



SmartFR™



Centralized Fault Records System



Table of Content

A. Product Overview	4
SYSTEM ARCHITECTURE.....	4
ADVANTAGES	4
KEY FUNCTIONS	5
SOFTWARE CONNECTION	5
DATA STRUCTURE.....	5
SUPPORTED OPERATING SYSTEM	5
HARDWARE MINIMUM REQUIREMENT.....	5
B. Technical Highlights	6
1. DATA VIEWER TOOLS (VIEWER DX)	6
1.1. Station View	6
1.2. SOEs.....	6
1.3. Fault Events	7
1.4. Fault Analysis.....	7
1.5. Station Communications.....	8
1.6. Relay Communications.....	8
2. CONFIGURATION TOOLS (STATION DX)	9



A. Product Overview

SmartFR™ is a software that can automatically collect and analyze digital fault recording data in control and protection systems, the results of which is presented to operators.

SYSTEM ARCHITECTURE

Figure 1 shows data flow of system:

- ◆ Protection relays (1) are the source of data for SmartFR™. The relay protection devices (1) are located at the substation.
- ◆ Dedicated WAN/LAN (2) is utilized for connection between relays (1) and control center.
- ◆ Fault Data Driver (3) collects fault data in various file formats, convert to a common one and store in RDBMS Database (4).
- ◆ Client applications (5) shall read data from RDBMS database (4) and display in user interface.

Figure 2 shows overall system architecture of SmartFR™.

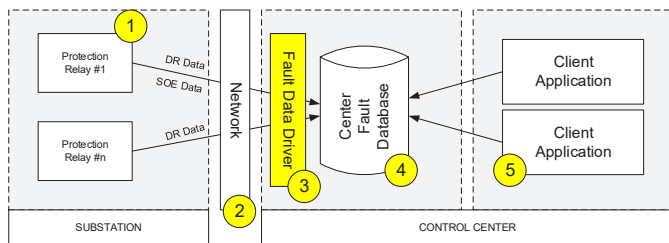


Figure 1. Data flow

ADVANTAGES

- ◆ Fully meet with requirements to facilitate the analysis of disturbances on power system or both generation and transmission & distribution assets
- ◆ Provides High-Accuracy Time-Stamping
- ◆ Provides Oscillography and Event Reporting
- ◆ Automatically collect, archive and visualize for fault records and disturbance records of protection relays & fault recorders.
- ◆ Automatically collect, archive and display Sequence of Events (SOEs) of protection relays and BCUs
- ◆ Accurately time-stamp SOE, FR, and DDR data, which can then be easily time-synchronized by the user
- ◆ A compact, economical system that includes the needed equipment to fully meet all of customer requirements; these systems are designed to operate in harsh substation environments
- ◆ Provide system-wide detail records and analysis tools, such as: searching and filtering for data analysis
- ◆ Client/Server architecture
- ◆ Distributed collection system and Centralized Data Management. All event records are stored at central database.
- ◆ Manage more than a thousand IEDs in hierarchy
- ◆ Compliant with International standards: IEC, NERC, IEEE
- ◆ Compatible with Fault record and Disturbance record protocols including: IEC61850-8-1 File Services, FTP, Telnet, proprietary protocol, etc.
- ◆ Support latest version of COMTRADE file format
- ◆ Support IEDs from various manufacturers: SEL, Alstom, GE, Siemens, IngeTeam, Nari, Toshiba, etc.

