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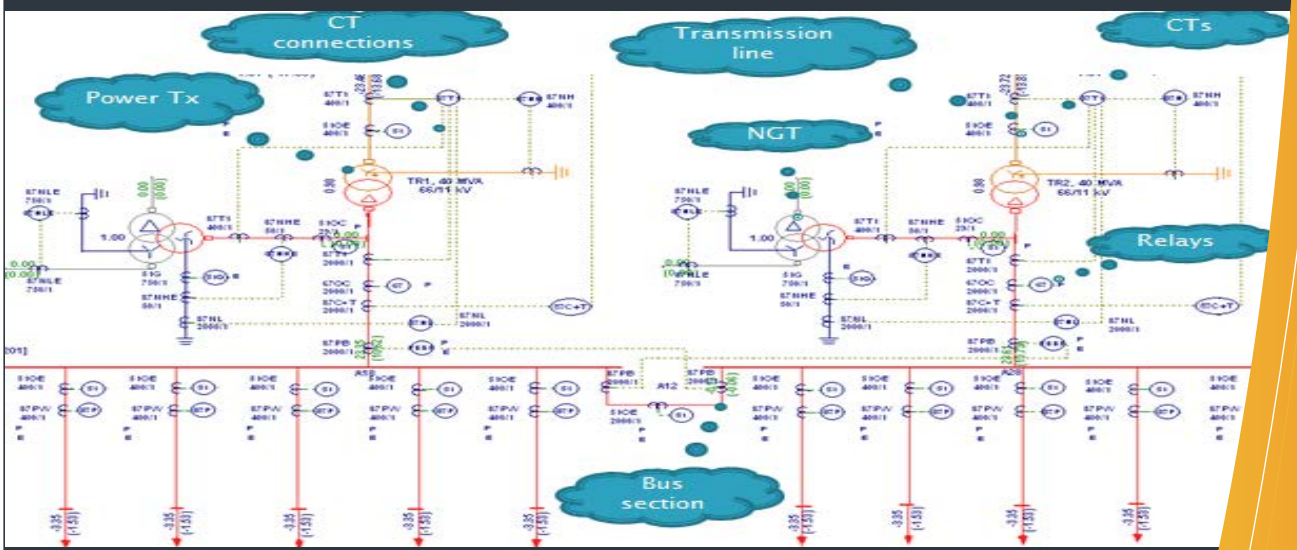
MiProtection

Protection Simulation's and Management Software



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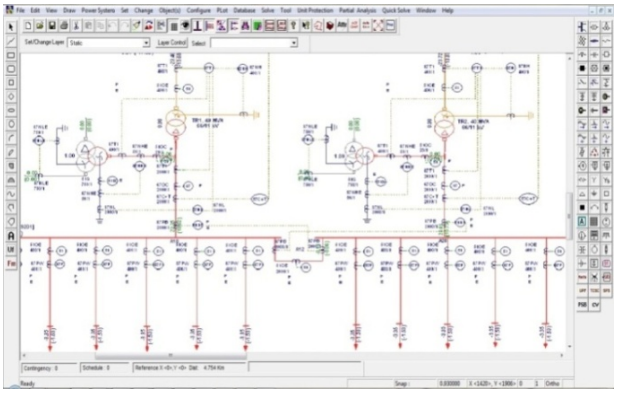
MiProtection

Power System Protection & Simulation Software Package

INTRODUCTION

MiProtection is highly interactive, user-friendly windows based Power system protection analysis package. It includes a set of modules for performing a wide range of power system protection studies including both equipment protection and system protection and other system studies. MiProtection features include a top notch Windows GUI.



PROTECTION SYSTEM MODELLING

- Standard power system components and relay symbols.
- Association of relays to power system elements.
- Switching status for all relay elements from the screen.
- Highlighting of relay operational sequence after the analysis.
- Display of sequence operation of relays with respect to tripping time.
- Display of fault on the SLD with standard notation after fault creation.
- Disturbance analysis with single click on mapping of disturbance files with corresponding relay.

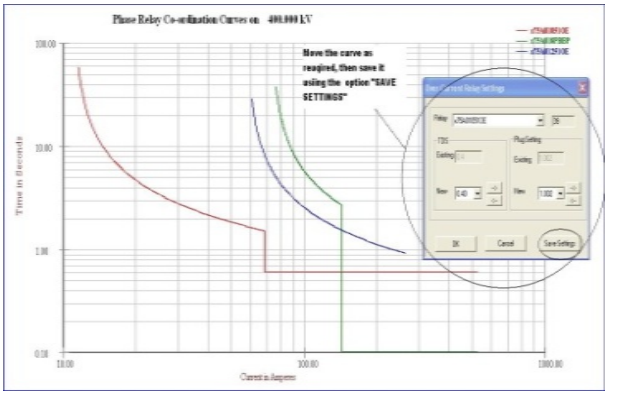
RELAY DATABASE UTILITY

- Enhanced database creation including detailed modeling of all relay elements with standard libraries.
- Splitting of database into two groups – element information and library information - avoids repetitive entry of power system elements having same parameters.
- Studies at your fingertips - once relay database is created accurately; protection study can be conducted.
- Toggling facility - database to network editor, data base to graph to facilitate easier navigation.

