

Australian Protection Coordination Software - Raising Standards, Reducing Costs

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Sydney-based *DataShare Power Engineering Software's* most successful product is its electrical protection coordination software, *RELCORD/32 for Windows*. Wholly developed in Australia it is, naturally, well suited to the practices and equipment used in the Australasian region, yet it has also found acceptance much further a field, such as in the UK.

While many so-called "protection coordination" software packages are little more than curve plotting utilities, *RELCORD* has far higher levels of functionality than just this. It actually layers protection coordination capabilities onto a full-featured fault calculation program. It is this integration with the underlying network data of the fault calculation software that enables it to ... amongst other things ... suggest settings to the user to achieve wanted discrimination times, and to facilitate thorough testing of existing - or proposed new - protection settings!

A further benefit of this integration with the network model data is that its protection coordination analyses are inherently sensitive to the operating condition of that network model. So if you change the operating conditions of the network model eg. change source fault levels, parallel transformers, take a feeder out of service, etc. and then re-analyse the coordination, the reaction of the protection devices modelled on the network to the changed levels and distribution of fault current in the network is immediately revealed.

WELL PROVEN TECHNOLOGY

First released in a DOS version in the late 1980's, and then in a much improved Windows version in the mid-1990's, this software has been widely used and validated. Its licensed user base includes many electricity utilities (large and small), consulting engineers, the mining industry and a variety of other industrial users.

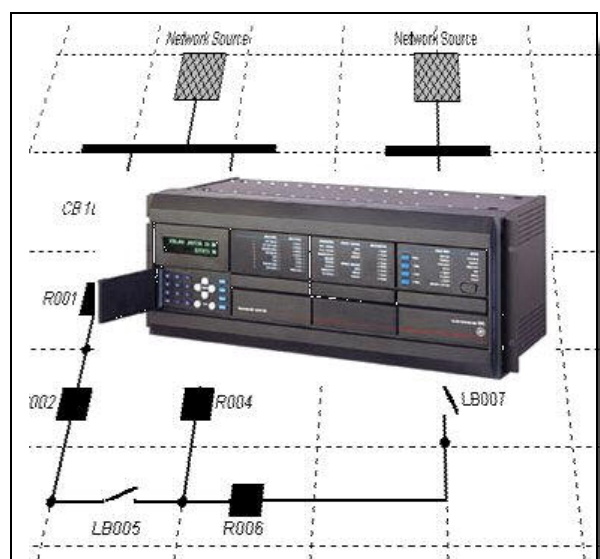
While the majority of these users are in Australia and New Zealand there are a number in other overseas locations even though there has been little overseas promotion other than in New Zealand.

RELCORD/32 for Windows models and coordinates over-current/ground-fault relays (primarily with inverse-time and definite time characteristics), HV & MV fuses, circuit-breakers, distribution line automatic circuit reclosers (ACR's), etc.

It has been successfully applied to protection coordination projects involving transmission, sub-transmission, distribution

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and industrial networks.

Fully meshed and radially operated networks are both equally well supported.

RAPID PAYBACK

The process of coordinating electrical protection devices can be a time consuming process demanding the meticulous attention of highly skilled and experienced personnel. With the use of such computerised tools such as *RELCORD/32 for Windows* the efficiency and effectiveness of the whole process is greatly improved. Also, much of the work can then be performed by relatively less-skilled and experienced staff.

It is not unusual for the value of time saved to return a full payback of the purchase price of the software after its use on just one, or two, medium-sized projects!

Further, the avoidance of an unwarranted power outage, or the successful limitation of the extent of the outage to the minimum section of the network needed to be switched off to isolate the fault can, in many cases, save far more than the initial cost of the software licence.

THOROUGH CHECKING OF SETTINGS MADE POSSIBLE

A special feature that enables a user to be much more thorough in evaluating settings - existing or proposed - is the “*Operating Time Check*” function.

This feature allows the users to quickly and easily test a range of contingency conditions. By more conventional methods great reliance has

to be placed on the judgement of the protection engineer to anticipate what conditions will most challenge the protection system. This is because other methods require so much detailed work to be done that it is not feasible to check every contingency.

The “*Operating Time Check*” function counteracts this practical limitation. In effect it allows the user to nominate **any type of fault** on the network, **under any operation condition** of the network, and to determine what will be the **operating time** for **any protection device** modelled on the network, **if any(!)**, for that particular fault.

It takes literally only a few minutes to check each contingency condition to see if the settings will provide proper selectivity and acceptable operating times. So it is no real burden to check a number of contingency conditions, including double, and even triple, contingencies to see that worse-case conditions are suitably protected.

SIMULATION OF IN-FIELD FAULTS

This same feature also allows faults that have occurred in the field to be simulated to see, for example, if some particular level of impedance in a fault might explain an unexpected operation of protection, or a failure of coordination.