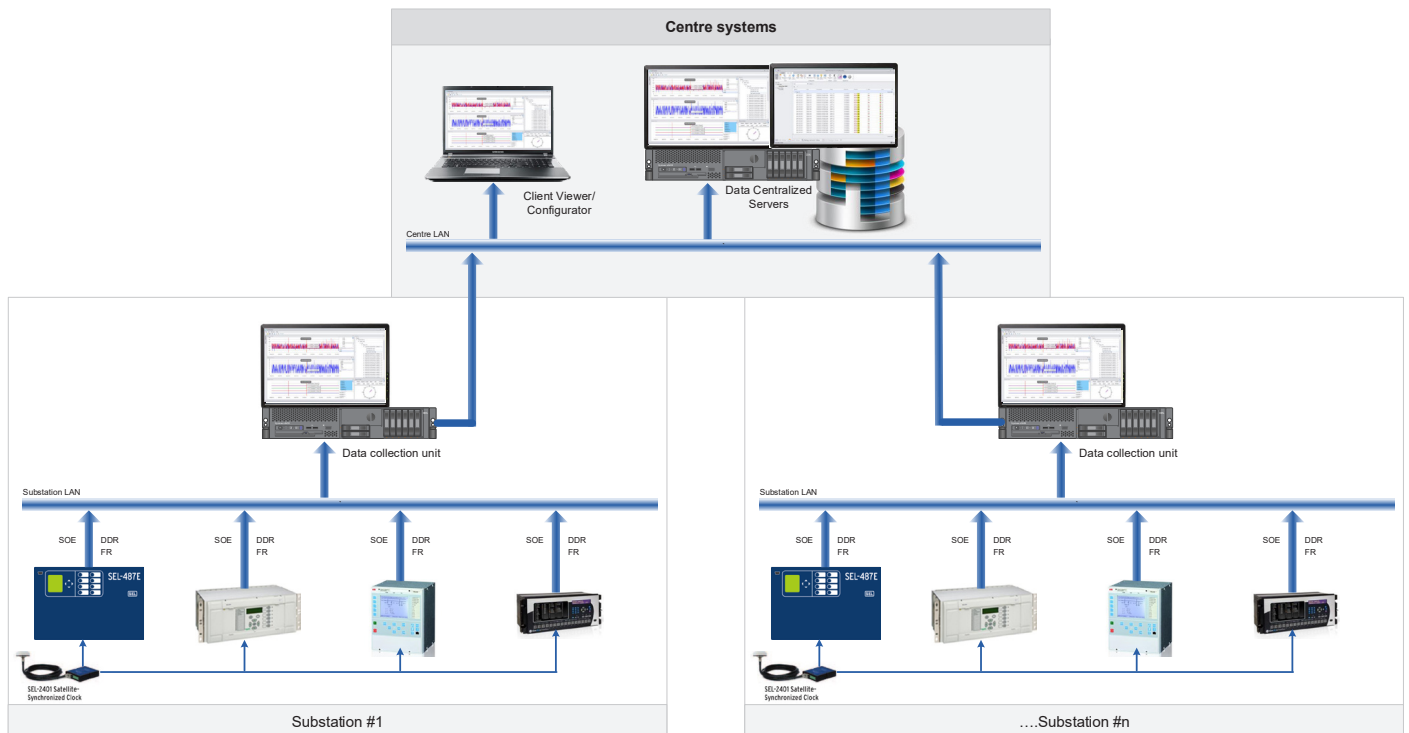


Figure 2. Overall System Architecture

KEY FUNCTIONS

SmartFR™ will analyzes, extractes and filters data stored in fault records, and displayed graphically to facilitate fault analysis .

Various data can be displayed, including :

- ◆ Simultaneous display of several fault records.
- ◆ Summary of fault records
- ◆ Wave-form data or vector data of analog channels, digital output signals and can be added
- ◆ Data of several analog channels, vector channels or digital outputs may be displayed at the same view
- ◆ Time stamp is unique in all displays
- ◆ Time cursor can be assigned at essential moment (relay trip, fault clearance or any user-selected one)

SOFTWARE CONNECTION

The software system is combination of the softwares installed at Sub-station and Control Center. In which, Station DX software is for system configuration and Viewer DX software is for data view and fault analysis.

DATA STRUCTURE

SmartFR™ organizes data in tree structure. In which, the root node is stations, inside the station node is children nodes as shown in Figure 4.

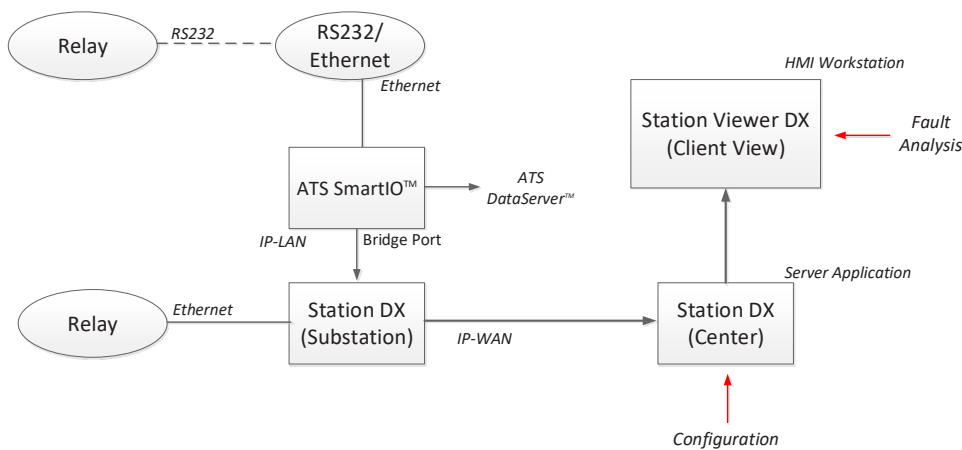


Figure 3. Software Connection Model

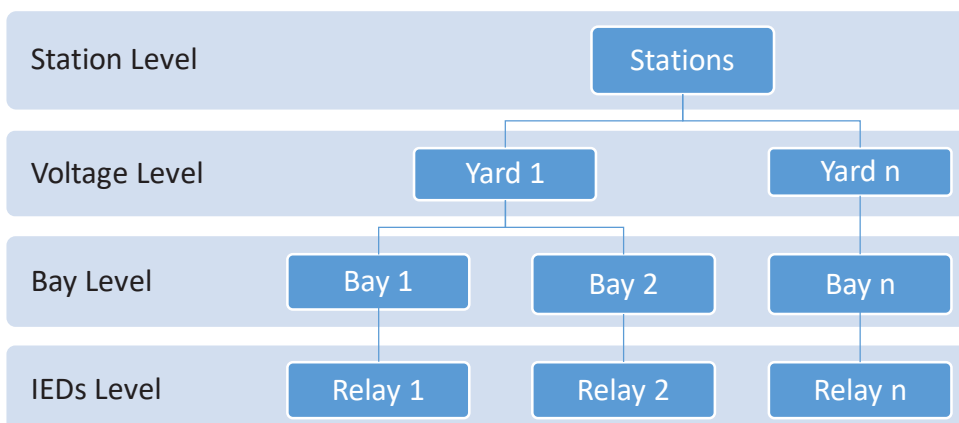


Figure 4. Data structure

SUPPORTED OPERATING SYSTEM

- ◆ Microsoft Windows XP
- ◆ Microsoft Windows Vista
- ◆ Microsoft Windows 7
- ◆ Microsoft Windows 8
- ◆ Microsoft Windows 10
- ◆ Microsoft Server 2003
- ◆ Microsoft Server 2008
- ◆ Microsoft Server 2012

