AEPC Online Debugging Software

User Manual

Altai Global Electric Ltd.

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Altai Global Electric Ltd.

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1. Software Description

This software is compatible with all protection devices produced by our company and offers a wide range of functions, including SAMP INFO, LINKS, settings management, parameters management, BO, BI, event query, waveform recording, device upgrade, time synchronization, and more, as shown in Figure 1-1.

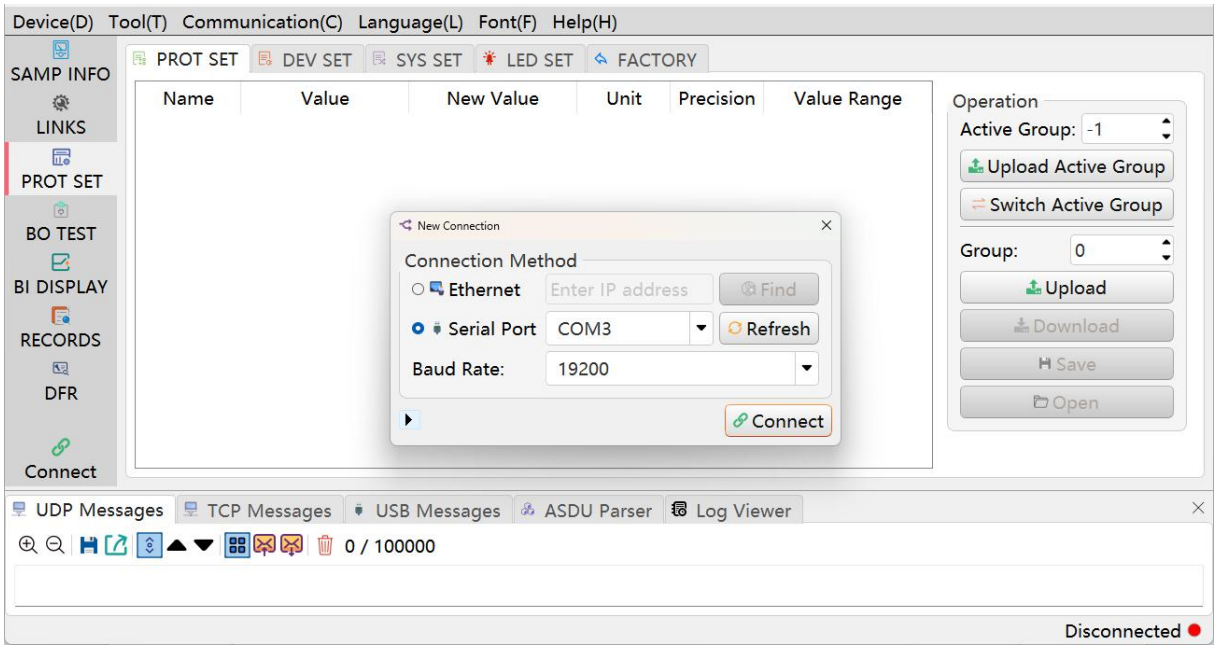


Figure 1-1 Main Interface of the Software

1.1. Software Features

This software has the following features:

1. Complies with the IEC 60870-5-103 standard for information interfaces of protective relays;
2. Supports three interface languages: Chinese, English, and Russian;
3. Supports two types of physical transmission media: Ethernet and serial port;
4. Supports device upgrades, facilitating future program updates;
5. Compatible with operating systems such as Windows 7, Windows 8, Windows 10, and Windows 11;
6. Supports real-time viewing of communication messages, making debugging easier;
7. Supports control word programming, allowing quick configuration by selecting different options to customize various functions;
8. Utilizes multi-threading technology for communication, ensuring smooth message transmission and stable, lag-free operation.

1.2. Operating Environment

This software is a portable program that requires no installation, occupies minimal disk space, uses little memory, is easy to use, and supports Windows 7 and later versions of the operating system.

2. Usage Instructions

2.1. Launch the software

Double-click the AEPC.exe executable file to launch the AEPC online debugging software, as shown in the software directory in Figure 2-1.

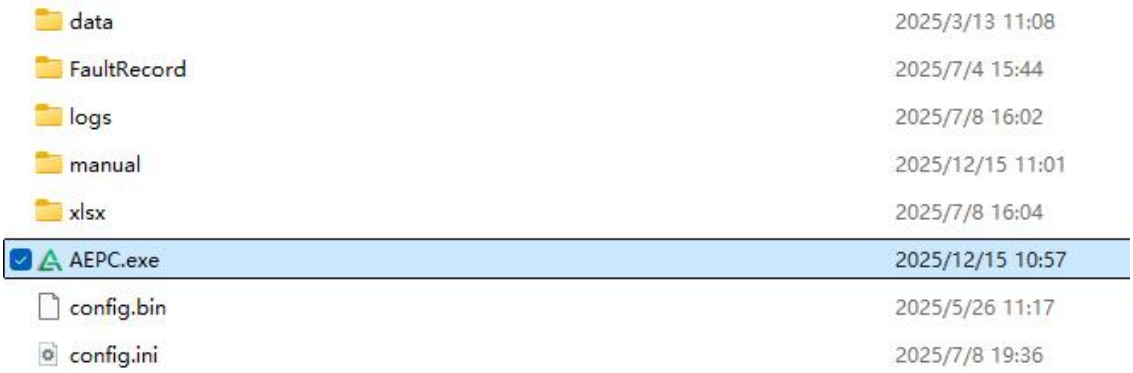


Figure 2-1 Software Directory

The main interface of the software is shown in Figure 2-2. The menu bar is located at the top, the navigation bar on the left, the functional area in the center, and the toolbar and status bar at the bottom. By clicking the buttons in the left navigation bar, users can access different functional interfaces. The toolbar allows real-time viewing of messages from various communication media, and the ASDU parser can analyze each field in an ASDU message segment, making it easier to identify issues.

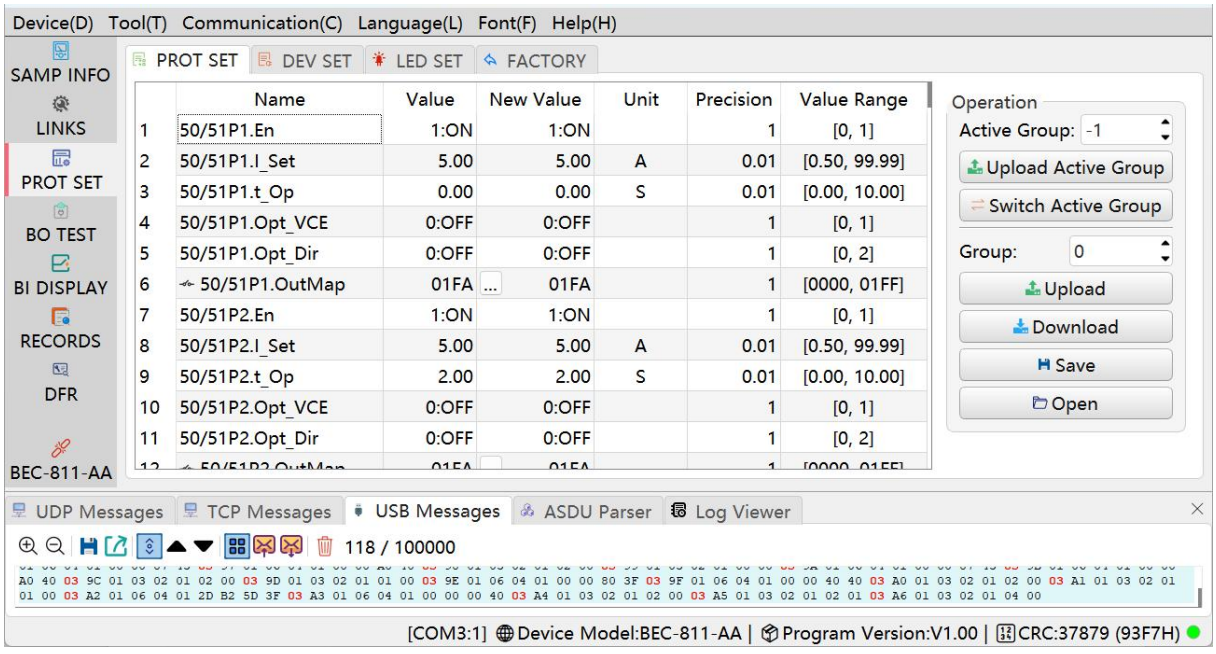


Figure 2-2 Main interface of the software

2.2. Connect to the device

This software supports device connection via two types of physical transmission media: Ethernet and serial port. The following describes each connection method.

Steps to connect a device via Ethernet:

1. Plug one end of the network cable into the computer and the other end into the device;
2. Set the computer's IP address to a static IP, ensuring it is in the same subnet as the device's IP address, for example: 192.168.1.xxx;
3. Click the "New Connection" button in the menu bar or the "Connect" button at the lower left of the navigation bar to open the New Connection window, as shown in Figure 2-3;
4. Enter the device's IP address and click the "Connect" button to wait for a successful connection, or click the "Find" button to let the software find and connect to the device automatically.

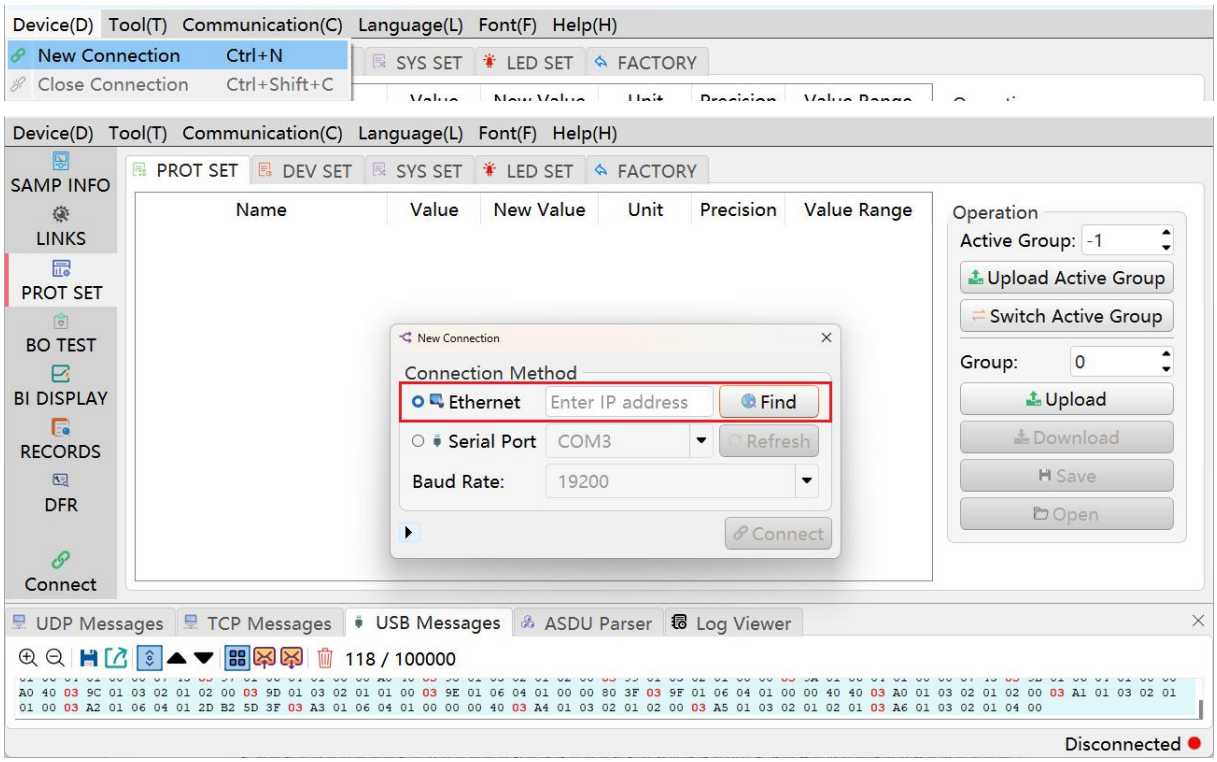


Figure 2-3 Connect via Ethernet

Steps to connect a device via serial port:

1. Plug one end of the serial cable into the computer and the other end into the device;
2. Click the "New Connection" button in the menu bar or the "Connect" button at the lower left of the navigation bar to open the New Connection window, as shown in Figure 2-3;
3. Click the "Refresh" button to update the list of serial ports, select the appropriate port number, and choose the correct baud rate, as shown in Figure 2-4;
4. Click the "Connect" button and wait for the device to connect successfully.