ANALYSIS

- Modeling of phase and earth over-current relays with NI, VI, RI, EI & DT characteristics.
- Modeling of phase to phase and phase to earth loop characteristics of distance relays.
- Over current Relay Coordination (ORCD) and Distance Relay Coordination (DRCD) modules can be used for verifying the validity of existing settings of over-current and distance relays. Also, these modules can be used to generate new settings for over-current and distance relays respectively.
- Visualisation and co-ordination of over-current relays using the graph plotter facility.
- Modeling of unit protection schemes such as differential protection for transformers, lines/cables and busbar and restricted earth fault protection and verification of settings.

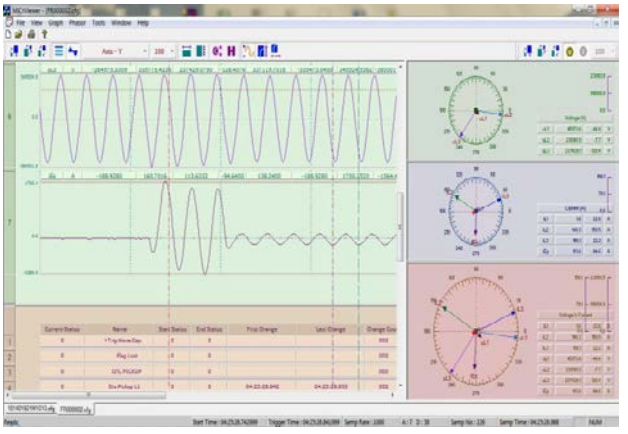
GRAPH PLOT



Also, these modules can be used to generate new settings for over-current and distance relays respectively.

- Visualisation and co-ordination of over-current relays using the graph plotter facility.
- Modeling of unit protection schemes such as differential protection for transformers, lines/cables and busbar and restricted earth fault protection and verification of settings.
- Log and semi log view for relay coordination and setting graphs.
- Horizontal and vertical movement of relay curves as per the predefined steps.
- Pick drag and drop facility for relay curves.
- Changing the base voltage of the plotted graphs.
- Coordination of relays from graph itself to the desired value.

COMTRADE VIEWER



- Used for viewing the COMTRADE files of the Disturbance Recorder (DR) data received.
- Facilitates to view vector diagrams of voltages and currents of the DR data.
- Selected interval view of a particular file.
- Selected disturbance view of a particular relay.
- Harmonics present in disturbance record can be viewed in tabular form.

Protection Coordination

INTRODUCTION

Relay Co-ordination can be conducted for relays of all make and with user defined characteristics for over current and distance relays. Various simulation options are available. Provides new relay settings for improved performance and compute zone settings for Distance Relays.

FEATURE HIGHLIGHTS

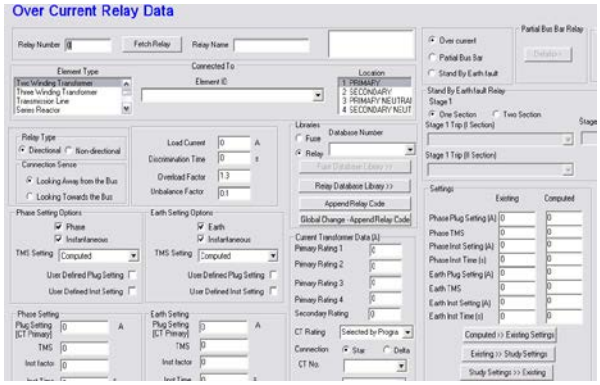
- Radial and Mesh Networks
- Automatic/Interactive/Manual Primary-back-up relay pairs generation
- Save and retrieval of selected relay pairs
- Embedded fault calculation
- Phase and earth relay co-ordination
- Optimum setting for motor relays
- Hot and cold curves considered / Extensive database of relays
- Extensive fuse data / Easy adding of new relay to library
- Graphical co-ordination Pick, drag and drop relay curves
- Verification of existing relay settings
- Fault simulation and relay trip sequence
- Text and graphical output / Thermal curves for each equipment
- Optional voltage input from load flow or flat start
- Overload factor; unbalance factor and discrimination time for each relay
- Inbuilt discrimination time calculator