HARDWARE MINIMUM REQUIREMENT

- ◆ Processor: 1 gigahertz (GHz) or faster processor or SoC
- ◆ RAM: 1 gigabyte (GB) for 32-bit or 2 GB for 64-bit
- ◆ Hard disk space: 16 GB for 32-bit OS 20 GB for 64-bit OS
- ◆ Display: 800x600

B. Technical Highlights

1. DATA VIEWER TOOLS (VIEWER DX)

The program provides:

- ◆ Navigation function
- ◆ Data Filtering Function
- ◆ Search/Find function
- ◆ Data Display tool:
 - * Station View : view SOEs and Events data according to sub-station structure.
 - * SOEs: list of Sequency of Events (SOEs)
 - * Fault Events: list of faults, events.
 - * Station Comms : View information and monitor communication status from the center to Gateway computers at the substation.
 - * Relay Comms : View information and monitor communication status to relays.

1.1. Station View

This is main screen of ViewerDX. The screen provide following information:

- * The left panel shows the substation, voltage level, bay, relay, status and connection time of relay. Lost connection status will be indicated in **red**, and **blue** will show good connection.
- * The right panel shows the list of Events and SOEs for selected relay.

1.2. SOEs

The screen will display the entire SOEs of relays of all substations. User can select Tree View mode to view data by station, voltage level, bay level, relay.

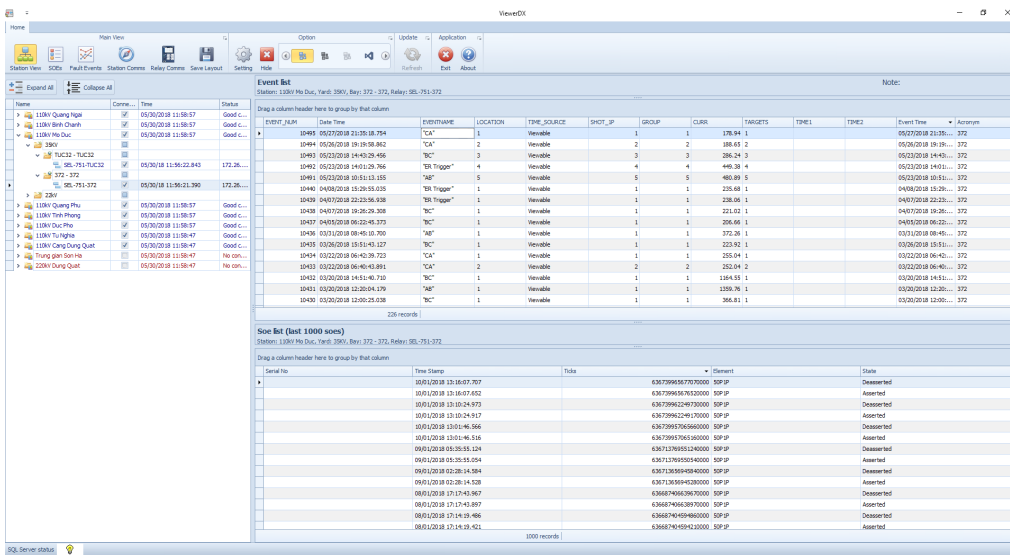


Figure 5. Station View Screen

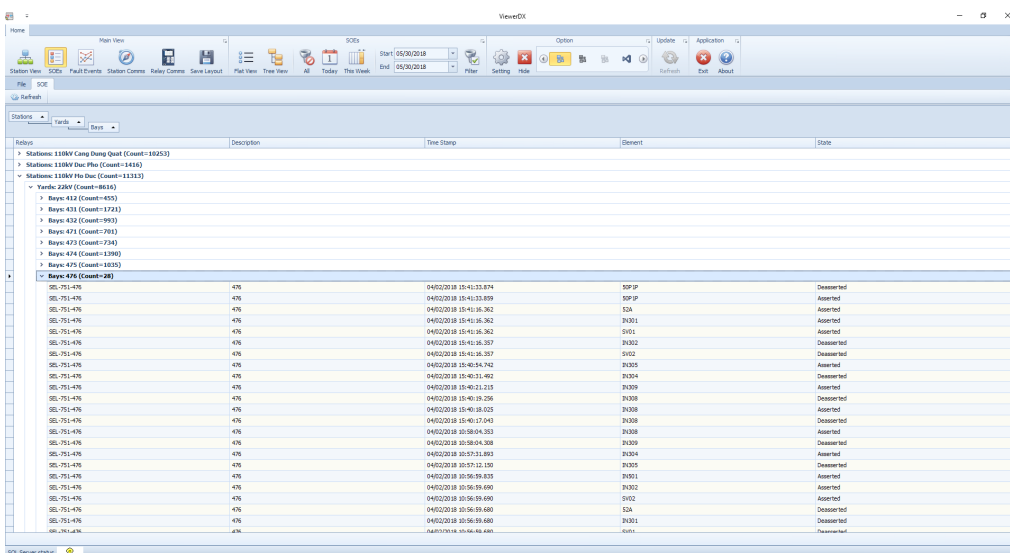


Figure 6. SOEs Screen

1.3. Fault Events

Fault Events screen provides fault and events list of all relays. It also provides summary data of each fault or event.

