Instruction Manual of SCD Configuration Tool

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1.Overview

Typical substation automation system of standards implementation process is: The owner/design institute provides the SSD (Substation Specification Description) file, IED manufacturers provide ICD (IED configuration Description) file, SCD (Substation Configuration Description) file is generated by system integrators through system configuration, then the client side and server side both perform corresponding engineering work according to the SCD file. The client side can get substation equipment list, model, data source and the main wiring diagram and other kinds of information through SCD, the server side can parse out its relevant part from the SCD, and form a CID (Configured IED Description) or proprietary parameters to download in the device for execution.

Actually there is no very good correspondence between the three roles of prescribed standards and actual domestic roles such as users, design institutes and manufacturers, so this directly leads to the result that it is very difficult to strictly enforce the standard process in the project implementation. Typically, with regard to all 61850 projects which have been implemented in China, no user/design institute can provide the SSD file.

2.Nomenclature

CID: Configured IED Description.

ICD: IED Capabilities Description.

IEC 61400_25: International Standard IEC 61400_25. Communications for monitoring and control of wind power plants.

IEC 61850: International Standard IEC 61850. Communication Networks and Systems in Substations [1].

IED: Intelligent Electronic Device.

eFS (energyFactorySuite): Environment to develop energy generation and distribution facility engineering according to standard IEC.

INGESYS™ IT: Operation and control system to automate systems [2].

INGESYS™ eFS. Electrical power substation automation system.

LN: Logical Node.

LCB: Log Control Block.

LD: Logical Device.

RCB: Report Control Block.

SCD: Substation Configuration Description.

SCL: Substation Configuration Description Language.

SSD: Substation Specification Description.

3. Function Introduction

SCD configuration tools comprehensively realize finding, opening, modifying, saving and checking of SCD file. Its main functions are as follows:

1) Import of IED File
2) Export of CID
3) Communication Management
4) IED Management
5) Verification
6) Export GOOSE configuration
7) Text View
8) SCD configuration tools can supply for substation:
   IED configuration tools
   System (Substation) configuration tools
   IED interrogation, monitoring and analysis software tools
   Diagnostics and maintenance tools
9) SCD configuration tools can play an IED configurator and a system configurator.
10) SCD configuration tools can model the IED and substations
11) SCD configuration tools can import or export the files defined by IEC 61850.
12) SCD configuration tools included the engineering environment
13) SCD configuration tools can define control and protection devices data models according to the IEC 61850
14) SCD configuration tools can adjust to the communication and hierarchy model architectures established by the IEC 61850
15) SCD configuration tools can create any IEC 61850 data model starting from scratch thus generating ICD files
16) SCD configuration tools can import these regulating files from the different units
17) The automatically generated database is the only system database used in SCD configuration tools
18) Database Main characteristics:

- Graphical IED engineering tool.
- Easy creation of complex information models.
- Internal repository of all the IEDs modelled.
- Dictionary with the definitions included in the first revision of the standard to improve the

comprehension of the models.

- Creation and modification of datasets and control blocks.
- Quick assignments of initial values and descriptions.
- Graphical display of the information model either as a tree or a list of items with filter functionality.
- Import and export of normative configuration files (ICD files).

19) Database Specific functions:

- Definition of the data model of the protection or control device (“ICD”).
- Definition of the supervision and command graphic consoles.
- Definition of the operation and maintenance historic records.
- Definition of the states and alarms with the state change time.
- Definition of the data/measurement groups through “DataSets”.
- Definition of the report groups through “Reports”.
- Definition of the historical groups through “Logs”.
- Definition of the settings.
- Definition of the local or remote commands.

20) With SCD configuration tools there are several options to create a new IED model:

- Using the templates of the standards.
- Using the data types of a previous created device.
- Importing a normative SCL file (ICD, CID or SCD files).

21) To access to the information the tool provide:

- FILTERS that reduce the information model size. Some available filters are:
- Type: LogicalDevice, LogicalNode, DataObject…
- FunctionalConstraint: Smart I/O, MX, CO…
- Name of the element.
- VIEWS that help users to visualize the information desired.
- Select the columns needed.
- Create your own configurations.
- SEARCHES that help users to find where a data type is used.

22) SCD configuration tools can import or export configuration files defined by IEC 61850.

23) SCD configuration tools allows integrating control and protection devices in the data base of the substation according to the IEC-61850

24) SCD configuration tools can establishes communication architecture based on the client-server model

25) The information model defined by the IEC 61850 standard for electrical substations is organized hierarchically in different levels

26) With SCD configuration tools, IED models can be created for each type of device.

27) If in an installation there are various devices of the same type, the configuration will only be done once

28) SCD configuration tools Main characteristics are:

- Graphical IEC 61580 system engineering tool.
- Instantiation of the IEDs of the substation from the library defined in the Tool Factory.
- Assignation of the name and Access Point to the IED.
- Configuration of the system topology and assignation of communications to the IED.
- Edition of settings.

• Edition de DATA_SET and Control Blocks (Report Control Block, Setting Group Control Block and GOOSE Control Block).
• Graphical display of the information model either as a tree or a list of items.
• Powerful filter mechanism to display/modify initial values, descriptions…
• Import and export normative configuration files. (CID, SCD).

29) SCD configuration tool enables to define a complete system with the following steps:
• Define the system topology
• Add IEDs to the system
• IEDs created with the IED configuration tool are instantiated to create the substation configuration.
• Configure IED parameters
• Set initial values, descriptions, etc.
• Modify, add and remove datasets and report or GOOSE control blocks (only if they are different from those defined in the IED model)

30) SCD configuration tool are designed for network troubleshooting, analysis, and communications protocol monitoring. It can separate simulator into “server” and “client” According IEC 61850-2.
31) The tool emulates an IEC 61850 client and facilitates the test of the communications
32) The application configuration is based on: CID file, IED data base in the substation tool or IEC 61850 self-description services.
33) SCD configuration tool has storage of the displayed information into excel.
34) The tool offers a powerful report monitoring with services:
• Data polling
• Dataset polling
• Settings and setpoints modification
• Event retrieval and configuration (report or log)
• Goose messages monitoring
• Control services
• File access based on an explorer appearance
• Device data model recover:
• Device data model generation based on the communications self-description services of the standard and automatic generation of an SCL file (CID).

35) The data model is loaded in the operation tool, users can communicate with the device simulating an IEC 61850 client.
36) The tool can recover the device data model based on the communications.
37) This tool can simulate an IEC 61850 server application that emulates the communication behavior of a real device based on CID file or IEC data base in the substation tool, with service as below:
• Self-description services.
• Data model.
• Setting model.
• Unbuffered / buffered reporting.
• Goose messages
• Control models: normal and enhanced security, direct and SBO control based on SCL loaded.

The data model loaded in the tool and users can communicate with the device using any other IEC 61850 client.

38) The engineering tool features:

Open system Software
User-friendly and easy to use engineering tools
Access control password
Authentication of authorized user
System versioning and configuration management
Configuration wizards
Commissioning test facility
IEC 61850 compliant
Hierarchical navigation tree-view structure based on IED object hierarchy
TCP/IP communication access interface
Able to create IED configuration template
Able to create Bay configuration template based on selected IED configuration
Able to communicate and exchange information using XML based SCL
Able to import and generate SCD file

39) The IED Configuration tool features:
Open system Software
User-friendly and easy to use engineering tools
Access control password
Authentication of authorized user
IED versioning and configuration management
Configuration wizards
Commissioning test facility
IEC 61850 compliant
Hierarchical navigation tree-view structure based on IED object hierarchy
TCP/IP communication access interface
Able to communicate and exchange information using XML based SCL
Able to access and generate ICD file and CID file

40) The IED interrogation, monitoring and analysis software tools features
Manufacturer Native Proprietary Software
User-friendly and easy touse engineering tools
Include as part of device mandatory accessories
Access control password
Device setting, function selection and configuration
Device configuration programmable logic editor
Disturbance, fault and event analysis/evaluation
Device communication
Commissioning test facility
IEC 61850 compliant
Hierarchical navigation tree-view structure based on IED
Object hierarchy
TCP/IP communication access interface

41) The diagnostics and maintenance tools features
Manufacturer Native Proprietary Software
User-friendly and easy touse engineering tools

Access control password
Authentication of authorized user
System, network, and device Diagnostics
Communication network tools such as Ping, Traceroute, Network Analyser, File Transfer, etc.
System, network and IED Maintenance
Device communication
Commissioning test facility
IEC 61850 compliant
Hierarchical navigation tree-view structure based on IED
Object hierarchy
TCP/IP communication access interface

4. Installation Instructions

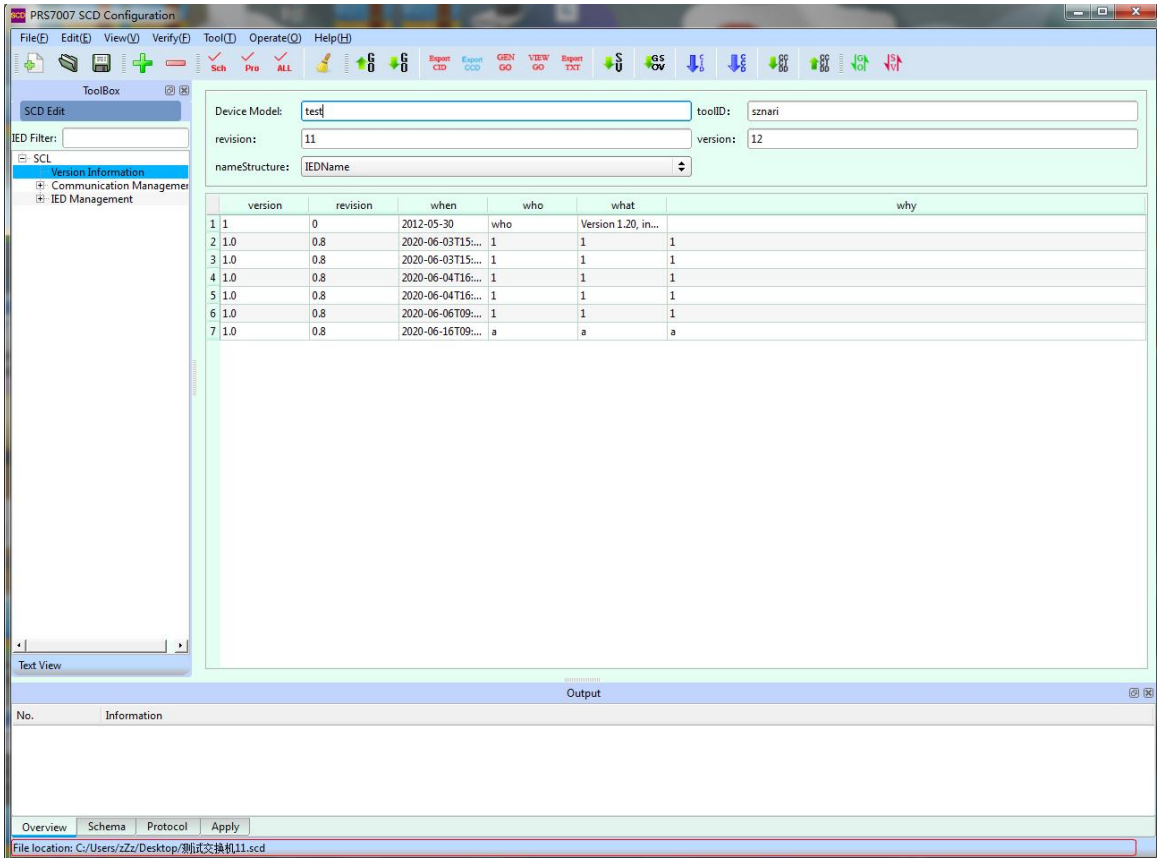
SCD configuration tools rely on .NET framework, which needs to install dotnetfx.exe, Scd_Icd installation package.msi before install. If the initial two programs are still not be launched after installation, vcredist_x86.exe should be installed.