OVER CURRENT CO-ORDINATION

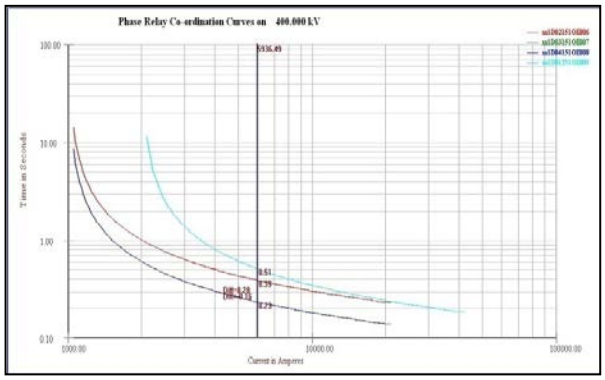
- Phase relay coordination
- Earth relay coordination / Standby earth fault
- Partial busbar protection simulation / Fuse coordination
- Instantaneous setting for relays
- Directional and non directional feature for relays
- Pre-loaded standard relay curves
- Normalized curve and fault line feature
- View existing and newly computed relay settings simultaneously
- Partial analysis for selected relays / Quick solve

DISTANCE RELAY CO-ORDINATION

- Phase relay coordination
- Automatic computation of zone setting
- Standard relay characteristics (example: mho, circular, etc.,)
- View existing and newly computed relay settings simultaneously
- Impedance seen by the relay for faults
- Quick solve

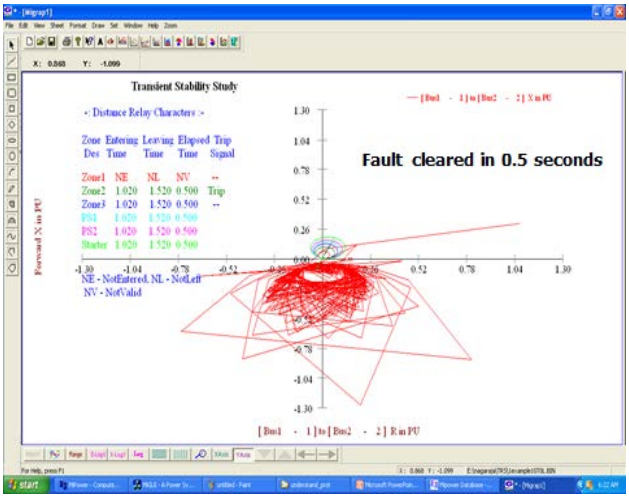


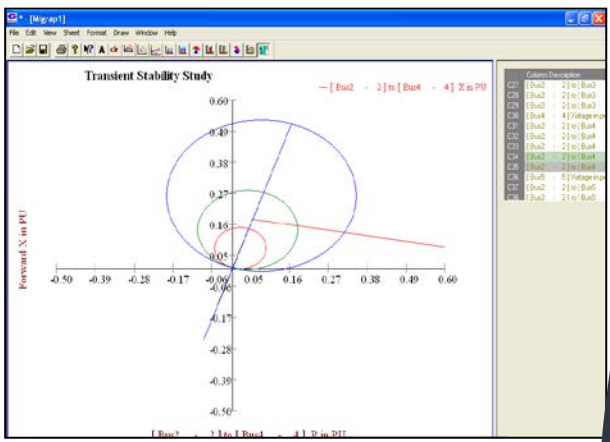
OVER CURRENT RELAY DATA



FAULT LINE

DISTANCE RELAY DATA





TYPICAL GRAPH FOR DISTANCE RELAY

Equipment Protection

INTRODUCTION

A unit protection system involves the measurement of fault currents (and possibly voltages) at each end of the zone, and the transmission of information between the equipment at zone boundaries. Protection schemes such as differential protection (for transformers, lines, busbar etc) and distance protection (for lines) are employed to achieve equipment protection. The following types of protection schemes are available in MiProtection.

- Transformer differential
- Restricted earth fault
- Line pilot
- Bus bar differential
- Line/cable differential
- Distance protection

TRANSFORMER DIFFERENTIAL

A transformer differential protection compares the current flowing to the transformer with the current leaving the transformer.
Power transformers introd often not only a change magnitudes of voltages currents but also a change phase angle. These effects m be considered in obtaining correct analysis of fault conditi by the differential protection.

- Choice of relay library based on the manufacturer
- User defined bias slope setting
- Provision to enter CT details for 2 winding and 3 winding transformers
- Provision to enter existing relay settings
- Program computed transformer differential settings

RESTRICTED EARTH FAULT

Restricted earth fault (REF) relay is a unit protection intended for one winding of a transformer (neutral winding) the input of which is from a neutral bushing CT and in some applications, balanced by the output of three line CTs in the Y-winding directly connected to neutral. This provides accurate sensing of zero-sequence leakage for a fault within its zone of - protection, i.e., on the windings.

REF relay in MiProtection has:

- Choice of relay library based on the manufacturer.
- User choice of current or voltage setting
- Provision to enter normal and sensitive current setting range details.
- User choice of voltage setting details in % or volts.
- Program computed stabilizing resistance value.
- Program computed current/voltage settings.