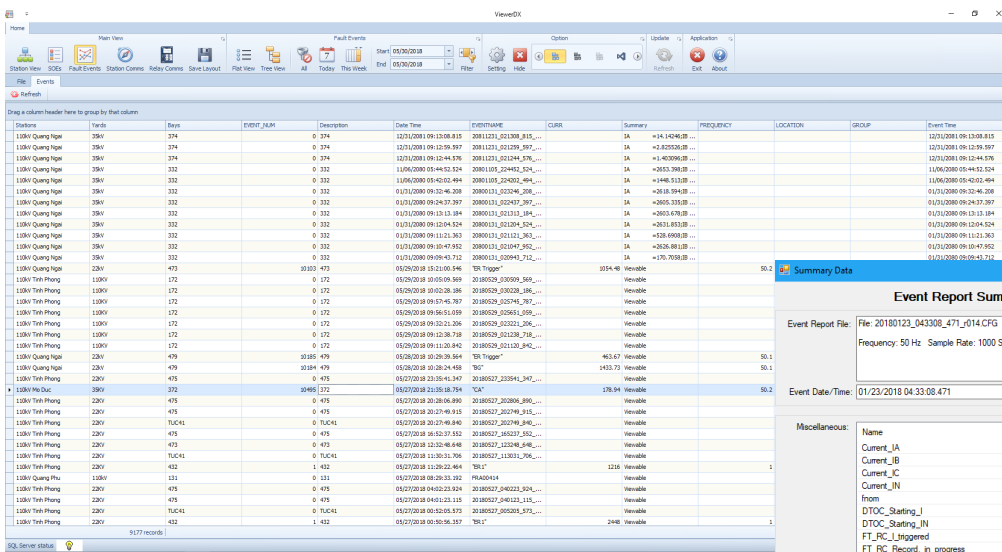


Figure 7. Fault Events Screen

1.4. Fault Analysis

Fault Analysis application can be called from Wave Form button on Event Report Summary screen.

Fault Analysis screen has two graphs for displaying measurement value (analog) and one for displaying the protection signal value (digital).

On the graphs, the user can move the cursor to see the value and corresponding time during the event.

The Phasor panel on the right will display measurement value and corresponding phase angle.

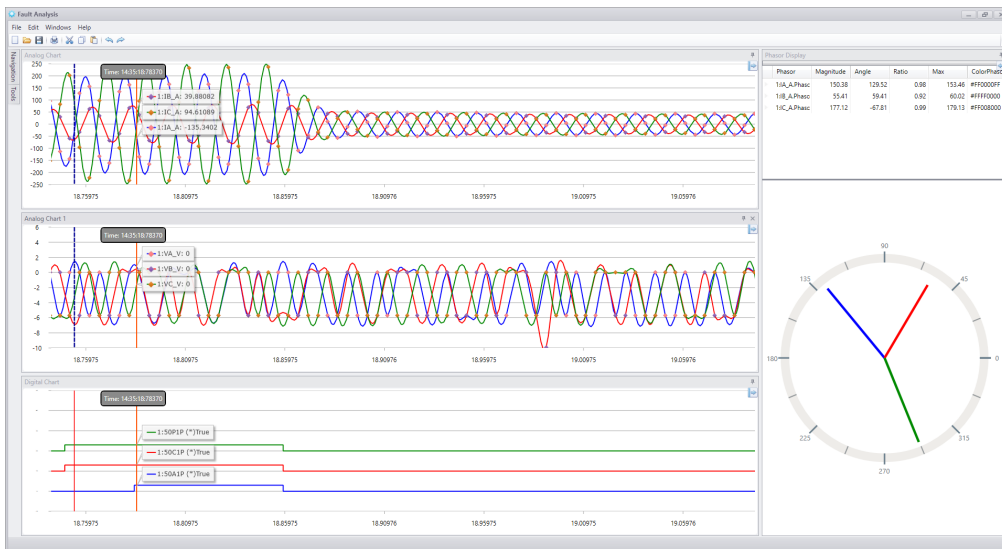


Figure 8. Fault Analysis

B. Technical Highlights

1.5. Station Communications

Lost connection status of substation will be indicated in **red**, and **blue** will show good connection.

