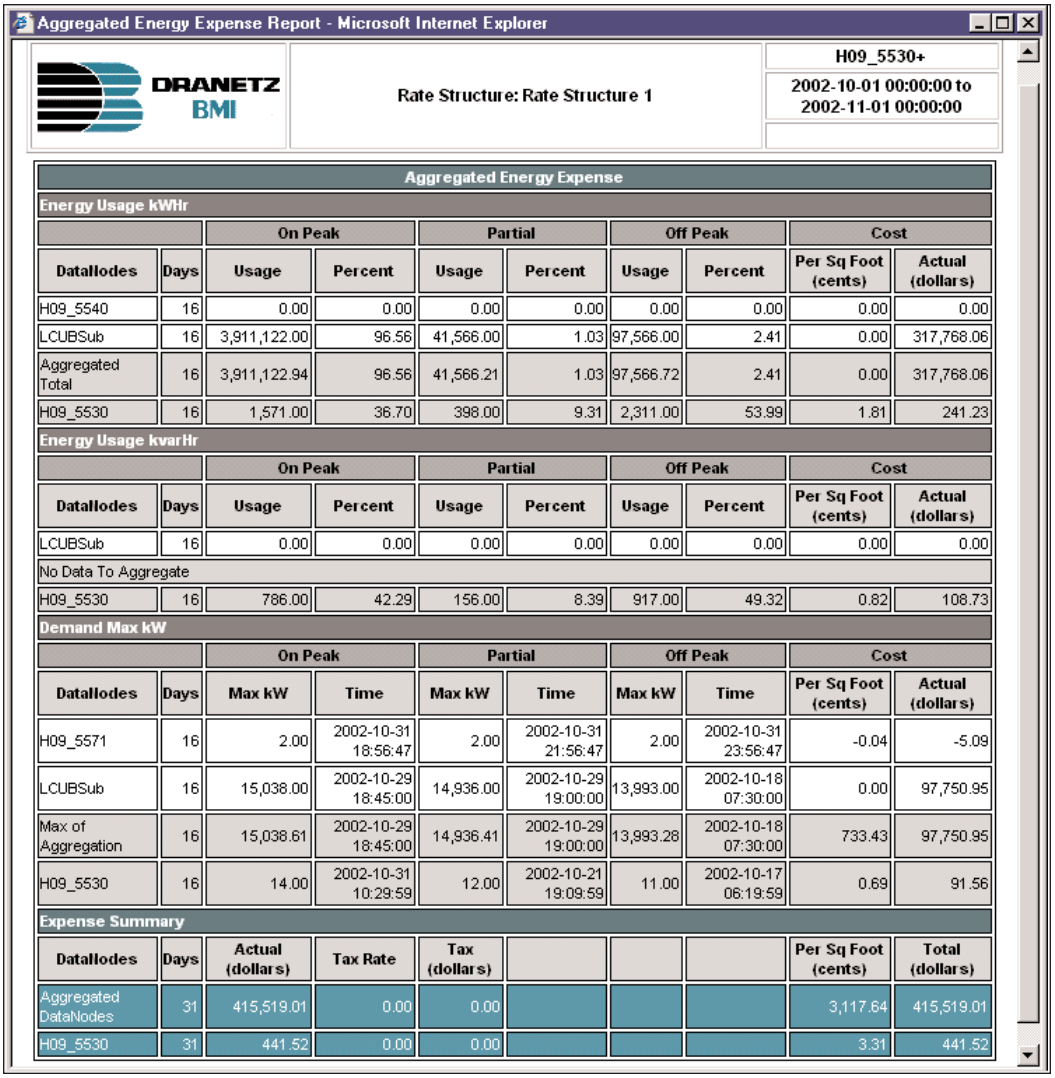
Select the DataNodes to aggregate in the expense report under the DataNodes window. As with the other reports, specify the date and time range of interest.

Click on the Compare button if you want to compare the total of the aggregated DataNodes to that of another DataNode. Click on the Aggregate Only button if you simply want to view the aggregate total.

Select any Rate Structure that is enabled under the Setup Page, Answer Module - Energy Usage. See page 7-23 of Chapter 7 *Setup Page* for details on the Energy Usage - Rate Structures. If doing a comparison, select the desired DataNode under the Comparison DataNode window.

NOTE: If a comparison is being performed, the comparison DataNode will not be included in the aggregation even if selected.

A sample Aggregated Energy Expense report is shown below. The report is divided into four sections: Energy Usage kWHr, Energy Usage kvarHr, Demand Max kW, and Expense Summary.



Aggregated Energy Expense Report - Microsoft Internet Explorer

DRANETZ BMI

Rate Structure: Rate Structure 1

H09_5530+

2002-10-01 00:00:00 to 2002-11-01 00:00:00

Aggregated Energy Expense

Energy Usage kWHr

		On Peak		Partial		Off Peak		Cost	
DataNodes	Days	Usage	Percent	Usage	Percent	Usage	Percent	Per Sq Foot (cents)	Actual (dollars)
H09_5540	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LCUBSub	16	3,911,122.00	96.56	41,566.00	1.03	97,566.00	2.41	0.00	317,768.06
Aggregated Total	16	3,911,122.94	96.56	41,566.21	1.03	97,566.72	2.41	0.00	317,768.06
H09_5530	16	1,571.00	36.70	398.00	9.31	2,311.00	53.99	1.81	241.23

Energy Usage kvarHr

		On Peak		Partial		Off Peak		Cost	
DataNodes	Days	Usage	Percent	Usage	Percent	Usage	Percent	Per Sq Foot (cents)	Actual (dollars)
LCUBSub	16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
No Data To Aggregate									
H09_5530	16	786.00	42.29	156.00	8.39	917.00	49.32	0.82	108.73

Demand Max kW

		On Peak		Partial		Off Peak		Cost	
DataNodes	Days	Max kW	Time	Max kW	Time	Max kW	Time	Per Sq Foot (cents)	Actual (dollars)
H09_5571	16	2.00	2002-10-31 18:56:47	2.00	2002-10-31 21:56:47	2.00	2002-10-31 23:56:47	-0.04	-5.09
LCUBSub	16	15,038.00	2002-10-29 18:45:00	14,936.00	2002-10-29 19:00:00	13,993.00	2002-10-18 07:30:00	0.00	97,750.95
Max of Aggregation	16	15,038.61	2002-10-29 18:45:00	14,936.41	2002-10-29 19:00:00	13,993.28	2002-10-18 07:30:00	733.43	97,750.95
H09_5530	16	14.00	2002-10-31 10:29:59	12.00	2002-10-21 19:09:59	11.00	2002-10-17 06:19:59	0.69	91.56

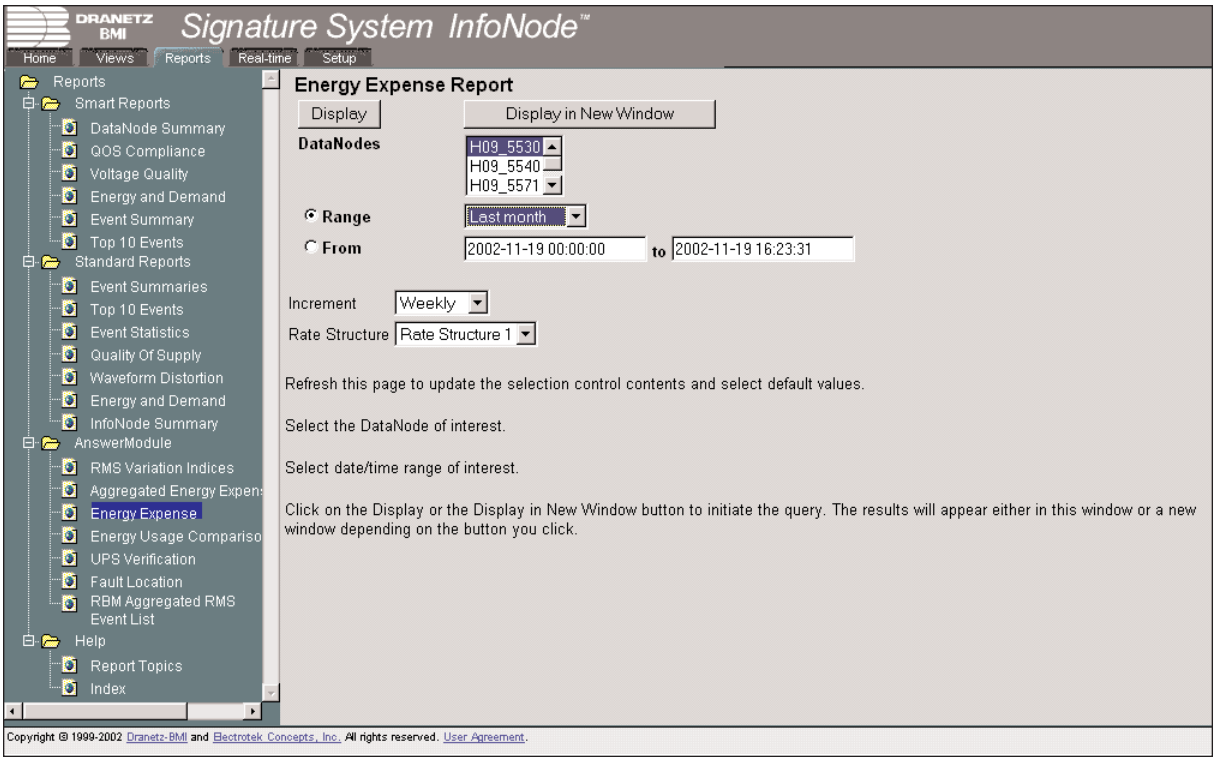
Expense Summary

DataNodes	Days	Actual (dollars)	Tax Rate	Tax (dollars)				Per Sq Foot (cents)	Total (dollars)
Aggregated DataNodes	31	415,519.01	0.00	0.00				3,117.64	415,519.01
H09_5530	31	441.52	0.00	0.00				3.31	441.52

Sample Aggregated Energy Expense Report

Energy Expense

The Energy Expense features a query setup to enable users to generate an expense report for each DataNode. Data is only available when the Energy Usage Answer Module is installed.

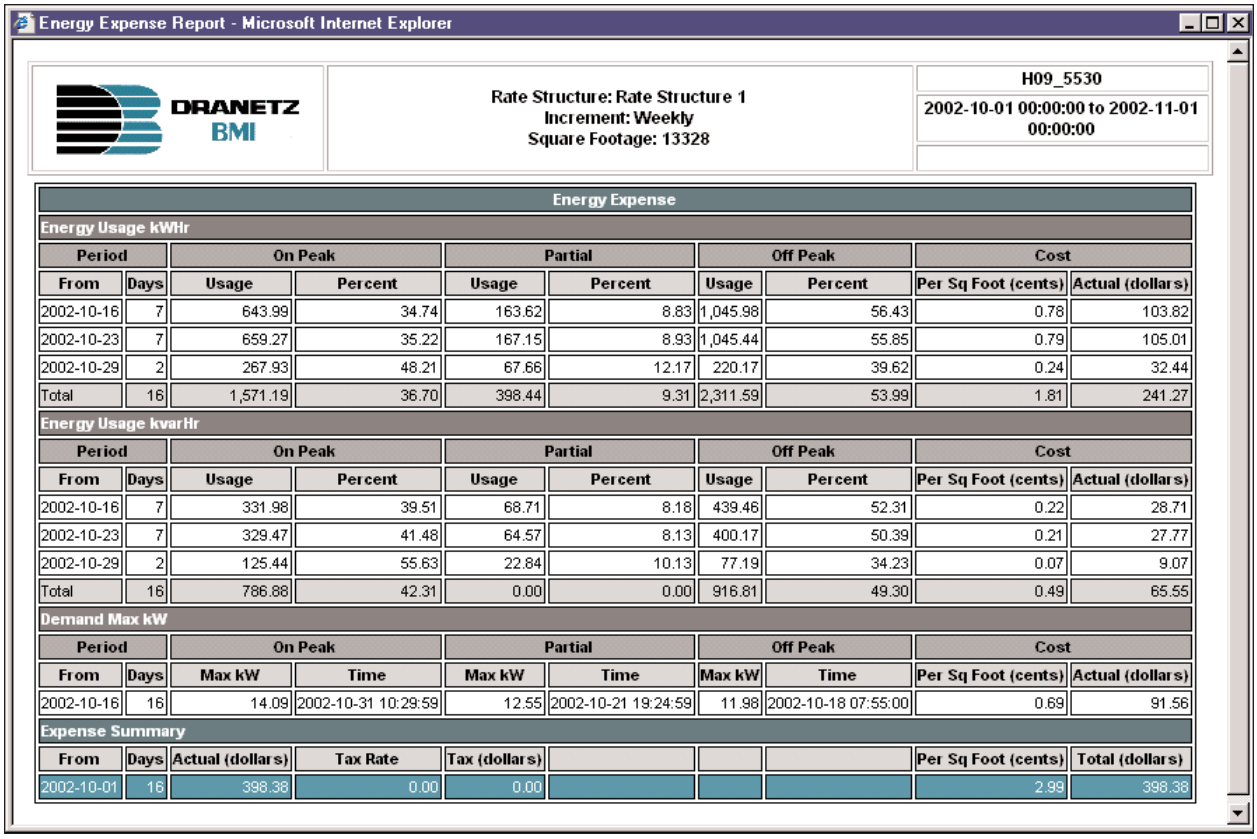


Setup screen for Energy Expense Report

Select the DataNode with which you want to generate an expense report. As with the other reports, specify the date and time range of interest. The user may choose to divide the time range into smaller increments under the Increment window. A typical selection for billing purposes is *Weekly.*

Select any Rate Structure that is enabled under the Setup Page, Answer Module - Energy Usage. See page 7-23 of Chapter 7 *Setup Page* for details on the Energy Usage - Rate Structures.

A sample Energy Expense report is shown below. The report is divided into four sections: Energy Usage kWHr, Energy Usage kvarHr, Demand Max kW, and Expense Summary.



Energy Expense Report - Microsoft Internet Explorer

DRANETZ BMI

Rate Structure: Rate Structure 1
Increment: Weekly
Square Footage: 13328

H09_5530
2002-10-01 00:00:00 to 2002-11-01 00:00:00

Energy Expense

Energy Usage kWHr

Period		On Peak		Partial		Off Peak		Cost	
From	Days	Usage	Percent	Usage	Percent	Usage	Percent	Per Sq Foot (cents)	Actual (dollars)
2002-10-16	7	643.99	34.74	163.62	8.83	1,045.98	56.43	0.78	103.82
2002-10-23	7	659.27	35.22	167.15	8.93	1,045.44	55.85	0.79	105.01
2002-10-29	2	267.93	48.21	67.66	12.17	220.17	39.62	0.24	32.44
Total	16	1,571.19	36.70	398.44	9.31	2,311.59	53.99	1.81	241.27

Energy Usage kvarHr

Period		On Peak		Partial		Off Peak		Cost	
From	Days	Usage	Percent	Usage	Percent	Usage	Percent	Per Sq Foot (cents)	Actual (dollars)
2002-10-16	7	331.98	39.51	68.71	8.18	439.46	52.31	0.22	28.71
2002-10-23	7	329.47	41.48	64.57	8.13	400.17	50.39	0.21	27.77
2002-10-29	2	125.44	55.63	22.84	10.13	77.19	34.23	0.07	9.07
Total	16	786.88	42.31	0.00	0.00	916.81	49.30	0.49	65.55

Demand Max kW

Period		On Peak		Partial		Off Peak		Cost	
From	Days	Max kW	Time	Max kW	Time	Max kW	Time	Per Sq Foot (cents)	Actual (dollars)
2002-10-16	16	14.09	2002-10-31 10:29:59	12.55	2002-10-21 19:24:59	11.98	2002-10-18 07:55:00	0.69	91.56

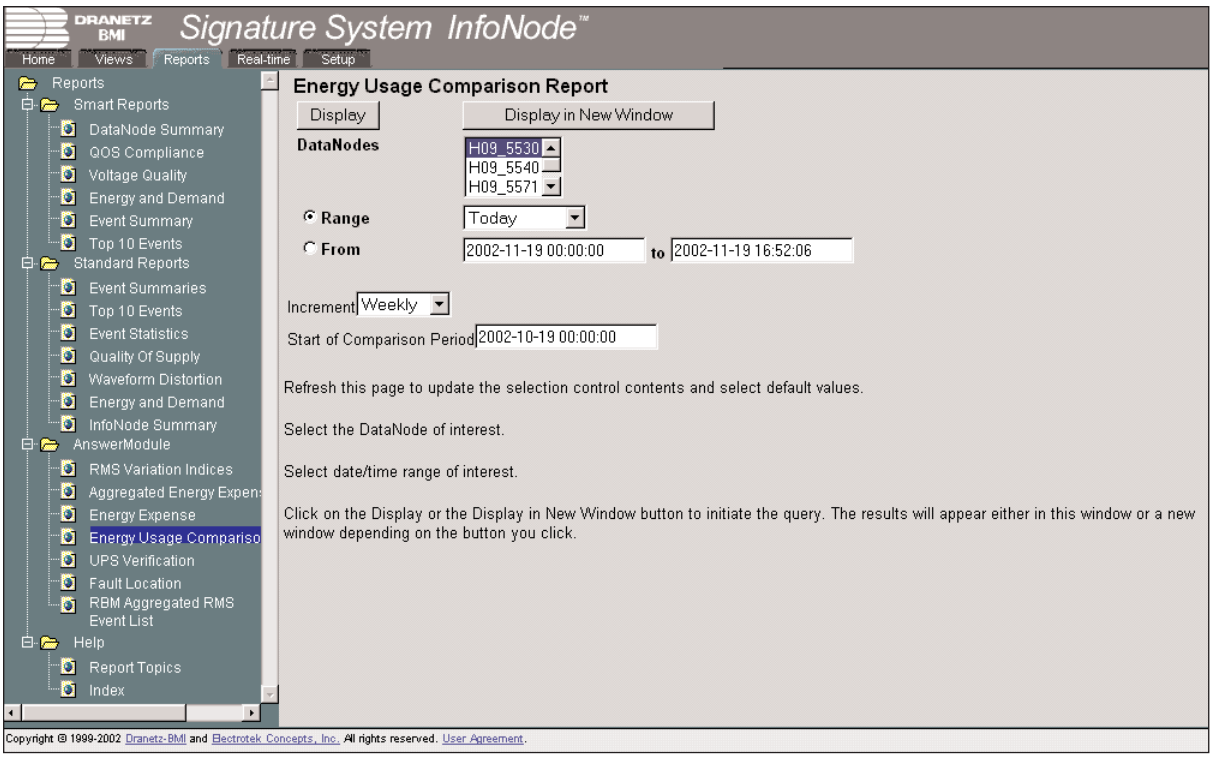
Expense Summary

From	Days	Actual (dollars)	Tax Rate	Tax (dollars)				Per Sq Foot (cents)	Total (dollars)
2002-10-01	16	398.38	0.00	0.00				2.99	398.38

Sample Energy Expense Report

Energy Usage Comparison Report

The Energy Usage Comparison Report features a query setup to enable users to generate a comparative energy usage report for each DataNode. Data is only available when the Energy Usage Answer Module is installed.

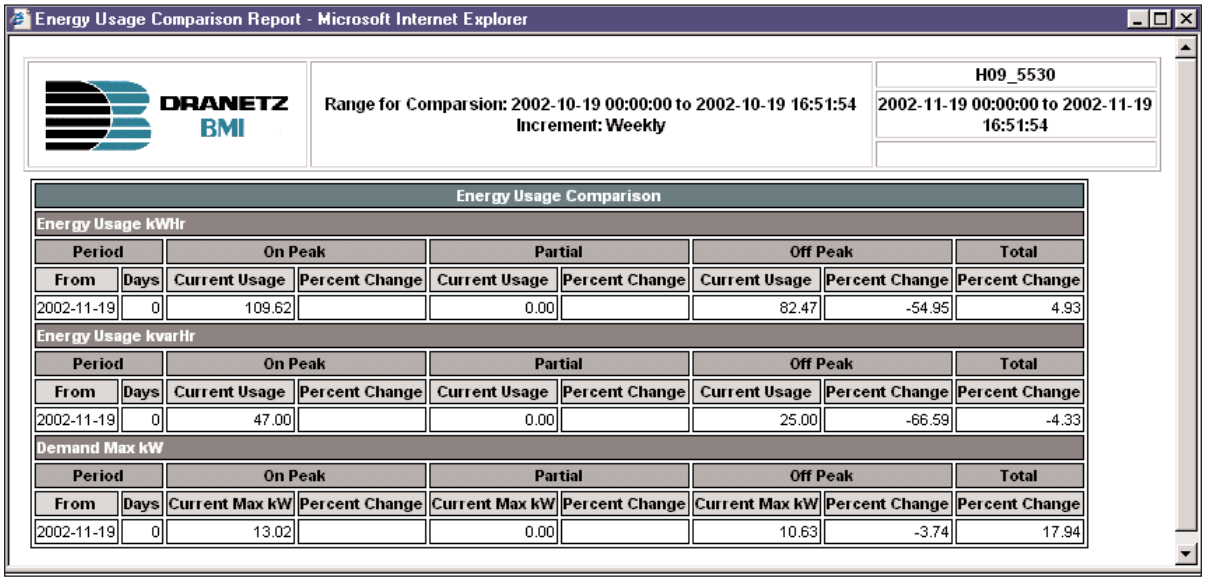


Setup screen for Energy Usage Comparison Report

Select the DataNode with which you want to generate a comparative usage report. As with the other reports, specify the date and time range of interest. The user may choose to divide the time range into smaller increments under the Increment window. Then enter the reference period in which you want to compare the current usage against under the Start of Comparison Period.

NOTE: If the reference period has more days than the current period, then it will be reduced to the number of days in the current period. The start time will remain as selected.

A sample Energy Usage Comparison report is shown below. The report is divided into three sections: Energy Usage kWHr, Energy Usage kvarHr, and Demand Max kW. Each section displays the current usage vis-a-vis the percent change from the refernce period for On Peak time, Partial Peak time, Off Peak time, and Total. A negative number indicates that the current usage is smaller than that of the reference period.



Energy Usage Comparison Report - Microsoft Internet Explorer

DRANETZ BMI

Range for Comparsion: 2002-10-19 00:00:00 to 2002-10-19 16:51:54
Increment: Weekly

H09_5530
2002-11-19 00:00:00 to 2002-11-19 16:51:54

Energy Usage Comparison

Energy Usage kWHr

Period		On Peak		Partial		Off Peak		Total
From	Days	Current Usage	Percent Change	Current Usage	Percent Change	Current Usage	Percent Change	Percent Change
2002-11-19	0	109.62		0.00		82.47	-54.95	4.93

Energy Usage kvarHr

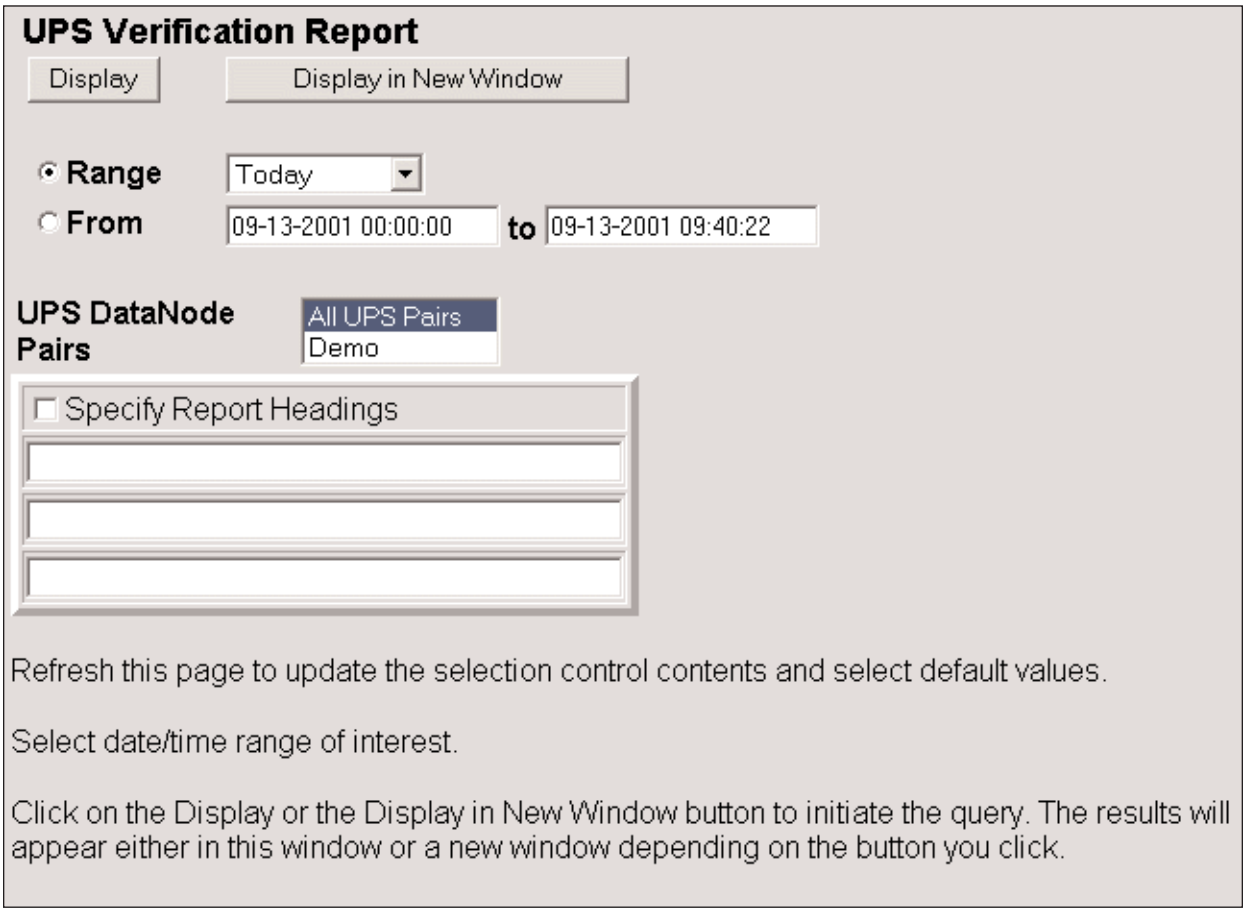
Period		On Peak		Partial		Off Peak		Total
From	Days	Current Usage	Percent Change	Current Usage	Percent Change	Current Usage	Percent Change	Percent Change
2002-11-19	0	47.00		0.00		25.00	-66.59	-4.33

Demand Max kW

Period		On Peak		Partial		Off Peak		Total
From	Days	Current Max kW	Percent Change	Current Max kW	Percent Change	Current Max kW	Percent Change	Percent Change
2002-11-19	0	13.02		0.00		10.63	-3.74	17.94

Sample Energy Usage Comparison Report

UPS Verification



Setup Screen for UPS Verification Report

NOTE: SARFI - System Average RMS (Variation) Frequency Index
SIARFI - System Instantaneous Average RMS (Variation) Frequency Index
SMARFI - System Momentary Average RMS (Variation) Frequency Index
STARFI - System Temporary Average RMS (Variation) Frequency Index

This report has a different query setup than the standard query setup. This report is produced for defined instrument pairs. The instrument pairs were created under the Setup tab for the UPS Verification Answer Module. The query setup for the UPS Verification report is shown above.

As with other reports, a date range or a start and end time need to be specified. However, for the UPS report instead of selecting an instrument, the user selects one or more instrument pairs.

The purpose of the UPS Verification Answer Module is to verify that the UPS or another mitigation device is functioning properly. A UPS DataNode pair consists of a DataNode monitoring the input of the UPS and another DataNode monitoring the output of the UPS. This was designed to be done with DataNodes that support cross-triggering. If the UPS is functioning properly, the DataNode at the UPS output will only see cross-triggered events. If the DataNodes being used do not support cross-triggering, then no event should be seen on the output DataNode. However, without cross-triggering, the absence of an event is not conclusive. The status determined by the UPS Verification Answer Module may be one of the following:

PASS
The UPS DataNode Pair has a status of PASS when an event is seen at the input DataNode, and only the cross-triggered event is seen on the output. The UPS has been determined to be functioning properly, as the disturbance on the input was not seen on the output.

FAIL
The UPS DataNode Pair has a status of FAIL when an event is seen at the input DataNode, and a disturbance event is also seen on the output DataNode within the time window defined at setup. The UPS has been determined to be not functioning properly.

Indeterminate
The UPS DataNode Pair has a status of Indeterminate when an event is seen at the input DataNode, and no event is seen on the output DataNode. The status is Indeterminate because no cross-triggered event was seen to verify that the output DataNode itself is functioning correctly.

The report consists of a table with event summary information for both the input and output DataNodes of the UPS Pairs and status information. The report also contains a Mag/Dur plot with data from both DataNode marked separately. A sample report can be seen below.

DRANETZ BMI

UPS Verification Report

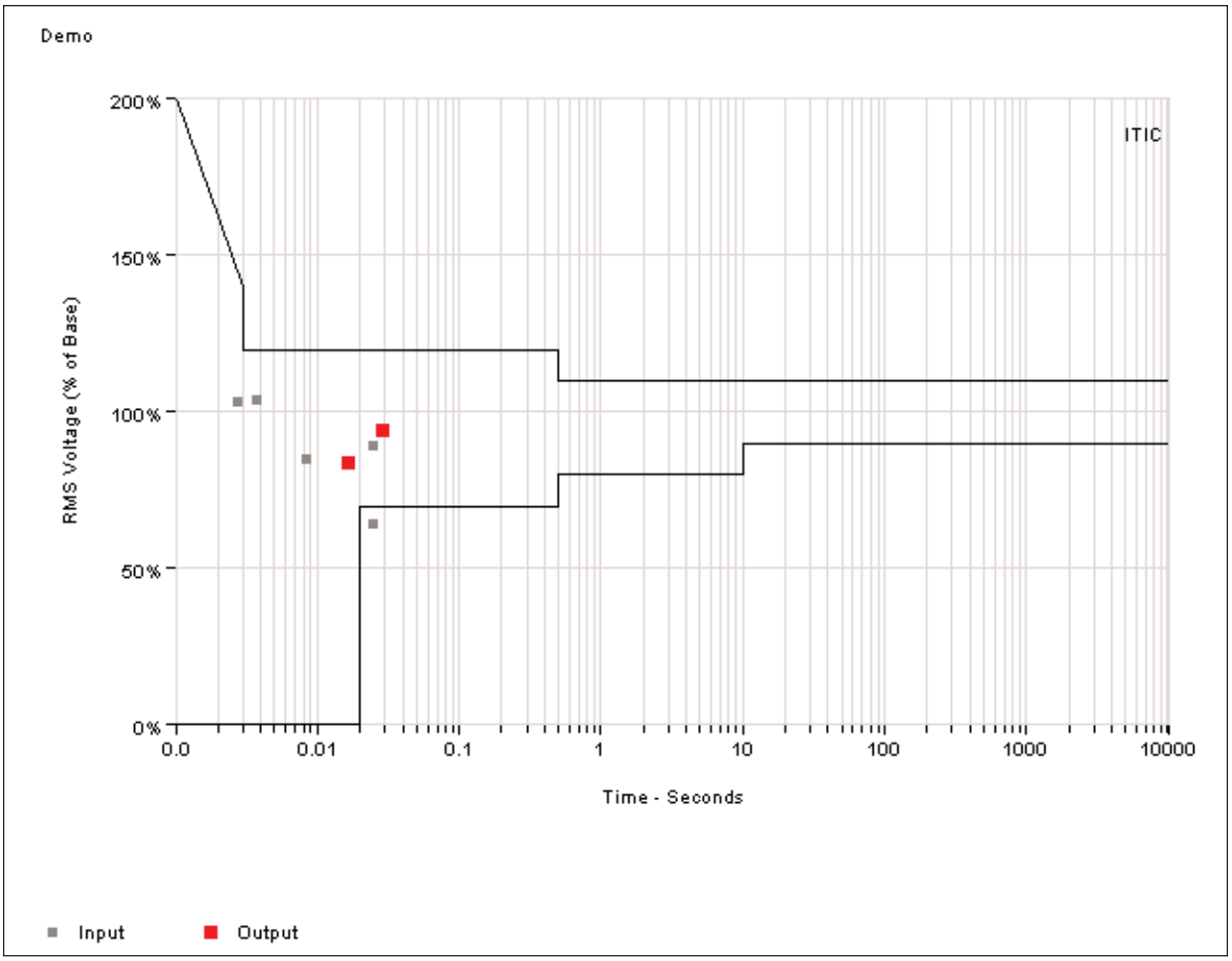
****

09-01-2001 00:00:00 to 09-03-2001 17:06:49

admin

Event Time	UPS DataNode Pairs	INPUT MONITOR			OUTPUT MONITOR			Status
		Event Type	Phase	Charateristics	Event Type	Phase	Charateristics	
09-03-2001 05:00:16	Demo	Transient	A	Mag = 407.V (1.04pu), Max Deviation (Peak-to-Peak) = 50.V (0.13pu), Dur = 0.004 s (0.23 cyc.), Upstream Capacitor Switching	Non-Event	NA	NA	Indeterminate
09-03-2001 05:00:16	Demo	Transient	B	Mag = 405.V (1.03pu), Max Deviation (Peak-to-Peak) = 29.V (0.07pu), Dur = 0.003 s (0.16 cyc.), Upstream Capacitor Switching	Non-Event	NA	NA	Indeterminate
09-02-2001 18:46:56	Demo	Instantaneous Sag	A	Mag = 247.V (0.89pu), Dur = 0.025 s (1.50 cyc.), Category = 2, Upstream Sag	Non-Event	NA	NA	Indeterminate
09-01-2001 13:16:00	Demo	Instantaneous Sag	B	Mag = 178.V (0.64pu), Dur = 0.025 s (1.50 cyc.), Category = 3, Upstream Sag	Transient	B	Mag = 368.5V (0.94pu), Max Deviation (Peak-to-Peak) = 124.2V (0.32pu), Dur = 0.029 s (1.76 cyc.), Frequency = 345 Hz	FAIL

Sample UPS Verification Report



Sample UPS Mag-Dur plot

Fault Location

This report requires no additional query parameters. It allows for the selection of multiple DataNodes. The information required for this Answer Module can be seen in page 7-24 of Chapter 7 *Setup Page*. The module computes distance-to-fault for all possible balance and unbalance faults, i.e. three-phase fault; single-line-to-ground (SLG) fault of phases A, B, and C; double-line-to-ground (DLG) faults of phases AB, BC, and CA; and line-to-line-to-ground (LLG) of phases AB, BC, and CA. Thus, there are ten types of faults considered. The distance-to-faults are estimated using two different equations; therefore, there are two estimates (lower and upper) for each fault type. A sample report is shown below.

DRANETZ BMI

CDRWest
All time
MaryRosenbalt

Radial Fault Report

Event Time	Monitor	Characteristics (Mag/Dur)	Fault Type	Lower Distance Estimate	Upper Distance Estimate
12/28/1999 13:49:11	CDRWest	Mag=19797.24V ,Duration= 0.17 secs	3 Phase Fault	20.44 (in 1000 ft)	20.44 (in 1000 ft)
02/28/2000 11:23:13	CDRWest	Mag=19797.24V ,Duration= 0.17 secs	3 Phase Fault	22.18 (in 1000 ft)	22.18 (in 1000 ft)
03/18/2000 03:09:37	CDRWest	Mag=19725.27V ,Duration= 0.17 secs	LLF at Phase BC	34.07 (in 1000 ft)	35.59 (in 1000 ft)
03/21/2000 16:41:32	CDRWest	Mag=14587.99V ,Duration= 0.17 secs	SLG at Phase A	20.45 (in 1000 ft)	21.43 (in 1000 ft)
03/29/2000 10:12:42	CDRWest	Mag=18521.32V ,Duration= 0.17 secs	SLG at Phase A	34.48 (in 1000 ft)	35.74 (in 1000 ft)
04/06/2000 04:41:44	CDRWest	Mag=19733.14V ,Duration= 0.17 secs	SLG at Phase B	24.50 (in 1000 ft)	25.57 (in 1000 ft)
04/29/2000 19:19:46	CDRWest	Mag=20153.18V ,Duration= 0.17 secs	SLG at Phase C	18.71 (in 1000 ft)	19.63 (in 1000 ft)
05/08/2000 01:21:49	CDRWest	Mag=19936.19V ,Duration= 0.17 secs	SLG at Phase C	25.96 (in 1000 ft)	27.06 (in 1000 ft)
06/01/2000 21:59:14	CDRWest	Mag=32479.91V ,Duration= 0.17 secs	DLG at Phase CA	23.10 (in 1000 ft)	23.10 (in 1000 ft)
06/12/2000 13:59:17	CDRWest	Mag=16093.82V ,Duration= 0.17 secs	DLG at Phase AB	20.95 (in 1000 ft)	20.95 (in 1000 ft)
06/23/2000 12:20:28	CDRWest	Mag=26828.52V ,Duration= 0.17 secs	LLF at Phase CA	23.74 (in 1000 ft)	25.04 (in 1000 ft)
06/29/2000 05:26:30	CDRWest	Mag=31307.88V ,Duration= 0.17 secs	SLG at Phase A	22.33 (in 1000 ft)	23.40 (in 1000 ft)
07/08/2000 11:29:32	CDRWest	Mag=30636.30V ,Duration= 0.17 secs	SLG at Phase A	36.31 (in 1000 ft)	37.64 (in 1000 ft)
07/29/2000 22:59:35	CDRWest	Mag=32011.26V ,Duration= 0.17 secs	SLG at Phase B	26.01 (in 1000 ft)	27.14 (in 1000 ft)
08/12/2000 14:51:37	CDRWest	Mag=34002.89V ,Duration= 0.17 secs	SLG at Phase C	20.12 (in 1000 ft)	21.10 (in 1000 ft)
08/18/2000 18:19:39	CDRWest	Mag=34001.41V ,Duration= 0.17 secs	SLG at Phase C	27.51 (in 1000 ft)	28.68 (in 1000 ft)

Sample Radial Fault Report

RBM (Reliability Benchmarking Methodology)

The RBM Answer Module adds two reports. The first is the RBM RMS Variation Indices (see page 5-6 for description) and the second is the RBM Aggregated RMS Event List described next.

RBM Aggregated RMS Event List

This report is a table of RBM Aggregated Events for the specified DataNode and time range. The RBM Aggregation Parameters define how the events are aggregated. For more information on the RBM Aggregation Parameters refer to page 7-26 of Chapter 7 *Setup Page*. The query setup for this report is the standard report query information, and requires no additional parameters to be selected. More parameters such as type of aggregation and method are set up in the Setup tab. A sample report is shown below.

DRANETZ BMI

RBM Aggregated Event Report

H09_5530

09-01-2001 00:00:00 to 09-05-2001 11:26:44

admin

Aggregated Event Start Time	Phase	Aggregated Magnitude	Aggregated Duration
09-01-2001 13:16:00	B	178 (64.37%)	0.025 Sec. (1.5 Cycle(s))
09-02-2001 18:46:56	A	247 (89.23%)	0.017 Sec. (1.0 Cycle(s))
09-04-2001 09:49:50	C	235 (84.84%)	0.008 Sec. (0.5 Cycle(s))

Query and Aggregation Parameters
Monitor Days in query - 5, actual range 5
Characterization Level - Temporal Aggregation
Worst Case Method - Min V
Aggregation Time - 60

Sample RBM Aggregated Event Report

Help

Much of what is written in this manual can be found in the Help option onscreen. Expanding the Help tree will provide Reports Topics and Index links.

Report Topics

The Report Topics page simply says that the user is currently in the Reports page. Four active buttons are found in this page: Contents, Index, <<, and >>. These buttons present different ways to access the same Help information. The differences lay only in the way each button organizes and lists information.

The >> button brings the user forward to the next linked page.

The << button brings the user backward to the previously linked page.

Index

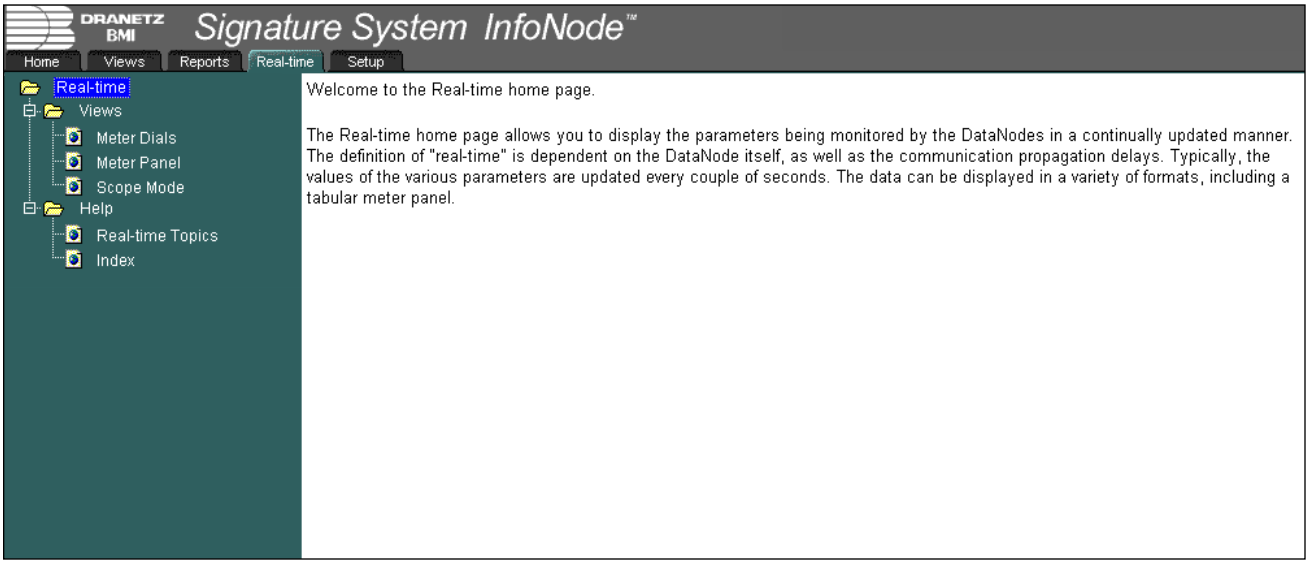
The Index page operates exactly like the Index portion of a book. Information is listed and categorized in alphabetical order. Click any button from A to Z to show various related topics under each letter. The topics are featured as hyperlinks.

The Contents button operates exactly like the Table of Contents in books. Information is listed and organized under different headings. The headings normally used here are the tab names. Sub-topics per heading appear as hyperlinks.

This chapter describes how the system enables users to view DataNode information in real-time mode. Through the different display options available, the users are able to view and capture DataNode information as it happens and when it happens on site.

Real-time Page

The Real-time page allows you to display the parameters being monitored by the DataNodes in a continually updated manner. The definition of "real-time" is dependent on the DataNode itself, as well as the communication propagation delays. Typically, the various parameter values are updated every couple of seconds. The data can be displayed in a variety of formats, including a tabular meter panel. The Real-time menu page appears as follows.



Real-time home page

Views

Meter Dials

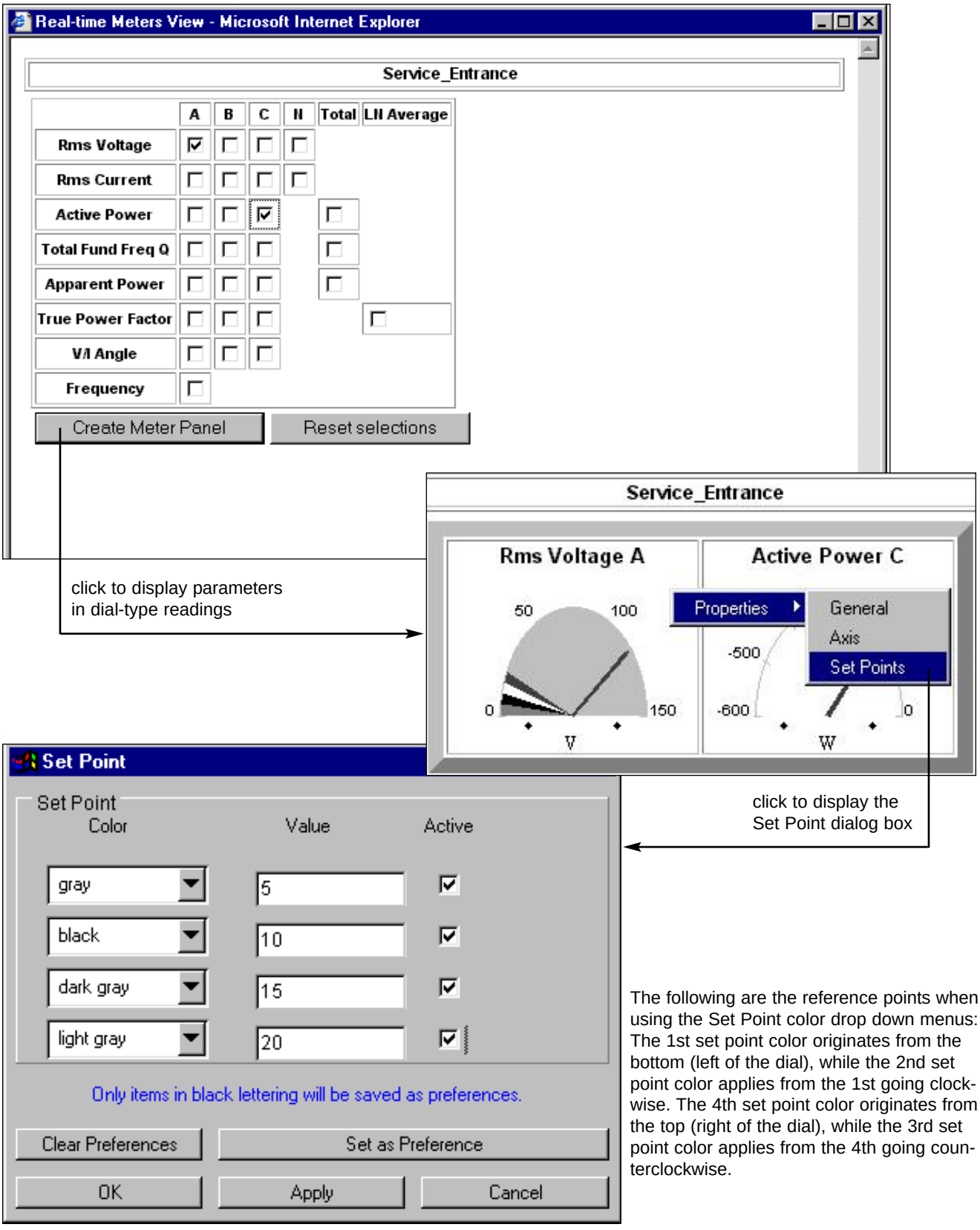
The Meter Dials enable you to define the parameters and create dial-type readings of each enabled DataNode parameter. The readings are updated at approximately once per second.

After selecting the parameters and creating the meter panel, the attributes of the meter panel can be changed by right-clicking the mouse button when the cursor is over the dial. Three categories can be selected:

General (contains options for changing color of the background and the needle)
Axis (contains options for changing min/max limits, label and line color, and text font)
Set Points (contains options for changing color, value and active status)

In the sample screens found next page, parameter values for a Service Entrance DataNode have been checked, after which the Create Meter Panel button was clicked. This resulted in the screen showing dial-type readings. Right-clicking on the dials shows Properties for General, Axis and Set Point options. A sample Set Point display screen also appears next page.

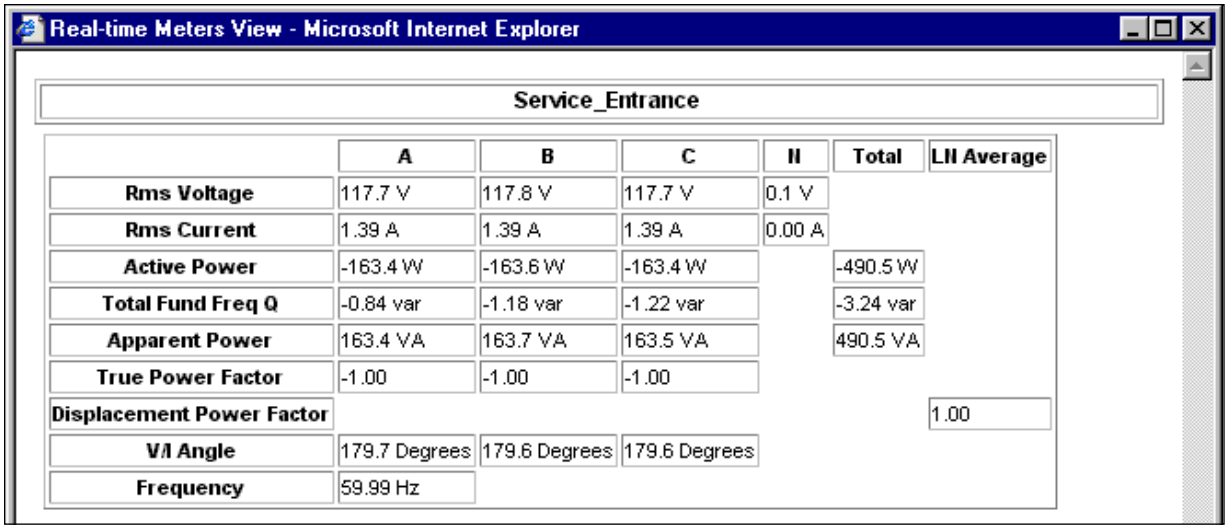
For a 5560 DataNode, new parameters are defined to support real-time display of flicker measurements. These parameters are required to meet the specification of a flicker meter. See page 10-20 for more information.



The following are the reference points when using the Set Point color drop down menus: The 1st set point color originates from the bottom (left of the dial), while the 2nd set point color applies from the 1st going clockwise. The 4th set point color originates from the top (right of the dial), while the 3rd set point color applies from the 4th going counterclockwise.

Meter Panel

The Meter Panel real time display consists of a table showing the parameters being measured by the DataNode for each of its channels. It is updated approximately every five seconds. Some power measurement information for a Service Entrance DataNode is shown in the sample Meter Panel table below.



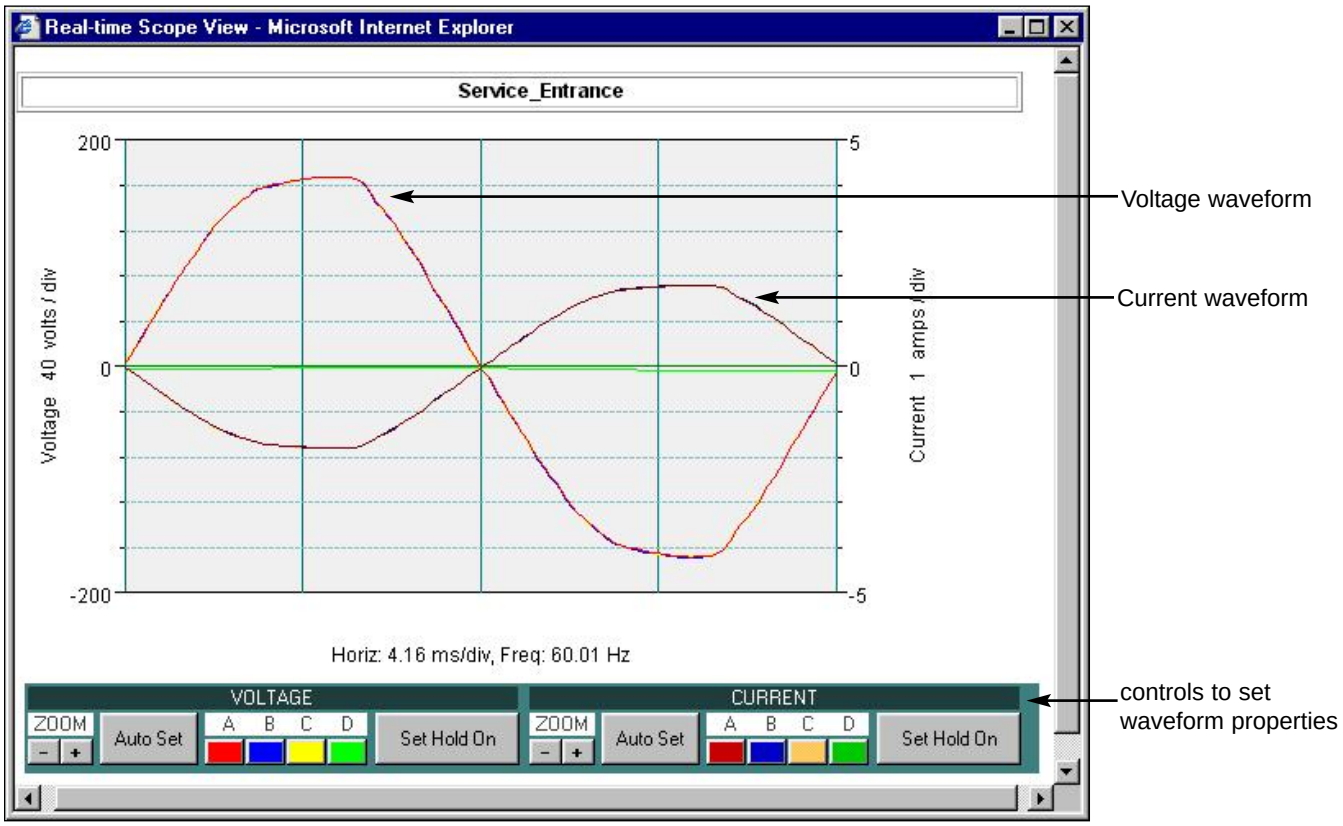
Service_Entrance

	A	B	C	N	Total	LN Average
Rms Voltage	117.7 V	117.8 V	117.7 V	0.1 V		
Rms Current	1.39 A	1.39 A	1.39 A	0.00 A		
Active Power	-163.4 W	-163.6 W	-163.4 W		-490.5 W	
Total Fund Freq Q	-0.84 var	-1.18 var	-1.22 var		-3.24 var	
Apparent Power	163.4 VA	163.7 VA	163.5 VA		490.5 VA	
True Power Factor	-1.00	-1.00	-1.00			
Displacement Power Factor						1.00
V/I Angle	179.7 Degrees	179.6 Degrees	179.6 Degrees			
Frequency	59.99 Hz					

Meter panel screen display

Scope Mode

The Scope display shows real time waveform data for up to 8 channels. Scope mode is only available in certain DataNode types, such as in EPQ DataNodes.



Help

Much of what is written in this manual can be found in the Help option onscreen. Expanding the Help tree will provide Real-time Topics and Index links.

Real-time Topics

The Real-time Topics page simply says that the user is currently in the Real-time page. Four active buttons are found in this page: Contents, Index, <<, and >>. These buttons present different ways to access the same Help information. The differences lay only in the way each button organizes and lists information.

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Index

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The Contents button operates exactly like the Table of Contents in books. Information is listed and organized under different headings. The headings normally used here are the tab names. Sub-topics per heading appear as hyperlinks.

This chapter explains the various programmable settings for the InfoNode. For security reasons, the settings can be changed only by persons with admin access privileges.

Setup Page

The Setup page is used to view and/or change any of the programmable features of both InfoNodes and DataNodes. The InfoNode Setup page is generic, without regard to which types of DataNodes are connected to the system. The DataNode Setup pages are specific to the type of DataNode. The left-hand frame contains the interactive tree from which users can view the setup information they need. The Setup tree can be expanded or collapsed. Click on the plus sign to further expand the tree and show more of the options available. Click on the minus sign to collapse the tree back up one level.

In order for a new user to access the system, the system administrator (someone with Admin privileges) must first set up an account for the new user. The system is shipped with default Admin, Guest and other accounts, which the system administrator should customize with your own name and password. Any changes made in the setup parameters are not confirmed until the Save Setup button found on the bottom of the page has been clicked.

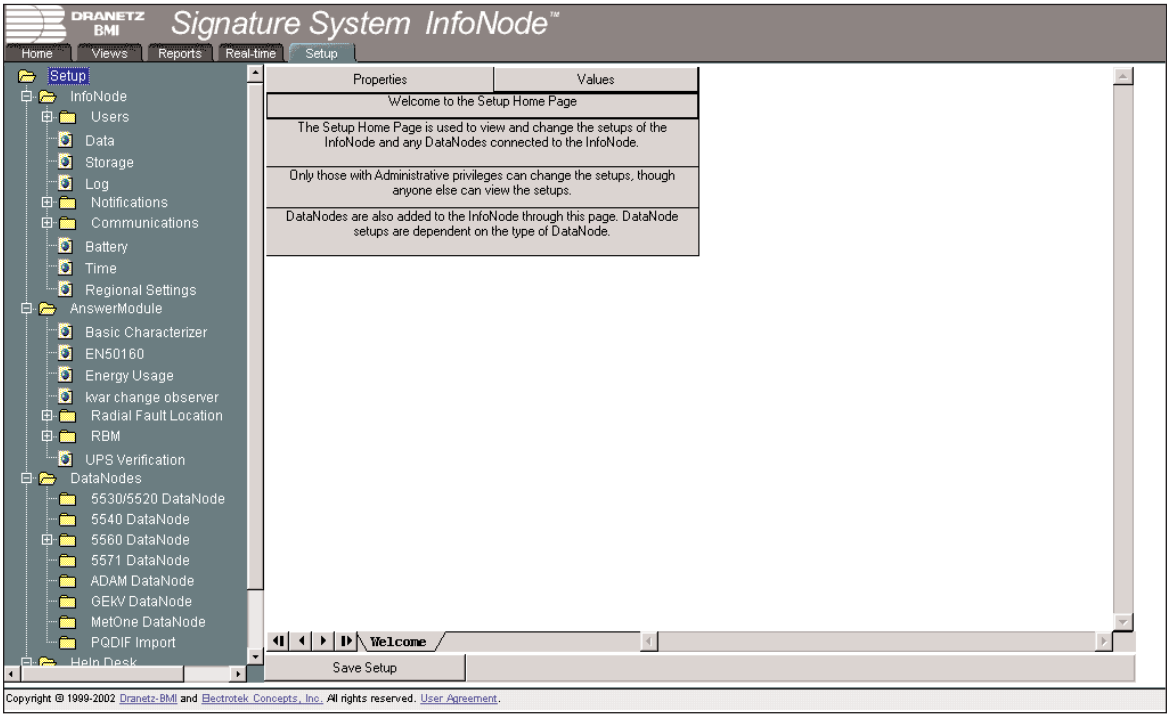
InfoNode

InfoNode Setup can be expanded to reveal the following data folders: Users, Notifications, Communications, Answer Module, DataNodes, and Help Desk.

Users

The Users section includes Guest, Viewer, Operator and Admin User. An Admin User can add new users by right clicking the mouse while the cursor is over the User folder. Only the Admin User can create accounts for others and change Security Levels. Once the accounts are created, the other types of User can change the *User Name*, *Password* and *Proficiency Level*.

User Name - up to 30 alphanumeric characters can be entered for the name.
Password - up to 12 alphanumeric characters can be used for the password. A confirmation window pops up to verify the password before proceeding.
Description - usually contains descriptive nature of the account created for a particular user.
Security Level - can only be assigned by someone with Admin privileges.
Proficiency Level - select either Novice or Expert user, where the setting will determine which types of reports and views will be displayed.



Setup home page

Properties	Values
User name	guest
Password	**********
Description	Free access for demos
Security level	Guest
Proficiency level	Novice

Sample display window screen for a user named 'guest'. By selecting an item on the Properties column, a cursor or choices will appear on the right column space. Enter your desired Values.