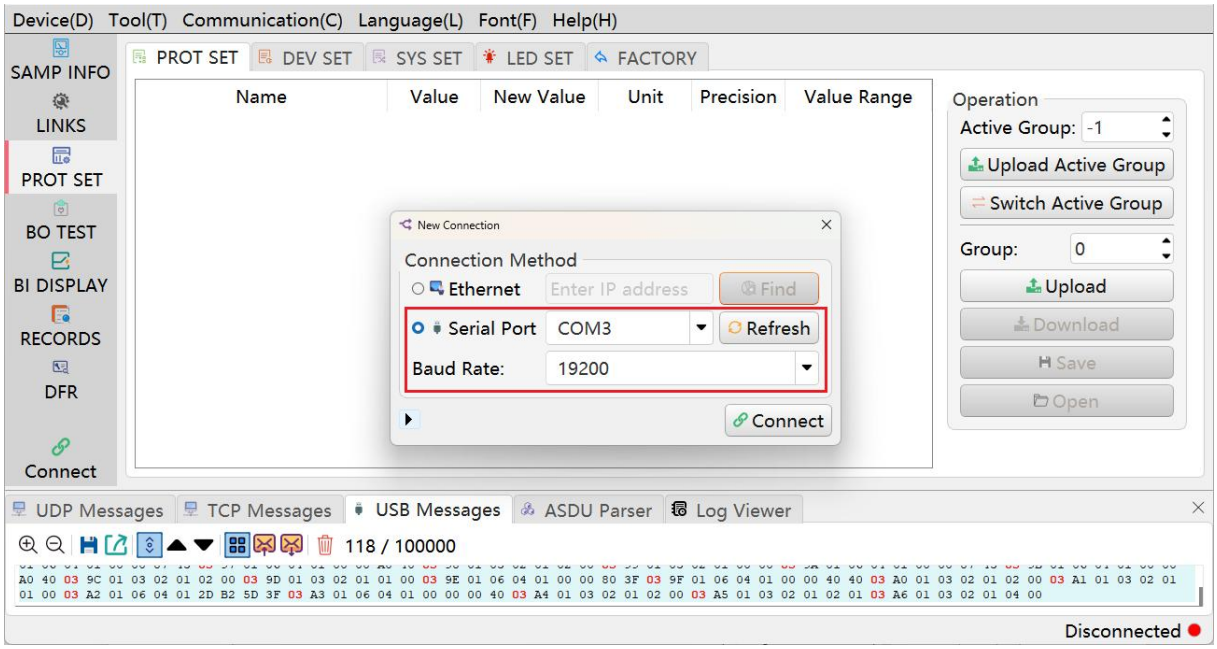


Figure 2-4 Connect via serial port

After a successful connection, the lower right corner of the status bar will display the device model, firmware version, and CRC. The communication status indicator will also turn green, as shown in Figure 2-5.

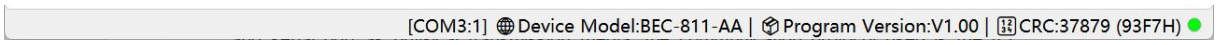


Figure 2-5 Status bar after a successful connection

After the connection is disconnected, the lower right corner of the status bar will display "Disconnected", and the communication status indicator will turn red, as shown in Figure 2-6



Figure 2-6 Status bar after disconnection

2.3. Communication Management

This software supports viewing messages transmitted during communication. For both Ethernet and serial port as physical transmission media, the communication protocol used is the IEC 60870-5-103 standard for protective relay information interfaces.

When connecting to a device via Ethernet, a connection request message must first be sent via UDP. The device then initiates a TCP connection to the software.

To view messages transmitted via UDP, click the "Communication" menu in the menu bar, then select "UDP", as shown in Figure 2-7.

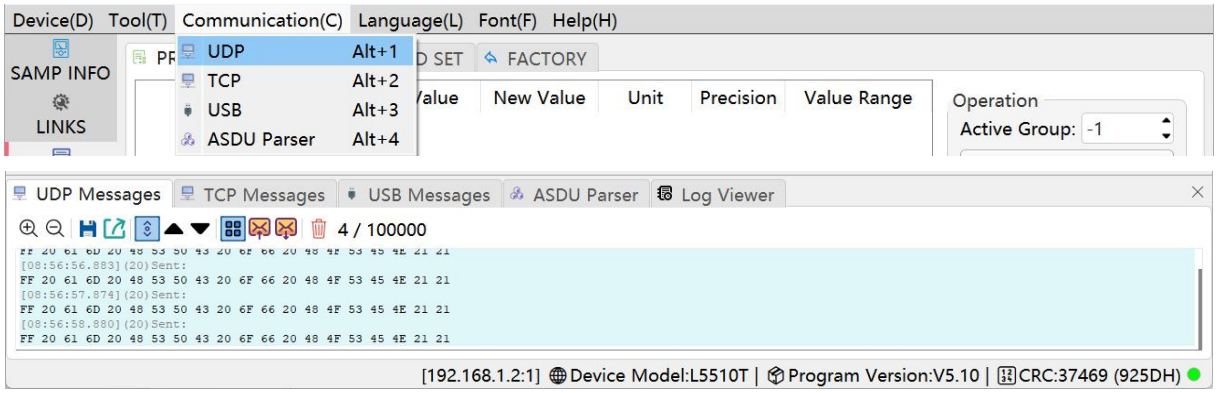


Figure 2-7 UDP messages

To view messages transmitted via TCP, click the "Communication" menu in the menu bar, then select "TCP", as shown in Figure 2-8.

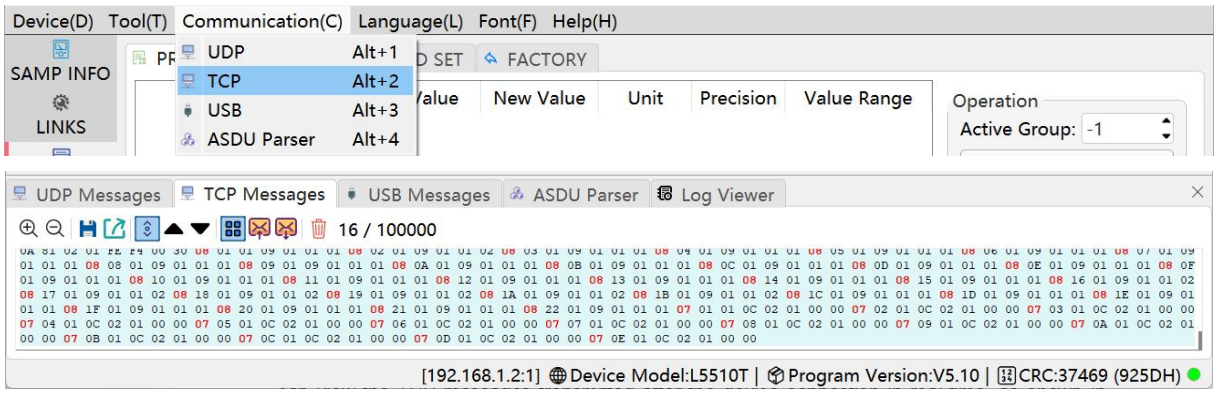


Figure 2-8 TCP messages

When connecting to a device via serial port, click the "Communication" menu in the menu bar, then select "USB", as shown in Figure 2-9.

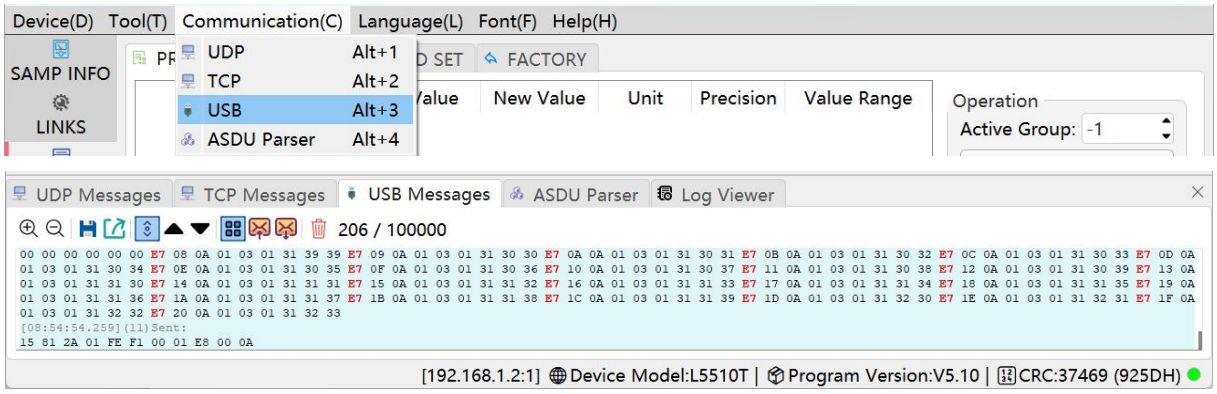
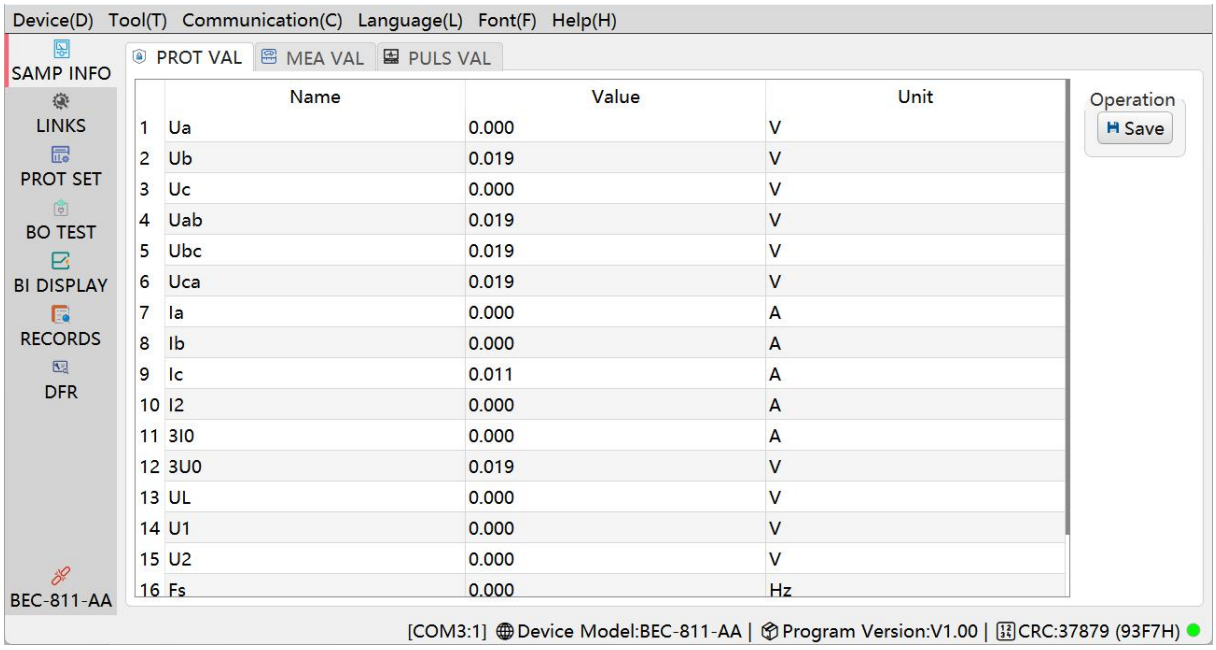


Figure 2-9 USB messages

2.4. Analog Channel

Click the "SAMP INFO" button to view analog channel data.

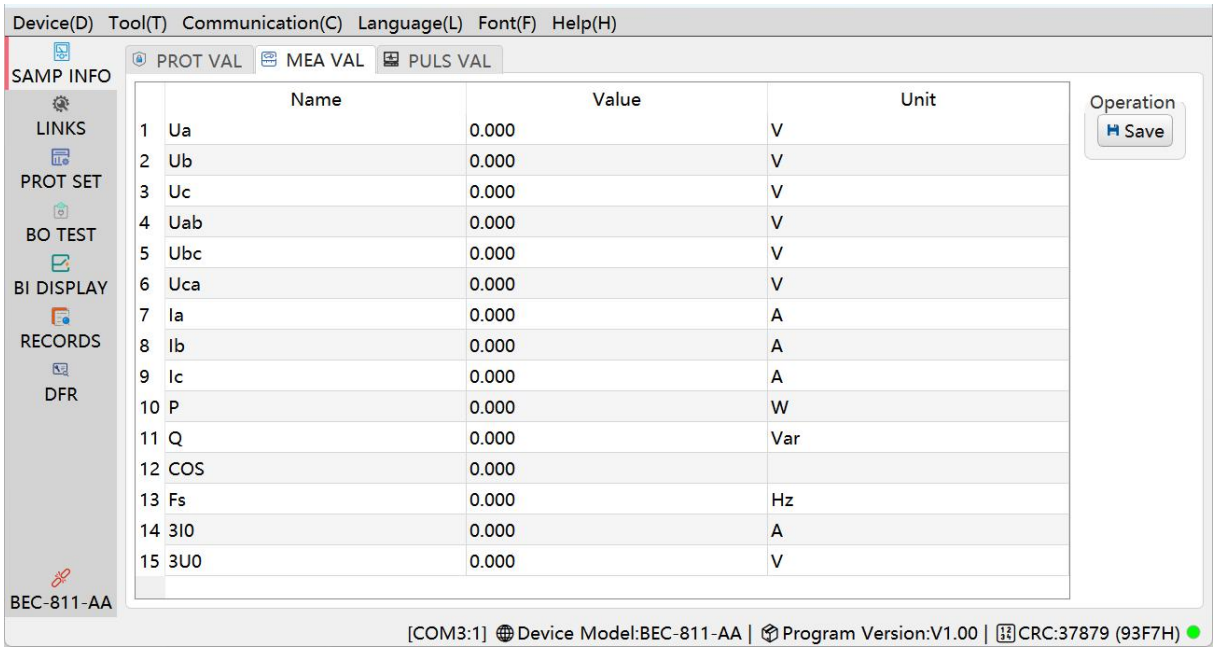
Click "PROT VAL" to view real-time protection data, as shown in Figure 2-10.