Having exposed any such anomaly, it can then be used to determine what changes may be needed to the settings ... or even to the fundamental design of the protection system ... to adequately deal with that condition.

VENDOR INDEPENDENT DEVICE MODELLING

A library of protection device models is supplied with *RELCORD/32 for Windows*. This library includes specific device models, as well as templates that can be customised by users for their own particular needs.

Categories of devices modelled include:

- Relays (over-current and ground-fault), both electro-mechanical and numerical (microprocessor) types
- Motor Protection Relays
- Fuses (MV & HV)
- Low voltage circuit breakers (LVCBs)
- Distribution line automatic circuit reclosers (ACRs)

And the templates include:

- Cable damage curves (for a variety of underground and aerial cables)
- Motor start curves
- Standard relay types, etc.

Manufacturers represented include:

- Relays: ABB (BBC); Alstom (GEC); Beckwith; CEE ; GE (Multilin); Merlin Gerin; Nilsen; P & B Golds; VA-Tech Reyrolle; SEL; Siemens & Westinghouse.
- Motor Protection Relays: Amp-control; Multilin; Sprecher & Schuh.
- Fuses: ALM, Alstom (GEC); B&S; Brush; Bussman; EMP; Holec; S&C; Taplin, etc.
- LVCBs: Merlin Gerin; Terasaki & Westinghouse.
- Reclosers: Coopers (Kyle, Mc Graw Edison); NULEC & VA-Tech Reyrolle.

The list of available device models is continually increasing.

New additions are automatically available to users whose software is covered by the optional Software Maintenance and End-user Support service.

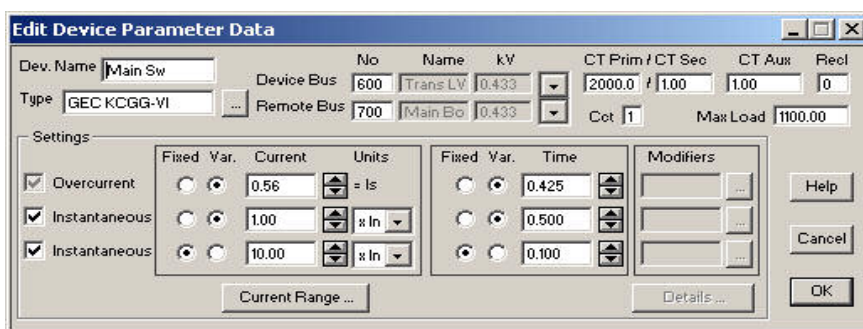


Figure 1. Protection Device Data dialog in RELCORD—note the fields on this dialog change depending on the type of device involved.

TIME-CURRENT PLOTS

Plots of time-current characteristics (TCCs) can be displayed on-screen, or output to any printer, or plotter, supported by Windows.

Plots of individual coordinated pairs of devices can be made, or a user-selected list of devices can be plotted as a group. This list can include “pseudo-devices” such as motor starting curves, cable damage curves, etc.

An option on the pairs plot is to include a third curve automatically generated that is the time margin between the primary and backup device curves over the current range that the two curves overlap. This enables the user to see-at-glance if coordination will be maintained at fault levels other than that at which the coordination was set.

When viewing on-screen plots, the user can click on the curve for any device to immediately access the device data dialog for that device (see Figure 1) and change any of the details (including device type, CT ratio, time or current setting) and on OK'ing the changes the user will see the screen plot updated to match the new details.

DEVICE MODELLING UTILITY

A utility program is provided as a standard part of the *RELCORD/32 for Windows* software package that allows the user to create new models of protection devices, or to edit existing models to suit their own particular needs. A number of modelling options are provided for to suit different tasks,

Relays conforming to the IEC/BS or ANSI standards - and those for which a formula describing the characteristic curve is published by the manufacturer - are directly represented (ie. without modelling) while others