After installation, the installation directory contains the following files or folders:

1) The executable program and related dynamic library file
2) SchemaFile: Schema grammar file
3) GooseCfg: Generated Goose configuration folder
   1 > DownLoad: Generated device Goose configuration file
   2 > UpLoad: Device to upload Goose configuration file

4.1. Instructions on Main Interface of SCD Configuration Tool

Main interface of SCD tool is as follows:

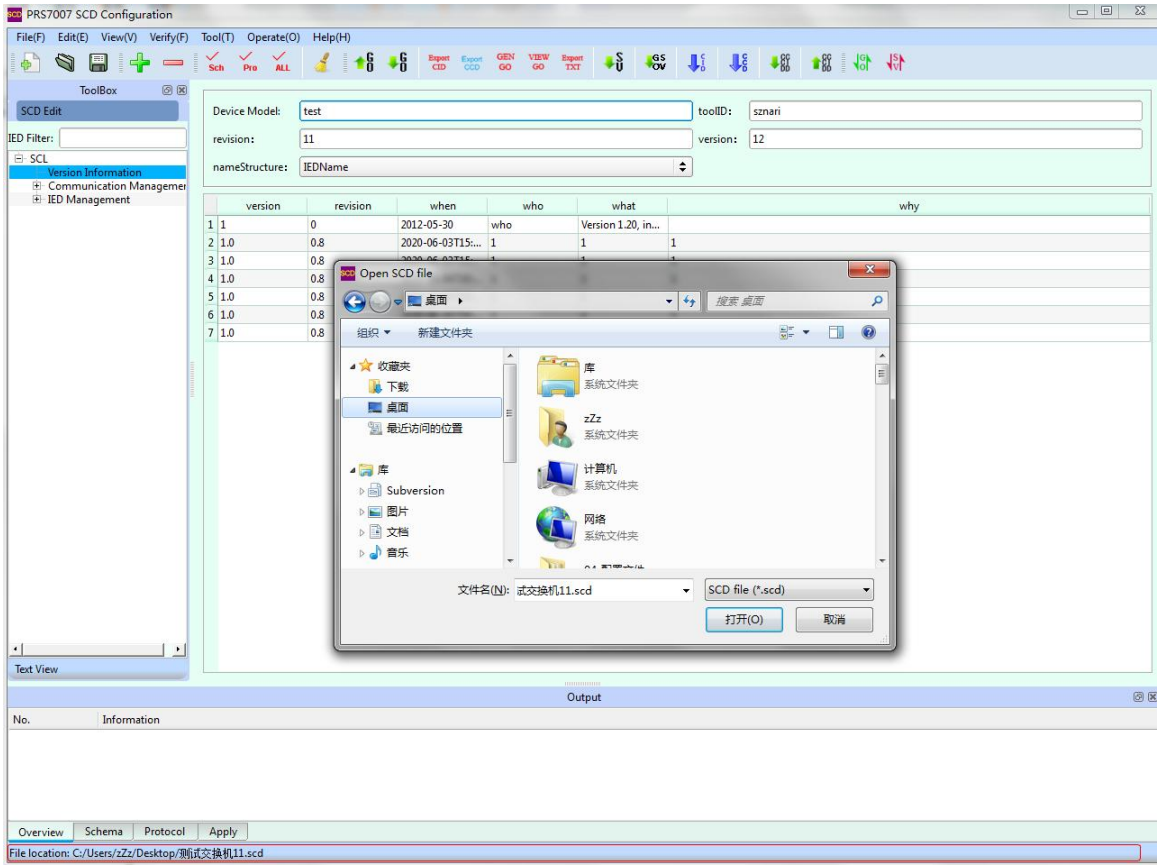


SCD tool is mainly divided into four areas:

1) The area of Menu and toolbar: Menus and Toolbars
2) Navigation area: Tree diagram of tool kit defines the functions of two parts: SCD editing and text browsing. SCD editing mainly covers modified version information, communication management and IED management; Text browsing mainly provides a function to browse four parts of SCD file in the way of XML, namely modified version information, communication information, IED information, and information on data type template.
3) Workspace: Information showed in this area is based on the choice of the tree diagram in the navigation area.
4) Output information area: It is mainly for some hints and authentication information in the process of operating SCD file.

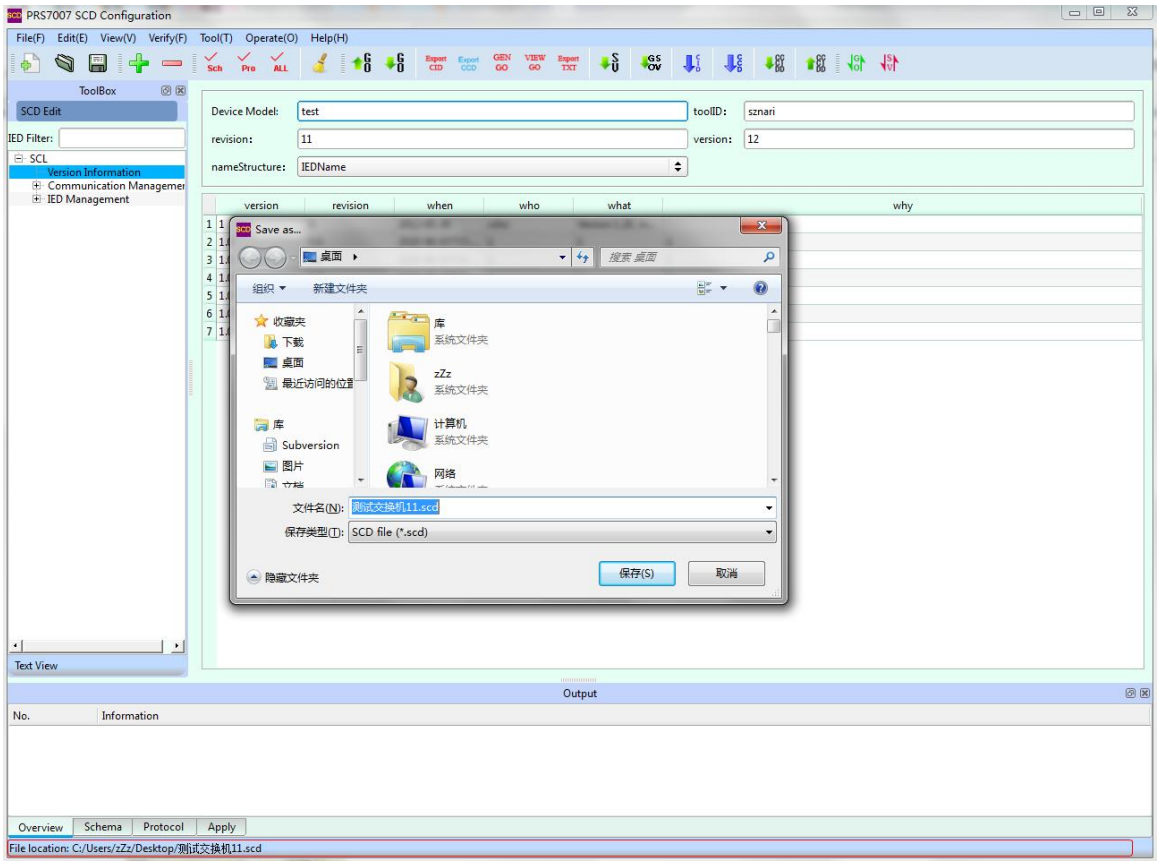
4.2. Import of ICD File

Based on the configuration flow of engineering practice, SCD configuration file is obtained by importing ICD document. The imported file comprises IED part of ICD file and Data Type Templates. For imported template part, it will take union set of various corresponding template contents of all imported IED.



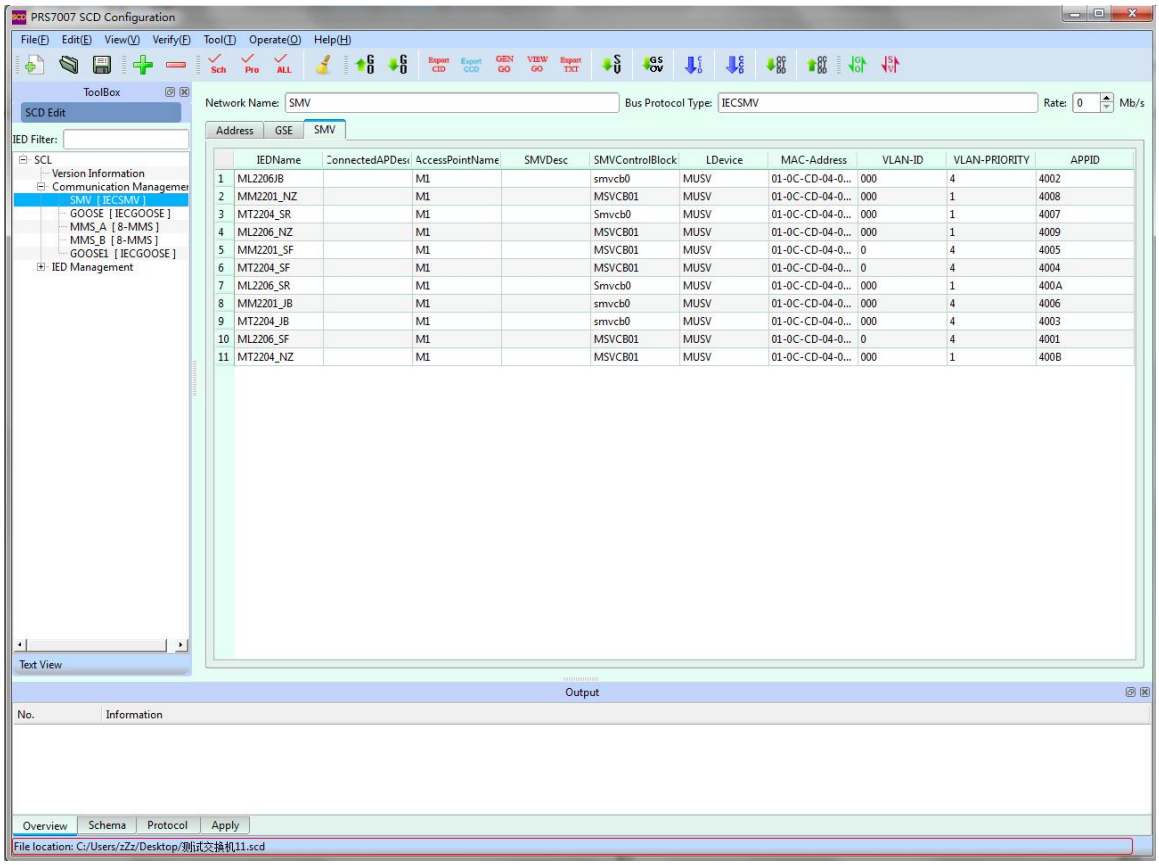
4.3. Export of CID File

This function completes export of the whole CID file needed by the device from SCD file. An IED of SCD is the default of export, and file name is the name of IED, such as CM5001. CID. Tools provide a single IED export and batch export function. One option is to choose an IED in the navigation area and use right-click menu to export, another is to select multiple IEDs in IED management interface and bulk export.



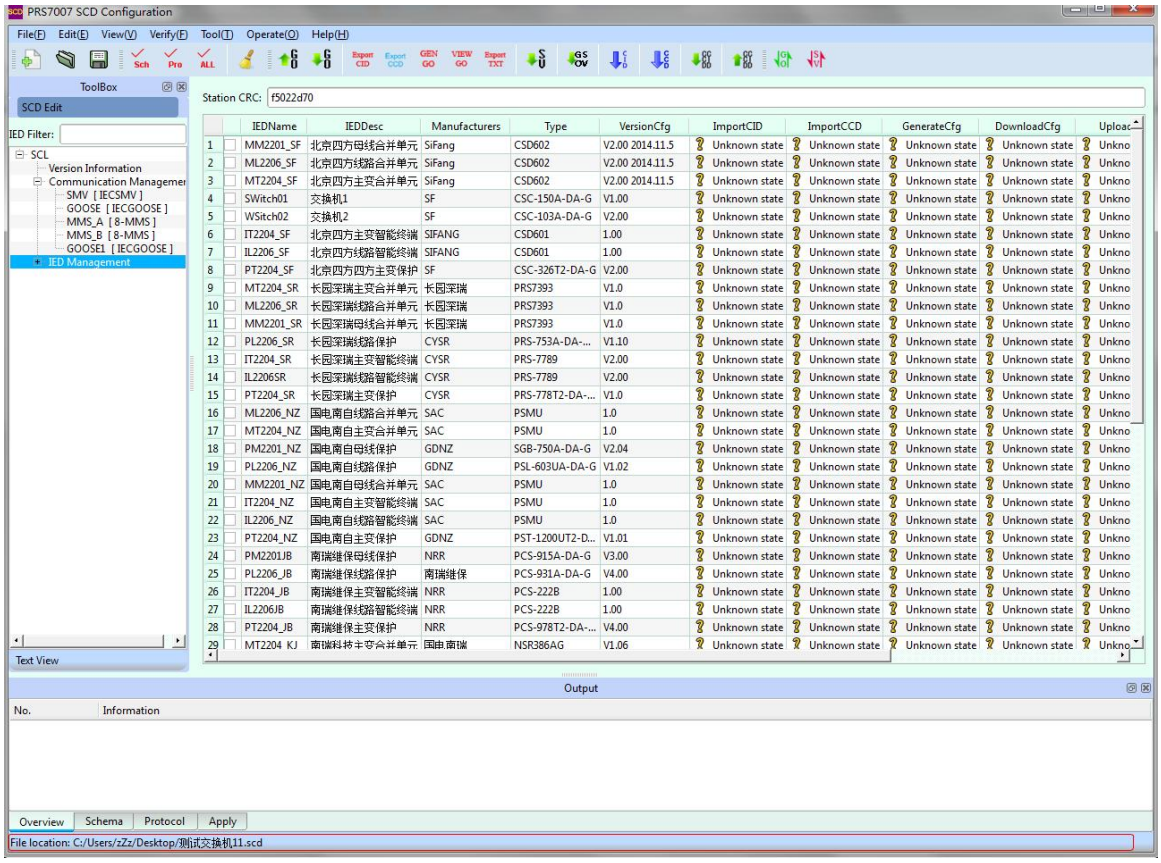
4.4. Communication Management

Communication management function is for setting up communications of the whole station in a unified way. It mainly depends on the type of access point of IED and practical needs to conduct network configuration of MMS, GOOSE, and SMV