	Name	Value	Unit
1	Ua	0.000	V
2	Ub	0.019	V
3	Uc	0.000	V
4	Uab	0.019	V
5	Ubc	0.019	V
6	Uca	0.019	V
7	Ia	0.000	A
8	Ib	0.000	A
9	Ic	0.011	A
10	I2	0.000	A
11	3I0	0.000	A
12	3U0	0.019	V
13	UL	0.000	V
14	U1	0.000	V
15	U2	0.000	V
16	Fs	0.000	Hz

Figure 2-10 PROT VAL

Click "MEA VAL" to view real-time measurement data, as shown in Figure 2-11.



	Name	Value	Unit
1	Ua	0.000	V
2	Ub	0.000	V
3	Uc	0.000	V
4	Uab	0.000	V
5	Ubc	0.000	V
6	Uca	0.000	V
7	Ia	0.000	A
8	Ib	0.000	A
9	Ic	0.000	A
10	P	0.000	W
11	Q	0.000	Var
12	COS	0.000	
13	Fs	0.000	Hz
14	3I0	0.000	A
15	3U0	0.000	V

Figure 2-11 MEA VAL

Click "PULS VAL" to view real-time pulse data, as shown in Figure 2-12.

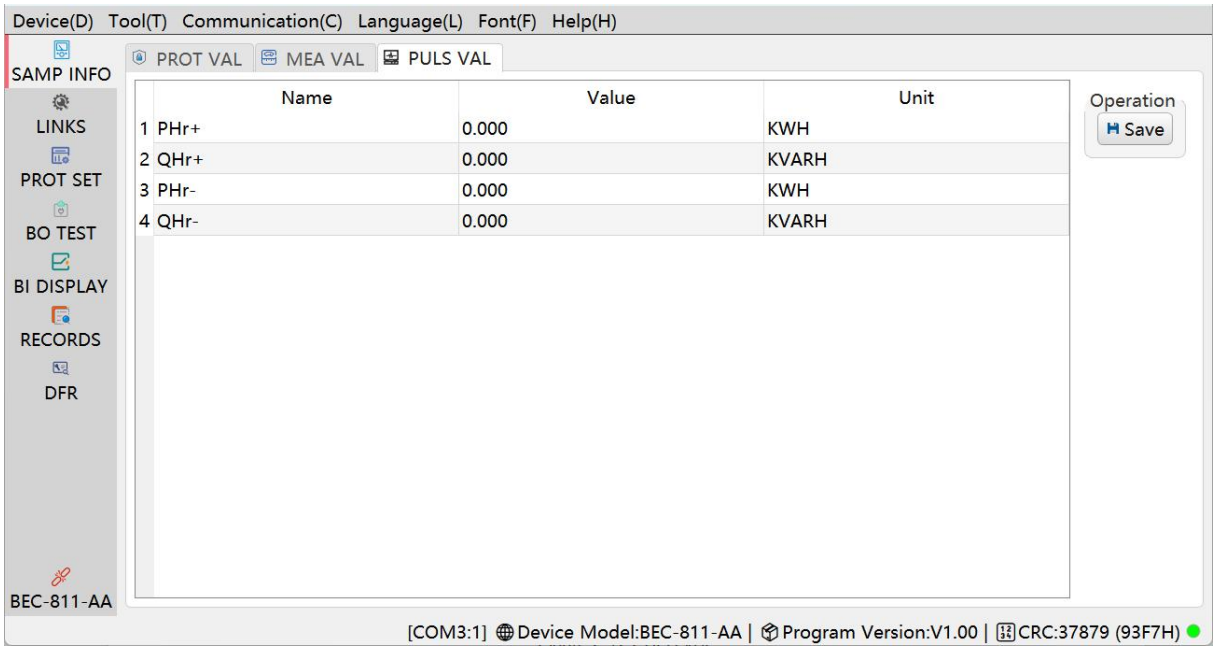


Figure 2-12 PULS VAL

2.5. LINKS

Click the "LINKS" button to manage soft switches.

Click the "Upload" button to upload the soft switch status, as shown in Figure 2-13.

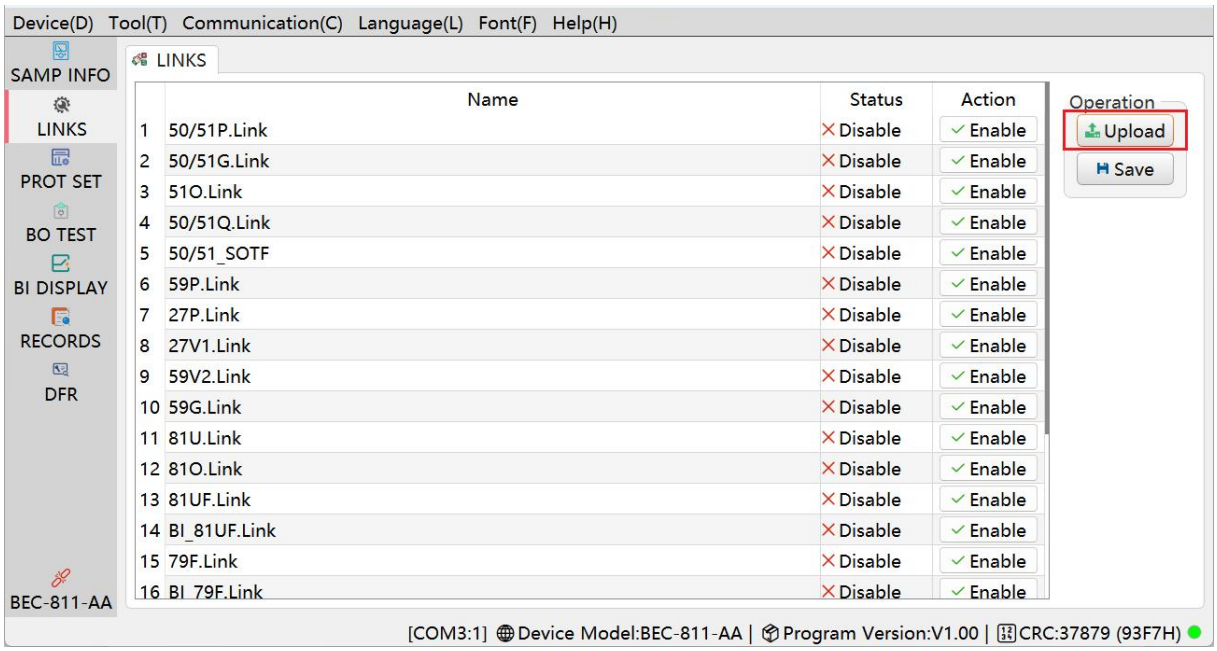


Figure 2-13 Upload the LINKS

Click the "Enable" and "Disable" buttons to operate the soft switch, as shown in Figure 2-14.

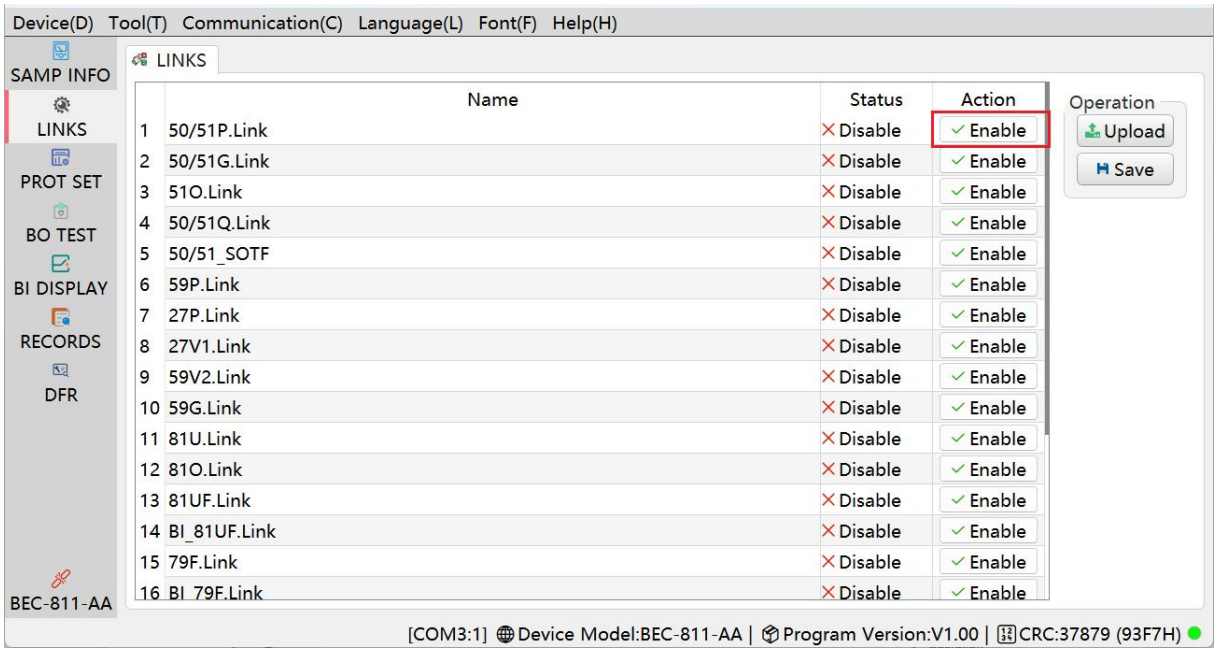


Figure 2-14 Modify the LINKS

Click the "Save" button to save the soft switch status to an Excel file, as shown in Figure 2-15.

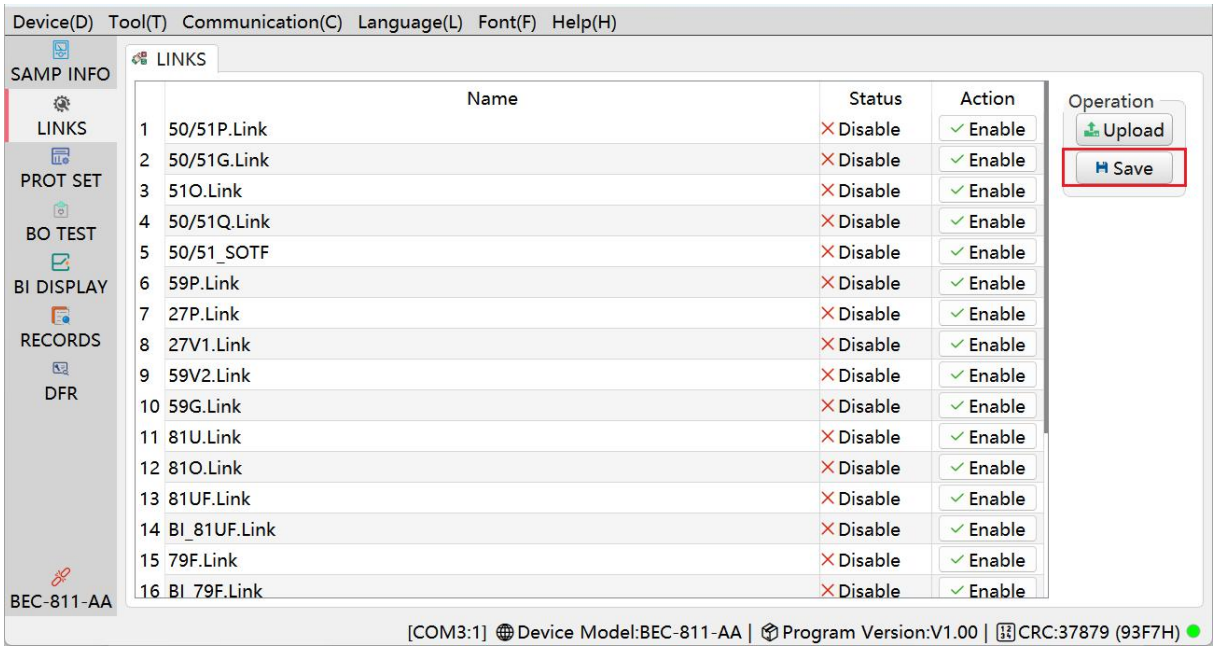


Figure 2-15 Save the LINKS

2.6. Settings Management

Click "PROT SET" to manage protection settings, device parameters, system parameters, and signal lights. You can double-click a cell in the "New Value" column to edit it.

2.6.1. PROT SET

Click "PROT SET" and the corresponding operation area appears on the right. You can upload the current active group, switch the active group, as well as upload, download, save, and open settings, as shown in Figure 2-16.

