



Knowledge Is PowerSM

The World Leader in Diagnostic Test Instruments
and Knowledge Services for Electric Power

TRXTM

Circuit Breaker
Diagnostic Software

Create and manage
your circuit breaker test plans
with software that combines
the automatic control of
the Doble TR & TDR
Circuit Breaker Test Instruments
test set with the functionality
of the Doble Client
Service database.



Library Test Plans	Breaker Test Plans	Test Results	
Time/Date	Special Id	Serial Number	Test Type
10/15/1997 13:10	[T4 390/190/36]		Close
10/15/1997 13:20	[T4 390/190/36]		Close
10/15/1997 14:11	[T4 390/190/36]		Close
10/15/1997 13:15	[T4 390/190/36]		Trip
10/15/1997 13:23	[T4 390/190/36]		Trip
10/15/1997 14:19	[T4 390/190/36]		Trip-Free



TRX, Doble Engineering Company's software system for Circuit Breaker and Circuit Switching Testing and maintenance, combines the automatic control of Doble's Circuit Breaker Test Instruments with the functions of a client server database. Designed to meet the needs for improved productivity and quality in preventive maintenance of Circuit Breakers, TRX is both a circuit breaker test tool and a database to document test methods, and historical test data.

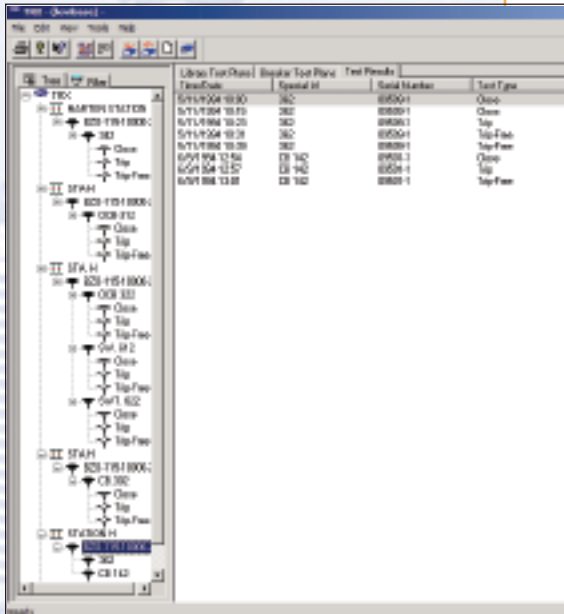


Figure 1 - TRX Navigation Window

The TRX software system is a menu driven and runs under Microsoft Windows operating system. TRX organizes circuit breaker test data in tree view, hierarchy folders like Microsoft Explorer. The representation of the test data and the Test Plan in TRX is simple and provides an intuitive navigation with Windows standard point-and-click conventions. In the TRX Navigation window, as shown in Figure 1, a circuit breaker record contains circuit breaker type, circuit breaker Special ID, and Test Results.

TRX Software provides database management of circuit breaker test data, as well as a provision for the standardization and creation of Test Plans. Consistent and standardized testing ultimately improves a power systems reliability. Library Test Plans allow the user to create standardized Test Plans for different circuit breaker types, which can be used as is or modified to suit a particular circuit breaker's testing requirements. Individual circuit breaker Test Plans can be created with or without using Library Test Plans. TRX provides an entry form for users to create a Test Plan and a database that stores both Test Plans and Test Results. TRX can be used with Doble's TR3000 and the TDR9000 Circuit Breaker Test Instruments. Existing Test Plans and Test Results, stored in TRX DOS, can be converted to the TRX Windows version.

TRX provides an efficient tool for viewing Test Results graphically or in a tabular report form. It provides editing, viewing and printing of the Test Plan stored in the database. Test Plan and Test Result data can be organized into one or as many separate databases as the user desires.