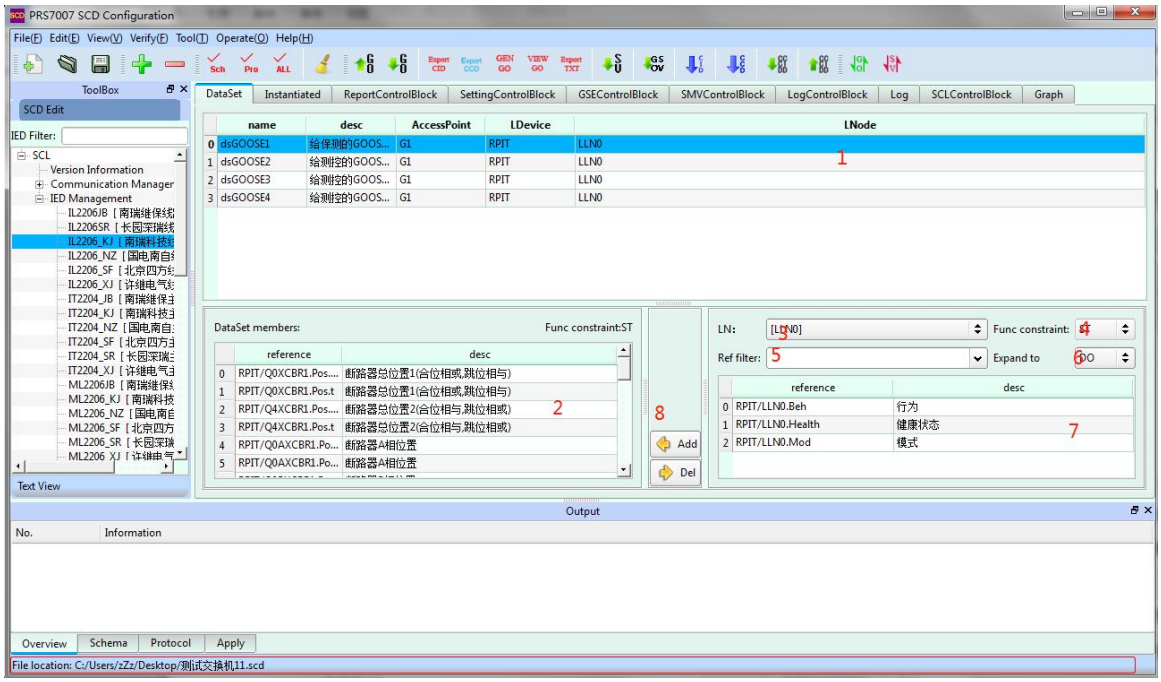
4.5. IED Management

IED management function is for configuring and combining SV data for data sets, report control block, the log control block, instantiation, GOOSE data assembly, GSE control block, SMV control block, fixed value control block, SCL control block, and the log which are specified by 61850 of IED.



4.5.1. Data set

Provides configuration function of IED data set, including data set attributes and data set members.



① List all IED data sets and the attributes thereof.

② List FCDA members of data sets and the attributes thereof.

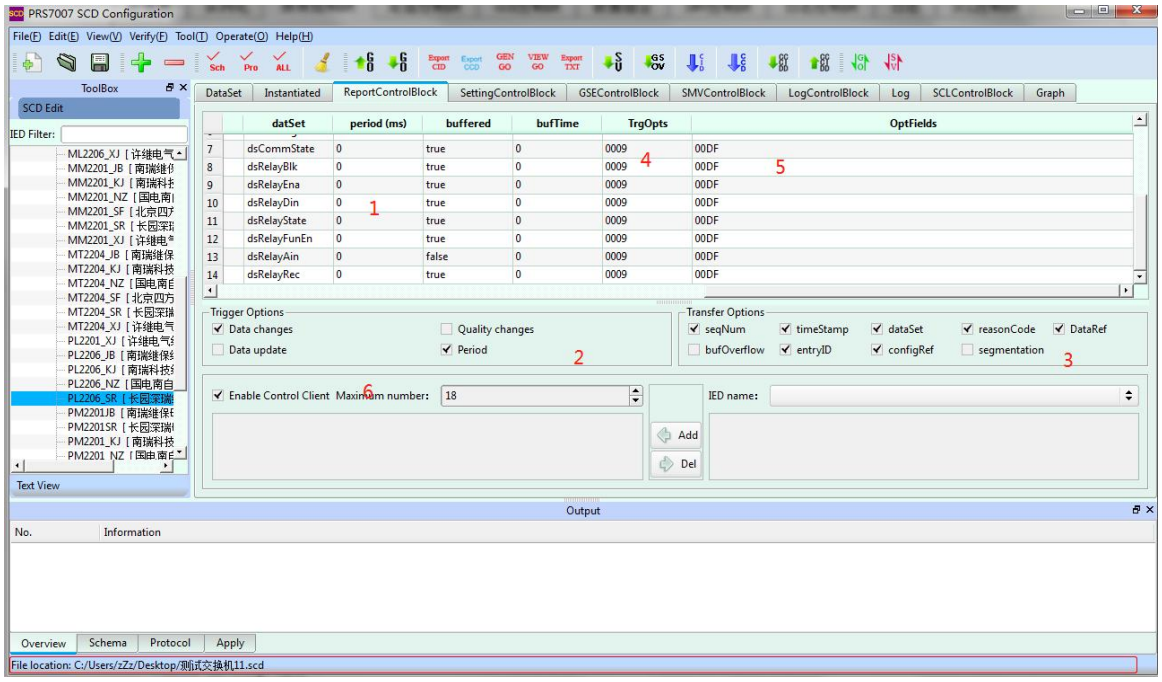
③,④,⑤,⑥ According to LN function constraint, and character string included in reference (case-sensitive), unfold references until DO or DA can filter out the eligible member references of data sets

⑦ List all eligible member references of data sets

⑧ Add/delete FCDA members of data sets. When adding, if members are already in, it will not add the existing members.

4.5.2. Report Control Module

Provides configuration function for report control module of IED

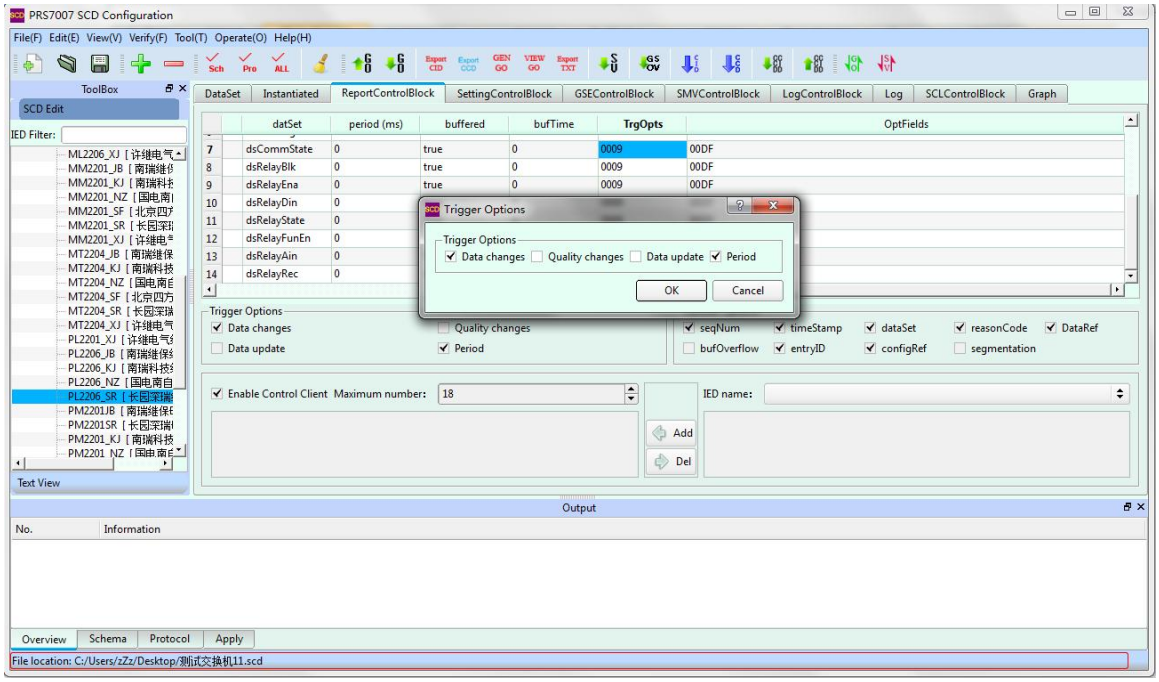


① List the report control module of IED and the attribute thereof;

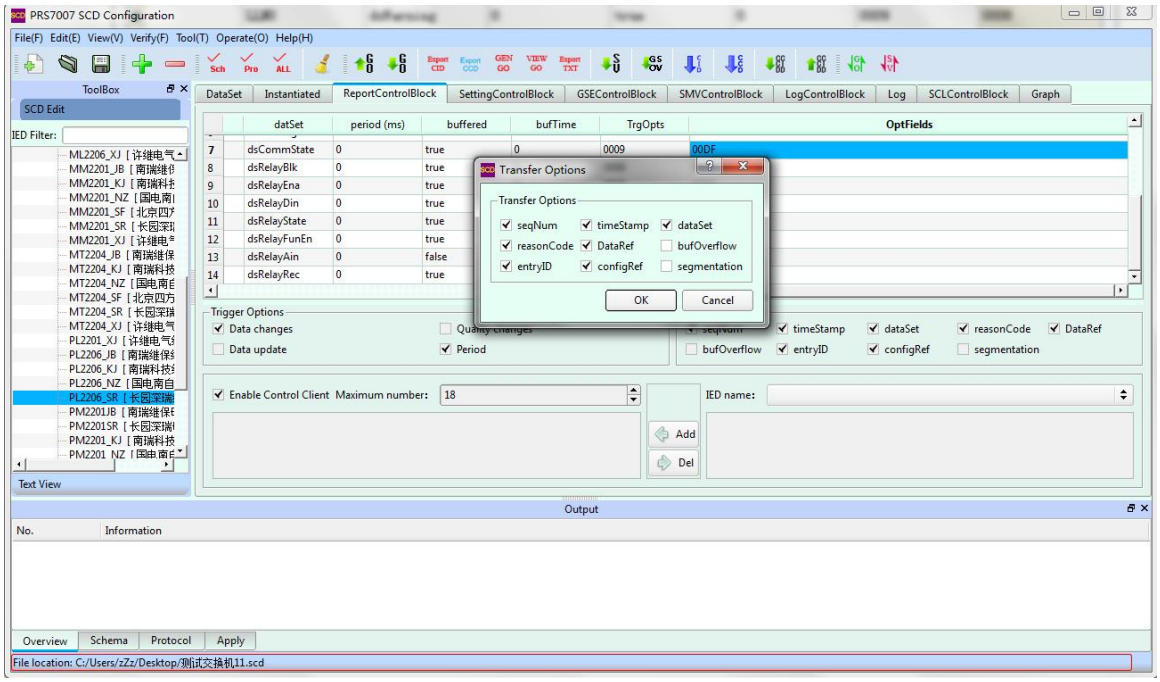
② Select the trigger option in the report control module. The value shown corresponds to the hexadecimal value in step ④;

③ Select the trigger option in the report control module. The value shown corresponds to the hexadecimal value in step ⑤.

④ Double click to set the trigger option. The value is displayed in hexadecimal number system.

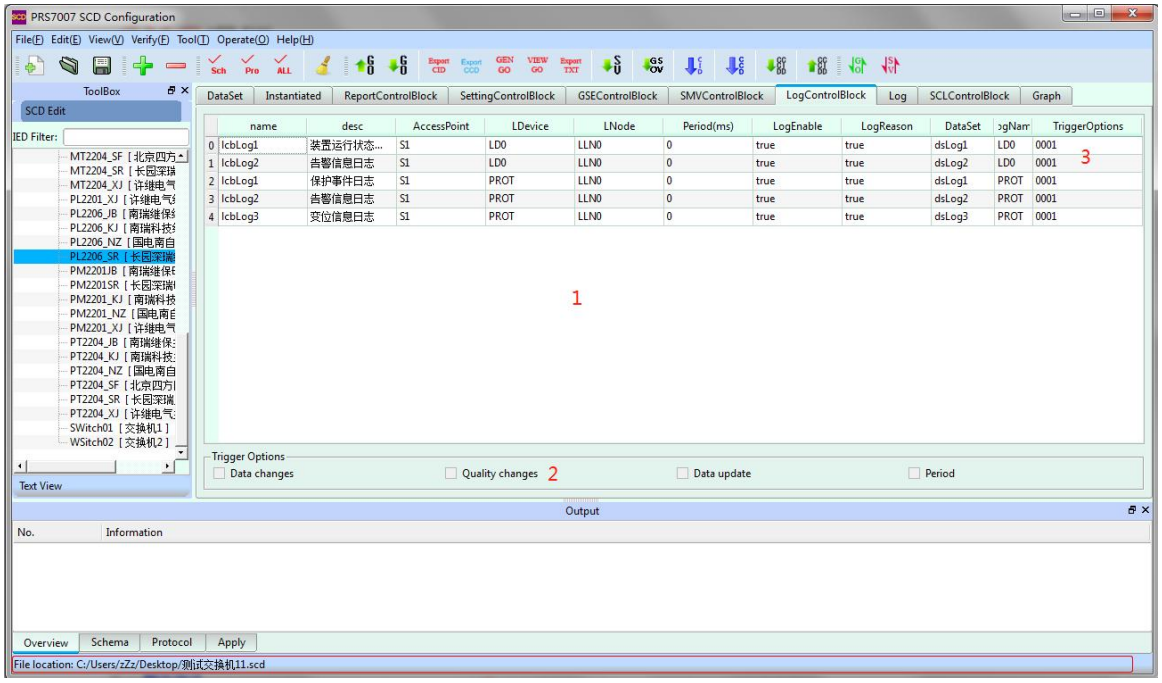


⑤ Double click to set the transmission option. The value is displayed in hexadecimal number system (a little different from that in 2006 Schema).