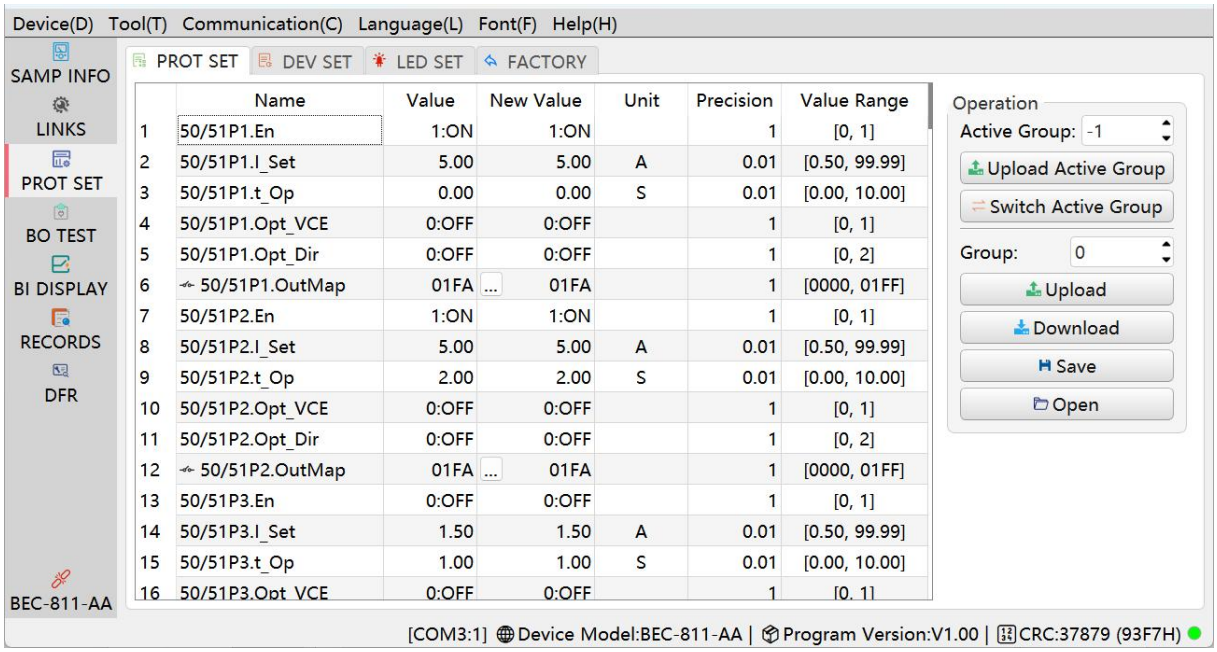


Figure 2-16 PROT SET

Clicking "Upload Active Group" and "Switch Active Group" allows you to upload the current active setting group and switch it into another setting group, as shown in Figure 2-17 and Figure 2-18.

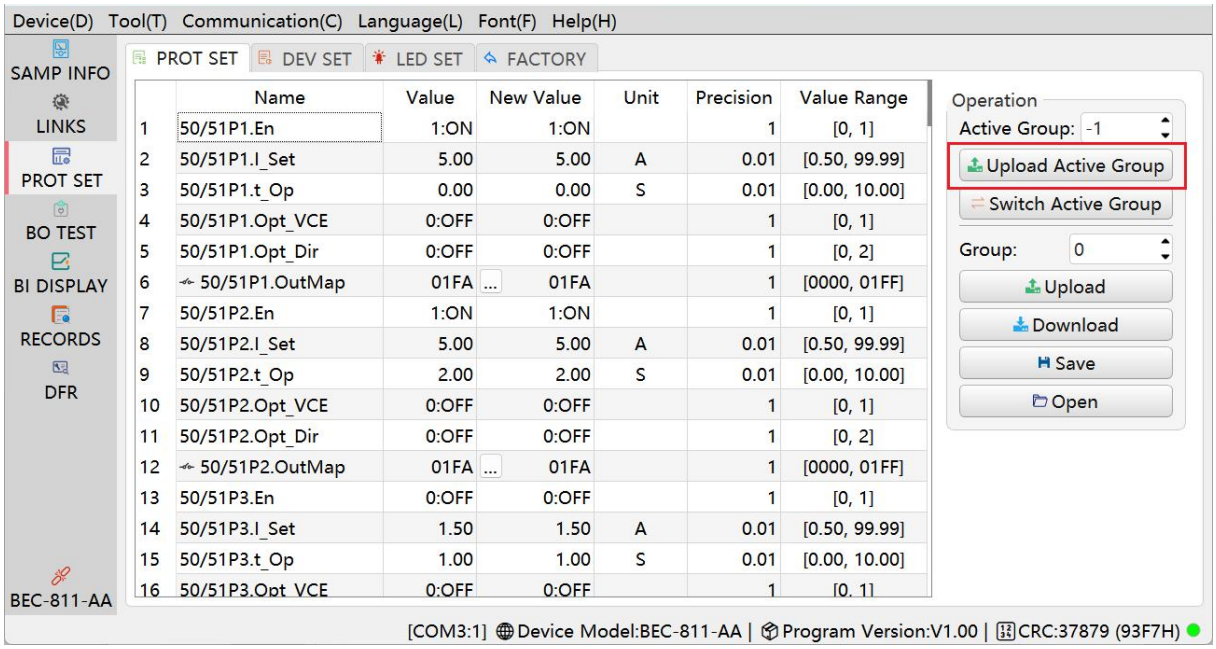


Figure 2-17 Upload Active Group

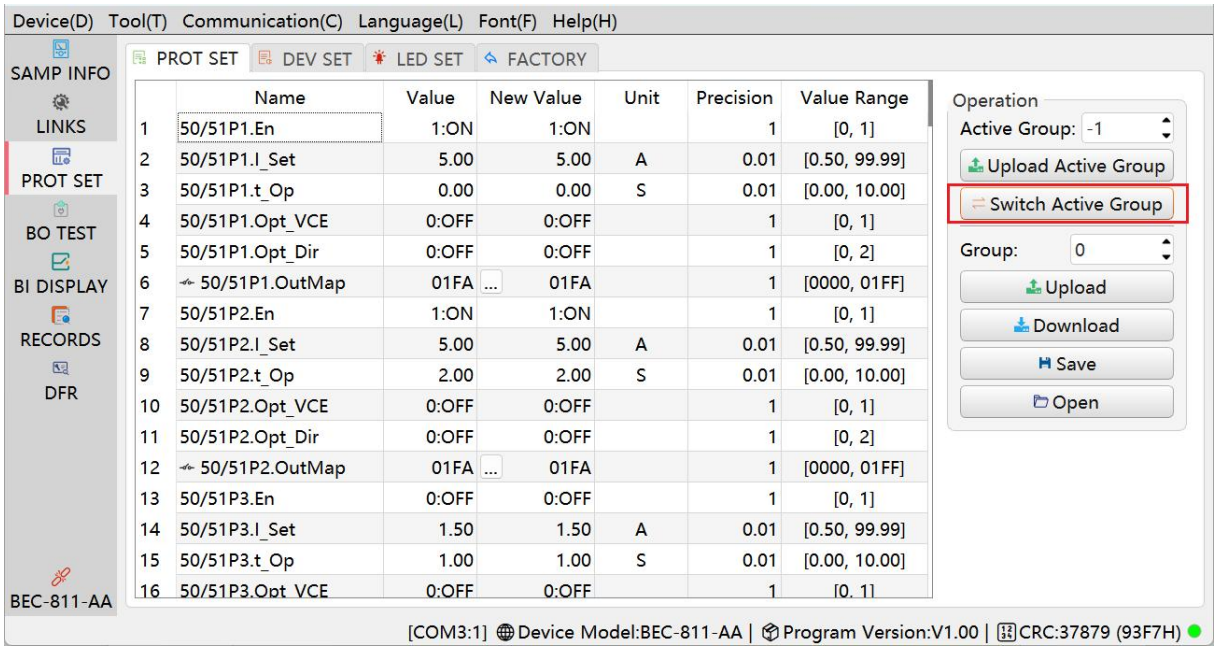


Figure 2-18 Switch Active Group

Click the "Upload" button to upload the settings, as shown in Figure 2-19.

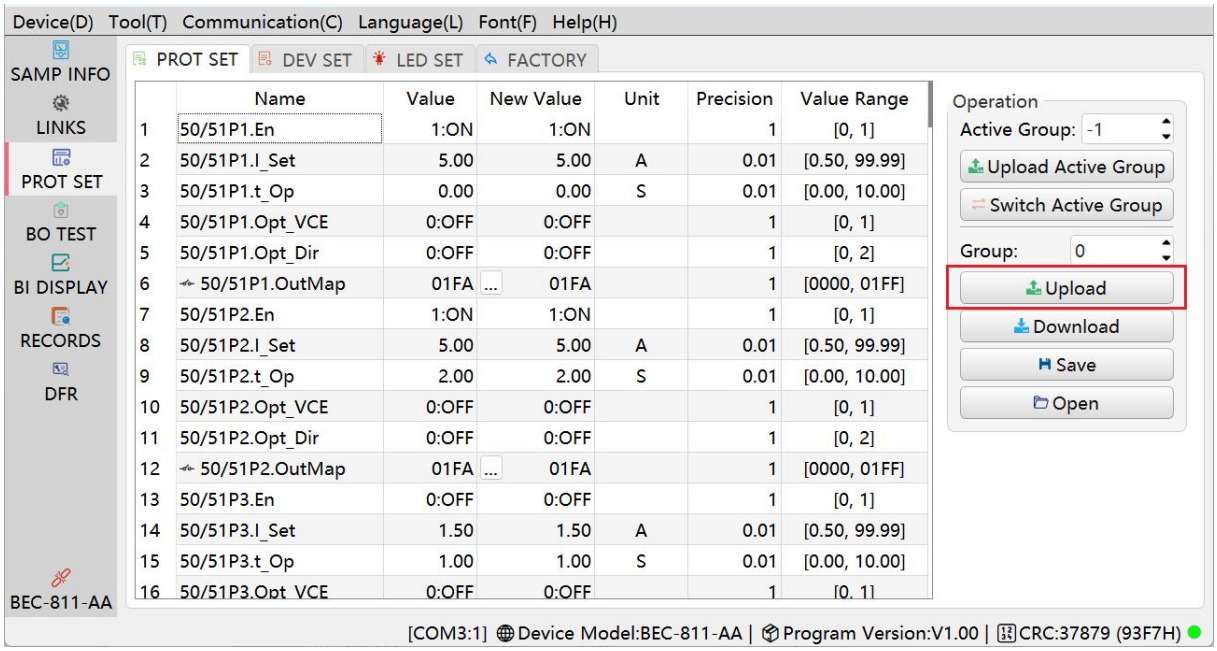


Figure 2-19 Upload settings

Click the "Download" button to download the new settings from the table to the device, as shown in Figure 2-20.

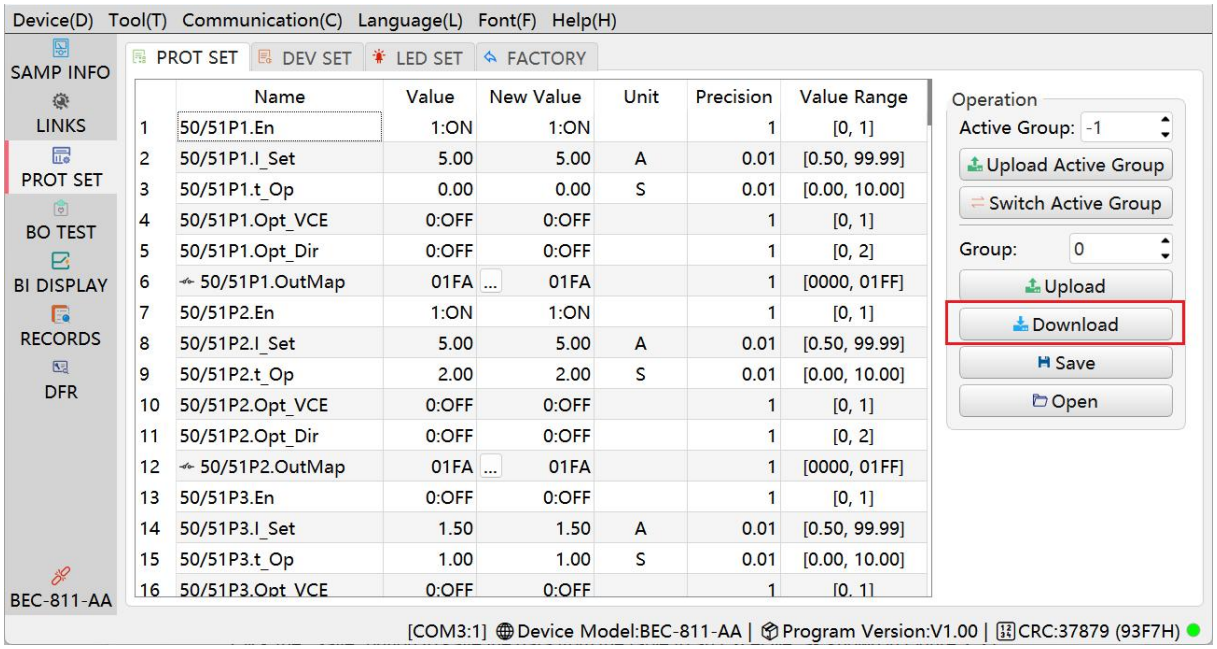


Figure 2-20 Download the new settings

Click the "Save" button to save the data from the table to an Excel file, as shown in Figure 2-21.