LINE PILOT

Pilot relaying is an adaptation of the principles of differential relaying for the protection of transmission-line sections. For faults occurring within the protected feeder it is desirable to trip the circuit breakers at each end to isolate the fault. A pair of pilot wire is used to transmit information between the two relays so that each may be able to compare the current flowing at its respective end with current at the other end

- User defined Line Pilot relay characteristics
- Choice of pilot wire voltage (either 5 or 15 kV)
- Choice of loop resistance between measured and computed
- Provision to input isolation transformer data
- Provision to input CT data
- Padding resistance as a computed output

BUS BAR DIFFERENTIAL

Busbar protection is primarily concerned with speedy isolation of busbar faults in less time than could be achieved by back-up line protection, with the twin objective of maintaining system stability and limitation of consequential damage

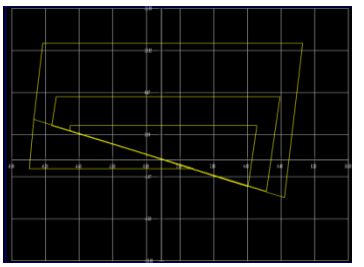
- Provision to enter relay details like max, min and step values of current in %.
- Provision to enter relay details like max, min and step values of alarm in %.
- Provision to enter relay details like max, min and step values of time in seconds.
- Variable resistor values: enter minimum, maximum and step values
- Provision to input pick up characteristics data for minimum, maximum and step details for over current setting in %, stabilizing factor (selective), stabilizing factor (check zone) and Time in ms.
- Provision to view computed and existing stabilizing resistance simultaneously

LINE/CABLE DIFFERENTIAL

The line cable differential function offers phase-segregated true current differential protection for transmission, sub-transmission and distribution networks. The function compares the currents entering and leaving the protected overhead line or cable.
Provision to include the influence of second harmonic inrush current.

- User defined values for minimum, maximum and step values in % for differential set, switch on, high set and 2nd harmonic restraint.
- Provision to view computed and existing settings simultaneously

LINE/CABLE DIFFERENTIAL



MiProtection offers a graphical tool, MiPContour, using which distance relay characteristics can be created. User can create characteristics library as per the relay settings by using this tool. Various types of characteristics followed in distance relays of different makes can be drawn and used for analysis.

MiPContour has the following features:

- Concept of layer for defining zones of operation.
- Facility to enter co-ordinates.
- Ability to draw shapes such as rectangle, square, circle, polygon and poly arc.
- Option to create separate library for phase and earth.
- Option to enter the characteristics on primary or secondary side of CT/CVT.

System Protection

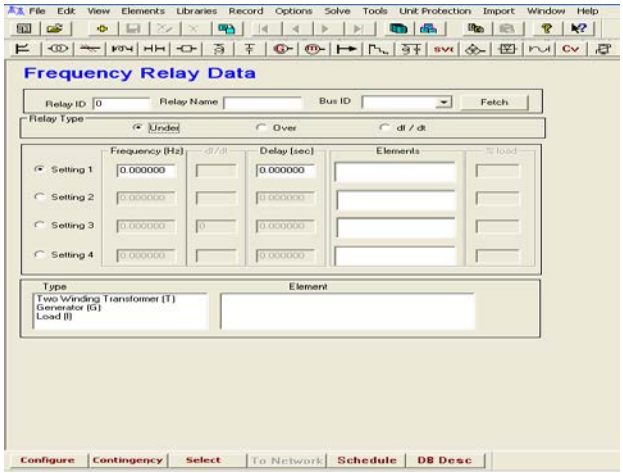
INTRODUCTION

In an Industrial Plant, during normal system operation the in-plant generators operate in synchronism with the grid. The power flow balance is maintained by either importing or exporting power to the grid. However, during severe system disturbance, the frequency and / or the voltage of the grid might violate the safe operating limits of the in-plant generators and load, thereby resulting in plant black out due to tripping initiated by generator protection. Further, loss of grid lines will result in either frequency or voltage related issues, depending on pre disturbance condition.

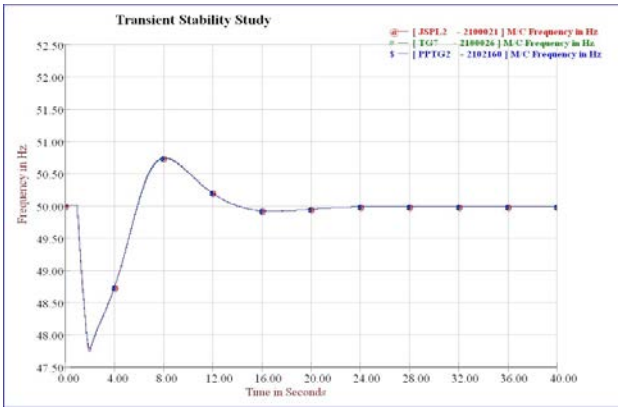
In order to avoid black out of the plant's sensitive loads and generators, grid islanding scheme needs to be developed, which can sense such severe grid disturbance and isolate the sensitive section from the non-sensitive one. Also in order to maintain the load generation balance, frequency dependent load shedding and generator tripping scheme (if necessary) needs to be developed.