4.5.3. Log Control Module

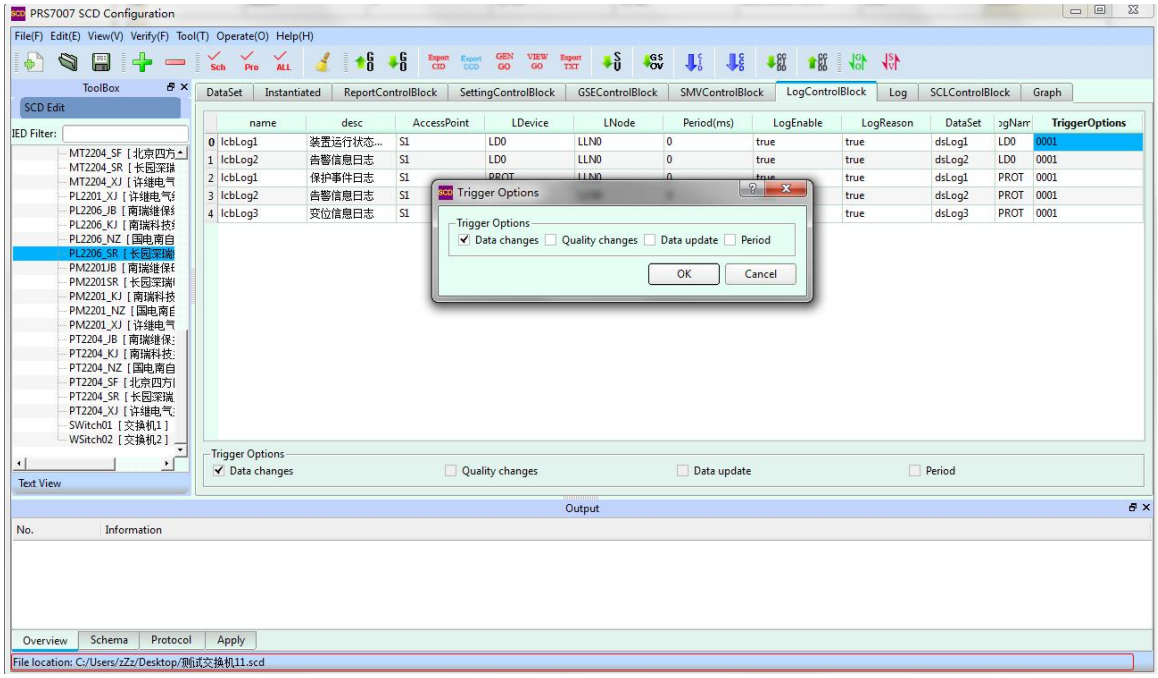
Provides configuration function for log control module of IED.



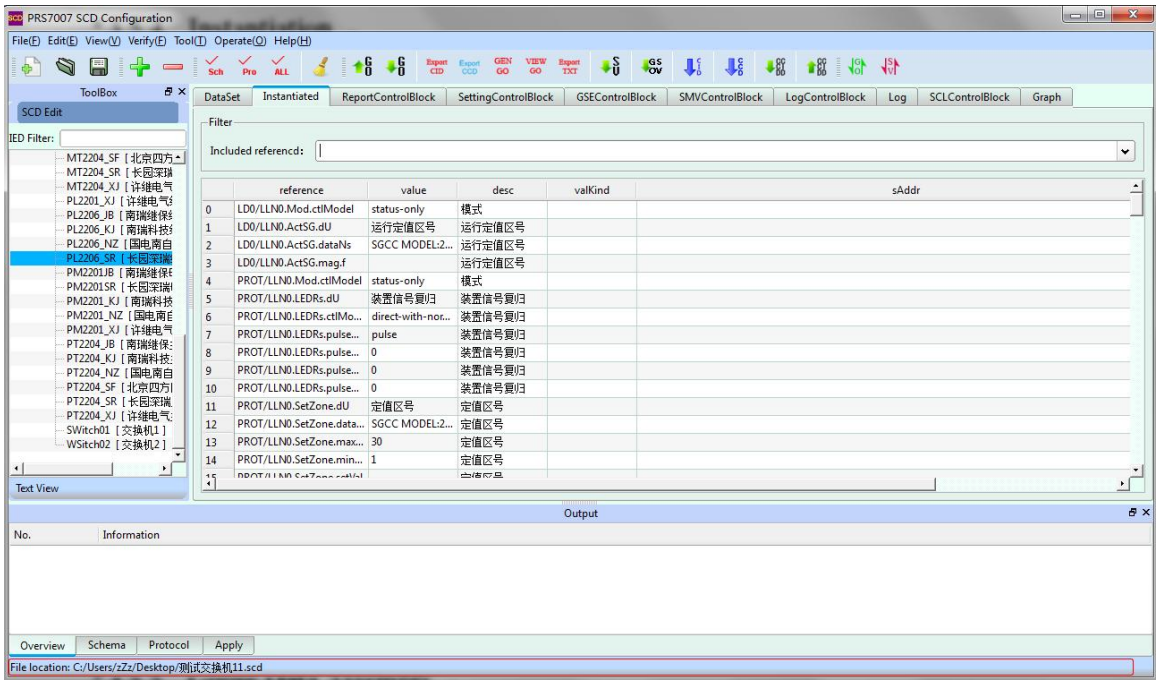
① List log control module of IED;

② Display the trigger option of selected log control module. The value shown corresponds to the hexadecimal value.

③ Double click to set the trigger option. The value is displayed in hexadecimal number system;

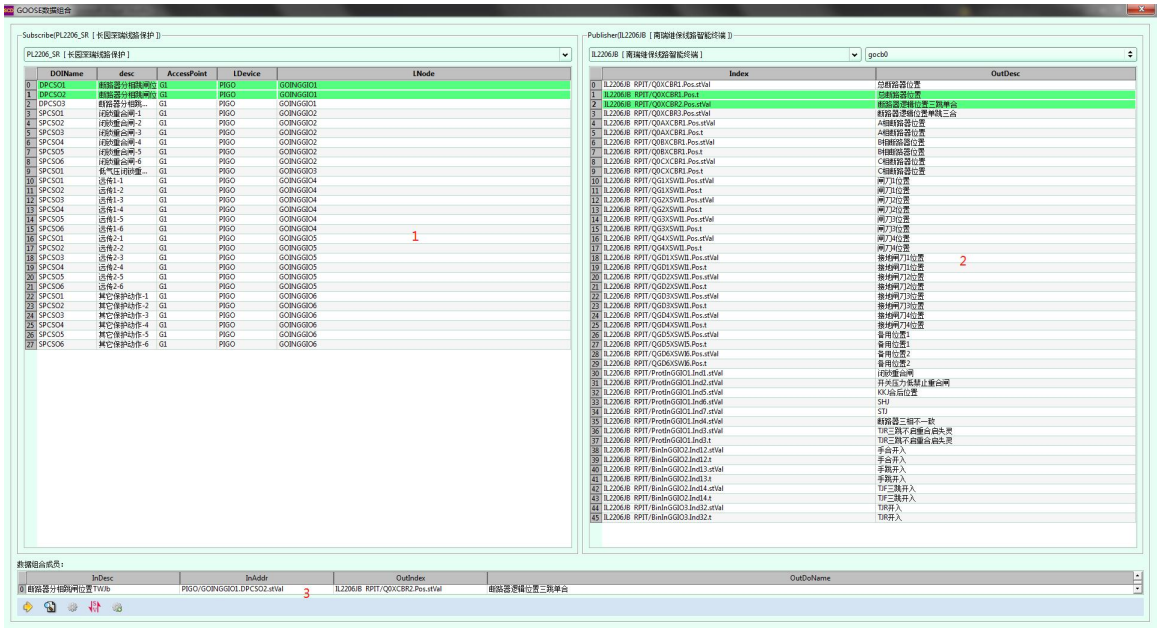


4.5.4. Instantiation



4.5.5. Goose Data Assembly

Provides configuration function for Inputs (association relationship with Goose) of IED.



Zone with red number 1: List all DOI under IED;

Zone with red number 2: Filter out all data set members (output) that meet the requirements;

Zone with red number 3: List Inputs member ExtRef (connection relation) that is related to selected DOI (import).

Notes:

1) Drag a clicked row of data from zone with red number 2 to the above row of data in zone with red

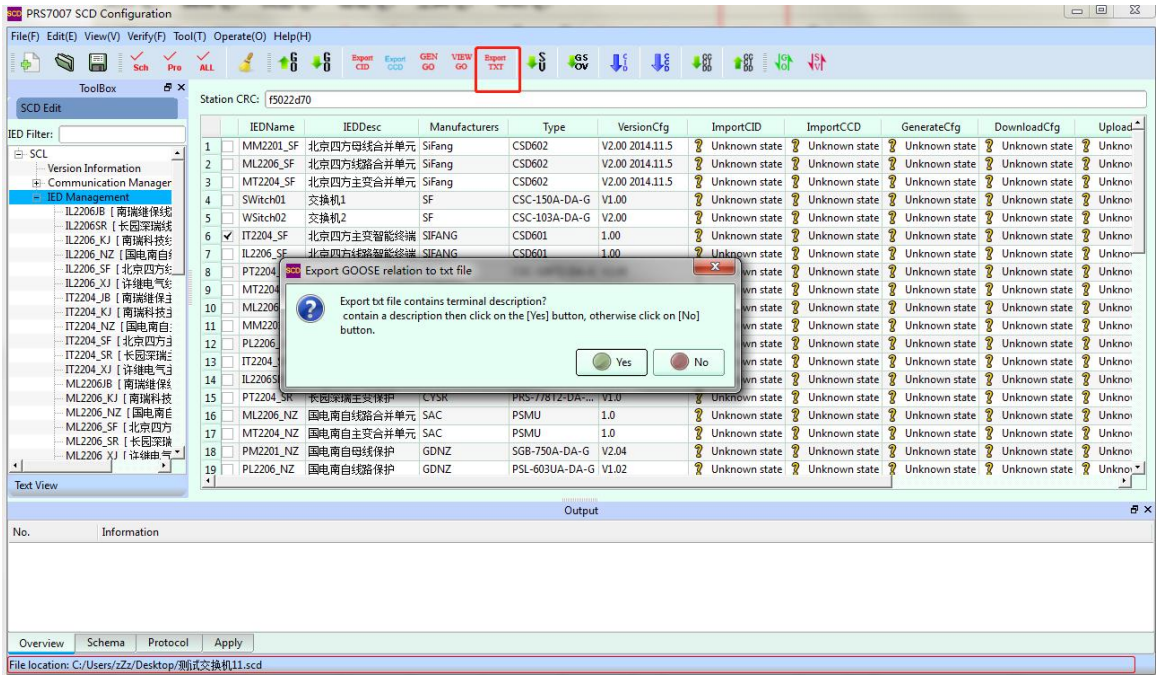
number 1, and release the mouse button to add Inputs member ExtRef to Goose data assembly.

2) Select a certain row of data in the zone with red number 3, and click the button  on the top to delete the Inputs number ExtRef.

3) Click button  to look over the association relationship of the currently configured Inputs member ExtRef in IED.

4) Click button  to configure the port information which is received in the Goose data assembly module.

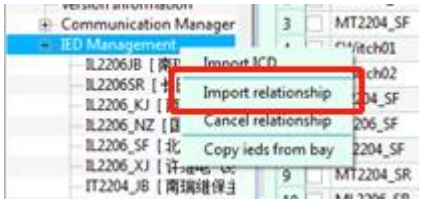
Configuration for association relationship among IEDs is the key point, and export function of association relationship is provided. Click [IED management] node and jump to IED list interface; and then, click IED to be exported and later click the button [export TXT] marked in red box.