TRX Circuit Breaker and Circuit Switching Diagnostic Software allows a user to:

- Create and Manage Circuit Breaker and Circuit Switcher Test Plans
- Display, Review and Print Test Results
- Store and Access Test Results

Figure 2 - Test Result - Tabular Format

BREAKER PERFORMANCE REPORT
TRXFORM VMS600: RE 4.51

Manufacturer: 2822-Berco Servco Location: max lab
Model Number: 321-PP-48-29 Circuit:
Serial Number: 470 Operation:
Mechanism #:
Mech Conts #:
Serial ID: 0-1978 OPERATION CHANNEL:
Test Type: TSD Test Scan Name:
Test was performed on 12/18/2003 at 14:28:49.

Mean Channels 1-8 Transfer Function
1.000 m/s Travel at the contacts is 1.000 m/s Travel at the rounded.

Resistor ramp released time
Test Initiation to Arc Contact Channel E = 3.0ms
Command Resistance Crp Pulse 66.0 ms
Command Currents Crp Current 18.75 A dc

MECHANICAL SWITCH CHANNELS 1-8 TRIP OPERATION		
Specifications	Test results	Comps
Breaker velocity in Open state 1		
Maximum 4.200 m/s	TRX: 3.833 m/s	Pass
Minimum 1.000		

Test Plans and Test Results Analysis

TRX contains an entry form for creating circuit breaker Test Plans. The Test Plan is a timesaving tool that can be used repeatedly to test similar circuit breakers consistently. TRX displays Test data and Test Results in two types of formats, Tabular and Graphic, for easy analysis. Both formats enable users to detect abnormalities in circuit breaker behavior.

User-defined expected values for the Test Results, along with their tolerances, can be specified in the Test Plan. Enabling the user to see the outcome at a glance, the Tabular format assigns a pass/fail rating to all parameters for which the Test Plan contains an expected value and tolerance limit. Figure 2 is an example of Test Results displayed in the Tabular format.

The Graphic format includes a powerful overlay feature, which allows the user to compare the Test Results to previous results, and even allows comparison to the Test Results of other circuit breakers of the same type. Contact timing, trip and close coil current, contact travel and velocity can be viewed graphically alone, or can be compared with a circuit breaker of the same type, or with the previous Test Results of the same circuit breaker. Features, which enhance

graphic display, such as zooming, overlaying of like traces and like tests and color coding, assist the user in analyzing the Test Results.

When the results from two or more tests made at different times are overlaid, small changes may be detected in the operation of the circuit breaker that could not otherwise be detected. TRX allows Test Result printing from the graphic viewer. Figure 3 shows an example of Test Results displayed in the Graphic format.