A similar analogy can be drawn to a utility network too.

FREQUENCY RELAY

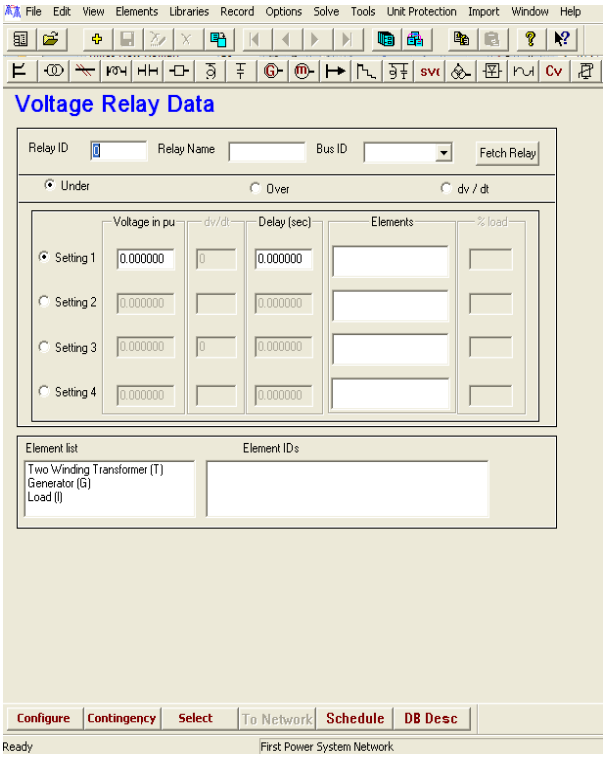


In a power system, during pre-disturbance condition if the net sensitive load is greater than the net sensitive generation, the resulting frequency, post islanding will drop below the nominal value (50/60 Hz) and the vice-versa. In order to prevent the frequency to fall below a certain value, load shedding needs to be undertaken. This is done based on the quantum of power mismatch and the priority of loads to be shed.

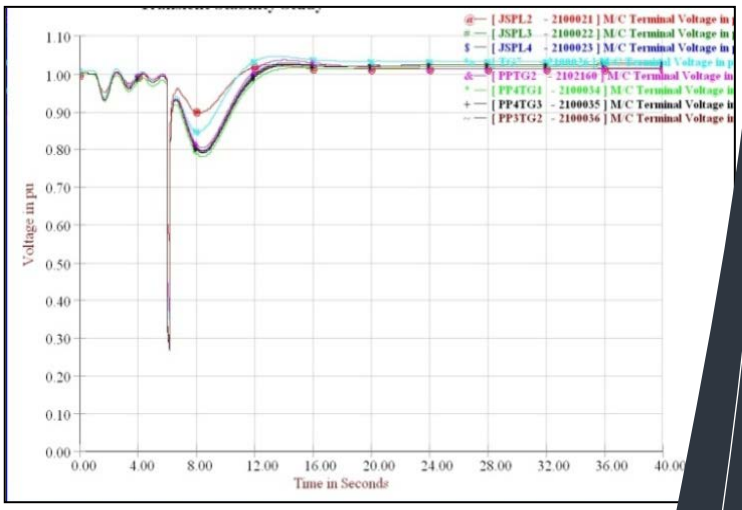


- User defined under frequency setting
- User defined over frequency setting
- User defined rate of change of frequency (df/dt)
- Choice of tripping any element in the power system network based on the frequency relay setting
- Provision to define up to four tripping settings

VOLTAGE RELAY

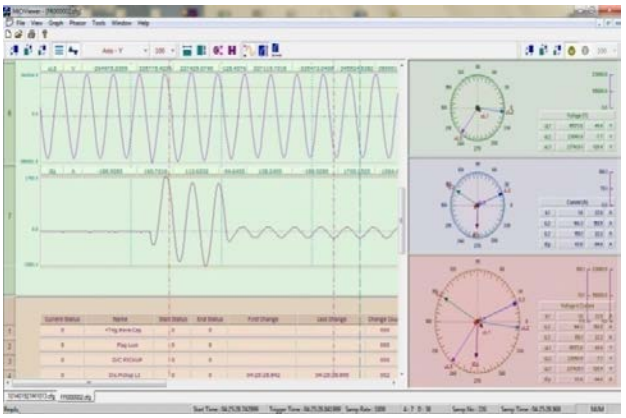


- User defined under voltage setting
- User defined over voltage setting
- User defined rate of change of voltage (dv/dt)
- Choice of tripping any element in the power system network based on the frequency relay setting
- Provision to define up to four tripping settings