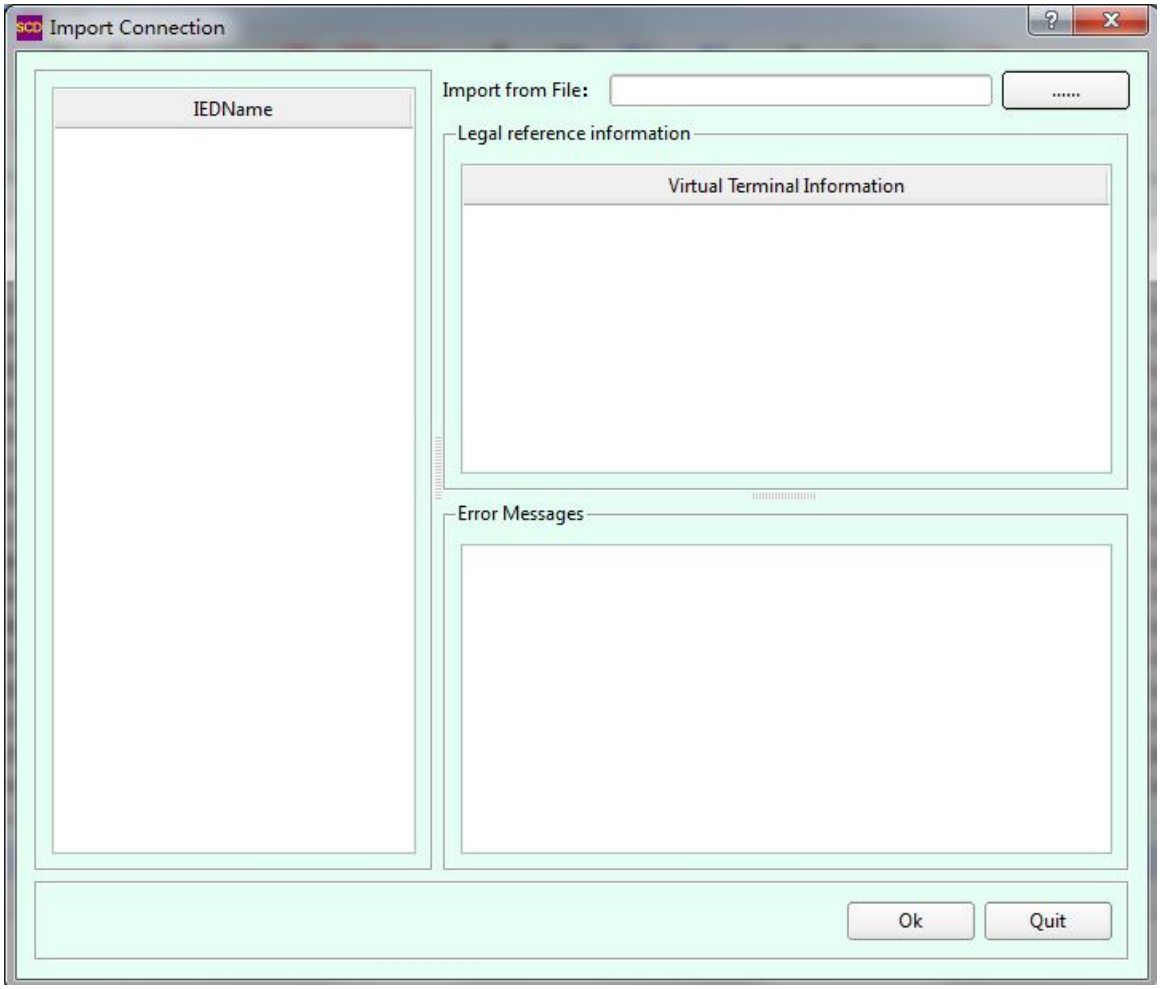
The exported document in txt format is stored as a backup copy and used for recovery of an error configuration during revision through the following steps:

1> Export association relationship excluding description of terminals into a document in txt format (Click button Cancel in a prompted dialog), and back up the document;

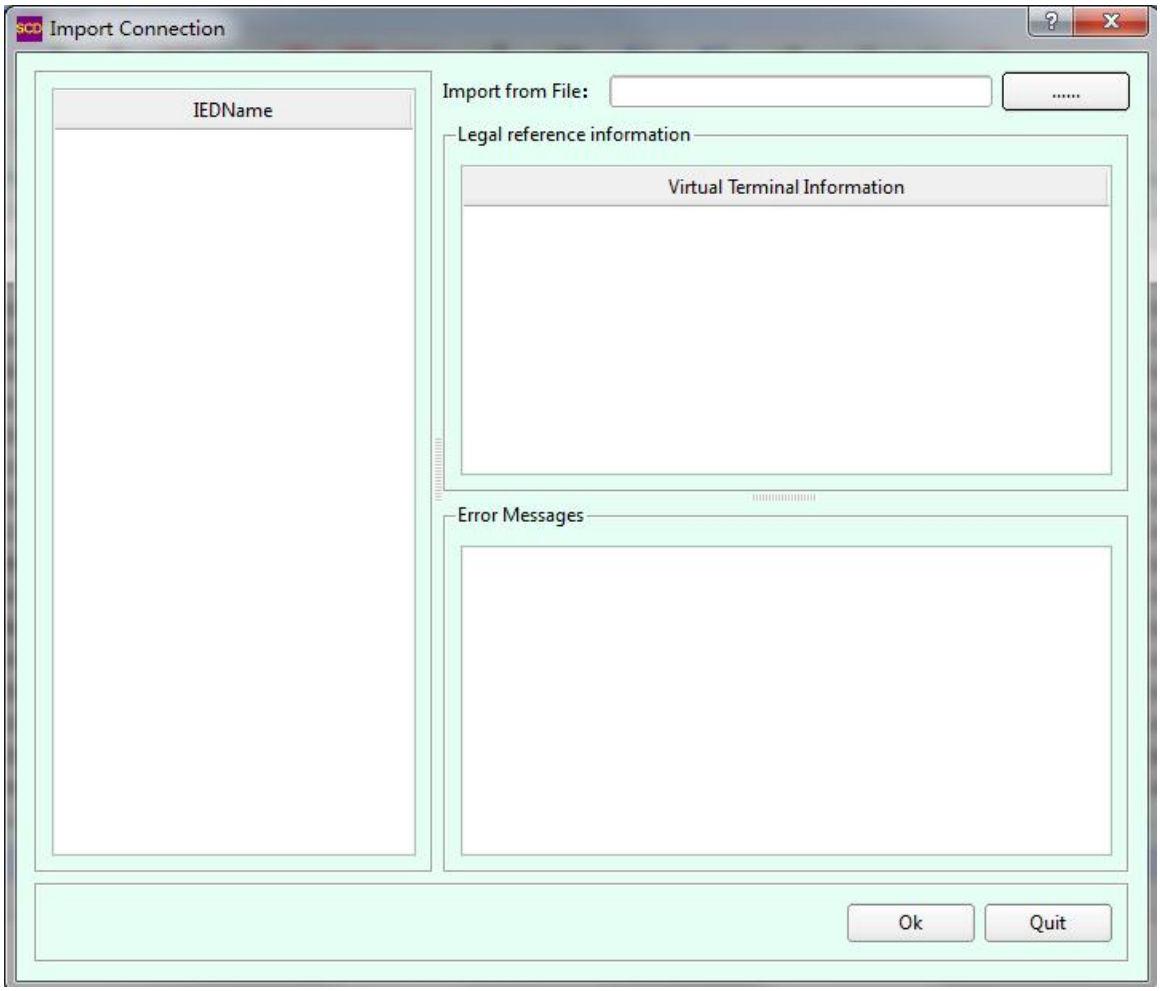
2> Right click on the button IED management node in the submenu of tool kit SCD's editing interface to import association relationship;



3> Select relational documents of backups;



The association relationship between import and export is shown, during which the legality thereof will be analyzed. Illegality of the association relationship will be prompted in the form of error message. If the association relationship is imported repeatedly, the error will be prompted as follows:

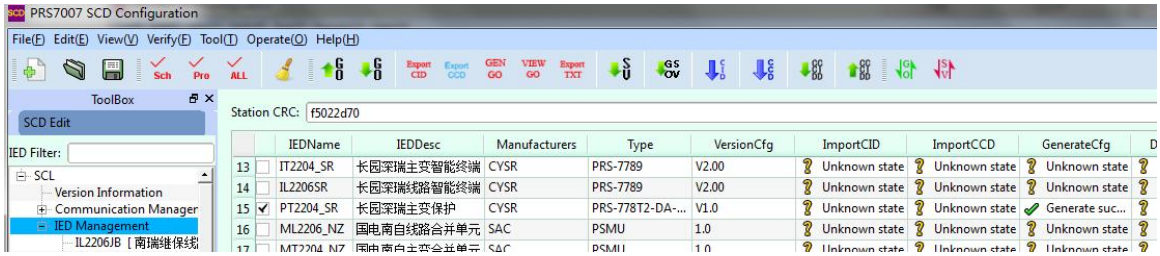


4> Select OK to import legal association relationship;

5> Export association relationship before revision and export another copy after the revision; make a comparison conveniently with the text comparing tool.

Meanwhile, comparison of Goose configuration is also conveniently done through the function of importing.

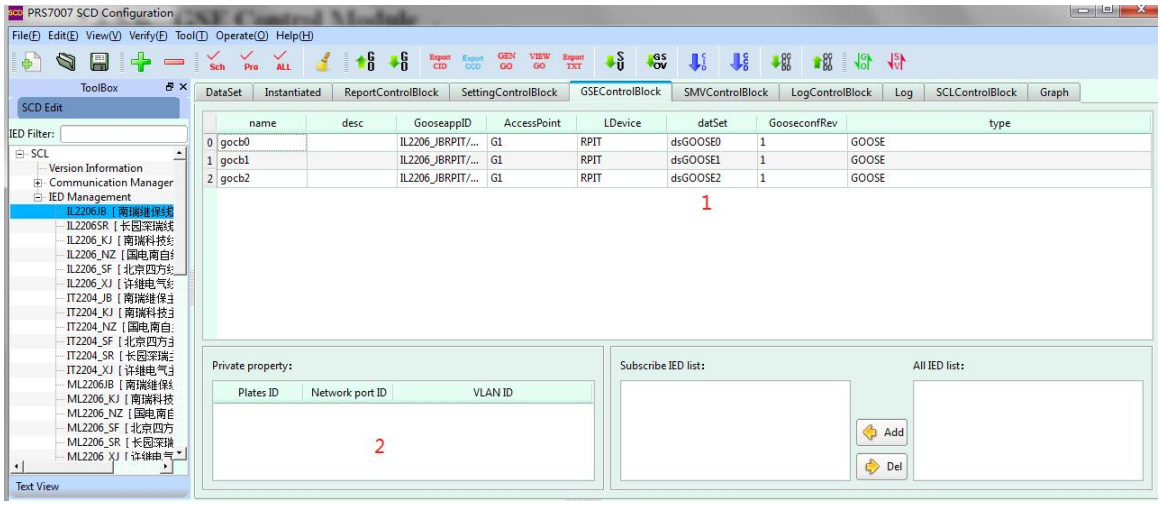
Given the configuration before revision is GooseCfg\UpLoad\ PRS7789.cfg, the Goose configuration shall be regenerated after the revision.



And then, click to view the configuration and get the comparison result.

4.5.6. GSE Control Module

Provides configuration function for GSE control module of IED, including GSSE and GOOSE types; the default one is GOOSE.

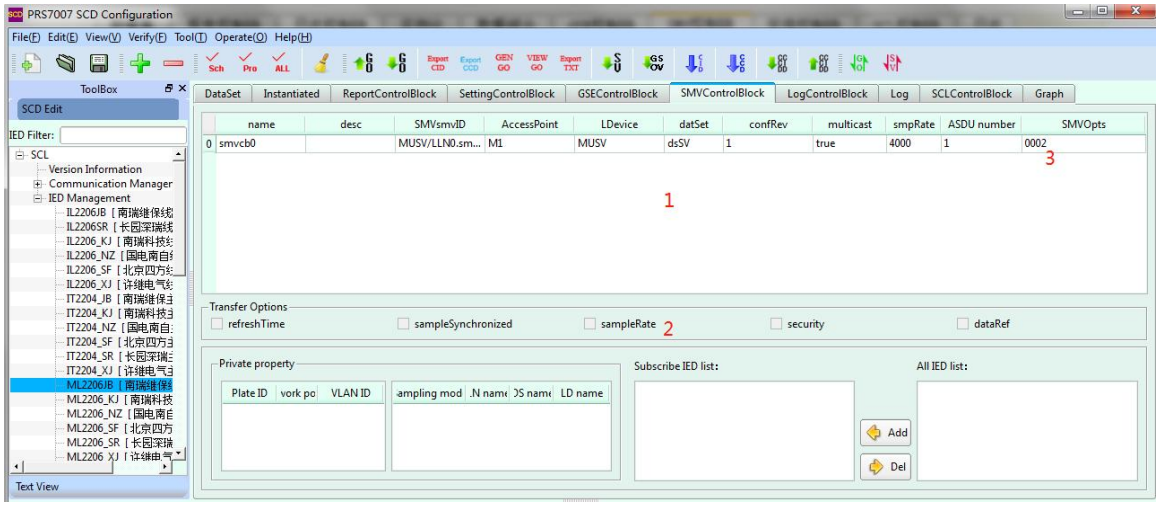


① List GSE control module of IED and attributes thereof;

② List plate & internet access number, private attribute of VLAN number, and SZNARI characteristic, which are for generation of Goose configuration;

4.5.7. SMV Control Module

Provides configuration function for SMV Control Module of IED.

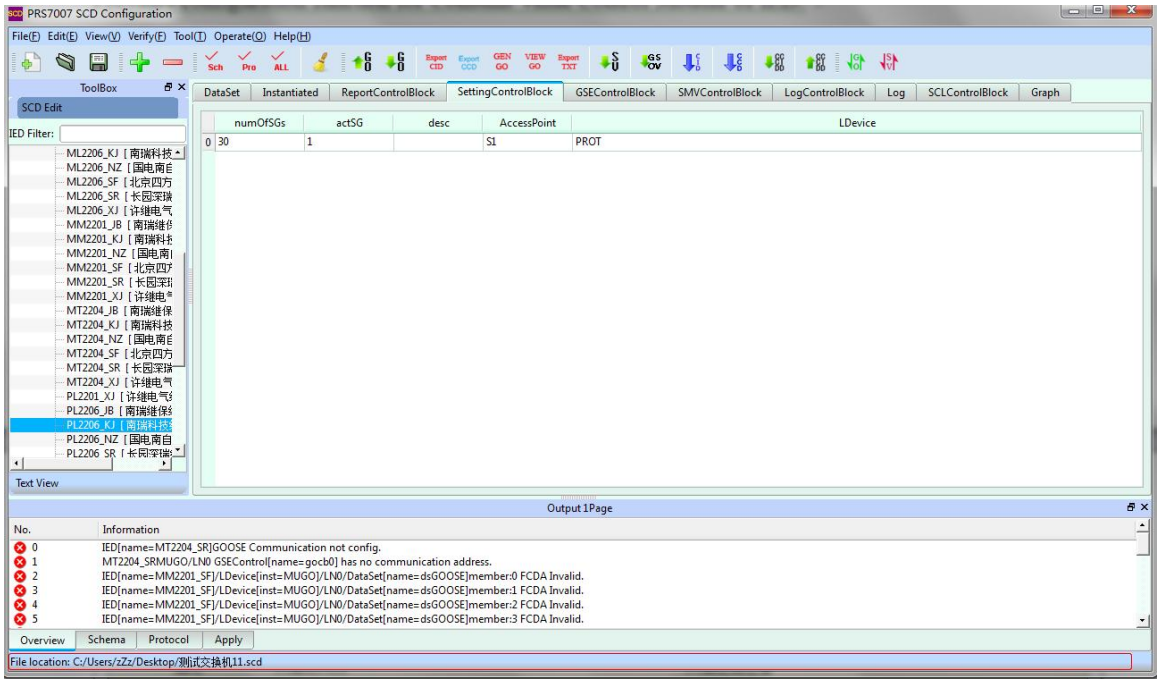


① List SMV control module of IED and attributes thereof;

② Display the transmission option of report control block.