Certain property items can be accessed only by those with admin privileges. Read next sections on Security Level and Proficiency Level.

Security Level

There are four levels of security provided. The security levels can only be assigned by someone with Admin privileges. These levels are known as roles and are defined as follows:

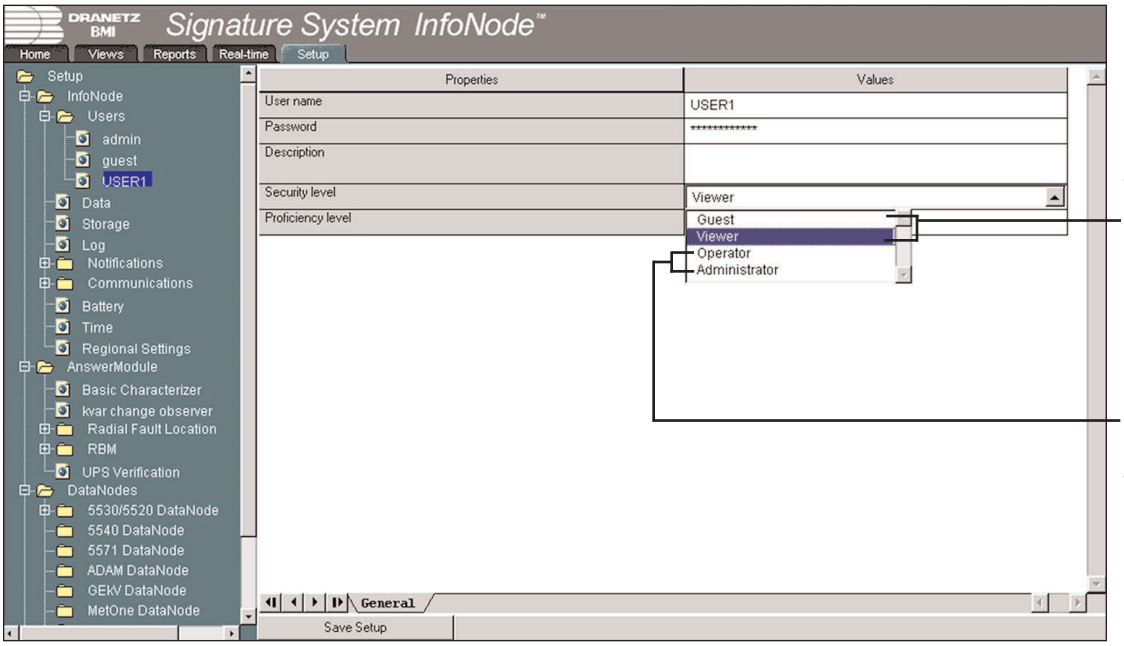
Guest - Can only view data. Cannot change user preferences or system setups. Cannot change the configuration of the instrument in any way.

Viewer - Can view data and access basic setup features. Can change only basic user preferences, e.g plot title, text size/color, background color, etc. You can open user preferences dialog box by right clicking on the event image and selecting properties.

Operator - Can view data, change user preferences, and change select DataNode and InfoNode setups. Cannot add users or change security levels.

Administrator - Can access basic setup, security account management, and network configuration parameters. Can access all features of the InfoNode including factory setup.
NOTE: The Administrator mode is accessible only to users with administrative privileges.

The InfoNode supports log-in accounts that have a user name, password and security level/role associated with each account. The InfoNode is able to support 60 to 100 accounts.



InfoNode Setup page. Above screen shows sample new user account being entered by the System Administrator. The Administrator assigns the security level that determines extent of user privileges.

Proficiency Level: Novice or Expert

Users may select between Novice or Expert modes which determine the number of DataNode tab settings that can be viewed and the types of reports and views that can be displayed. The novice mode allows users to access only the Smart series of items (Smart Setup, Smart Reports).

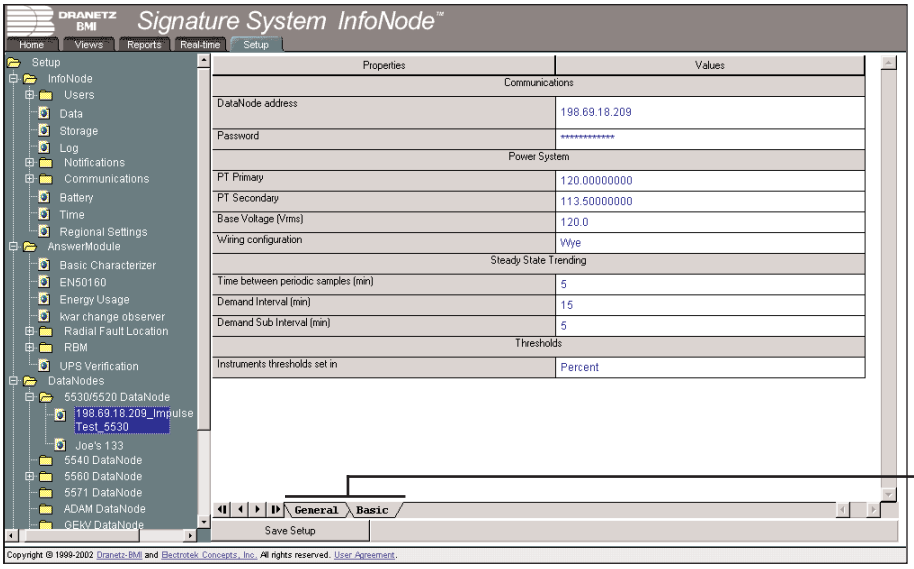
Users assigned the security level of Guest can only view, not change, DataNode settings. All Setup tab options for Guests are disabled.

The Novice mode displays only those options absolutely essential to the operation of the system. This entails only allowing users access to view two (2) DataNode Setup tabs, the General tab and Basic tab.

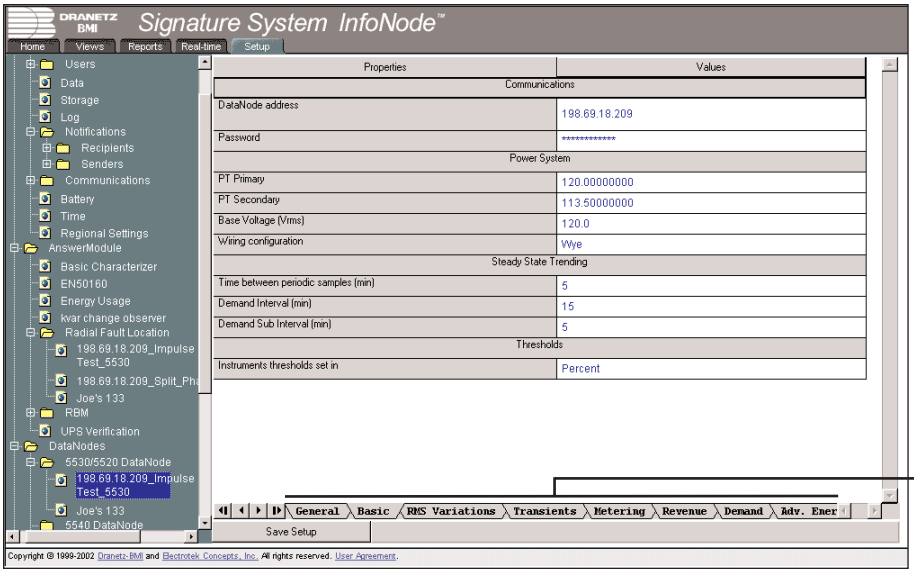
The Expert mode displays all the Setup tabs available in a particular DataNode.

To switch between Novice and Expert mode:

1. Click on the Setup tab>Users>User name.
2. Click on Proficiency Level to display drop down menu.
3. Select between Novice and Expert mode.
4. When done, click on Save Setup found at the bottom of the page. A Save confirmation window will pop up.
5. Click on Yes to save changes or No to exit without saving changes.



Sample DataNode screen set under Novice mode; Basic tab activated

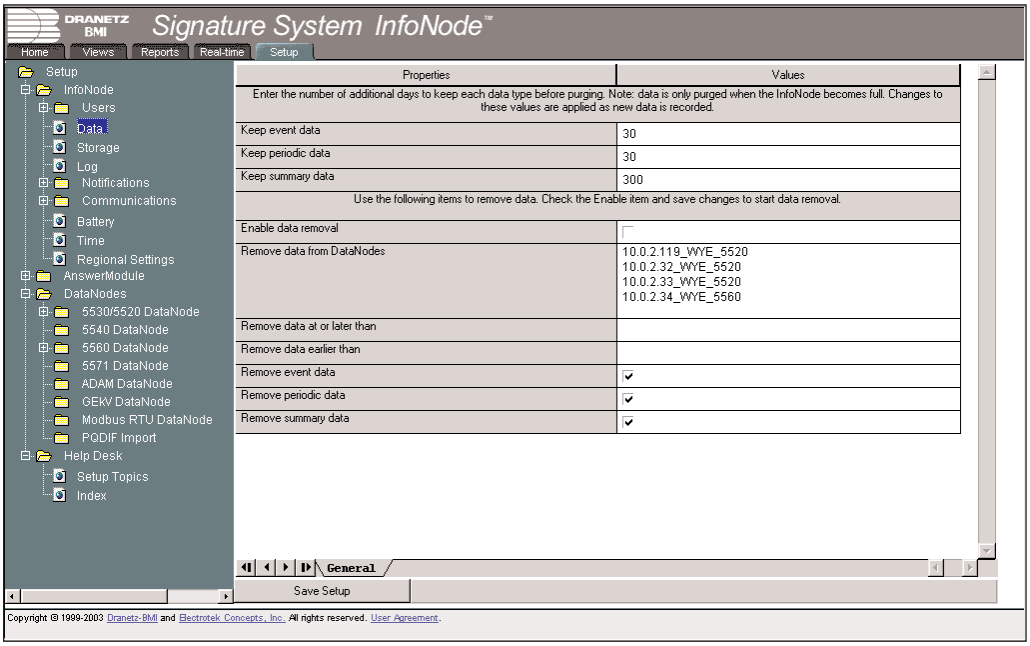


Sample DataNode screen set under Expert mode; Basic tab activated

Data

Data setup allows you to specify the number of additional days to keep each data type (*Keep event data*, *Keep periodic data*, *Keep summary data*) before purging. When the InfoNode becomes full, it purges data in a first-in-first-out order. This feature allows you to prioritize the order in which data is purged. The number of days to keep data values are used to bias the purge time of each type of data respectively. In an InfoNode with sufficient storage, this results in the lifetime of one type of data being extended by the specified number of days relative to other data types. The InfoNode always purges old data when it needs space for new data. Consequently, the lifetime of data is only extended by the specified number of days when sufficient storage is available. The purge time for data is biased and stored when the data is saved. Changes to the bias values are not applied to previously stored data.

The Data setup also allows you to remove data stored in the InfoNode. Select any one or a combination of DataNodes opposite *Remove data from DataNodes*. Specify the date and time range when you want the data removed from the DataNodes using *Remove data at or later than* or *Remove data earlier than*. Choose one or more data types to remove (*Remove event data*, *Remove periodic data*, *Remove summary data*). Once the data removal selection is specified, check the *Enable data removal* property and save the properties to start removing data. When data removal is in progress, all selection fields are disabled. You can stop data removal by clearing the Enable data removal property and saving the properties. Data removal can be a long process, particularly in a busy InfoNode with large amounts of data. Refresh the Data tab to see if data removal is complete.



Data - General tab properties

Storage

Storage setup is related to how much memory *Space to keep free (MB)* to add other software modules in the future, and whether to *Rebuild index* or *Rebuild query table* to compact the memory.

Log

The Log setup allows you to specify the number of additional days to keep each log entry type (*InfoNode activity*, *User activity*, *DataNode management*, *Alarms*) before purging. This mechanism is the same as that used for handling other purgeable data in the InfoNode. Refer to Data setup for more information on purging data. Right-click on the Log setup tree item to access the Clear Log menu command. Selecting this command removes all log entries stored in the InfoNode.

NOTE: Only Admin users can configure the log settings and delete log entries.

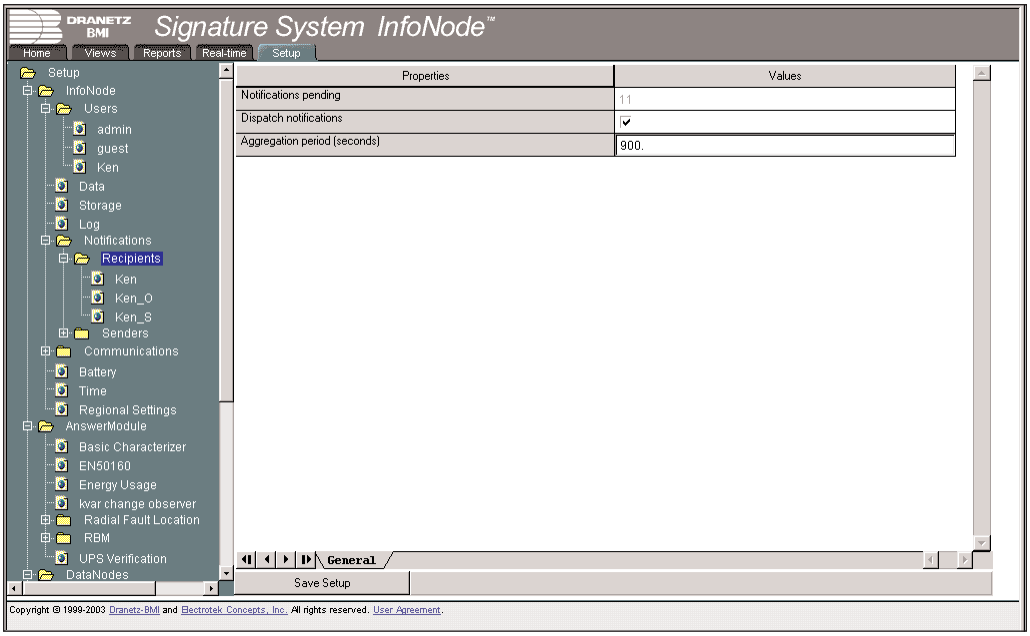
Notifications

The Notifications section is subdivided into Recipients and Senders. Notifications allow the system to automatically inform users about specific events related to every DataNode connected to the InfoNode. Notifications also inform users whether DataNode connection is lost or re-established, and when the InfoNode starts.

Recipients

Recipients define who will receive notifications. The General tab contains properties to indicate recipient notification status. Only those with Admin privileges may set whether to dispatch notifications or not. Users who access the InfoNode system as Guest, Viewer or Operator will find the General properties automatically disabled. They are not allowed to dispatch notifications nor change time settings when notifications will be sent to recipients.

Notifications pending - a counter on the number of notifications that will be dispatched to recipients at specified time interval. The counter will reset to zero once the pending notifications are sent to recipients. The counter sets automatically and is not user-programmable.
Dispatch notifications - the enable/disable checkbox indicate whether recipients will receive/not receive notifications.
Aggregation period (seconds) - the time interval upon which notifications are sent to recipients and updated. Notifications update is done every specified number of seconds (i.e. every 900 sec = 15 minutes).

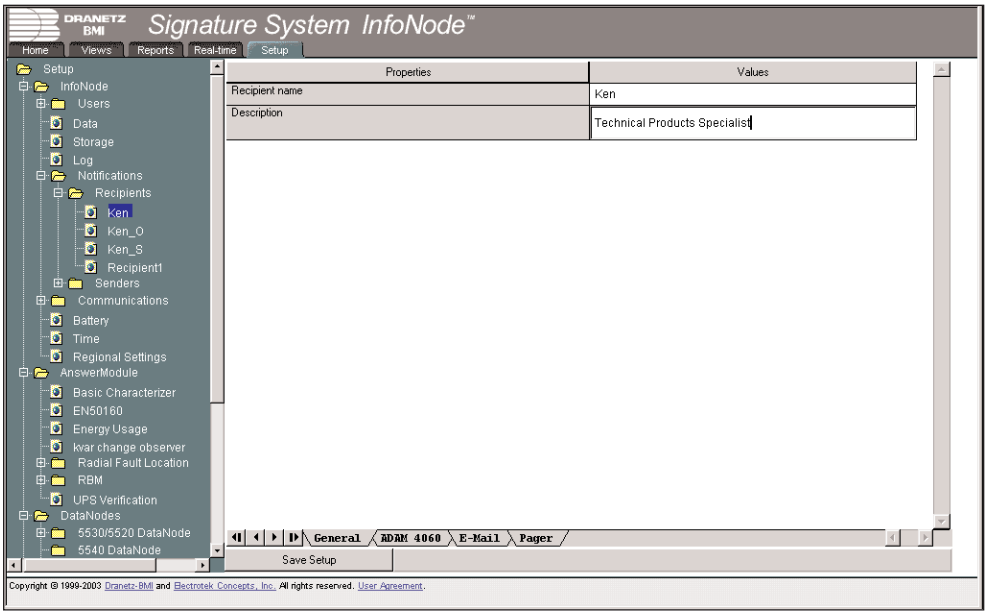


Recipients setup screen - General tab properties

To Add/Delete Recipient names:
· Right-click on the Recipient folder. The following options will appear: Add Recipient or Clear Notifications.
· Click on Add Recipients if you want to add a name in the list of recipients. Click on Clear Notifications if you want to delete all names in the list of recipients.
· Click on the Recipient Name to enter or change name and to program information about the type of recipient. Note the following tabs available on the bottom portion of the viewing area: ADAM 4060, E-Mail, Pager.
· Right-click on the recipient name if you want to Copy Recipient (duplicate recipient name and properties), Delete Recipient (remove recipient on the list), Test Recipient (send test messages to recipient), or Clear Notifications (reset pending notifications for the recipient).

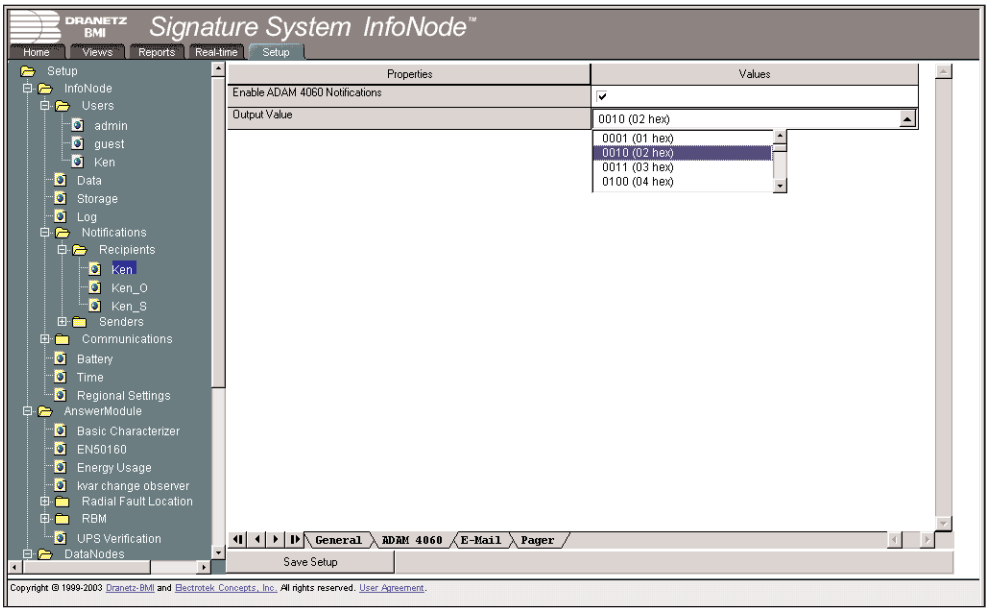
Notifications are dispatched to recipients in three ways: through ADAM 4060 Relay outputs, E-Mail, and/or Pager. Recipients must be set up before items in the Senders folder are programmed.

Click on a recipient to display the General tab properties. The *Recipient name* provided will be used to identify recipient and will appear under the Recipients folder on the left-hand frame. Further *Description* can be added to aid in recipient identification. Each recipient has a corresponding ADAM 4060 Relay outputs tab, E-Mail tab, and Pager tab described next. Note that when changing from one tab to another, a save confirmation box appears to confirm whether user wants to save the most recent changes in settings or not.



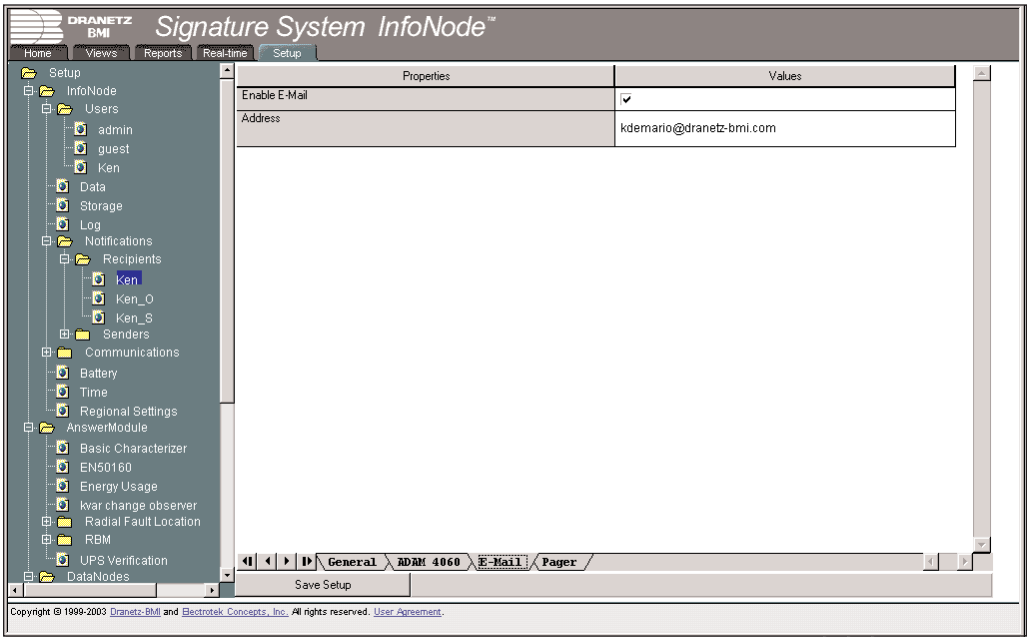
Recipient Name/General properties setup

Click on the ADAM 4060 tab. The *Enable ADAM 4060 Notifications* box must be checked for communication signals to ADAM modules to occur. The ADAM 4060 relay contact closure module is used to signal notifications to designated recipients. See page 12-3 for instructions on how to set up the ADAM 4060 contact closure module. Data for the ADAM modules may be configured in various format, one of which is the hexadecimal format displayed opposite the *Output Value* property. This format is selected by setting bits 0 and 1 of the data format. ASCII's condensed hexadecimal representation of data allows high resolution, quick communication and easy conversion to computer-compatible integer format. See page 7-12 for more information on ADAM Communication modules.



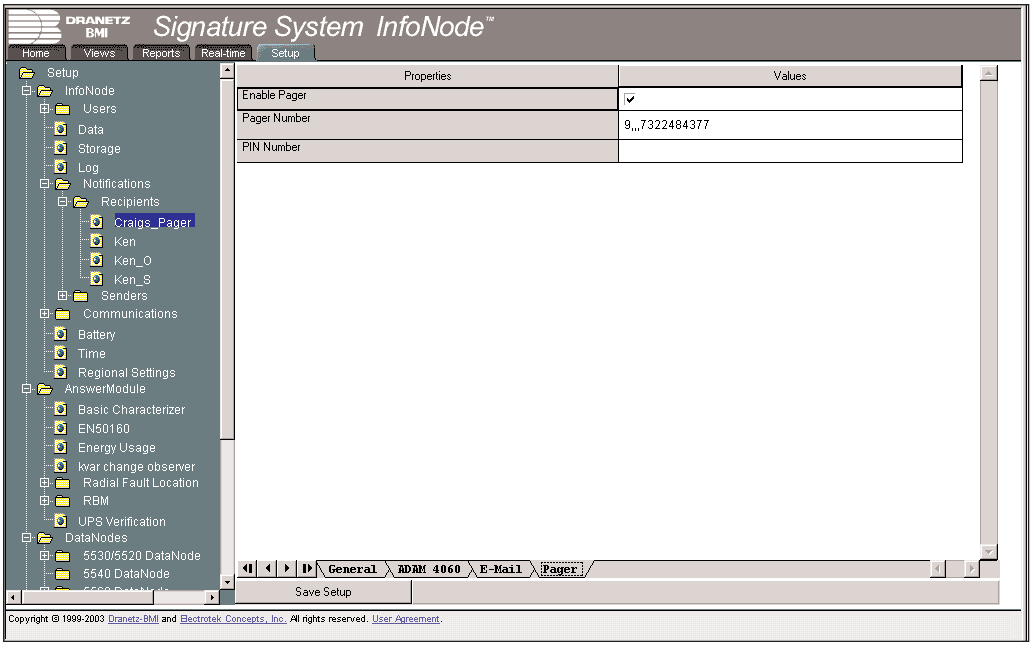
Recipient ADAM 4060 notification setup

Click on the Email tab. The *Enable Email* must be checked to allow notifications to be sent to the recipient's email address. Type in the recipient's electronic mail *Address* in the space provided.



Recipient Email notification setup

Click on the Pager tab. The *Enable Pager* must be checked to allow notifications to be sent to the recipient's pager unit. Type in the corresponding *Pager Number* and *PIN Number* where notification signals will be sent.



Recipient Pager notification setup

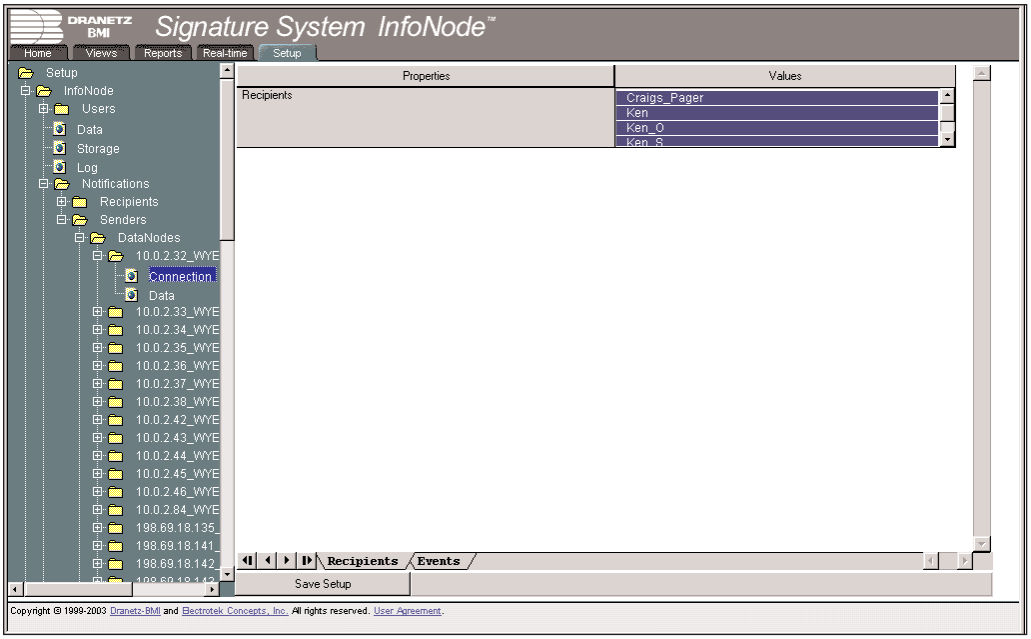
Senders

The Senders section branches out into DataNodes and InfoNodes.

DataNodes - each DataNode has its own unique identification and is monitored on their Connection status (whether connection is lost or re-established) and on the Data that they register.

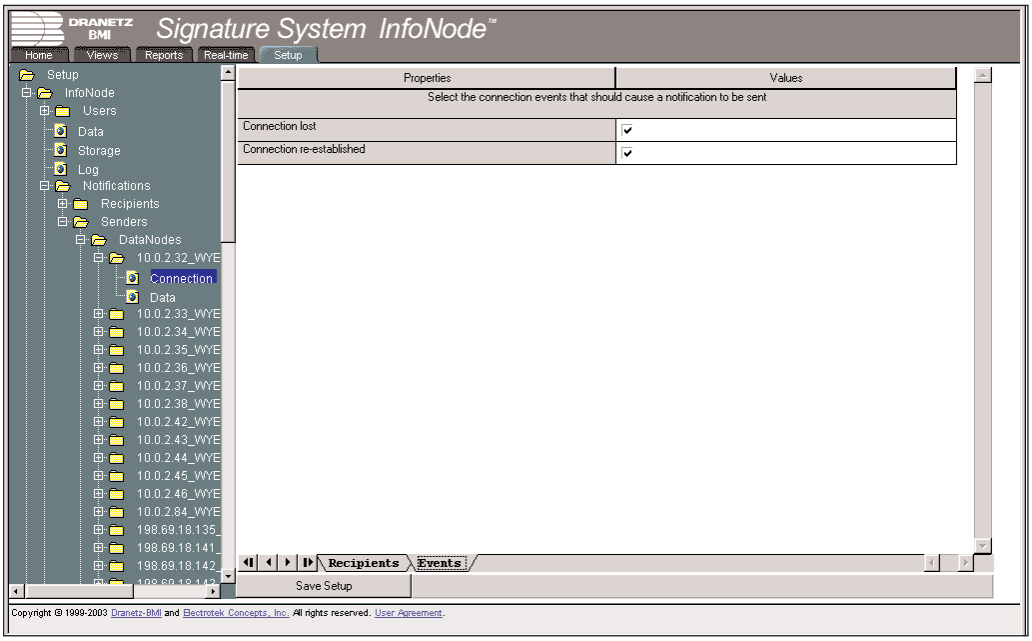
Connection

The *Recipients* tab indicate the names of recipients who are currently connected to the DataNode. These recipients will receive notifications pertaining to DataNode connection described next, provided the Administrator enabled/granted Dispatch Notifications (see page 7-5).



DataNode Recipients connection setup

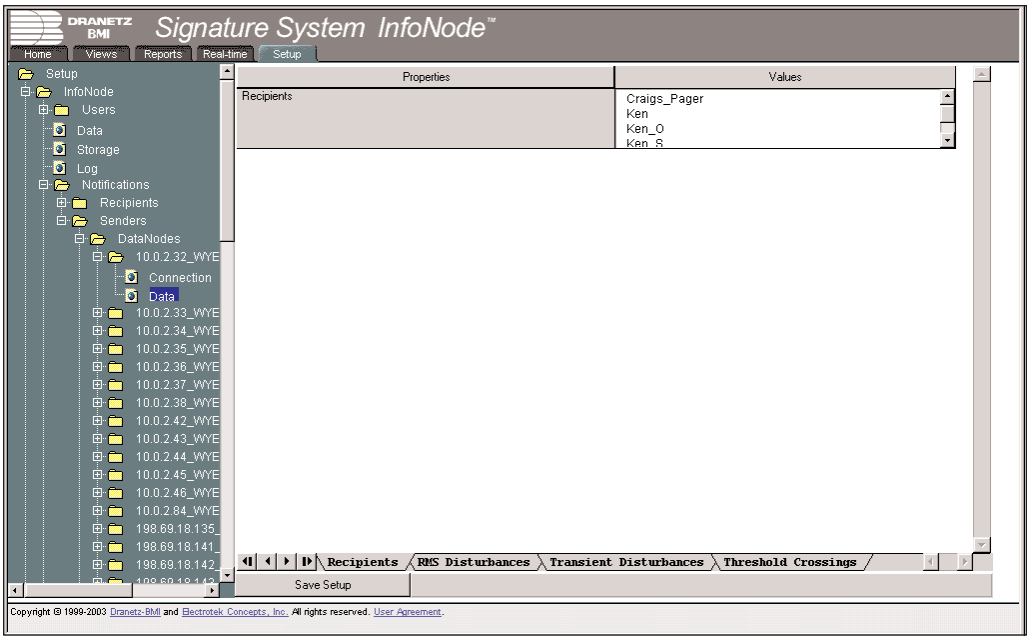
The Events tab contains the facility to communicate DataNode connection status to recipients. *Connection lost* must be enabled if you want to notify recipients whenever DataNode connection is lost. *Connection re-established* must be enabled if you want to notify recipients whenever DataNode connection is restored.



DataNode Events connection setup

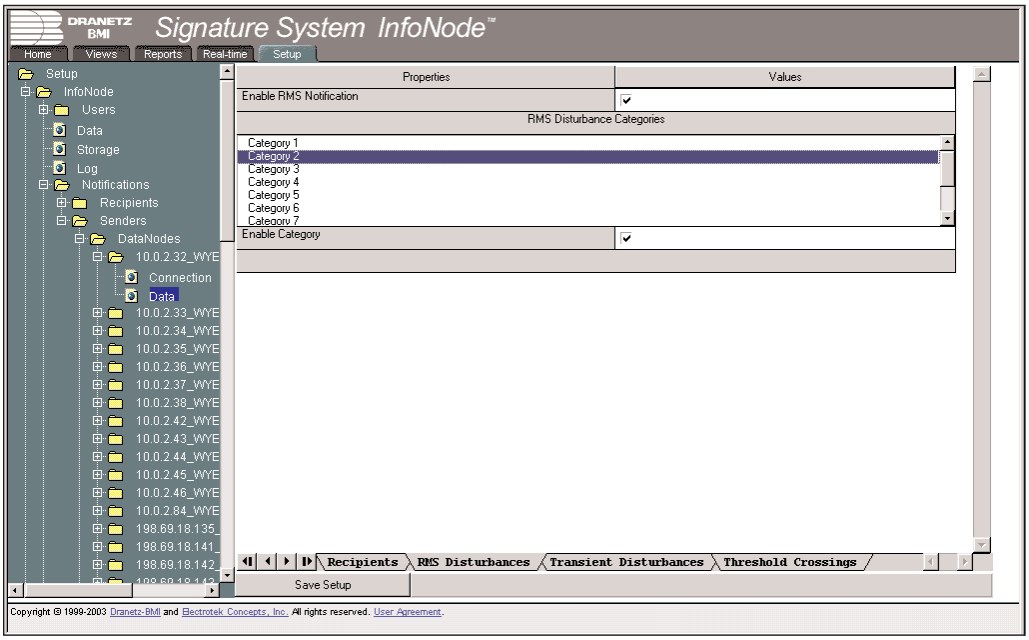
Data

The Recipients tab indicate the names of *Recipients* who are currently connected to the DataNode. These Recipients will receive notifications pertaining to specified events detected by the DataNode, provided the Administrator enabled/granted Dispatch Notifications (see page 7-5).



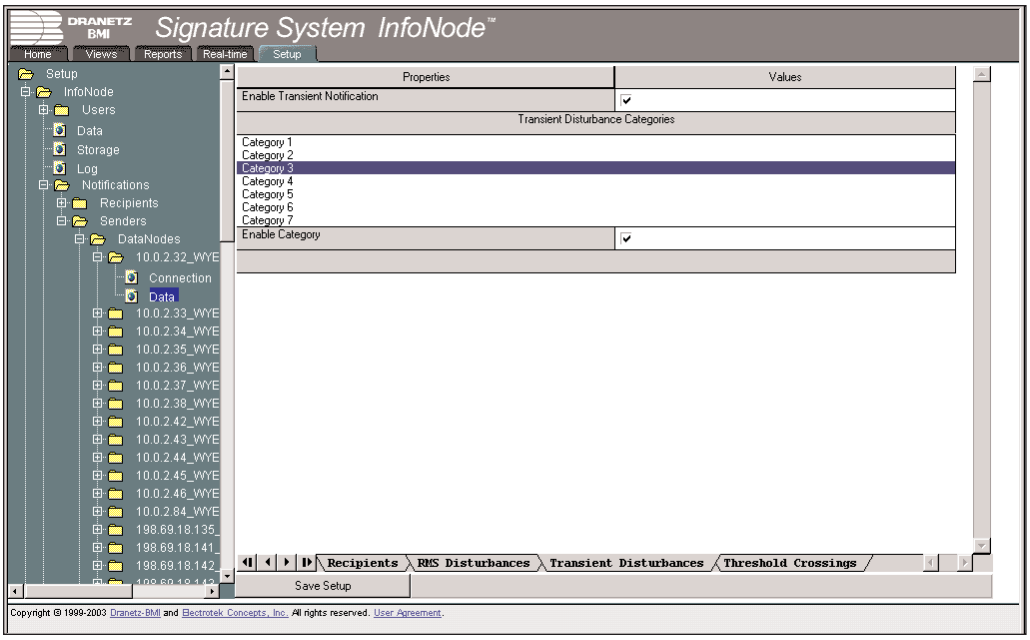
DataNode Recipients notification setup

The *Enable RMS Notification* must be checked to allow the system to send RMS disturbance event notifications to recipients. Threshold properties for the different *RMS Disturbance Categories* have been set under the Basic Characterizer - RMS Disturbance Categories tab (see page 7-19). The *Enable Category* allows users to select which category they want to activate and, as per the RMS disturbance category definition on page 7-18, register as RMS event. This selective enabling process allows users more control over the event notifications they receive.



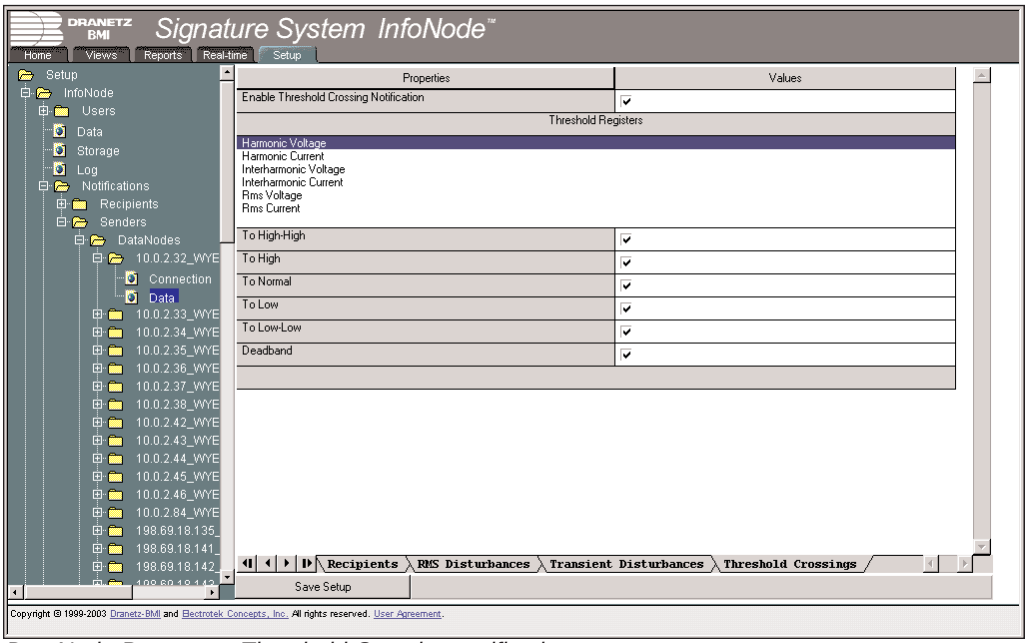
DataNode RMS Disturbances event notification setup

The *Enable Transient Notification* must be checked to allow the system to send Transient disturbances event notifications to recipients. Threshold properties for the different *Transient Disturbance Categories* have been set under the Basic Characterizer - Transient Disturbance Categories tab (see page 7-20). The *Enable Category* allows users to select which category they want to activate and, as per the transient disturbance category definition on page 7-20, register as transient event. This selective enabling process allows users more control over the event notifications they receive.



DataNode Transient Disturbances event notification setup

The *Enable Threshold Crossing Notification* must be checked to allow the system to send specified parameter threshold crossing notifications to recipients. The *Threshold Registers* lists the parameters available for which various threshold limits can be defined. Click on a parameter (i.e. Harmonic Voltage) and select the threshold limit/s (High-High, High, Normal, Low, Low-Low, Deadband) that you want enabled/disabled for that particular parameter. This means that once an enabled parameter has exceeded the threshold limit, an event will be registered. This selective enabling process allows users more control over the event notifications they receive and prevent the processing of unwanted data.

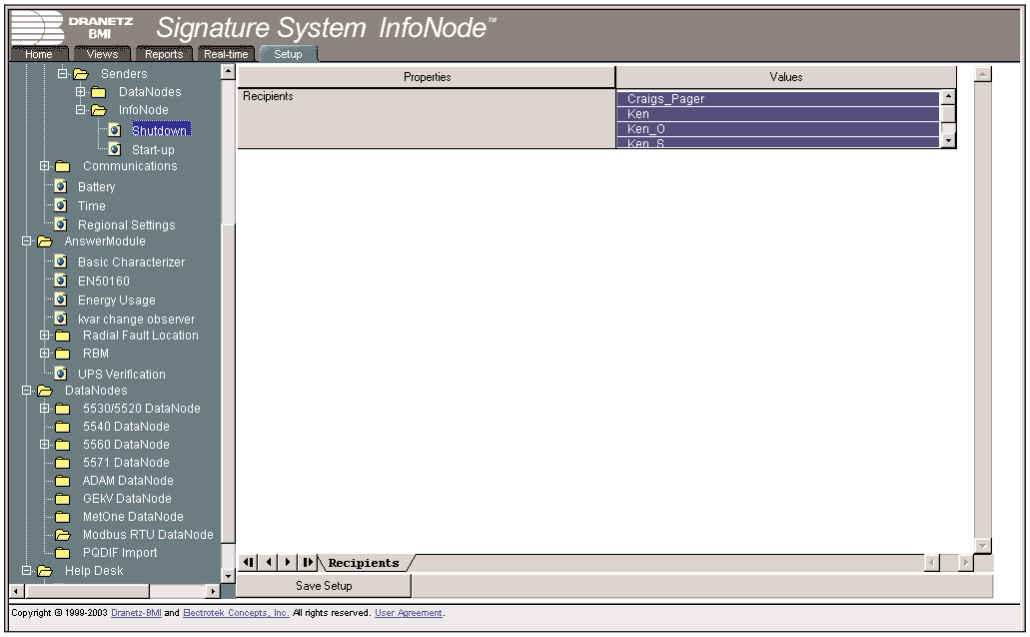


DataNode Parameter Threshold Crossing notification setup

InfoNodes- contains notifications regarding InfoNode system shutdown and start-up.

Shutdown

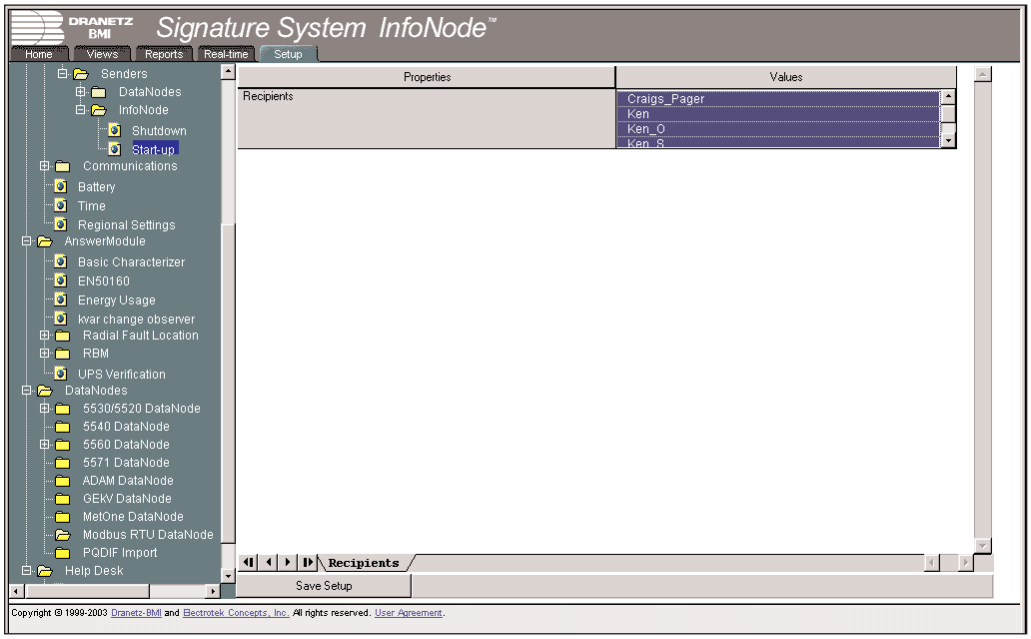
The InfoNode *Recipients* tab indicates the names of recipients who will receive notifications when the InfoNode shuts down operation. See page 7-5 for the procedure on how to add/delete recipients.



InfoNode Shutdown notification setup

Start-up

The InfoNode *Recipients* tab indicate the names of recipients who will receive notifications when the InfoNode starts up operation. See page 7-5 for the procedure on how to add/delete recipients.



InfoNode Start-up notification setup

Communications - The Communications data folder contains information on Internet Protocols and network settings.

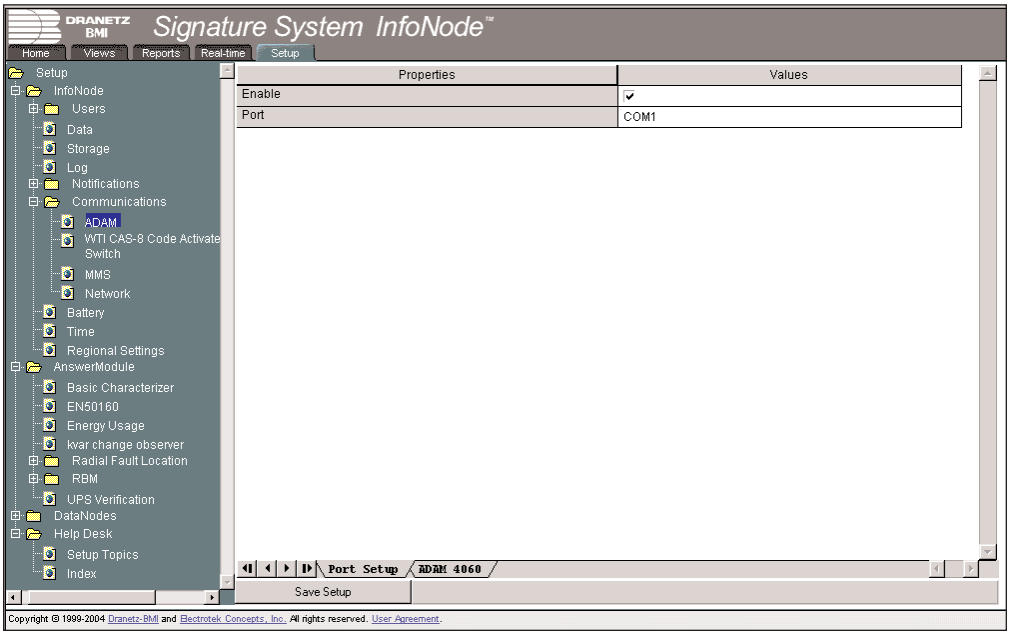
ADAM

ADAM Instrument and Communications Handler Setup

The ADAM handler supports the Advantech ADAM 4000 and 5000 series of distributed general purpose I/O modules. All input modules are supported through the ADAM instrument handler. Relay output functions for notifications are set as part of the communications handler. At this time only input modules are supported with the exception of the notification feature.

Port Setup tab

Select ADAM on the setup tree under the Communications branch. When selected, the following property page is displayed. The Port Setup tab is used to *Enable* ADAM communications. The Enable control must be checked for any communications to ADAM modules to occur. All ADAM communications will occur on the indicated port. Set the COM *Port* that will be used for ADAM modules. Only one ADAM RS-485 and RS-232 network on one COM port is supported.

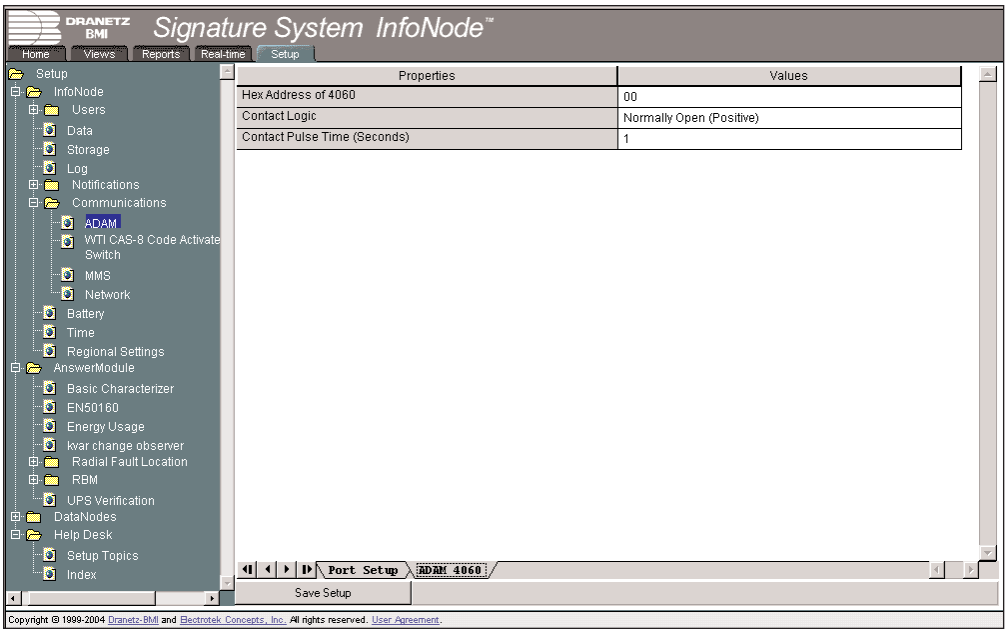


Port Setup tab

ADAM 4060 tab

The ADAM 4060 relay contact closure module is used to signal notifications to a third-party system (i.e. SCADA, BMS-Building Management System, etc.) that can only accept relay contacts as input. This portion of the setup allows for global setup of the properties that will be common to all uses of the single 4060 allowed on the system.

The *Hex (Hexadecimal) Address* property specifies the address of the 4060. The *Contact Logic* property allows specification of the logic "sense" of the messages to be sent. The default value of "Positive" (or Normally Open) means that a logical value of "1" is a closed contact and a logical "0" is an open contact. "Negative" (or Normally Closed) logic means the opposite: logical "1" is an open contact and logical "0" is closed. The *Contact Pulse Time* specifies how long the
contacts should be actuated to signal the notification. See the ADAM 4060 tab setup screen on page 7-13.



ADAM 4060 tab

Operation of the ADAM 4060

The ADAM communications handler is available to all parts of the InfoNode system through the Communications Manager. The handler is configured to use a specific serial port on the InfoNode. When a request for connection to an ADAM module is received, the handler attempts to open the specified port at 9600, 8, N, 1.

Once a connection is made, the application may issue commands that send data to the 4060 based on the logic sense and contact pulse time parameters. The connection attempts to verify that the command is completed. If the module reports an error condition, the error condition is reported back as part of the function return. If positive or if no response is detected, the connection attempts to restore the relay state to 'normal', 0 for positive logic and 1 for negative.

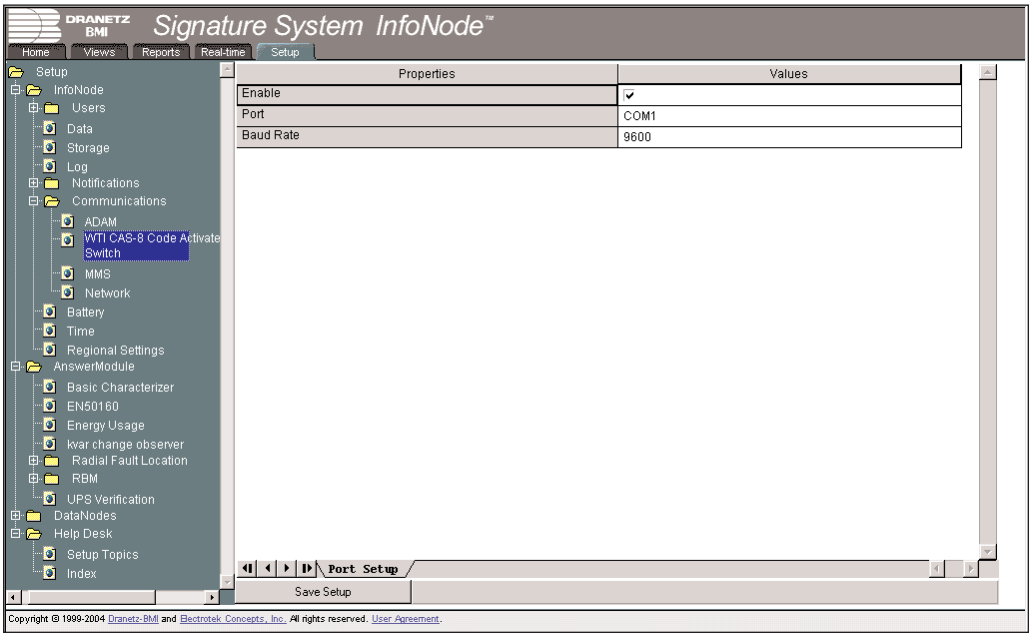
ADAM Instrument Handler Setup

See Chapter 12 ADAM Handler Setup for a detailed discussion on how to set up the individual InfoNode ADAM instrument handler. Programming of individual modules are accomplished via switch settings on the modules themselves.

Refer to the *ADAM 4000 Series User's Manual* for more details on how to configure, set up and install the ADAM modules. The Windows driver and the Utility disk for the ADAM-4000 Series are shipped along with the *ADAM 4000 Series User's Manual*, Copyright ©1997 Advantech Co., Ltd. The user's manual can also be accessed online at http://service.advantech.com.tw/download/Files/1-A2XID/Adam-4000_ed7.pdf

WTI CAS-8 Code Activated Switch

The Port Setup tab is used to enable/disable communications to a 5500 Series DataNode and/or GEKV DataNode. Check *Enable* to allow communications to the specified DataNode. All DataNode communications will occur on the indicated port. Set the COM *Port* that will be used for a specified DataNode. Only one RS-485 and RS-232 network on one COM port is supported. The *Baud Rate* refers to the speed in bits per second by which the COM port processes DataNode communications requests.



COMS Port Setup tab

MMS

MMS or Manufacturing Messaging Specification is where communications address settings for the InfoNode are configured. The MMS protocol is used for connections to UCA compliant devices such as the Signature System 5520, 5530 and 5560 DataNodes. The InfoNode also accepts incoming MMS connections for system discovery functions.

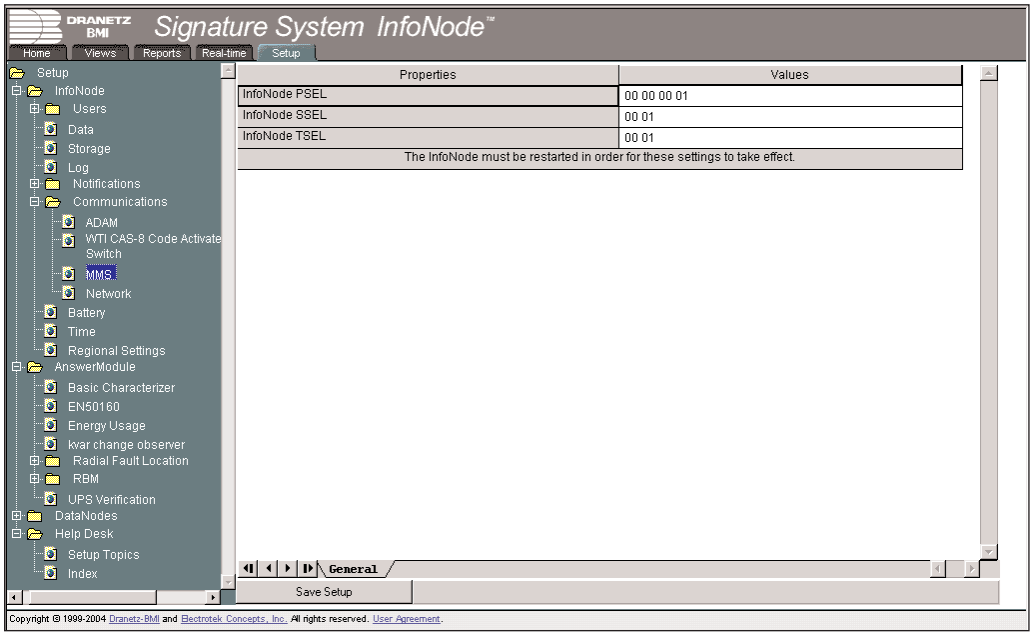
MMS contains the following property settings:
InfoNode NSAP refers to the OSI network address. This value is the equivalent of the IP address for the InfoNode or OSI networks. This value is not used and is removed as of firmware version 3.0.11.

InfoNode PSEL stands for Presentation Selector with default value 00 00 00 01.

InfoNode SSEL refers to Session Selector with default value 00 01.

InfoNode TSEL means Transport Selector with default value 00 01.

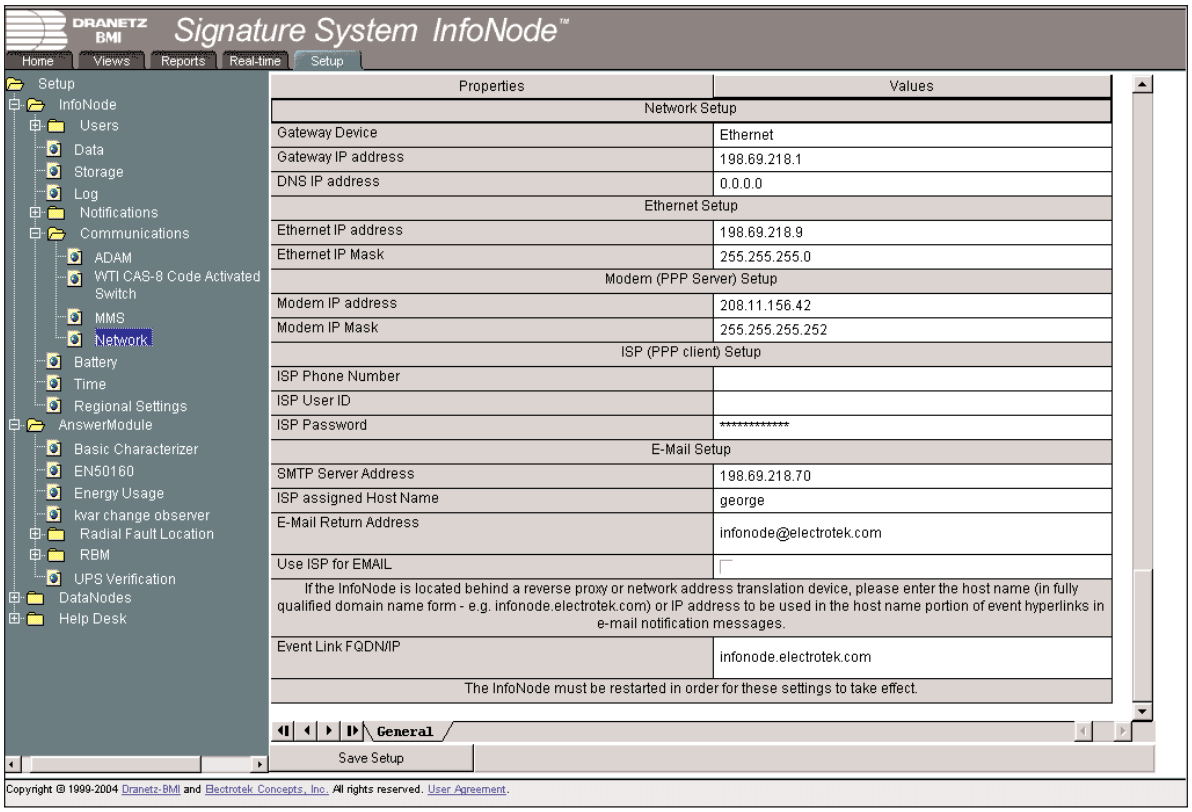
In general, you do not need to change the MMS settings from their default settings. The PSEL, SSEL, and TSEL values of the InfoNode must match those of the DataNode that the InfoNode communicates with. A mismatch results in "Connection Failures".