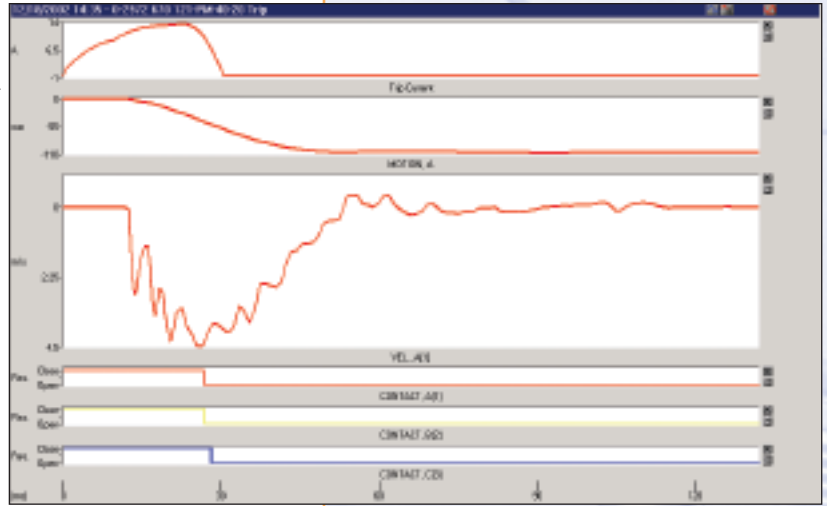


Figure 3 - Test Result - Graphic Format

Viewing Circuit Breaker Data

Once in the database, circuit breaker data is easily selected for viewing using the Tree and Filter functions in the Navigation Window. The Tree function organizes the circuit breakers alphabetically by Location, Circuit Breaker Type, Circuit Breaker Special ID, Test Type, and displays the nested levels in a way similar to Windows Explorer. Figure 1 displays the Tree function Tab selected in the Navigation Window. If the location is not known, the Filter function allows the user to display filtered data by Special ID or by Circuit Breaker Type. This is useful when searching for multiple instances of a particular Circuit Breaker Type in order to compare Test Results. Figure 4 shows the filter function tab in the navigation window.

On-Line Help

TRX's On-line Help can be accessed at any time by pressing the F1 key. Help in TRX is just one-click away and provides help to the user in creating Test Plans quickly and easily. Assistance on features, functions and the operation of the software and test instruments is also available in On-line Help. Figure 5 shows an example of one TRX Help screen.

TRXField™

TRXField, an independent component of TRX software, is designed for field use on a laptop computer. It does not contain the database features of TRX, but duplicates the entire Test Plan creation and Test Results analysis features of TRX. TRXField provides a quick and simple way to create Test Plans in the field for circuit breaker testing and Test Result analysis. If the expected results are specified then the TRXField software compares the actual Test Results with the user-defined, expected Test Result values to make pass or fail determinations.

A Test Plan can also be saved to various storage media. TRXField provides both the graphical display and a tabular report facilities for Test Results analysis.

TRXField provides a special tab for control of the TDR9000, Doble's newest state-of-the-art digital Circuit Breaker Test Instrument. Figure 6 shows the TDR9000 Control Panel. Tests Plans created by TRXField can be downloaded into a TDR9000 Circuit Breaker Test System via a serial port. The TDR9000 tab of TRXField provides a "virtual" control panel, which replicates the physical front panel of the TDR9000 Instrument.

The intuitive Windows point-and-click feature allows the user to activate and deactivate timing and measurement channels on the TDR9000. It also allows the user to select the type of test to be performed on the circuit breaker. The TDR9000 tab provides the quickest way to test a circuit breaker without creating the Test Plan in advance, which is very useful in efficient testing of the circuit breaker's problem. Additionally, if the user has a prepared Test Plan, the TDR9000 tab indicates graphically the required modules for the TDR9000 Test Instrument.

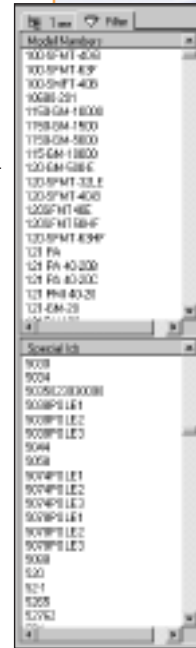


Figure 4 - Filter Function Tab

TRX User Group

The TRX User Group is an organization of over 200 companies worldwide. TRX User Group meetings are held at the spring Doble Client Conference in Boston, Massachusetts and the Doble Fall Planning meeting. Sessions are scheduled to discuss TRX, TDR9000 Circuit Breaker Test System and the TRX User's experience with the products. Typical discussions include testing techniques, Test Result Analysis and product enhancements. These meetings offer User Group Members the opportunity to contribute and exchange Test Plans. A TRX Email forum allows User Group members to exchange information on all aspects of circuit breaker maintenance and to circulate Test Plans.

The Doble Difference

Since 1920, the Doble Engineering Company has focused on condition assessment of substation apparatus to assist Electric Utility personnel. Doble's accumulated in-depth diagnostic expertise is engineered into the TRX Circuit Breaker Testing Software and its field component, TRXField. With TRX, you create and manage Test Plans quickly. The enhanced Tabular and Graphic Display features of TRX not only simplify result analysis but allow for comparison to previous Test Results and to other circuit breakers of the same type. Test Plans and Test Results can be displayed, reviewed and printed. Not only is TRX a circuit breaker test tool, it is also a database to document test methods and historical data. TRXField, an independent component of the TRX software, duplicates the entire Test Plan creation and Test Results analysis features of TRX for field use on a laptop computer. TRX allows for consistent, standardized testing to ultimately improve the power system's reliability.