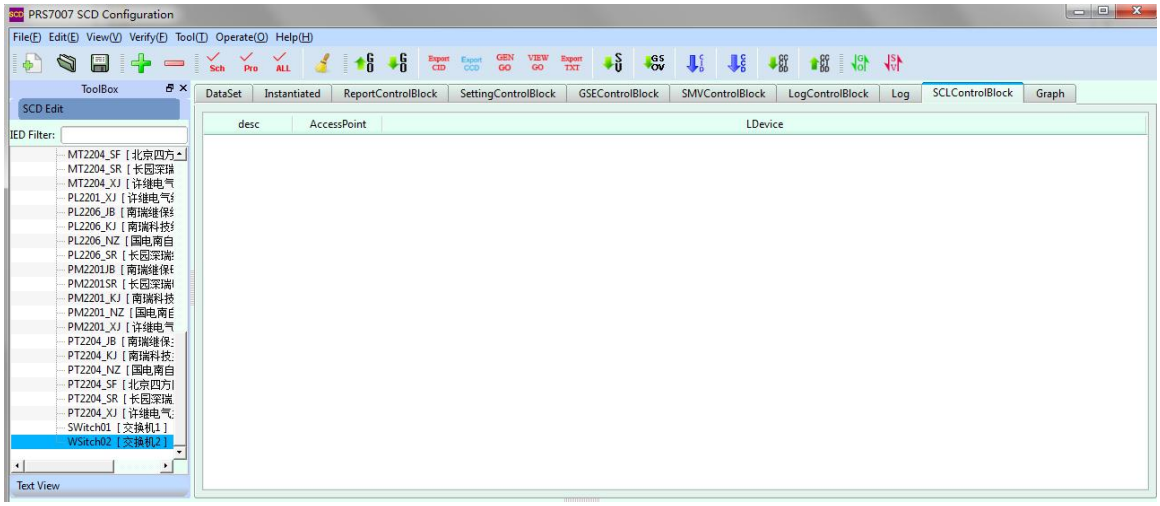
4.5.8. Constant Value Control Module

Provides configuration function for Constant Value Control Module of IED.



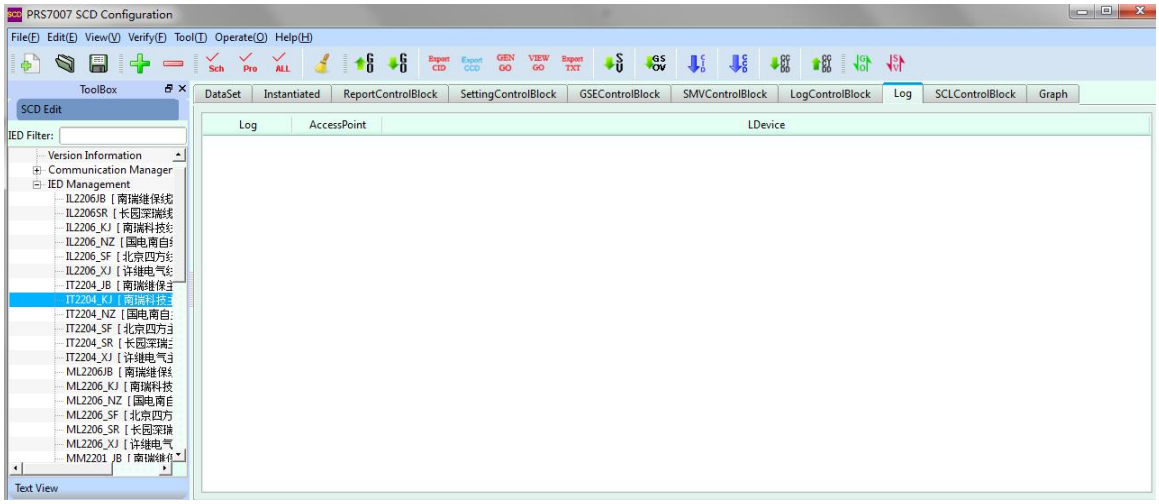
4.5.9. SCL Control Module

Provides configuration function for SCL Control Module of IED.

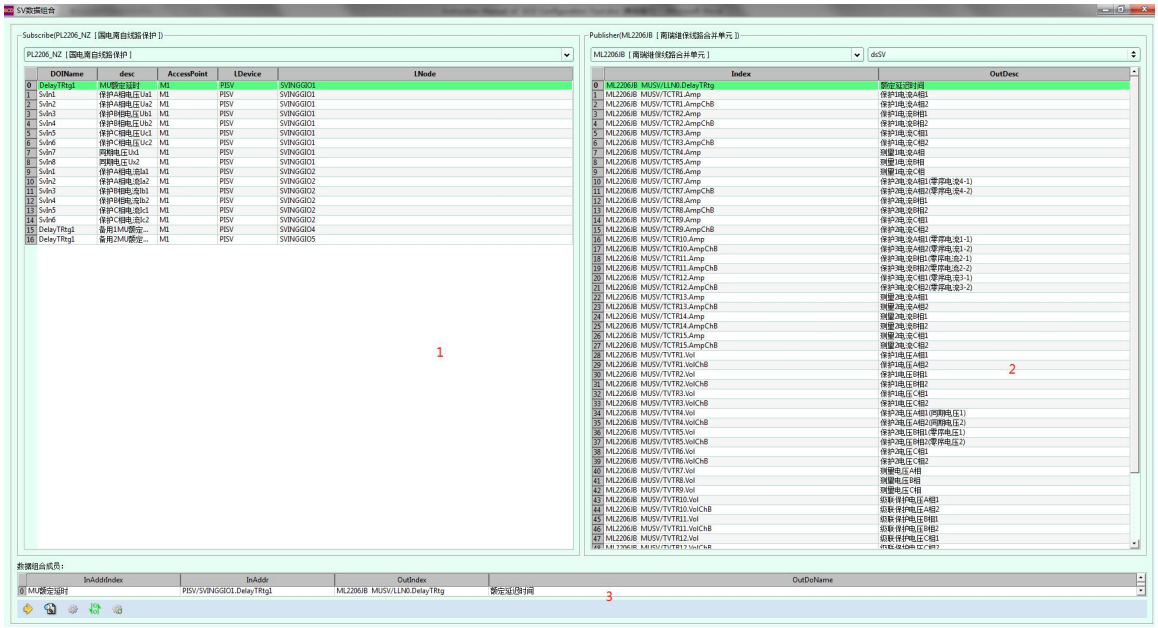


4.5.10. Log

Provides configuration function for Log of IED.



4.5.11. SV Data Assembly



Zone with red number 1: List all DOIs under IED;

Zone with red number 2: Filter out data set members that meet the requirements (export);
Zone with red number 3: List Inputs member ExtRef (connection relation) that is related to the selected DOI (import);

Notes:

1) Drag one selected row from zone with red number 2 to the above row of a certain item of data in zone with red number 1, and release the mouse button to add Inputs member ExtRef to SV;

2) Click a certain row of data in zone with red number 3, and click the button  on the top to delete Inputs member ExtRef.

3) Click button  to view the association relationship of the currently configured Inputs member ExtRef in IED;

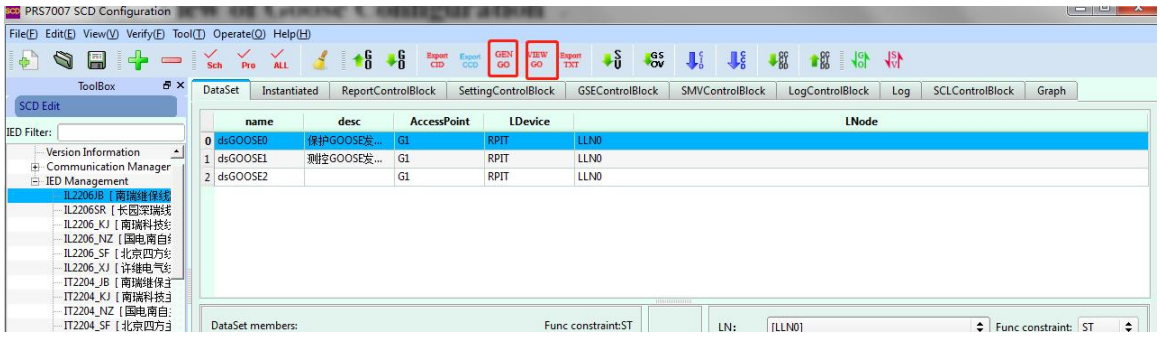
4) Click button  to configure port information that is received by SV.

4.6.Verification Function

Verification is provided respectively for Schema grammar and protocol. For the verification of Schema grammar, SCD file is verified in accordance with Schema grammar file under SchemaFile file; and for the verification of protocol, it is stipulated for verification of 61850 communication protocol. Verification information will be displayed in the output information zone.

4.7.View of Goose Configuration

View Goose configuration in IED, including communication configuration, ExtRef (connection relation) of Inputs, etc.



1) Select IED and click the button 

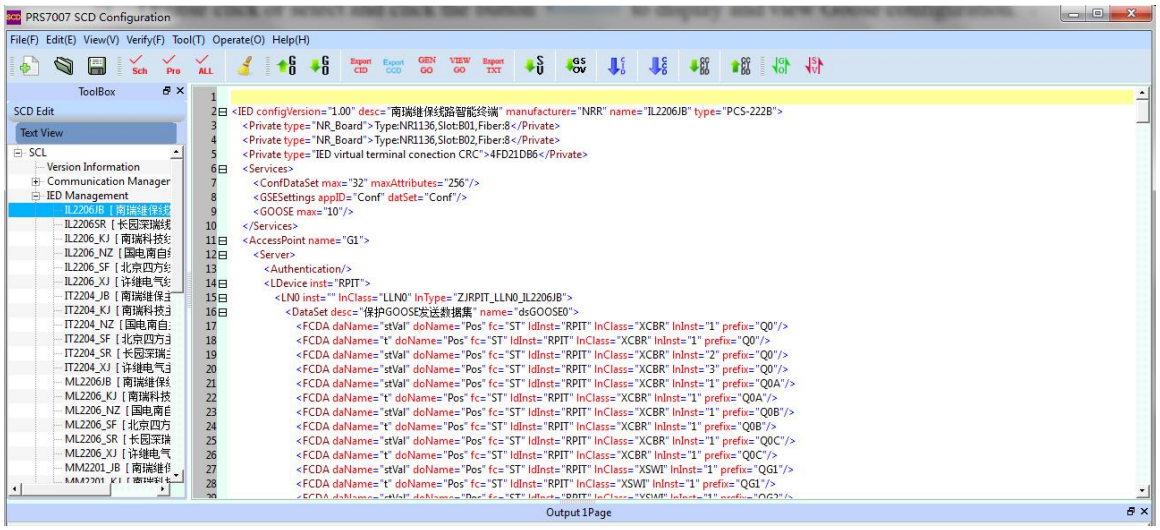
. There will be a green tick shown in the configuration generation column if the Goose configuration succeeds, and default name .cfg will be generated in subdirectory of GooseCfg\DownLoad.

2) Double click or select and click the button 

to display and view Goose configuration.

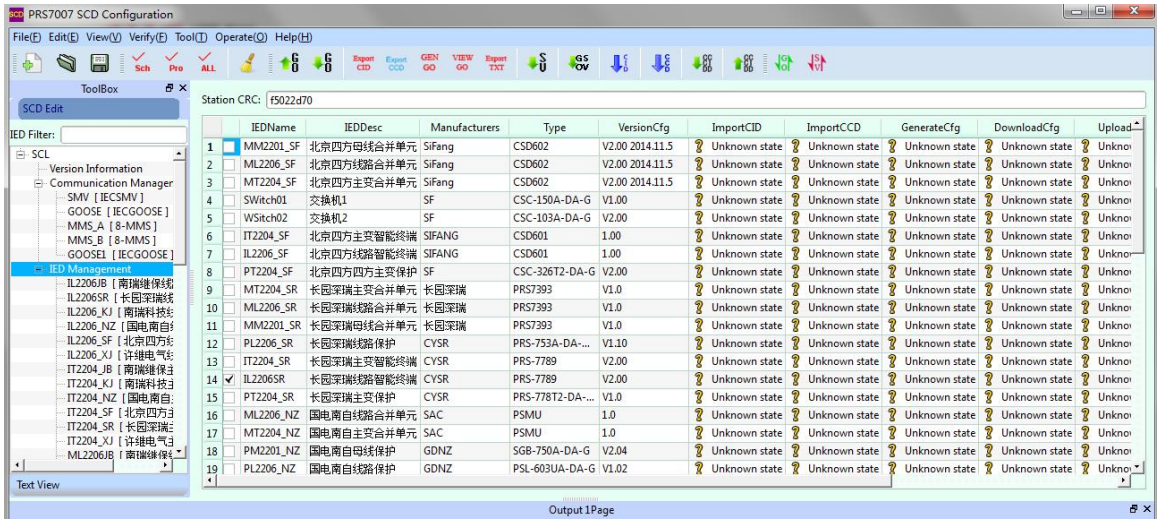
4.8. Text View

Text View mainly implements the function of browsing the information of the version of SCD files, communication information, IED information and data type template information in XML method.