MiCtViewer

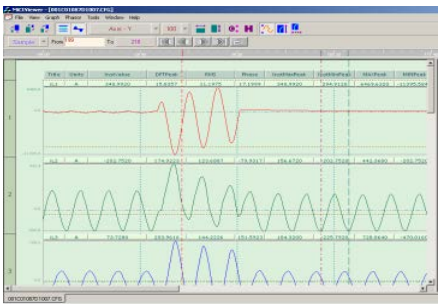
INTRODUCTION



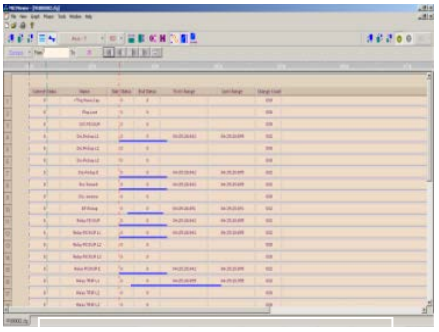
Disturbance Records stored in numerical relays following a disturbance have proven to be very useful for power system engineers in the departments of operation, maintenance and protection. Normally, these disturbance records (DRs) are stored in COMTRADE format, a standard defined by IEEE for ease of data transfer between various disturbance recording sources and analytical tools. MiCtViewer is developed in order to view and analyse DRs in COMTRADE format.

MiCtViewer allows the user to analyse the disturbance records in both numerical and graphical ways. The COMTRADE viewer reads the .cfg file and .dat file for the inputs and it displays the samples both in numerical as well as graphical format. The data display offers a high-resolution graphical interface for displaying, analyzing and manipulating analog and digital channels of an oscillographic record or a periodic load file. Displayed channels can be marked, zoomed, numerically processed and summarized. Several features such as comparison of channels, merging of files, correction of time, resampling, harmonicsetc are also provided in this module. MiCtViewer also provides facility for user to filter the channels necessary for analysis.The data is displayed for both analog and digital channels. User has the option to select or de-select the particular channels. MiCtViewer can also generate report on the browsed COMTRADE file.

ANALOG & DIGITAL PLOT

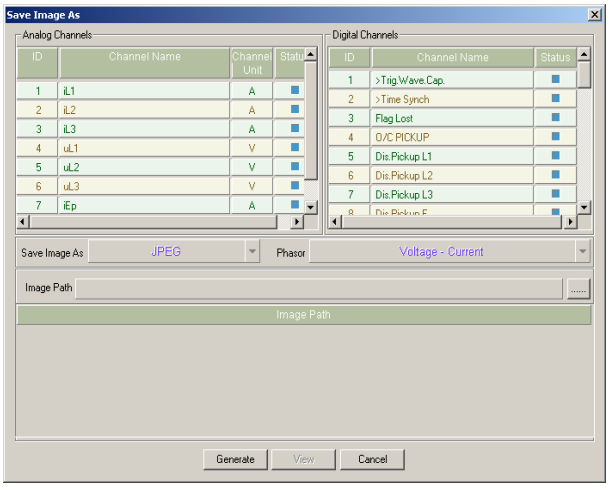


Analog Plot



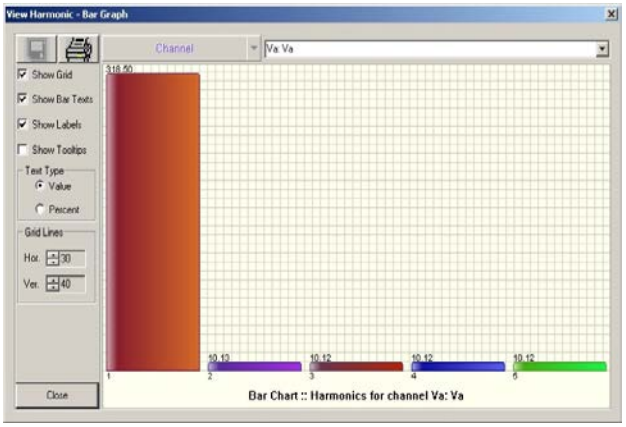
Digital Plot

GENERATE IMAGE – SAVE IMAGE AS



Save Image As: User can select the option to save the file into image format. The options available are .bmp and .jpeg.
Phasor: The options to select in the phasor window are None, Voltage, Current, Voltage andCurrent and all. Depending on the selection type the images are generated.

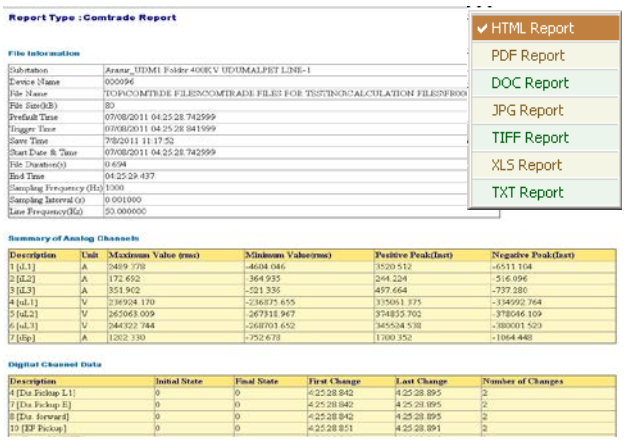
VIEW HARMONICS



- Computation of harmonics in the waveforms of analog channels.
- Harmonics upto the order of N/2 Hz (N -> Sampling frequency).
- Harmonics view in tabular form.
- Harmonics view in bar graphs.