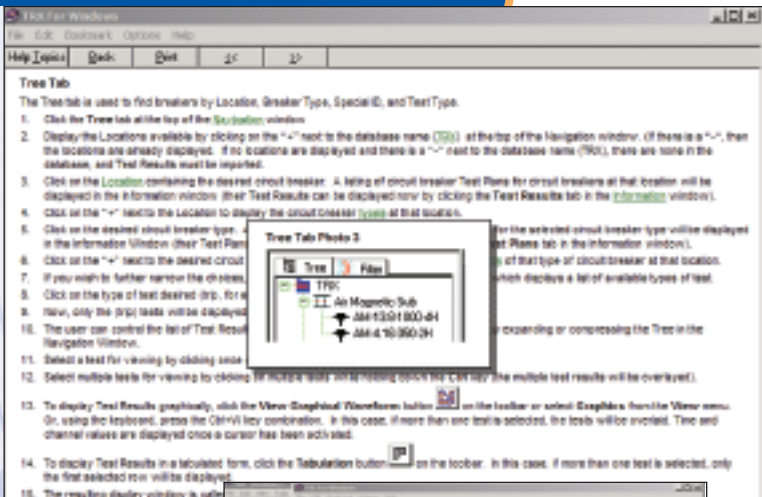


Figure 5 - On-Line Help Screen Example

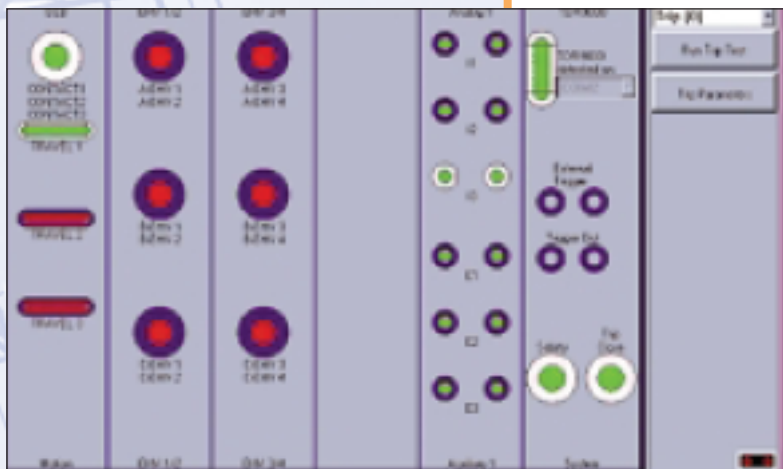
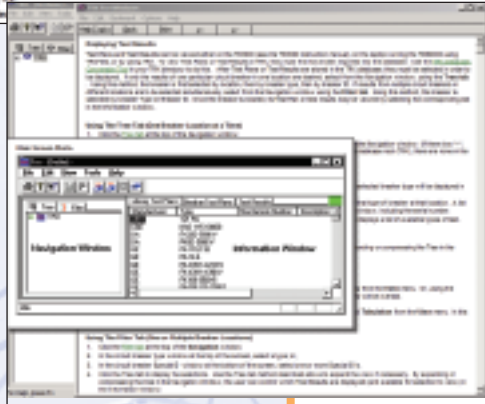


Figure 6 - TDR9000 Control Panel

Doble is certified ISO 9001:2000



Knowledge Is PowerSM

The World Leader in Diagnostic Test Instruments and Knowledge Services for Electric Power



Doble Engineering Company

www.doble.com

85 Walnut Street, Watertown, MA USA 02472

Tel +1-617-926-4900

Fax +1-617-926-0528

Doble Engineered Strategies

World-class Laboratory Services

Premiere Conferences and Events

Doble On-line Database

Industry-leading Diagnostics

Specifications are subject to change without notice.