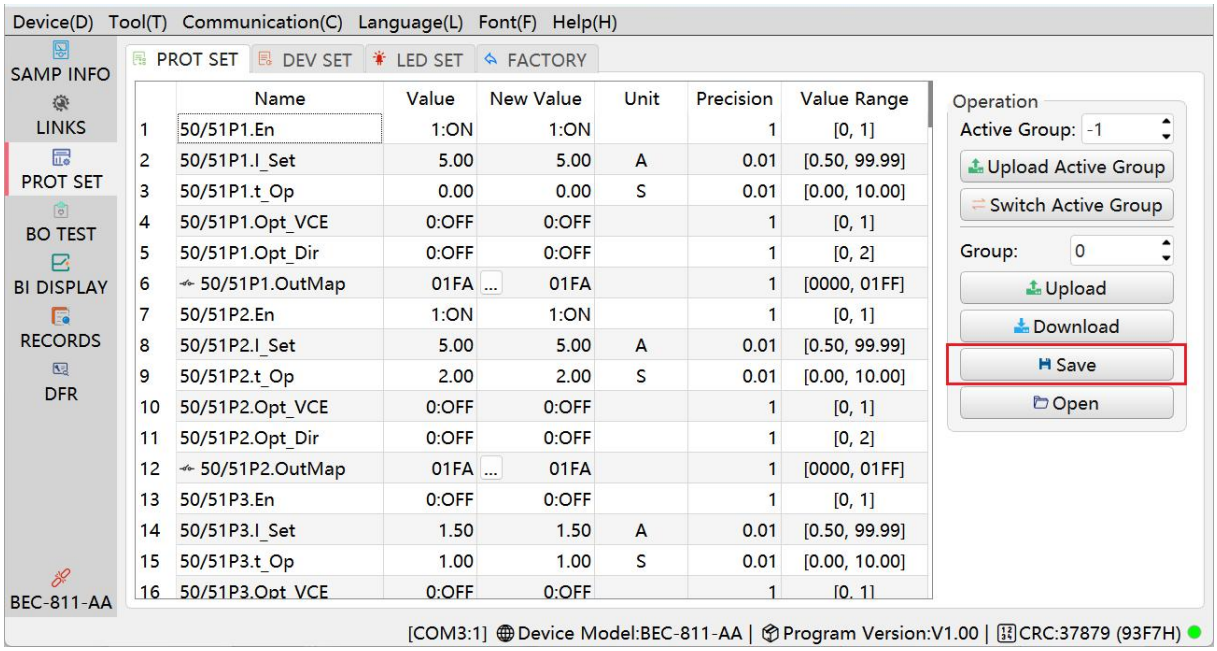


Figure 2-21 Save the settings

Click the "Open" button to import data from an Excel file into the software, as shown in Figure 2-22.

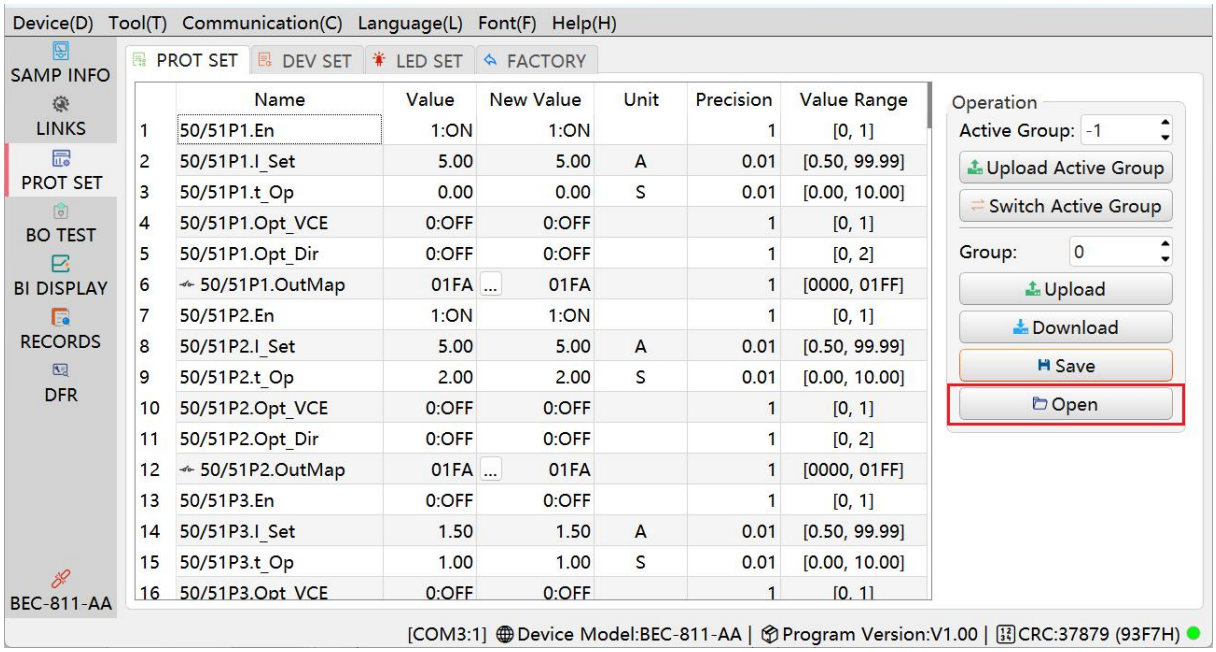


Figure 2-22 Open the settings

2.6.2. Device Settings

Click "DEV SET" to upload, download, save, or open device settings, as shown in Figure 2-23.

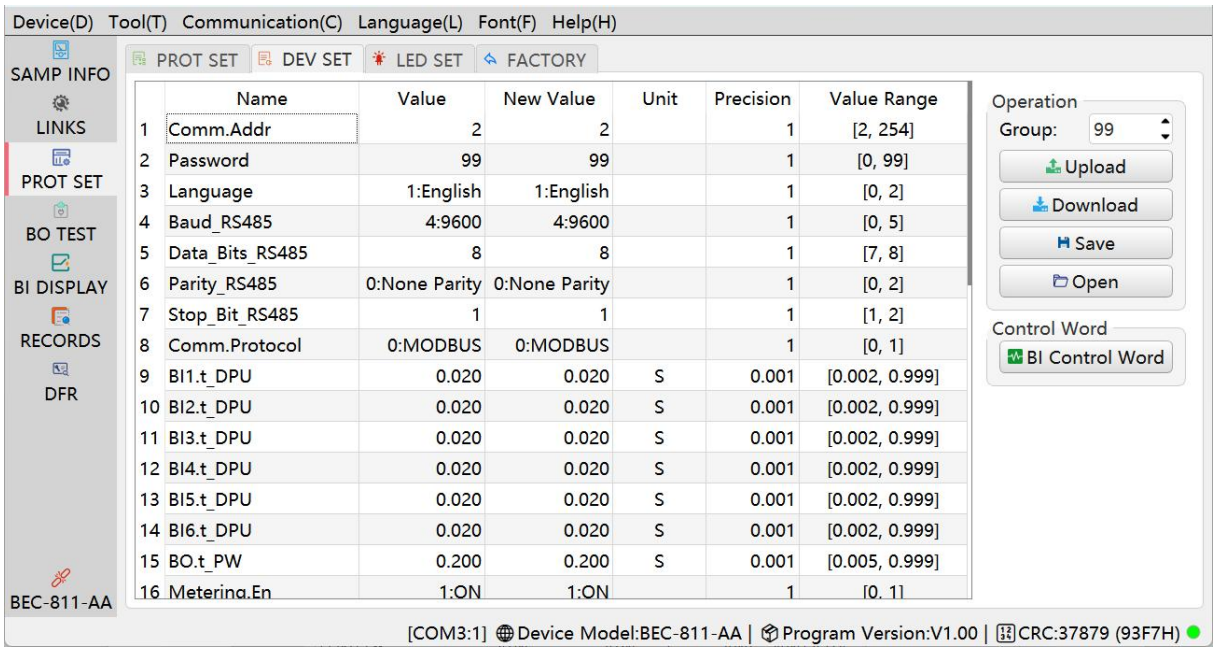


Figure 2-23 Device Settings

Click "Upload" to upload the device settings, as shown in Figure 2-24.

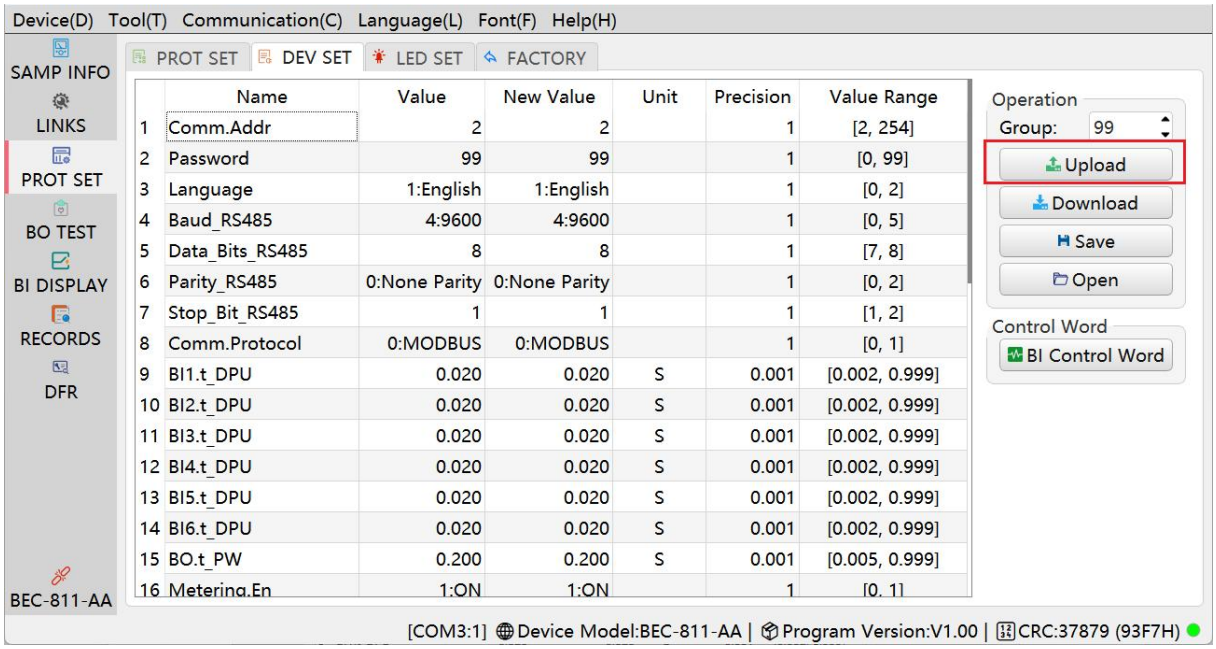


Figure 2-24 Upload settings

Click "Download", enter the password 99, and you can download the device settings to the device, as shown in Figure 2-25.

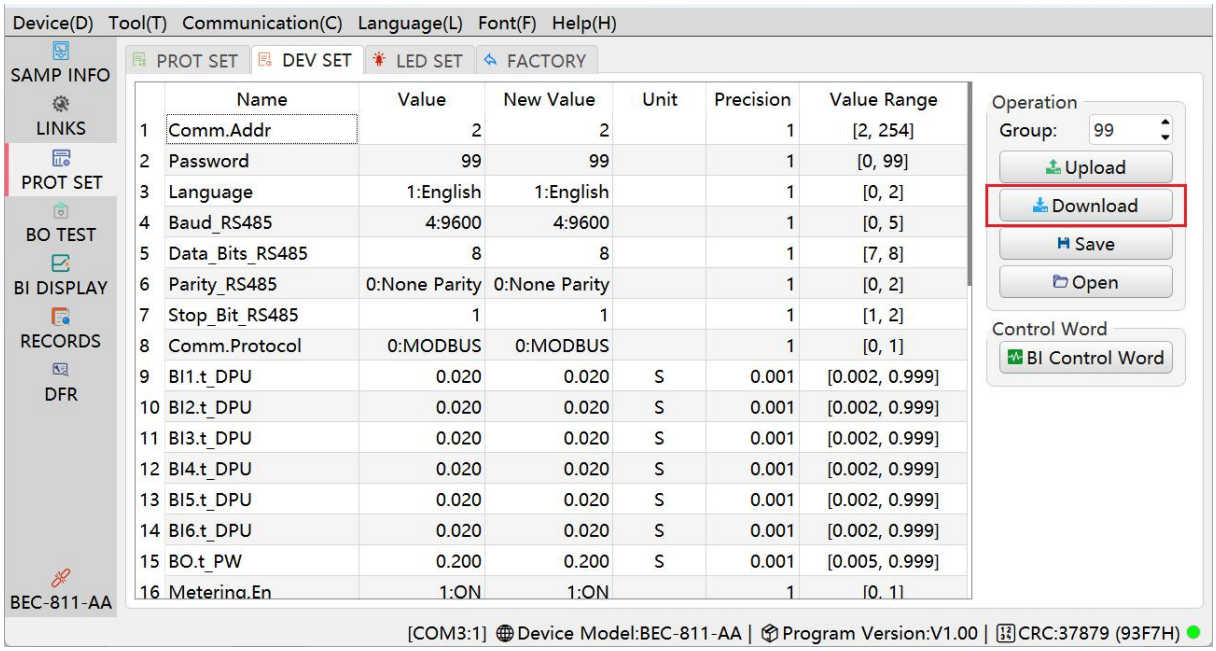


Figure 2-25 Download the new settings

Click the "Save" button to save the data from the table to an Excel file, as shown in Figure 2-26.