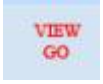
4.9. Configuration Download

SCD tool provides the downloading of Goose/SV configuration files, and downloading configuration files for the appliances is completed through the toolbar. Below are the detailed descriptions of the toolbar. Before the configuration file is generated, a certain IED needs to be chosen as in the picture below.



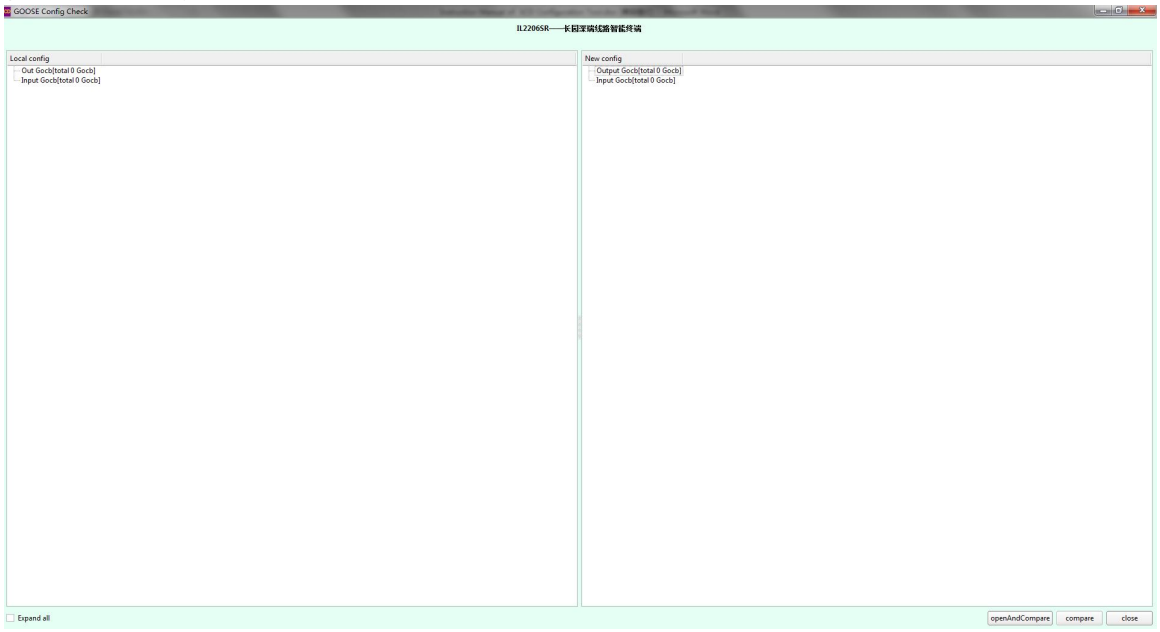
4.9.1. Upload Goose Configuration

The 

button implements the function of uploading Goose.cfg from the appliance to the local computer. Check the detailed information of the uploaded configuration with the 

button after you

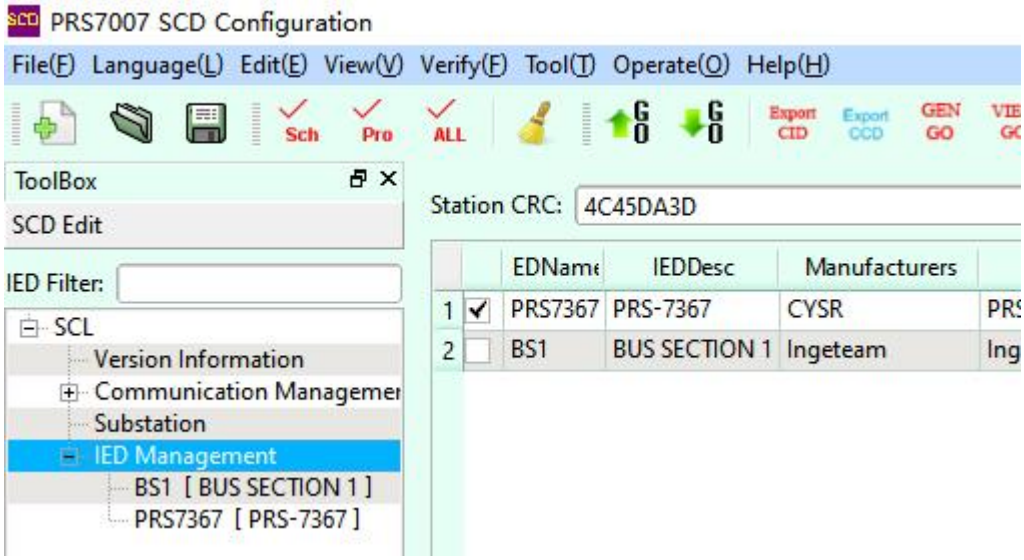
have completed uploading the file. Detailed configuration information is shown in the picture below (on the left of the tree graph are configurations uploaded from the appliance, and on the right are the configurations generated locally):

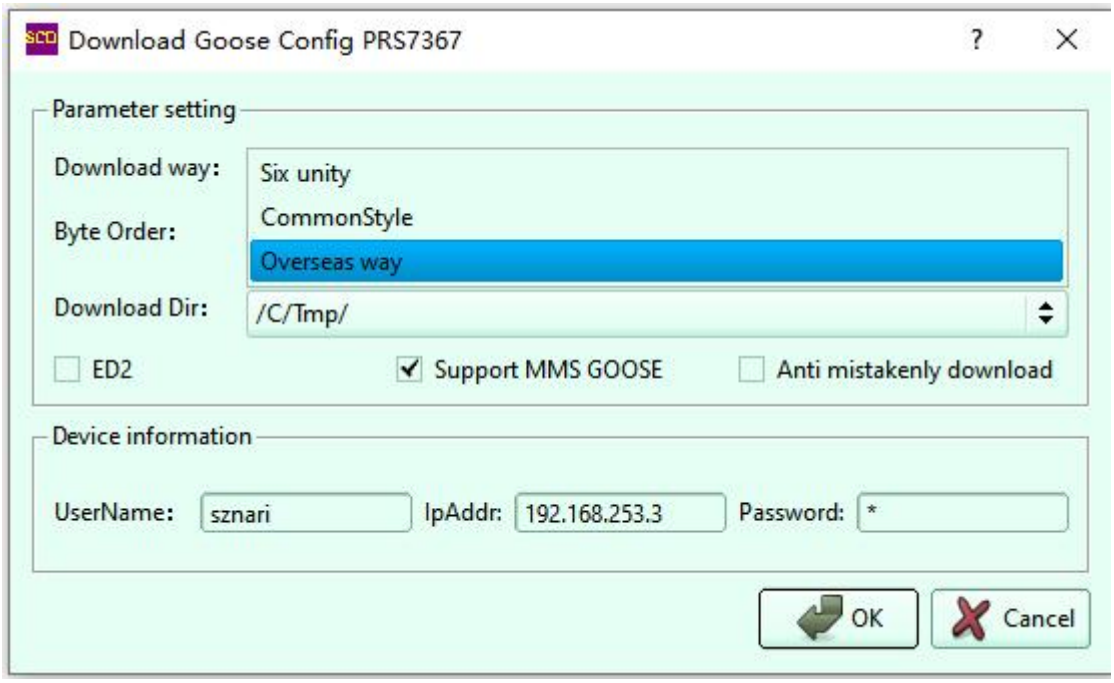


4.9.2. Download Goose Configuration

The  button implements the function of generating and downloading the GOOSE configuration for the currently selected IED appliance.

On the main interface, select the IED Management node and select an IED device in the right view,then click the  button，sselect the download way on the download interface as "Overseas way",and set the “Support MMS GOOSE” checked,input the correct IpAddr,finally start to download.





4.9.3. Generate GOOSE Configuration

The 

button implements the function of generating the GOOSE configuration for the currently selected IED appliance. Check the detailed information of the uploaded configuration with the 

button.

4.9.4. Download SV Configuration

The 

button implements the function of generating and downloading the SV configuration file for the currently selected IED appliance.

4.9.5. One-key Downloading of GOOSE/SV Configurations

The 

button implements the function of generating and downloading the GOOSE/SV configurations together for the currently selected IED appliance.

4.9.6. Download CID Configuration

The 

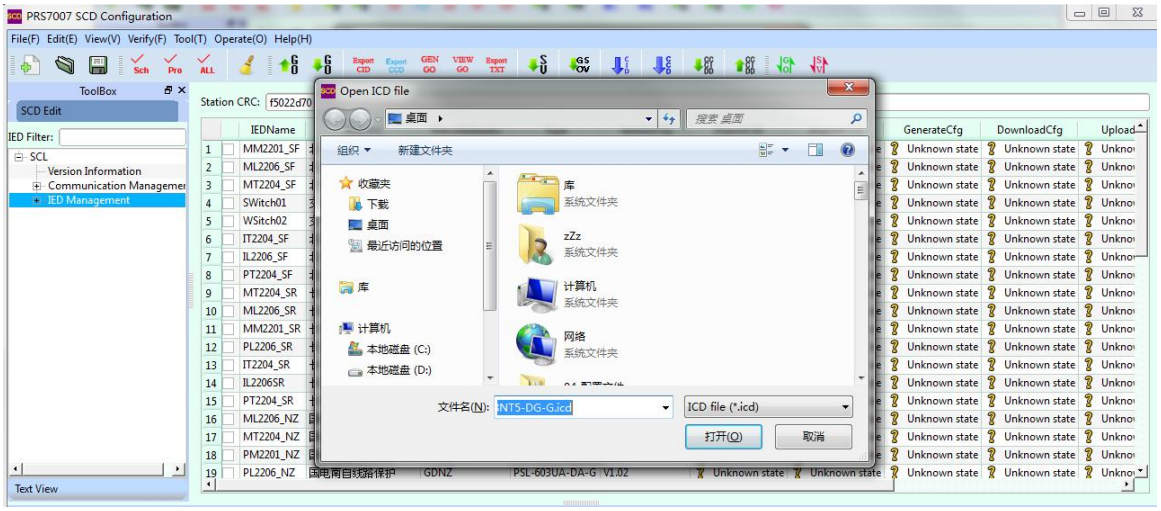
button implements the function of generating and downloading the CID configuration for the currently selected IED appliance.

5. Instructions

A realistic example is provided to show you how to use the SCD configuration tool.

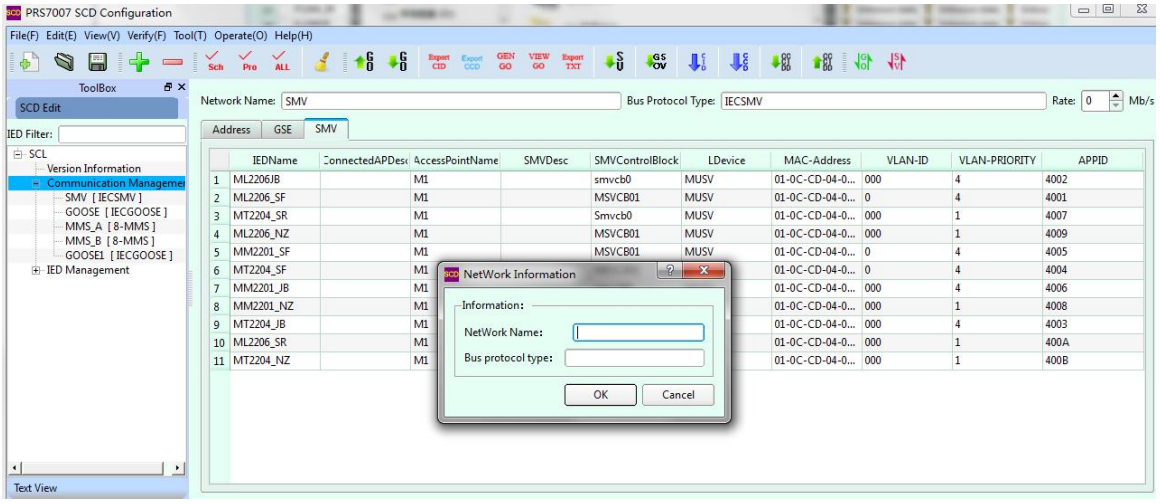
5.1.Import ICD File

Create a new SCD file – Example.scd, and import CE2001.icd and IE2201A.icd files separately.