Name	Address	Location
110kV Ngap Ngai	172.26.112.1	05/20/2018 12:00:01 Good connection to 110kV Ngap Ngai ip = 172.26.112.1
110kV Binh Chanh	172.26.116.1	05/20/2018 12:00:01 Good connection to 110kV Binh Chanh ip = 172.26.116.1
110kV Phu Duc	172.26.118.1	05/20/2018 12:00:01 Good connection to 110kV Phu Duc ip = 172.26.118.1
110kV Quang Phu	172.26.121.1	05/20/2018 12:00:01 Good connection to 110kV Quang Phu ip = 172.26.121.1
110kV Tam Phong	172.26.123.1	05/20/2018 12:00:01 Good connection to 110kV Tam Phong ip = 172.26.123.1
110kV Duc Phu	172.26.120.1	05/20/2018 12:00:01 Good connection to 110kV Duc Phu ip = 172.26.120.1
110kV Tu Nghia	172.26.125.1	05/20/2018 12:00:01 Good connection to 110kV Tu Nghia ip = 172.26.125.1
110kV Cong Dung Quai	172.26.114.1	05/20/2018 12:00:01 Good connection to 110kV Cong Dung Quai ip = 172.26.114.1
Trung gian Son Ha	192.26.112.11:20050	05/20/2018 12:00:01 No connection to Trung gian Son Ha ip = 192.26.112.11:20050
220kV Dung Quai	192.26.112.11:20070	05/20/2018 12:00:01 No connection to 220kV Dung Quai ip = 192.26.112.11:20070

Figure 9. Station Communication Screen

1.6. Relay Communications

Lost connection status of relay will be indicated in **red**, and **blue** will show good connection.

Station	Yard	Service Name	Relay Name	Address	Port	Enabled	Status	Connected	Acronym	Note
110kV Quang Ngai	226V	REL_SE_EVENTS	REL-751-479	172.26.112.10	23	✓	05/20/18 11:59:51.279 172.26.112.10:23 Login to REL-751-479 return...	✓	479	
110kV Quang Ngai	226V	REL_SE_EVENTS	REL-751-477	172.26.113.17	23	✓	05/20/18 11:59:51.176 172.26.113.17:23 Login to REL-751-477 return...	✓	477	
110kV Quang Ngai	226V	REL_SE_EVENTS	REL-751-331	172.26.113.13	23	✓	05/20/18 11:59:51.033 172.26.113.13:23 Login to REL-751-331 return...	✓	331	
110kV Quang Ngai	226V	REL_SE_EVENTS	REL-751-312	172.26.113.10	23	✓	05/20/18 11:59:51.279 172.26.113.10:23 Login to REL-751-312 return...	✓	312	
110kV Duc Phu	226V	IECOTRTRADE	F600-412	172.26.120.16	102	✓	05/24/18 09:33:54.007 172.26.120.16:102 connected = True, GetWellList ret...	✓	412	
110kV Duc Phu	226V	IECOTRTRADE	F600-471	172.26.120.15	102	✓	05/24/18 09:33:54.426 172.26.120.15:102 connected = True, GetWellList ret...	✓	471	
110kV Duc Phu	226V	IECOTRTRADE	F600-473	172.26.120.14	102	✓	05/24/18 09:33:54.019 172.26.120.14:102 connected = True, GetWellList ret...	✓	473	
110kV Duc Phu	226V	IECOTRTRADE	F600-475	172.26.120.13	102	✓	05/24/18 09:33:55.024 172.26.120.13:102 connected = True, GetWellList ret...	✓	475	
110kV Duc Phu	226V	IECOTRTRADE	F600-477	172.26.120.12	102	✓	05/24/18 09:33:54.130 172.26.120.12:102 connected = True, GetWellList ret...	✓	477	

Figure 10. Relay Communication Screen

Tree View Mode of Relay Communication

- Station: 110kV Binh Chanh (Count=13)
 - Yard: 110kV (Count=7)
 - Bay: 112 (Count=1)
 - IECOTRTRADE P264-112 172.16.14.1 102 ✓ 05/20/18 12:00:37.295 172.16.14.1:102 connected = True, GetWellList return = B. ✓ 112
 - Bay: 122 (Count=1)
 - IECOTRTRADE P262-122 172.16.14.26 102 ✓ 05/20/18 12:00:38.295 172.16.14.26:102 connected = True, GetWellList return = B. ✓ 122
 - Bay: 171 (Count=2)
 - IECOTRTRADE P263-171 172.16.14.37 102 ✓ 05/20/18 12:00:34.855 172.16.14.37:102 connected = True, GetWellList return = B. ✓ 171
 - IECOTRTRADE P264-171 172.16.14.38 102 ✓ 05/20/18 12:00:34.855 172.16.14.38:102 connected = True, GetWellList return = B. ✓ 171
 - Bay: 172 (Count=2)
 - IECOTRTRADE P260-172 172.16.14.39 102 ✓ 05/20/18 12:00:35.279 172.16.14.39:102 connected = True, GetWellList return = B. ✓ 172
 - IECOTRTRADE P264-172 172.16.14.29 102 ✓ 05/20/18 12:00:36.279 172.16.14.29:102 connected = True, GetWellList return = B. ✓ 172
 - Bay: 17 (Count=1)
 - IECOTRTRADE P0741-17 172.16.14.25 102 ✓ 05/20/18 12:00:04.185 172.16.14.25:102 connected = True, GetWellList return = B. ✓ 17

- Station: 110kV Duc Phu (Count=13)
- Station: 110kV Phu Duc (Count=13)
 - Station: 110kV Quang Ngai (Count=17)
 - Station: 110kV Tam Phong (Count=25)
 - Station: 110kV Tu Nghia (Count=15)
 - Station: 220kV Dung Quai (Count=15)
 - Station: Trung gian Son Ha (Count=4)

Figure 11. Tree View Mode of Relay Communication

2. CONFIGURATION TOOLS (STATION DX)

Station DX software provides tools for configure Stations, Yards, Bays and relays of system. It include editor tool for creating, editing and management of all Stations, Yards, Bays and relays information.