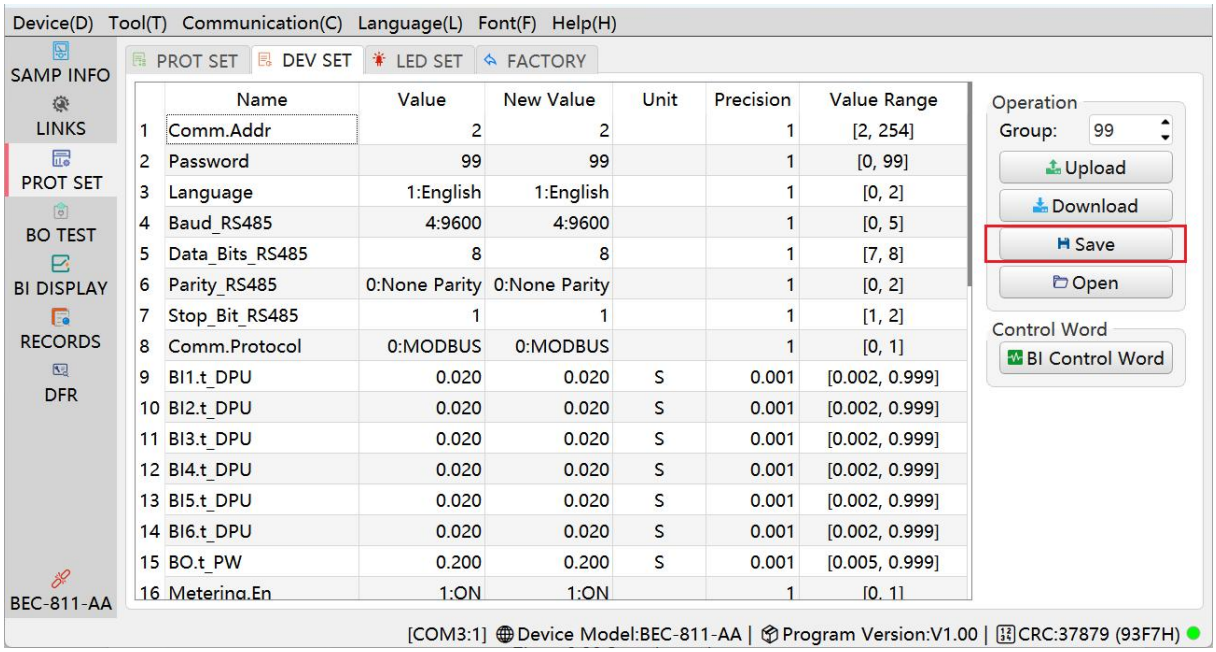


Figure 2-26 Save the settings

Click the "Open" button to import data from an Excel file into the software, as shown in Figure 2-27.

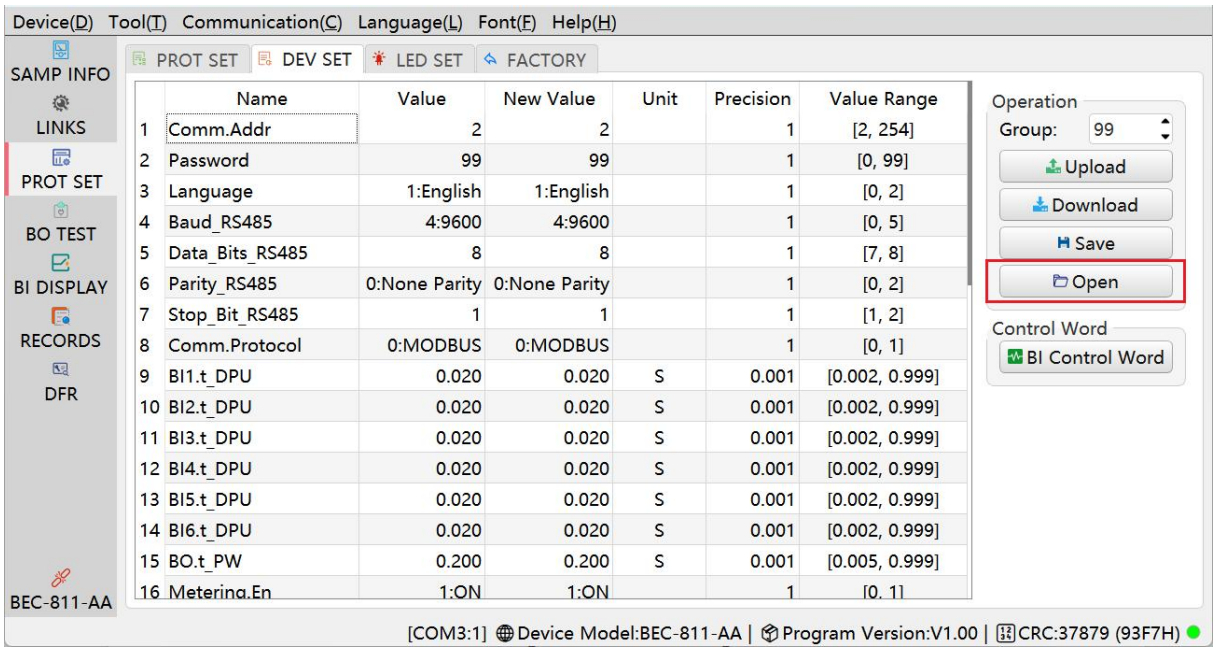


Figure 2-27 Open the settings

2.6.3. LED SET

Click "LED SET" to upload, download, save, or open LED settings, as shown in Figure 2-28.

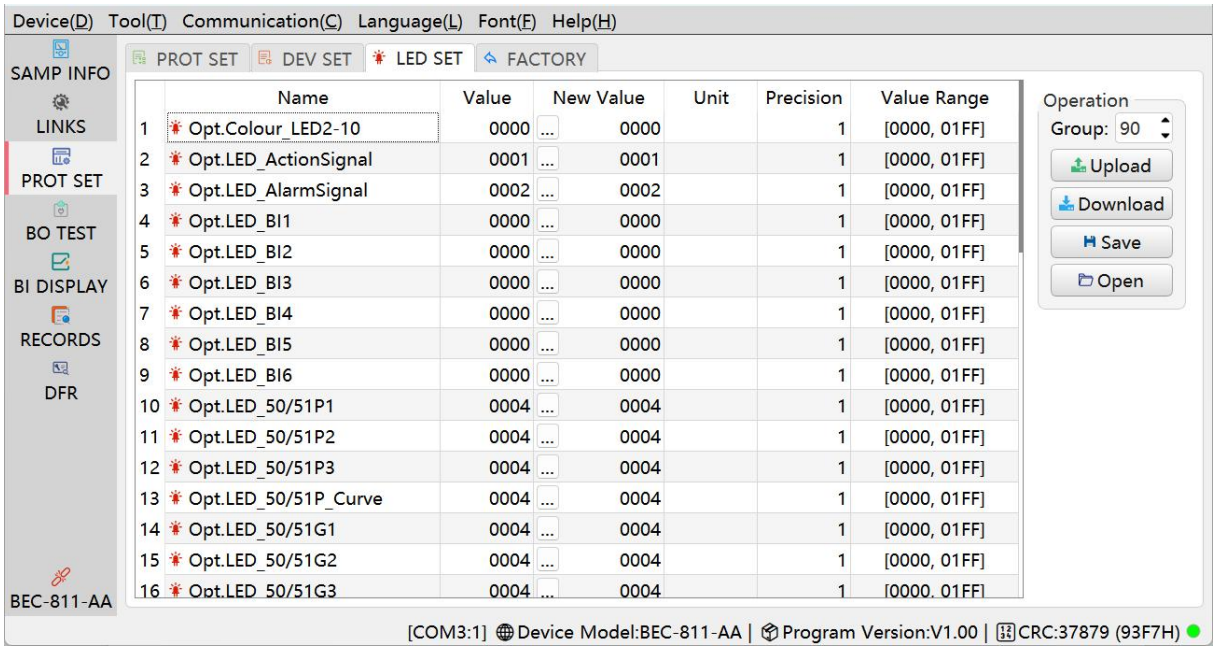


Figure 2-28 LED Settings

Click "Upload" to upload the LED settings, as shown in Figure 2-29.

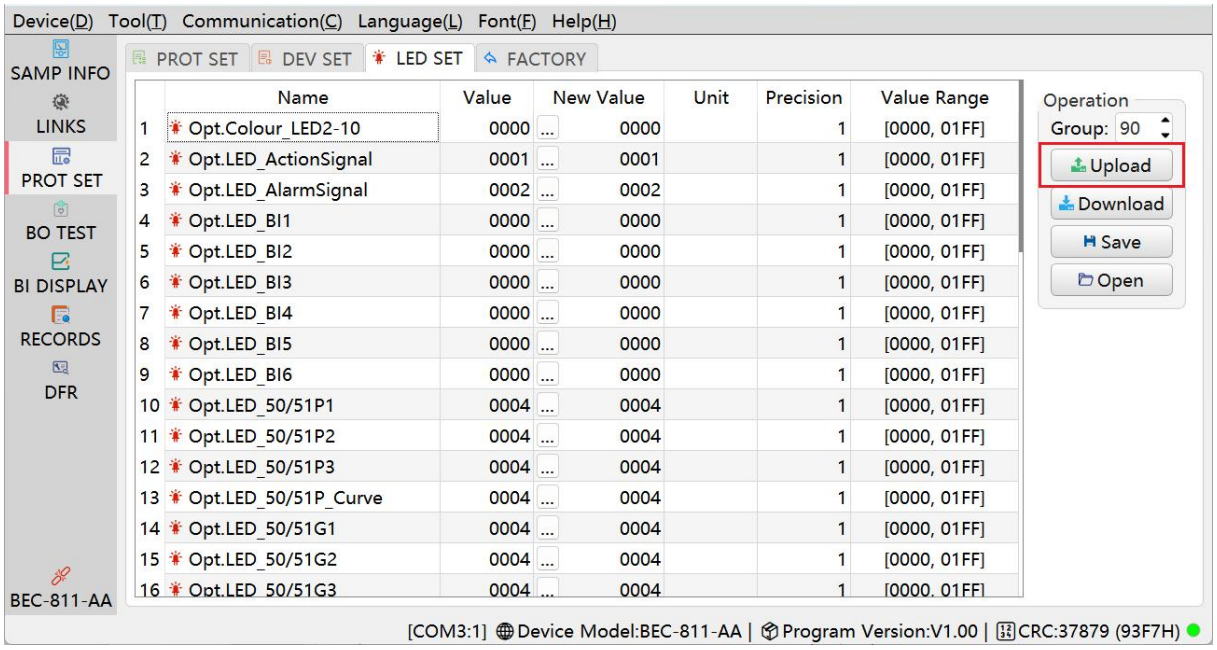


Figure 2-29 Upload settings

Click "Download", enter the password 99, and you can download the LED settings to the device, as shown in Figure 2-30.

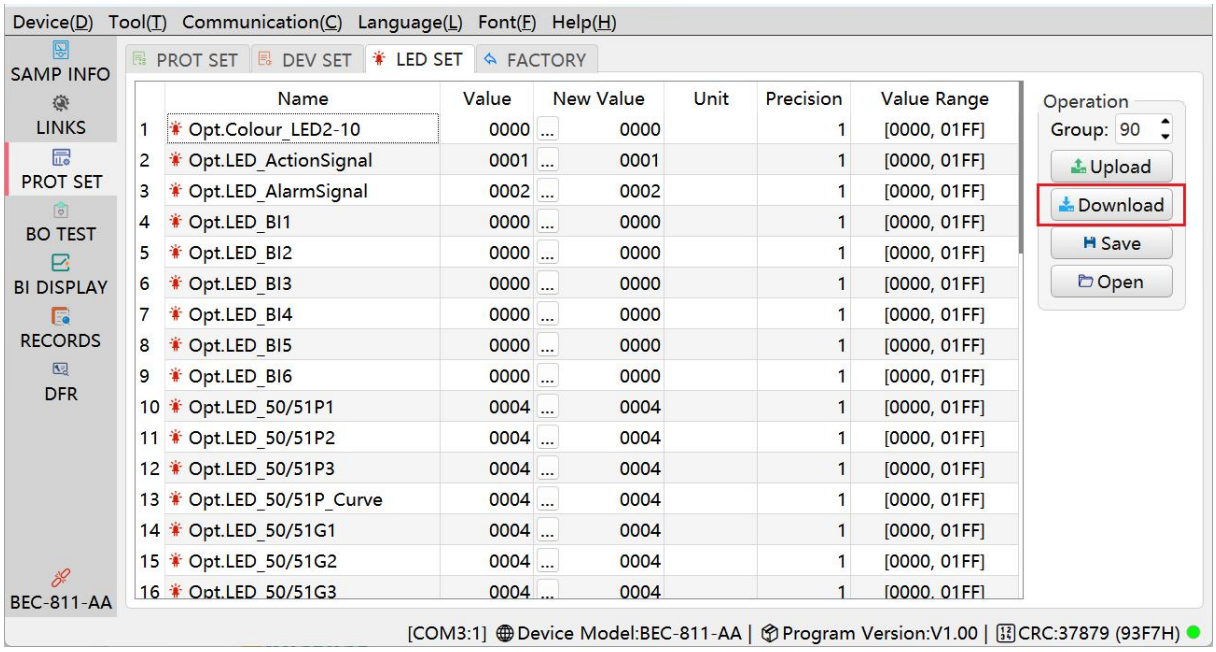


Figure 2-30 Download the new settings

Click the "Save" button to save the data from the table to an Excel file, as shown in Figure 2-31.