MMS General setup tab

Network

Network contains the properties that allow the InfoNode to link DataNodes and ADAM modules to its self-contained web server and user interface. It is possible to communicate with the InfoNode through either LAN or modem connections. Each communication method requires specific configuration settings. In the ISP Setup screen below, the *Network Setup* features the settings required for the InfoNode to operate on the network. The *Modem Setup* and *ISP Setup* feature the settings required for dial-up networking and to establish interface links between the InfoNode and the computer's modem.



NET ISP Setup tab

The InfoNode uses the PAP protocol for PPP dial-up connection authentication. This is a simple, unencrypted authentication protocol. It is more secure than the standard web page authentication but less secure than an encryption based PPP authentication protocol. You must therefore use an ISP that supports PPP dial-up accounts that allow PAP authentication. Most ISPs permit PAP authentication.

Windows 2000 server is used by some enterprises to provide remote access. Windows 2000 defaults to a very secure configuration and hence does not support PAP authentication by default.

To enable PAP authentication on Windows 2000 server, there are several configuration options that must be set:
· PAP must be enabled in the Routing and Remote Access Service management console for the RRAS server
· PAP must be enabled in the RRAS policy object in the RRAS management console
· Clear text authentication must be permitted in the RRAS policy object

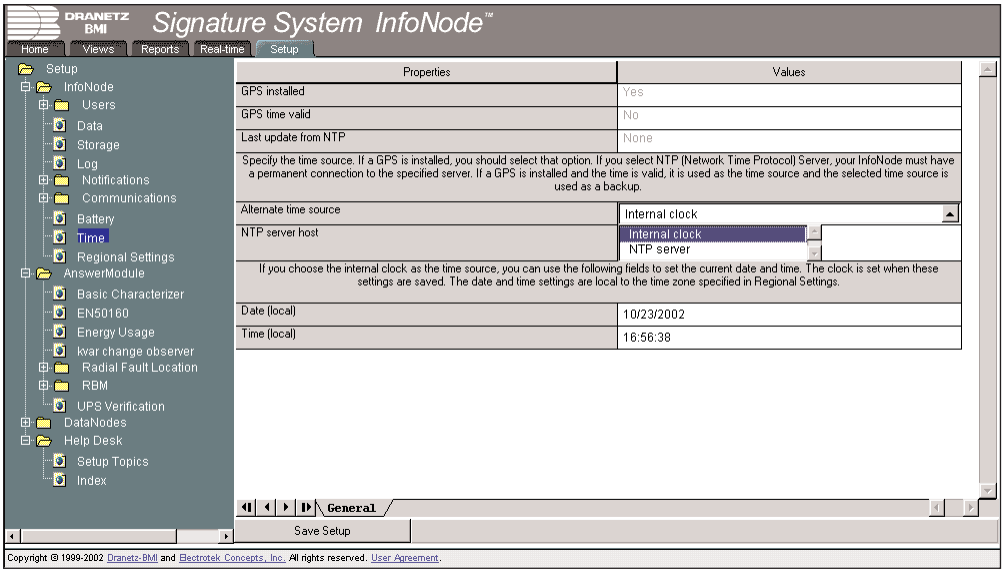
Only when PAP is enabled in all three places will a Windows 2000 RRAS server authenticate a PAP authenticated PPP login. In addition to this, you must specify the login ID in the InfoNode using DOMAIN\ UserID notation for PAP authenticated logins to a Windows 2000 RRAS server. This is described in the Microsoft Knowledge Base article at http://support.microsoft.com.

Battery

The InfoNode system allows users to check on the *Battery status* (whether charged or discharged) and the remaining *Battery capacity*. For convenience, the system allows users to keep date/time records when the *Last discharge* test was and when the *Next discharge* test will be.

Time

The InfoNode optionally provides for an on-board GPS receiver capable of receiving time signals from the GPS system and utilizing those signals to continuously update the system clock. If there is no GPS present or the GPS is present but a signal is not available, then you can specify whether the Time Manager uses the internal clock or an Internet clock source. To use the Internet clock source, you should specify the IP address of the NTP Server Host. A sample Time window screen appears as follows.



Setup screen for Communications - Time

Regional Settings

Regional Settings allows you to use different formatting conventions found in different parts of the world.

The following properties are found under the Date and Time tab. Select the applicable *Time zone* depending on your geographic location. Enable/Disable the option to *Adjust for daylight saving changes*. Select your preferred date and time settings to include *Date separator* (/ or - or .), *Date ordering* (mm/dd/yy, dd/mm/yy, yy/mm/dd), *Time separator* (: or .), and *Time format* (12 versus 24 hour format).

Under the Number tab, users can set the *Measurement system* using the U.S. system or the Metric system of measurement.

Answer Module

Answer Modules provide different types of reports that answer specific questions about data, such as whether the transient event was caused by a PF capacitor switching and whether the event occurred upstream or downstream from the monitoring point. The list of Answer Modules depends upon which optional modules were purchased and installed on the InfoNode. The minimum required InfoNode firmware version for the Graphical Interface Display (one-line) AnswerModule is V3.2.

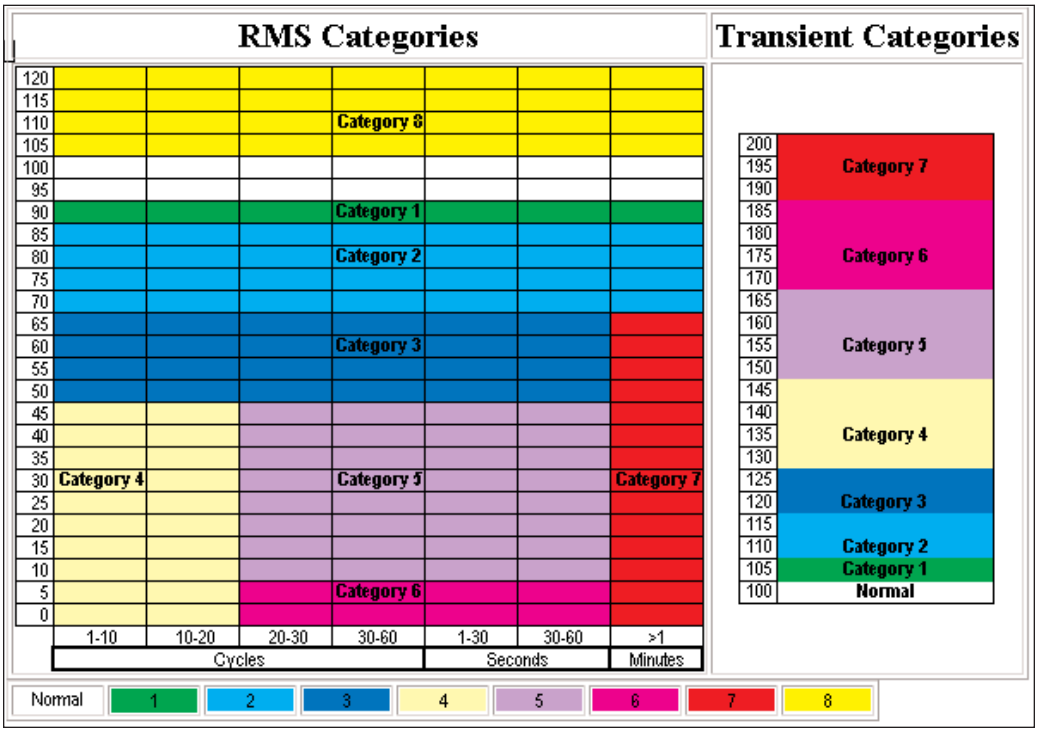
Basic Characterizer

Enables automatic detection of voltage sags which are often the most common type of power disturbance. Once detected, the Answer Module characterizes the sag. This Answer Module is the general and/or basic characterizer of the data. It characterizes RMS events as sags, swells, or interruptions. This Answer Module characterizes data based upon categories. The default settings of the categories are based on IEEE 1159 guide for characterizing power quality events, and these default settings can be seen in the figure next page.

The number in the magnitude column represents the range of values starting from that number up to but not including the number in the cell above it.

For RMS Variations, the categories do not necessarily represent a continuum; they are simply numbers that represent non-overlapping rectangles in mag/dur space. The categories generally represent increased risk of equipment malfunction. Note that Category 8 (swells) only stops at 125% for display purposes and in reality represents any swell greater than 105%.

For Transient Variations, the categories represent a continuum of peak transient over voltage. Note that Category 7 only stops at 205% for display purposes and in reality represents any transient with a peak magnitude greater than 190%.

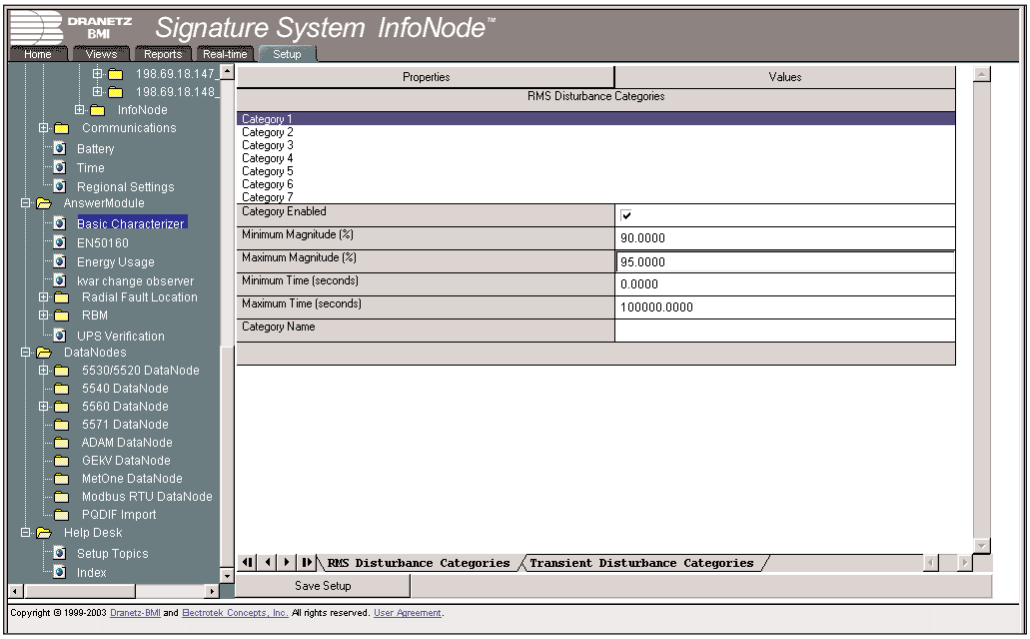


Definition of RMS & Transient Disturbance Categories

The user may modify the categories. The setup for this Answer Module allows the user to define the criteria for RMS and Transient Disturbance Categories.

RMS Disturbance Categories
The user may define up to nine RMS disturbance categories using the threshold property settings found in the setup screen. Click on a desired category, then set the corresponding threshold property limit (see definitions of the threshold properties below). Assign different threshold settings for each category. Once the threshold limits are crossed and the Category Enabled box checked, the RMS disturbance category will be classified as an event. These pre-defined RMS disturbance event categories are then reported as signal notifications to recipients (see page 7-9).

For example, in the RMS Disturbance Categories setup screen below, Category 1 was selected. Limit values for Category 1 were defined in the respective threshold property fields. The Category Enabled box has been checked to activate Category 1 as an event when threshold limits have been crossed.



Setup screen for RMS Disturbance Categories

For the selected category, the following fields need to be defined. Care should be taken so that categories do not overlap or that dead areas are created.

Category Enabled
For this to be a disturbance category it must be enabled. Check the box to activate or clear the box to deactivate.

Minimum Magnitude
The minimum magnitude is defined as a percent of normal that defines this category.

Maximum Magnitude
The maximum magnitude is defined as percent of normal that defines this category.

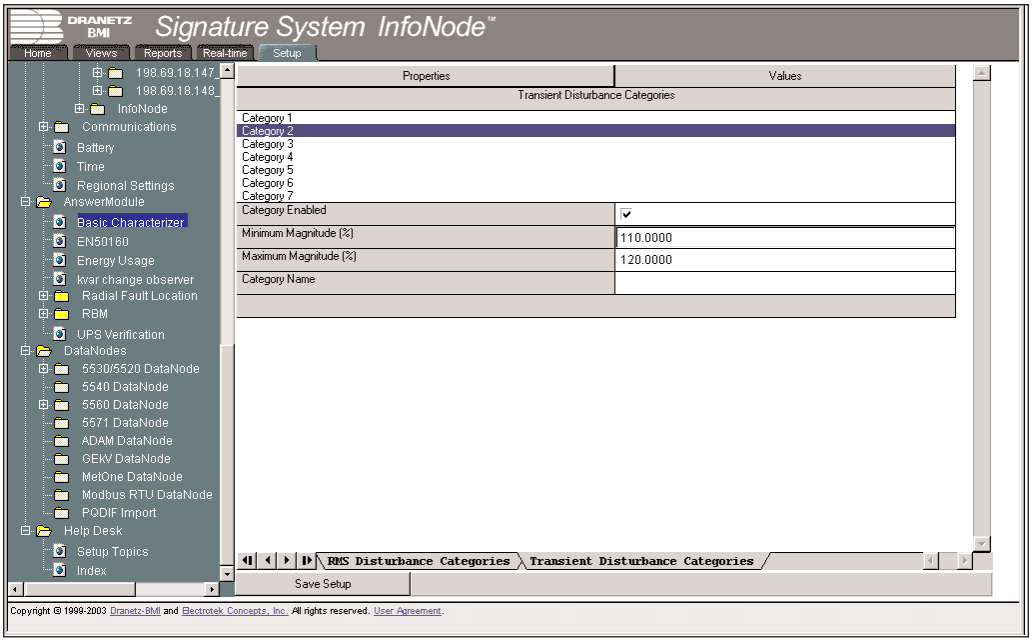
Minimum Time
The minimum duration is the minimum amount of time that the magnitude must be sustained.

Maximum Time
The maximum duration is the maximum amount of time that the magnitude can be sustained.

Category Name
The category name describes the defined category, and will appear in the characteristics field in Event Summaries and Notifications.

Transient Disturbance Categories
The user may define up to nine Transient disturbance categories using the threshold property settings found in the setup screen. Click on a desired category, then set the corresponding threshold property limit (see definitions of the threshold properties below). Assign different threshold limits for each category. Once the threshold limits are crossed and the Category Enabled box checked, the Transient disturbance category will be classified as an event. These pre-defined Transient disturbance event categories are then reported as signal notifications to recipients (see page 7-10).

For example, in the Transient Disturbance Categories setup screen below, Category 2 was selected. Limit values for Category 2 were defined in the respective threshold property fields. The Category Enabled box has been checked to activate Category 2 as an event when threshold limits have been crossed.



Setup screen for Transient Disturbance Categories

Category Enabled
For this to be a disturbance category it must be enabled. Check the box to activate or clear the box to deactivate.

Minimum Magnitude
The minimum magnitude is defined as a percent of normal that defines this category.

Maximum Magnitude
The maximum magnitude is defined as percent of normal that defines this category.

Category Name
The category name describes the defined category.

EN50160
EN50160 is a European product standard for voltage characteristics in public distribution networks. The EN50160 requires a 5560 QOS (Quality of Supply) DataNode for data acquisition. As per EN50160, the QOS compliance evaluation period is one week, beginning at midnight on Sunday. These can be altered using the EN50160 setup properties, however the system would no longer be calculating the information in strict compliance with the standard.

The EN50160 Setup properties include *Start day* and *Start time,* where users can program their preferred day and time when they want the evaluation period to commence. Users can also set the *Length* of the evaluation period in days, weeks, or months. Refer to Chapter 10 *5560 QOS* for more discussion on the 5560 DataNode.

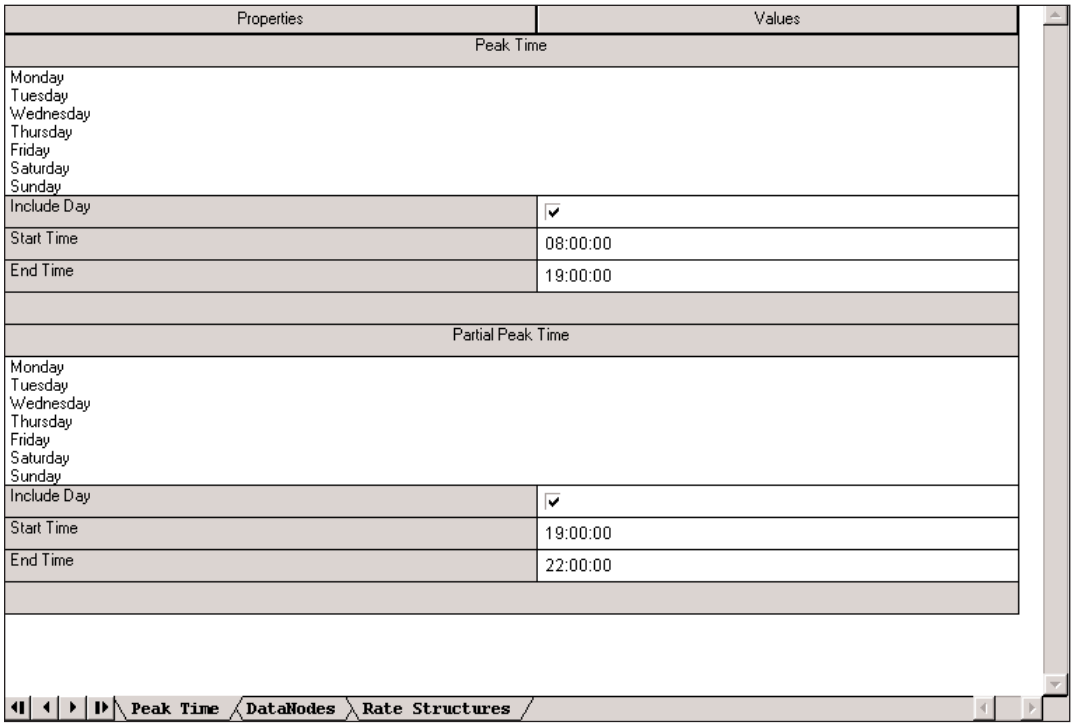
Energy Usage

The Signature System InfoNode provides users the ability to track power flow and generate reports for the purpose of monitoring energy usage and expense. The setup necessary for the expense reports has three sections, namely Peak Time, DataNode, and Rate Structures. See page 5-8 of Chapter 5 *Reports Page* for details on the energy expense and usage reports.

NOTE: Utility rate structures are very complex and vary greatly. Therefore, the Energy Usage Answer Module is not intended to completely replicate your utility bill and is intended for comparison only.

Peak Time

Reducing consumption during peak times or shifting loads to off-peak times amounts to significant savings on energy costs. Energy providers typically charge different rates for energy consumption during peak time and energy consumption during off-peak times. The setup for peak time is described below.



Setup screen for Energy Usage - Peak Time

Under Peak Time or Partial Peak Time category, select the desired day (for bank select click+shift) and check the *Include Day* box to enable time settings. Clear the box to disable the selected days.

Start Time

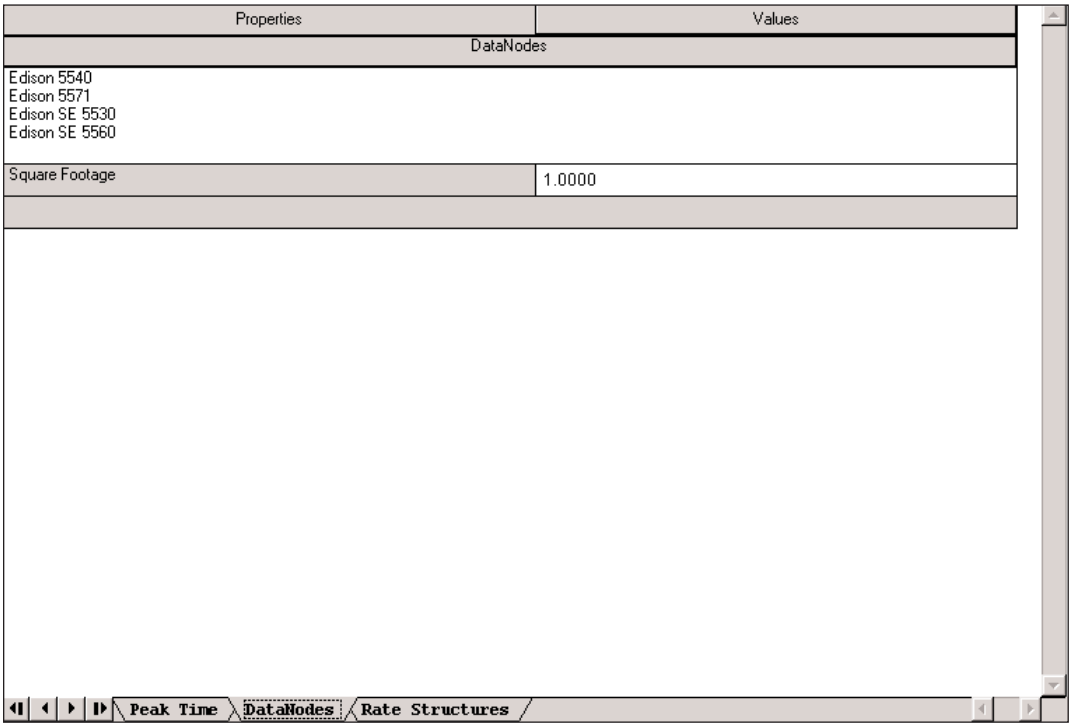
Start time refers to when the peak time begins.

End Time

End Time refers to when the peak time ends.

DataNodes

The screen below enables users to select the DataNode site where they are monitoring energy consumption. The user may specify the square footage that each DataNode is monitoring. This will allow the user to view energy expense on per square foot basis. The setup required for the DataNodes can be seen below.



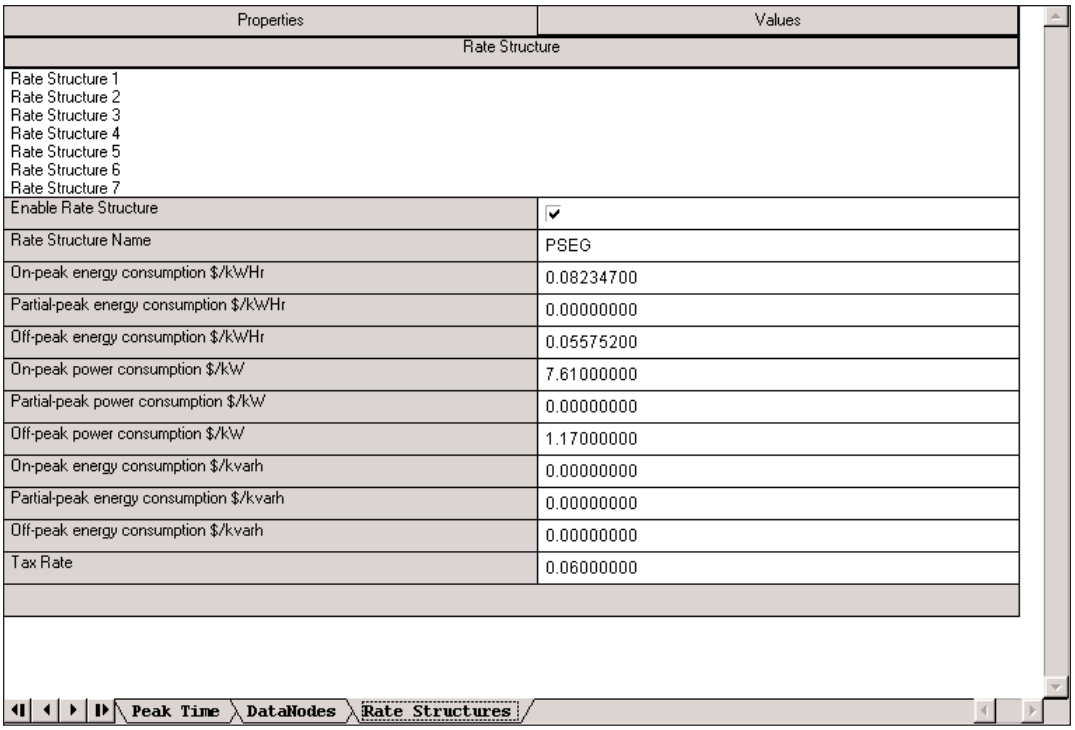
Setup screen for Energy Usage - DataNodes

Square Footage

Select the desired DataNode and enter the square footage that the DataNode is monitoring.

Rate Structures

The user may define up to twenty different rate structures. The user-defined rate structures allow users to produce energy expense reports that accurately reflect the charges being applied by a respective energy provider. The setups required are discussed below.



Setup screen for Energy Usage - Rate Structures

Enable Rate Structure

For the rate structure to be available in the energy expense reports, it must be enabled. Check the box to activate or clear the box to deactivate.

Rate Structure Name

The name used to describe the rate structure. This name will be displayed in the list for selecting a rate structure.

On-peak energy consumption $/kWHr

The cost of energy consumption, measured in kWHr, during the peak time.

Off-peak energy consumption $/kWHr

The cost of energy consumption, measured in kWHr, during the off-peak time.

On-peak power consumption $/kW

The penalty charged for the maximum demand (kW) that occurred during peak time over the billing period.

Off-peak power consumption $/kW

The penalty charged for the maximum demand (kW) that occurred during off-peak time over the billing period.

On-peak energy consumption $/kvarHr

The cost of energy consumption, measured in kvarHr, during the peak time.

Off-peak energy consumption $/kvarHr

The cost of energy consumption, measured in kvarHr, during the off-peak time.

Tax Rate

The tax applied on billings.

kvar Change Observer

The kvar Change Observer Answer Module is for substation applications only. The Answer Module is an add-on to the PF Capacitor switching module and determines if the kvar change is balanced or unbalanced. The setup required for this Answer Module is described below.

Properties	Values
Activate kvar change observer	☑
kvar balance threshold between phases	0.1000

Setup screen for kvar Change Observer

Activate kvar Change Observer
Check the box to activate or clear the box to deactivate.

kvar balance threshold between phase
If the difference between the phases is greater than the set threshold, the kvar change is unbalanced.

Radial Fault Location

Identifies the source of radial line faults as they occur. The Radial Fault Location estimates the distance to a fault location, allowing a quick dispatch of linemen for repairs, reducing the time for locating problem source. Required input data are the three phase voltage and current waveforms along with the positive and zero sequence impedance of the primary feeder. An optional input datum is the feeder length. The setup screen can be seen below.

Properties	Values
Activate AnswerModule	☐
Ground fault pickup current threshold (amperes):	150.0000
Phase fault pickup current threshold (amperes):	800.0000
Ratio of fault peak current to pre-fault peak current:	2.0000
Sequence impedance unit:	Ohms per 1000 ft
Length of primary feeder (unit is based on the unit length in sequence impedance unit)	120.0000
Positive-sequence impedance of the primary feeder (real):	0.0570
Positive-sequence impedance of the primary feeder (imaginary):	0.1225
Zero-sequence impedance of the primary feeder (real):	0.1790
Zero-sequence impedance of the primary feeder (imaginary):	0.4150

Setup screen for Radial Fault Location

Activate Answer Module
Check the box to activate or clear the box to deactivate.

Ground fault pickup current threshold (amperes)
The value of the current that needs to be exceeded before it is considered a ground fault.

Phase fault pickup current threshold (amperes)
The value of the current that needs to be exceeded before it is considered a phase fault.

Ratio of fault peak current to pre-fault peak current
A threshold to compare RMS values before and during a fault.

Sequence impedance unit
Units used for impedance and feeder length.

Length of primary feeder
This information is optional. If it is available, it should be supplied. If it is not available, enter feeder length = 0.

Positive-sequence impedance of the primary feeder (real)
The real part of the complex number positive sequence impedance.

Positive-sequence impedance of the primary feeder (imaginary)
The imaginary part of the complex number positive sequence impedance.

Zero-sequence impedance of the primary feeder (real)
The real part of the complex number zero sequence impedance.

Zero-sequence impedance of the primary feeder (imaginary)
The imaginary part of the complex number zero sequence impedance.

RBM (Reliability Benchmarking Methodology)

Aggregation Parameters

The RBM Answer Module is an RMS Variation Index. The setup for this Answer Module consists of setting up aggregation parameters. At different times it may be necessary to either break apart measurements into measurement components or combine them through aggregation. The setup required for aggregation can be seen below.

Properties	Values
Characterization Level	Temporal Aggregation
Aggregation Time	1 Minute
Aggregation Window Type	Fixed
Worst Case Method	Min V

Setup screen for RBM Aggregation Parameters

Characterization Level

· Phase Aggregation

The most basic of the three aggregation levels is phase aggregation. This characterizes the data in such a way that all of the phases are analyzed. Measurement components are the constituent recordings of a three-phase measurement. By definition, measurement components are single-phase. The process of phase aggregation entails finding the worst-case of a series of measurement components associated with a single phase or channel.

· Measurement Aggregation

Measurement aggregation represents all of the data from all phases of a measurement by the characteristics of the worst-case phase. An event determined by measurement aggregation is a combination of measurement components.

· Temporal Aggregation

The goal of temporal aggregation is to collect all measurements taken by a monitoring instrument or instruments that were due to the same power system occurrence, and identify them as one event.

Aggregation Time

This control specifies the width of the temporal aggregation window (in seconds). Selecting one of the pre-defined intervals from the drop-down list sets the aggregation window.

Aggregation Window Type

· Fixed

When a "Fixed" aggregation window type is specified, the length of the aggregation window is fixed by the aggregation time. Thus, all measurements occurring within the specified number of seconds are aggregated.

· Variable

When a "Variable" aggregation window is specified, the length of the aggregation window is not fixed and is determined by how closely the events occur to each other in time.

Worst Case Method

The Worst Case Method control allows the user to specify which measurement component characteristics are used to represent the aggregated measurement. A popular method of performing phase aggregation is by finding the "worst-case" measurement component from the measurement components associated with that phase.

· Max V Deviation

Using this method, the component exhibiting the maximum deviation from nominal voltage is used to represent the aggregate measurement. Thus, the sag or swell that deviates the farthest in absolute value from nominal voltage (1.0 per unit) is selected.

· Max Area
Using this method, the component exhibiting the maximum product of voltage deviation and duration from within tolerance is used to represent the aggregate measurement. Thus, the sag or swell that has the largest volt-seconds area deviation from nominal voltage is selected.

· Min V
Using this method, the component exhibiting the minimum voltage is used to represent the aggregate measurement. Thus, the largest sag is selected.

· Max V
Using this method, the component exhibiting the maximum voltage is used to represent the aggregate measurement. Thus, the largest swell is selected.

UPS Verification

The UPS Verification Answer Module verifies the operation of a UPS or another mitigation device. This requires setting pairs of DataNodes for monitoring the UPS. A DataNode is installed at the input and output of the UPS. This Answer Module allows for creating up to five UPS DataNode pairs. The setup screen can be seen below.

Properties	Values
UPS Input/Output DataNode Pairs	
UPS Pair 1 UPS Pair 2 UPS Pair 3 UPS Pair 4 UPS Pair 5	
UPS Pair Name	Demonsrtation Pair
UPS Input DataNode	EPQ 5530
UPS Output DataNode	EPQ 5520
Delta (sec) for time synchronization	0.5000

Setup screen for UPS Verification

UPS Pair Name
This is a descriptive name for the DataNode pair monitoring the UPS.

UPS Input DataNode
Select the DataNode monitoring the UPS input from the list of available DataNodes. Selecting "Not Set" deactivates this pair for the Answer Module.

UPS Output DataNode
Select the DataNode monitoring the UPS output from the list of available DataNodes. Selecting "Not Set" deactivates this pair for the Answer Module.

Delta (sec) for time synchronization
The delta between the input event time and the output event time allowed for it to be considered the same event. If the DataNodes are time-synched together, this should be set to 1.

DataNodes
DataNodes, being the frontline, data-acquisition component of the Signature System, are available in various models and configurations. The setup of a DataNode is dependent on the DataNode type. Click on DataNodes in the left frame to view the different DataNode types that the InfoNode currently supports. The current list consists of the following:

5530/5520 DataNode
The 5530/5520 belong to the Enhanced Power Quality (EPQ) family of DataNodes. EPQ DataNode is available in three model types: Model 5530, Model 5520, and Model 5510. They are designed to do comprehensive and PQ-optimized acquisition of power quality related disturbances and events. The salient features of EPQ Datanode include voltage and current trigger and capture mechanisms, increased system performance allowing users to identify data of interest and to record only that data, cross-triggering feature that permits linking of many DataNodes, and TCP/IP Ethernet communications.

5540 DataNode
The 5540 is known as the Energy Management (EM) DataNode. It is designed to help users manage their energy consumption. The 5540 is equipped with a 3-line LED display for viewing all measured parameters without the use of a computer. Among the more important parameters it can measure are true RMS voltage and current, kW, kVA, power factor, frequency, kWh, and kVAR. Energy data from the 5540 EM DataNode can be viewed in real time by multiple users using Signature System InfoNode via a standard web browser.

5560 DataNode
The 5560, also known as Quality of Supply (QOS) DataNode, is designed to monitor quality of supply compliance as specified by European Standard EN50160. It can be set in Strict compliance with EN50160 or can be customized using Custom setups. Under Strict compliance, only the General and Basic tabs are visible and modifiable. This is the standard method in using the 5560. For those who have unique applications requiring modification of the standard setups, the Compliance Setup selection box on the Basic tab can be changed to Custom.

5571 DataNode
The 5571 is an upgrade path for users of the 7100 PQNode who wish to access the InfoNode and its web-based interface. An inexpensive upgrade kit is available to convert existing 7100 PQNodes into 5571s for use in the Signature System. The 5571 is available in two model types, distinguished by their enlosures and connections to the circuit: Model 5571 and Model 5571S.

ADAM Modules
The Signature System readily interfaces with and acquires data from the popular Advantech® ADAM-4000 and ADAM-5000 series data acquisition and control modules. The ADAM-4000 series modules interface through RS-485 to an InfoNode. The ADAM-5000 series system is a backplane configuration. Any combination of 5000 series plug-in modules may be used to monitor various types of applications. The 5000 series is one of the most diverse and flexible DA&C systems and is available in four or eight slot configurations. Both are equipped with CPU, Watchdog Timer, RS-232 & RS-485 (x2) interfaces, error checking, system diagnostics and diagnostic display.

GEkV DataNode
GE's kV Vector Electricity Meter is the first of a new generation of electronic meters that extend functionality beyond the the bounds of traditional metering. The kV Meter adds automatic installation verification plus power quality and cost of service measurements. The kV Meter also improves traditional meter tasks by adding consolidated forms, 57 to 120 or 120 to 480 volt measurement capability, improved billing protection and standardized meter reading and programming.

MetOne DataNode
No data available at this time.

PQDIF Import
No data available at this time.

General Guidelines in Setting Up DataNodes through the InfoNode Setup Page

The following guidelines help promote smooth and optimal system performance of DataNode program settings. Bear in mind that while the InfoNode setup is generic, the DataNode is not. This means that the InfoNode setup section is not affected by the types of DataNodes connected to it. On the other hand, the DataNode setup section is customized and dependent on particular DataNode model configurations.

1. Privileges to change DataNode settings depend on the Security Level assigned by the system administrator (see page 7-2). Without the proper access privileges, you can only view the setup pages.

2. Make sure to select the appropriate DataNode group that you wish to configure under the DataNode setup tree. The Tree Directory of groups and sites is displayed on the left side of the screen. It uses the standard convention of collapsible trees and folders.

3. Clicking on a plus sign (+) that is adjacent to a DataNode group will open up that folder and display the elements (specific DataNodes site/s) contained within it. Clicking on a minus sign (-) will collapse that folder and no longer display the elements within it.

4. A DataNode group that has no plus or minus sign displayed means that the folder is empty. To add a DataNode site, select the appropriate DataNode group and click on the right mouse button. The Add DataNode button will appear; click on it. A new DataNode name will appear in the tree directory. Click on the new name to display the DataNode parameter screen on the right window pane. Use this screen to modify the DataNode parameters.

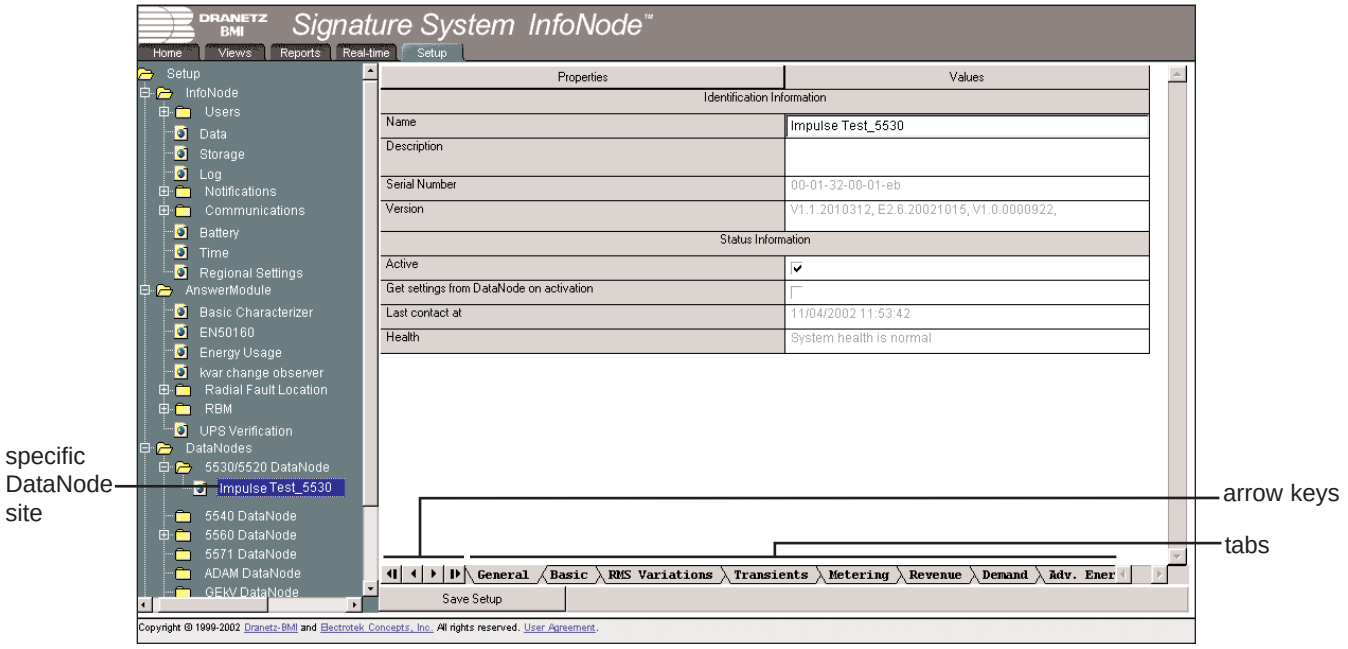
5. The InfoNode Setup page provides a wide variety of user-configured features represented as tabs located across the bottom of the Setup page. Click on a specific DataNode site to display the various parameters on the right hand pane. Consider this screen area as your work space. The parameters change depending on which tab is selected.

6. Use the arrow keys to navigate through the different tabs.

<|- automatically selects the first or leftmost tab
< - selects one tab left of another
> - selects one tab right of another
|> - automatically selects the end or rightmost tab

7. DataNode setup display screens appear in two column format: the Properties column and the Values column. The Properties column lists the names of available parameters in each tab. The Values column contains either textual notations, numeric values, or check boxes pertaining to the parameters described. Use the scroll bars to view and access the different properties and values available on screen.

Below is a sample DataNode site setup display with General tab selected as active screen.



8. Parameters are enabled when Value settings appear in blue or black and the field is clickable. Users may make appropriate changes on enabled parameters anytime.

9. Parameters are disabled when value settings appear in gray. Disabled value settings have either been configured as such so they cannot be altered or they need to be activated in order to trend the values listed on the page.

10. After putting in the desired value changes, click on the Save Setup button. You must always save the changes you made before exiting or selecting a different setup tab. Otherwise, the changes will not take effect. To help ensure that changes are saved, a confirmation window appears after encoding new value settings and just before you switch to a different tab or exit setups.

11. Checkboxes may be found under the Values column of select properties in various tabs. A checked box means that the parameter it represents is activated/enabled. An unchecked box means that the parameter is not activated/disabled.

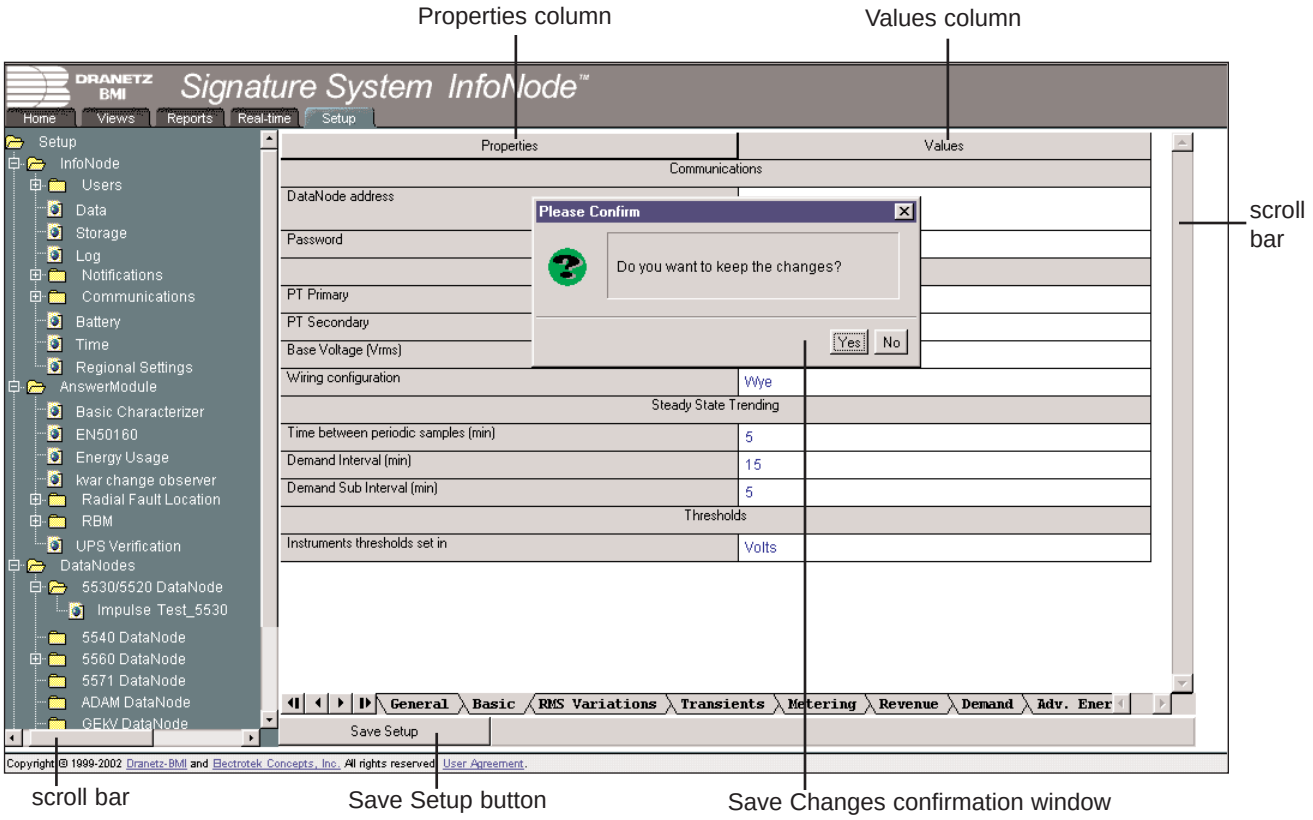
12. The *Active* property is found under the General tab in all DataNode types. Click on its corresponding checkbox in the value field. The InfoNode does not start communications with the DataNode until the Active box is checked. It is recommended that all changes and settings are made prior to activating the DataNode.

13. Remember that the InfoNode acts as a complete gateway for the various data captured and stored in the DataNode. The InfoNode Setup tab is where users configure properties and values for specific DataNode sites. Users can view the resulting data using the Views tab, Real-time tab, and Reports tab.

14. Help is available from any page, though it is tab-sensitive, not context-sensitive. On-screen help is available for various topics under the Help Desk folder. The Help Desk can be accessed through hyperlinks to jump to a selected topic, or by using the index.

15. Further assistance can be obtained by contacting Dranetz-BMI Technical Support staff at 1-800-372-6832.

Below is a sample display screen showing the Save Setup button, the confirmation window for saving changes, and scroll bar to view the different properties and values available on screen.



This chapter describes the procedures on how to program the 5530/5520 DataNode. It covers the following topics:

DataNode Tabs
Where Data for Programmed Settings Appear
Programming the Tabs

DataNode Tabs

The *General Guidelines in Setting Up DataNodes* found on page 7-29 of Chapter 7 *Setup Page* provides important background information for this chapter. Familiarity with the General Guidelines is advised before continuing on with the discussion below.

Below is a list of the various 5530/5520 DataNode tabs available and the programmable setups found in each tab. The list also notes which tabs are trending pages. A trending page contains an enable/disable checkbox which allows trending of values listed on that page. For DataNodes that use Firmware version prior to V2.6, most trending pages are optional and need to be enabled using the checkboxes found in the Basic tab. For DataNodes that use Firmware V2.6 and higher, all trending pages are displayed and the enabling checkboxes can be found in the individual tabs.

General tab - features Identification and Status information of a particular DataNode. Contains property to activate DataNode.
Basic tab - features Communications, Power System, Steady State Trending, and Thresholds data
RMS Variations tab - features Limit, Pre- and Post- Event Captures, RMS Variations Sampling Intervals, and Intervals data
Transients tab - features Cycle Counts and Individual Channel Parameters data
Metering tab - this trending page features checkboxes to Enable Trending of Metering properties and to Select the journal entry/entries to change
Revenue tab - this trending page features checkboxes to Enable Trending of Revenue properties and to Select the journal entry/entries to change
Demand tab - this trending page features checkboxes to Enable Trending of Demand properties and to Select the journal entry/entries to change
Advanced Energy tab - this trending page features checkboxes to Enable Trending of Advanced Energy properties and to Select the journal entry/entries to change
Advanced Metering tab - this trending page features checkboxes to Enable Trending of Advanced Metering properties and to Select the journal entry/entries to change
Unbalance tab - this trending page features checkboxes to Enable Trending of Unbalance properties and to Select the journal entry/entries to change
Harmonics tab - this trending page features checkboxes to Enable Trending of Harmonics properties and to Select the journal entry/entries to change
Flicker tab - this trending page features checkboxes to Enable Trending of Flicker properties and to Select the journal entry/entries to change; it also allows the setting of Sample Intervals (minutes)
Advanced Harmonics tab - this trending page features checkboxes to Enable Trending of Advanced Harmonics properties and to Select the journal entry/entries to change
Transducers tab - features data on Phase rotation, Channel Mapping and Transducer Ratios
Advanced tab - features data on Cross Triggering, additional data on Communications, Passwords, One Time Operations, Channel Mapping, and One Time Firmware Operations
Accumulator Resets tab - features checkboxes to enable/disable Demand Resets and Energy Accumulators

To illustrate DataNode program settings in detail, this Chapter makes use of a hypothetical DataNode1 under the 5530/5520 DataNode Setup. This Chapter provides a detailed discussion of the functionalities in each tab.

Where Data for Programmed Settings Appear

The Signature System InfoNode/DataNode is designed to provide programming support as well as data display. The InfoNode Setup page is where the parameters and value settings are programmed. The programmed parameters and value settings are translated and displayed in meaningful data format under the Views page, Real-time page, and Reports page. Refer to the previous chapters for more details on the Views, Real-time, and Reports pages.

5530/5520 DataNode Setup

Programming the Tabs

LEGEND (Please note the following conventions are used in the screen displays):
Items in *italics* are not programmable, but included for information purpose to the user.
Items in **bold** are examples of what can be entered.
Selections available in drop down menu are enclosed in brackets { xxxx }.

Caution: Dranetz-BMI has already set default values for the various parameters in each DataNode. The default values have been tested to result in optimal system performance. Users are advised not to change the default value settings unless there are applications which require advanced setups.

1. **General** tab

Properties	Values
Identification Information	
Name	**DataNode 1**
Description	**Service Entrance**
Serial Number	*53000001*
Version	*2.0.798*
Status Information	
Active	☑
Get settings from DataNode on activation	☐
Last contact at	*7/25/01 4:38*
Health	*System health is normal*

typically describes where DataNode is located

MAC address

enable to activate the DataNode site

DataNode status

The General tab contains identification and health status description of the DataNode.

IDENTIFICATION INFORMATION includes the Name and Description which users can assign for a particular DataNode type. Simply click on the **Name** or **Description** value field and the cursor is set for users to type in the space provided. Description typically describes the place where the DataNode hardware is located. Users are allowed to enter up to 30 alphanumeric characters under the Name and Description fields.

The **Serial Number** and **Version** of the DataNode hardware are automatically set by default. This instrument-specific information is available only for viewing and cannot be altered or changed from the InfoNode.
NOTE: The serial number represents the network MAC address of the DataNode and not its factory assigned serial number.

STATUS INFORMATION properties includes **Active**, which indicates whether communications between the DataNode and the InfoNode are enabled. When checked, this means that the DataNode is actively communicating and exchanging information with the InfoNode. When making changes in the different value settings of a DataNode, it is recomended to uncheck the Active box first, make the changes, then check the Active box again. Also when adding a new DataNode, the Active box should be checked last to establish link with the DataNode site. Click the Home page to see which DataNodes are actively communicating with the InfoNode.

Users also have the option to **Get settings from DataNode on activation**. When checked, the default DataNode settings will be overwritten by those contained within the DataNode displayed. Remember to click the **Save Setup** button found at the bottom of the page to save any change that has been done. To aid users, a Save confirmation window appears after changes have been made and when users are about to switch to a different tab. In order to use this feature, you must enter the appropriate IP address via the Basic tab prior to activating. Status properties also records the date and time of **Last contact**. It also indicates the **Health** status, whether the DataNode system is functioning normally or not, and status of InfoNode to DataNode communications.

2. **Basic** tab

Properties	Values
Communications	
DataNode address	**10.0.2.32**
Password	**********
Power System	
PT Primary	**1.00000000**
PT Secondary	**1.00000000**
Base Voltage (Vrms)	**120.0**
Wiring configuration	**Wye** {Single Phase, Wye, Delta, Split Single Phase}
Steady State Trending	
Time between periodic samples (min)	**5**
Demand Interval (min)	**15**
Demand Sub Interval (min)	**5**
Thresholds	
Instruments Thresholds set in	**Percent** {Volts, Per Unit, Percent}

click fields to display drop down menu

The Basic tab (for 5530/5520 DataNodes using Firmware V2.6 and higher) contains value settings for the following: Communications, Power System, Steady State Trending, and Thresholds.

NOTE: 5530/5520 DataNodes that use firmware versions prior to V2.6 display a Basic tab that has different functional interface than above. In the prior firmware versions, trending pages are hidden and users need to enable them using the checkboxes in the Basic page. These checkboxes are found under Steady State Trending and it is where various hidden tabs are selected to be made visible or not. The trending tabs contain the setups for related properties, and are named Basic Metering, Basic Revenue Metering, Demand, Advanced Energy, Advanced Metering, Unbalance and Sequence Components, Harmonics, and Advanced Harmonics. Each of these labels has a checkbox opposite them. To activate, click the corresponding value field and the box is checked. Basic Metering is the only hidden tab that is activated by default. In subsequent firmware versions (V2.6 and higher), the enabling checkboxes were moved to the tabs themselves.

COMMUNICATIONS is where the IP information for the specific DataNode is entered. Each 5530/5520 DataNode is shipped from the factory with an **IP Address**. This IP Address is entered here. **Password** is the password for InfoNode to DataNode communications. The password is typically left at factory default.
NOTE: The password entered must match that of the DataNode.
Under POWER SYSTEM, users can set values for PT Primary, PT Secondary and Base Voltage (Vrms). **PT Primary** and **PT Secondary** allow the setting of the primary and secondary components respectively, of all transducer ratios. Ratios for all three phases are set when this field is changed and saved. If the values for the individual phases are different, the phase A setting is displayed. No setup values are changed unless the user modifies this field and saves the changes. The values being modified here are the same as the individual values on the Transducers page (see page 8-22). For a 5530/5520, the default value of both PT Primary and PT Secondary is 1.

Users can also input values for the **Base voltage (Vrms)**. This field is where the user specifies the nominal line voltage. The value serves as the basis for computing High and Low limits under the RMS Variations tab when percent of nominal or per unit options are used. Users can also select the **Wiring configuration** of the circuit. Simply click on the value field and a drop down menu lists Single Phase, Wye, Delta and Split Single Phase.

When making voltage connections to a Single phase circuit, use channel A differential inputs. Neutral to ground measurements are recommended but not required for proper operation. When making Split Phase measurements, use both channels A and B for voltage and current connections. The neutral is chosen as the reference for measurement purposes. Neutral to ground measurements are recommended but not required for proper operation. When using the Wye setup mode, channels A, B and C are connected to voltage and current. The neutral is connected to common and is the reference for the three channels. Neutral to ground measurements are recommended but not required for proper operation. Various setups are possible when using the Delta setup mode. For example, the 3 Phase Delta uses voltage channels A, B and C as differential inputs with channel A using source voltage A-B, channel B using B-C, and channel C using C-A as the reference. Use channels A, B and C for current connections. Neutral to ground measurements are recommended but not required for proper operation. Refer to the Series 5500 DataNode User's Guide, Chapter 2 Preparation for Use, for illustrations of the different wiring configurations using DataNode 5520 and DataNode 5510/5530.

STEADY STATE TRENDING allows for the periodic sampling of the voltage and/or current waveforms. For instance, the **Time between periodic samples** allows users to set the time (in minutes) of how often RMS and waveform snapshots will be recorded.

Demand interval and **Demand sub-interval** refer to that time period used in calculating power demand values. Both Demand properties can be assigned value settings within the range of 1 to 120 minutes. Note however that the value set for Demand sub-interval must be an integer-divisor of Demand Interval since the former applies when updating certain parameters of the latter.

Under THRESHOLDS, users can choose the threshold units under **Instruments thresholds set in**. Click on the value field and a drop down selection of Volts, Per Unit, and Percent appears. The limits entered in subsequent tabs will correspond to the setting made here.

3. **RMS Variations** tab

Properties	Values
Limits	
A-N Voltage {Bank selection enables programming limits below} B-N Voltage C-N Voltage N-G Voltage A-B Voltage B-C Voltage C-A Voltage A Current B Current C Current N Current	
Limit enabled	☐
High limit	**110.0**
Low limit	**90.0**
Pre- and Post- Event Captures	
Pre-event start RMS samples (cycles)	**2**
Post-event start RMS samples (cycles)	**238**
Pre-event start waveform samples (cycles)	**2**
Post-event start waveform samples (cycles)	**6**
Post-event end RMS samples (cycles)	**2**
Pre-event end waveform samples (cycles)	**6**
Post-event end waveform samples (cycles)	**2**
Cycles in range to end event	**1**
RMS Variations Sampling Intervals	
Number of Rates to Use	**3**
Intervals	
Reduced sampling rate #1 Reduced sampling rate #2 Reduced sampling rate #3	
Sample min/max/avg every N cycles	**6**
Number of seconds to use this rate	**6.000000**

phase-to-neutral or phase-to-phase values displayed depend upon the Wiring Configuration set under the Basic tab

units of measure depend on setting in Basic tab

RMS stands for root mean square, a mathematical formula used to measure the average voltage and current behaviors. Voltage and current activities are measured to check their behavior patterns within a set or programmed threshold. Threshold is the point within which the voltage or current parameter is said to be within tolerance. Thresholds are set in ranges with high limit (threshold above the programmed limit) and low limit (threshold below the programmed limit). RMS Variations result whenever voltage or current behaviors rise above or fall below the programmed thresholds. Dranetz-BMI instruments label RMS voltage or current variations as either sags (voltage or current decreases below low limit) or swells (voltage or current increases above high limit) as per IEEE 1159.

In the RMS Variations tab, the following properties can be set: Limits, Pre and Post- Event Captures, RMS Variations Sampling Intervals, and Intervals.

Under LIMITS, letters A, B and C represent each leg or phase of a three-phase system, while letter N represents the neutral conductor. The channels used to trigger threshold values are automatically set depending on the wiring configuration selected under the Basic tab. **High limit** and **Low limit** values can be enabled and programmed individually for each phase-to-neutral and phase-to-phase setting.

To program individual limit values, select the appropriate line that describes the phase-neutral or phase-to-phase

setting that you wish to change. If the same limit value will be assigned to more than one phase, press Shift + click to select multiple phases. Enter your limit value for the corresponding phase in the High limit and Low limit fields. Click the **Limit enabled** box to activate. Click the Save Setup button every time you assign different limit values.

PRE- AND POST- EVENT CAPTURES contain parameters that help users program the number of RMS and waveform cycles to be saved before (pre-) and after (post-) the start and the end of the event. These parameters are **Pre-event start RMS samples**, **Post-event start RMS samples**, **Pre-event start waveform samples**, **Post-event start waveform samples**, **Post-event end RMS samples**, **Pre-event end waveform samples**, and **Post-event end waveform samples**. The parameters capture RMS sample or RMS waveform cycles that may be used to analyze and manage power event patterns and behavior.

With regard to the beginning and end of RMS variation events, such transition points are determined according to the following rules. As per IEC and IEEE standards for multi-phase systems, the beginning of the event occurs when any phase goes outside the limits. The start of an RMS variation event is denoted as the time one or more phases of voltage or current goes outside of the programmed high or low thresholds. The end point of the event is defined as the point when all channels for which triggers are enabled have come back within limits (plus internally calculated hysteresis) for a minimum duration of **Cycles in range to end event**. Until this criteria is met, any subsequent excursions beyond the thresholds are considered part of the original disturbance. Disturbance monitoring requires that voltage be continuously sampled, and recorded only if the signals exceed specified values. Most types of disturbances, with the exception of voltage variations, require that current be recorded as well.

The user also has the ability to specify how RMS trace data is recorded during the event. This mechanism is found under RMS VARIATIONS SAMPLING INTERVALS, where **Number of rates to use** refers to the number of reduced sampling rate ranges to be used to record RMS variation activities. The sampling data referred to here may be any or all of the three sample rates found under INTERVALS - **Reduced sampling rate #1**, **Reduced sampling rate #2**, and **Reduced sampling rate #3**. When one of these items is selected, the reduced sampling rate parameters can be set for that item. Data for the sample rates only apply to RMS, not waveform, variations.

The reason behind storing sampling rates is that the memory capacity of the monitoring instrument makes it impractical to record an entire long duration sag or swell point by point. The waveforms before and after the trigger are digitized to help identify the cause of the excursion, but only RMS values are stored over the full duration event that is longer than the pre- and post- trigger setting. If the event has not ended after a programmed time period, the instrument switches to averaging cycles of RMS data to further conserve memory yet accurately represent the event. At this point, the RMS plot diverges from a single-valued line to a band of minimum, maximum and average values. During extremely long events, the instrument switches to successively longer averaging periods explained next.