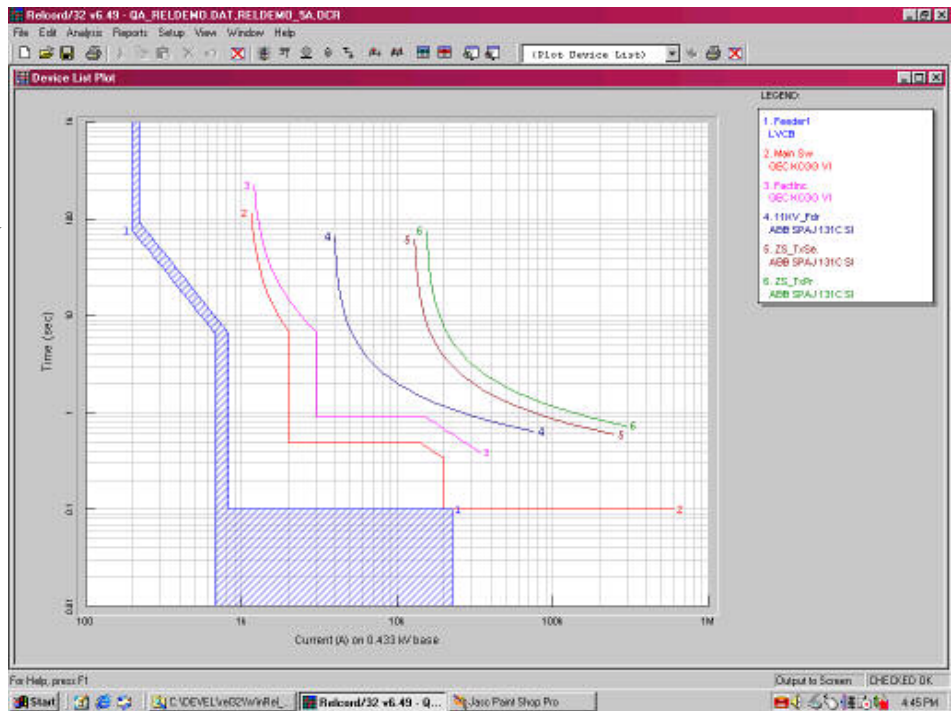


Figure 2. An example of an on-screen plot of a group of protection devices in *RELCORD/32 for Windows*.

can be modelled by various curve fitting options. For accurate modelling of electro-mechanical relays where, typically, the characteristic is not a true “template” across the range of available time settings, a special interpolating model is used.

SOFTWARE DEVELOPMENT & END-USER SUPPORT

All ongoing development of the *RELCORD* software is carried at DataShare’s Sydney offices.

New features are continually being added

- and improvements made - to the software. Many of these are the result of suggestion from users of the software.

Technical support for end-users is also provided from DataShare’s Sydney offices. Support is available directly by e-mail, phone or fax, or enquiries may be made through DataShare’s internet web-site.

An initial period of Software Maintenance and End-user Support is automatically provided to purchasers of the software. At the end of this initial period, the user has the option of

subscribing annually to a continuation of this service.

END-USER TRAINING

DataShare can provide end-user training on the software, if required. If suitable training facilities are available, the training can, optionally, be provided on-site. This often allows more personnel to be trained to use the software than if external training is used.

The structured training program concentrates on the practical aspects of applying and using the software but, where appropriate, it can - if the client chooses - include a session reviewing basic principles.

IDEAL TRAINING TOOL

RELCORD is an ideal training tool for design, maintenance and operating personnel.

It allows the user to test the performance of the protection under a variety of conditions and helps them appreciate the effect that the operating condition of the network can have on protection effectiveness.

It also provides them with a benign

environment in which they can test out possible changes to the protection system.

OTHER DATA SHARE SOFTWARE PRODUCTS

Other software products available from DataShare Power Engineering Software include:

- **POWSYS/32 for Windows** - Load Flow Analysis software - assessment of network voltages and power flows and losses under normal operating conditions.
- **FAULT/32 for Windows** - Fault calculation software, including assessment of symmetrical and asymmetrical faults (note that this software is an integral part of the *RELCORD/32 for Windows*).
- **ProtectionDB** - a customised database for storing data, including setting details, about protection devices
- **LVDROP for Windows*** - design

* LVDROP for Windows © Energex Limited

of electrical reticulation systems with distributed loads (eg residential subdivisions/estates, etc.).

- **ViewBase/SI** - Spatial (mapping) interface to asset databases and similar management systems
- **ViewBase/GIS** - similar features to ViewBase/SI, but with additional capabilities to assist with creating map objects representing assets, adding attribute data, modelling of network electrical connectivity and the creation of a schematic, as well as a geographic, user interface.

DataShare is also the regional distributor for the full range of software from North American-based **CYME International**.

These products include:

- **Power Systems Analysis Framework (PSAF)** with analysis modules for Load Flow, Fault Calcula-

tion, Harmonic Analysis, Dynamic Stability assessments.

- **CYMCAP for Windows** - Underground cable thermal analysis to determine thermal ratings under steady-state and transient loading conditions for single cables or groups of cables with mutual heating.
- **CYMGRD for Windows** - Substation grounding design and assessments.
- **CYMDIST for Windows** - Distribution Primary Feeder Analysis—load flow, fault calculation, protection coordination, harmonic analysis, reliability assessments, switching optimisation, etc.
- **CYMTCC for Windows** - Protection coordination.

Further information on these and other products is available from

Load Flow Analysis
 Harmonic Analysis

Fault Calculation
 Substation Grounding

Protection Coordination
 Dynamic Stability

LV Distributor Design
 Cable Thermal Analysis

Spatial Interfacing
 Protection Database

Meter Load Profile Data Analysis

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