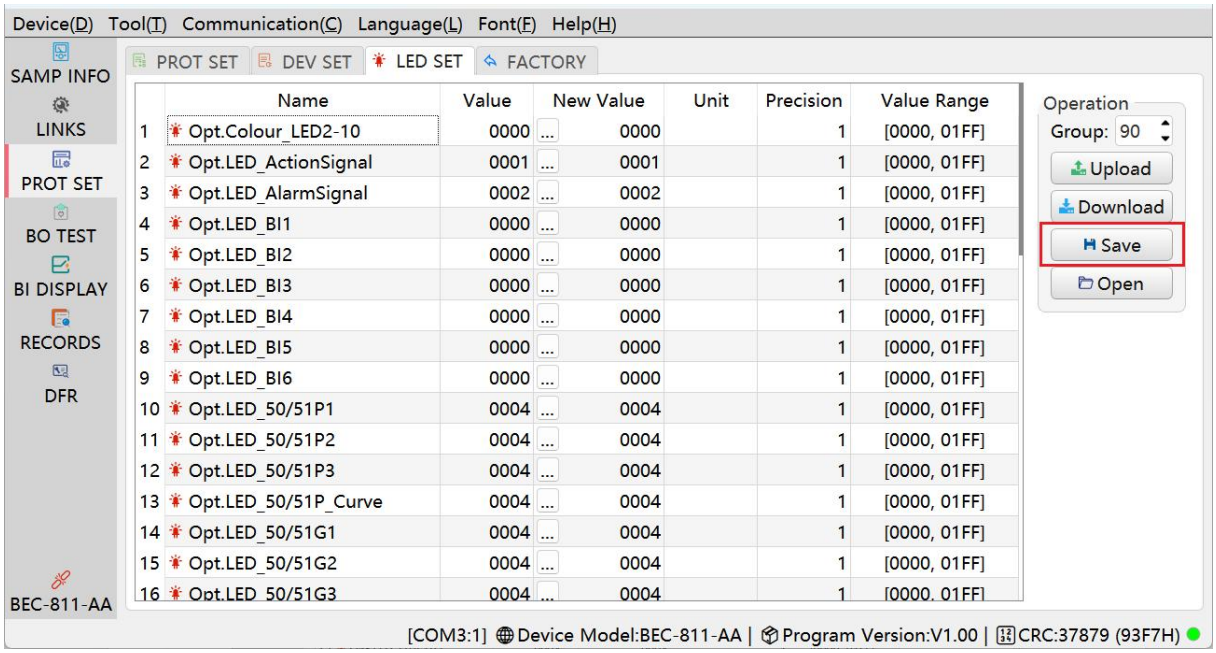


Figure 2-31 Save the settings

Click the "Open" button to import data from an Excel file into the software, as shown in Figure 2-32.

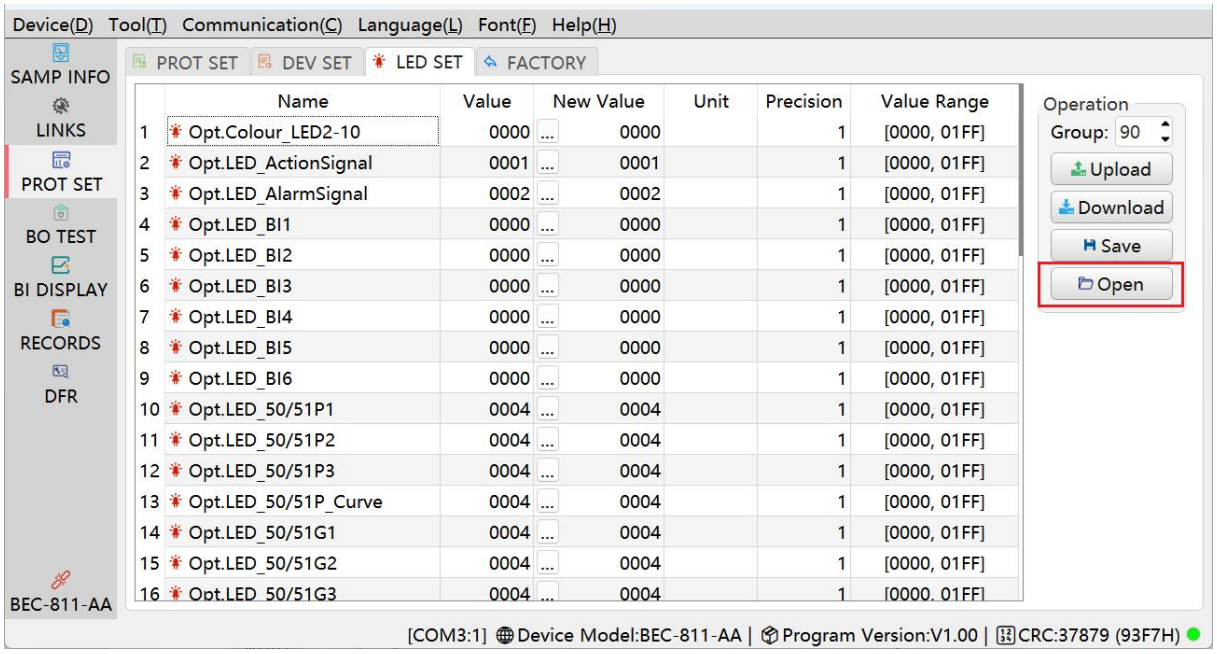


Figure 2-32 Open the settings

2.7. Control Word Programming

This software supports control word programming, enabling quick configuration of control words by selecting different options to customize a variety of functions. You can open the control word programming window by clicking the “**...**” button in the "New Value" column, or by directly clicking the "Control Word" buttons in the operation area, as shown in Figure 2-33.

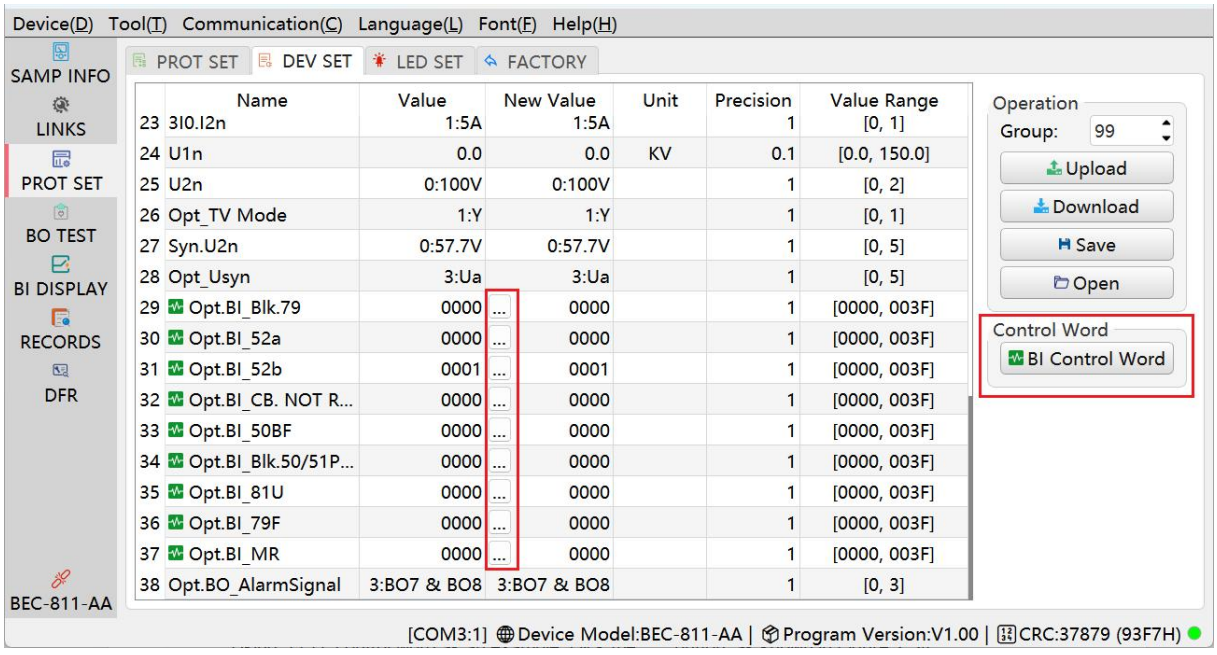


Figure 2-33 Control Word Programming

Using “LED” control word as an example, click the "**...**" button, as shown in Figure 2-34.

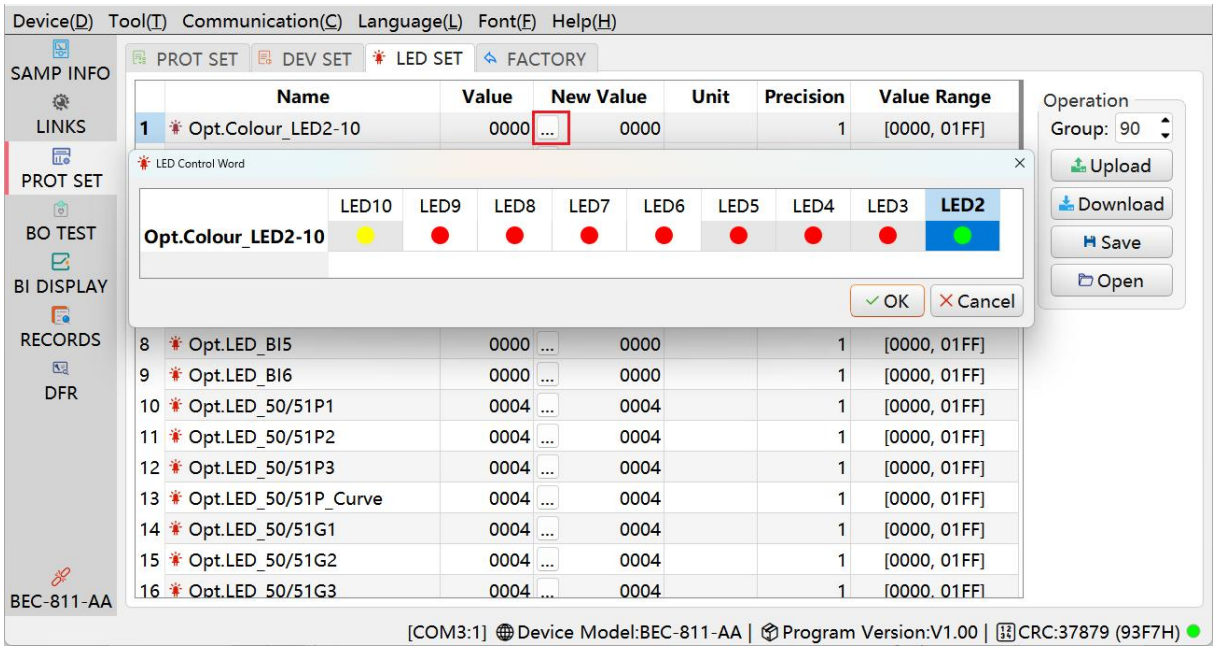


Figure 2-34 “LED” Control Word

You can double-click a cell or right-click after selecting cells to check the desired options. Once the selection is completed, the software will automatically calculate the corresponding control word. The control word shown in Figure 2-34 is illustrated in Figure 2-35.