The sample rates represent three supplemental recording interval or chart speeds defined for recording long events. When recording at reduced rates, three values are saved for each data point - the minimum, maximum, and average value of the previous interval. The **Sample min/max/avg every N cycles** refers to the number of cycles to average for the selected reduced sampling rate. While **Number of seconds to use this rate** refer to the number of seconds to record at the selected reduced sampling rate.

The following default sequence is used to program reduced sampling rates:

For 60 Hz systems
a. 6 cycle intervals for 8 seconds (80 samples)
b. 30 cycle intervals for 20 seconds (40 samples)
c. 60 cycle intervals for 90 seconds (90 samples)

For 50 Hz systems
a. 5 cycle intervals for 8 seconds (80 samples)
b. 25 cycle intervals for 20 seconds (40 samples)
c. 50 cycle intervals for 90 seconds (90 samples)

For further discussion on RMS Variation Triggering and Recording, please refer to the EPQ DataNode Series User's Guide.

4. **Transients** tab

Properties	Values
Cycle Counts	
Number of pre-trigger cycles	**1**
Number of post-trigger cycles	**2**
Individual Channel Parameters	
A-N Voltage B-N Voltage C-N Voltage N-G Voltage A Current B Current C Current N Current	
Instantaneous limit enabled	☐
Instantaneous limit	**120.0**
Peak detector limit enabled	☐
Peak detector limit	**100**
Waveform change limit enabled	☐
Waveform change magnitude limit	**10.0**
Waveform change duration limit (% of cycle)	**10.0**

phase-to-neutral or phase-to-phase values displayed depend upon the Wiring Configuration set under the Basic tab

Transients are disturbances which are shorter in duration than sags and swells. There are two basic types of transients: 1) impulsive transients commonly caused by lightning and load switching, and 2) oscillatory transients often attributed to capacitor bank switching. The EPQ DataNode has extensive transient recording capabilities for all transient events, using waveshape, instantaneous peak, and dual positive and negative high frequency peak detectors.

Impulsive transients are characterized by a very rapid change in the magnitude of the measured quantity. Because these types of disturbances exhibit high frequencies, they are quickly damped by the system. They tend to be unidirectional when close to their source. Impulses are commonly caused by capacitors or inductors switching on line, loose wires, lightning, static, and power failures.

Oscillatory transients are defined as a temporary, rapid discontinuity of the waveform. Frequency is the most important characteristic in identifying this type of transient event. Frequencies are further classified into high (500 kHz or greater), medium (5 to 500 kHz), or low (5 kHz or less).

Transient events in the form of wave faults are captured using the waveform change detection technique. This is done by recording present cycle samples and comparing it to samples from the previous cycle. Waveshape trigger values include the magnitude and duration of the difference between the present and previous cycle.

Transients can be captured using the high frequency positive/negative peak detectors, crest factor peak (instantaneous), and/or the waveshape variation triggering functions. The high frequency detected transient uses special circuitry to detect and capture impulsive transients as small as 1 microsecond. These transients are the positive and/or negative value above or below the low frequency waveshape. **These are only enabled if the flicker tab is disabled.** The crest factor or instantaneous peak is the absolute peak sample value within one cycle. The high frequency peak detector and instantaneous transients are triggerable for voltage and current.

Under the CYCLE COUNTS, the user can define a number of cycles of waveform to record prior to the

trigger point. This is set under the value field **Number of pre-trigger cycles**. Users can also define the number of cycles of waveform to record after the trigger. This value is set under **Number of post-trigger cycles**. Typical values for these settings are 1 and 2 respectively. Setting these values to 0 causes one cycle of data to be recorded for each event - the cycle in which the transient was detected. Note also that the cycle of waveform containing the trigger point is always recorded. For example, if the pre-trigger cycle count is 1 and the post-trigger count is set to 2, then a total of 4 cycles (including the cycle containing the trigger point) of waveform and peak detector values are recorded.

Under INDIVIDUAL CHANNEL PARAMETERS, letters A, B and C represent different channels, N stands for neutral, while G stands for ground conductor. The channel values are pre-defined and automatically set depending upon the Wiring configuration selected under the Basic tab.

The DataNode provides configuration variables that specifies how many cycles to record the **Instantaneous limit, Peak detector limit** and **Waveform change magnitude limit.** These limit values can be enabled and programmed individually for each phase and phase-to-phase setting.

The instantaneous limit value is compared against the absolute value of each A/D sample of the voltage and current channel waveforms (128 A/D samples taken per cycle). If any point is greater than the specified limit, the cycle the trigger occurred on plus the specified number of pre- and post- trigger cycles will be recorded as an event. Enter your limit values in the corresponding field for each phase-neutral or phase-to-phase setting, and click the **Instantaneous limit enabled** box to activate. In earlier versions of the software, this same value is used for the high frequency dual peak detectors as well.

The instantaneous limit is in units of Volts or Percent of base depending on the unit of thresholds selected under the Basic tab. If the instantaneous limit is set at or below 100%, transients are effectively disabled because a permanent trigger condition exists and locks out further events. The Peak detector limit can also be set in units of Volts or Percent of base depending on the thresholds unit set under the Basic tab. Since the fundamental frequency component is filtered out using the peak detector trigger mechanism, peak detector limits set below 100% can be specified.

Other configuration variables that determine the operation of transient capture capability of the DataNode are the waveform trigger parameter, instantaneous peak waveform trigger level, and dual peak high frequency detector output trigger level. Values for these parameters are set under **Waveform change magnitude limit** and **Waveform change duration limit**. Normally the default values for these is 10%. These limit values can be enabled and programmed individually for each phase and phase-to-phase setting. To activate the waveform limit values, click the **Waveform change limit enabled** box.

For further discussion on Transient Event Recording, refer to the EPQ DataNode Series User's Guide.

Trending Tabs

The following tabs are known as trending pages: Metering, Revenue, Demand, Advanced Energy, Advanced Metering, Imbalance, Harmonics, Flicker, and Advanced Harmonics. These tabs contain an enable/disable checkbox at the top of the page. The purpose of the checkbox on any trending page is to enable trending of properties and values listed on that page. If the box is checked, the settings on that page go into effect. If the box is not checked, the remaining settings are persisted but are not in effect. For DataNodes using Firmware V2.6 and higher, all trending pages are displayed. For DataNodes using firmware versions prior to V2.6, most trending pages are hidden and need to be enabled for display (see Note on page 8-3 Basic tab). When exiting from the page, a save confirmation window appears. Click on Yes to save changes. Click on No to exit the menu tab without saving changes.

NOTE: All trending tabs operate in the same manner, the difference being the parameter measured. Therefore the same description of how to use can appear once and not be repeated.

5. **Metering** tab

Properties	Values
Enable Trending (This page)	
Basic Metering (Metering, MMXUO)	☑
Select the journal entry/entries to change	
Line-Neutral Voltage (A-N)	Apparent Power (A)
Line-Neutral Voltage (B-N)	Apparent power (B)
Line-Neutral Voltage (C-N)	Apparent Power (C)
Neutral-Ground Voltage	Total Apparent Power
Line-Line Voltage (A-B)	Power Factor (A)
Line-Line Voltage (B-C)	Power Factor (B)
Line-Line Voltage (C-A)	Power Factor (C)
Line Current (A)	Average Power Factor
Line Current (B)	Angle Between Phases (A)
Line Current (C)	Angle Between Phases (B)
Line Current (N)	Angle Between Phases (C)
Active Power (A)	Frequency
Active Power (B)	
Active Power (C)	
Total Active Power	
Enable Periodic Sampling	☑
High-High limit enabled	☐
High-High limit	**135.0**
High limit enabled	☐
High limit	**125.0**
Low limit enabled	☐
Low limit	**105.0**
Low-Low limit enabled	☐
Low-Low limit	**90.0**
Deadband enabled	☐
Deadband	**3.0**

phase-to-neutral or phase-to-phase values displayed depend upon the Wiring Configuration set under the Basic tab

The RMS voltage variations have their own tab relative to capturing and monitoring power quality events such as sags and swells (see page 8-5 RMS Variations). In addition, the RMS voltage and current values can be trended using periodic readings that are stored in a journal.

Under ENABLE TRENDING (THIS PAGE) is a checkbox in the value field opposite **Basic Metering**. The box enables the trending of values listed in Metering page. If the box is checked, the settings on the page go into effect. If the box is not checked, the remaining

settings are persisted but are not in effect.
Under SELECT JOURNAL ENTRY/ENTRIES TO CHANGE, the various phase-neutral and phase-to-phase parameters are displayed. High and low limits can be enabled and individually set for each phase-neutral and phase-to-phase value. Note however that the available phase values depend on the Wiring Configuration selected under the Basic tab. For instance, for wye circuits L-N, N-G and L-L limits can be set. For delta circuits, only L-L limits can be set.

Highlight the parameter value you wish to change, then check the **Enable periodic sampling** box. Check the threshold enable box, and then enter the value for that threshold. Repeat this for all parameters of interest.
NOTE: The 5530 DataNode has an internal limit on the number of variables it can track for the purpose of periodic recording and limit rule evaluation. Indiscriminate selection of parameters should be avoided.

Each parameter has five threshold limits: **High-high**, **High**, **Low**, **Low-Low**, and **Deadband**.
High-High limit - specifies an absolute limit for comparison that is higher than the high limit
High limit - specifices an absolute limit for comparison that is higher than the low limit
Low limit - specifies an absolute limit for comparison that is lower than the high limit
Low-Low limit - specifies an absolute limit for comparison lower than the low limit
Deadband limit - specifies how much a value can change before another event is recorded

The High-High must be greater than High, Low-Low less than Low. The hysteresis values assigned to limits are set by the system and not programmable by the user. All limit values are used to determine if corresponding reporting or logging action should take place. Note that these limits are the absolute or actual values to trigger on, not a percent of fixed or floating base as can be used in Voltage RMS Variation and Transients limits.

For example, if a frequency is detected to cross the threshold limit, then an event is recorded. If the frequency goes from out of limits to within limits (that is below the high limit minus the hysteresis and above the low limit plus the hysteresis) then another event is recorded.

Enabling the parameters for periodic sampling make them appear in the Real-time tab.

6. **Revenue** tab

Properties	Values
Enable Trending (This page)	
Basic Revenue Metering (Revenue, MMTRQ)	☐
Select the journal entry/entries to change	
Phase Energy (A) Phase Energy (B) Phase Energy (C) Total Energy Integrated Reactive Power (A) Integrated Reactive Power (B) Integrated Reactive Power (C) Total Integrated Reactive Power	
Enable periodic sampling	☐
High-High limit enabled	☐
High-High limit	**135.0**
High limit enabled	☐
High limit	**125.0**
Low limit enabled	☐
Low limit	**105.0**
Low-Low limit enabled	☐
Low-Low limit	**90.0**
Deadband enabled	☐
Deadband	**3.0**

Under ENABLE TRENDING (THIS PAGE) is a checkbox in the value field opposite **Basic Revenue Metering**. The box enables the trending of values listed in Basic Revenue Metering page. If the box is checked, the settings on the page go into effect. If the box is not checked, the remaining settings are persisted but are not in effect.

Each of the individual phase and three phase total energy and integrated reactive power values found under SELECT THE JOURNAL ENTRY/ENTRIES TO CHANGE can be enabled.

Highlight the parameter value you wish to change, then check the **Enable periodic sampling** box. Check the threshold enable box and then enter the value for that threshold. Repeat this for all parameters of interest.

Each parameter has five threshold limits: **High-high**, **High**, **Low**, **Low-Low**, and **Deadband**.
High-High limit - specifies an absolute limit for comparison that is higher than the high limit
High limit - specifices an absolute limit for comparison that is higher than the low limit
Low limit - specifies an absolute limit for comparison that is lower than the high limit
Low-Low limit - specifies an absolute limit for comparison lower than the low limit
Deadband limit - specifies how much a value can change before another event is recorded

The High-High must be greater than High, Low-Low less than Low. Deadband is the equivalent of sensitivity. The hysteresis values assigned to limits are set by the system. All limit values are used to determine if corresponding reporting or logging action should take place. Note that these limits are the absolute or actual values to trigger on, not a percent of fixed or floating base as can be used in Voltage RMS Variation and Transients limits.

For example, if Total Energy is detected to cross the threshold limit, then an event is recorded. If the Total Energy goes from out of limits to within limits (that is below the high limit minus the hysteresis and above the low limit plus the hysteresis), then the event is recorded.

Enabling the parameters for periodic sampling make them appear in the Real-time tab.

7. **Demand** tab

Properties	Values
Enable Trending (This page)	
Demand (Demand, MDMDUO)	☐
Select the journal entry/entries to change	
Real Power, Dmd, Total Reactive Power, Dmd, Total Apparent Power Dmd, Total Average PF Over Last Interval Peak Real Power Dmd Total Var Dmd Coincident w/Pk W Dmd VA Dmd Coincident w/Pk W Dmd Avg PF Coincident w/Pk W Dmd Peak Reactive Power Dmd, Total W Dmd Coincident w/Pk Var Dmd VA Dmd Coincident w/Pk Var Dmd Avg PF Coincident w/Pk Var DMd Peak Apparent Power Dmd, Total W Dmd Coincident w/Pk W Dmd Var Dmd Coincident w/Pk VA Dmd Avg PF Coincident w/Pk VA Dmd Predicted Real Power Dmd, Total Predicted Reactive Power Dmd, Total Predicted Apparent Power Dmd, Total Current Demand (A) Current Demand (B) Current Demand (C) Average Current Demand Peak Current Demand (A) Peak Current Demand (B) Peak Current Demand (C) Average Peak Current Demand	
Enable periodic sampling	☐
High-High limit enabled	☐
High-High limit	**135.0**
High limit enable	☐
High limit	**125.0**
Low limit enabled	☐
Low limit	**105.0**
Low-Low limit enabled	☐
Low-Low limit	**90.0**
Deadband enabled	☐
Deadband	**3.0**

Demand values are computed as the average value over the demand interval, which can be programmed as a different value than the periodic readings. The following parameter values can be enabled: individual phase and three phase total real power demand, reactive demand, apparent power demand, average PF and peak real power values.

Under ENABLE TRENDING (THIS PAGE) is a checkbox in the value field opposite **Demand**. The box enables the trending of values listed in Demand page. If the box is checked, the settings on the page go into effect. If the box is not checked, the remaining settings are persisted but are not in effect.

The following parameter values can be enabled under SELECT THE JOURNAL ENTRY/ENTRIES TO CHANGE: individual phase and three phase total real power demand, reactive demand, apparent power demand, average PF, and peak real power values.

Highlight the parameter value you wish to change, then check the **Enable periodic sampling** box. Check the threshold enable box, and then enter the value for that threshold. Repeat this for all parameters of interest.

Each parameter has five threshold limits: **High-high**, **High**, **Low**, **Low-Low**, and **Deadband**.
High-High limit - specifies an absolute limit for comparison that is higher than the high limit
High limit - specifices an absolute limit for comparison that is higher than the low limit
Low limit - specifies an absolute limit for comparison that is lower than the high limit
Low-Low limit - specifies an absolute limit for comparison lower than the low limit
Deadband limit - specifies how much a value can change before another event is recorded

The High-High must be greater than High, Low-Low less than Low. Deadband is the equivalent of sensitivity. The hysteresis values assigned to limits are set by the system. All limit values are used to determine if corresponding reporting or logging action should take place. Note that these limits are the absolute or actual values to trigger on, not a percent of fixed or floating base as can be used in Voltage RMS Variation and Transients limits.

For example, if Real Power Demand is detected to cross the threshold limit, then an event is recorded. If the Real Power Demand goes from out of limits to within limits (that is below the high limit minus the hysteresis and above the low limit plus the hysteresis), then the event is recorded.

8. **Advanced Energy** tab

Properties	Values
Enable Trending (This page)	
Advanced Energy (Adv. Anergy, MFLOO)	☐
Select the journal entry/entries to change	
Forward fund. freq. WHrs (A) Forward fund. freq. WHrs (B) Forward fund. freq. WHrs (C) Reverse fund. freq. WHrs (A) Reverse fund. freq. WHrs (B) Reverse fund. freq. WHrs (C) Forward tot. fund. freq. WHrs Reverse tot. fund. freq. WHrs Forward fund. freq. VarHrs (A) Forward fund. freq. VarHrs (B) Forward fund. freq. VarHrs (C) Reverse fund. freq. VarHrs (A) Reverse fund. freq. VarHrs (B) Reverse fund. freq. VarHrs (C) Forward tot. fund. freq. VarHrs Reverse tot. fund. freq. VarHrs Fundamental freq. VA hours (A) Fundamental freq. VA hours (B) Fundamental freq. VA hours (C) Total fundamental freq. VA hours	
Enable periodic sampling	☐
High-High limit enabled	☐
High-High limit	**135.0**
High limit enabled	☐
High limit	**125.0**
Low limit enabled	☐
Low limit	**105.0**
Low-Low limit enabled	☐
Low-Low limit	**90.0**
Deadband enabled	☐
Deadband	**3.0**

The Advanced Energy tab shows various energy parameters on per phase and total basis as well as in forward and reverse mode. Fundamental frequency is used as the reference unit. Frequency is specified in hertz. Fundamental frequency refers to the principal component of a wave, i.e. the component with the lowest frequency or greatest amplitude.

Under ENABLE TRENDING (THIS PAGE) is a checkbox in the value field opposite **Advanced Energy**. The box enables the trending of values listed in Advanced Energy page. If the box is checked, the settings on the page go into effect. If the box is not checked, the remaining settings are persisted but are not in effect.

Under SELECT THE JOURNAL ENTRY/ENTRIES TO CHANGE, highlight the phase value parameter you wish to change then check the **Enable periodic sampling** box. Check the threshold enable box and then enter the value for that threshold. Repeat this for all parameters of interest.

Each parameter has five threshold limits: **High-high, High, Low, Low-Low,** and **Deadband**.
High-High limit - specifies an absolute limit for comparison that is higher than the high limit
High limit - specifices an absolute limit for comparison that is higher than the low limit
Low limit - specifies an absolute limit for comparison that is lower than the high limit
Low-Low limit - specifies an absolute limit for comparison lower than the low limit
Deadband limit - specifies how much a value can change before another event is recorded

The High-High must be greater than High, Low-Low less than Low. Deadband is the equivalent of sensitivity. The hysteresis values assigned to limits are set by the system. All limit values are used to determine if corresponding reporting or logging action should take place. Note that these limits are the absolute or actual values to trigger on, not a percent of fixed or floating base as can be used in Voltage RMS Variation and Transients limits.

For example, if the Total Fundamental Frequency is detected to cross the threshold limit, then an event is recorded. If the Total Fundamental Frequency goes from out of limits to within limits (that is below the high limit minus the hysteresis and above the low limit plus the hysteresis), then the event is recorded.

9. **Advanced Metering** tab

Properties	Values
Enable Trending (This page)	
Advanced Metering (Adv. Metering, MADVO)	☐
Select the journal entry/entries to change	
Total VA - Arith. Method Total VA - Vect. Method Total Fund. VA - Arith. Method Total Fund. VA - Vect. Method Worst True Power Factor Total Arithmetic True PF Total Vector True Power Factor Displacement Power Factor (A) Displacement Power Factor (B) Displacement Power Factor (C) Worst Displacement Power Factor Average Displacement PF Total Arithmetic Disp. PF Total Vector Disp. Power Factor Residual Current Net Current	
Enable periodic sampling	☐
High-High limit enabled	☐
High-High limit	**135.0**
High limit enabled	☐
High limit	**125.0**
Low limit enabled	☐
Low limit	**105.0**
Low-Low limit enabled	☐
Low-Low limit	**90.0**
Deadband enabled	☐
Deadband	**3.0**

Under ENABLE TRENDING (THIS PAGE) is a checkbox in the value field opposite **Advanced Metering**. The box enables the trending of values listed in Advanced Metering page. If the box is checked, the settings on the page go into effect. If the box is not checked, the remaining settings are persisted but are not in effect.

Under SELECT THE JOURNAL ENTRY/ENTRIES TO CHANGE, multiple total apparent power and power factor parameters, calculated using arithmetic and vector sums of the individual phases, can be enabled. Highlight the parameter value you wish to change, then check the **Enable periodic sampling** box. Check the threshold enable box, and then enter the value for that threshold. Repeat this for all parameters of interest.

Each parameter has five threshold limits: **High-High, High, Low, Low-Low,** and **Deadband**.
High-High limit - specifies an absolute limit for comparison that is higher than the high limit
High limit - specifices an absolute limit for comparison that is higher than the low limit
Low limit - specifies an absolute limit for comparison that is lower than the high limit
Low-Low limit - specifies an absolute limit for comparison lower than the low limit
Deadband limit - specifies how much a value can change before another event is recorded

The High-High must be greater than High, Low-Low less than Low. Deadband is the equivalent of sensitivity. The hysteresis values assigned to limits are set by the system. All limit values are used to determine if corresponding reporting or logging action should take place.

For example, if the Displacement Power Factor is detected to cross the threshold limit, then an event is recorded. If the Displacement Power Factor goes from out of limits to within limits (that is below the high limit minus the hysteresis and above the low limit plus the hysteresis), then the event is recorded.

10. **Unbalance** tab

Properties	Values
Enable Trending (This page)	
Unbalance and Sequence Components (Sequence,MSQIO)	☐
Select the journal entry/entries to change	
Sequence Voltage (Pos) Sequence Voltage (Neg) Sequence Voltage (Zero) Sequence Current (Pos) Sequence Current (Neg) Sequence Current (Zero) V Imbalance: L-N dev. from avg (A-N) V Imbalance: L-N dev. from avg (B-N) V Imbalance: L-N dev. from avg (C-N) V Imbalance: L-L dev. from avg (A-B) V Imbalance: L-L dev. from avg (B-C) V Imbalance: L-L dev. from avg (C-A) V Imbalance: L-N Max from avg V Imbalance: L-L Max from avg V Imbalance: Neg. Seq. Method V Imbalance: Zero Seq. Method I Imbalance: dev. from avg (A) I Imbalance: dev. from avg (B) I Imbalance: dev. from avg (C) I Imbalance: Max dev. from avg I Imbalance: Neg. Seq. Method I Imbalance: Zero Seq. Method	
Enable periodic sampling	☐
High-High threshold enabled	☐
High-High threshold	**135.0**
High threshold enabled	☐
High threshold	**125.0**
Low threshold enabled	☐
Low threshold	**105.0**
Low-Low threshold enabled	☐
Low-Low threshold	**90.0**
Deadband enabled	☐
Deadband	**3.0**

The voltage and current imbalance for each phase from the average value for all three phases can be trended and limits set. The positive, negative and zero sequence components for voltage and current can be trended.

Under ENABLE TRENDING (THIS PAGE) is a checkbox in the value field opposite **Unbalance and Sequence Components**. The box enables the trending of values listed in Unbalance page. If the box is checked, the settings on the page go into effect. If the box is not checked, the remaining settings are persisted but are not in effect.

Under SELECT THE JOURNAL ENTRY/ENTRIES TO CHANGE, highlight the parameter value you wish to change, then check the **Enable periodic sampling** box. Check the threshold enable box, and then enter the value for that threshold. Repeat this for all parameters of interest.

Each parameter has five threshold limits: **High-high**, **High**, **Low**, **Low-Low**, and **Deadband**.
High-High limit - specifies an absolute limit for comparison that is higher than the high limit
High limit - specifices an absolute limit for comparison that is higher than the low limit
Low limit - specifies an absolute limit for comparison that is lower than the high limit
Low-Low limit - specifies an absolute limit for comparison lower than the low limit
Deadband limit - specifies how much a value can change before another event is recorded

The High-High must be greater than High, Low-Low less than Low. Deadband is the equivalent of sensitivity.

11. **Harmonics** tab

Properties	Values
Enable Trending (This page)	
Harmonics (MHAIO)	☐
Percent Eddy Current Loss	**8.000**
Maximum Demand Load Current	**100.000**
Select the journal entry/entries to change	
Voltage THD - Fund. Normalized (A-N) Voltage THD - Fund. Normalized (B-N) Voltage THD - Fund. Normalized (C-N) Voltage THD - Fund. Normalized (N-G) Voltage THD - RMS Normalized (A-N) Voltage THD - RMS Normalized (B-N) Voltage THD - RMS Normalized (C-N) Voltage THD - RMS Normalized (N-G) Voltage TID - Fund. Normalized (A-N) Voltage TID - Fund. Normalized (B-N) Voltage TID - Fund. Normalized (C-N) Voltage TID - Fund. Normalized (N-G) Voltage TID - RMS Normalized (A-N) Voltage TID - RMS Normalized (B-N) Voltage TID - RMS Normalized (C-N) Voltage TID - RMS Normalized (N-G) Voltage Harmonic RMS (A-N) Voltage Harmonic RMS (B-N) Voltage Harmonic RMS (C-N) Voltage Harmonic RMS (N-G) Voltage Interharmonic RMS (A-N) Voltage Interharmonic RMS (B-N) Voltage Interharmonic RMS (C-N) Voltage Interharmonic RMS (N-G) Voltage TIF - Fund. Normalized (A-N) Voltage TIF - Fund. Normalized (B-N) Voltage TIF - Fund. Normalized (C-N) Voltage TIF - Fund. Normalized (N-G) Voltage TIF - RMS Normalized (A-N) Voltage TIF - RMS Normalized (B-N) Voltage TIF - RMS Normalized (C-N) Voltage TIF - RMS Normalized (N-G) Voltage Crest Factor (A-N) Voltage Crest Factor (B-N) Voltage Crest Factor (C-N) Voltage Crest Factor (N-G) Current THD - Fund. Normalized (A) Current THD - Fund. Normalized (B) Current THD - Fund. Normalized (C) Current THD - Fund. Normalized (N) Current THD - RMS Normalized (A) Current THD - RMS Normalized (B) Current THD - RMS Normalized (C) Current THD - RMS Normalized (N)	Current TID - Fund. Normalized (A) Current TID - Fund. Normalized (B) Current TID - Fund. Normalized (C) Current TID - Fund. Normalized (N) Current TID - RMS Normalized (A) Current TID - RMS Normalized (B) Current TID - RMS Normalized (C) Current TID - RMS Normalized (N) Current Harmonic RMS (A) Current Harmonic RMS (B) Current Harmonic RMS (C) Current Harmonic RMS (N) Current Interharmonic RMS (A) Current Interharmonic RMS (B) Current Interharmonic RMS (C) Current Interharmonic RMS (N) IT Product (A) IT Product (B) IT Product (C) IT Product (N) Current Crest Factor (A) Current Crest Factor (B) Current Crest Factor (C) Current Crest Factor (N) Current Total Demand Distortion (A) Current Total Demand Distortion (B) Current Total Demand Distortion (C) K Factor (A) K Factor (B) K Factor (C) K Factor (A) Transformer Derating Factor (A) Transformer Derating Factor (B) Transformer Derating Factor (C) Total Phase Harmonic Power (A-N) Total Phase Harmonic Power (B-N) Total Phase Harmonic Power (C-N) Signed Phase Harmonic Power (A-N) Signed Phase Harmonic Power (B-N) Signed Phase Harmonic Power (C-N)
Enable periodic sampling	☐
High-High limit enabled	☐
High-High limit	**135.0**
High limit enabled	☐
High limit	**125.0**
Low limit enabled	☐
Low limit	**105.0**
Low-Low limit enabled	☐
Low-Low limit	**90.0**
Deadband enabled	☐
Deadband	**3.0**

Harmonics are waveform distortion, a steady-state deviation from an ideal power frequency sinusoid and is characterized by the spectral content of the waveform. Many non-linear devices such as battery chargers, switching power supplies or transformers inject currents at harmonic (integer multiples of the fundamental) frequencies into the system. Harmonic currents and the voltage distortion they create as they flow through system impedances can reduce equipment operating reliability and service life. Harmonics can be particularly troublesome where capacitors are applied on the distribution system. Capacitors may result in resonance at a harmonic frequency, leading to high harmonic voltages and currents throughout the system.

Interharmonics are frequency components between the harmonic frequencies. The IEC 1000-4-7 Standard dictates that harmonic analysis is done using 5Hz bins. The RMS of the frequency bins between the 2nd and 3rd harmonic is referred to as the H_{2-3} interharmonic.

Under ENABLE TRENDING (THIS PAGE) is a checkbox in the value field opposite **Harmonics**. The box enables the trending of values listed in Harmonics page. If the box is checked, the settings on the page go into effect. If the box is not checked, the remaining settings are persisted but are not in effect.

Under SELECT JOURNAL ENTRY/ENTRIES TO CHANGE, various harmonic parameters can be trended using periodic readings that are stored in a journal. Harmonic distortion of voltage or current is calculated through a Fourier transformation of the waveform into harmonic magnitudes and phase angle spectra. These spectra are used to determine figures of merit such as total harmonic distortion (THD) and telephone influence factor (TIF). The total interharmonic distortion (TID) is calculated similar to the THD. (See Appendix A *Quantities Calculated from Periodic Voltage and Current Measurements*)

The InfoNode/DataNode system allows simultaneous measurements of voltage and current so that harmonic power flow can be obtained. Depending on value parameters set, the program can record a sampling of the waveform synchronized to the fundamental frequency, to ensure accurate calculation of harmonic phase angles. The sampling rate is sufficient to determine up to the 50th harmonic and interharmonic or better. A comprehensive range of high and low limits can be enabled and individually set for each measured parameter. Highlight the value parameter you wish to change, then check the **Enable periodic sampling** box. Check the threshold enable box and then enter the value for that threshold. Repeat this for all parameters of interest.

Each parameter has five threshold limits: **High-high, High, Low, Low-Low,** and **Deadband**.
High-High limit - specifies an absolute limit for comparison that is higher than the high limit
High limit - specifices an absolute limit for comparison that is higher than the low limit
Low limit - specifies an absolute limit for comparison that is lower than the high limit
Low-Low limit - specifies an absolute limit for comparison lower than the low limit
Deadband limit - specifies how much a value can change before another event is recorded

The High-High must be greater than High, Low-Low less than Low. Deadband is the equivalent of sensitivity. The hysteresis values assigned to limits are set by the system. All limit values are used to determine if corresponding reporting or logging action should take place. Note that these limits are the absolute or actual values to trigger on, not a percent of fixed or floating base as can be used in Voltage RMS Variation and Transients limits.

For example, if the Voltage Harmonic RMS is detected to cross the threshold limit, then an event is recorded. If the Voltage Harmonic RMS goes from out of limits to within limits (that is below the high limit minus the hysteresis and above the low limit plus the hysteresis), then the event is recorded. All activated Harmonic parameters and value settings defined can be viewed under the Real-time tab.

For further discussion on Harmonic Distortion, please refer to the EPQ DataNode Series User's Guide.

12. **Flicker** tab

Properties	Values
Enable Trending (This page)	
Flicker (Flicker, MFLKO)	☑
Sample Intervals (minutes)	
Pst Sample Interval	**10**
Plt Sample Interval	**180**
Select the journal entry/entries to change	
Pst of last complete interval (A) Pst of last complete interval (B) Pst of last complete interval (C) Plt of last complete interval (A) Plt of last complete interval (B) Plt of last complete interval (C) Sliding window Plt calculation (A) Sliding window Plt calculation (B) Sliding window Plt calculation (C) Output 5-Pinst-peak value (A) Output 5-Pinst-peak value (B) Output 5-Pinst-peak value (C) Output 4-1 min TC LPF of Pinst (A) Output 4-1 min TC LPF of Pinst (B) Output 4-1 min TC LPF of Pinst (C) Output 3-square root of Pinst (A) Output 3-square root of Pinst (B) Output 3-square root of Pinst (C) LPF of Output 3 (A) LPF of Output 3 (B) LPF of Output 3 (C)	
Enable periodic sampling	☑
High-High limit enabled	☐
High-High limit	**0.00**
High limit enabled	☐
High limit	**0.00**
Low limit enabled	☐
Low threshold	**0.00**
Low-Low limit enabled	☐
Low-Low limit	**0.00**
Deadband enabled	☐
Deadband	**0.00**

There are three flicker values available for trending: the Short term flicker or Pst, the long term flicker or Plt, and Plt calculated on a sliding window. The other parameters shown above (journal entries) are used primarily for specialized testing. Flicker measurements are classified per IEC 1000-4-15.

Under ENABLE TRENDING (THIS PAGE) is a checkbox in the value field opposite **Flicker** which enables the trending of values listed in this page. If the box is checked, the settings on the page go into effect. **Enabling this will automatically disable the high-frequency dual peak detectors located in the Transients tab.** If the box is not checked, the remaining settings are persisted but are not in effect.

Under SAMPLE INTERVALS are two numeric edit controls: the **Pst Interval** and the **Plt Interval**. Pst is short term perceptibility, used to set the Pst calculation interval. Typical calculation is over 10 minute interval, though this can be programmed. Plt is long term perceptibility, used to set Plt calculation interval. Typical calculation is over 2 hour interval, though this can also be programmed. The Plt interval must be an integer multiple of the Pst interval. Sliding Plt recalculates the Plt value at each Pst interval, rather than only at the Plt interval.

Under SELECT JOURNAL ENTRY/ENTRIES TO CHANGE, various flicker parameters can be trended using periodic readings that are stored in a journal.

Highlight the value parameter you wish to change then check the **Enable periodic sampling** box. Check the threshold enable box and then enter the value for that threshold. Repeat this for all parameters of interest.

Each parameter has five threshold limits: **High-high, High, Low, Low-Low,** and **Deadband**.
High-High limit - specifies an absolute limit for comparison that is higher than the high limit
High limit - specifices an absolute limit for comparison that is higher than the low limit
Low limit - specifies an absolute limit for comparison that is lower than the high limit
Low-Low limit - specifies an absolute limit for comparison lower than the low limit
Deadband limit - specifies how much a value can change before another event is recorded

The High-High must be greater than High, Low-Low less than Low. Deadband is the equivalent of sensitivity. The hysteresis values assigned to limits are set by the system. All limit values are used to determine if corresponding reporting or logging action should take place. Note that these limits are the absolute or actual values to trigger on, not a percent of fixed or floating base as can be used in Voltage RMS Variation and Transients limits.

13. **Advanced Harmonics** tab

Properties	Values
Enable Trending (This page)	
Advanced Harmonics (Individual, MHAIO)	☑
Trend harmonics for phase A	☑
Trend harmonics for phase B	☑
Trend harmonics for phase C	☑
Harmonics to Trend	
Phase Voltages	**2-25**
Neutral Voltages	
Phase Currents	
Neutral Current	
Interharmonics to Trend	
Phase Voltages	**2-25**
Neutral Voltages	
Phase Currents	
Neutral Current	

sample harmonic values to trend

sample interharmonic values to trend

The following parameters are found under ENABLE TRENDING (THIS PAGE): **Advanced harmonics (Individual)** and **Trend harmonics for phases A, B and C**. Opposite these parameters are checkboxes which enable the trending of values listed in Advanced harmonics page. If the box is checked, the settings on the page go into effect. If the box is not checked, the remaining settings are persisted but are not in effect.

Caution: Selection of numerous harmonics and interharmonics can exceed the total number of journal parameters (typically 200) that can be trended.

Voltage and current harmonics for each phase and neutral channel can be trended under HARMONICS TO TREND. Similarly, voltage and current interharmonics for each phase and neutral channel can also be trended under INTERHARMONICS TO TREND. The value fields are left blank to allow the users to choose the numbers or the range of harmonic frequencies to trend.

Numbers can be entered individually with commas separating the numbers, or a range of harmonics can be specified using a dash between lower and upper values. Also, the suffix ‘o’ or ‘e’ can be used to specify only the odd or even harmonics, respectively, in a given range. Selecting numerous harmonics indiscriminately can take up all of the allowable trending parameters. Users are advised to select harmonics to trend prudently.

Resulting individual harmonic sampling and graphs can be seen in the Smart Trends folder under the Views tab.

14. **Transducers** tab

Properties	Values
Phase rotation	**Normal (counter clockwise)** {Normal (counter clockwise), Reverse (clockwise)}
Channel Mapping	
Phase A voltage Phase A current Phase B voltage Phase B current Phase C voltage Phase C current Neutral voltage Neutral current	
Signal is connected to	**Channel 1**
Channel is inverted	☐
Transducer Ratios	
Phase A-N VT Phase B-N VT Phase C-N VT Neutral VT Phase A CT Phase B CT Phase C CT Neutral CT Phase A-B VT Phase B-C VT Phase C-A VT	
Transducer Primary	**1.00000000**
Transducer Secondary	**1.00000000**
Magnitude correction	*1.00000000*
Phase correction	*0.00000000*
DC offset	*0.00000000*

phase-to-neutral or phase-to-phase values displayed depend upon the Wiring Configuration set under the Basic tab

Transducers are typically PTs (potential transformers) and CTs (current transformers) that are used to interface the instrument to the power circuit. PTs allow the instrument to measure circuits that are not within the measurement range of the instrument. CTs measure the current of the circuit and convert it to within the measurement range of the instrument.

For **Phase rotation**, users can choose whether to have phasor shift clockwise or counterclockwise, depending on the way they have set up their system. Click the value field to display the drop down menu featuring Normal (counter clockwise) or Reverse (clockwise). Either orientation will yield the same mathematical calculations of voltage and current measurements. The 5530 is able to automatically determine phase rotation of the voltage channels and then match up the current channels.

The 5530 DataNode will swap voltage phases to ensure positive sequence phase rotation (counter clockwise according to IEEE definitions) and then swap and invert current channels to match.

The InfoNode is designed with a software user interface to enable users to do channel swapping and inversion information. Channel mapping is used to correct for errors in wiring the instrument to the circuit. If a mistake is made, such as an inverted CT or a phase is connected to the wrong channel, it can be corrected in the software instead of changing the wiring to the instrument. Note that it is recommended that the actual wiring be changed, but channel mapping can correct the problem if this is not practical.

A channel-mapping array is provided to permit manual configuration of channel swapping and inversion. Under CHANNEL MAPPING, click on the corresponding voltage or current phase to show which channel the **Signal is connected to**. Click and enable the value field opposite **Channel is inverted to** as it applies.

The channel-mapping array works by specifying a numeric code in each array slot that indicates which phase is connected to the physical 5530 DataNode channel.

Normally, the channels and phases are matched as shown below. Channels can be swapped and/or inverted to correct mistakes in wiring.

Voltage Phase A	Channel 1
Voltage Phase B	Channel 2
Voltage Phase C	Channel 3
Voltage Neutral	Channel 4
Current Phase A	Channel 5
Current Phase B	Channel 6
Current Phase C	Channel 7
Current Neutral	Channel 8

The DataNode employs two A/D converters to sample the voltage and current channels for a given phase simultaneously. Measurement errors may result if the voltage and current signals are not correctly paired. Under TRANSDUCER RATIOS, users can set values for the **Transducer Primary** and **Transducer Secondary**. Values to account for any voltage or current transformers can be entered for each input channel. The primary and secondary values are entered. For example, if the primary voltage is 2400 volts and the secondary voltage is 120 volts, then those values should be entered. This gives an effective 20:1 reduction in voltage. When the input voltage to the DataNode is 120V, the displayed value will be 2400 volts. The **Magnitude correction**, **Phase correction**, and **DC offset** values are not programmable.

15. **Advanced** tab

Properties	Values
Cross Triggering	
Broadcast Group ID	**1234**
Enable sending rms trigger	☐
Enable responding to received rms trigger	☐
Enbable sending transient trigger	☐
Enable responding to received transient trigger	☐
Broadcast address - if empty, uses local	
Communications	
When configurations differ ...	**... use the DataNode setup** {use the DataNode setup} {use the InfoNode setup}
Passwords	
User Account Password	**********
Admin Account Password	**********
InfoNode Access User ID	**admin**
InfoNode Access Password	**********
Firmware Access User ID	**admin**
Firmware Access Password	**********
One Time Operations	
Reset 302 Default Setup	☐
Clear 332 Database and reboot	☐
Do both of the above	☐
Don't save data from next download	☐
Clear last journal ID	☐
One Time Firmware Operations	
CAUTION: These operations will copy new firmware to the DataNode	
Load IOP (302) firmware	☐
Load ACP (332) firmware	☐
Load both IOP (302) and ACP (332) firmware	☐
Load both to all DataNodes	☐

click to display drop down menu

Parameters under the Advanced tab allow the administrator or user to set up functions that affect communications, information access and download between the InfoNode and DataNode systems.

The 5530/5520 can be configured to issue a UDP (cross trigger) broadcast message when an RMS variation and/or transient occurs. The 5530/5520 can also be configured to listen for such messages and cause an RMS variation or transient recording to occur regardless of whether or not its own trigger conditions for that instrument were met. Under CROSS TRIGGERING, a **Broadcast Group ID** is assigned to allow for different groups of cross trigger senders/recipients.

The broadcast ID number in the InfoNode must match the broadcast group ID set under the TCP/IP parameter of the Datanode. The DataNode also uses this ID mechanism for multiple DataNode cross triggering and is guaranteed only on an un-routed network. The group ID is sent along with the broadcast message and only those receivers with the same group ID will respond to the broadcast if so enabled. The broadcast address can be specified to send a broadcast to a directed address other than the local network if desired. However, results cannot be guaranteed and data may be lost if the message takes too long to arrive at its destination.

Checkboxes are seen opposite the next four items **Enable sending rms trigger**, **Enable responding to received rms trigger**, **Enable sending transient trigger**, **Enable responding to received transient trigger**. The user specifies which event types are generated and/or listened for through these checkboxes.When said parameters are activated, the system in effect utilizes trigger messages as trip signals. If **Broadcast address is empty**, message broadcast is routed through the local network. The user specifies a group ID and optionally a broadcast address.

Under COMMUNICATIONS, users are given the option to return to the default InfoNode or DataNode settings **When configurations differ** and communication errors occur.

Access privileges are determined under PASSWORDS. The passwords entered in the InfoNode system must match the ones stored under the Password section of the Signature System DataNode. Otherwise, access to information may be denied. The **User Account Password** and **Admin Account Password** refer to two different user categories. An Admin User can create and add an account for a new Basic User. Both Admin and Basic users can assign properties such as their own user name and password. See page 7-1 User section for more details.

The default **InfoNode Access User ID** is ‘admin’. The default **InfoNode Access Password is** ‘password’. These parameters allow access to view and change information in the InfoNode system. The default **Firmware Access User ID** is 'admin'. The default **Firmware Access Password is** ‘password’. These parameters allow access to view and change information in the DataNode system. To change passwords, simply click on the Password value fields. A confirmation window appears everytime you click on the password value field. The window asks whether you want to change and save a new password.

Parameters are also available for ONE TIME OPERATIONS on the EPQ DataNode. These one time procedures include configuring the DataNode to its default settings and/or clearing memory space by rebooting. Observe caution in undertaking these procedures since they cannot be undone. To return to the default DataNode settings, activate the **Reset 302 default setup** value field. To clear old data and reboot DataNode, activate the **Clear 332 Database and reboot** value field. To execute both procedures at one time, activate **Do both of the above**. To save memory space, the administrator or user may choose to activate **Don't save data from next download**. To discard the most recent journal ID entries, activate the **Clear last journal ID** value field.

Finally, parameters for downloading new or updated firmware are available under ONE TIME FIRMWARE OPERATIONS. A firmware is a program or instruction stored in Flash memory which implements the communications interface and data acquisition between the outside world and the instrument.

Based on the parameters available, the administrator or user can activate value fields to **Load IOP firmware** or to **Load ACP firmware** or to **Load both IOP and ACP firmware**. The IOP and ACP firmware are two different sets of firmware. The IOP communicates directly with the InfoNode, while the ACP is comprised of the host CPU and DSP. If the value fields are activated, new firmware is downloaded on demand from InfoNode to DataNode. New firmware is downloaded automatically if the boot ROM finds that the existing firmware in the DataNode is missing or corrupt. The administrator or user also has the option to **Load Both (IOP and ACP) firmware to all DataNodes**. Download is accomplished using the standard Internet File Transfer Protocol (FTP). The DataNode must be connected to the network where the updates are to be extracted from to ensure a successful download. Since these one time operations cannot be undone, observe caution when performing download firmware procedures.

16. **Accumulator Resets** tab

Properties	Values
Demand Resets	
Reset Real Power, DMD, total (Never reset)	☐
Reset Reactive Power, DMD, total (Never reset)	☐
Reset Apparent Power, DMD, total (Never reset)	☐
Reset Peak Current Demand (A) (Never reset)	☐
Reset Peak Current Demand (B) (Never reset)	☐
Reset Peak Current Demand (C) (Never reset)	☐
Reset Peak Current Demand (N) (Never reset)	☐
Reset Average Peak Current Demand (Never reset)	☐
Reset All Values	☐
Energy Accumulators	
Reset Phase Energy (Never reset)	☐
Reset Total Energy (Never reset)	☐
Reset Integrated Reactive Power (Never reset)	☐
Reset Total integrated Reactive Power (Never reset)	☐
Reset Forward fund. freq. WHrs (Never reset)	☐
Reset Reverse fund. freq. WHrs (Never reset)	☐
Reset Forward tot. fund. freq. WHrs (Never reset)	☐
Reset Reverse tot. fund. freq. WHrs (Never reset)	☐
Reset Forward fund. freq. VarHrs (Never reset)	☐
Reset Reverse fund. freq. VarHrs (Never reset)	☐
Reset Forward tot. fund. freq. VarHrs (Never reset)	☐
Reset Reverse tot. fund. freq. VarHrs (Never reset)	☐
Reset Fundamental freq. V A Hours (Never reset)	☐
Reset Total Fund. freq. VA Hours (Never reset)	☐

In connection with electric utility billing practices, the InfoNode and DataNode system has an interface to reset demand and energy accumulation readings. The Accumulator Resets tab allows one to reset the parameters to defined values, but not to change or configure new values. The notation 'Never reset' appears to mean that the parameter values register original readings and have never been reset at any time. The moment the reset parameter is activated/enabled, the notation will change and will reflect the date and time of last reset.

Under DEMAND RESETS, Real or True Phase power demand, Reactive power demand, and Apparent power demand can be reset. See Appendix E *Glossary* for the definitions of the various power parameter values. The system maintains a running maximum known as "peak demand" on per phase basis and per average demand current value. It also stores the date and time of each peak demand. Peak demand is the maximum electrical power load consumed or produced in a defined period of time.

Under ENERGY ACCUMULATORS, the system calculates and stores accumulated values for energy (in kWHr unit), reactive energy (in kVarH unit), and apparent energy (in kVAH unit). Kilowatt-Hour (kWHr) is the equivalent energy supplied by a power of 1000 watts for one hour. Watt is the unit for real power. Kilovar-hour (kVarH) is equal to 1000 reactive volt-ampere hours. Var is an abbreviation for volt ampere reactive. It measures the integral of the reactive power of the circuit into which the instrument is connected. Var is the unit for reactive power. Kilovolt-ampere (kVA) is equivalent to 1000 volt-amperes. VA is the unit for apparent power. Apparent power is the product of voltage and current of a single-phase circuit in

which the two reach their peaks at different times. See Appendix E *Glossary* for the definitions of the various power parameter values.

The accumulated energy values include real power factor (average three-phase) which is mathematically defined as "demand kW/demand kVA". It also displays integrated and total integrated reactive power. The system also calculates and stores apparent energy (VA). Real Power (W) and Apparent Power (VA) are reset together; you cannot reset one without resetting the other. Likewise, the Watthour Meter and Varhour Meter are reset together.

The system uses the fundamental frequency as reference for calculating energy values in one of two modes: forward or reverse. In forward mode, the circuit monitor considers the direction of power flow, allowing the accumulated energy magnitude to both increase and decrease. In reverse mode, the circuit monitor accumulates energy as positive, regardless of the direction of power flow. In other words, the energy value increases, even during reverse power flow. The default accumulation mode is reverse.

Summary of EPQ DataNode Setup Parameters and Tabs Where they can be Found

PARAMETERS	TAB WHERE FOUND
Active Power	METER
Active Power Demand	DEMAND
ANSI Transformer Derating Factor	HARMONICS
Apparent Power	METER
Apparent Power Demand	DEMAND
Arith. Sum PF	ADVANCED METER
Arithmetic Sum DF	ADVANCED METER
Arithmetic Sum VA	ADVANCED METER
Avg PF @ Peak P Dmd	DEMAND
Avg PF @ Peak Q Dmd	DEMAND
Current Crest Factor	HARMONICS
Current THD	HARMONICS
Current THD (Rms)	HARMONICS
Current TID	HARMONICS
Current TID (Rms)	HARMONICS
Displacement Power Factor	ADVANCED METER
Frequency	METER
Fund Arithmetic Sum VA	ADVANCED METER
Fund Freq VA Hrs	ADVANCED ENERGY
Fund Vector Sum VA	ADVANCED METER
Fwd Fund Freq varHrs	ADVANCED ENERGY
Fwd Fund. Freq WHrs	ADVANCED ENERGY
Harmonic Power	HARMONICS
HRms Voltage	HARMONICS
I Imbalance (rms/rms avg)	UNBALANCE
I Imbalance (S0/S1)	UNBALANCE
I Imbalance (S2/S1)	UNBALANCE
IEEE 519 Current TDD	HARMONICS
Interharmonic Rms Current	HARMONICS
Interharmonic Rms Voltage	HARMONICS
IT Product	HARMONICS
Negative Sequence Current	UNBALANCE
Negative Sequence Voltage	UNBALANCE
Net Current	ADVANCED METER
P Dmd @ Peak Q Dmd	DEMAND
P Dmd @ Peak S Dmd	DEMAND
Peak Active Power Demand	DEMAND
Peak Apparent Power Demand	DEMAND
Peak Demand Current	DEMAND
Peak Reactive Power Demand	DEMAND
PF @ Peak VA Dmd	DEMAND
PF Demand	DEMAND
Positive Sequence Current	UNBALANCE
Positive Sequence Voltage	UNBALANCE
Predicted P Dmd	DEMAND
Predicted Q Dmd	DEMAND
Predicted VA Dmd	DEMAND

Summary of EPQ DataNode Setup Parameters and Tabs where they can be Found

PARAMETERS	TAB WHERE FOUND
Pst	FLICKER
Plt	FLICKER
Plt Sliding	FLICKER
Q Dmd @ Peak P Dmd	DEMAND
Q Dmd @ Peak VA Dmd	DEMAND
Reactive Power Demand	METER
Reactive Power Demand	DEMAND
Residual Current	ADVANCED METER
Rms Current	RMS Variation, TRANSIENTS, METER
Rms Current Demand	DEMAND
Rms Current Individual Harmonics	ADVANCED HARMONICS
Rms Harmonic Current	HARMONICS
Rms Voltage	RMS Variation, TRANSIENTS, METER
Rms Voltage Individual Harmonics	ADVANCED HARMONICS
Rvs Fund Freq varHrs	ADVANCED ENERGY
Rvs. Fund. Freq. WHrs	ADVANCED ENERGY
Total Fund Freq Q	ADVANCED ENERGY
Transformer K Factor	HARMONICS
True Power Factor	METER, ADVANCED METER
V Imbalance (rms/rms avg)	UNBALANCE
V Imbalance (S0/S1)	UNBALANCE
V Imbalance (S2/S1)	UNBALANCE
V RMS Harmonic	HARMONICS
V/I Angle	METER
VA Dmd @ Peak Q Dmd	DEMAND
VA Dmd @ Peak P Dmd	DEMAND
Var Hours	REVENUE
Vector Sum DF	ADVANCED METER
Vector Sum PF	ADVANCED METER
Vector Sum VA	ADVANCED METER
Voltage Crest Factor	HARMONICS
Voltage THD	HARMONICS
Voltage THD (Rms)	HARMONICS
Voltage TID	HARMONICS
Voltage TID (Rms)	HARMONICS
Voltage TIF	HARMONICS
Voltage TIF (Rms)	HARMONICS
Watt Hours	REVENUE
Zero Sequence Current	UNBALANCE
Zero Sequence Voltage	UNBALANCE

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5540 Energy Management (EM) DataNode Setup

Refer to the 5540 DataNode User's Guide for more detailed information about connections and setups.

A 5540 Series DataNode

Recommended Setup before connecting to an InfoNode
The 5540 DataNode must be programmed from its front panel to properly communicate with the InfoNode. To enter the program mode, see the DataNode 5540 User's Guide. The communications should be set as follows:

8 BIT EVEN
9600 baud
XON/XOFF
BINARY RS232
ADDRESS x (where x matches the value setup in the InfoNode for that 5540)

If using RS232 or RS485, the cables between the InfoNode and 5540 must go though a null modem; that is, transmit and receive must be interchanged, as well as interchanging the positive (+) and negative (-) lines for both transmit and receive.

Specifications for 5540 EM DataNode

Measurements
23 parameters including true RMS voltage and current, kVA, kW, PF, frequency, kVAR, kWh, kVAh, kVARh, current demand, kVA demand, kW demand

Voltages
3-phase L-L or L-N (660 Vrms L-L, 500 Vrms L-N FS), 45-65 Hz fundamental, accuracy ±0.3% RDG (FS for 10%-120% FS)

Currents
3-phase (5 Arms or 1Arms FS), accuracy ±0.3% RDG (FS for 2%-120% FS)

Instrument Power
96-138 Vac / 185-250 Vac; 50-60 Hz, 10 Va

Enclosure Environments
ABS panel mount, cutout 92x92mm (3.375” square); screw terminal connections for voltage and current; operating -20^{O}C to +60^{O}C, 0-95% RH non-condensing

Front Panel
GE Lexan film; daylight-visible display, sealed tactile feedback controls

Communications
RS-485 to InfoNode, InfoNode supports up to 32 DataNodes (16 on each of two InfoNode COM ports), InfoNode access through Internet, Ethernet, Intranet, or dial-up telephone line

Additional Features
External synchronization via dry contacts; supports voltage and current multipliers, user-selected wiring configuration, communications address, kW demand period, and Ampere demand period

Programming Standard Tabs

LEGEND (Please note the following conventions used in the screen displays):
Items in *italics* are not programmable, but included for information purpose to the user.
Items in **bold** are examples of what can be entered.
Selections available in drop down menu are enclosed in brackets { xxxx }.

Caution: Dranetz-BMI has already set default values for the various parameters in each DataNode. The default values have been tested to result in optimal system performance. Users are advised not to change the default value settings unless there are applications which require advanced setups.

1. **General** tab

Properties	Values
Identification Information	
Name	**Edison 5540**
Description	
Serial Number	*Unknown*
Version	*65535*
Status Information	
Active	☑
Get settings from DataNode on activation	☐
Last contact at	*11/05/2002 11:33:04*
Health	*System health is normal*

General Setup contains DataNode Identification and Status information. Users can enter a 30 character alphanumeric name for the DataNode, detailed DataNode description (such as location of DataNode), and enable checkboxes to activate DataNode connection settings.

General tab parameters of the 5540 DataNode function similarly as that of the 5530/5520 DataNode. Refer to page 8-2 for the detailed description of the General tab parameters displayed above.

2. **Basic** tab

Properties	Values
Communications	
Address	**1**
Polling Interval (sec)	**300**
Serial Port	**COM1** {COM1, COM2}
Baud Rate	**9600** {9600, 4800, 2400, 1200}
Parity	**Even** {Even, None}
Protocol	**MODBUS** {MODBUS, ASCII}
Display	
Display Thresholds as:	**Percent** {Volts, Per Unit, Percent}
Base Voltage	208.0
Inputs	
Wiring Configuration	**4-wire, L-N** {3-wire, open delta} {3-wire, direct} {4-wire, L-L}
PT Ratio	**1.0000**
CT Primary	**20**
Registers	
Phase A RMS Voltage (L-L or L-G)	☐
Phase B RMS Voltage (L-L or L-G)	☑
Phase C RMS Voltage (L-L or L-G)	☑
Phase A RMS Current (Amps)	☑
Phase B RMS Current (Amps)	☑
Phase C RMS Current (Amps)	☑
Phase A Active Power (kW)	☐
Phase B Active Power (kW)	☐
Phase C Active Power (kW)	☐
Total Active Power (kW)	☐
Phase A Reactive Power (kvar)	☐
Phase B Reactive Power (kvar)	☐
Phase C Reactive Power (kvar)	☐
Total Reactive Power (kvar)	☐
Phase A Apparent Power (kva)	☐
Phase B Apparent Power (kva)	☐
Phase C Apparent Power (kva)	☐
Total Apparent Power (kva)	☐

Basic tab screen display continued next page

... continued

Phase A Power Factor (PU)	☐
Phase B Power Factor (PU)	☐
Phase B Power Factor (PU)	☐
Total Power Factor (PU)	☐
Frequency (Hz)	☐
Total Positive Energy Flow (kWh)	☐
Total Negative Energy Flow (kWh)	☐
Total Positive Integrated Reactive Power Flow (kvarh)	☐
Total Negative Integrated Reactive Power Flow (kvarh)	☐
Total Integrated Apparent Power Flow (kvah)	☐
kVA Dermand	☐

Basic Setup contains data on Communications, Display, Inputs and Registers.