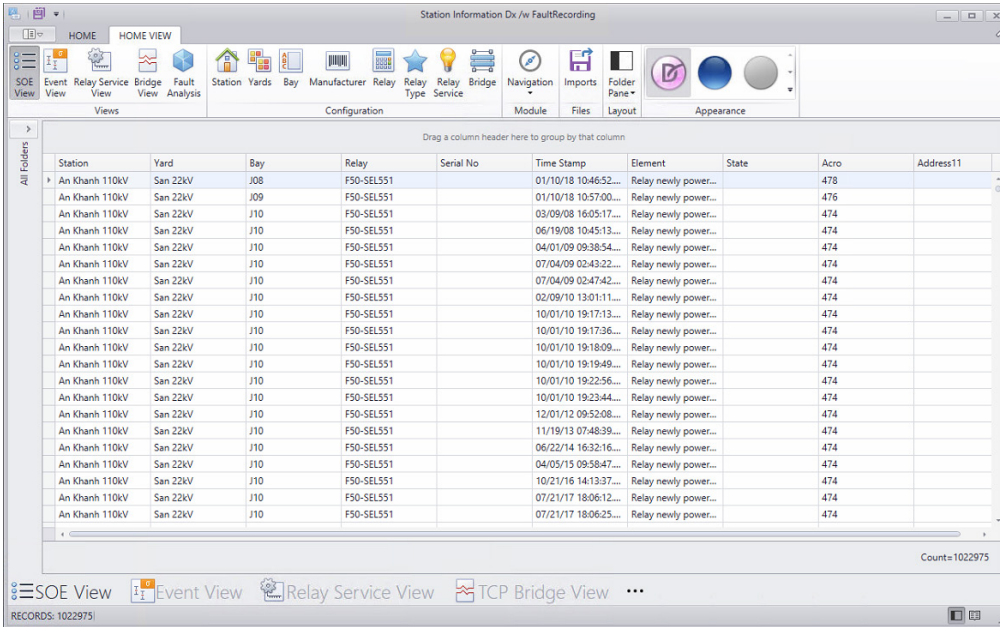


Figure 12. Station DX Main Screen

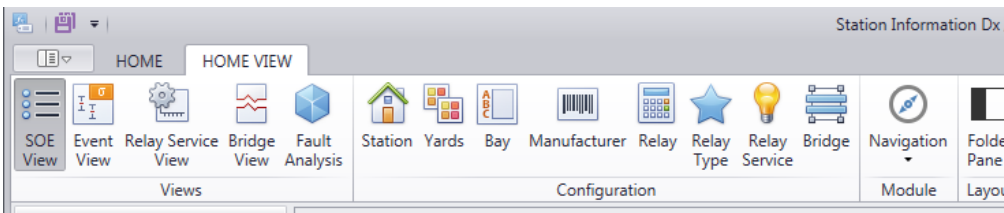


Figure 13. Station DX Main Menu

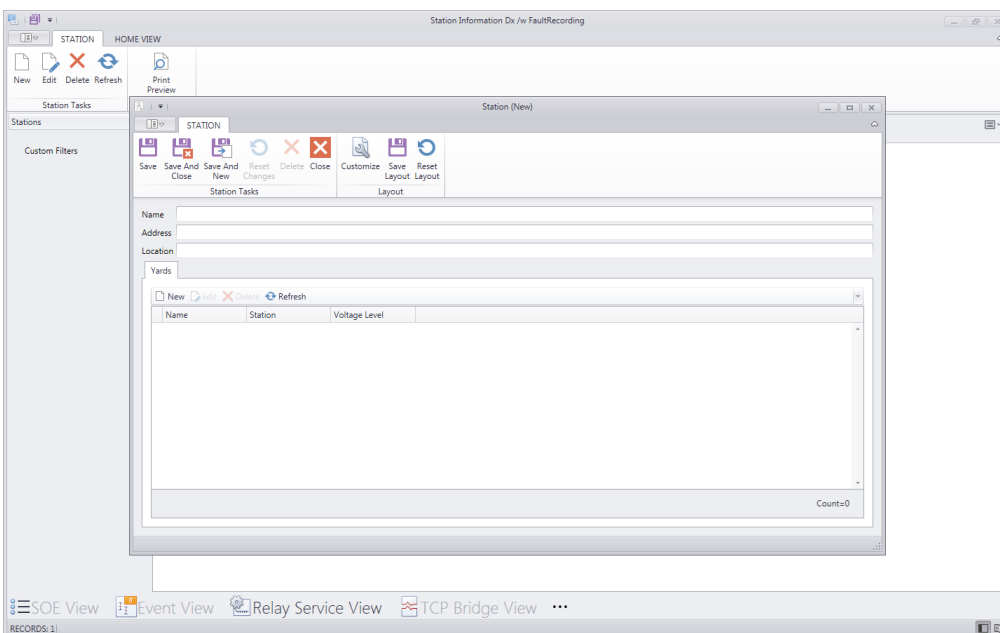


Figure 14. Station Editor

B. Technical Highlights

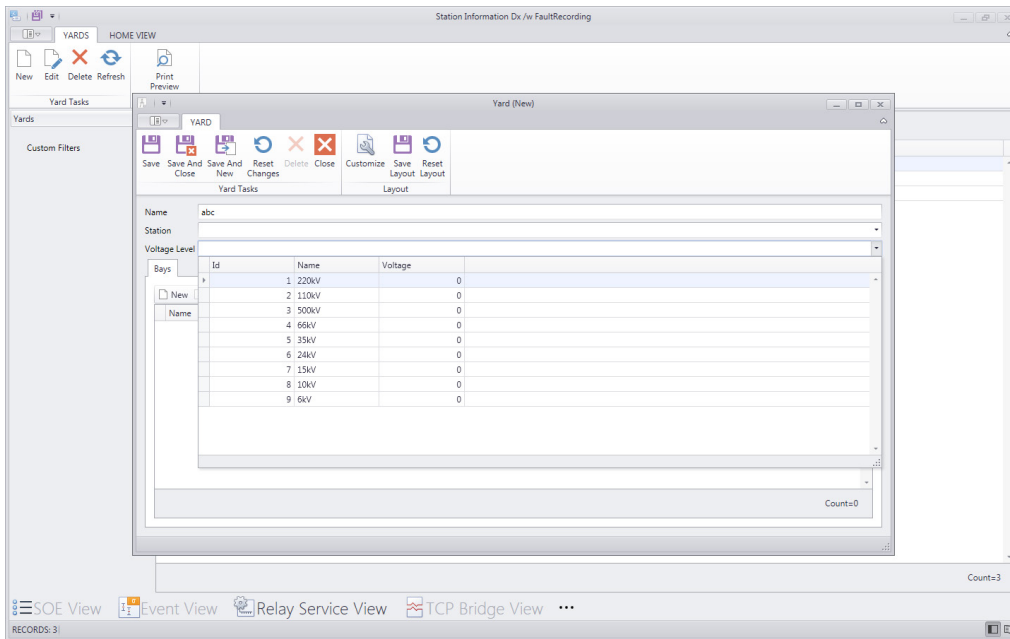


Figure 15. Yard Editor