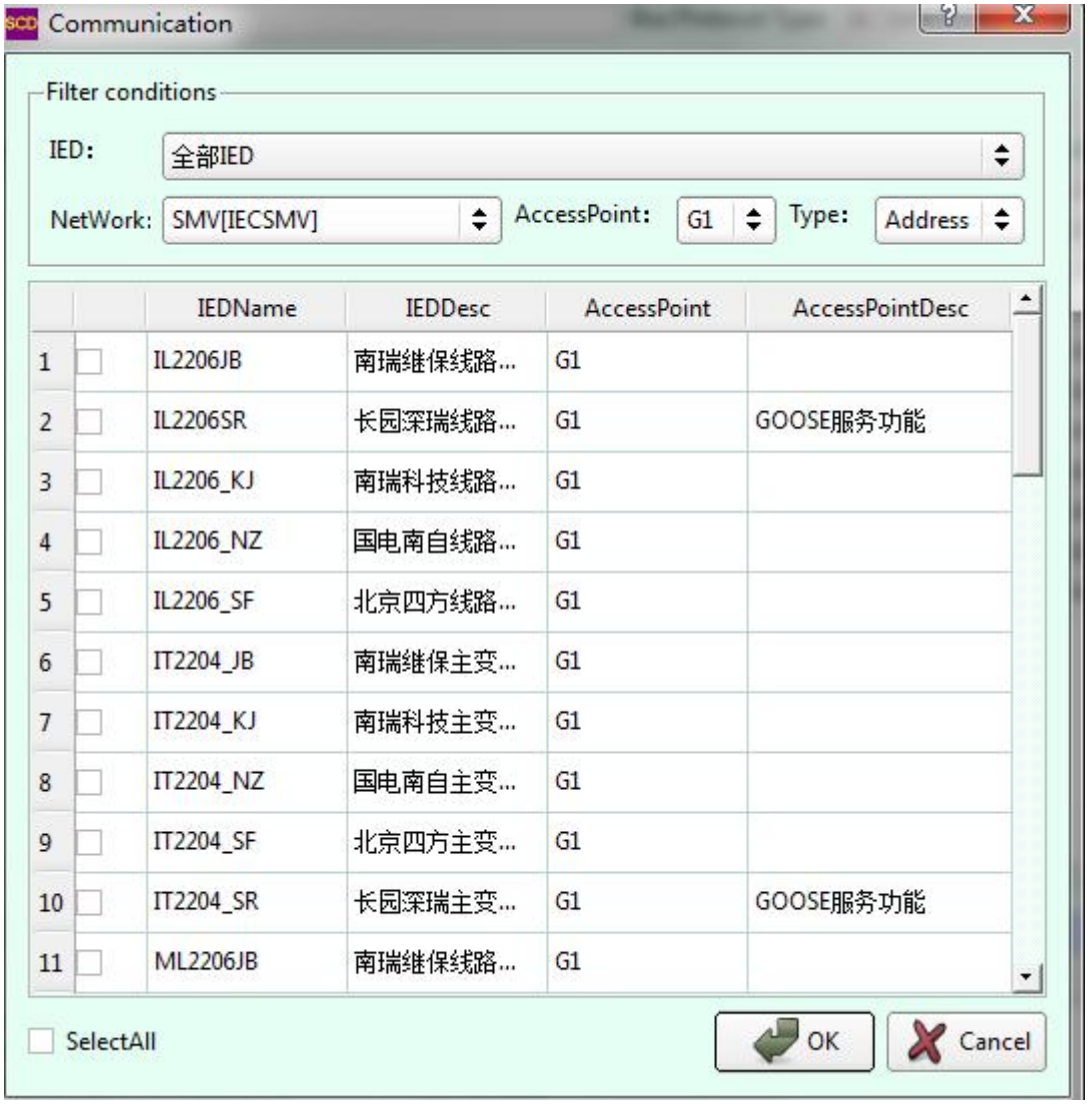


5.2. Communication Configuration

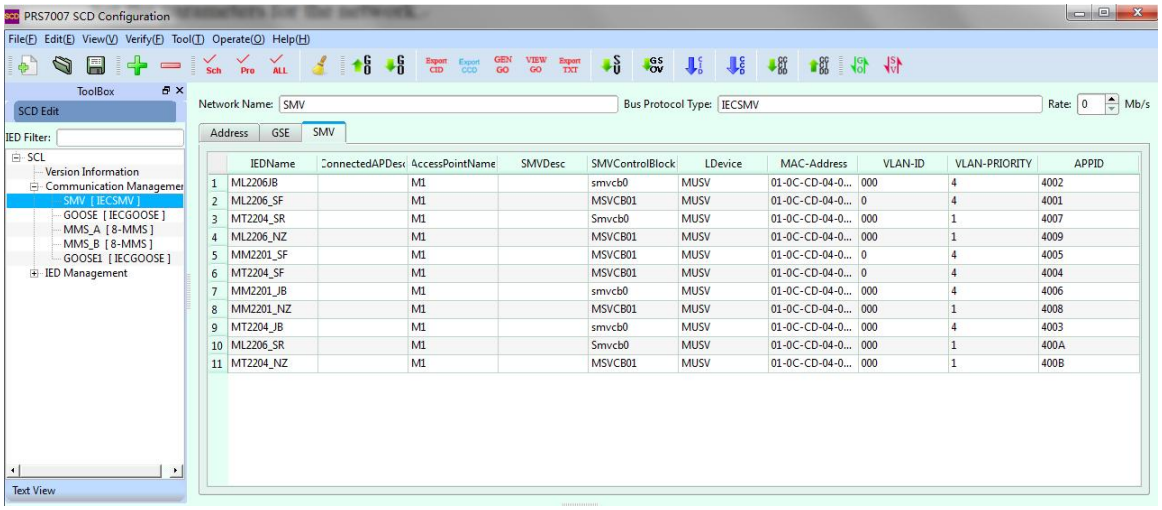
To set communication parameters as needed, select Communication Manager in the navigation zone, right click on it and select Add Network in the context menu.



Then click  in the toolbar to add ConnecteAP for the network.



Set the parameters for the network.



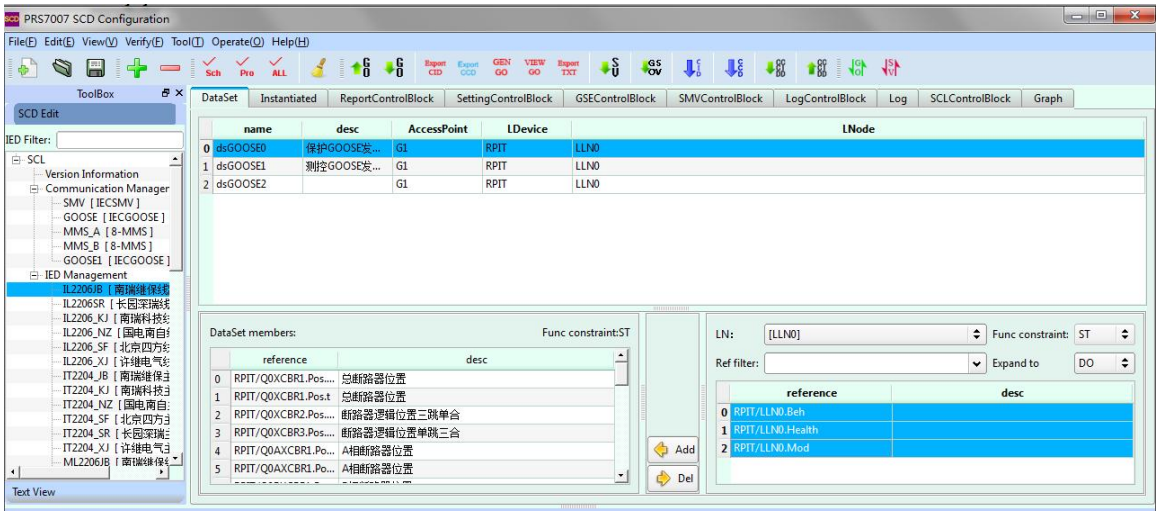
5.3.IED Configuration

IED configuration mainly performs the configurations for the data set, data assembly, and GSE control

module.

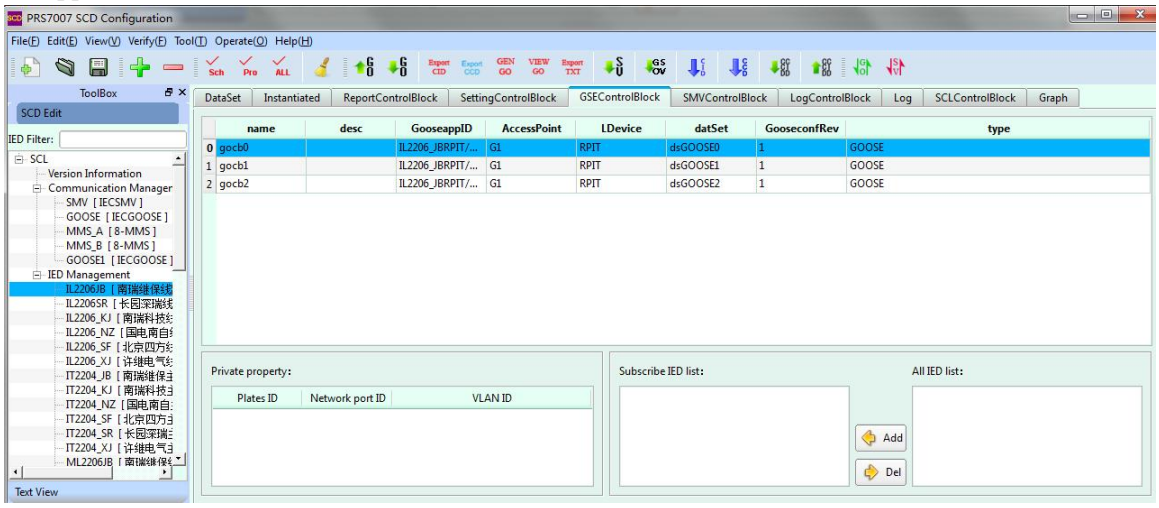
1) Data Set

Select data set, filter out the eligible FCDAs, and add FCDA members for the data set.



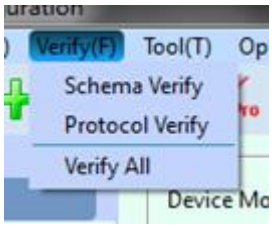
2) GSE Control Module

GSE Control Module mainly configures the private attributes. Private attributes specify the parameters for the appliance to send and receive data.



5.4.Verification

Verification of the SCD file is needed after you have completed these settings. Verification function can be accessed through the verification menu



or toolbar.

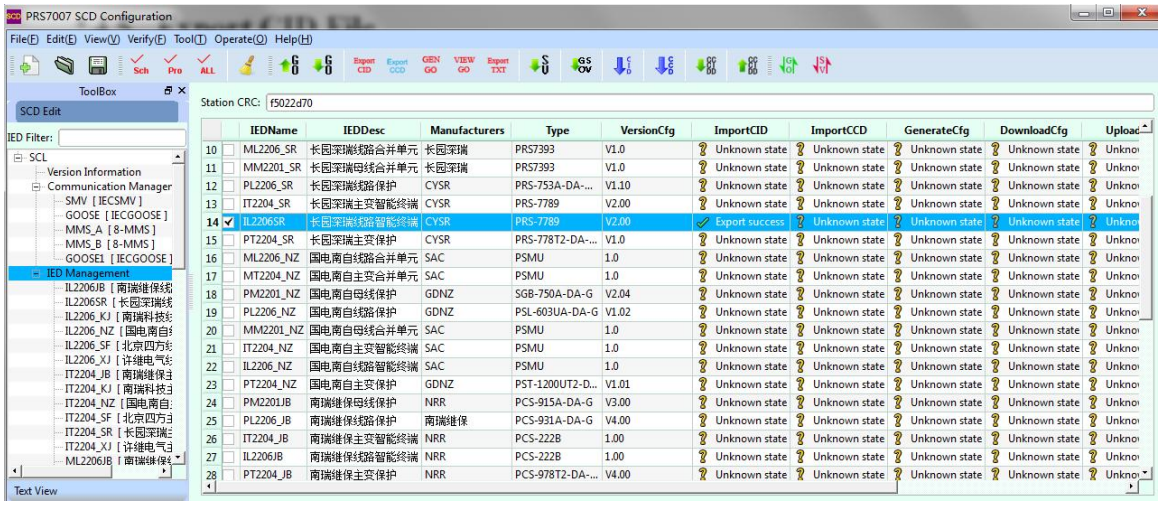
Schema Verification mainly verifies whether the SCD files match the format required by Schema. Schema is a 2003 version.

Protocol Verification mainly verifies:

1) Whether there is duplication of the names of the visiting points
2) Whether there is duplication of the names of LDs
3) Whether the prefix, lnClass and lnInst of the LN are the same at the same time; whether the corresponding LNodeType for the LN exists
4) Whether there is duplication of names of the data sets; whether the relevant LN, LNodeType, DO, DOType, DA, DAType of the FCDA in the data set exist; whether at least one FCDA member exists in the data sets
5) Whether there is duplication of names of the report control modules; whether the linked data set of the report control module exists
6) Whether there is duplication of names of GSE control modules; whether the linked data set of the GSE control module exists; whether the private attributes of GES control module are legal
7) Whether there is duplication of names of SMV control module; whether the linked data set of GSE control module exists;
8) Whether there is duplication of names of Log control modules; whether the linked data set of the Log control module exists;
9) The number of Fixed-value control modules under LN0 can only be 1
10) Whether the DOI-relevant DO, DOType, DA, DAType exist
11) Whether the corresponding DOType of LNodeType/DO exists
12) Whether the corresponding DAType or EnumType of DOType/DA exists

5.5.Export CID File

Select the IED of the CID file to be exported, and export the CID file.



5.6.Export GOOSE Configuration

Certain amount of verification, relevant to GOOSE configuration, is performed during the process of exporting the GOOSE configuration, the GOOSE configuration file is generated through the verification.

6. Notes

In compliance with the specific requirements of grammars of the files themselves and projectization, there are some matters that need special attention as follows:

1) The name of the data set or control module shall be unique in the LN or LN0
2) The name of the data set linked to the control module must exist in LN or LN0
3) The number of fixed values shall be equal to or greater than that of the current fixed value zone
4) Grammar verification must be performed when file configuration is completed, and then verified through the verification function. The file can only be written to the server after you have confirmed that there are no mistakes.