COMMUNICATIONS parameters include the following:
•**Address**: must be a unique address between 1 and 32 for each DataNode
•**Polling Interval (sec)**: typically 300 seconds
•**Serial Port**: either COM1 or COM2 of the InfoNode
•**Baud Rate**: typically 9600 baud
•**Parity**: a method of checking the accuracy of binary numbers where an extra bit, called parity bit, is added to a number; if Even parity is used, the sum of all 1's in the number and its corresponding parity bit is alway seven; if None (odd parity) is used, the sum of the 1's and the parity bit is always odd
•**Protocol**: mechanism for information exchange between InfoNode and DataNode; either MODBUS or ASCII

DISPLAY parameters include the following:
•**Display Thresholds as**: displays parameters in either Volts, Percent, or PU (per unit)
•**Base Voltage**: needed if using percent or per unit
•**Base Power**: needed if using percent or per unit

INPUTS parameters include the following:
•**Wiring Configuration**: set to either 3 wire open delta, 4 wire Line-to-Neutral, 3 wire direct, or 4 wire L-L
•**PT Ratio**: if the voltage inputs are connected to an external PT
•**CT Primary**: the maximum nominal current on the primary side of the CT; the secondary ratio is determined by the version of the instrument in use

REGISTERS parameters include the following:
•Registers: check boxes to select those to save for trending
- •RMS Voltage and Current
- •Active Power in kilowatts, Reactive Power in kVARs, Apparent Power in kVA, Power Factor
- •Frequency in Hz
- •Total Energy Flow: three phase sum of the real or active energy flowing from the source to the load (positive) and from the load to the source (negative) in kWhr
- •Total Reactive Integrated Power Flow: three phase sum of the reactive energy flowing from the source to the load (positive) and from the load to the source (negative) in kVARhr
- •Total Apparent Integrated Power Flow: three phase sum of the apparent energy flowing in kVAhr
- •KW Demand: average real or active power over the demand interval
- •KVA Demand: average apparent power over the demand interval

3. **Advanced** tab

Properties	Values
Reset Accumulators on Next Connect	☐
Demand Period (min)	15
Average Buffer Size	8 entries
Front Panel Reset Enabled	☑
Phase A RMS Voltage (L-L or L-G)	
Enabled	☑
High-High Threshold	120.000
High Threshold	110.000
Low Threshold	90.000
Low-Low Threshold	80.000
Phase B RMS Voltage (L-L or L-G)	
Enabled	☑
High-High Threshold	120.000
High Threshold	110.000
Low Threshold	90.000
Low-Low Threshold	80.000
Phase C RMS Voltage (L-L or L-G)	
Enabled	☑
High-High Threshold	120.000
High Threshold	110.000
Low Threshold	90.000
Low-Low Threshold	80.000
Phase A RMS Current (Amps)	
Enabled	☑
High-High Threshold	24.000
High Threshold	20.000
Low Threshold	5.000
Low-Low Threshold	0.000
Phase B RMS Current (Amps)	
Enabled	☑
High-High Threshold	24.000
High Threshold	20.000
Low Threshold	5.000
Low-Low Threshold	0.000
Phase C RMS Current (Amps)	
Enabled	☑
High-High Threshold	24.000
High Threshold	20.000
Low Threshold	5.000
Low-Low Threshold	0.000

Advanced tab screen display continued next page

... continued

Phase A Active Power (kW)	
Enabled	☐
High-High Threshold	5750.000
High Threshold	4420.000
Low Threshold	985.000
Low-Low Threshold	0.000
Phase B Active Power (kW)	
Enabled	☐
High-High Threshold	5750.000
High Threshold	4420.000
Low Threshold	985.000
Low-Low Threshold	0.000
Phase C Active Power (kW)	
Enabled	☐
High-High Threshold	5750.000
High Threshold	4420.000
Low Threshold	985.000
Low-Low Threshold	0.000
Total Active Power (kW)	
Enabled	☐
High-High Threshold	17250.000
High Threshold	13260.000
Low Threshold	2955.000
Low-Low Threshold	0.000
Phase A Reactive Power (kvar)	
Enabled	☐
High-High Threshold	0.000
High Threshold	0.000
Low Threshold	0.000
Low-Low Threshold	0.000
Phase B Reactive Power (kvar)	
Enabled	☐
High-High Threshold	0.000
High Threshold	0.000
Low Threshold	0.000
Low-Low Threshold	0.000
Phase C Reactive Power (kvar)	
Enabled	☐
High-High Threshold	0.000
High Threshold	0.000
Low Threshold	0.000
Low-Low Threshold	0.000

Advanced tab screen display continued next page

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Total Reactive Power (kvar)	
Enabled	☐
High-High Threshold	0.000
High Threshold	0.000
Low Threshold	0.000
Low-Low Threshold	0.000
Phase A Apparent Power (kva)	
Enabled	☐
High-High Threshold	5750.000
High Threshold	4420.000
Low Threshold	985.000
Low-Low Threshold	0.000
Phase B Apparent Power (kva)	
Enabled	☐
High-High Threshold	5750.000
High Threshold	4420.000
Low Threshold	985.000
Low-Low Threshold	0.000
Phase C Apparent Power (kva)	
Enabled	☐
High-High Threshold	5750.000
High Threshold	4420.000
Low Threshold	985.000
Low-Low Threshold	0.000
Total Apparent Power (kva)	
Enabled	☐
High-High Threshold	17250.000
High Threshold	13260.000
Low Threshold	2955.000
Low-Low Threshold	0.000
Phase A Power Factor (PU)	
Enabled	☐
Low Threshold	0.000
Low-Low Threshold	0.000
Phase B Power Factor (PU)	
Enabled	☐
Low Threshold	0.000
Low-Low Threshold	0.000
Phase C Power Factor (PU)	
Enabled	☐
Low Threshold	0.000
Low-Low Threshold	0.000

Advanced tab screen display continued next page

... continued

Total Power Factor (PU)	
Enabled	☐
Low Threshold	0.000
Low-Low Threshold	0.000
Frequency (Hz)	
Enabled	☐
High-High Threshold	0.000
High Threshold	0.000
Low Threshold	0.000
Low-Low Threshold	0.000
Total Positive Energy Flow (kWh)	
Enabled	☐
High-High Threshold	0.000
High Threshold	0.000
Total Negative Energy Flow (kWh)	
Enabled	☐
Low Threshold	0.000
Low-Low Threshold	0.000
Total Positive Integrated Reactive Power Flow (kvarh)	
Enabled	☐
High-High Threshold	0.000
High Threshold	0.000
Total Negative Integrated Reactive Power Flow (kvarh)	
Enabled	☐
Low Threshold	0.000
Low-Low Threshold	0.000
Total Integrated Apparent Power Flow (kvah)	
Enabled	☐
High-High Threshold	0.000
High Threshold	0.000
kVA Demand	
Enabled	☐
High-High Threshold	17250.000
High Threshold	13260.000

Advanced Setup provides you with the ability to set limits for triggering of various parameters, as well as to setup other functions, such as demand interval.

•**Demand Period**: in minutes, typically 15

•**Average Buffer Size**: typically 8

•**Front Panel Reset Enabled**: check box to set

•**Limits for each parameter, typically HI-HI, HI, LO, LO-LO**: Some parameters will only have the first two or the last two, where the numbers could only be positive or negative, respectively

Introduction

The 5560 QOS (Quality of Supply) DataNode is designed to monitor and report quality of supply compliance as specified by European Standard EN50160. The 5560 DataNode provides the full set of data required to verify compliance with EN50160, while maintaining the power quality diagnostic capabilities expected from Dranetz-BMI.

Scope of EN50160 Standard*

It is important to note that EN50160 is defined for the electricity supplied at the supply terminals, and does not deal with the supply system or the consumer's installation or equipment itself.

As the standard deals with the voltage characteristics in public distribution networks, other aspects essential for the supply quality (for instance short circuit power) are not treated in this standard. The standard is applicable only under normal operating conditions of the supply system. This includes also the correct operation of protection devices in the case of a fault in the network (blowing of a fuse, operation of a circuit-breaker, etc.), the operation of loads agreed between customer and supplier, and changes in the network.

The standard lists several specific examples of exceptional conditions, out of supplier's control, that can cause one or more of the characteristics to go beyond the values given. These conditions include exceptional weather conditions and other natural disasters, third party interference, acts by public authorities, industrial action, force majeure, and power shortages resulting from external events. Under such conditions the EN50160 does not apply.

EN50160 is not an EMC standard. It does not give compatibility levels or emission limits. Moreover the standard does not have the function of specifying the requirements for electrical equipment. Its sole function is to give values for the main voltage characteristics of electricity supplied by Low Voltage (LV) and Medium Voltage (MV) public networks. That means EN50160 is a product standard giving the voltage characteristics which can be expected at the supply terminals. This standard does not describe the average situation in the public supply networks but the maximum values or variations of the voltage characteristics under normal operating conditions which can be expected by the customer at any place of the network.

*Based on Draft Guide to the Application EN50160, CENELEC Report, CLC/BTTF 68-6(SG)1 Rev., January 1999.

5560 DataNode QOS Functional Components

The QOS compliance monitoring functionality of the 5560 DataNode is optimized to ensure error-free setup and reporting for EN50160 applications. Selections are provided to allow a user to configure the system to collect either a super-set or sub-set of the measurements required for EN50160 monitoring. Statistical data is calculated on the required 12 parameters specified in EN50160 over the (1 week) interval to produce a PASS/FAIL decision of compliance. Statistical and trending visualizations show what the values of each of the parameters were over the interval, and at what time did they approach or exceed limits.

As with other Dranetz-BMI DataNodes, the 5560 DataNode is set up and viewed through a web browser, with no software to learn and install.

The QOS functional components built into the 5560 DataNode are incorporated into the various tab pages of the InfoNode system. The user interface employed by the 5560 DataNode is identical to that of other DataNodes, except that additional monitoring and setup protocols were installed to meet the data acquisition requirements of the QOS compliance standards.

This Chapter describes the following QOS functional components built into the 5560 DataNode.

- Specifications for 5560 DataNode
- Home Page Reporting of QOS Compliance
- QOS Status Views
  - > QOS Status Query
  - > QOS Status Summary
  - > Compliance Statistical Graph
  - > Smart Views
- QOS Compliance Reports
  - > Smart Reports
  - > Standard Reports
- Real-time Display of QOS Data
- 5560 DataNode System Setup
  - >EN50160 General Setup tab
  - >5560 DataNode Setup

References to the sections above are advertently made in the other Chapters of this manual where they relate.

5560 DataNode Specifications

Configurations: External CT and voltage pods; 1A/5A current with 5x overcurrent.

Voltages: 4 channels, accuracy +/- 0.1% of reading, +/- 0.1% FS.

Currents: 4 channels, accuracy +/- 0.1% of reading, +/- 0.1% FS.

Instrument Power: 90-250Vac, 50/60Hz; optional 105-150Vdc; built-in UPS with 4-year battery life.

Enclosure/Environments: Rack, panel, desktop, NEMA 4x options; 0-60 deg C standard.

Communications: 10BaseT Ethernet to InfoNode. InfoNode access through Internet, Intranet, dial-up or wireless telephone line.

Additional Features: Remote firmware update; automatic report writer software option.

Certifications and design standards: CE, ISO9001, EMC Directive (89/366/EEC), IEC 61000-4-7, IEC 61000-4-15, EN61010-1 (1993), EN61010-1/A2.

NOTE: The 5560 DataNode is actually a 5520/5530 EPQ DataNode with different firmware. EPQ DataNodes can be upgraded to 5560. Please contact Dranetz-BMI factory for details.

Measurements:
Power Frequency - Mean value based on time between zero crossings of voltage of Phase A calculated over 10 second window.

Magnitude of the supply voltage - RMS calculated over 1 cycle with ½ cycle steps.

Supply voltage variations - Ten minute mean of RMS calculated over 1 cycle with ½ cycle steps.

Rapid voltage changes (Flicker) - As per EN61000-4-15.

Supply voltage dips - 1% to 90% of Un. Depth of RMS calculated over 1 cycle with ½ cycle steps, along with 10msec to 60 seconds in duration, reported in tabular form.

Short interruptions of the supply voltage - <1% of Un on ½ cycle RMS with duration less or equal to 3 min. RMS calculated over 1 cycle with ½ cycle steps.

Temporary power - Frequency overvoltage between live conductors and earth - 110% of Un or Uc. RMS calculated over 1 cycle with ½ cycle steps

Transient overvoltages between live conductors and earth - Captured at 128 samples/cycle along with crest and waveshape triggers.

Supply voltage unbalance - Negative phase sequence divided by positive phase sequence components.

Harmonic voltage - As per EN61000-4-7.

Interharmonic voltage - As per EN61000-4-7.

Mains signalling voltage on the supply voltage - User selectable 5 frequencies below 3KHz.

Parameters measured include kVA, KW, True PF, DPF, KVAR, kWhr, kVAR and other power related parameters.

Home Page Reporting of QOS Compliance

The Quality of Supply compliance status for the latest complete evaluation period of each DataNode is reported via the InfoNode Home page. Information about QOS compliance appears in two parts of the Home page: the DataNode status paragraph and the DataNode status table.

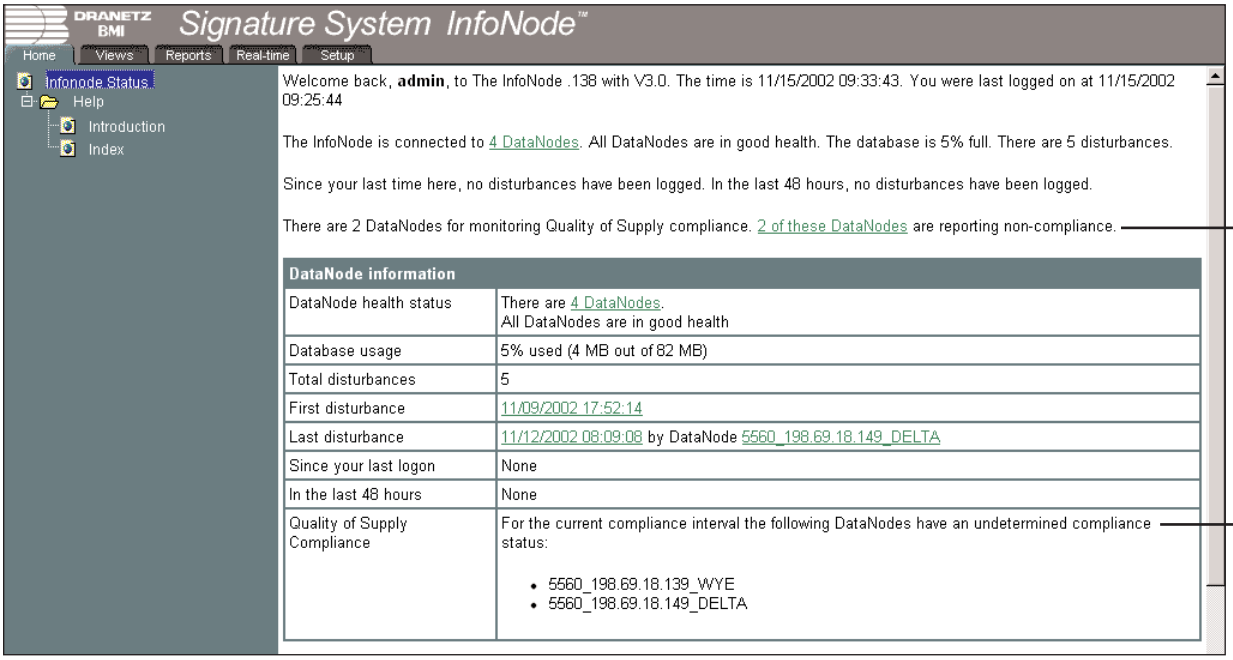
NOTE: Other types of DataNode (EPQ, 5540, etc.) may exist in the system. QOS Status may not apply to the other DataNodes.

Compliance Message on DataNode Status Paragraph

A report on QOS compliance appears in the DataNode status paragraph. If the 5560 QOS is compliant, the following message is shown “There is one DataNode for monitoring Quality of Supply compliance. This DataNode is reporting compliance." If the QOS DataNode is non-compliant or have undetermined compliance, further messages appear under the DataNode status table described next. The non-compliance message is hyperlinked to the Quality of Supply Compliance section in the DataNode status table.

Compliance Message on DataNode Status Table

An additional section featuring the non-compliance status of QOS DataNodes appear in the DataNode status table. The table indicates which DataNodes are not in compliance and/or have undetermined compliance status for the specified interval. DataNodes that are non-compliant are hyperlinked to the QOS Status view.



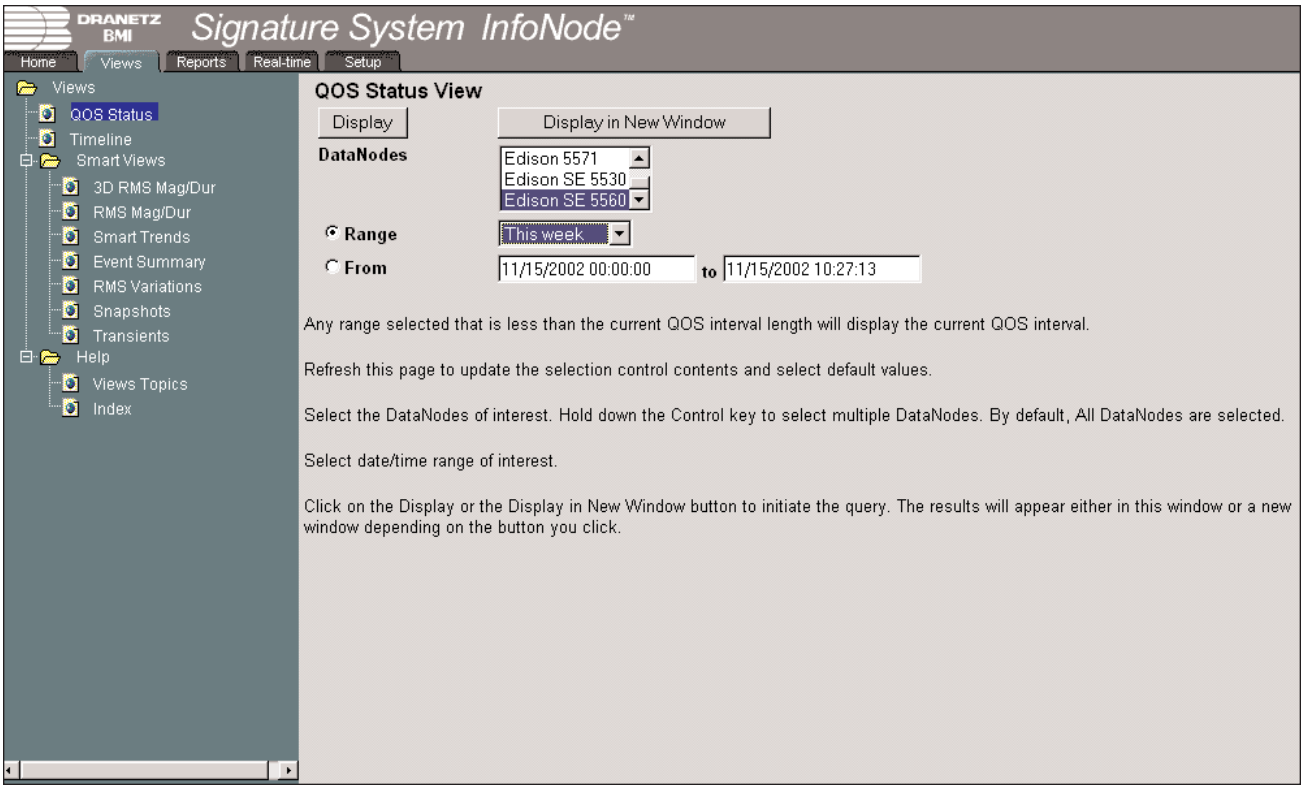
5560 DataNode Home Page

QOS Status View

QOS Status Query

A new element called QOS Status has been added in the Views page. QOS Status will appear in InfoNode systems that have QOS data acquisition modules (5560 DataNode) in it. Click on the QOS Status to display the standard query selection shown below. Users have the option to view QOS status data for single or multiple DataNode(s). Users can also select the time range or specify a time period to view data from. Only data for 5560 DataNodes will be displayed in the set once the Display or Display in New Window button is clicked.

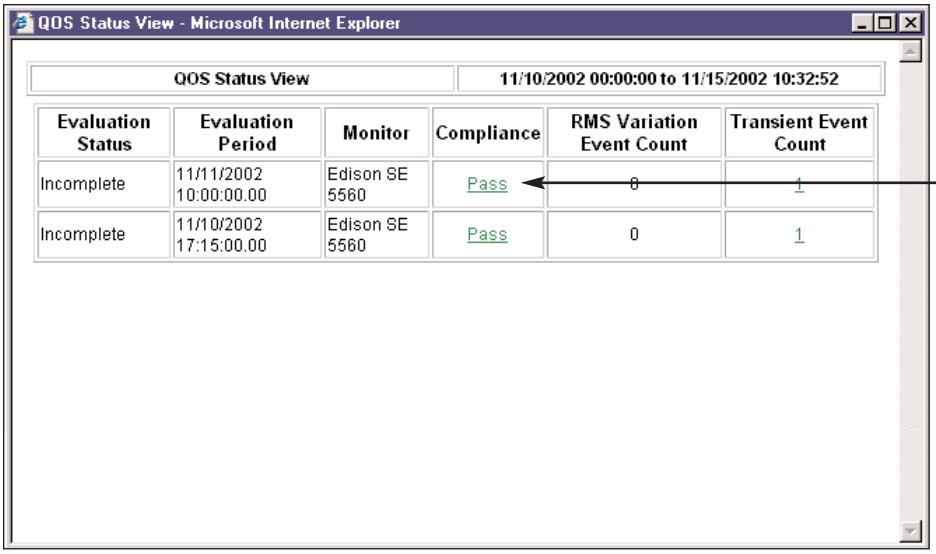
Once selections have been made, click on either Display or Display in New Window. The QOS Status Summary table shown next page is displayed.



QOS Status Query Screen

QOS Status Summary

The QOS Status Summary table lists the monitoring periods (weeks) that fall within the selected date range for the selected DataNode(s), as well as how many RMS and Transient Events occurred during the monitoring periods. The standard monitoring period is one complete week, usually beginning Sunday 00:00. Any Time/Date Query that specifies a range that would include part of a monitoring period (less than one week) will have that particular Evaluation Status marked as Incomplete and the Compliance marked as Undetermined. For completed monitoring periods, Compliance status may either be PASS or FAIL. A PASS or FAIL status is hyperlinked to the Compliance Statistical Bar Chart. See text below for the description of the items contained in the QOS Status Summary table.



QOS Status Summary Table

Evaluation Status: The evaluation status is either Complete (full week) or Incomplete (less than a week). An evaluation status is Incomplete under the following scenarios.

· It is the current evaluation period and it has simply not completed.

· It is a previous evaluation period but not enough data samples were included in the statistical analysis. This may be due to the following reasons: data was not collected or too many samples were tagged as unusable due to RMS variations or some other EN50160 criteria.

NOTE: The criteria defining completeness of an evaluation period is described on page 10-21 EN50160 General Setup tab.

Evaluation Period: This column displays the date and time of the beginning of the evaluation period. Each evaluation period is independent of each other.

Monitor: This column displays the name of the DataNode to which the evaluation period belongs.

Compliance: The EN50160 Answer Module determines compliance. For completed periods, Compliance displays PASS (Green) or FAIL (Red). For incomplete periods, Compliance displays Undetermined (Black). A PASS or FAIL compliance status is hyperlinked to the Compliance Statistical Bar Chart featuring the 7 parameters required for determining compliance. See sample bar chart on page 10-6.

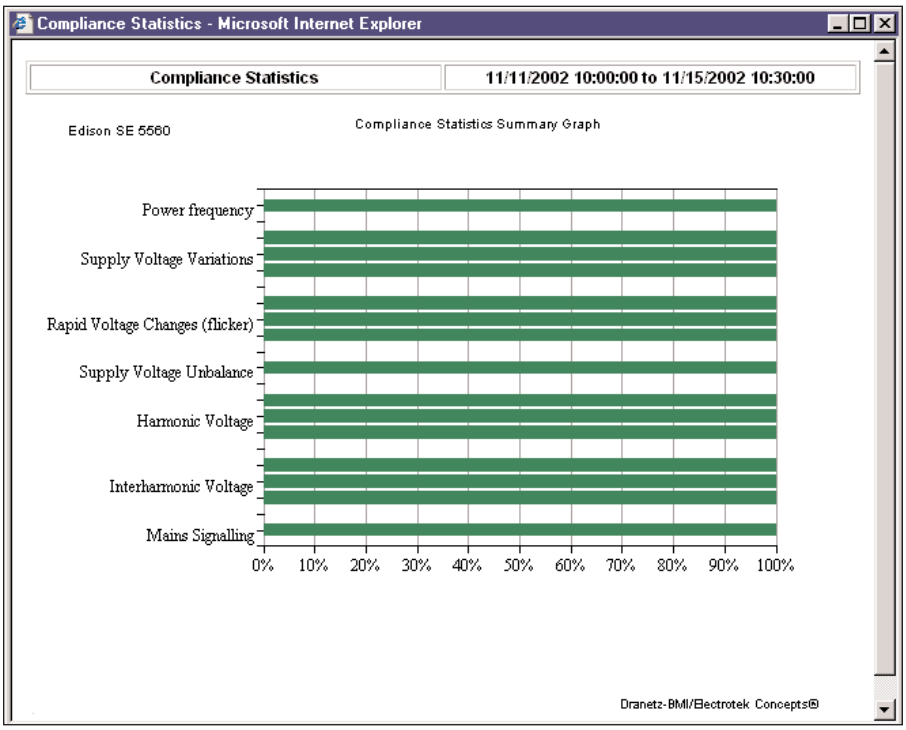
RMS Variation Event Count: The RMS variation event count is a hyperlink to EN50160 DISDIP table for RMS variation events. See page 10-15 for the EN50160 DISDIP Table and 3D Bar Chart for RMS Variations

Transient Event Count: The Transient event count is a hyperlink to EN50160 Transient DISDIP table for Transient Events and Transient Overvoltages. See page 10-15.

Compliance Statistical Graph

The Compliance Statistical Bar Chart shown below displays the seven parameters that are required for determining compliance. The bar chart indicates the percentage of the intervals passing the specified compliance criteria. The color of the bar indicates the compliance status. A green bar indicates that the parameter is within compliance. A red bar indicates that the parameter does not comply with EN50160 Standard.

The graph atuoscales to enable maximum viewing. The minimum value on the left of the horizontal axis will be the 10% multiple that is less than the lowest compliance level for the seven parameters displayed. If the value is less than 1%, the bar will graph 1% so that is visible. See text below for the description of each parameter. For QOS compliance limits of each parameter, refer to the Compliance Limits in QOS Setups and Reports table on page 10-8.



Compliance Statistical Bar Chart

Power Frequency: In case of fault operation, parts of an interconnected system may become isolated. Compliance will be assessed over an observation period of one week, by a statistical analysis carried out over the sequence of 10 seconds measurements. Frequency is represented by a single value and a single bar. The bar is a hyperlink to the Power Frequency Graph. See page 10-17.

Supply Voltage Variations: Under normal operating conditions, load changes cause variations of the 10 minute average supply voltage. Generally this is compensated by automatic voltage regulation within a period of a few tens of seconds. Supply Voltage Variations display a cluster of bars, one for each phase. The color of each bar indicates the compliance status for its phase. A green bar indicates that the parameter is within compliance. A red bar indicates that the parameter does not comply with EN50160.

Rapid Voltage Changes (Flicker): Typical rapid voltage changes do not exceed a magnitude of + 5% or - 5% of the nominal or declared voltage. This limitation is possible because connection of loads capable of creating rapid voltage changes is usually subjected to regulations. But under certain conditions, higher values up to 10% may occasionally occur. These higher values can occur for instance in areas where higher power motor equipment (blowers, pumps, compressors, etc.) is used. Flickers display a cluster of bars, one for each phase. The color of each bar indicates the compliance status for its phase. A green bar indicates that the parameter is within compliance. A red bar indicates that the parameter does not comply with EN50160.

Supply Voltage Unbalance: The unbalance of a three phase supply voltage consists of a loss of symmetry of the phase voltage vectors (magnitude and/or angle), created mainly by unbalanced load. Compliance is verified when 95% of the sequence of valid 10 minute values are within the specified tolerance of normally 2% (in single phase/two phase supplies 3%). Supply Voltage Unbalance is represented by a single value and a single bar. The color of the bar indicates the compliance status. A green bar indicates that the parameter is within compliance. A red bar indicates that the parameter does not comply with EN50160.

Harmonic Voltage: Harmonics display a cluster of bars, one for each phase. The color of each bar indicates the compliance status that is calculated by 'anding' the statuses of Total Harmonic Distortion (THD) and each Harmonic 2 thru 25. The bars for Harmonic Voltage all link to the same graph. See page 10-16.

With regard to the Harmonic bars (see graph on page 10-6), if 3 bars all go to 100% but one phase is red, this indicates that the THD is in compliance but one or more of the individual harmonic components is not in compliance. Clicking on the bars will show harmonic component detail.

Many instruments used for harmonic measurements of power supply systems express their output with reference to the fundamental component of the voltage, especially those indicating the THD Factor.

Harmonic values are specified only up to order 25 (EN50160 limit), for the practical reason that for higher orders the values are generally so small as to be impractical to measure. Another reason is because of the difficulty of giving values which would be relevant to all networks.

Interharmonic Voltage: Interharmonics display a cluster of bars, one for each phase. The color of each bar indicates the compliance status that is calculated by adding the statuses of Total Interharmonic Distortion (TID) and each Interharmonic 2 thru 25. The bars for Interharmonic Voltage all link to the same graph. See page 10-16.

Mains Signalling: With regard to signal transmission over the public supply network it is necessary to distinguish between ripple control systems (frequency range from 100 Hz to 3 kHz) and mains communication systems (frequency range 3 kHz to 148,5 kHz).

Mains Signalling display a cluster of bars, one for each phase. The color of each bar indicates the compliance status that is calculated by adding the statuses of each of the defined frequencies (a maximum of five) for its phase. A green bar indicates that the parameter is within compliance. A red bar indicates that the parameter does not comply with EN50160.

Harmonic Compliance Limit Values

The general approach of EN50160 is to express all voltage characteristics by reference to the nominal voltage or declared voltage, as appropriate. The following are the Harmonic Compliance Limit values in relation to the nominal voltage.

Harmonic Number	Limit
DC	
2	2%
3	5%
4	1%
5	6%
6 thru 24	0.5%
7	5%
9	1.5%
11	3.5%
13	3%
15	0.5%
17	2%
19	1.5%
21	0.5%
23	1.5%
25	1.5%

Compliance Limits in QOS Setup and Reports

- Low-Voltaqe Supply nominal voltage Un, upper limit 1Kv
- Medium-Voltaqe Supply Characteristics - declared voltage Uc, range 1kV to 35kV

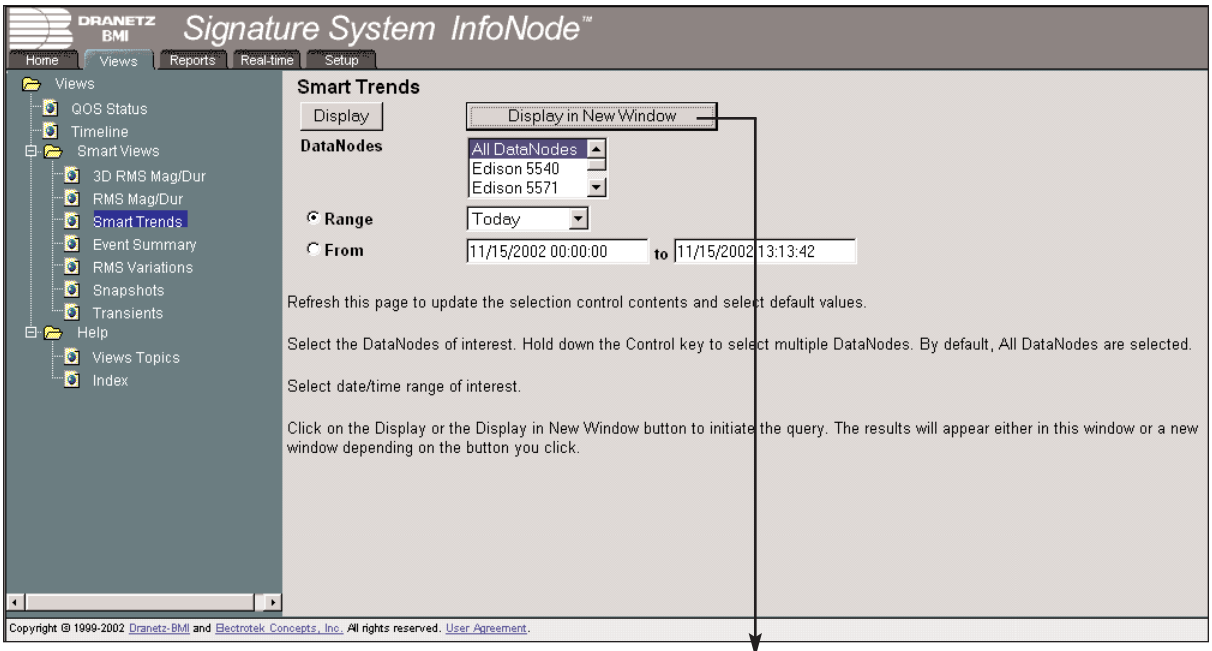
Category	Limits for QOS Compliance to Pass
Power frequency with synchronous connection to an interconnected system	Mean value over 10 seconds ▪ ± 1% during 95% of a week ▪ +4% / -6% during 100% of a week
Power frequency with no synchronous connection to an interconnected system	Mean value over 10 seconds ▪ ± 2% during 95 % of a week ▪ ± 15% during 100% of a week
Magnitude of the supply voltage (In low voltage systems, declared and nominal voltage are equal)	Mean rms over 10 minutes ▪ ± 10% of Un or Uc during 95% of one week ▪ + 10% - 15% of Un during 100% of one week
Supply voltage variations (Under normal operating conditions, excluding situations arising from faults or voltage interruptions)	Mean rms over 10 minutes ▪ ± 10% of Un or Uc during 95% of one week ▪ + 10% - 15% of Un during 100% of one week
Rapid voltage changes	Plt ≤ 1 for 95 % of the time Also 5% normal, 10% infrequent for LV, 4 & 6 for MV
Supply voltage dips	No criteria specified, just reported in DISDIP table
Short interruptions of the supply voltage	<1 second for 70 % of the short interruptions
Temporary power-frequency overvoltage between live conductors and earth	1.5KV for LV 170% for solidly or impedance earth, 200% (unearthed of resonate earth)
Transient overvoltages between live conductors and earth	Short duration surges: < 1 µs Medium duration surges: > 1 to < 100 µs Long duration surges: > 100 µs
Supply voltage unbalance (Under normal operating conditions)	10 minute mean rms values of the negative phase sequence component / positive phase sequence component ▪ ≤2 % during 95 % each period of one week
Harmonic voltage (Under normal operating conditions)	10 minute mean rms values Individual harmonic voltage up to 25 th shall be less than or equal to the value of Un given under Harmonic Compliance Limits (on page 10-7) during 95% of one week ▪ ≤8% THD (THD up to the 40) less than or equal to 8
Interharmonic voltage	No criteria specified so use same as Harmonics Individual interharmonic voltage up to 24-25 th shall be less than or equal to the value of Un given under Harmonic Compliance Limits (on page 10-7) during 95% of one week ▪ ≤8% THD (THD up to the 39/40)
Mains signalling voltage on the supply voltage	3 second mean of signal voltages compared against the Meister curve

Smart Views

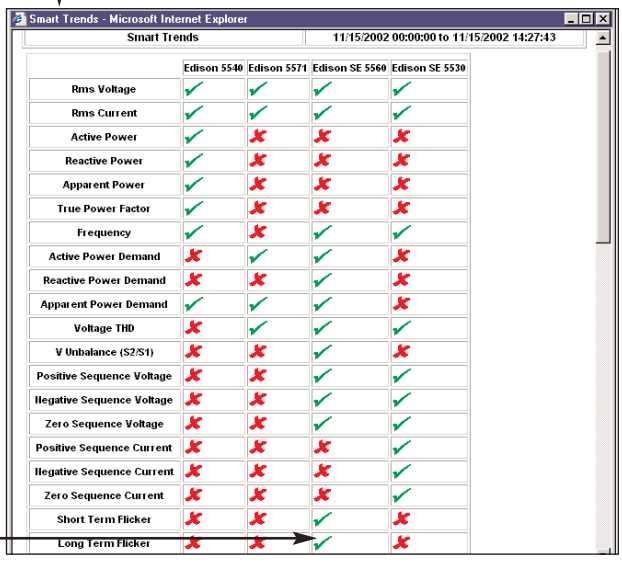
Smart Views are similar to Reports of the same name. While Reports are used to summarize data, Smart Views are typically used to zoom in on data, fix data properties, and add/change channels for data trending (see page 10-10).

Smart Trend

Smart Trend displays timeline types of graph of a large range of parameters, based on the type of DataNode and which parameters were saved for trending. After using the standard query to select the DataNodes and time/date range, a display of all possible parameters that can be trended is shown. Clicking a green check mark will trend that parameter for the selected phase and will also show a histogram of the different values with a cumulative probability line. Red X marks indicate that the particular parameter is not available for trending. In the sample screens below, a 5560 DataNode is selected for display under the standard query selection. Clicking on the Display or Display in New Window will show the list of parameters available for trending as the bottom screen shows.



Smart Trends Query Screen

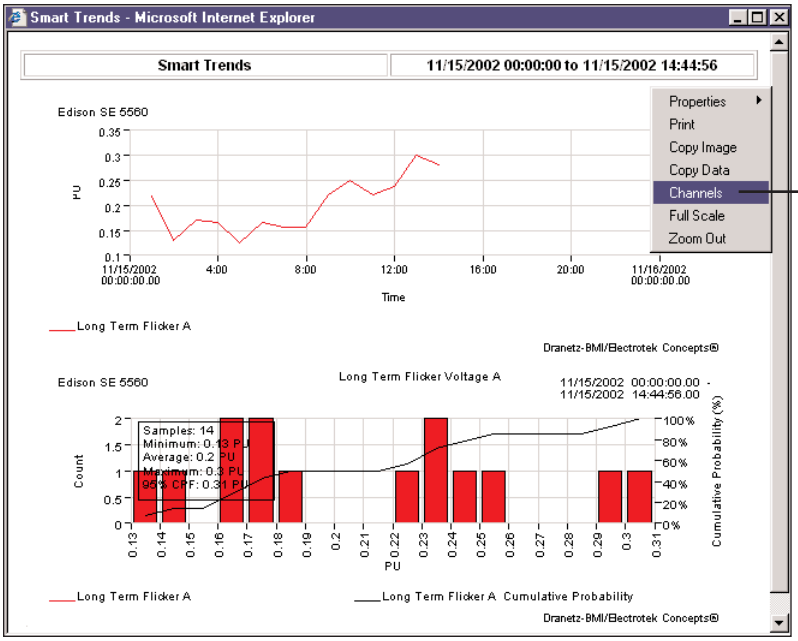


Click the green check mark to trend the parameter for the selected DataNode. See page 10-10. (Screen capture shows only a partial list of parameters)

Trend Parameters for 5560 DataNode

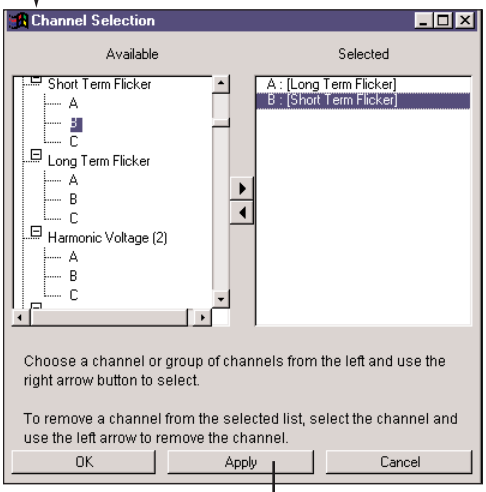
Timeline Graphs for Smart Trends

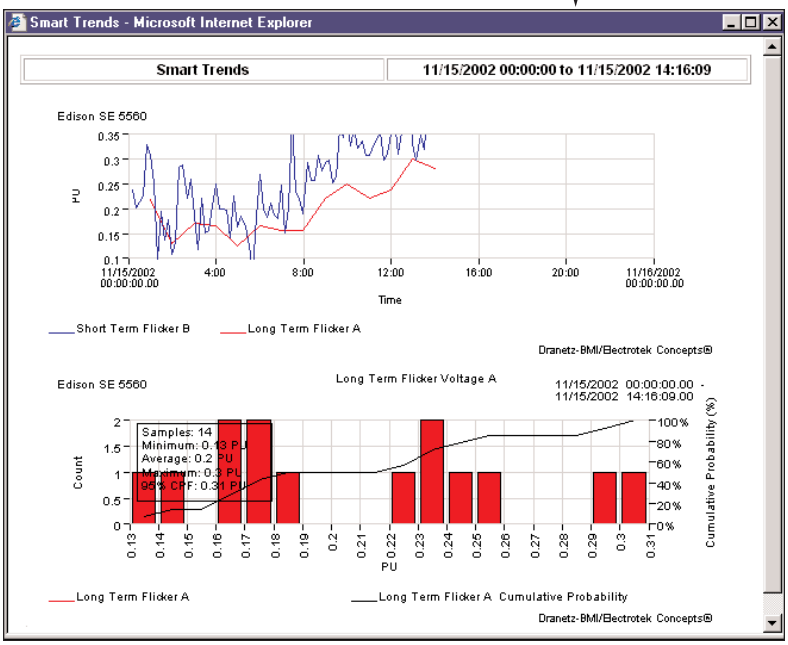
As discussed in the previous page, clicking on a green check mark will trend the parameter for the selected phase and will also show a histogram of the different values with a cumulative probability line. Sample display screens below show timeline graphs for Long Term Flicker (Pst) and Short Term Flicker (Plt) quantities. Plt Slide is also available for trending. See page 10-41 for the list of other Flicker parameters available for trending. Smart trends which are linked from the EN50160 Status View display an item for 95% CPF in the data block.



Timeline Graph with data trend for Long Term Flicker

Right-click to view menu options for other parameters. For example, to view data plots of other channels, select Channels and follow instructions on the Channel Selection dialog box below.





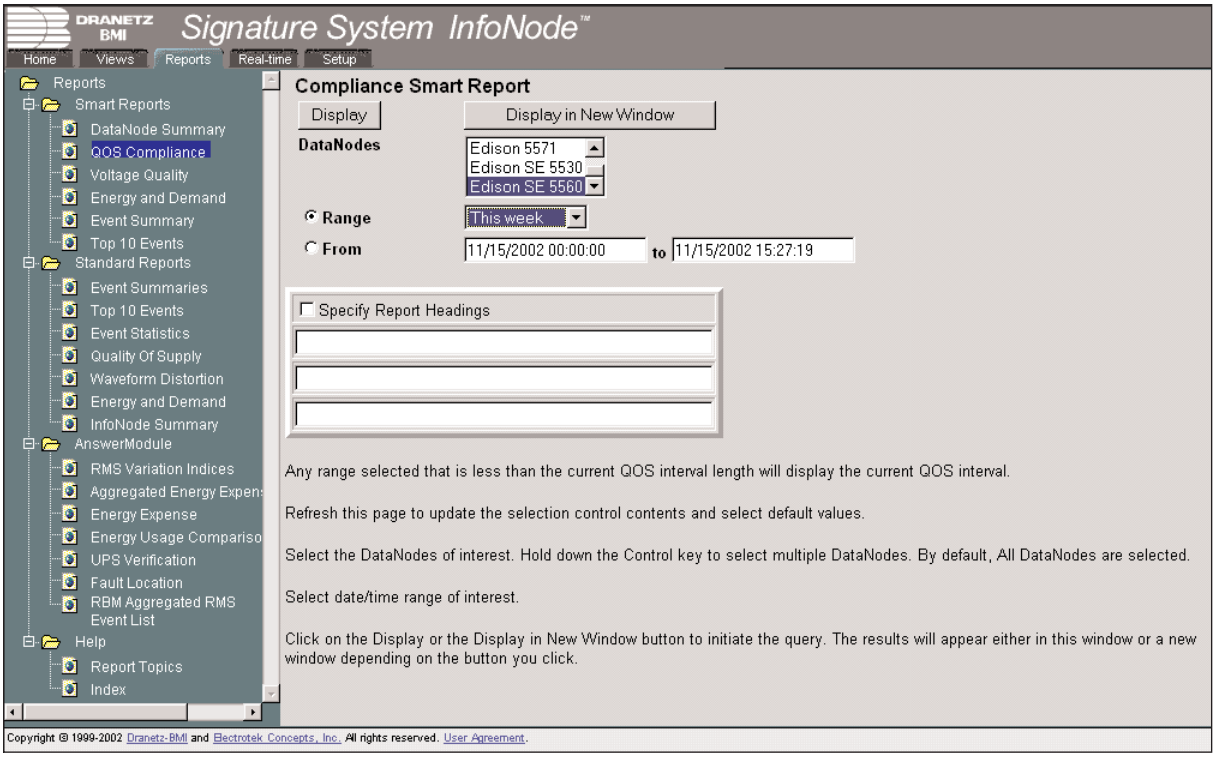
Timeline Graph with additional data trend for Short Term Flicker

QOS Compliance Reports

Smart Reports

QOS Compliance allows the user to look at all EN50160 compliance information for all 5560 DataNodes. Click on QOS Compliance to display the standard query selection shown below. Users have the option to view compliance reports for single or multiple DataNode(s). Users can also select the time range or specify a time period to view data from. Only data for 5560 DataNodes will be displayed in the result set once the Display or Display in New Window button is clicked.

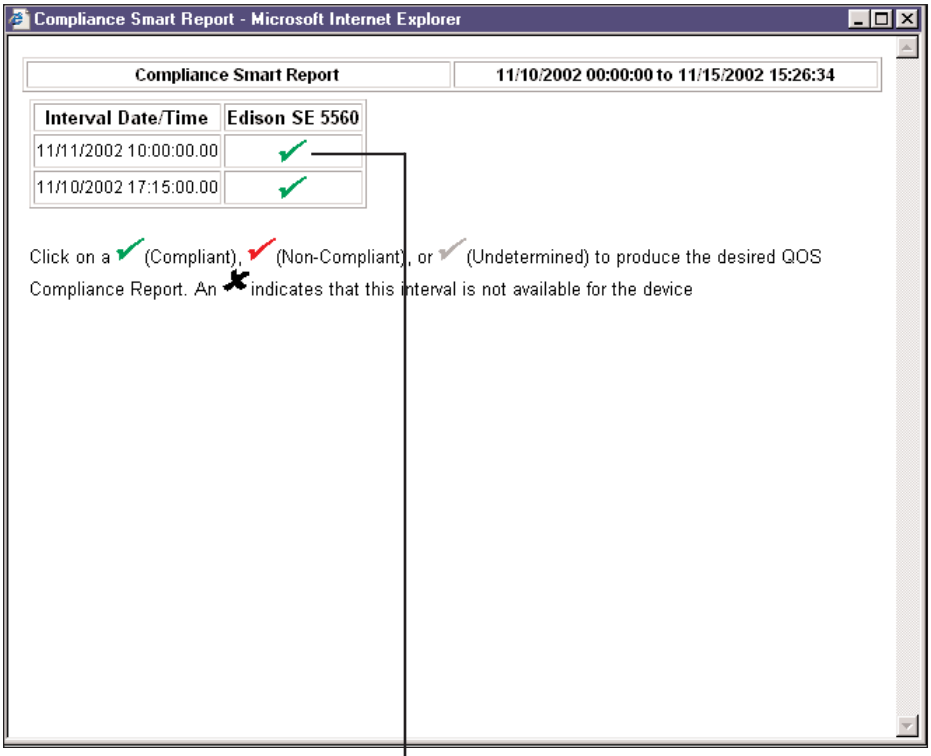
Once selections have been made, click on either Display or Display in New Window. The QOS Compliance table shown next page is displayed.



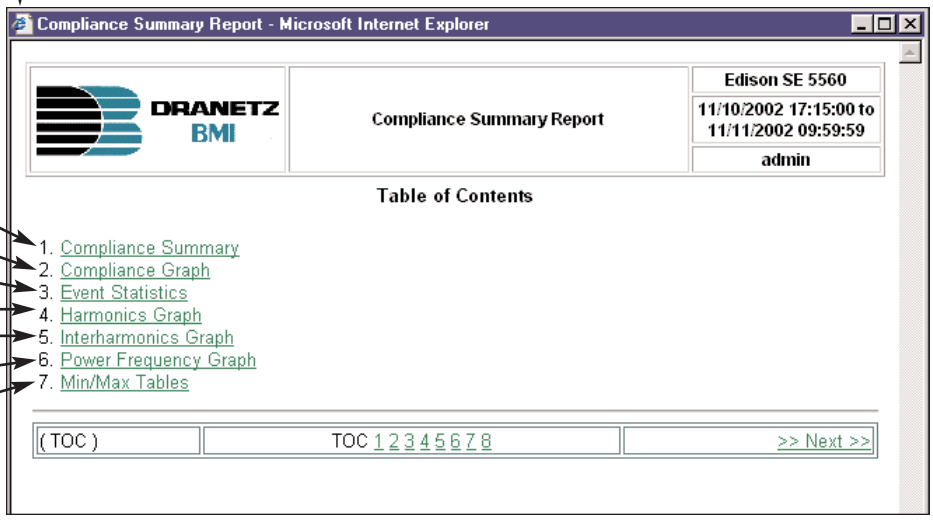
QOS Compliance Query Screen

QOS Compliance Summary Table and Table of Contents

The QOS Compliance table shown below displays the 5560 DataNodes and time intervals specified in the QOS Compliance Query screen. A check sign indicates the availability of a report for the DataNode in the specified interval. The check sign is color coded: green means the DataNode is compliant during the specified interval; red means the DataNode is non-compliant during the specified interval; gray means undetermined since evaluation status is still incomplete. The 'X' sign indicates the inavailability of a compliance report (the interval specified in the query screen is not available for the DataNode device). Select and click on a check sign to produce the desired QOS Compliance Summary Report. The report is summarily presented in Table of Contents format, wherein content data appear in hyperlinks. See sample QOS Compliance Table of Contents at the bottom of this page.



QOS Compliance Summary Table



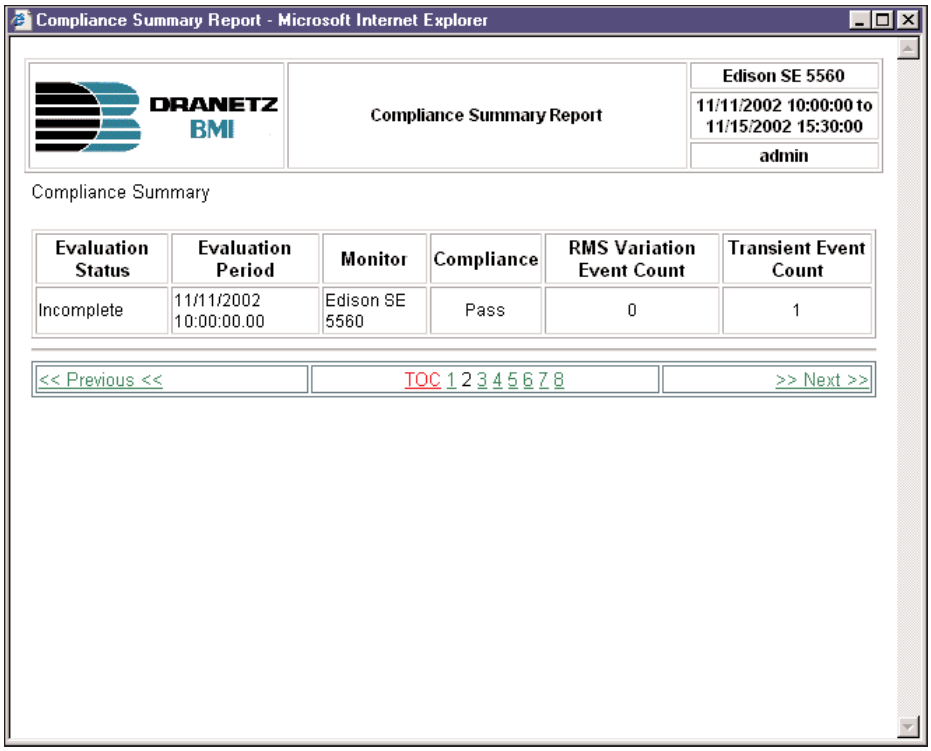
QOS Compliance Table of Contents

QOS Compliance Reports

The compliance reports listed under the Table of Contents are for a single 5560 DataNode and appear as hyperlinks. Click on the hyperlink to view the report in detail. Each compliance report, graph and statistical data is described below. Note that these reports are identical to data that are accessible from the Views tab, except that Reports does not produce data in hyperlinks (e.g. user will not be able to click on a bar as if it is a link).

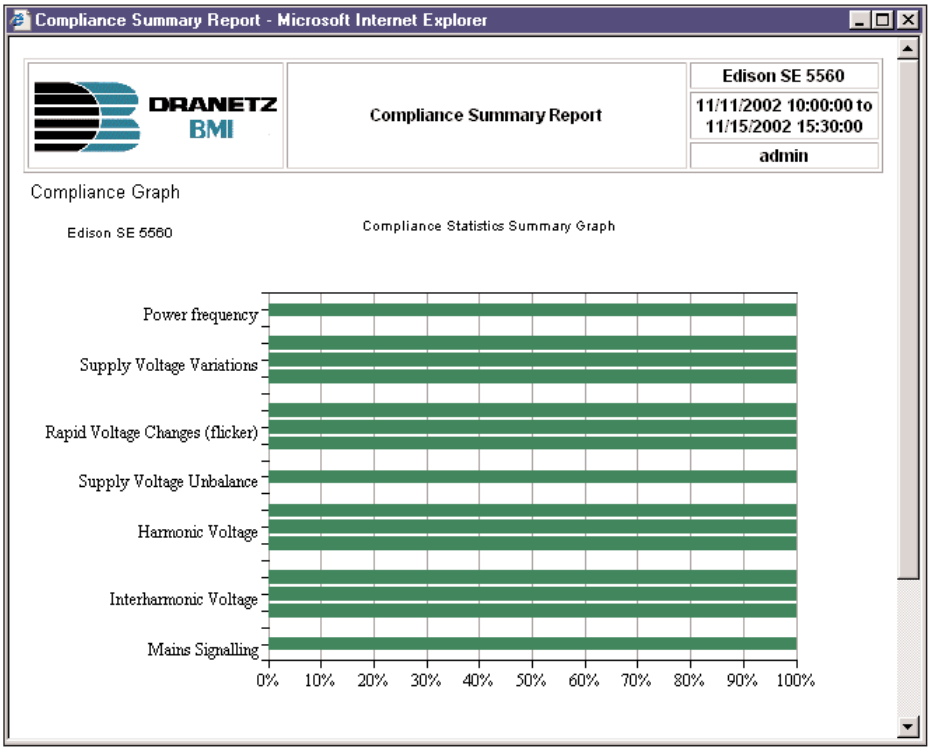
1. Compliance Summary

The QOS Status Summary table lists the evaluation periods that fall within the selected date range of a single DataNode. For completed periods (weeks), Compliance status may either be PASS or FAIL. For incomplete periods (less than a week), Compliance status is Undetermined. Unlike the QOS Status Summary (see page 10-5) accessible from Views, Compliance information accessed from Reports (i.e. PASS or FAIL status) is not hyperlinked. Refer to page 10-5 for the description of each column heading found in the Compliance Summary table below.



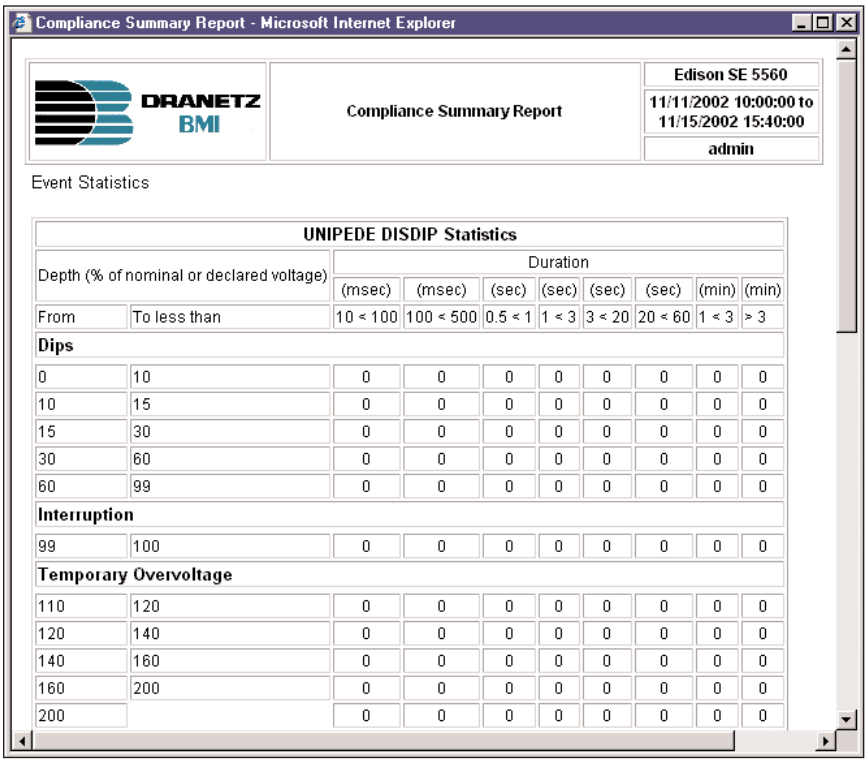
2. Compliance Graph

The Compliance Graph displays the seven parameters that are required for determining compliance. The bars indicate the percentage of the intervals passing the specified compliance criteria. A green bar indicates that the parameter is within compliance. A red bar indicates that the parameter does not comply with EN50160 Standard. Unlike the Compliance Statistical Bar Chart (see page 10-6) accessible from Views, users cannot click on the bar as if it is a link. Refer to page 10-6 for the description of each parameter contained in the graph below.



3. Event Statistics

The EN50160 DISDIP table is based upon the statistics calculated by the 5560 Answer Module. It includes the Table for Transient Overvoltages and the EN50160 DISDIP 3D Graph. UNIPEDE DISDIP data is collected and saved on a weekly basis with the counts reset as the final save occurs. If additional data is detected for an evaluation period after that period has been saved, that interval data is retrieved and updated. The DISDIP sag and swells table is shown below. All data required for this table is collected and saved. The observations containing the weekly data are marked for one-year expiration allowing the data to be retained in the InfoNode for at least one year.