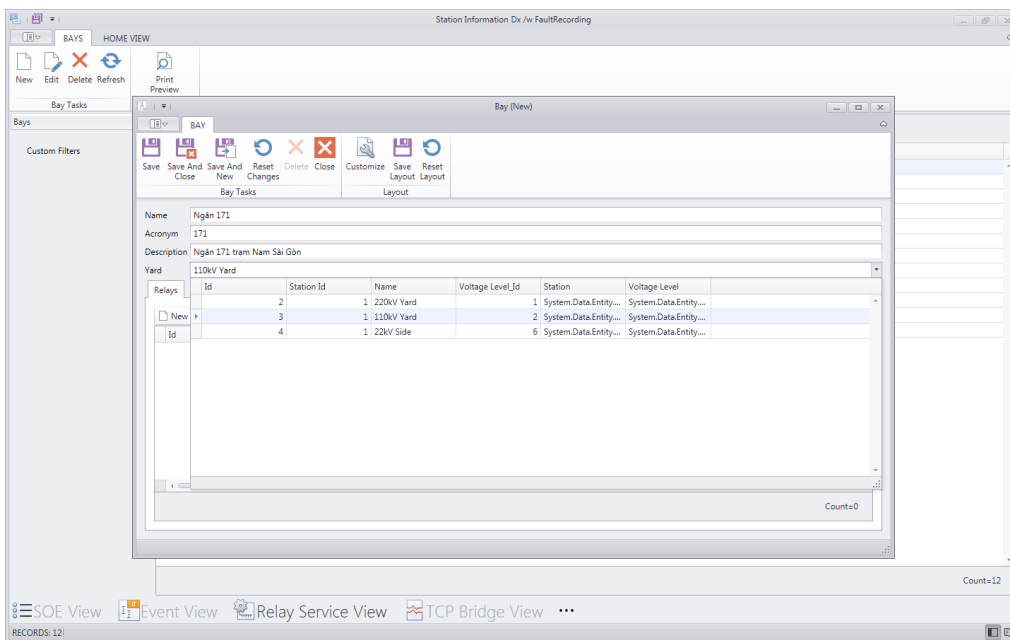


Figure 16. Bay Editor

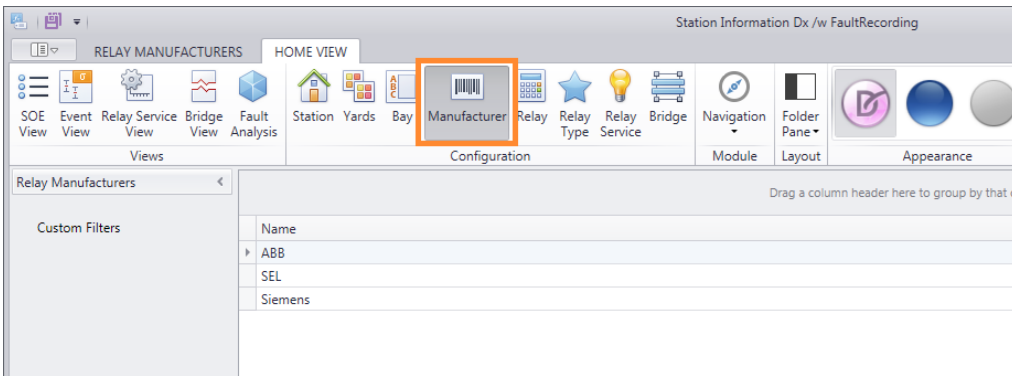


Figure 17. Relay Manufacturer Management

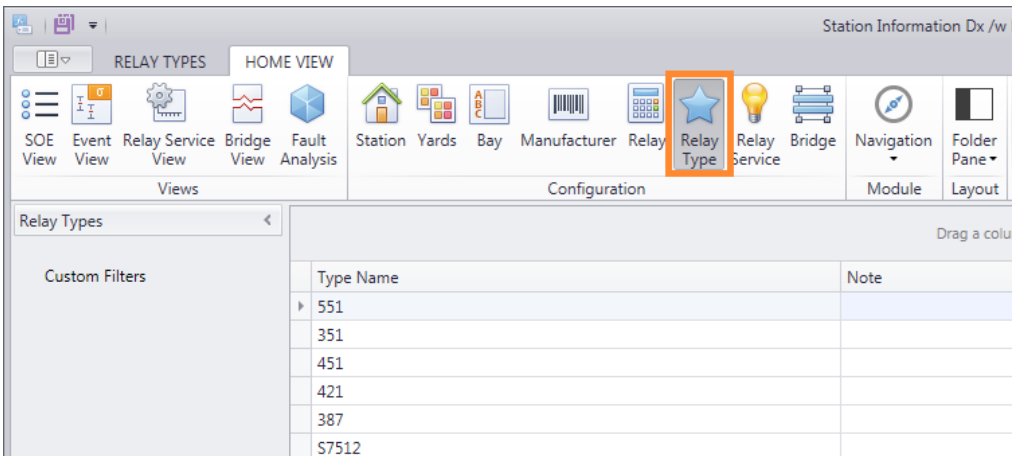


Figure 18. Relay Type Management

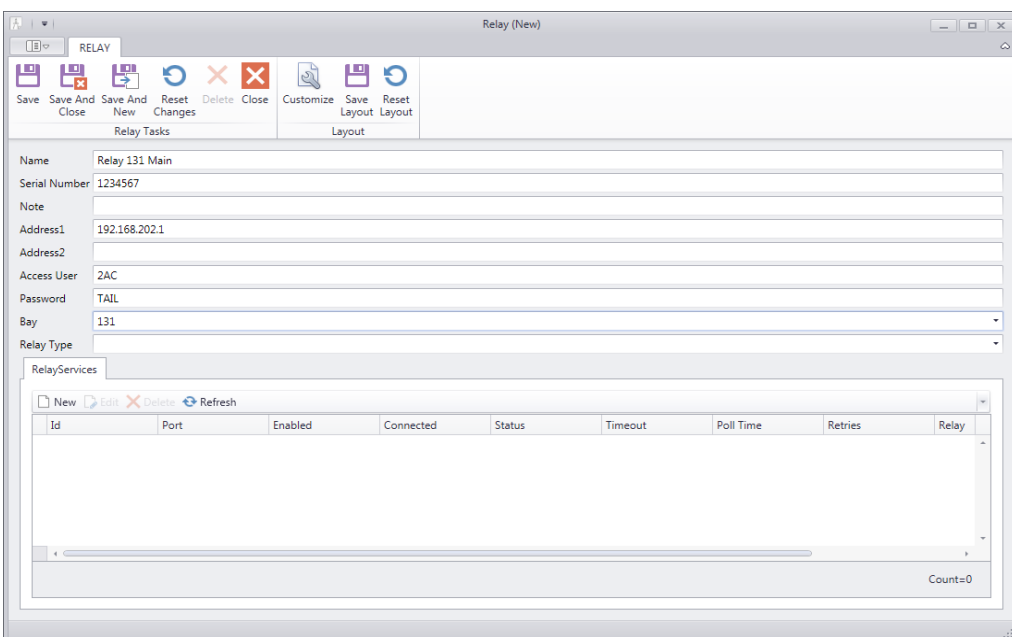


Figure 19. Relay Editor

Head Office

Suite #604 - VNA8 Building,
8 Tran Hung Dao Str., Hanoi, Vietnam
T. +84-24-3825 1072
F. +84-24-3825 8037
W. www.ats.com.vn
E. ecommerce@ats.com.vn

Factory

Lot No. A2CN6,
Tu Liem Industrial Zone,
Hanoi, Vietnam
T. +84-24-3780 5053
F. +84-24-3780 5060

HCMC Office

13-15 Nguyen The Loc Street
Ho Chi Minh City, Vietnam
T. +84-28-3948 3548
F. +84-28-3948 3549