MiCtViewer

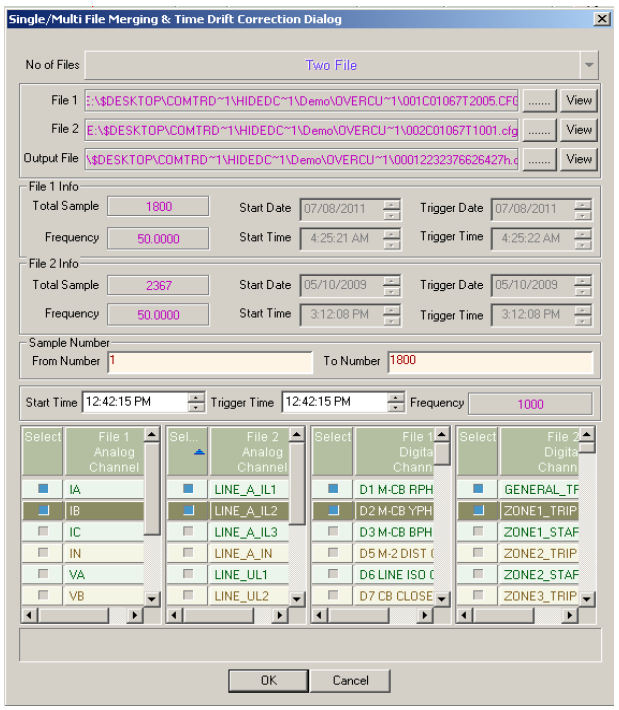
REPORT



The summary of the report includes:

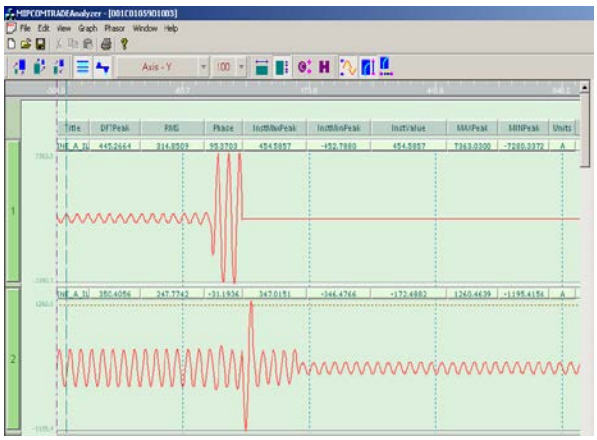
- File information
- Summary of analog channels
- Digital channel data
- Digital channel sequence events
- Images of analog, digital and phasor section
- Report Types: Multiple report types are available.

FILE MERGE



File merge tool allows users to modify existing COMTRADE files by removing unwanted channels, changing the sampling frequency and setting the start and end times. The result of this is a new COMTRADE file with filtered data which can be processed further for analysis.

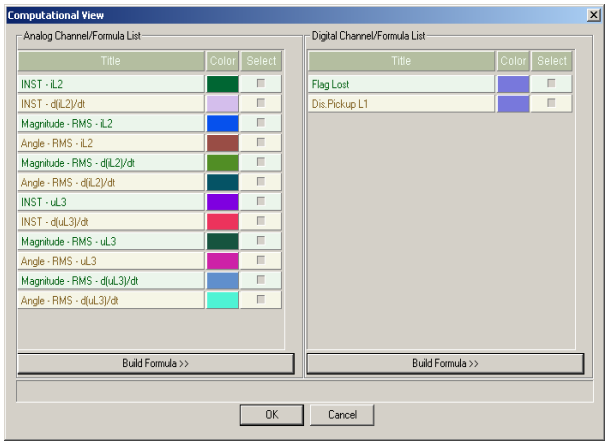
COMPARISON OF CHANNELS



The channels of interest can be selected and plotted for comparison. This can help the user to understand the type of disturbance and the various sequence of events occurred.

COMPUTATIONAL TOOL

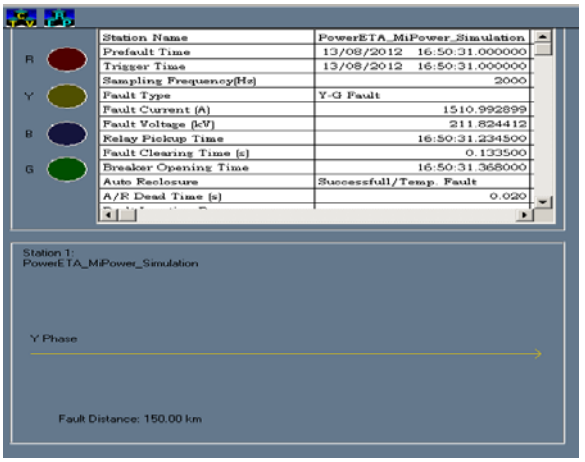
The calculation tool can be used for computation of basic electrical quantities such as active power, reactive power, impedance, rate of change of parameters etc from the voltage and current information. This feature allows the user to build the necessary functions and also plot.