Compliance Summary Report - Microsoft Internet Explorer

DRANETZ BMI

Compliance Summary Report

Edison SE 5560
11/11/2002 10:00:00 to 11/15/2002 15:40:00
admin

Event Statistics

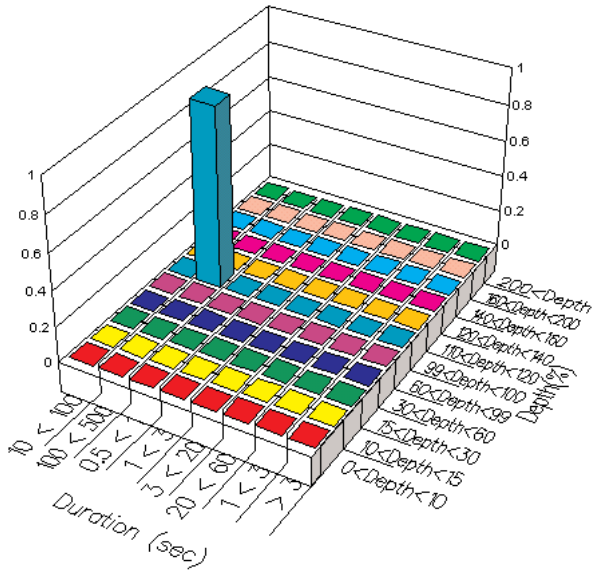
UNIPEDE DISDIP Statistics

Depth (% of nominal or declared voltage)		Duration (msec)	(msec)	(sec)	(sec)	(sec)	(sec)	(min)	(min)
From	To less than	10 < 100	100 < 500	0.5 < 1	1 < 3	3 < 20	20 < 60	1 < 3	> 3
Dips									
0	10	0	0	0	0	0	0	0	0
10	15	0	0	0	0	0	0	0	0
15	30	0	0	0	0	0	0	0	0
30	60	0	0	0	0	0	0	0	0
60	99	0	0	0	0	0	0	0	0
Interruption									
99	100	0	0	0	0	0	0	0	0
Temporary Overvoltage									
110	120	0	0	0	0	0	0	0	0
120	140	0	0	0	0	0	0	0	0
140	160	0	0	0	0	0	0	0	0
160	200	0	0	0	0	0	0	0	0
200		0	0	0	0	0	0	0	0

EN50160 DISDIP Table for Transient Events

Transient Overvoltage		Counts
110	120	0
120	140	0
140	160	0
160	200	28
200		0

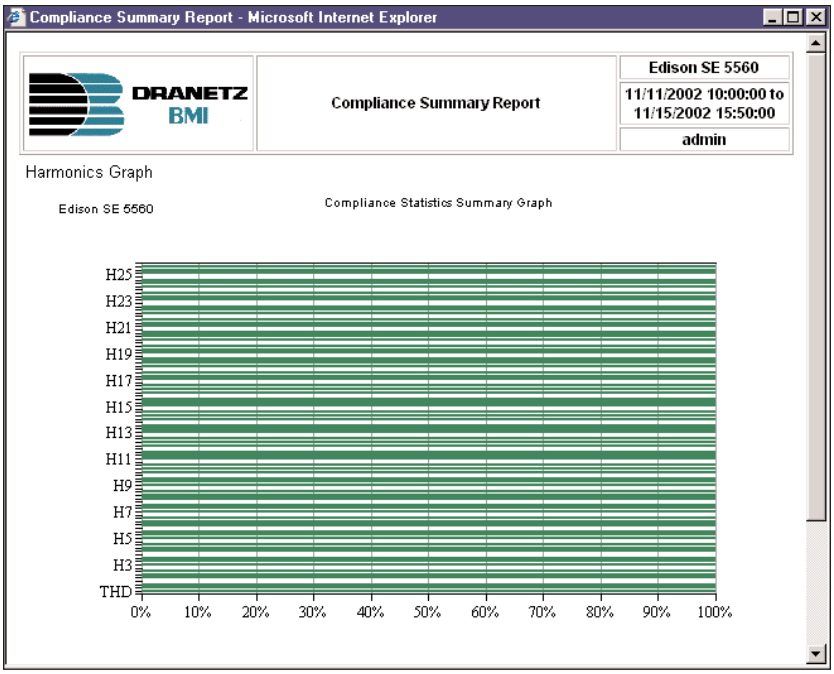
Table for Transient Overvoltages



EN50160 3D Graph for RMS Variations

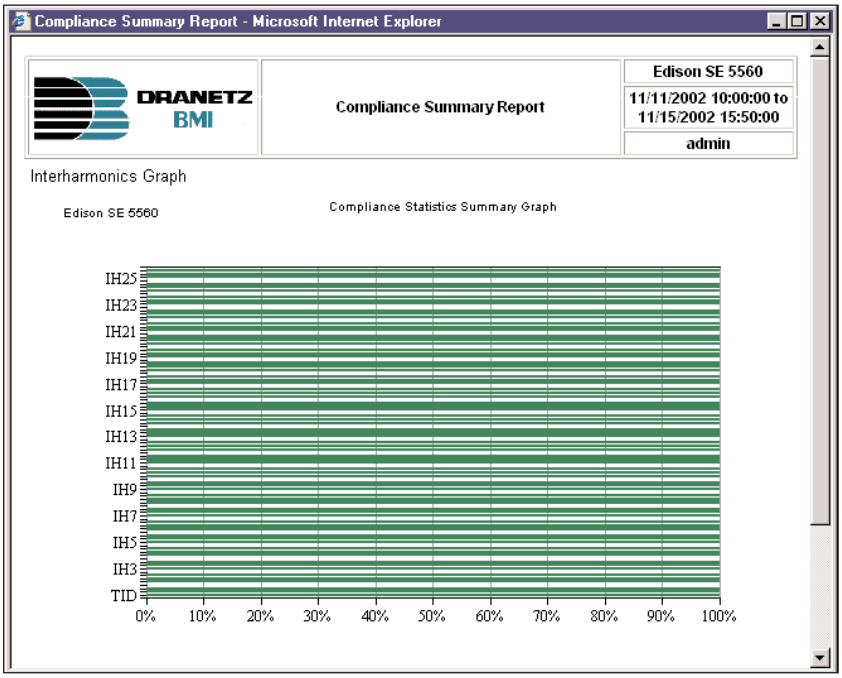
4. Harmonics Graph

The Harmonics Graph displays the status of each of the individual harmonics and THD for each phase. The bar chart indicates the percentage of the intervals passing the specified compliance. Odd harmonic numbers are marked on vertical axis. Even harmonic numbers are located in between. A sample harmonics plot is shown below.



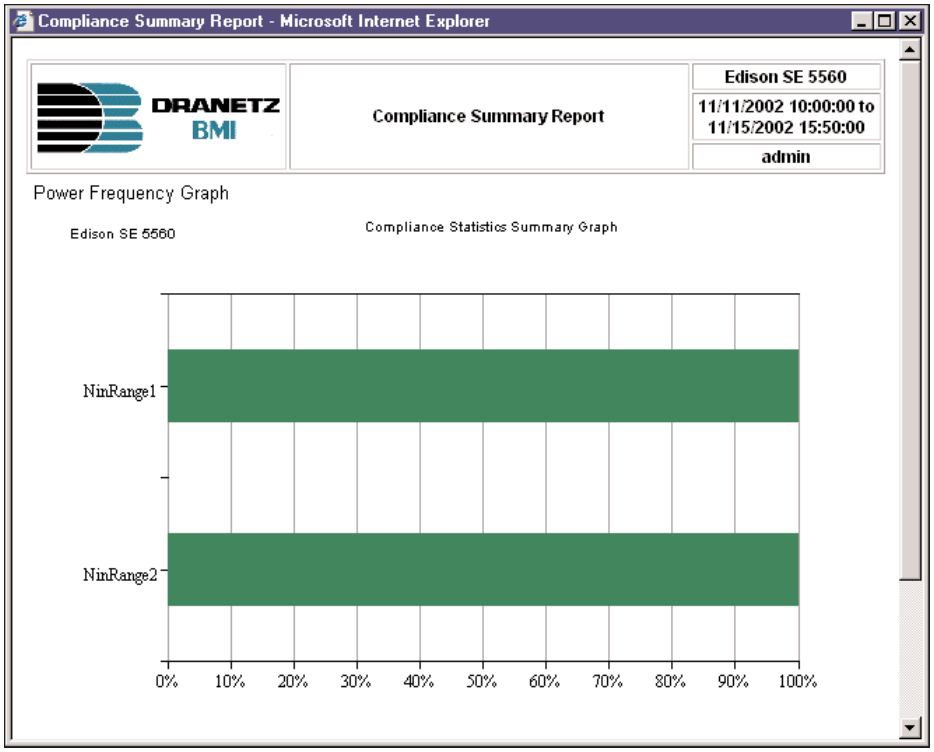
5. Interharmonics Graph

The Interharmonics Graph displays the status of each of the individual interharmonics and TID for each phase. The bar chart indicates the percentage of the intervals passing the specified compliance. Interharmonic numbers are actually groups of 5Hz frequency bars between the adjacent harmonic values. For example, the IH3 is the interharmonic values between 2nd and 3rd harmonic. A sample plot is shown below.



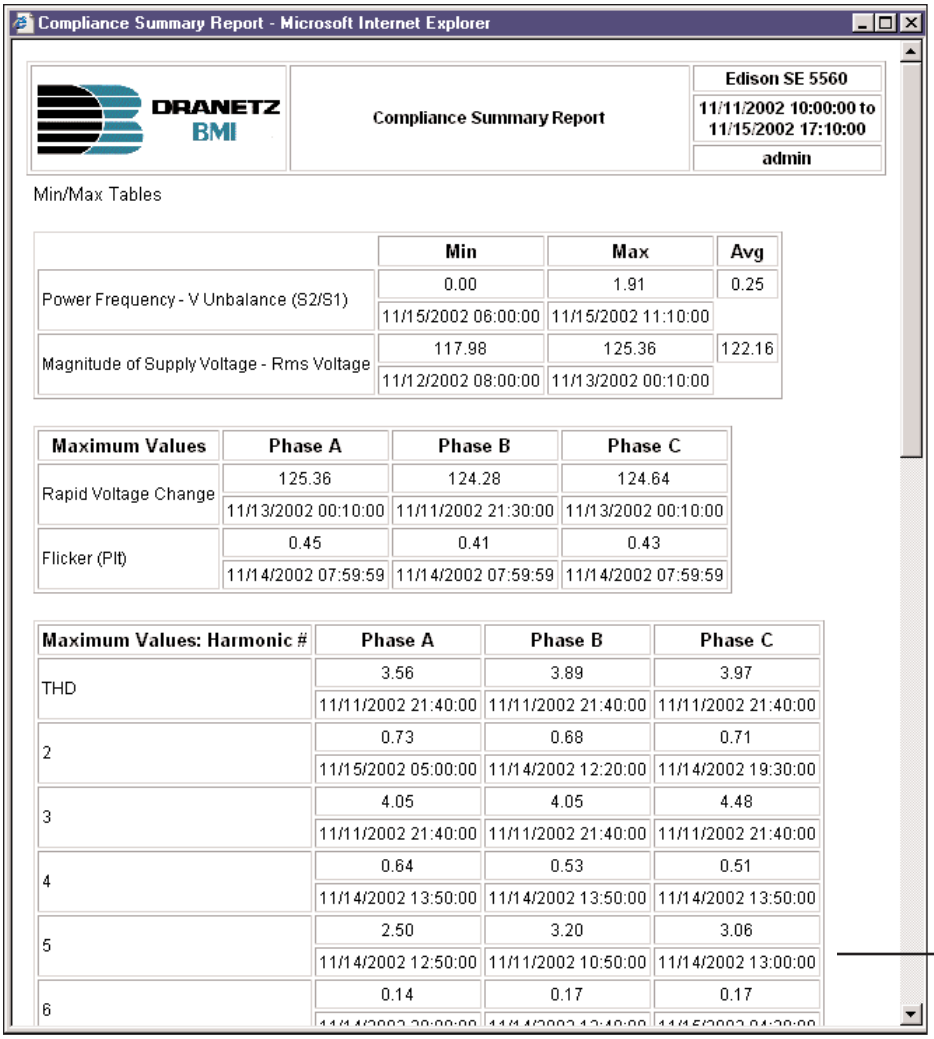
6. Power Frequency Graph

The Power Frequency parameter has two ranges considered for compliance. This graph displays the status of parameter with respect to each range. The bar chart indicates the percentage of the intervals passing the specified compliance. A sample plot is shown below.



7. Min/Max Tables

The Min/Max table displays the minimum, maximum and average values for Power Frequency and RMS Voltage along with time and date of occurrence. Maximum phase values of Rapid Voltage Change, Flicker, Supply Voltage Unbalance, and Harmonics are also displayed along with time and date of occurrence. A sample min/max table is shown below.



Compliance Summary Report - Microsoft Internet Explorer

DRANETZ BMI

Compliance Summary Report

Edison SE 5560

11/11/2002 10:00:00 to 11/15/2002 17:10:00

admin

Min/Max Tables

	Min	Max	Avg
Power Frequency - V Unbalance (S2/S1)	0.00	1.91	0.25
	11/15/2002 06:00:00	11/15/2002 11:10:00	
Magnitude of Supply Voltage - Rms Voltage	117.98	125.36	122.16
	11/12/2002 08:00:00	11/13/2002 00:10:00	

Maximum Values	Phase A	Phase B	Phase C
Rapid Voltage Change	125.36	124.28	124.64
	11/13/2002 00:10:00	11/11/2002 21:30:00	11/13/2002 00:10:00
Flicker (Plt)	0.45	0.41	0.43
	11/14/2002 07:59:59	11/14/2002 07:59:59	11/14/2002 07:59:59

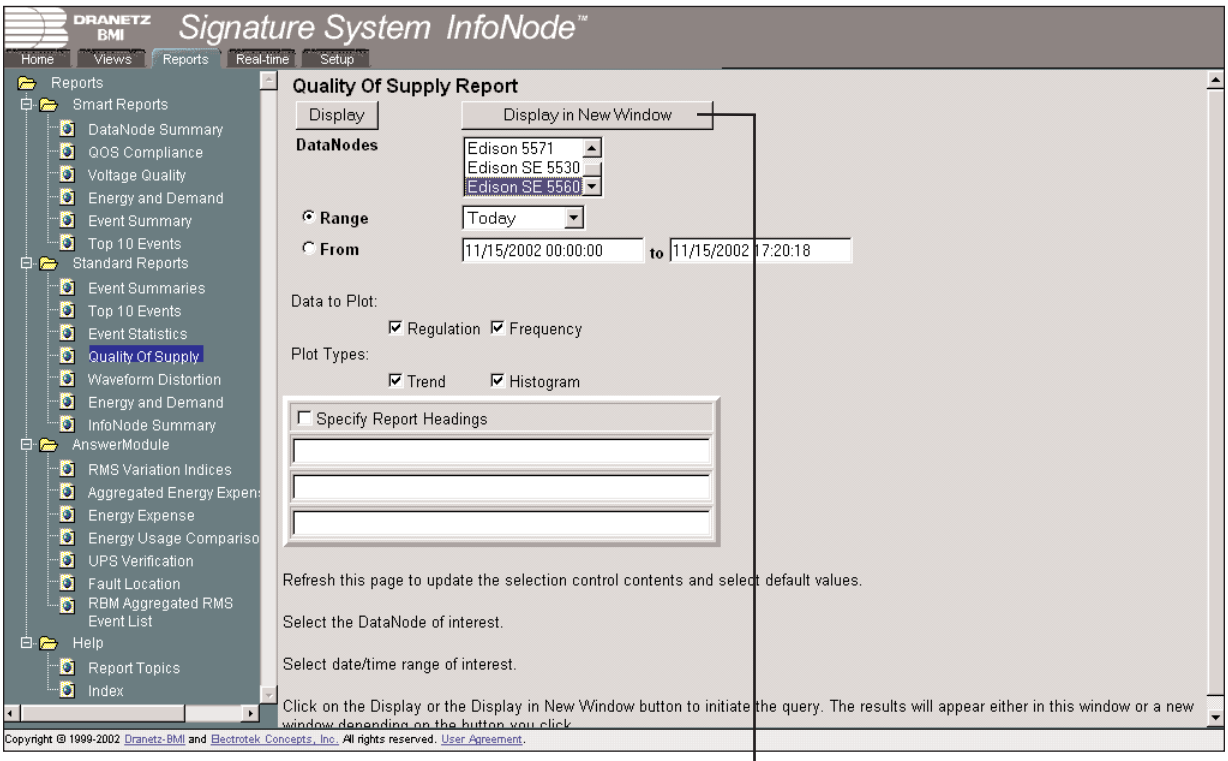
Maximum Values: Harmonic #	Phase A	Phase B	Phase C
THD	3.56	3.89	3.97
	11/11/2002 21:40:00	11/11/2002 21:40:00	11/11/2002 21:40:00
2	0.73	0.68	0.71
	11/15/2002 05:00:00	11/14/2002 12:20:00	11/14/2002 19:30:00
3	4.05	4.05	4.48
	11/11/2002 21:40:00	11/11/2002 21:40:00	11/11/2002 21:40:00
4	0.64	0.53	0.51
	11/14/2002 13:50:00	11/14/2002 13:50:00	11/14/2002 13:50:00
5	2.50	3.20	3.06
	11/14/2002 12:50:00	11/11/2002 10:50:00	11/14/2002 13:00:00
6	0.14	0.17	0.17

Harmonic values up to order no. 25 (complete harmonic values not captured on screen)

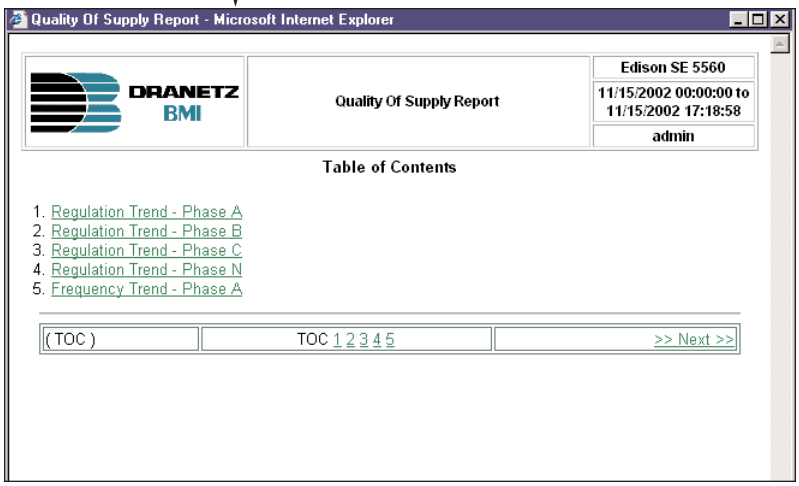
Standard Reports

Quality of Supply

Quality of Supply Report is an analysis of the voltage, similar to the requirements of the EN50160, which specifies that various parameters must be within a specified percentage for 95% of the time. Users can select from an analysis of the Voltage Regulation, Unbalance, and Frequency, with the information presented as a trend and/or histogram. The screen below shows the standard query selection for Quality of Supply Report. Once DataNode, Date, Time range, Data to Plot, and Plot type selections have been made, click on the Display or Display in New Window button. A table of contents featuring data trends in hyperlinks will appear as shown at the bottom of this page. QOS Regulation Trend and Frequency Trend link to the same graphs as that of RMS Voltage and Frequency respectively under Views - Smart Trends (see pages 10-9 thru 10-10).



Quality of Supply Query Screen



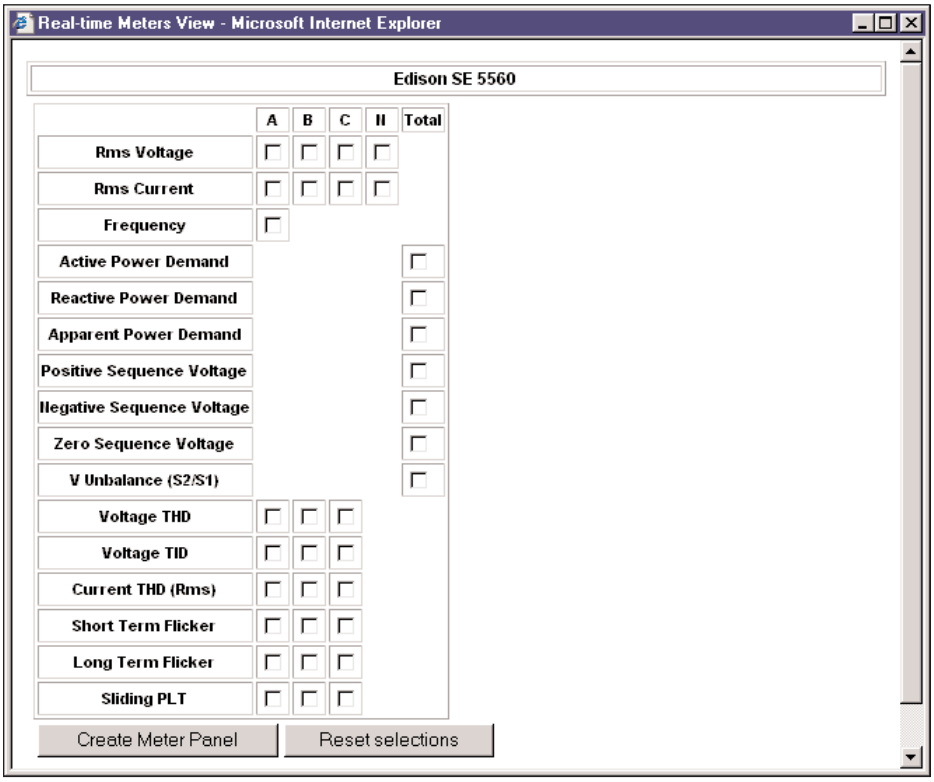
Quality of Supply Table of Contents

Real-time Display of QOS Data

Among the new parameters included in the 5560 DataNode, in addition to those available in DataNode 5530/5520, are those required to meet the specification of a flicker meter as per EN61000-4-15. Thus, under Real-time page, new channels are defined to support real-time display of flicker measurements. Flicker is the effect on the visual human perception by a changing emission of light by lamps subjected to fluctuations of their supply voltage. Voltage fluctuations consist of a sequence of rapid voltage changes, spaced in time close enough to stimulate the response of the eye-brain is defined as flicker.

As the annoyance created by flicker is a function of both the intensity of Flicker and the duration of exposure, the severity of the disturbance is described by two parameters: the short term severity (Pst) and the long term severity (Plt).

Values for the flicker parameter include the Pst of last complete interval, Plt of last complete interval, Plt calculated using a sliding interval, maximum instantaneous P (Max. P_{inst}), LPF of P_{inst}, the square root of P_{inst}, and LPF of the square root of P_{inst}. These values are included in the channel selection when configuringthe jpurnal recordings (see Flicker Setup Tab on page 10-41). Note that only channels for which flicker data is present in the system are included in the selection. A sample real time display parameter screen is shown below. Users can choose which channels (A, B, C, N, Total) to activate by clicking on the respective checkbox. Refer to Chapter 6 for information on how to generate meter-type readings.

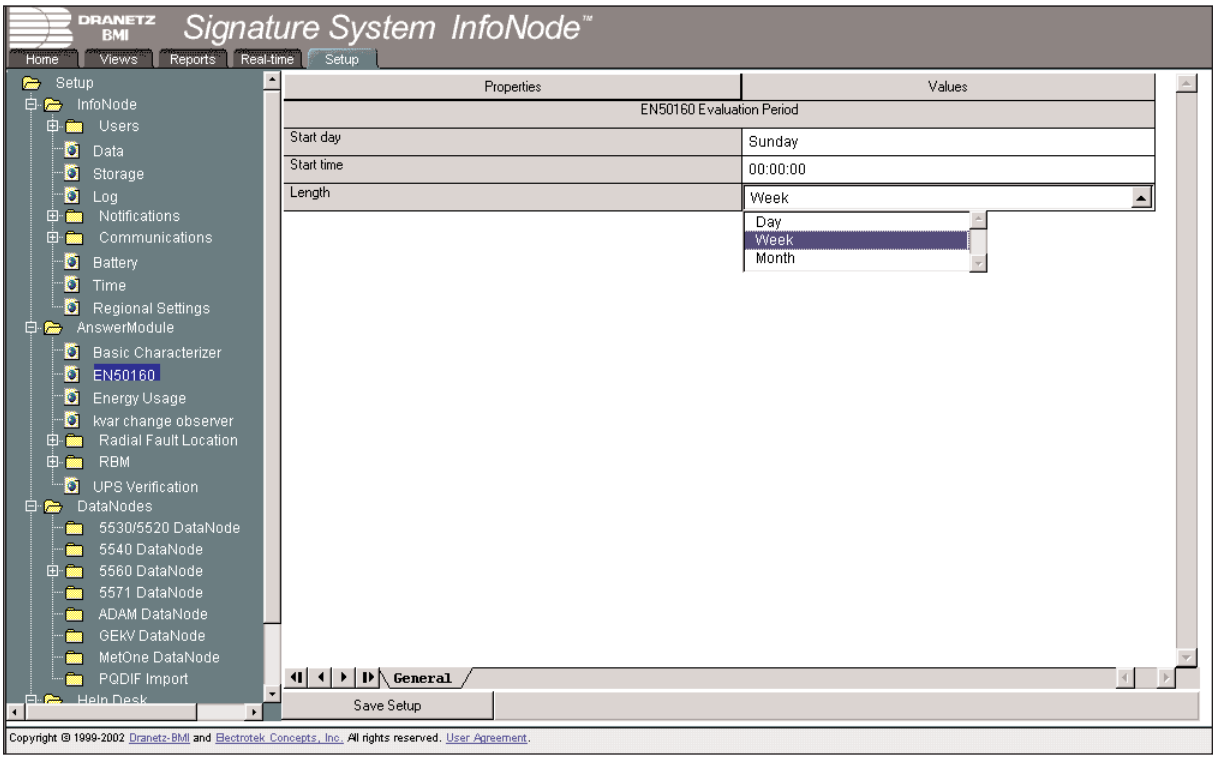


Real Time Display Parameters

5560 DataNode System Setup

EN50160 General Setup tab

The EN50160 General tab requires several setup parameters. All Answer Module setups are global to the InfoNode and apply to all instruments that are gathering EN50160 information.



EN50160 EVALUATION PERIOD properties consist of the Start day, Start time, and Length of the evaluation period. The Start day and Start time properties can be altered and the unit will remain in strict compliance with EN50160. The Length cannot be altered due to the 7-day week period by which the unit calculates information in strict compliance with the EN50160. To program the properties, click on the respective value fields to display the drop down menu.

Start day - Specifies the day of the week when the statistics will be reset. Day is selected from a drop down menu containing the days of the week. The default start day is Sunday.

Start time - Specifies the time of day when the statistics will be reset. Time is an edit box that defaults to 00:00:00 (midnight of Sunday according to standard). Click on the value field to change time.

Length - Allows the user to set the evaluation period to a value other than the EN50160 specified period of 1 week. Users are cautioned against changing this value as this will result in a non-standard evaluation. The default is 1 week.

EN50160 Calculations and Statistics

This section lists the calculations and statistics that are gathered from incoming data and processed by the EN50160 Answer Module.

For each 5560 DataNode configured in the system, the Answer Module compiles the required statistics and persists them to the database for retrieval under the Views and Reports pages of the InfoNode. The partial statistics are persisted as each set of incoming data is analyzed so that partial period statistics are available, even though it cannot predict that a site will pass in compliance until interval is complete.

Intermediate statistics for the current evaluation period are made available but are marked as incomplete. Early in an evaluation period there may not be enough data to provide meaningful statistics and Pass/Fail evaluations for the various criteria. Due to this fact, partial statistics are not available until at least 100 valid samples have been accumulated and evaluated.

As disturbance based statistics (DISDIP) are simple counts of events in various ranges, this information is made available at any time during an evaluation period.

At the end of the evaluation period, the statistic calculations are completed and the statistical observation is marked as Complete. If for some reason, the evaluation period was less than a complete period, the observation is marked as an Incomplete period so the reporting elements can take appropriate action.

All EN50160 compliance statistics are calculated from data retrieved from the DataNode journal (steady state values) and characterized events (transients and RMS variations).

For all periodic quantities, the total number of valid measurements in the evaluation period is tabulated. A particular period is excluded from the analysis if a sag below 85% of nominal or a swell above 115% of nominal occurred based on cycle-by-cycle RMS voltage minima and maxima. For those items tabulated in the InfoNode, the exclusion is based on the minimum and maximum value available in 10-minute RMS voltage min/max/avg trend value log.

The table below details the statistical information gathered by the Answer Module.

				Additional Data Collection			
Parameter	**Interval (default)**	**Data Source**	**Stats**	**Avg**	**Min w/TS**	**Max w/TS**	**3 Phase**
Magnitude of Supply	10 Min	SS VRMS	Valid Intervals Within +/- 10%	YES	YES	YES	YES
Supply Voltage Unbalance	10 Min	SS S2/S1	Valid Intervals <= 2%	YES	NO	YES	NO
Power Frequency	10 Min*	SS Count Reports from DataNode	DataNode Calculation - Pass in all intervals within broad limit and 95% of intervals with narrow limits	NO	NO	NO	YES
Rapid Voltage Changes – Flicker	2 Hours	SS Plt	2 Hour Plt <= 1.0	YES	YES	YES	YES
Rapid Voltage Changes - Step Changes	1 Week	RMS Variations	90% to 95% LV, 94% to 96% MV	NO	NO	NO	YES
Harmonic Voltage	10 Min	SS Harmonic Group Spectra, THD + 2 to 25 Harmonics	THD <= 8%, Table for Individual Harmonics	YES	NO	YES	YES
Interharmonic Voltage	10 Min	SS Interharmonic Group, TID and components 2 to 25	TID <= 1%, All components <= 0.5%	YES	NO	YES	YES
Mains Signaling Frequencies	10 Min**	SS Count Reports from DataNode	DataNode Calculation - Pass if in range 99% of intervals	NO	NO	NO	YES

Notes:
*Power Frequency sampling done in DataNode at 10 second intervals, reported to journal every 10 minutes.
**Mains Signalling sampling done in DataNode at 3 second intervals, reported to journal every 10 minutes.

5560 DataNode Setup

General Information

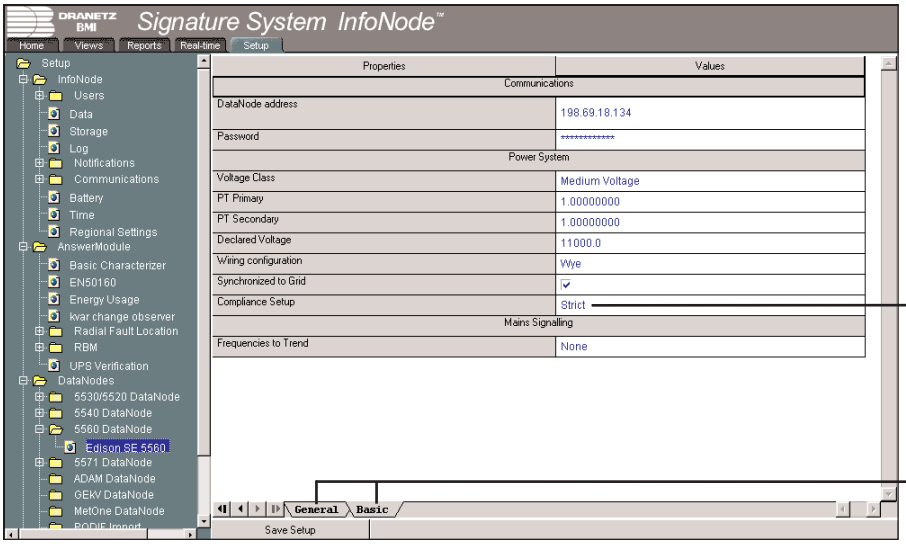
DataNodes have a wide variety of user-programmable features that can be set under the DataNode Setup tab of the InfoNode. Select the appropriate folder under the DataNode setup tree, then select the DataNode type that you wish to program. DataNode Properties and Values will be displayed on the right frame. Use the tabs across the bottom of the page to select the appropriate category of programmable features. Typically, a DataNode includes such categories as General, Basic, RMS Variations, and Advanced settings. Users can change setups depending on their access privileges. See page 7-29 for more General Guidelines on setting up DataNodes.

Where Data for Programmed Settings Appear

Data is recorded based upon programmed settings and displayed in Views page, Real-time page and Reports page. Refer to the previous pages of this chapter as well as to the previous Chapters for more details on the Views, Real-time and Reports pages.

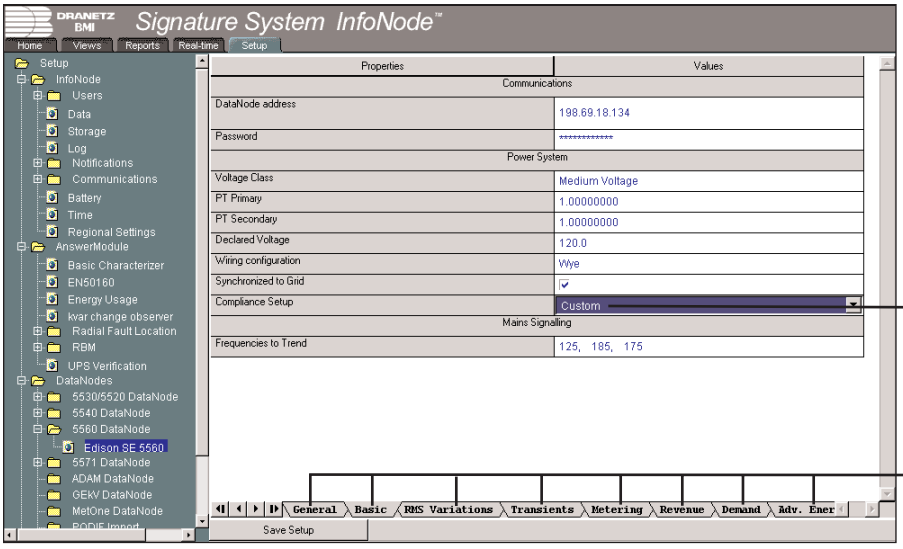
5560 DataNode

The setup of a DataNode is dependent on the DataNode type. 5560 DataNodes can be set up in **Strict** compliance with EN50160 or can be set up using **Custom** setups. Under Strict compliance, only the General and Basic tabs are visible and modifiable. This is the standard method for using the 5560. For those who have unique applications requiring modification of the standard setups, the Compliance Setup selection box on the Basic tab can be changed to Custom. See sample screens below.



5560 DataNode with Compliance Setup: Strict

Tabs available under Strict compliance: General and Basic (Basic tab shown)



5560 DataNode with Compliance Setup: Custom

Tabs available under Custom compliance:
General, Basic, RMS Variations, Transients, Metering, Revenue, Demand, Adv. Energy, Adv. Metering, Imbalance, Harmonics, Flicker, Adv. Harmonics, Transducers, Advanced, Accumulated Resets

5560 DataNode Tabs
The parameters available in each tab are discussed in detail in the next sections. Note the following conventions used in the screen displays.
LEGEND:
Items in *italics* are not programmable, but included for information purpose to the user.
Items in **bold** are examples of what can be entered.
Selections available in drop down menu are enclosed in brackets { xxxx }.
Caution: Dranetz-BMI has already set default values for the various parameters in each DataNode. The default values have been tested to result in optimal system performance. Users are advised not to change the default value settings (except user-defined properties i.e. Name, IP Address, etc.) unless there are applications which require advanced setups.

1. **General** tab

Properties	Values
Identification Information	
Name	**Edison SE 5560**
Description	**Service Entrance**
Serial Number	*00-01-32-00-01-b9*
Version	*E1.0.238000714*
Status Information	
Active	☑
Get settings from DataNode on activation	☐
Last contact at	*08/01/2002 13:03:08*
Health	*System health is normal*

typically describes where DataNode is located

activate (check) to establish link with the DataNode site

The General tab contains identification and performance status description of the DataNode.

IDENTIFICATION INFORMATION includes the Name and Description which users can assign for a particular DataNode type. Simply click on the **Name** or **Description** field to type in the space provided. Description typically describes the location where the DataNode is monitoring. Users are allowed to enter up to 30 alphanumeric characters under the Name and Description fields.

The **Serial Number** and **Version** of the DataNode hardware are set by default. This instrument-specific information is available only for viewing and cannot be altered or changed from the InfoNode.

STATUS INFORMATION properties include **Active**, which describes current communications interface between the DataNode and the InfoNode system. When checked, this means that the DataNode is actively communicating and exchanging information with the system. When making changes in the different value settings of a DataNode, it is wise to uncheck the Active box first, make the changes, then check the Active box again. This helps ease and speed up processing time. Also when adding a new DataNode, the Active box must be checked to establish link with the DataNode site. Click the Home page to check which DataNodes are actively communicating with the InfoNode.

Users also have the option to **Get settings from DataNode on activation**. When checked or enabled, the default DataNode settings will be re-configured and re-displayed. The settings in the DataNode will overwrite those in the InfoNode and be used for monitoring.

Remember to click the Save Setup button found at the bottom of the page to save any change that have been done. To aid users, a Save confirmation window appears after changes have been made and when users are about to switch to a different tab.

Status properties also records the date and time of **Last contact**. It also indicates **Health** status, whether the DataNode system is functioning normally or not. Both information are set by default and cannot be altered by users.

2. **Basic** tab

Properties	Values
Communications	
DataNode Address	198.69.18.202
Password	**********
Power System	
Voltage Class	**Low Voltage** {Low Voltage, Medium Voltage}
PT Primary	**1.00000000**
PT Secondary	**1.00000000**
Declared Voltage	**230**
Wiring configuration	**Wye** {Single Phase, Wye, Delta, Split Single Phase}
Synchronized to Grid	☐
Compliance Setup	**Custom** {Strict, Custom}
Mains Signalling	
Frequencies to Trend	**None**

click fields to display drop down menu

The Basic tab contains value settings for the following: Communications, Power System, and Mains Signalling. For a 5560 DataNode, the Basic page highlights those fields necessary for the DataNode to properly acquire data.

COMMUNICATIONS is where the IP information for the specific DataNode is entered. Each 5560 QOS is shipped from the factory with an IP Address. This IP address is entered under the **DataNode Address** field. **Password** is the password for InfoNode to DataNode communications. The password is typically left at factory default.
NOTE: The password must match that of the DataNode.

Under POWER SYSTEM, users can configure **Voltage Class** by clicking on the value field. A drop down menu with two entries, Low Voltage (LV) and Medium Voltage (MV), appears. LV is defined as <1kV nominal. MV is 1kV to 35kV nominal.

PT Primary allows for setting the primary component of all the transducer ratios. Ratios for all three phases are set when this field is changed and saved. If the values for the individual phases are different, the phase A setting is displayed. No setup values are changed unless the user modifies this field and saves the changes. The values being modified here are the same as the individual values on the Transducers page. For a 5560 DataNode, the default PT Primary value is 1.0 if the Voltage Class is Low and 120.0 if the Voltage class is Medium. (120:1 with 10V nominal input is for monitoring 13kV distribution voltage).

PT Secondary allows for setting the secondary component of all the transducer ratios. Ratios for all three phases (A, B, C) are set when this field is changed and saved. If the values for the individual phases are different when using custom setups, the phase A setting is displayed. No setup values are changed unless the user modifies this field and saves the changes. The values being modified here are the same as the individual values on the Transducers page. The default value is 1.0 in all cases.

Declared Voltage (also known as Nominal Voltage in a 5530 DataNode) is where users specify the nominal input line voltage. For a 5560 DataNode, the default is 230.0 when using Wye Configuration. For Delta Configuration, Declared Voltage is set to 400 if the Voltage Class is Low and to 11000.0 if the Voltage Class is Medium.

To set **Wiring Configuration**, click on the value field and a drop down menu lists Single Phase, Wye, Delta and Split Single Phase. The default wiring configuration is Delta.

Synchronized to Grid indicates that the system being monitored is not islanded (isolated from the power grid). The box is checked by default indicating that the system is synchronized, not islanded.

Compliance Setup is a drop down selection box containing two entries: Strict EN50160 and Custom EN50160. Compliance setup determines which pages are visible to the user and therefore which setup fields may be changed. If Strict EN50160 is selected, only the General and Basic pages are displayed. If Custom EN50160 is selected, all Setup pages are visible. Strict EN50160 compliance setup is the default.
Under MAINS SIGNALLING, users can enter

Frequencies to Trend. This value field is editable. Use None if no frequency values will be trended or enter a delimited list of signalling frequencies to monitor using a comma to separate the frequency values. Only the first five valid frequencies in the list are stored. A valid frequency is divisible by 5 Hz. and is less than 3.84 kHz. The Mains Signalling graph can be accessed from the Views page, but the signalling frequency is not trended or available for real-time meter.

3. **RMS Variations** tab

Properties	Values
Limits	
A-N Voltage {Bank selection enables programming limits below} B-N Voltage C-N Voltage N-G Voltage A-B Voltage B-C Voltage C-A Voltage A Current B Current C Current N Current	
Limit enabled	☑
High limit	**110.0**
Low limit	**90.0**
Pre- and Post- Event Captures	
Pre-event start RMS samples (cycles)	**2**
Post-event start RMS samples (cycles)	**238**
Pre-event start waveform samples (cycles)	**2**
Post-event start waveform samples (cycles)	**6**
Post-event end RMS samples (cycles)	**2**
Pre-event end waveform samples (cycles)	**6**
Post-event end waveform samples (cycles)	**2**
Cycles in range to end event	**1**
RMS Variations Sampling Intervals	
Number of Rates to Use	**3**
Intervals	
Reduced sampling rate #1 Reduced sampling rate #2 Reduced sampling rate #3	
Sample min/max/avg every N cycles	**6**
Number of seconds to use this rate	**6.000000000**

phase-to-neutral or phase-to-phase values displayed here depend upon the Wiring Configuration set under the Basic tab

RMS stands for root mean square, a mathematical formula used to measure the average voltage and current. Voltage and current changes are measured and checked against their programmed limits. Thresholds are set in ranges with high limit (threshold above the programmed limit) and low limit (threshold below the programmed limit). RMS Variations result whenever voltage or current RMS value rises above or fall below the programmed thresholds.

The following properties can be set in the RMS Variations page: Limits, Pre and Post- Event Captures, RMS Variations Sampling Intervals, and Intervals.

Under LIMITS, letters A, B and C represent each leg or phase of a three-phase system, while letter N represents the neutral conductor. The channels used to trigger are auto set. **High limit** and **Low limit** values can be enabled and programmed individually for each phase-to-neutral and phase-to-phase setting.

To program individual limit values, select the appropriate line that describes the phase-to-neutral or phase-to-phase setting that you wish to change. If the same limit value will be assigned to more than one phase, press Shift + click to select multiple phases. Enter your limit value for the corresponding phase in the High limit and Low limit fields. Click the **Limit enabled** box to activate. Click the Save Setup button every time you assign different limit values.

PRE- AND POST- EVENT CAPTURES contain parameters that help users program the number of RMS and waveform cycles to be saved before (pre-) and after (post-) the start and the end of the event. These parameters are **Pre-event start RMS samples**, **Post-event start RMS samples**, **Pre-event start waveform samples**, **Post-event start waveform samples**, **Post-event end RMS samples**, **Pre-event end waveform samples**, and **Post-event end waveform samples**. The parameters capture RMS sample or RMS waveform cycles that may be used to analyze and manage power event patterns and behavior.

With regard to the beginning and end of RMS variation events, such transition points are determined according to the following rules. As per IEC and IEEE standards for multi-phase systems, the beginning of the event occurs when any phase goes outside the limits. The start of an RMS variation event is denoted as the time one or more phases of voltage or current goes outside of the programmed high or low thresholds. The end of the event is denoted as the time all phase voltages and currents are back within the limits and the number of cycles specified within limits has been satisfied. Disturbance monitoring requires that voltage be continuously sampled, and recorded only if the signals exceed specified values. Most types of disturbances, with the exception of voltage variations, require that current be recorded as well.

The user also has the ability to specify how RMS trace data is recorded during the event. This mechanism is found under RMS VARIATIONS SAMPLING INTERVALS, where **Number of rates to use** refer to the number of reduced sampling rate ranges to be used to record RMS variation activities. The sampling data referred to here may be any or all of the three sample rates found under INTERVALS - **Reduced sampling rate #1**, **Reduced sampling rate #2**, and **Reduced sampling rate #3**. When one of these items is selected, the reduced sampling rate parameters can be set for that item. Data for the sample rates only apply to RMS, not waveform, variations.

The reason behind storing sampling rates is that the memory capacity of the monitoring instrument makes it impractical to record an entire long duration sag or swell point by point. The waveforms before and after the trigger are digitized to help identify the cause of the excursion, but only RMS values are stored over the full duration of the event that are longer than the pre- and post- trigger settings. If the event has not ended after a programmed time period, the instrument switches to averaging cycles of RMS data to further conserve memory yet accurately represent event. At this point, the RMS plot diverges from a single-valued line to a band of minimum, maximum and average values. During extremely long events, the instrument switches to successively longer averaging periods explained next.

The sample rates represent three supplemental recording interval or chart speeds defined for recording long events. When recording at reduced rates, three values are saved for each data point - the minimum, maximum, and average value of the previous interval. The **Sample min/max/avg every N cycles** refers to the number of cycles to average for the selected reduced sampling rate. While **Number of seconds to use this rate** refer to the number of seconds to record at the selected reduced sampling rate.

The following default sequence is used to program reduced sampling rates:

For 60 Hz systems
a. 6 cycle intervals for 8 seconds (80 samples)
b. 30 cycle intervals for 20 seconds (40 samples)
c. 60 cycle intervals for 90 seconds (90 samples)

For 50 Hz systems
a. 5 cycle intervals for 8 seconds (80 samples)
b. 25 cycle intervals for 20 seconds (40 samples)
c. 50 cycle intervals for 90 seconds (90 samples)

4. **Transients** tab

Properties	Values
Cycle Counts	
Number of pre-trigger cycles	**1**
Number of post-trigger cycles	**2**
Individual Channel Parameters	
A-N Voltage B-N Voltage C-N Voltage N-G Voltage A Current B Current C Current N Current	
Instantaneous limit enabled	☑
Instantaneous limit	**200.0**
Waveform change limit enabled	☑
Waveform change magnitude limit	**10.0**
Waveform change duration limit (% of cycle)	**10.0**

phase-to-neutral or phase-to-phase values displayed here depend upon the Wiring Configuration set under the Basic tab

Transients are disturbances which are shorter in duration than sags and swells. There are two basic types of transients: 1) impulsive transients commonly caused by lightning and load switching, and 2) oscillatory transients often attributed to capacitor bank switching. The DataNode program has extensive transient recording capabilities for all transient events, using waveshape, instantaneous peak, and dual positive and negative high frequency peak detectors.

Under CYCLE COUNTS, the user can define a number of cycles of waveform to record prior to the trigger point. This is set under **Number of pre-trigger cycles**. Users can also define the number of cycles of waveform to record after the trigger. This value is set under **Number of post-trigger cycles**. Typical values for these settings are 1 and 2 respectively.

Under INDIVIDUAL CHANNEL PARAMETERS, letters A, B and C represent different channels, N stands for neutral, while G stands for ground conductor. The channel values are pre-defined and automatically set depending upon the Wiring Configuration selected under the Basic tab.

The DataNode program provides configuration variables that specifies how many cycles to record the **RMS Instantaneous limit** and **Waveform change magnitude limit.** These limit values can be enabled and programmed individually for each phase-to-neutral and phase-to-phase setting.

The instantaneous limit value is compared against the absolute value of each A/D sample of the voltage and current channel waveforms (128 A/D samples taken per cycle). Enter your limit values in the corresponding field for each phase or phase-to-phase setting, and click the **Instantaneous limit enabled** box to activate.

Other configuration variables that determine the operation of transient capture capability of the DataNode are the waveform trigger parameter, instantaneous peak waveform trigger level, and dual peak high frequency detector output trigger level. Values for these parameters are set under **Waveform change magnitude limit** and **Waveform change duration limit**. Limit values can be enabled and programmed individually for each phase-to-neutral and phase-to-phase setting. To activate the waveform limit values, click the**Waveform change limit enabled** box.

Trending Tabs

The following tabs are known as trending pages: Metering, Revenue, Demand, Adv. Energy, Adv. Metering, Unbalance, Harmonics, Flicker, and Adv. Harmonics. These pages contain an enable/disable checkbox at the top of the page. The purpose of the checkbox on any trending page is to enable trending of properties and values listed on that page. If the box is checked, the settings on that page go into effect. If the box is not checked, the remaining settings are persisted but are not in effect. Trending pages are available only for Custom EN50160 Compliance Setup. Trending pages are hidden under Strict EN5160 Compliance Setup.

5. **Metering** tab

Properties	Values
Enable Trending (This page)	
Basic Metering (Metering, MMXUO)	☑
Select the journal entry/entries to change	
Line-Neutral Voltage (A-N)	Apparent Power (A)
Line-Neutral Voltage (B-N)	Apparent power (B)
Line-Neutral Voltage (C-N)	Apparent Power (C)
Neutral-Ground Voltage	Total Apparent Power
Line-Line Voltage (A-B)	Power Factor (A)
Line-Line Voltage (B-C)	Power Factor (B)
Line-Line Voltage (C-A)	Power Factor (C)
Line Current (A)	Average Power Factor
Line Current (B)	Angle Between Phases (A)
Line Current (C)	Angle Between Phases (B)
Line Current (N)	Angle Between Phases (C)
Active Power (A)	Frequency
Active Power (B)	
Active Power (C)	
Total Active Power	
Enable Periodic Sampling	☑
High-High limit enabled	☐
High-High limit	**112.49**
High limit enabled	☐
High limit	**154.16**
Low limit enabled	☐
Low limit	**87.50**
Low-Low limit enabled	☐
Low-Low limit	**75.00**
Deadband enabled	☐
Deadband	**2.50**

phase-to-neutral or phase-to-phase values displayed here depend upon the Wiring Configuration set under the Basic tab

Under ENABLE TRENDING (THIS PAGE) is a check-box in the value field opposite **Basic Metering**. The box enables the trending of values listed in Metering page. If the box is checked, the settings on the page go into effect. If the box is not checked, the remaining settings are persisted but are not in effect.

Under SELECT THE JOURNAL ENTRY/ENTRIES TO CHANGE, the various phase-to-neutral and phase-to-phase parameters are displayed. High and low limits can be enabled and individually set for each phase-to-neutral and phase-to-phase value. Note however that the available phase values depend on the Wiring Configuration selected under the Basic Tab. For instance, for wye circuits L-N,

N-G and L-L limits can be set. For delta circuits, only L-L limits can be set.

Highlight the phase value parameter you wish to change then check the enable box. Check the threshold enable box and then enter the value for that threshold. Repeat this for all parameters of interest.

The enable box refers to the **Enable periodic sampling** parameter. Note that the 5560 DataNode has an internal limit on the number of variables it can track for the purpose of periodic recording and limit rule evaluation. Indiscriminate selection of parameters should be avoided.

Each parameter has five threshold limits: **High-high**, **High**, **Low**, **Low-Low**, and **Deadband**.
High-High limit - specifies an absolute limit for comparison that is higher than the high limit.
High limit - specifices an absolute limit for comparison that is higher than the low limit.
Low limit - specifies an absolute limit for comparison that is lower than the high limit.
Low-Low limit - specifies an absolute limit for comparison lower than the low limit.
Deadband limit - specifies how much a value can change before another event is recorded.

The High-High must be greater than High, Low-Low less than Low. The hysteresis values assigned to limits are set by the system and not programmable by the user. All limit values are used to determine if corresponding reporting or logging action should take place.

For example, if a frequency is detected to cross the threshold limit, then an event is recorded. If the frequency goes from out of limits to within limits (that is, below the high limit minus the hysteresis and above the low limit plus the hysteresis) then another event is recorded.

Enabling parameters for periodic sampling make them available in the Real-time tab.

6. **Revenue** tab

Properties	Values
Enable Trending (This page)	
Basic Revenue Metering (Revenue, MMTRO)	☑
Select the journal entry/entries to change	
Phase Energy (A) Phase Energy (B) Phase Energy (C) Total Energy Integrated Reactive Power (A) Integrated Reactive Power (B) Integrated Reactive Power (C) Total Integrated Reactive Power	
Enable periodic sampling	☐
High-High limit enabled	☐
High-High limit	**00.0**
High limit enabled	☐
High limit	**00.0**
Low limit enabled	☐
Low limit	**00.0**
Low-Low limit enabled	☐
Low-Low limit	**00.0**
Deadband enabled	☐
Deadband	**00.0**

Under ENABLE TRENDING (THIS PAGE) is a checkbox in the value field opposite **Basic Revenue Metering**. The box enables the trending of values listed in Basic Revenue Metering page. If the box is checked, the settings on the page go into effect. If the box is not checked, the remaining settings are persisted but are not in effect.

Each of the individual phase-to-neutral and three phase total energy and integrated reactive power values found under SELECT THE JOURNAL ENTRY/ENTRIES TO CHANGE can be enabled.

Highlight the parameter value you wish to change, then check the **Enable periodic sampling** box. Check the threshold enable box and then enter the value for that threshold. Repeat this for all parameters of interest.

Threshold enable refers to the checkboxes opposite the limits. Each parameter has five threshold limits: **High-high**, **High**, **Low**, **Low-Low**, and **Deadband**.
High-High limit - specifies an absolute limit for comparison that is higher than the high limit.
High limit - specifices an absolute limit for comparison that is higher than the low limit.
Low limit - specifies an absolute limit for comparison that is lower than the high limit.
Low-Low limit - specifies an absolute limit for comparison lower than the low limit.
Deadband limit - specifies how much a value can change before another event is recorded.

The High-High must be greater than High, Low-Low less than Low. Deadband is the equivalent of sensitivity. The hysteresis values assigned to limits are set by the system. All limit values are used to determine if corresponding reporting or logging action should take place.

For example, if Total Energy is detected to cross the threshold limit, then an event is recorded. If the Total Energy goes from out of limits to within limits (that is, below the high limit minus the hysteresis and above the low limit plus the hysteresis), then the event is recorded.

Enabling parameters for periodic sampling make them available in the Real-time tab.

7. **Demand** tab

Properties	Values
Enable Trending (This page)	
Demand (Demand, MDMDO)	☑
Select the journal entry/entries to change	
Real Power, Dmd, Total Reactive Power, Dmd, Total Apparent Power Dmd, Total Average PF Over Last Interval Peak Real Power Dmd Total Var Dmd Coincident w/Pk W Dmd VA Dmd Coincident w/Pk W Dmd Avg PF Coincident w/Pk W Dmd Peak Reactive Power Dmd, Total W Dmd Coincident w/Pk Var Dmd VA Dmd Coincident w/Pk Var Dmd Avg PF Coincident w/Pk Var DMd Peak Apparent Power Dmd, Total W Dmd Coincident w/Pk W Dmd Var Dmd Coincident w/Pk VA Dmd Avg PF Coincident w/Pk VA Dmd Predicted Real Power Dmd, Total Predicted Reactive Power Dmd, Total Predicted Apparent Power Dmd, Total Current Demand (A) Current Demand (B) Current Demand (C) Average Current Demand Peak Current Demand (A) Peak Current Demand (B) Peak Current Demand (C) Average Peak Current Demand	
Enable periodic sampling	☑
High-High limit enabled	☐
High-High limit	**1.00**
High limit enable	☐
High limit	**0.00**
Low limit enabled	☐
Low limit	**0.00**
Low-Low limit enabled	☐
Low-Low limit	**0.00**
Deadband enabled	☐
Deadband	**0.00**

Demand values are computed as the average value over the demand interval, which can be programmed as a different value than the periodic readings.

Under ENABLE TRENDING (THIS PAGE) is a checkbox in the value field opposite **Demand**. The box enables the trending of values listed in Demand page. If the box is checked, the settings on the page go into effect. If the box is not checked, the remaining settings are persisted but are not in effect.

The following parameter values can be enabled under SELECT THE JOURNAL ENTRY/ENTRIES TO CHANGE: individual phase and three phase total real power demand, reactive demand, apparent power demand, average PF, and peak real power values.

Highlight the parameter value you wish to change, then check the **Enable periodic sampling** box. Check the threshold enable box, and then enter the value for that threshold. Repeat this for all parameters of interest.

Each parameter has five threshold limits: **High-high**, **High**, **Low**, **Low-Low**, and **Deadband**.
High-High limit - specifies an absolute limit for comparison that is higher than the high limit.
High limit - specifices an absolute limit for comparison that is higher than the low limit.
Low limit - specifies an absolute limit for comparison that is lower than the high limit.
Low-Low limit - specifies an absolute limit for comparison lower than the low limit.
Deadband limit - specifies how much a value can change before another event is recorded.

The High-High must be greater than High, Low-Low less than Low. Deadband is the equivalent of sensitivity. The hysteresis values assigned to limits are set by the system. All limit values are used to determine if corresponding reporting or logging action should take place.

For example, if Real Power Demand is detected to cross the threshold limit, then an event is recorded. If the Real Power Demand goes from out of limits to within limits (that is, below the high limit minus the hysteresis and above the low limit plus the hysteresis), then the event is recorded.

8. **Advanced Energy** tab

Properties	Values
Enable Trending (This page)	
Advanced Energy (Adv. Energy, MFLOO)	☑
Select the journal entry/entries to change	
Forward fund. freq. WHrs (A) Forward fund. freq. WHrs (B) Forward fund. freq. WHrs (C) Reverse fund. freq. WHrs (A) Reverse fund. freq. WHrs (B) Reverse fund. freq. WHrs (C) Forward tot. fund. freq. WHrs Reverse tot. fund. freq. WHrs Forward fund. freq. VarHrs (A) Forward fund. freq. VarHrs (B) Forward fund. freq. VarHrs (C) Reverse fund. freq. VarHrs (A) Reverse fund. freq. VarHrs (B) Reverse fund. freq. VarHrs (C) Forward tot. fund. freq. VarHrs Reverse tot. fund. freq. VarHrs Fundamental freq. VA hours (A) Fundamental freq. VA hours (B) Fundamental freq. VA hours (C) Total fundamental freq. VA hours	
Enable periodic sampling	☐
High-High limit enabled	☐
High-High limit	**1.00**
High limit enabled	☐
High limit	**0.00**
Low limit enabled	☐
Low limit	**0.00**
Low-Low limit enabled	☐
Low-Low limit	**0.00**
Deadband enabled	☐
Deadband	**0.00**

Journal entries in the Advanced Energy tab show various energy parameters on per phase and total basis as well as in forward and reverse mode. Fundamental frequency is used as the reference unit. Frequency is specified in hertz. Fundamental frequency refers to the principal component of a wave, i.e. the component with the lowest frequency or greatest amplitude.

Under ENABLE TRENDING (THIS PAGE) is a checkbox in the value field opposite **Advanced Energy**. The box enables the trending of values listed in Advanced Energy page. If the box is checked, the settings on the page go into effect. If the box is not checked, the remaining settings are persisted but are not in effect.

Under SELECT THE JOURNAL ENTRY/ENTRIES TO CHANGE, highlight the phase value parameter you wish to change then check the **Enable periodic sampling** box. Check the threshold enable box and then enter the value for that threshold. Repeat this for all parameters of interest.

Threshold enable refers to the checkboxes opposite the limits. Each parameter has five threshold limits: **High-high**, **High**, **Low**, **Low-Low**, and **Deadband**.
High-High limit - specifies an absolute limit for comparison that is higher than the high limit.
High limit - specifices an absolute limit for comparison that is higher than the low limit.
Low limit - specifies an absolute limit for comparison that is lower than the high limit.
Low-Low limit - specifies an absolute limit for comparison lower than the low limit.
Deadband limit - specifies how much a value can change before another event is recorded.

The High-High must be greater than High, Low-Low less than Low. Deadband is the equivalent of sensitivity. The hysteresis values assigned to limits are set by the system. All limit values are used to determine if corresponding reporting or logging action should take place.

For example, if the Total Fundamental Frequency is detected to cross the threshold limit, then an event is recorded. If the Total Fundamental Frequency goes from out of limits to within limits (that is, below the high limit minus the hysteresis and above the low limit plus the hysteresis), then the event is recorded.

9. **Advanced Metering** tab

Properties	Values
Enable Trending (This page)	
Advanced Metering (Adv. Metering, MADVO)	☐
Select the journal entry/entries to change	
Total VA - Arith. Method Total VA - Vect. Method Total Fund. VA - Arith. Method Total Fund. VA - Vect. Method Worst True Power Factor Total Arithmetic True PF Total Vector True Power Factor Displacement Power Factor (A) Displacement Power Factor (B) Displacement Power Factor (C) Worst Displacement Power Factor Average Displacement PF Total Arithmetic Disp. PF Total Vector Disp. Power Factor Residual Current Net Current	
Enable periodic sampling	☐
High-High limit enabled	☐
High-High limit	**1.00**
High limit enabled	☐
High limit	**0.00**
Low limit enabled	☐
Low limit	**0.00**
Low-Low limit enabled	☐
Low-Low limit	**00.0**
Deadband enabled	☐
Deadband	**0.0**

Under ENABLE TRENDING (THIS PAGE) is a checkbox in the value field opposite **Advanced Metering**. The box enables the trending of values listed in Advanced Metering page. If the box is checked, the settings on the page go into effect. If the box is not checked, the remaining settings are persisted but are not in effect.

Under SELECT THE JOURNAL ENTRY/ENTRIES TO CHANGE, multiple total apparent power and power factor parameters, calculated using arithmetic and vector sums of the individual phases, can be enabled. The parameters include: Total Arithmetic VA, Total Vector VA, Total Fundamental Arithmetic VA, Total Fundamental Vector VA, True Power Factor (PF), Worst True PF, Total Arithmetic True PF, Total Vector PF, Displacement PF, Worst Displacement PF, Average Displacement PF, Total Arithmetic Displacement PF, Total Vector PF, Residual Current, and Net Current. Definitions of these terms can be found on Appendix E *Glossary.*

Highlight the parameter value you wish to change, then check the **Enable periodic sampling** box. Check the threshold enable box and then enter the value for that threshold. Repeat this for all parameters of interest.

Each parameter has five threshold limits: **High-High**, **High**, **Low**, **Low-Low**, and **Deadband**.
High-High limit - specifies an absolute limit for comparison that is higher than the high limit.
High limit - specifices an absolute limit for comparison that is higher than the low limit.
Low limit - specifies an absolute limit for comparison that is lower than the high limit.
Low-Low limit - specifies an absolute limit for comparison lower than the low limit.
Deadband limit - specifies how much a value can change before another event is recorded.

The High-High must be greater than High, Low-Low less than Low. Deadband is the equivalent of sensitivity. The hysteresis values assigned to limits are set by the system. All limit values are used to determine if corresponding reporting or logging action should take place.

For example, if the Displacement Power Factor is detected to cross the threshold limit, then an event is recorded. If the Displacement Power Factor goes from out of limits to within limits (that is, below the high limit minus the hysteresis and above the low limit plus the hysteresis), then the event is recorded.

10. **Unbalance** tab

Properties	Values
Enable Trending (This page)	
Imbalance and Sequence Components (Sequence, MSQIO)	☑
Select the journal entry/entries to change	
Sequence Voltage (Pos) Sequence Voltage (Neg) Sequence Voltage (Zero) Sequence Current (Pos) Sequence Current (Neg) Sequence Current (Zero) V Imbalance: L-N dev. from avg (A-N) V Imbalance: L-N dev. from avg (B-N) V Imbalance: L-N dev. from avg (C-N) V Imbalance: L-L dev. from avg (A-B) V Imbalance: L-L dev. from avg (B-C) V Imbalance: L-L dev. from avg (C-A) V Imbalance: L-N Max from avg V Imbalance: L-L Max from avg V Imbalance: Neg. Seq. Method V Imbalance: Zero Seq. Method I Imbalance: dev. from avg (A) I Imbalance: dev. from avg (B) I Imbalance: dev. from avg (C) I Imbalance: Max dev. from avg I Imbalance: Neg. Seq. Method I Imbalance: Zero Seq. Method	
Enable periodic sampling	☑
High-High limit enabled	☐
High-High limit	**0.00**
High limit enabled	☐
High limit	**0.00**
Low limit enabled	☐
Low threshold	**0.00**
Low-Low limit enabled	☐
Low-Low limit	**0.00**
Deadband enabled	☐
Deadband	**0.00**

The voltage and current imbalance for each phase from the average value for all three phases can be trended and limits set. The positive, negative and zero sequence components for voltage and current can be trended.

Under ENABLE TRENDING (THIS PAGE) is a checkbox in the value field opposite **Imbalance**. The box enables the trending of values listed in Imbalance page. If the box is checked, the settings on the page go into effect. If the box is not checked, the remaining settings are persisted but are not in effect.

Under SELECT THE JOURNAL ENTRY/ENTRIES TO CHANGE, highlight the parameter value you wish to change then check the **Enable periodic sampling** box. Check the threshold enable box and then enter the value for that threshold. Repeat this for all parameters of interest.

Threshold enable refers to the checkboxes opposite the limits. Each parameter has five threshold limits: **High-high**, **High**, **Low**, **Low-Low**, and **Deadband**.
High-High limit - specifies an absolute limit for comparison that is higher than the high limit.
High limit - specifices an absolute limit for comparison that is higher than the low limit.
Low limit - specifies an absolute limit for comparison that is lower than the high limit.

Low-Low limit - specifies an absolute limit for comparison lower than the low limit.
Deadband limit - specifies how much a value can change before another event is recorded.

The High-High must be greater than High, Low-Low less than Low. Deadband is the equivalent of sensitivity. The hysteresis values assigned to limits are set by the system. All limit values are used to determine if corresponding reporting or logging action should take place.

For example, if the Positive Sequence Voltage is detected to cross the threshold limit, then an event is recorded. If the Positive Sequence Voltage goes from out of limits to within limits (that is, below the high limit minus the hysteresis and above the low limit plus the hysteresis), then the event is recorded.

11. **Harmonics** tab

Properties	Values
Enable Trending (This page)	
Harmonics (Harmonics, MHAIO)	☑
Percent Eddy Current Loss	8.000
Maximum Demand Load Current	100.000
Select the journal entry/entries to change	
Voltage THD - Fund. Normalized (A-N)	Current THD - RMS Normalized (C)
Voltage THD - Fund. Normalized (B-N)	Current THD - RMS Normalized (N)
Voltage THD - Fund. Normalized (C-N)	Current TID - Fund. Normalized (A)
Voltage THD - Fund. Normalized (N-G)	Current TID - Fund. Normalized (B)
Voltage THD - RMS Normalized (A-N)	Current TID - Fund. Normalized (C)
Voltage THD - RMS Normalized (B-N)	Current TID - Fund. Normalized (N)
Voltage THD - RMS Normalized (C-N)	Current TID - RMS Normalized (A)
Voltage THD - RMS Normalized (N-G)	Current TID - RMS Normalized (B)
Voltage TID - Fund. Normalized (A-N)	Currrent TID - RMS Normalized (C)
Voltage TID - Fund. Normalized (B-N)	Current TID - RMS Normalized (N)
Voltage TID - Fund. Normalized (C-N)	Current Harmonic RMS (A)
Voltage TID - Fund. Normalized (N-G)	Current Harmonic RMS (B)
Voltage TID - RMS Normalized (A-N)	Current Harmonic RMS (C)
Voltage TID - RMS Normalized (B-N)	Current Harmonic RMS (N)
Voltage TID - RMS Normalized (C-N)	Current Interharmonic RMS (A)
Voltage TID - RMS Normalized (N-G)	Current Interharmonic RMS (B)
Voltage Harmonic RMS (A-N)	Current Interharmonic RMS (C)
Voltage Harmonic RMS (B-N)	Current Interharmonic RMS (N)
Voltage Harmonic RMS (C-N)	IT Product (A)
Voltage Harmonic RMS (N-G)	IT Product (B)
Voltage Interharmonic RMS (A-N)	IT Product (C)
Voltage Interharmonic RMS (B-N)	IT Product (N)
Voltage Interharmonic RMS (C-N)	Current Crest Factor (A)
Voltage Interharmonic RMS (N-G)	Current Crest Factor (B)
Voltage TIF - Fund. Normalized (A-N)	Current Crest Factor (C)
Voltage TIF - Fund. Normalized (B-N)	Current Crest Factor (N)
Voltage TIF - Fund. Normalized (C-N)	Current Total Demand Distortion (A)
Voltage TIF - Fund. Normalized (N-G)	Current Total Demand Distortion (B)
Voltage TIF - RMS Normalized (A-N)	Current Total Demand Distortion (C)
Voltage TIF - RMS Normalized (B-N)	K Factor (A)
Voltage TIF - RMS Normalized (C-N)	K Factor (B)
Voltage TIF - RMS Normalized (N-G)	K Factor (C)
Voltage Crest Factor (A-N)	K Factor (A)
Voltage Crest Factor (B-N)	Transformer Derating Factor (A)
Voltage Crest Factor (C-N)	Transformer Derating Factor (B)
Voltage Crest Factor (N-G)	Transformer Derating Factor (C)
Current THD - Fund. Normalized (A)	Total Phase Harmonic Power (A-N)
Current THD - Fund. Normalized (B)	Total Phase Harmonic Power (B-N)
Current THD - Fund. Normalized (C)	Total Phase Harmonic Power (C-N)
Current THD - Fund. Normalized (N)	Signed Phase Harmonic Power (A-N)
Current THD - RMS Normalized (A)	Signed Phase Harmonic Power (B-N)
Current THD - RMS Normalized (B)	Signed Phase Harmonic Power (C-N)

Harmonics screen display continued next page

...continued

Enable periodic sampling	☑
High-High limit enabled	☐
High-High limit	**0.000**
High limit enabled	☐
High limit	**0.000**
Low limit enabled	☐
Low limit	**0.000**
Low-Low limit enabled	☐
Low-Low limit	**0.000**
Deadband enabled	☐
Deadband	**0.000**

Harmonics are waveform distortion, a steady-state deviation from an ideal power frequency sinusoid and is characterized by the spectral content of the waveform. Many non-linear devices such as battery chargers, switching power supplies or transformers inject currents at harmonic (integer multiples of the fundamental) frequencies into the system.

Under ENABLE TRENDING (THIS PAGE) is a check-box in the value field opposite **Harmonics**. The box enables the trending of values listed in Harmonics page. If the box is checked, the settings on the page go into effect. If the box is not checked, the remaining settings are persisted but are not in effect.

Under SELECT JOURNAL ENTRY/ENTRIES TO CHANGE, various harmonic parameters can be trended using periodic readings that are stored in a journal. Harmonic distortion of voltage or current is calculated through a Fourier transformation of the waveform into harmonic magnitudes and phase angle spectra. These spectra are used to determine figures of merit such as total harmonic distortion (THD) and telephone influence factor (TIF). (See Appendix A *Quantities Calculated from Periodic Voltage and Current Measurements*)

The InfoNode/DataNode system allows simultaneous measurements of voltage and current so that harmonic power flow can be obtained. Depending on value parameters set, the program can record a sampling of the waveform synchronized to the fundamental frequency, to ensure accurate calculation of harmonic phase angles. The sampling rate is sufficient to determine up to the 50th harmonic or better. A comprehensive range of high and low limits can be enabled and individually set for each measured parameter.

Highlight the value parameter you wish to change then check the **Enable periodic sampling** box. Check the threshold enable box and then enter the value for that threshold. Repeat this for all parameters of interest.

Each parameter has five threshold limits: **High-high**, **High**, **Low**, **Low-Low**, and **Deadband**.
High-High limit - specifies an absolute limit for comparison that is higher than the high limit.
High limit - specifices an absolute limit for comparison that is higher than the low limit.
Low limit - specifies an absolute limit for comparison that is lower than the high limit.
Low-Low limit - specifies an absolute limit for comparison lower than the low limit.
Deadband limit - specifies how much a value can change before another event is recorded.

The High-High must be greater than High, Low-Low less than Low. Deadband is the equivalent of sensitivity. The hysteresis values assigned to limits are set by the system. All limit values are used to determine if corresponding reporting or logging action should take place.

For example, if the Voltage Harmonic RMS is detected to cross the threshold limit, then an event is recorded. If the Voltage Harmonic RMS goes from out of limits to within limits (that is, below the high limit minus the hysteresis and above the low limit plus the hysteresis), then the event is recorded. All activated Harmonic parameters and value settings defined can be viewed under the Real-time tab.

12. **Flicker** tab

Properties	Values
Enable Trending (This page)	
Flicker (Flicker, MFLKO)	☑
Sample Intervals (minutes)	
Pst Sample Interval	**10**
Plt Sample Interval	**180**
Select the journal entry/entries to change	
Pst of last complete interval (A) Pst of last complete interval (B) Pst of last complete interval (C) Plt of last complete interval (A) Plt of last complete interval (B) Plt of last complete interval (C) Sliding window Plt calculation (A) Sliding window Plt calculation (B) Sliding window Plt calculation (C) Output 5-Pinst-peak value (A) Output 5-Pinst-peak value (B) Output 5-Pinst-peak value (C) Output 4-1 min TC LPF of Pinst (A) Output 4-1 min TC LPF of Pinst (B) Output 4-1 min TC LPF of Pinst (C) Output 3-square root of Pinst (A) Output 3-square root of Pinst (B) Output 3-square root of Pinst (C) LPF of Output 3 (A) LPF of Output 3 (B) LPF of Output 3 (C)	
Enable periodic sampling	☑
High-High limit enabled	☐
High-High limit	**0.00**
High limit enabled	☐
High limit	**0.00**
Low limit enabled	☐
Low threshold	**0.00**
Low-Low limit enabled	☐
Low-Low limit	**0.00**
Deadband enabled	☐
Deadband	**0.00**

The Flicker page is an extended trending setup page unique to the 5560 DataNode. There are three flicker values available for trending: the Short term flicker or Pst, the long term flicker or Plt, and Plt calculated on a sliding window. Flicker is measured as per IEC 1000-4-15.

Under ENABLE TRENDING (THIS PAGE) is a checkbox in the value field opposite **Flicker** which enables the trending of values listed in this page. If the box is checked, the settings on the page go into effect. If the box is not checked, the remaining settings are persisted but are not in effect.

Under SAMPLE INTERVALS are two numeric edit controls: the **Pst Interva**l and the **Plt Interval**. Pst Interval is used to set the Pst calculation interval. The default value is 10 minutes. Plt interval is used to set the Plt calculation interval. The default value is 120 minutes.

Under SELECT JOURNAL ENTRY/ENTRIES TO CHANGE, various flicker parameters can be trended using periodic readings that are stored in a journal.

Highlight the value parameter you wish to change then check the **Enable periodic sampling** box Check the threshold enable box and then enter the value for that threshold. Repeat this for all parameters of interest.

Threshold enable refers to the checkboxes opposite the limits. Each parameter has five threshold limits: **High-high, High**, **Low**, **Low-Low**, and **Deadband**.
High-High limit - specifies an absolute limit for comparison that is higher than the high limit.
High limit - specifices an absolute limit for comparison that is higher than the low limit.
Low limit - specifies an absolute limit for comparison that is lower than the high limit.
Low-Low limit - specifies an absolute limit for comparison lower than the low limit.
Deadband limit - specifies how much a value can change before another event is recorded.

The High-High must be greater than High, Low-Low less than Low. Deadband is the equivalent of sensitivity. The hysteresis values assigned to limits are set by the system. All limit values are used to determine if corresponding reporting or logging action should take place.

13. **Advanced Harmonics** tab

Properties	Values
Enable Trending (This page)	
Advanced Harmonics (Individual, MHAIO)	☑
Trend harmonics for phase A	☑
Trend harmonics for phase B	☑
Trend harmonics for phase C	☑
Harmonics to Trend	
Phase Voltages	**2-25**
Neutral Voltages	
Phase Currents	
Neutral Current	
Interharmonics to Trend	
Phase Voltages	**2-25**
Neutral Voltages	
Phase Currents	
Neutral Current	

sample harmonic values to trend

sample interharmonic values to trend

The following parameters are found under ENABLE TRENDING (THIS PAGE): **Advanced harmonics (Individual)** and **Trend harmonics for phases A, B and C**. Opposite these parameters are checkboxes which enable the trending of values listed in Advanced harmonics page. If the box is checked, the settings on the page go into effect. If the box is not checked, the remaining settings are persisted but are not in effect.

Voltage and current harmonics for each phase and neutral channel can be trended under HARMONICS TO TREND. Similarly, voltage and current interharmonics for each phase and neutral channel can also be trended under INTERHARMONICS TO TREND. The value fields are left blank to allow the users to choose the numbers or the range of harmonic frequencies to trend.

Numbers can be entered individually with commas separating the numbers, or a range of harmonics can be specified using a dash between lower and upper values. Also, the suffix ‘o’ or ‘e’ can be used to specify only the odd or even harmonics, respectively, in a given range.

Resulting individual harmonic sampling and graphs can be seen in the Smart Trends folder under the Views tab.

14. **Transducers** tab

Properties	Values
Phase rotation	**Normal (counter clockwise)** {Normal (counter clockwise), Reverse (clockwise)}
Channel Mapping	
Phase A voltage Phase A current Phase B voltage Phase B current Phase C voltage Phase C current Neutral voltage Neutral current	
Signal is connected to	**Channel 1**
Channel is inverted	☐
Transducer Ratios	
Phase A-N VT Phase B-N VT Phase C-N VT Neutral VT Phase A CT Phase B CT Phase C CT Neutral CT Phase A-B VT Phase B-C VT Phase C-A VT	
Transducer Primary	**1.00000000**
Transducer Secondary	**1.00000000**
Magnitude correction	*1.00000000*
Phase correction	*0.00000000*
DC offset	*0.00000000*

phase-to-neutral or phase-to-phase values displayed depend upon the Wiring Configuration set under the Basic tab

Transducers are typically PTs (potential transformers) and CTs (current transformers) that are used to interface the instrument to the power circuit. PTs allow the instrument to measure circuits that are not within the measurement range of the instrument. CTs measure the current of the circuit and convert it to within the measurement range of the instrument.

For **Phase rotation**, users can choose whether to have phasor shift clockwise or counterclockwise, depending on the way they have set up their system. Click the value field to display the drop down menu featuring Normal (counter clockwise) or Reverse (clockwise). Either orientation will yield the same mathematical calculations of voltage and current measurements. The 5560 is able to automatically determine phase rotation of the voltage channels and then match up the current channels. The 5560 DataNode will swap voltage phases to ensure positive sequence phase rotation (counter clockwise according to IEEE definitions) and then swap and invert current channels to match.

Channel mapping is used to correct for errors in wiring the instrument to the circuit. If a mistake is made, such as an inverted CT or a phase is connected to the wrong channel, it can be corrected in software instead of changing the wiring to the instrument. Note that it is recommended that the actual wiring be changed but channel mapping can correct the problem if this is not practical.

A channel-mapping array is provided to permit manual configuration of channel swapping and inversion. Under CHANNEL MAPPING, click on the corresponding voltage or current phase to show which channel the **Signal is connected to**. Click and enable the value field opposite **Channel is inverted to** as it applies.

The channel-mapping array works by specifying a numeric code in each array slot that indicates which phase is connected to the physical 5560 DataNode channel.

Normally, the channels and phases are matched as shown below. Channels can be swapped and/or inverted to correct recurring mistakes.

Voltage Phase A	Channel 1
Voltage Phase B	Channel 2
Voltage Phase C	Channel 3
Voltage Neutral	Channel 4
Current Phase A	Channel 5
Current Phase B	Channel 6
Current Phase C	Channel 7
Current Neutral	Channel 8

The DataNode employs two A/D converters to sample the voltage and current channels for a given phase simultaneously. Measurement errors may result if the voltage and current signals are not correctly paired. Under TRANSDUCER RATIOS, users can set values for the **Transducer Primary** and **Transducer Secondary**. Values to account for any voltage or current transformers can be entered for each input channel. The primary and secondary values are entered. For example, if the primary voltage is 2400 volts and the secondary voltage is 120 volts, then those values should be entered. This gives an effective 20:1 reduction in voltage. When the input voltage to the DataNode is 120V, the displayed value will be 2400 volts. The **Magnitude correction**, **Phase correction**, and **DC offset** values are not programmable.

15. **Advanced** tab

Properties	Values
Cross Triggering	
Broadcast Group ID	**1234**
Enable sending rms trigger	☐
Enable responding to received rms trigger	☐
Enbable sending transient trigger	☐
Enable responding to received transient trigger	☐
Broadcast address - if empty, uses local	
Communications	
When configurations differ ...	**... use the DataNode setup** {use the DataNode setup} {use the InfoNode setup}
Passwords	
User Account Password	**********
Admin Account Password	**********
InfoNode Access User ID	**admin**
InfoNode Access Password	**********
Firmware Access User ID	**admin**
Firmware Access Password	**********
One Time Operations	
Reset 302 Default Setup	☐
Clear 332 Database and reboot	☐
Do both of the above	☐
Don't save data from next download	☐
Clear last journal ID	☐
One Time Firmware Operations	
CAUTION: These operations will copy new firmware to the DataNode	
Load IOP (302) firmware	☐
Load ACP (332) firmware	☐
Load both IOP (302) and ACP (332) firmware	☐
Load both to all DataNodes	☐

click to display drop down menu

Parameters under the Advanced tab allow the administrator or user to set up functions that affect communications, information access and download between the InfoNode and DataNode systems.

The 5560 can be configured to issue a UDP cross-trigger broadcast message when RMS variation and/or Transient occurs. The 5560 can also be configured to listen for such messages and cause RMS variation or transient recording to occur regardless of whether or not its own trigger conditions for that instrument were met. Under CROSS TRIGGERING, a **Broadcast Group ID** is assigned to allow for different groups of cross-trigger senders/recipients. The broadcast ID number in the InfoNode must match the broadcast group ID set under the TCP/IP parameter of the Datanode. The DataNode also uses this ID mechanism for multiple DataNode cross triggering and is guaranteed only on an un-routed network. The group ID is sent along with the broadcast message and only those receivers with the same group ID will respond to the broadcast if so enabled. The broadcast address can be specified to send a broadcast to a directed broadcast address other than the local network if desired but results cannot be guaranteed and data may be lost if the message takes too long to arrive at its destination.

Checkboxes are seen opposite the next four items **Enable sending rms trigger**, **Enable responding to received rms trigger**, **Enable sending transient trigger**, **Enable responding to received transient trigger**. The user specifies which event types are generated and/or listened for through these checkboxes.When said parameters are activated, the system in effect utilizes trigger messages as trip signals. If **Broadcast address is empty**, message broadcast is routed through the local network. The user specifies a group ID and optionally a broadcast address.

Under COMMUNICATIONS, users are given the option to return to the default InfoNode or DataNode settings **When configurations differ** and communication errors occur.

Access privileges are determined under PASSWORDS. The passwords entered in the InfoNode system must match the ones stored under the Password section of the DataNode. Otherwise, access to information may be denied. The **User Account Password** and **Admin Account Password** refer to two different user categories. An Admin User can create and add an account for a new Basic User. Both Admin and Basic users can assign properties such as their own user name and password. Refer to the Users section on Chapter 7 *Setup Page* for more details on this.

The default **InfoNode Access User ID** is 'admin'. This has a matching valid **InfoNode Access Password**. The default password is ‘password’. These parameters allow access to view and change information in the InfoNode system. The default **Firmware Access User ID** is 'admin'. This also has a matching valid **Firmware Access Password**. These parameters allow access to view and change information in the DataNode system. To change passwords, simply click on the Password value fields. A confirmation window appears everytime you click on the password value field. The window asks whether you want to change and save a new password.

Parameters are also available for ONE TIME OPERATIONS on the 5560 DataNode. These one time procedures include configuring the DataNode to its default settings and/or clearing memory space by rebooting. Observe caution in undertaking these procedures since they cannot be undone. To return to the default DataNode settings, activate the **Reset 302 default setup** value field. To clear old data and reboot DataNode, activate the **Clear 332 Database and reboot** value field. To execute both procedures at one time, activate **Do both of the above**. To save memory space, the administrator or user may choose to activate **Don't save data from next download**. To discard the most recent journal ID entries, activate the **Clear last journal ID** value field.

Finally, parameters for downloading new or updated firmware are available under ONE TIME FIRMWARE OPERATIONS. A firmware is a program or instruction stored in Flash memory which implements the communications interface and data acquisition between the outside world and the instrument. Based on the parameters available, the administrator or user can activate value fields to **Load IOP firmware** or to **Load ACP firmware** or to **Load both IOP and ACP firmware**. The IOP and ACP firmware are two different sets of firmware. The IOP communicates directly with the InfoNode, while the ACP is comprised of the host CPU and DSP. If the value fields are activated, new firmware is downloaded on demand from InfoNode to DataNode. New firmware is downloaded automatically if the boot ROM finds that the existing firmware in the DataNode is missing or corrupt. The administrator or user also has the option to **Load Both (IOP and ACP) firmware to all DataNodes**. Download is accomplished using the standard Internet File Transfer Protocol (FTP). The DataNode must be connected to the network where the updates are to be extracted from to ensure a successful download. Since these one time operations cannot be undone, observe caution when performing download firmware procedures.

16. **Accumulator Resets** tab

Properties	Values
Demand Resets	
Reset Real Power, DMD, total (Never reset)	☐
Reset Reactive Power, DMD, total (Never reset)	☐
Reset Apparent Power, DMD, total (Never reset)	☐
Reset Peak Current Demand (A) (Never reset)	☐
Reset Peak Current Demand (B) (Never reset)	☐
Reset Peak Current Demand (C) (Never reset)	☐
Reset Peak Current Demand (N) (Never reset)	☐
Reset Average Peak Current Demand (Never reset)	☐
Reset All Values	☐
Energy Accumulators	
Reset Phase Energy (Never reset)	☐
Reset Total Energy (Never reset)	☐
Reset Integrated Reactive Power (Never reset)	☐
Reset Total integrated Reactive Power (Never reset)	☐
Reset Forward fund. freq. WHrs (Never reset)	☐
Reset Reverse fund. freq. WHrs (Never reset)	☐
Reset Forward tot. fund. freq. WHrs (Never reset)	☐
Reset Reverse tot. fund. freq. WHrs (Never reset)	☐
Reset Forward fund. freq. VarHrs (Never reset)	☐
Reset Reverse fund. freq. VarHrs (Never reset)	☐
Reset Forward tot. fund. freq. VarHrs (Never reset)	☐
Reset Reverse tot. fund. freq. VarHrs (Never reset)	☐
Reset Fundamental freq. V A Hours (Never reset)	☐
Reset Total Fund. freq. VA Hours (Never reset)	☐

In connection with electric utility billing practices, the InfoNode and DataNode system has an interface to reset demand and energy accumulation readings. The Accumulator Resets tab allows one to reset the parameters to defined values, but not to change or configure new values. The notation 'Never reset' appears to mean that the parameter values register original readings and have never been reset at any time. The moment the reset parameter is activated/enabled, the notation will change and will reflect the date and time of last reset.

Under DEMAND RESETS, Real or True Phase power demand, Reactive power demand, and Apparent power demand can be reset. See Appendix E *Glossary* for the definitions of the various power parameter values. The system maintains a running maximum known as "peak demand" on per phase basis and per average demand current value. It also stores the date and time of each peak demand. Peak demand is the maximum electrical power load consumed or produced in a defined period of time.

Under ENERGY ACCUMULATORS, the system calculates and stores accumulated values for energy (in kWHr unit), reactive energy (in kVarH unit), and apparent energy (in kVAH unit). Kilowatt-Hour (kWHr) is the equivalent energy supplied by a power of 1000 watts for one hour. Watt is the unit for real power. Kilovar-hour (kVarH) is equal to 1000 reactive volt-ampere hours. Var is an abbreviation for volt ampere reactive. It measures the integral of the reactive power of the circuit into which the instrument is connected. Var is the unit for reactive power. Kilovolt-ampere (kVA) is equivalent to 1000 volt-amperes. VA is the unit for apparent power. Apparent power is the product of voltage and current of a single-phase circuit in which the two reach their peaks at different times. See Appendix F *Glossary* for the definitions of the various power parameter values.

The accumulated energy values include real power factor (average three-phase) which is mathematically defined as "demand kW/demand kVA". It also displays integrated

and total integrated reactive power. The system also calculates and stores apparent energy (VA). Real Power (W) and Apparent Power (VA) are reset together; you cannot reset one without resetting the other. Likewise, the Watthour Meter and Varhour Meter are reset together.

The system uses the fundamental frequency as reference for calculating energy values in one of two modes: forward or reverse. In forward mode, the circuit monitor considers the direction of power flow, allowing the accumulated energy magnitude to both increase and decrease. In reverse mode, the circuit monitor accumulates energy as positive, regardless of the direction of power flow. In other words, the energy value increases, even during reverse power flow. The default accumulation mode is reverse.

EN50160 Compliance Default Trending Setup

PARAMETERS	TAB WHERE FOUND	STATUS	DEFAULT VALUES & COMMENTS
Total Fund Freq Q	ADV. ENERGY	OFF	
Fund Freq VA Hrs	ADV. ENERGY	OFF	
Fwd Fund Freq varHrs	ADV. ENERGY	OFF	
Fwd Fund. Freq WHrs	ADV. ENERGY	OFF	
Rvs Fund Freq varHrs	ADV. ENERGY	OFF	
Rvs. Fund. Freq. WHrs	ADV. ENERGY	OFF	
Rms Current Individual Harmonics	ADV. HARMONICS	OFF	
Rms Voltage Individual Harmonics	ADV. HARMONICS	ON	2-25 for Va,Vb,Vc. Limits per table.
Arith. Sum PF	ADV. METER	OFF	
Arithmetic Sum DF	ADV. METER	OFF	
Arithmetic Sum VA	ADV. METER	OFF	
Displacement Power Factor	ADV. METER	OFF	
Fund Arithmetic Sum VA	ADV. METER	OFF	
Fund Vector Sum VA	ADV. METER	OFF	
Vector Sum DF	ADV. METER	OFF	
Vector Sum PF	ADV. METER	OFF	
Vector Sum VA	ADV. METER	OFF	
Residual Current	ADV. METER	OFF	
Net Current	ADV. METER	OFF	
Active Power Demand	DEMAND	ON	is TOTAL only
Apparent Power Demand	DEMAND	ON	is TOTAL only
Avg PF @ Peak P Dmd	DEMAND	OFF	
Avg PF @ Peak Q Dmd	DEMAND	OFF	
P Dmd @ Peak Q Dmd	DEMAND	OFF	
P Dmd @ Peak S Dmd	DEMAND	OFF	
Peak Active Power Demand	DEMAND	OFF	
Peak Apparent Power Demand	DEMAND	OFF	
Peak Demand Current	DEMAND	OFF	
Peak Reactive Power Demand	DEMAND	OFF	
PF @ Peak VA Dmd	DEMAND	OFF	
PF Demand	DEMAND	OFF	
Predicted P Dmd	DEMAND	OFF	
Predicted Q Dmd	DEMAND	OFF	
Predicted VA Dmd	DEMAND	OFF	
Q Dmd @ Peak P Dmd	DEMAND	OFF	
Q Dmd @ Peak VA Dmd	DEMAND	OFF	
Reactive Power Demand	DEMAND	ON	is TOTAL only
Rms Current Demand	DEMAND	OFF	
VA Dmd @ Peak P Dmd	DEMAND	OFF	
VA Dmd @ Peak Q Dmd	DEMAND	OFF	
ANSI Transformer Derating Factor	HARMONICS	OFF	
Current Crest Factor	HARMONICS	OFF	
Current THD	HARMONICS	OFF	
Current THD (Rms)	HARMONICS	ON	A,B,C,TOT. no limits
Current TID	HARMONICS	OFF	

EN50160 Compliance Default Trending Setup

PARAMETERS	TAB WHERE FOUND	STATUS	DEFAULT VALUES & COMMENTS
Current TID (Rms)	HARMONICS	OFF	
Harmonic Power	HARMONICS	OFF	
HRms Voltage	HARMONICS	OFF	
IEEE 519 Current TDD	HARMONICS	OFF	
Interharmonic Rms Current	HARMONICS	OFF	
Interharmonic Rms Voltage	HARMONICS	ON	2/3 thru 24/25, Va,Vb, Vc. Limits per table.
IT Product	HARMONICS	OFF	
Rms Harmonic Current	HARMONICS	OFF	
Transformer K Factor	HARMONICS	OFF	
Voltage Crest Factor	HARMONICS	OFF	
Voltage THD	HARMONICS	OFF	
Voltage THD (Rms)	HARMONICS	OFF	
Voltage TID	HARMONICS	OFF	
Voltage TID (Rms)	HARMONICS	OFF	
Voltage TIF	HARMONICS	OFF	
Voltage TIF (Rms)	HARMONICS	OFF	
V RMS Harmonic	HARMONICS	OFF	
I Imbalance (rms/rms avg)	UNBALANCE	OFF	
I Imbalance (S0/S1)	UNBALANCE	OFF	
I Imbalance (S2/S1)	UNBALANCE	OFF	
Negative Sequence Current	UNBALANCE	OFF	
Negative Sequence Voltage	UNBALANCE	ON	Is TOTAL only. No limit
Positive Sequence Current	UNBALANCE	OFF	
Positive Sequence Voltage	UNBALANCE	ON	Is TOTAL only. No limit
V Imbalance (rms/rms avg)	UNBALANCE	OFF	
V Imbalance (S0/S1)	UNBALANCE	OFF	
V Imbalance (S2/S1)	UNBALANCE	ON	Is TOTAL only. Limits per table.
Zero Sequence Current	UNBALANCE	OFF	
Zero Sequence Voltage	UNBALANCE	ON	Is TOTAL only. No limit
Active Power	METER	OFF	
Apparent Power	METER	OFF	
Frequency	METER	ON	Is TOTAL only. Limits per table.
Reactive Power Demand	METER	OFF	
V/I Angle	METER	OFF	
True Power Factor	METER, ADV. METER	ON	Total, no limits.
Var Hours	REVENUE	OFF	
Watt Hours	REVENUE	OFF	
Rms Current	RMS VARIATION, TRANSIENTS, METER	OFF	
Rms Voltage	RMS VARIATION	ON	For Va, Vb, Vc: Low and High to 90 and 110%. All related values per 5530 defaults.
Transient Voltage	TRANSIENTS	ON	For Va, Vb, Vc: Waveshape 10%/10%; Crest set to 200%.
Rms Voltage	METER	ON	For Va, Vb, Vc : H-Hi to 150%; Hi to 115%; Lo to 85%; Lo-Lo to 1%, Deadband off.

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5571/5571S DataNode Setup

Refer to the DataNode 5571/5571S User's Guide for more detailed information about connections and setups.

A 5571S DataNode

Programming Standard Tabs

LEGEND (Please note the following conventions used in the screen displays):
Items in *italics* are not programmable, but included for information purpose to the user.
Items in **bold** are examples of what can be entered.
Selections available in drop down menu are enclosed in brackets { xxxx }.

Caution: Dranetz-BMI has already set default values for the various parameters in each DataNode. The default values have been tested to result in optimal system performance. Users are advised not to change the default value settings unless there are applications which require advanced setups.
Basic Setup contains data on Communications, Display, Inputs and Transformer Ratios (Scale Factors).

1. **General** tab

Properties	Values
Identification Information	
Name	**Edison 5571**
Description	
Serial Number	*7100UA53*
Version	*4H*
Status Information	
Active	☑
Get settings from DataNode on activation	☐
Last contact at	*11/05/2002 15:02:49*
Health	*System health is normal*

General Setup contains DataNode Identification and Status information. Users can enter a 30 character alphanumeric name for the DataNode, detailed DataNode description (such as location of DataNode), and enable checkboxes to activate DataNode connection settings.

General tab parameters of the 5571/S DataNode function similarly as that of the 5530/5520 DataNode. Refer to page 8-2 for the detailed description of the General tab parameters displayed above.

2. **Basic** tab

Properties	Values
Communications	
Serial Port	**COM2** {COM1, COM 2}
New Device Address	**1**
Present Device Address	**1**
Display	
Display Thresholds as	**Percent** {Volts, Per Unit, Percent}
Input	
Low Neutral Range	☐
Power Type	**Three Phase Wye** {Single Phase, Split Single Phase, Three Phase Wye, Three Phase Delta}
Input Fergquency (Hz)	**60** {50, 60}
Base Voltage (Vrms)	**208.0**
Voltage A - Transformer Ratios	
Primary	**1.000**
Secondary	**1.000**
Current A - Transformer Ratios	
Primary	**1.000**
Secondary	**1.000**
Voltage B - Transformer Ratios	
Primary	**1.000**
Secondary	**1.000**
Current B - Transformer Ratios	
Primary	**1.000**
Secondary	**1.000**
Voltage C - Transformer Ratios	
Primary	**1.000**
Secondary	**1.000**
Current C - Transformer Ratios	
Primary	**1.000**
Secondary	**1.000**
Voltage N - Transformer Ratios	
Primary	**1.000**
Secondary	**1.000**
Current N - Transformer Ratios	
Primary	**1.000**
Secondary	**1.000**

COMMUNICATIONS parameters include:
•**Serial Port**: either COM1 or COM2 of the InfoNode
•**New Device Address**: must be a unique address between 1 and 89 for each DataNode; if more than one DataNode is to be connected on the same COM port, they should be added one at a time; trying to connect multiple units with the default address of 1 would not be successful
•**Present Device Address**: either what was previously entered or the default address of 1 (one); if only one DataNode is connected to the COM port and the present address is unknown, 0 (zero) can be used

DISPLAY parameters include:
•**Display Thresholds as**: to display parameters in either volts, percent, or PU (per unit)

INPUTS parameters include:
•**Low Neutral Range**: check box to enable Low Range on Neutral Voltage Channel
•**Power Type**: sets the Wiring Configuration to either single phase, split phase, 3 phase delta, 3 phase wye
•**Input Frequency (Hz)**: either 50 or 60 Hz
•**Base Voltage**: needed if using percent or per unit

TRANSFORMER RATIOS include:
•**PT Ratios**: if the voltage inputs are connected to an external PT, enter the primary and secondary values
•**CT Ratios**: if the current inputs are connected to an external CT, enter the primary and secondary values
Memory Setup allocates memory along with number of cycles captured to different types of events.

3. **Memory** tab

Properties	Values
Waveform Changes	
Enabled	☑
Cycles Before	**1**
Cycles After	**4**
RMS Events	
Enabled	☑
Cycles Per Sample	**1**
Max. Event Duration (samples)	**512**
Cycles to Trigger	**1**
Cycles to End	**1**
Impulses	
Enabled	☑
Cycles Before	**1**
Cycles After	**4**
Snapshots	
Enabled	☑
Interval (sec.)	**10860**
Timeline	
Enabled	☑
Interval (sec.)	**10860**
Demand Report	
Enabled	☑
Demand Interval (min.)	**15** {1, 5, 15, 30, 60}
Sliding Interval (min.)	**15** {1, 5, 15, 30, 60}

WAVEFORM CHANGES parameters include:
•**Enabled**: Waveshape (distortion) enabled check box
•**Cycles Before**: number of cycles before (typically 1)
•**Cycles After**: number of cycles after (typically 4)

RMS EVENTS parameters include:
•**Enabled**: RMS variation enabled check box
•**Cycles per Sample**: cycles per measurement sample (typically 1)
•**Max. Event Duration (samples)**: maximum event duration (typ. 512)
•**Cycles to Trigger**: cycles to trigger (typ. 1)
•**Cycles to End**: cycles to end (typ. 1)

IMPULSES parameters include:
•**Enabled**: Impulses (transients) enabled check box
•**Cycles Before**: cycles before (typ. 1)
•**Cycles After**: cycles after (typ. 1)

SNAPSHOTS parameters include:
•**Enabled**: Snapshot (waveforms) enabled check box
•**Interval (sec.)**: interval between recording in seconds (typ. 10860)

TIMELINE parameters include:
•**Enabled**: Timeline (steady state min/max/avg) enabled check box
•**Interval (sec.)**: interval between recording in seconds (typ. 900)

DEMAND REPORT parameters include:
•**Enabled**: Demand report (power) check box enabled
•**Demand Interval (min.)**: demand interval in minutes (typ. 15)
•**Sliding Interval (min.)**: sliding demand interval in minutes (typ. 15)

4. **Thresholds** tab

Properties	Values
Waveform Changes	
Voltage (Percent)	10.0
Duration (% of cycle)	10
RMS Events	
RMS Event - Voltage A	
Swell (Percent)	110.0
Sag (Percent)	90.0
RMS Event - Voltage B	
Swell (Percent)	110.0
Sag (Percent)	90.0
RMS Event - Voltage C	
Swell (Percent)	110.0
Sag (Percent)	90.0
RMS Event - Voltage N	
Swell (Percent)	10.0
Impulses	
Peak Voltage (Vpk)	200.0

Thresholds Setup provides you with the ability to set limits for triggering of various parameters. Values entered are based on the display settings under the Basic tab (volts, percent, or per unit).

WAVEFORM CHANGES parameters include:
•**Voltage**: waveshape faults voltage variation from previous cycle (typ 8%)
•**Duration**: duration or window over which to compare against in % of cycle (typ. 10)

RMS EVENTS parameters include RMS Events on per phase basis:
•**Swell** (hi limit, typically 110%)
•**Sag** (low limit typically 90%)

IMPULSES parameter consists of:
•**Peak Voltage (Vpk)**: Impulse in volts peak (typ 200)

5. **Advanced** tab

Properties	Values
UPS Duration (sec.)	300
Send firmware on next connect?	☐
Showing check sum error?	☐
Send cal. on next connect?	☐
5571 GPS option installed?	☐

Advanced Setup provides you with the ability to set limits to setup other functions such as UPS time, not previously described.

•**UPS Duration (sec.)**: typ 300
•**Send firmware on next connect?**: check box to enable such from InfoNode to DataNode
•**Showing check sum error?**: check box to enable such in log
•**Send calibration on next connect?**: check box to enable such from DataNode to InfoNode
•**5571 GPS option installed?**

ADAM Instrument Handler Setup

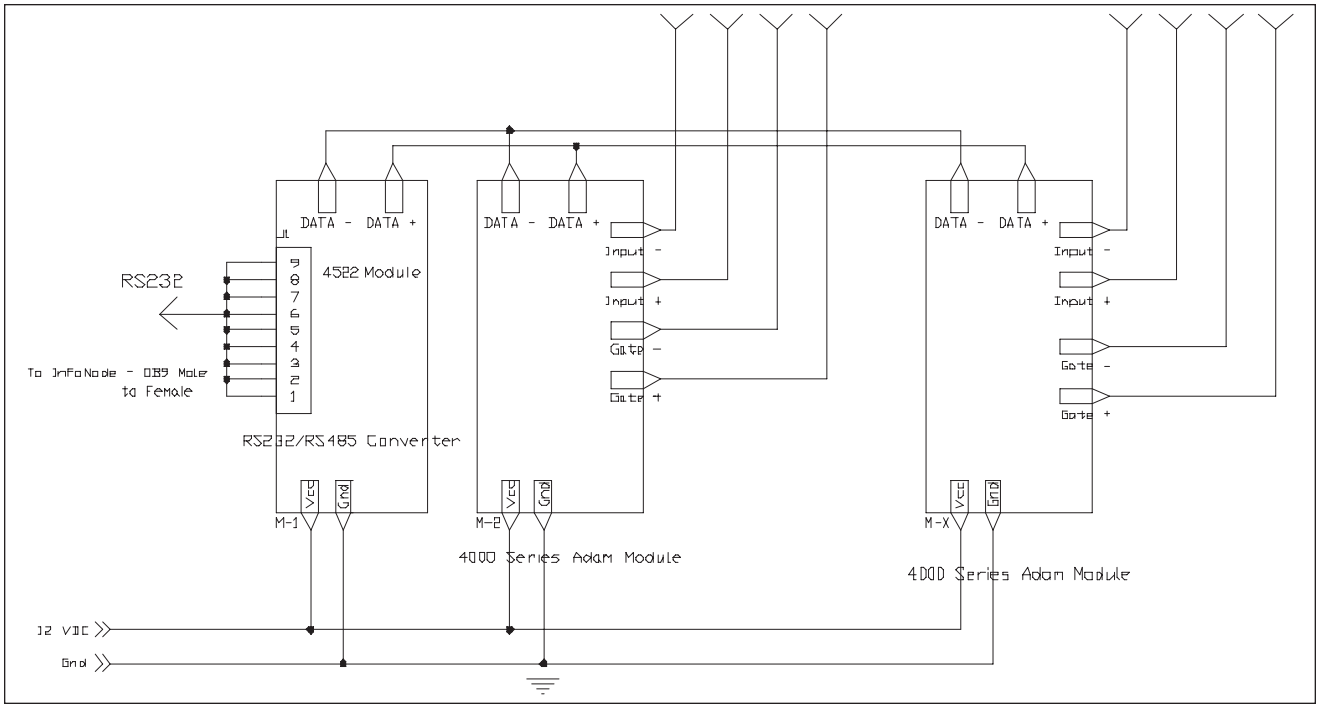
This section applies to the set up of the individual InfoNode ADAM instrument handler. Programming of individual modules are accomplished via switch settings on the modules themselves. This handler supports both the 4000 and 5000 series modules from Advantech. The 4000 series consists of stand alone modules, where each module is assigned a unique RS-485 address between 1 and 254. The 5000 series uses a single chassis to hold 4 or 8 modules. The chassis is assigned a single RS-485 address and the individual modules are addressed by slot number within the chassis. Note that the ADAM 5000 chasis can communicate with the InfoNode via RS-485 (requires external adaptor) or RS-232.

ADAM Module Connection Setup

The following are required to setup and configure an ADAM environment:
ADAM Modules
A host computer, such as an IBM PC/AT, that can output ASCII characters with an RS-232 or RS485 port
Power supply for the ADAM Modules (+10 and +30 VDC)
ADAM Series Utility software
ADAM Isolated RS-232/RS-485 Converter (optional)
ADAM Repeater (optional)

Host Computer: Any computer or terminal that can output in ASCII format over either RS-232 or RS-485 can be connected as the host computer. When only RS-232 is available, an ADAM RS-232/RS-485 Converter is required to transform the host signals to the correct RS-485 protocol. Since this module is not addressable by the host, the baud rate must be set using a switch inside the module. The factory default setting is 9600 baud. The converter also provides opto-isolation and transformer-based isolation to protect your equipment.

Power Supply: ADAM Module operation is guaranteed when using any power supply between +10 and +30 VDC. All power supply specifications are referenced at module connector. When modules are powered remotely, the effects of line voltage drops must be considered. All modules use on-board switching regulators to sustain good efficiency over the +10 and +30 V input range, therefore we can assume that the actual current draw is inversely proportional to the line voltage. Select power cables according to the number of modules connected and the length of the power lines.

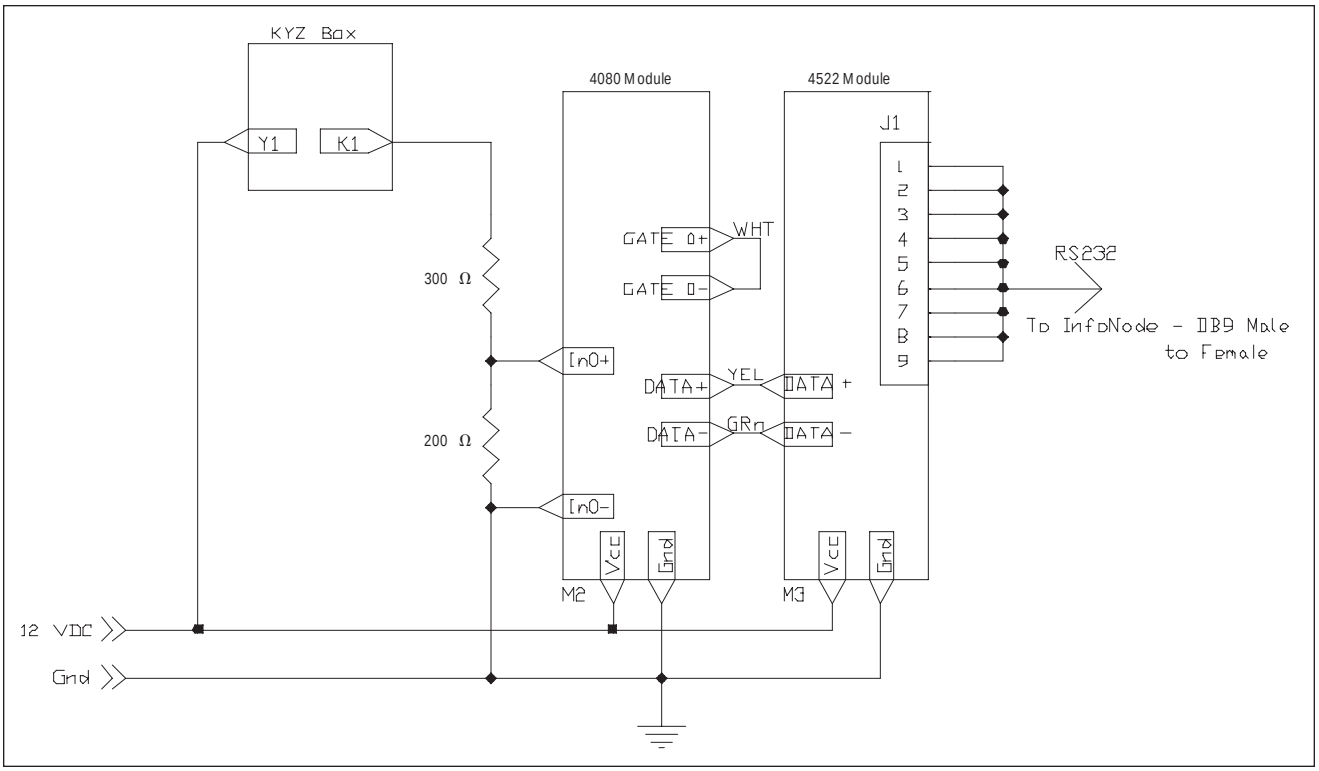


Generic Connections for the 4000 Series ADAM Module

12 ADAM Handler Setup

ADAM Utility Software: A menu-driven program is provided for ADAM Module configuration, monitoring and calibration. Dranetz-BMI ships ADAM Modules with the necessary Windows driver and the Utility software disk.

ADAM Repeater: When communication lines exceed 4,000 ft (1200 meter) or the number of ADAM modules connected is more than 32, a repeater should be connected to expand the first segment. Up to 8 Repeater modules can be connected allowing connection of up to 256 ADAM modules.



ADAM 4080 Module to KYZ Box Connection

For more information on ADAM Module setup, installation and configuration:
Refer to the *ADAM 4000 Series User's Manual* for more details on how to configure, set up and install the ADAM modules. The Windows driver and the Utility disk for the ADAM-4000 Series are shipped along with the *ADAM 4000 Series User's Manual*, Copyright ©1997 Advantech Co., Ltd. The user's manual can also be accessed online at http://service.advantech.com.tw/download/Files/1-A2XID/Adam-4000_ed7.pdf

ADAM 4060 Contact Closure Module Setup

The ADAM 4060 relay contact closure module is used to signal notifications to designated recipients. Data for the ADAM modules may be configured in various format, one of which is the hexadecimal format. The procedure below describes how to set up the optional ADAM contact module to relay notifications from DualNode 5593 to the designated recipient.

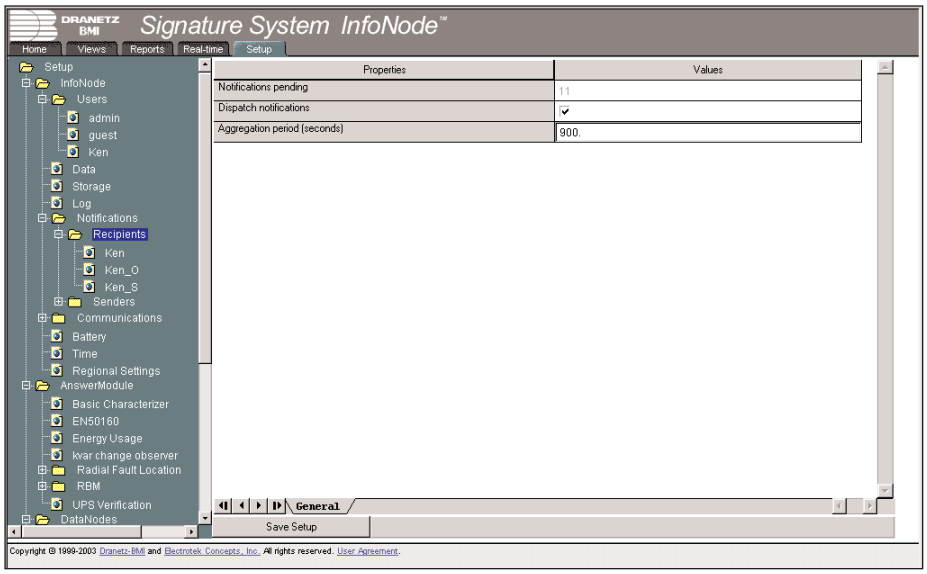
NOTE: Only those with admin privileges may set whether to dispatch notifications or not. Users who access the InfoNode system as Guest, Viewer or Operator are not allowed to dispatch notifications nor change time settings when notifications will be sent to recipients.

1. The RS232 cable between COM1 on the InfoNode and the ADAM 232 to 485 converter is wired 'straight' (as in Dranetz-BMI 8010 PQNode) i.e. not null Modem.

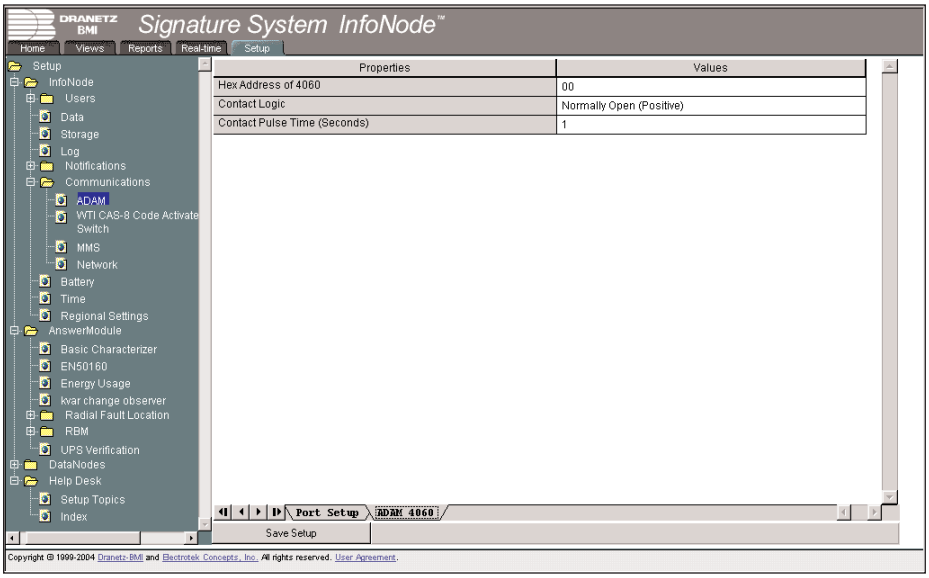
2. There is no need to set up an ADAM 4060 or 5060 DataNode. It is just an alarm feature programmed in the Recipients section.

3. Using the setup functions under Setup Page, set the unit up as a recipient. Recipients determine who will receive notifications.

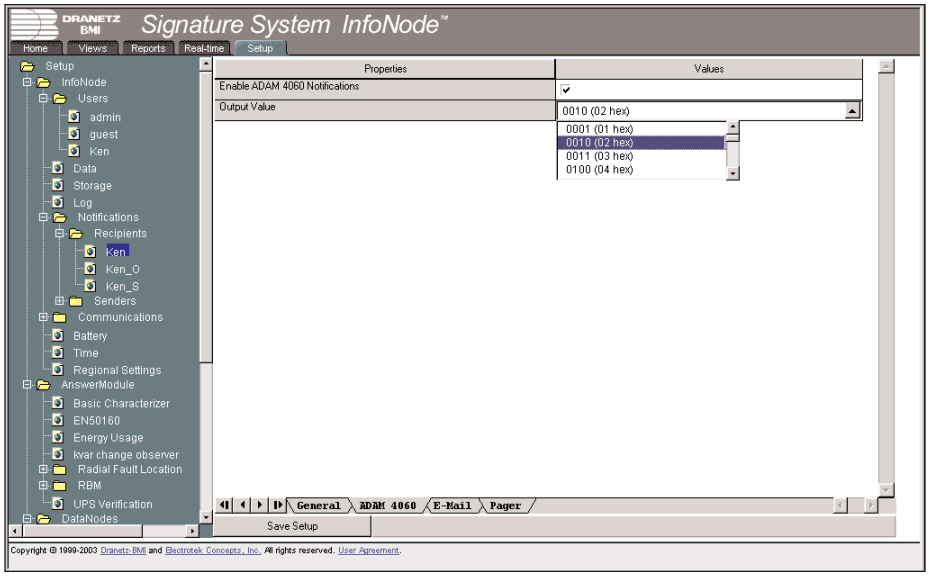
4. Enable the *Dispatch Notifications* field in the Recipients setup screen. Go to Setup Page - Notifications > Recipients > General tab. See page 7-5 for more information on the Recipients - General properties tab.



5. The Hex value in the ADAM 4060 tab, under the ADAM folder, is the given HEX value of the particular 4060 viz 01. Go to Setup Page - Communications > ADAM > ADAM 4060 tab. See pages 7-12 to 7-13 for more information on the Communications - ADAM 4060 properties tab.



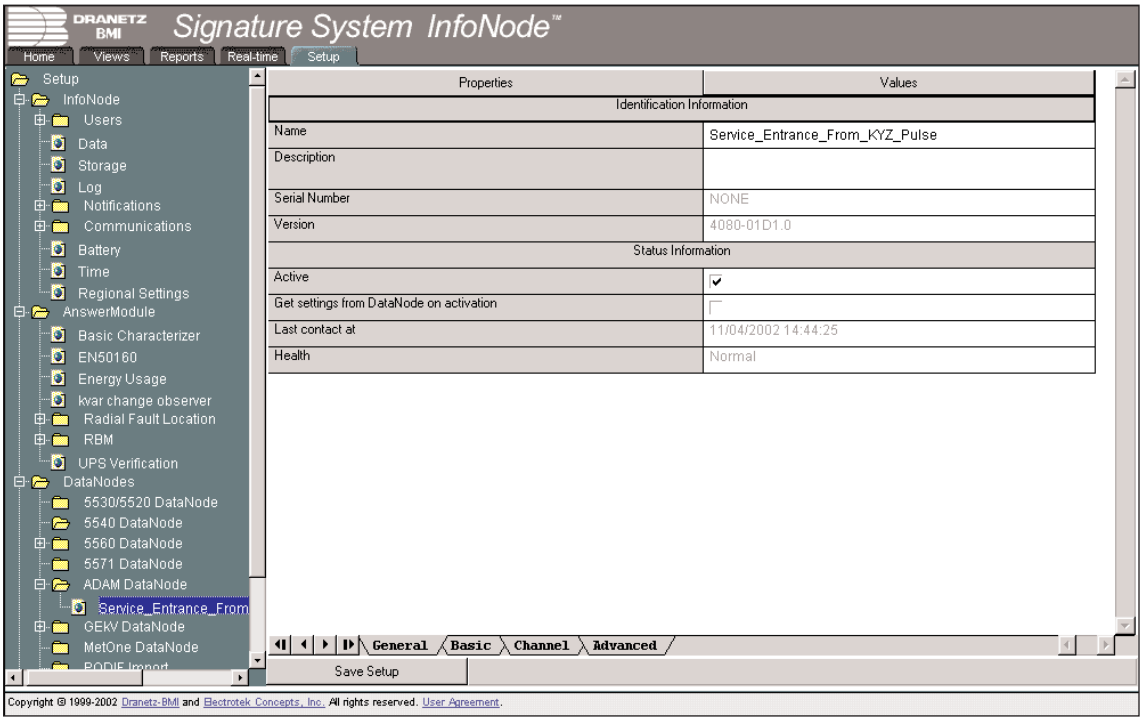
6. The relay (1-4) HEX address is different. It is chosen from the drop down box in the recipient section. For example, Relay 1 is 0001 and is HEX 01; Relay 4 is 1000 and is HEX 8. Go to Setup Page - Notifications > Recipients > ADAM 4060 tab. See page 7-6 for more information on the Recipient - ADAM 4060 notification setup screen.



NOTE: It takes approximately 4 seconds for a test transmission to close the relay and around 3.5 minutes for a rms sag to be alarmed.

Signature System supports a wide variety of ADAM modules to fit any applications. See page 12-6 for the list of available modules supported by the Signature System. Right-click on the ADAM Module folder and click on Add DataNode to add your particular ADAM module. Select the ADAM DataNode site name type and your work space area will be displayed on the right frame. Polling rate for ADAM modules typically last from 2 to 5 seconds (not a guaranteed rate). Use the tabs across the bottom of the page to select the appropriate group of programmable features. The parameters available in each tab are discussed in detail in the next section.

1. **General** tab



The General tab is common with all other Instrument Handler Setup tabs. It contains ADAM DataNode specific status information.