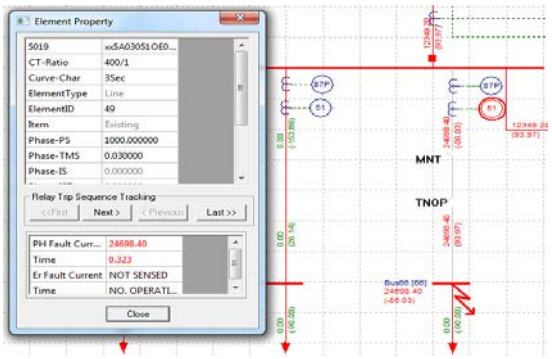
Post Mortem Analysis

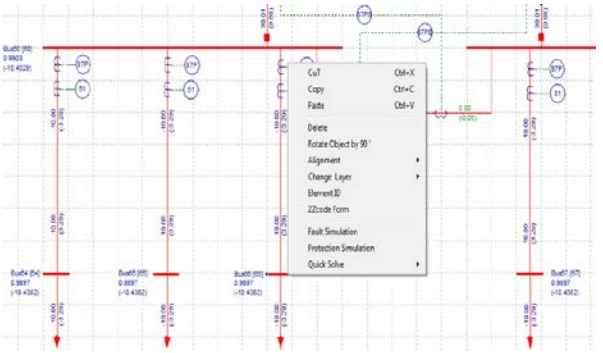
COMTRADE FILE ANALYSIS

This tool has been provided so that operators may simulate previous faults and verify protection settings and system behavior. A list of all recorded waveforms reported by a recording device is maintained so that users may choose from the list and simulate the event of their choice. Operators may check different relay settings and protection schemes before applying them to the field in order to maintain protection system reliability and prevent mal-operation. This tool also provides an opportunity for post mortem analysis of faults and re-submission of reports on faults that have already passed.



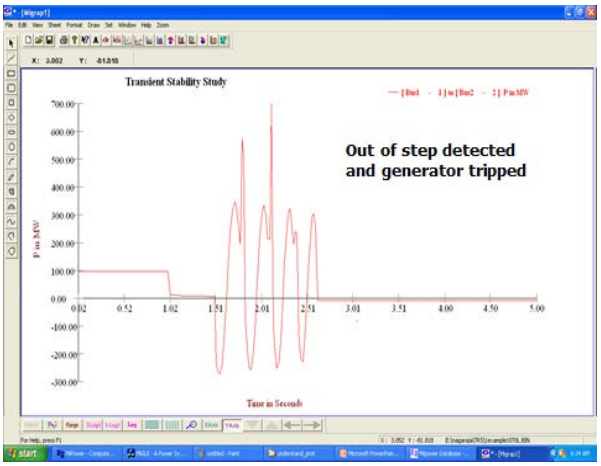
PROTECTION SIMULATION

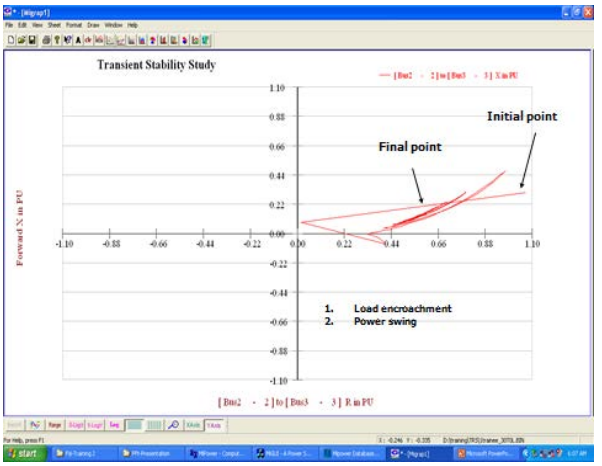




Protection simulation is a feature provided in MiProtection for observing the sequence of operation of relays when a fault is simulated in the system, after complete modeling of the system is carried out. Modeling of the system includes preparation of system Single Line Diagram (SLD) and database along with the relays. Protection simulation can then be performed by simulating faults at different buses (or lines, transformers) to analyze the sequence of operation of the relays which can give exact visualization of the primary and backup relays.

DYNAMIC STUDIES AND RELAY BEHAVIOUR





- Critical clearing time computation
- Voltage and frequency relay setting
- Power swing and out of step protection

An Indian Product of International repute

Power Research & Development Consultants Pvt. Ltd.

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