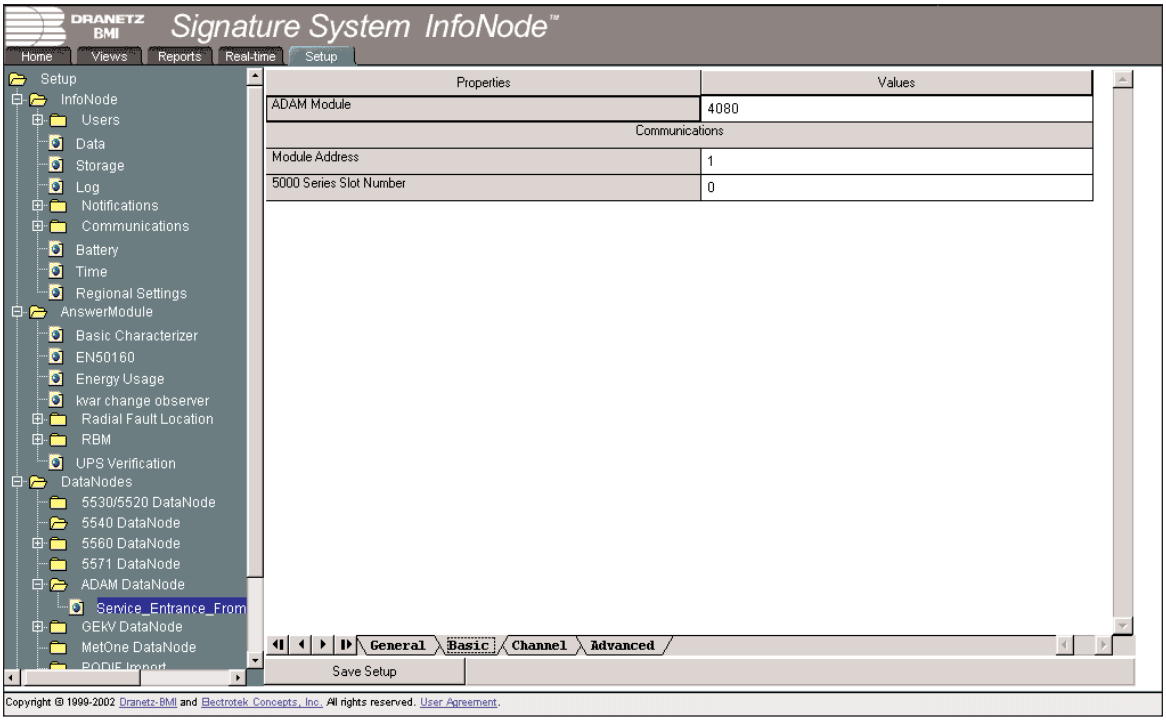
IDENTIFICATION INFORMATION includes the name and description that users can assign to the ADAM DataNode. Simply click on the **Name** or **Description** value field to type in the space provided. The **Name** property is used to identify the instrument within the InfoNode and when data is downloaded from the InfoNode. The **Description** field allows a longer more meaningful description string to be associated with the instrument.

The **Serial Number** and **Version** of the DataNode hardware are not available and will show as 'None'. The InfoNode supplies this information after establishing communications with the instrument. This instrument-specific information is available only for viewing and cannot be changed from the InfoNode.

STATUS INFORMATION properties include the **Active** checkbox that indicates when the instrument should be online and available for communications and download. The **Get settings from DataNode on activation** property is not available for ADAM modules.

The InfoNode records the date and time of **Last contact** with the instrument. It also indicates **Health** status, whether the system is functioning normally or not. Both information are set by default and cannot be changed by users. The InfoNode supplies both contact and health information after establishing communications with the instrument.

2. **Basic** tab



The Basic Tab is used to select a module type and set the Module address.

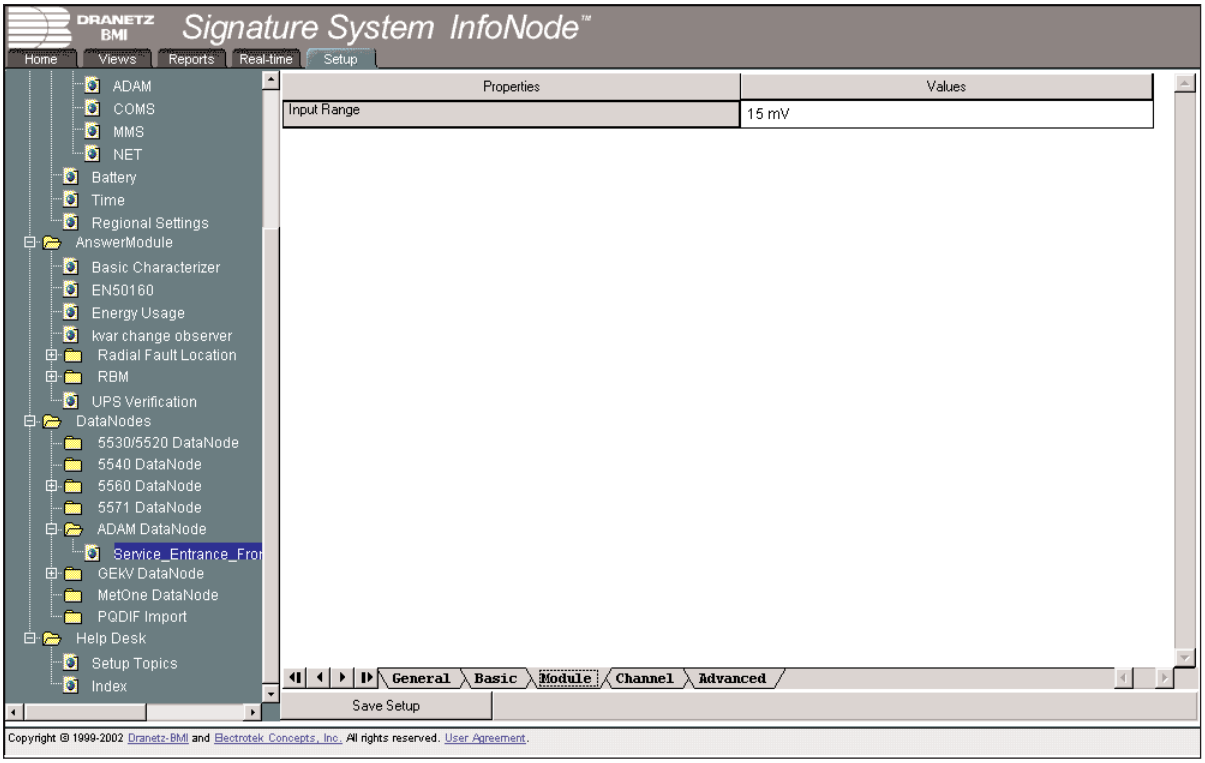
The following **ADAM modules** are supported:
4000 Series
4017 8 Channel Analog Input
4018 8 Channel Thermocouple/General Analog Input
4018M 8 Channel Thermocouple/General Analog Input with memory
4050 7 Channel Digital Input/8 Channel Digital Output (Output not supported)
4052 8 Channel Digital Input (6 differential, 2 single ended)
4053 16 Channel Digital Input
4080 2 Channel Counter/Frequency Module (up/down counter mode only)

5000 Series
5000 4 Slot Chassis
5000E 8 Slot Chassis
5017 8 Channel Analog Input
5018 7 Channel Thermocouple/General Analog Input
5050 16 Channel Digital Input/Output (Output not supported)
5051 16 Channel Digital Input/Output
5052 8 Channel Isolated Digital Input
5080 4 Channel Counter/Frequency Module (up/down counter mode only)

The **ADAM Module** dropdown property allows selection of the desired module from the available module types.

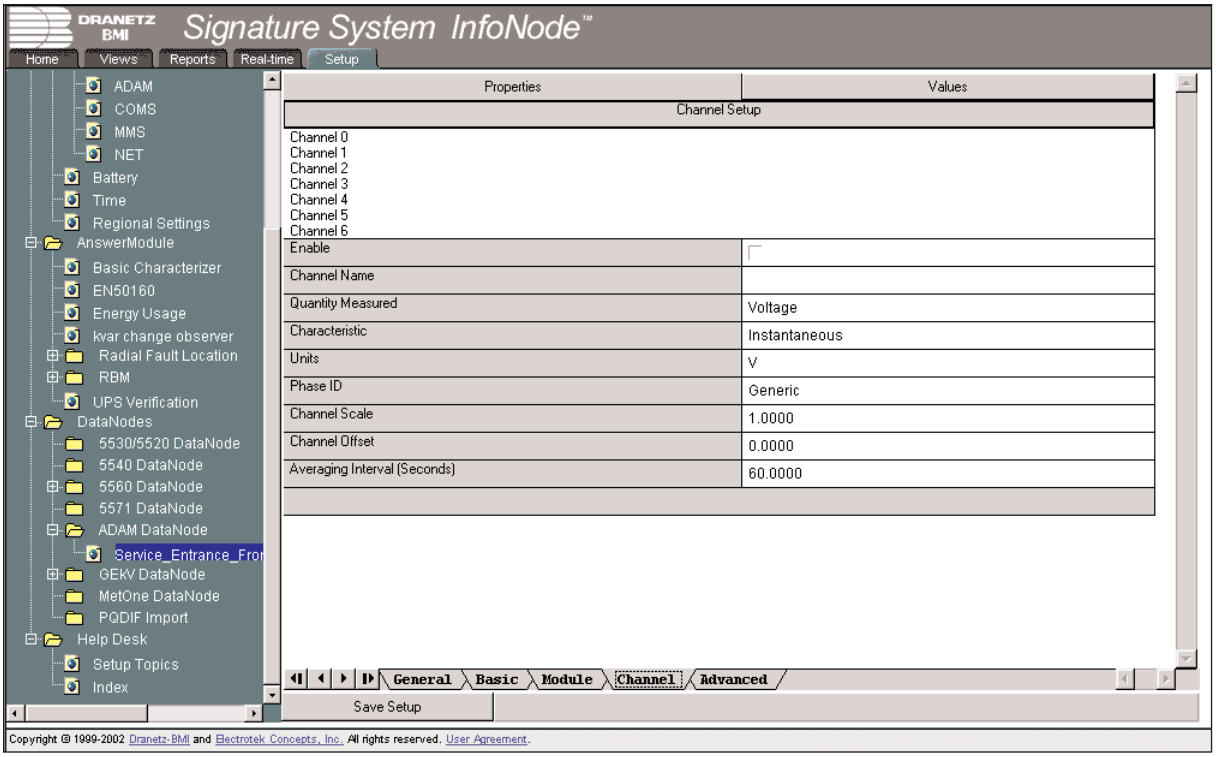
The **Module Address** property is used to specify the RS-485 address where ADAM 4000 series modules will be found. For ADAM 5000 series modules, this is the address of the 5000 or 5000e chassis. The **5000 Series Slot Number** is used to indicate the position of the module in the chassis. Positions start at 0.

3. **Module** tab



Once the Module type has been selected, the remaining tabs apply to the specific Module selected. The Module tab is module-specific and tabs vary depending on module type.

4. **Channel** tab (for Thermocouple/General Analog Input Modules - ADAM 4018, 5018)



When a general purpose analog input module or thermocouple module with voltage or current range is selected the Channel Tab contains the following properties.

The tab shows each channel available for the selected module and range. The channels are labeled **Channel 0** through **Channel n** where n is the number of channels available. By selecting one of the entries in the list, you will be setting the parameters for that channel.

The **Enable** property signals that the selected channel is to be monitored and stored.

The **Channel Name** property is used to label and select this channel in other interfaces in the InfoNode. Any arbitrary name with up to 80 characters can be specified .

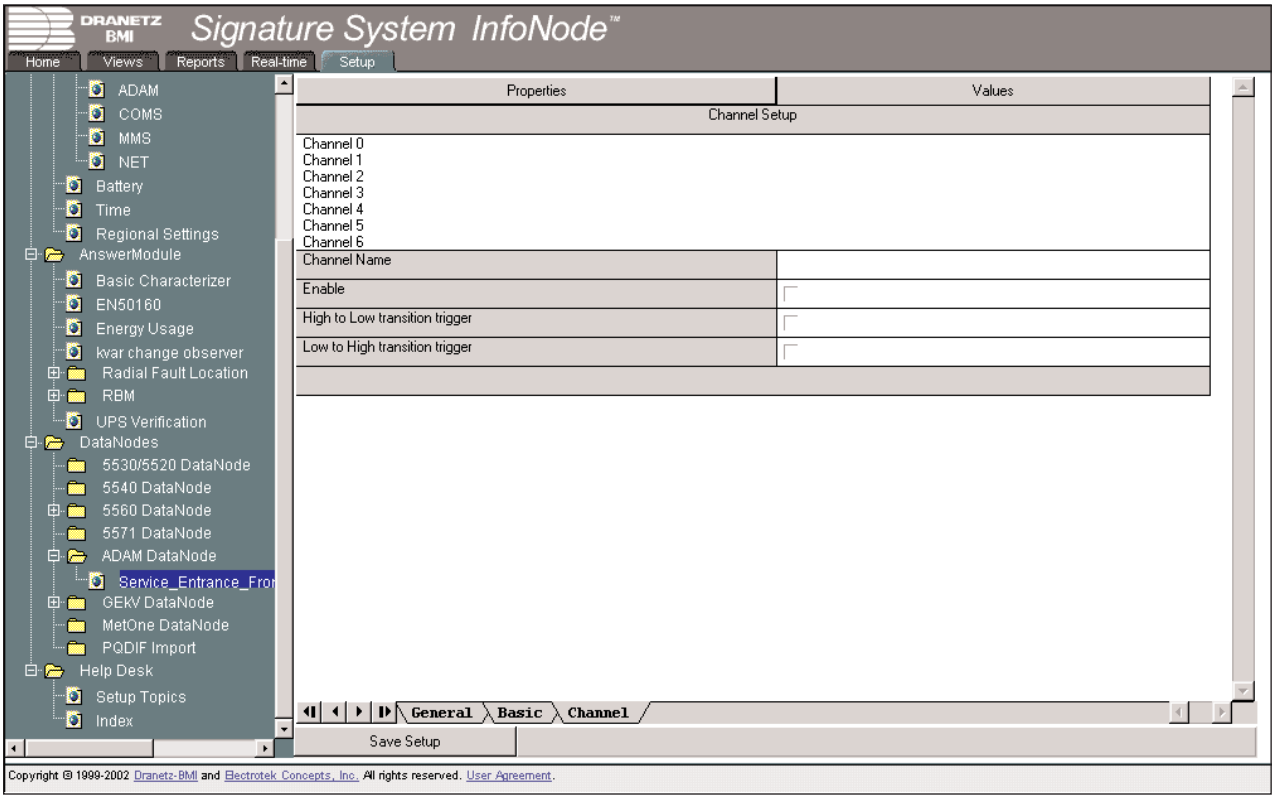
The **Quantity Measured**, **Characteristic** and **Units** properties are used to define the channel type in the InfoNode database. An example might be Voltage (Quantity Measured), Instantaneous Sampled (Characteristic), and Volts (Units).

The **Channel Scale** property specifies the number used to scale the value read from the ADAM Module. This depends on the transducers that are measuring the real signal. For instance, a speed sensor might output 1 Volt per 50 rpm which would give a Channel Scale of 50.

The **Channel Offset** property allows an offset to be applied to the signal measured from ADAM module. This must be specified in scaled units. If a pressure transducer were to output 0 volts at 1000 mbar and you desire a reading of 1000 mbar, specify 1000 for the offset assuming the appropriate scale was specified in the Channel Scale to convert input signal to mbar.

The **Averaging Interval** property is used to tell the system how often to store values for this unit. The signals are sampled as quickly as the system can depending upon the number of instruments attached. The data is aggregated into minimum, maximum and average values over the averaging period and stored at the end of the interval.

5. **Channel** tab (for General Digital Input Modules - ADAM 4050/4052, 5050/5052)



The tab shows each channel available for the selected module. The channels are labeled **Channel 0** through **Channel n** where n is the number of channels available. By selecting one of the entries in the list, you will be setting the parameters for that channel. Note that while the channels on the ADAM units begin numbering at 0, the channel numbering here begins at 1. Input 0 maps to channel 1, input 1 maps to channel 2, etc.

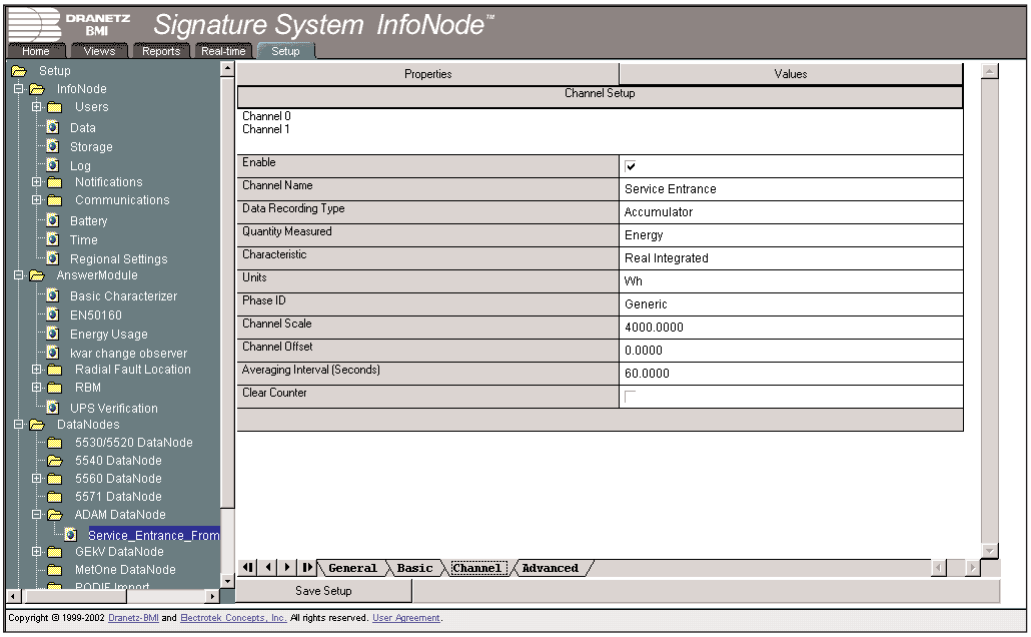
The **Enable** property signals that this channel is to be monitored and stored. When the channel is enabled, a steady state trend entry is made at every transition from low to high or high to low.

The **Channel Name** property is used to label and select this channel in other interfaces of the InfoNode. Any arbitrary name with up to 80 characters can be specified .

The **Hi to lo transition trigger** property when checked will cause an event to be generated whenever the signal transitions from a logical 1 to a logical 0.

The **Lo to hi transition trigger** property when checked will cause an event to be generated whenever the input signal transitions from a logical 0 to logical 1.

6. **Channel** tab (for Counter Input Modules - ADAM 4080, 5080)



The tab shows each channel available for the selected module and range. The channels are labeled **Channel 0** through **Channel n** where n is the number of channels available. By selecting one of the entries in the list, you will be setting the parameters for that channel.

The **Enable** property signals that the selected channel is to be monitored and stored.

The **Channel Name** property is used to label and select the channel in other interfaces of the InfoNode. Any arbitrary name with up to 80 characters can be specified.

The **Data Recording Type** property specifies how the data is to be stored. Data storage options are either Interval or Accumulator. For Interval data, the value of the counter at the beginning of the sampling interval is subtracted from the value of the counter at the end of the interval. For Accumulator data, accumulated value of the counter is stored.

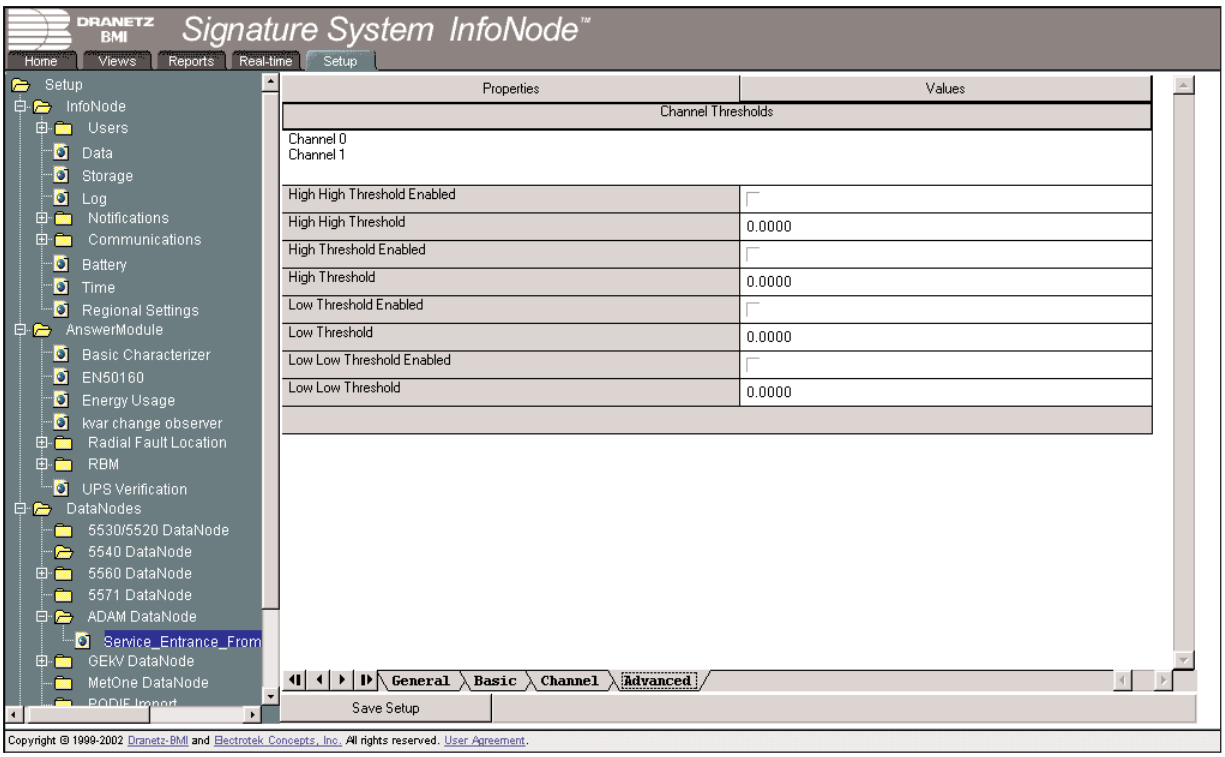
The **Quantity Measured**, **Characteristic** and **Units** properties are used to define the channel type in the InfoNode database. Selection from these characteristics allows the InfoNode to group the channel with appropriate channels during selection, and allow some reports to include the signals measured in more meaningful ways. Sample input values are Voltage (for Quantity Measured), Instantaneous Sampled (for Characteristic), and Volts (for Units).

The **Channel Scale** property specifies the number used to scale the value read from the ADAM unit to the value you wish to record. This depends on the transducers that are measuring the real signal. For instance, a flow sensor might output 5 counts per liter. If the unit of measure is in liters, the scale would be 1/5 or 0.20.

The **Channel Offset** property allows an offset to be applied to the signal measured from ADAM module. This must be specified in scaled units. If a pressure transducer were to output 0 volts at 1000 mbar and you desire a reading of 1000 mbar, specify 1000 for the offset assuming the appropriate scale was specified in the Channel Scale to convert input signal to mbar.

The **Averaging Interval** property indicates how often the value should be saved. The values are read as fast as possible to allow trigger checking as specified on the Advanced tab.

7. **Advanced** tab



The **Advance tab** is available for all analog and counter modules. It allows the specification of threshold limits for the input channels.

The tab shows each channel available for the selected module and range. The channels are labeled **Channel 0** through **Channel n** where n is the number of channels available. By selecting one of the entries in the list, you will be setting the thresholds for that channel.

There are 4 threshold settings available. These are used to specify the four available threshold trigger levels: **Low-Low**, **Low**, **High** and **High-High**. Each threshold can be independently enabled and set.

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Optional Accessories

The following optional accessories are available to enhance the function and performance of theSeries 5500 InfoNode. *Specifications are subject to change without notice. Contact Dranetz-BMI Customer Service for the latest information on options and accessories.*

Internal Options

Memory
(internal hardware for 5502)
- •64M Flash Memory Module: 64MFLASH
- •128M Flash Memory Module: 128MFLASH
- •256M Flash Memory Module: 256MFLASH

Modem and GPS
(internal hardware and firmware for 5502 and 5504)
- •56Kbps MNP10 Modem: 56KMDM
- •GPS Receiver: GPSR

Software
(internal firmware for 5502 and 5504)
- •PF Cap Directivity Answer Module: SW-PFCAP
- •VAR Verifier Answer Module: SW-kVAR (Requires SW-PFCAP - PF Cap Directivity SW Module)
- •RBM Indices Software Module: SW-RBMI
- •Radial Line Fault SW Module: SW-RADL
- •Sag Directivity SW Module: SW-SAG
- •UPS Verification SW Module: SW-UPSV
- •Advantech 4000/5000 ADAM Modules: SW-IADAM
- •GE KV Series of Wattmeters SW Module: SW-GEKV

Accessories

(external hardware for 5502-5504)
- •AUI-to-Fiber Optic Transceiver: AUIFIBER
- •Active Antenna for GPS w/ brackets: GPSANT
- •100’ GPS Extension Cable: GPS100
- •100’ Fiber Optic Extension Cable: FBR100
- •9F-9F Pin Null RS-232 6’ Cable: RS232NUL
- •10BaseT Null 6’Cable: 10BTNUL
- •RS-232 to RS-485 Converter: RS232/485-9F
- •Mounting Brackets (length: 15.12”): 550BRKTL
- •Mounting Brackets (length: 8.88”): 550BRKTS
- •19” Rack Mounting Panel: 55 RACK
- •Dual Unit Mounting Enclosure: 55DUAL
- •Enclosure for Single InfoNode (24x24x8): NEMA4INFO
- •INDC Power

ADAM Module
- •8 Channel Analog Input: ADAM 4017
- •8 Channel Thermocouple/General Analog Input: ADAM 4018
- •8 Channel Thermocouple/General Analog Input w/ memory: ADAM 4018M
- •7 Channel Digital Input/8 ChannelDigital Output: ADAM 4050 (Output not supported)
- •8 Channel Digital Input (6 differential, 2 single ended): ADAM 4052
- •16 Channel Digital Input: ADAM 4053
- •Relay contact closure model: ADAM 4060
- •2 Channel Counter/Frequency Module (up/down counter mode only): ADAM 4080
- •4 Slot Chassis: ADAM 5000
- •8 Slot Chassis: ADAM 5000E
- •8 Channel Analog Input: ADAM 5017
- •7 Channel Thermocouple/General Analog Input: ADAM 5018
- •16 Channel Digital Input/Output: ADAM 5050 (Output not supported)
- •16 Channel Digital Input/Output: ADAM 5051
- •4 Channel Isolated Digital Input: ADAM 5052
- •4 Channel Counter/Frequency Module (up/down counter mode only): ADAM 5080
- •RS-232 to RS-485 Converter: ADAM 4522
- •Isolated RS-232 to RS-485 Converter: ADAM 4520
- •12VDC 820ma power supply: ADAMPWR

13 Optional Equipment

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InfoNode Specifications	5502	5504
Operating Range		
AC Voltage	90-250Vac	90-250Vac
DC Voltage	105-125Vdc	105-125Vdc
Frequency	47-63Hz	47-63Hz
Power Consumption	35W max	35W max
NiCad Battery Replacement	4 years typical	4 years typical
UPS Time	10 seconds	10 seconds
Clock drift w/o GPS	10 msec/minute maximum	10 msec/minute maximum
Internal RAM Memory	32M	32M
Internal Flash Memory	8M standard	(hard drive)
Environmental		
Operating Temperature	0 to 65°C	10 to 50°C
Storage Temperature	-20 to 70°C	-20 to 70°C
Operating Humidity (non-condensing)	0-95%	0-95%
Physical Characteristics		
Dimensions	13"W x 8"D x 5"H	13"W x 8"D x 5"H
Weight	7.1 lbs	7.1 lbs
Enclosure	Painted Aluminum	Painted Aluminum
Connections		
Ethernet - 10 base T	RJ45	RJ45
Ethernet - AUI	Female 15 pin D	Female 15 pin D
COM1 - RS232	Male 9 pin D	Male 9 pin D
COM2 - RS232	Male 9 pin D	Male 9 pin D
GPS option	Male BNC	Male BNC
Modem option	RJ11C	RJ11C
Options		
Memory		
Flash	64M, 128M, 256M	NA
Disk Drive	NA	2G (available database, not hard drive size)
GPS Receiver		
Clock accuracy	10 msec	10 msec
Modem		
Max Baud Rate	56K	56K
Type	V56 / MNP 10	V56 / MNP 10
Mounting		
Rack mount	19"	19"
NEMA 4X	weatherproof	weatherproof
Bracket Set	2 per unit	2 per unit
Software		
Upload Firmware	Via FTP	Via FTP
Browser	Microsoft IE5.5+	Microsoft IE5.5+

14 Specifications

Theory of operation and detailed hardware description

The InfoNode is based on a PC-104 bus architecture as opposed to a PC ISA, EISA, or PCI bus. The CPU motherboard acts as the PC-104 backplane and implements a PC architecture parallel port, serial RS-232/485 ports, an Ethernet port, and a watchdog timer circuit. The parallel port on 5502/04 is used as the interface to the power supply board.

There are three PC-104 modules used with the system - the GPS, the Modem, and the solid state flash drive. The solid state flash drive (16 MB for standard version) is the core storage in the system for the primary system firmware (3 MB) and also holds the data. The GPS uses the Rockwell Zodiac chipset and is operated in binary mode. The GPS is interfaced into the system by an onboard serial port (COM3) and via a hard wired interrupt request line (IRQ15). The optional modem is a 56 kbps PC-104 bus modem that has an on-board serial port (COM4). The 5504 replaces the solid state Flash drive with a hard disk.

The motherboard also supports 1024K of on-board, write protected flash memory which is used to hold the low level boot code and diagnostics. This firmware allows communication with the instrument even if the storage is completely disabled. The InfoNode firmware architecture is based on booting to the PharLap operating system monitor via this boot flash, then transferring control to either the diagnostics program in the boot flash or to the primary operating firmware on the solid-state drive.

In addition to the PC-104 based CPU and boards, the InfoNode contains two additional boards - the power supply and the power supply control board and UPS. These boards power the unit, provide UPS capability during an interruption or RMS variation, and is also where the hard drive is mounted (5504). The power supply board communicates with the CPU board via a parallel port interface. This interface allows the InfoNode firmware to detect when the power supply transitions to UPS so that e-mail and/or pager notifications can occur and orderly system shutdown can proceed. Upon a long duration interruption, the InfoNode sends a signal to the power supply board every few seconds to keep the UPS running until these tasks are complete.

The InfoNode is an integral system component that participates in a hierarchical store-and-forward data/information management system with the added benefit of advanced information processing at each stage in the chain (DataNode, InfoNode, NodeCenter, NodeLink). Data is stored internally using the Power Quality Data Interchange Format (PQDIF) developed by Electrotek, now being standardized by the IEEE as part of standard 1159.3. The system also uses ISO communication protocols (UCA). For enterprise systems, at the top of the hierarchy is the NodeCenter management system (both Utility and Facility versions) that is Microsoft NT Server 4.0/5.0 based. All end-user interaction with individual DataNodes, InfoNodes and the NodeCenter system is via a WWW browser. There are some stand-alone utility programs for administrative use when the NodeCenter software is not available (like backup/restore of individual InfoNode databases, and periodic download of PQDIF databases).

Compliance information

FCC Part 68 Compliance Information

Introduction
Remote devices can be connected to the RJ-11C jack. A modem is installed internal to the equipment.

Compliance with FCC Rules and Regulations
The internal modem complies with Part 68 of the FCC rules. On the rear panel of this equipment is a label that contains, among other information, the FCC registration number and ringer equivalence number (REN) for this equipment. If requested, this information must be provided to the telephone company.

Notification of the Telephone Company: All direct connection to the telephone network must be made through standard plugs and jacks as described in Part 68, Subpart F of the FCC Rules. The terminal equipment cannot be used on public coin service provided by the telephone company. Connection to Party Line Service is allowable and subject to state tariffs. Contact the state public utility commission, public service or corporation commission for information.

Before connecting the equipment to the telephone network, notify the telephone company of the line that you are using, the FCC Registration Number, the Ringer Equivalence of the Modem, and the type of Jack used for connection.

•FCC Registration Number:
5CQTAI-40146-MS-E
•Ringer Equivalence: 0.7B
•Phone Jack (USOC): RJ-11C

Ringer equivalence number: The REN is used to determine the quantity of devices which may be connected to the telephone line. Excessive REN's on the telephone line may result in the devices not ringing in response to an incoming call. In most, but not all areas, the sum of the REN's should not exceed five (5.0). To be certain of the number of devices that may be connected to the line, as determined by the total REN's contact the telephone company to determine the maximum REN for the calling area.

Incidence of harm: If the terminal equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

Responsibilities of the telephone company: The telephone company may make changes in it's facilities, equipment, operations, or procedures that could affect the operation of the equipment. If this happens, the telephone company will provide advance notice in order for you to make the necessary modifications in order to maintain uninterrupted service.

In case of trouble: If trouble is experienced with this equipment, please contact Dranetz-BMI Customer Service Department, (732) 287-3680 for repair and warranty information. If the trouble is causing harm to the telephone network, the telephone company may request you to remove the equipment from the network until the problem is resolved.

Service: All service and repairs must be performed by Dranetz-BMI. If unauthorized modification or repair is performed, both the FCC Registration and the manufacturer's warranty in effect become null and void. If a malfunction is suspected, it is your responsibility to contact Dranetz-BMI Customer Service Department for further instructions. Telephone Number: (732) 287-3680.

14 Specifications

Maintenance and Service

In normal use, only the internal backup battery pack requires periodic replacement. No other special maintenance or calibration of the InfoNode is required. Contact Dranetz-BMI Technical Support in case of trouble.

Battery Pack Safety Precautions

• WARNING: DO NOT intentionally short circuit the battery pack. The batteries are capable of providing hazardous output currents if short circuited. Do not attempt to charge the batteries with an external charger.

• ADVERTENCIA: NO ponga intencionalmente la batería en cortocircuito. Las baterías son capaces de proporcionar corrientes de salida peligrosas si están en cortocircuito. No intente cargar las baterías con un cargador externo.

• AVERTISSEMENT: NE PAS court-circuiter délibérément le bloc-batterie. Lors d'un court-circuit, les batteries risquent d'émettre des courants effectifs dangereux. Ne pas tenter de charger les batteries au moyen d'un chargeur externe.

• WARNUNG: Die Batterien dürfen NICHT kurzgeschlossen werden. Im Falle eines Kurzschlusses können die Batterien lebensgefährliche Ausgangsströme leiten. Die Verwendung eines externen Ladegeräts kann zu einer Explosion der Batterien führen.

Battery Safety Precautions
The following safety precautions must be adhered to.

o Keep batteries away from children. Never permit a child to play with a battery as an ornament or toy.
o Do not disassemble battery or battery pack.
o Do not dispose of battery in fire.
o Dispose of a used battery promptly in accordance with local Environmental Protection Agency (EPA) regulations.
o Visually inspect the battery pack for corrosion.

Medidas de seguridad de la batería
Deberán observarse las medidas de seguridad siguientes:

o No deberá mantenerse las baterías al alcance de los niños. No deberá permitirse que un niño juegue con una batería.
o No deberá desensamblarse ninguna batería ni el compartimiento de la misma.
o No deberá prenderse fuego a una batería.
o Toda batería agotada deberá desecharse de manera rápida según las normas locales de la Agencia de protección del medio ambiente (EPA).
o Deberá verificarse que el compartimiento de las baterías no esté corroído.

Mesures de sécurité relatives aux batteries
Il est très important de suivre les mesures de sécurité suivantes.

o Ne pas laisser les batteries à la portée des enfants. Ne jamais laisser un enfant jouer avec une batterie.
o Ne pas démonter de batterie ou de bloc-batterie.
o Ne pas jeter de batterie dans le feu.
o Se débarrasser rapidement des batteries usagées en se conformant aux règlements de l'EPA (Agence américaine pour la protection de l'environnement).
o Inspecter le bloc-batterie à l'oeil nu pour rechercher les signes de corrosion.

Batterie-Sicherheitsvorkehrungen
Die folgenden Sicherheitsvorkehrungen müssen beachtet werden.

o Halten Sie Batterien von Kindern fern. Erlauben Sie einem Kind unter keinen Umständen, eine Batterie als Verzierung oder Spielzeug zu benutzen.
o Nehmen Sie Batterien oder Batteriepackungen nicht auseinander.
o Entsorgen Sie Batterien nicht durch Verbrennen.
o Entsorgen Sie verbrauchte Batterien umgehend nach den gesetzlichen Umweltschutzbestimmungen.
o Prüfen Sie die Batteriepackung optisch auf Korrosion.

Battery pack replacement
The internal backup battery pack has a life expectancy of four years under normal use.

• WARNING: Replace with Dranetz-BMI battery pack 116455-G1 only.

• ADVERTENCIA: Reemplace con bateria Dranetz-BMI 116455-G1 solamente.

• AVERTISSEMENT: Remplacer par la batterie Dranetz-BMI 116455-G1 exclusivement.

• WARNUNG: Nur mit Dranetz-BMI 116455-G1 Batteriesatz auswechseln.

To replace the battery pack:
1. Press the InfoNode power switch to the OFF position. Verify that the power indicator lamp is off. Disconnect all power to the unit. Disconnect all external communications cables from the rear panel.

2. Open the cabinet by removing the seven screws that retain the cover to the chassis. Facing the rear panel, carefully swing the cover upwards and back.

3. The battery pack is located on the Input Filter Board. Observe the mounting orientation of the battery pack. Remove the battery pack hold-down strap by loosening its two retaining screws.

4. Disconnect the polarized battery pack connector from the circuit board. Remove the old battery pack and replace only with Dranetz-BMI Battery Pack, P/N 116455-G1. Observe correct mounting orientation.

5. Connect the polarized battery pack connector to the circuit board. Replace the battery pack hold-down strap and tighten the two screws securely.

6. Install the cover on the chassis and tighten the seven screws securely.

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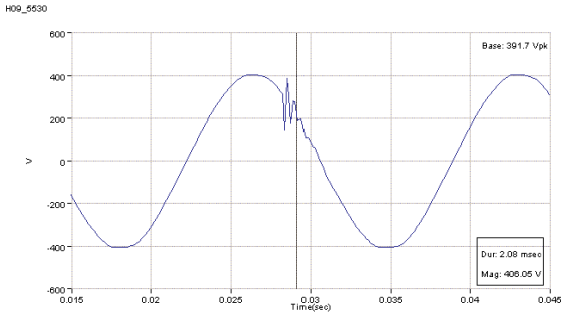
Quantities Calculated from Periodic Voltage and Current Measurements

Quantity	*Defining Equation*	*Comments*
Apparent Power	$S = V_{RMS} \cdot I_{RMS}$ (eq. 1)	
Real Power	$P = \frac{1}{N}\sum_{i=1}^{N} V_i \cdot I_i$ (eq. 2)	N = Samples per cycle V_i = Voltage at i^{th} sample I_i = Current at i^{th} sample
True Power Factor	$PF = \frac{P}{S}$ (eq. 3)	
Total Harmonic Distortion (THD)	$THD = \frac{1}{X_1}\sqrt{\sum_{h=2}^{h_{max}} X_h^{\,2}}$ (eq. 4)	X_h = rms voltage or current at harmonic h h_{Max} = Highest resolved harmonic
Telephone Influence Factor	$TIF = \frac{\sqrt{\sum_{h=1}^{h_{max}} (X_h \cdot W_h)^2}}{X_{RMS}}$ (eq. 5) h W h W h W h W 1 0.5 17 5,100 31 7,820 50 9,670 3 30 18 5,400 33 8,330 53 8,740 5 225 19 5,630 35 8,830 55 8,090 6 400 21 6,050 36 9,080 59 6,730 7 650 23 6,370 37 9,330 61 6,130 9 1,320 24 6,650 39 9,840 65 4,400 11 2,260 25 6,680 41 10,340 67 3,700 12 2,760 27 6,970 43 10,600 71 2,750 13 3,360 29 7,320 47 10,210 73 2,190 15 4,350 30 7,570 49 9,820 83.3 840	W_h = Harmonic weighting factor from table
IT Product	$IT = I_{RMS} \cdot TIF$ (eq. 6)	Calculated for voltage by replacing I_{rms} with kV_{rms}
Crest Factor	$CF = \frac{Max\ X_i}{X_{RMS}}$ (eq. 7)	X_i = Voltage or current at i^{th} sample in one cycle. Note that CF for sinusoidal wave is 1.414, not 1.0.

Summary of Power Quality Variations

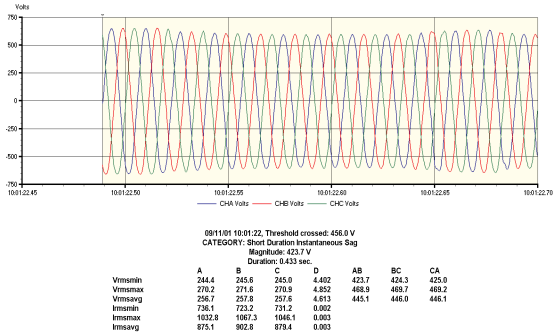
Transients
Oscillatory Transient
Impulsive Transient



Decaying Oscillation
Low frequency < 5 kHz
Med. frequency 5-500 kHz
High frequency > 500 kHz

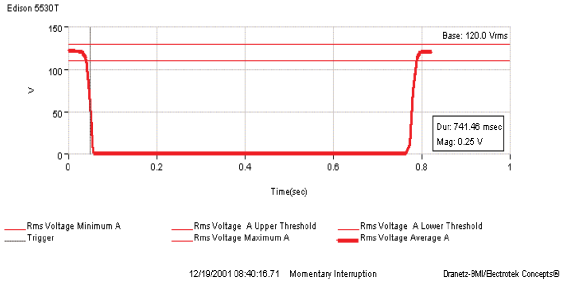
Unidirectional
Typical duration < 200 msec

Short Duration Variations
Sag



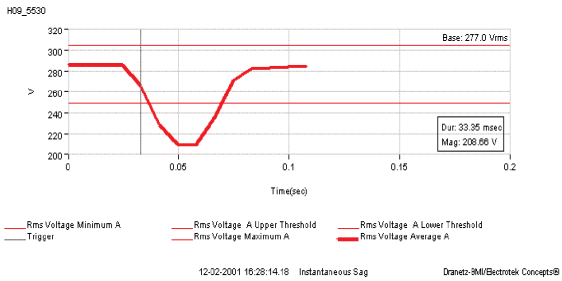
Instantaneous ½ - 30 cycles
Momentary ½ - 3 seconds
Temporary 3 sec - 1 min

Long Duration Variations
Undervoltage
Overvoltage



Duration > 1 minute

Interruptions
Momentary
Temporary
Outage

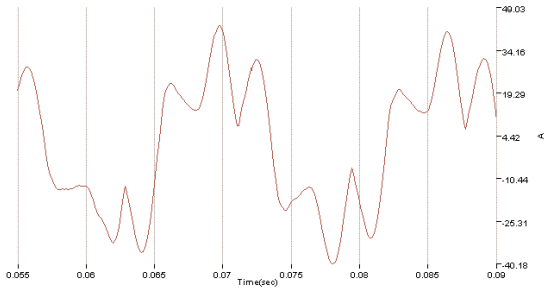


½ - 3 seconds
3 sec - 1 min
> 1 minute

Appendix B

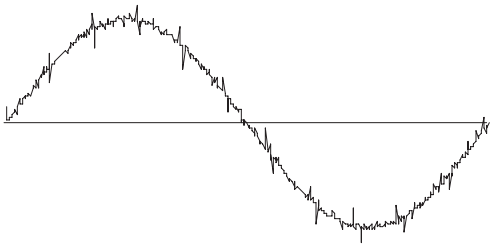
Summary of Power Quality Variations

Waveform Distortion
Harmonic Distortion



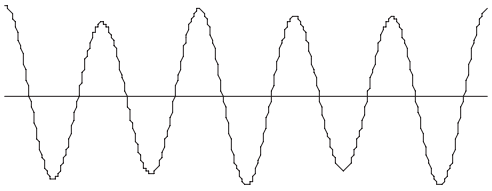
Continuous distortion
2nd - 49nd harmonic components

Noise



High frequency distortion
Broadband spectral components < 200 kHz

Voltage Fluctuations
Flicker



Intermittent magnitude variations
Frequency components < 25 Hz

System Parameters Affecting Power Quality and Diagnostic Evaluations

Category	Causes	Impacts
Impulses	• Lightning	• Transformer failures • Arrester failures • Customer equipment damage due to low-side surges
Low frequency transients	• Capacitor switching	• Tripping of ASDs and other sensitive equipment • Voltage magnification at customer capacitors
Medium frequency transients	• Traveling waves from lightning impulses • Capacitor and circuit switching transients	• Failure of customer equipment (transient is coupled to customer system through transformer winding capacitances)
High frequency transients	• Switching on secondary systems • Lightning-induced ringing • Local ferroresonance	• Radiated noise may disrupt sensitive electronic equipment • High rate of rise oscillations may cause low voltage power supplies to fail
Voltage sags	• Local and remote faults	• Dropouts of sensitive customer equipment
Voltage swells	• Single-line-to-ground faults	• Equipment overvoltages • Failure of MOVs forced into conduction
Long duration voltage variations	• Load switching • Capacitor switching • System voltage regulation	• Problems with equipment that require constant steady-state voltage
Harmonics	• Nonlinear loads	• Misoperation of sensitive equipment • Capacitor failures or fuse blowing • Telephone interference
Voltage flicker	• Arc furnaces and other intermittent loads	• Lighting flicker • Misoperation of sensitive loads

Protocols Supported for InfoNode and DataNodes

EPQ DataNodes	Internet Communication Protocols/Ports		
HTTP	port 80	normal web requests, replies, file transfers, XML	server only
FTP	port 20 and 21	firmware update	client only
SNTP	port 123	time synchronization	client only
TELNET	port 23	remote management	server only
SMTP	port 25	email protocol	
SYSLOG	port 514	debug logging	slave only
ModBUS/TCP	port 502	ModBUS over TCP/IP	slave only
ISO/TCP	port 102	RFC 1006 ISO protocol over TCP/IP	for MMS protocol
WPT Private	port 38642	cross trigger protocol	
WPT Private	ports 38643 and 38644	discovery protocol	

EPQ DataNodes	High Level/Non-Internet Protocols and Formats		
UCA GOMSFE 0.9 over MMS/TCP		primary InfoNode to DataNode communication protocol	
COMTRADE		event capture format converted to PQDIF in InfoNode	create only

InfoNode	Internet Communication Protocols/Ports		
HTTP	port 80	normal web requests, replies, file transfers, XML	server only
FTP	ports 20 and 21	firmware update	client/server
ISO/TCP	port 102	RFC 1006 ISO protocol over TCP/IP	for MMS protocol
SNTP	port 123	time synchronization	client and server
SYSLOG	port 514	debug logging	client and server
SMTP	port 25	email protocol	

InfoNode	High Level/NonInternet Protocols and Formats (dependent on installed handlers)		
UCA GOMSFE 0.9 over MMS/TCP		primary InfoNode to DataNode communication protocol	
COMTRADE		event capture format converted to PQDIF in InfoNode read only	
IEEE 1159.3		PQDIF primary data storage and exchange format	
XML		used for HTTP based information transfer between InfoNode and client software	
Advantech ADAM	RS232 & RS485	serial protocol	master only
ModBUS	RS232 & RS485	serial protocol	master only
MetOne	RS232	proprietary protocol for meteorological stations	master only
DBMI 7100	RS232 & RS485	proprietary serial protocol	master only
ANSI C18.12	RS232 & RS485	metering protocol	master only
TAP		pager modem protocol	

Signature System Network Capabilities

The Signature System uses industry standard TCP/IP network communication. The Signature System is configurable to work with most popular network addressing schemes, including Classes A, B, and C. Most company local area networks or LANs utilize the Class C addressing scheme. Class C is also well suited for small stand-alone networks. For these reasons, the factory default and the shipped network settings of the Signature System makes use of the Class C addressing scheme.

For proper operation, the addressing scheme of the Signature System devices must match the addressing scheme of the network to which they are connected. For example, you cannot mix Class C and Class B hosts on the same physical network.

Description of Networking Classes

IP Addressing

An IP address is a 32-bit number, usually represented in a dotted decimal notation
(i.e. 146.34.47.24), which uniquely identifies every host connected to an internet network.

Each field between the periods is an 8-bit number (called an octet), with values between 0 and 255.

The numbers 0, 127, and 255, however, have special meanings when they appear.
For an unknown address, Zeros are used, i.e. when a machine is requesting that a server assign to it an IP address.
When a machine refers to its own address, 127 is used. The terminology for this is loopback.
To broadcast a packet to every host on a local network, the value 255 is used.

Hosts use these addresses to send each IP packet along to its final destination. Routing is the process of deciding how a particular packet travels to its final destination.

There are several classes of IP addresses as defined by the IETF (Internet Engineering Task Force):
Class A - very large networks
Class B - large networks
Class C - small networks
Class D - multicast
Class E - reserved future use

There are two parts to an IP address. Where the division takes place depends on the network class. The first part of the address is the network address; the remaining part is the host address.

Class A

Class A is for very large networks. The first octet is of the form 0xxxxxxx, which means it can range from 1 to 126. Networks of this type use only the first octet as the network address. This means there can only be 126 Class A Networks. The remaining portion, the next 3 octets or 24 bits, form the host address. This allows 16,194,277 computers on a Class A network. An example of a Class A IP Address is 10.0.0.0, with a Subnet Mask of 255.0.0.0.

Class B

Class B is for large networks. It is common for universities to have Class B addresses assigned to them. The first octet has the form 10xxxxxx, which can range from 128 to 191. The definition of network address for Class B is the first two octets, which allows 16,382 Class B networks. The last two octets form the host address, allowing 64,009 hosts (remember that 0, 127, and 255 cannot be used) on each Class B network. An example of a Class B IP Address is 129.10.0.0, with a Subnet Mask of 255.255.0.0.

Class C

Class C is for small networks, where the first octet is of the form 110xxxxx, which can range from 192 to 223. The network address consists of the first three octets, allowing 1,984,279 different Class C networks with only 253 hosts per network. An example of a Class C IP Address is 192.168.1.0, with a Subnet Mask of 255.255.255.0.

Other Classes

The IP specification states that addresses whose first octet have the form 111xxxxx are 'extended' addresses, reserved for future use. Since the first three classes were defined, Class D, Multicast, was added to the list.

The Internet Assigned Numbers Authority (IANA) has reserved the following three blocks of the IP address space for private networks:

Class A	10.0.0.0	- 10.255.255.255 (10/8 prefix)
Class B	172.16.0.0	- 172.31.255.255 (172.16/12 prefix)
Class C	192.168.0.0	- 192.168.255.255 (192.168/16 prefix)

Note that by definition, these test network addresses are not routable on the Internet.

Glossary

Amp, Ampere
The quantitative unit measurement of electrical current.

Angle between Phases
The phase angle between the Phase Fundamental Voltage and Current at power line Frequency.

Apparent Phase Power
RMS voltage * RMS current on per phase basis.

Average DPF
Arithmetic average of each phase displacement power factor.

Current
The flow of electricity in a circuit as expressed in amperes. Current refers to the quantity or intensity of electrical flow. See *voltage*.

Deadband (or Sensitivity)
A value programmed as an incremental/decremental threshold from the last deadband value that would be recorded as an event, making it the new value to be compared with.

Delta
A type of connection in a three-phase circuit, often the primary side of a transformer. A delta connection may or may not have a neutral conductor.

Demand Interval
Time interval used for the power demand values to be calculated. The values are updated every sub-interval.

Demand Sub-interval
An interval less than the demand interval, equal to the demand interval divided by an integer value. Demand calculations are made every sub-interval, on the values that occured during the most recent Demand Interval. Values become valid after the first Demand Interval has expired.

Displacement PF
Cosine of angle between fundamental frequency voltage and current on a per phase basis.

Distortion
An abnormal waveshape.

Distribution
Outside the building, distribution refers to the process of routing power from the power plant to the users. Inside the building, distribution is the process of using feeders and circuits to provide power to devices.

Fixed Base
A fixed nominal value that is used with the limits in percent.

Floating Base
The nominal value is the average value over the specified update interval.

Frequency Deviation
A change in the power frequency lasting from several cycles to several hours.

Ground
The point at which other portions of a circuit are referenced when making measurements. Power systems grounding is that point to which the neutral conductor, safety ground, and building ground are connected. This grounding electrode may be a water pipe, driven ground rod, or the steel frame of the building.

High Limit
Set point or threshold above the normal range.

High-High or Very High Limit
Set point or threshold above the high limit.

Hz, Hertz
The frequency of alternating current. The term Hertz is synonymous with cycles per second.

Harmonic
A frequency that is a multiple of the fundamental frequency. For example, 120 Hz is the seond harmonic of 60 Hz, 180 Hz is the third harmonic, and so forth.

Harmonic Distortion
Excessive distortion in the voltage or current waveform that introduces harmonic frequencies. Harmonic distortion can be caused by electronic loads drawing current in non-sinusoidal waveshapes. It can shorten equipment life and cause serious safety problems by overheating transformers and conductors.

Hysteresis
An amount by which a threshold is altered to suppress disturbance graphs that would otherwise be triggered by small fluctuations in the measured signal. If hysteresis is used, the threshold is altered by the specific amount (equal to the hysteresis value) after an initial disturbance is triggered until the signal crosses the altered threshold.

Impulse
Instantaneous voltage deviation which may not affect rms voltage because of its short time duration. Impulses can be caused by loads switching on line, loose wires, lightning, static and power failures. Impulses can cause data disruption and equipment malfunction and damage. See *transient*.

Instantaneous or Crest Transient
The largest magnitude value in a cycle.

KHz, Kilohertz
1000 Hertz or cycles per second

Line
A current carrying conductor.

Line-to-Line
A given condition between conductors of a multi-phase feeder.

Line-to-Line values for wye circuits
Vab = Van - Vbn; Vbc = Vbn - Vcn; Vca = Vcn - Van

Line-to-Neutral
A given condition between a phase conductor and a neutral conductor.

Load
Any electrical device connected to a power source.

Low-Low or Very Low Limit
Set point or threshold below the low limit.

Low Limit
Set point or threshold below the normal range.

MHz, Megahertz
One million Hertz or cycles per second.

Negative Sequence
The three phase vectors that would make a motor rotate in the reverse direction. U_{2a} = 1/3 (Ua + a^2*Ub + a*Uc), where a* is the 120 degree vector operator, a^2* is the 240 degree vector operator.

Net Current
Vector sum of all phase currents, including neutral.

Neutral Conductor
One of the conductors of a three-phase wye system. Sometimes called the return conductor, it carries the entire current of a single-phase circuit and the resultant current in a three-phase system. The neutral conductor is bonded to the ground on the output of a three-phase delta wye transformer.

Peak
The maximum instantaneous measurement of an electrical event.

Peak Detected Transient
High frequency deviation from low frequency or normal sine wave value in either the positive or negative direction that exceeds programmed limits.

Periodic Reading Interval
Time interval used to periodically record the parameter for trending or time plots.

Phase
The timing between two or more events tied to the same frequency.

Phase Balancing
The practice of placing equal electrical loads on each leg of a three phase system. See *balance* and *neutral conductor*.

Phase Shift
The displacement in time of one periodic waveform relative to other waveforms.

Positive Sequence
The three phase vectors that would make a motor rotate in the positive direction. U_{1a} = 1/3 (Ua + a*Ub + a^2*Uc), where a* is the 120 degree vector operator, a^2* is the 240 degree vector operator.

Power
The capacity for doing work. In the electrical environment, this is usually measured in watts.

Power Factor
Watts divided by volt amperes, or the ratio of actual power to apparent power.

Power Factor - (true PF)
Watts divided by Volt-amperes on per phase basis (except delta) and total values.

Power Factor Displacement
The ratio of the power of the fundamental wave, in watts, to the apparent power on the fundamental wave, in volt-amperes.

Power Quality
The concept of powering and grounding sensitive electronic equipment in a manner that is suitable to the operation of that equipment.

Primary
The input winding of a transformer.

Reactive Phase Power
Volt ampere reactive power for individual phases.

Residual Current
Vector sum of phase currents (not including neutral).

RMS, Root Mean Square
The square root of the arithmetic mean of the squares of a set of electrical amplitudes.

RMS Sag
Low RMS voltage or current excursions below some programmed threshold. Motor starts and faults on the utility system are two common causes of sags. Sags can cause loads to turn off and reset circuits to operate unexpectedly.

RMS Swell
High RMS voltage or current excursions above the programmed threshold. Swells can be caused by voltage regulation problems, removing loads from the system, or adding loads with stored energy. Swells can damage equipment or disrupt electronic loads.

RMS Variation
RMS voltage excursions exceeding some programmed threshold. See *RMS sag* and/or *RMS swell*. A change in square root of the sum of samples squared divided by number of samples (128) that crosses limit.

Sag
A short term RMS voltage decrease that exceeds an established lower limit.

Secondary
The output winding of a transformer.

Sequence Imbalance
Negative sequence component divided by positive sequence.

Single Phase
Portions of a power source that represents only a single phase of the three phases that are available.

Sinusoid
A sine wave.

Surge
See *swell.*

Swell
A short term voltage increase that exceeds an established upper limit.

THD, Total Harmonic Distortion
A percentage describing how much a measured waveform differs from an ideal sine wave.

Total
The phases used in computing the totals depend on the wiring configuration and parameter. Typically, wye and delta configurations use the three individual phases, except for power related, which use the IEEE 1459 equivalent wye method.

Three Phase
An electrical system with three different voltage lines or legs each carrying sine waves that are 120 degrees out of phase from one another.

Threshold
The point within which the measured parameter is said to be within tolerance.

Total Apparent Power
Square root of (total WATTs squared + total VARs squared).

Total Arithmetic True PF
Total Real Power divided by Total Arithmetic Volt-Amperes.

Total Arithmetic VA
Arithmetic sum of individual phase volt-ampere values.

Total Fundamental Arithmetic VA
Arithmetic sum of the volt amperes of the fundamental frequency components of each phase.

Total Fundamental Vector VA
Square root of (fundamental frequency component of WATTs squared + fundamental VARs squared).

Total Power
Arithmetic sum of phase Watts.

Total Reactive Power
Arithmetic sum of phase VARs.

Total Vector VA
Square root of (total WATTs squared + total VARs squared).

Transformer
A device used for changing the voltage of an AC circuit and/or isolating a circuit from its power source.

Transient
A subcycle disturbance in the AC waveform that is evidenced by a sharp, brief discontinuity of the waveform. May be of either polarity and may be additive to or subtractive from the nominal waveform.

Trend
A plot of an event characteristic versus time.

True PF
Total Real Power divided by Total VA.

True Phase Power or Real Power
Measured in watts, of each phase, calculated over 1 second from cycle-by-cycle power values (voltage sample * current sample). Not valid for delta configurations.

Volt
The quantitative measurement of electrical force or potential also called electromotive force.

Voltage
The force of electricity in a circuit as expressed in volts. It is the measure of work it takes to move a charge through a circuit.

Waveform
The graphic form of an electrical power.

Waveshape Fault
A cycle-to-cycle change in the voltage waveform characteristic. A waveshape fault may not be large enough or fast enough to have impulse characteristics, and at the same time, may not add or subtract significantly from the voltage to create a sag or swell. Waveshape faults can be caused by loose wiring, switching between two power sources, etc. Waveshape faults can cause damage and disruption to all types of loads.

Worst Displacement PF
Displacement PF of phase with largest deviation from 1.

Worst PF
True PF of the individual phase with largest deviation from 1.

Zero Sequence
U_{0a} = 1/3 (Ua + Ub + Uc).

F Appendix

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