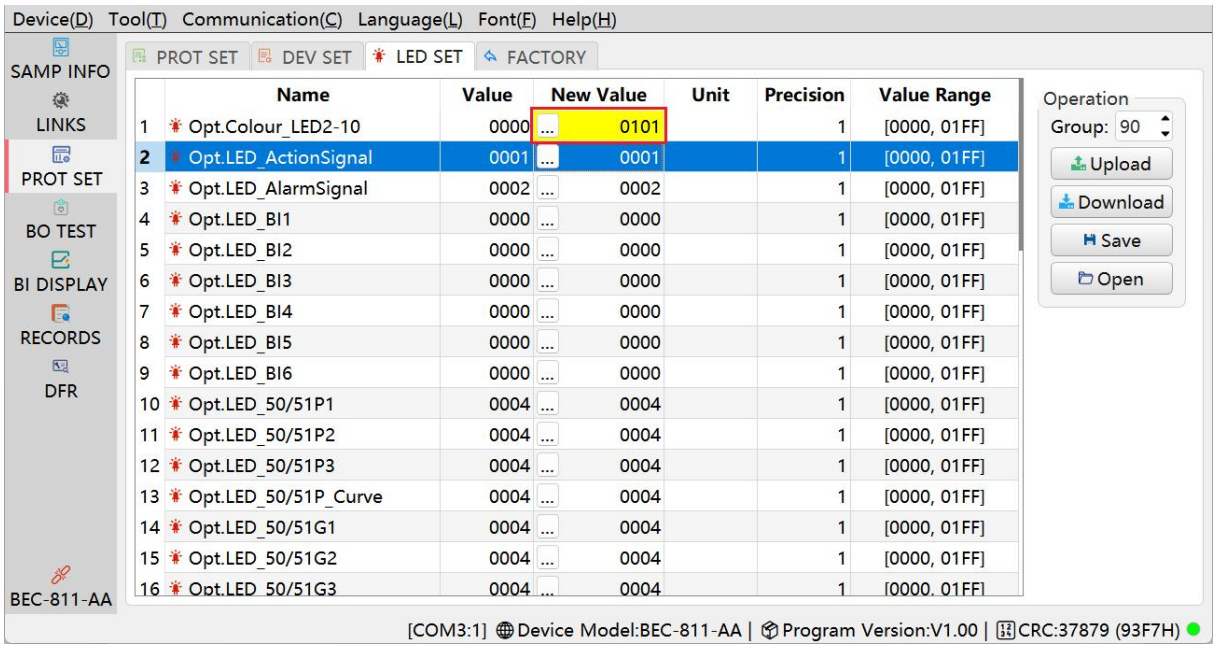


Figure 2-35 “LED” Control Word

2.8. BO TEST

Click on “BO TEST” to perform trip and close tests on each BO, as shown in Figure 2-36.

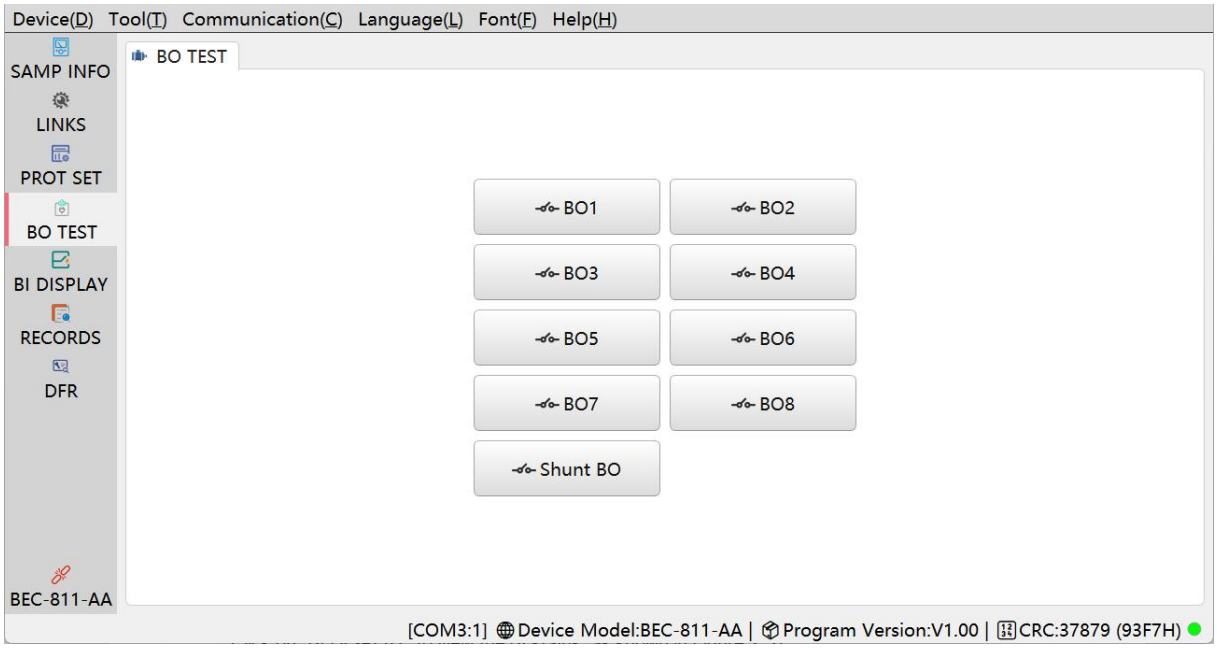


Figure 2-36 BO TEST

2.9. BI DISPLAY

Click on “BI DISPLAY” to view the BI status, as shown in Figure 2-37.

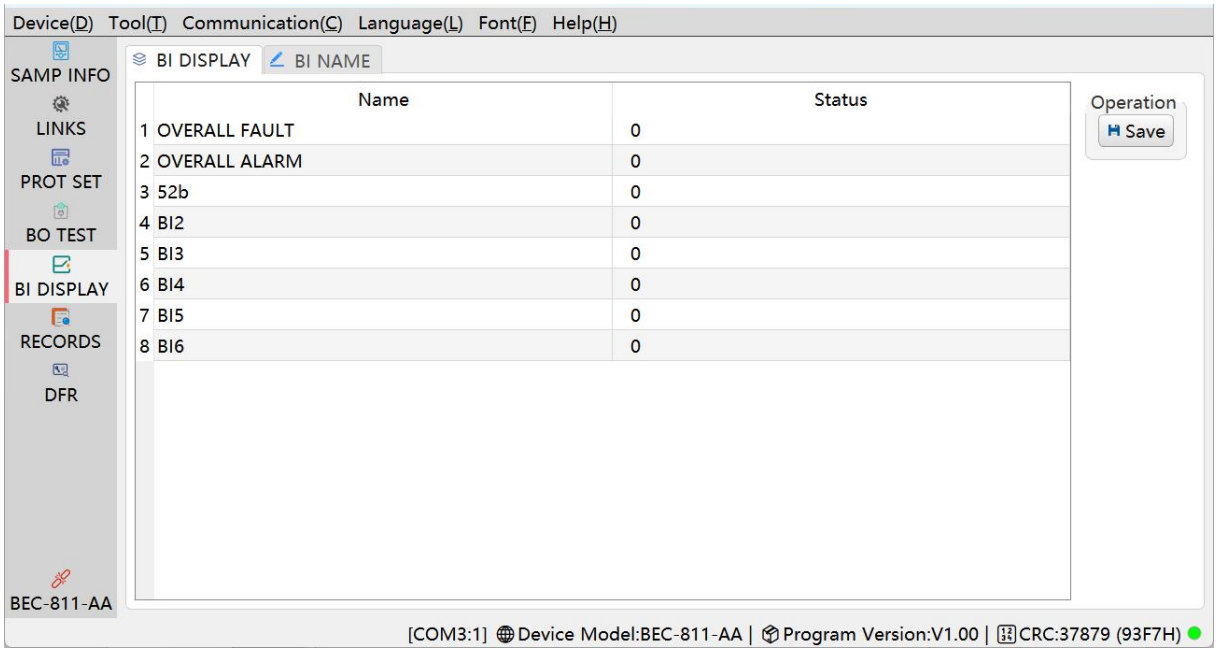


Figure 2-37 BI DISPLAY

2.10. Event Query

Click "RECORDS" to upload event reports, supporting queries for events such as trip reports, self-check reports, SOE reports, and operation records. When the number of uploaded entries

exceeds 100, you can navigate through pages. You can also click "Save" button to export the uploaded events to an Excel file.

For example, to view the SOE report, click the "Upload" button to upload the SOE reports, as shown in Figure 2-38.

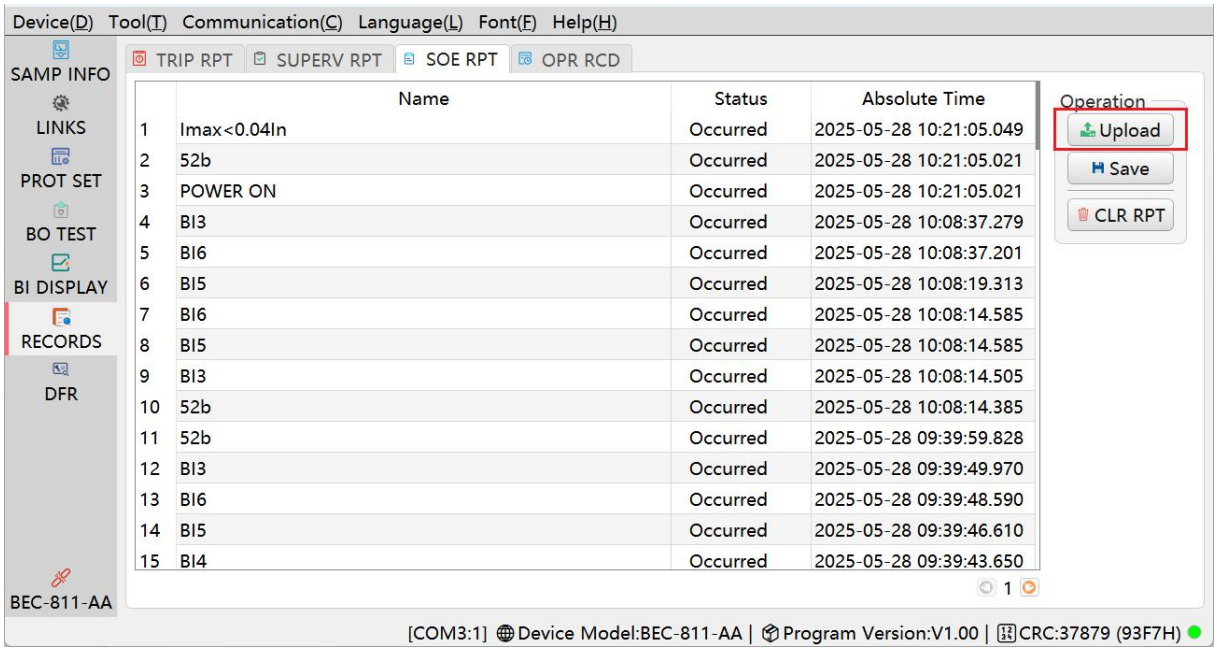


Figure 2-38 Upload SOE reports

You can also click "Save" button to save the events from the table as an Excel file, as shown in Figure 2-39.

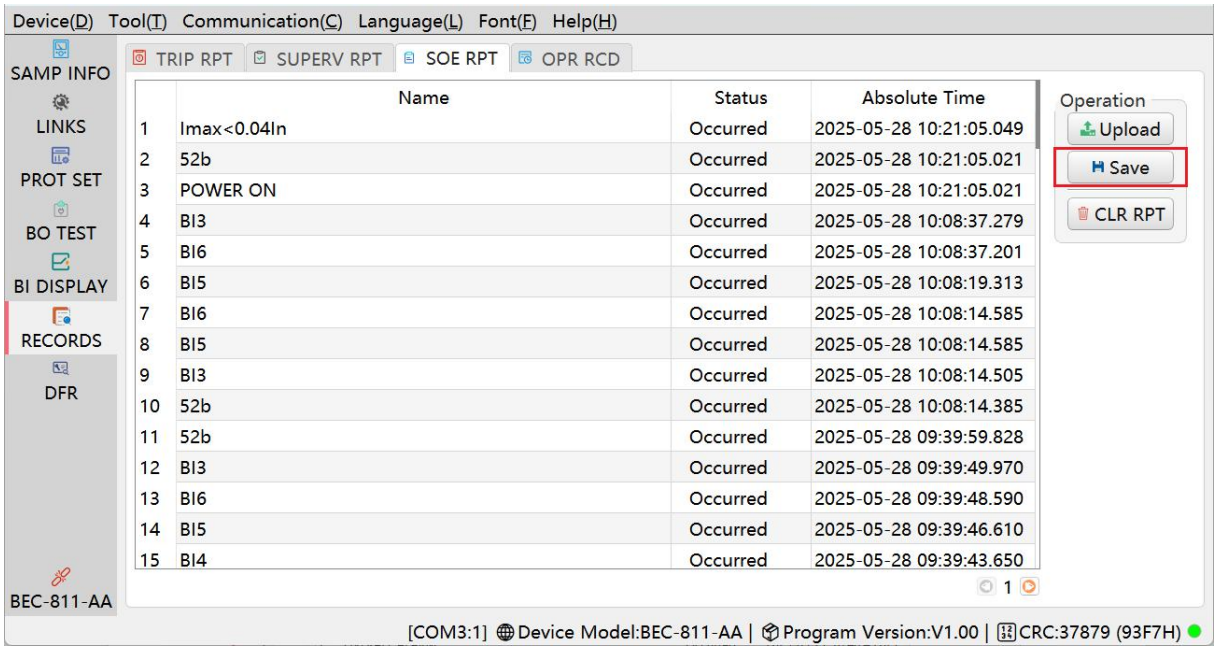


Figure 2-39 Save SOE reports

Click the "Previous Page" and "Next Page" buttons to switch pages, as shown in Figure 2-40.

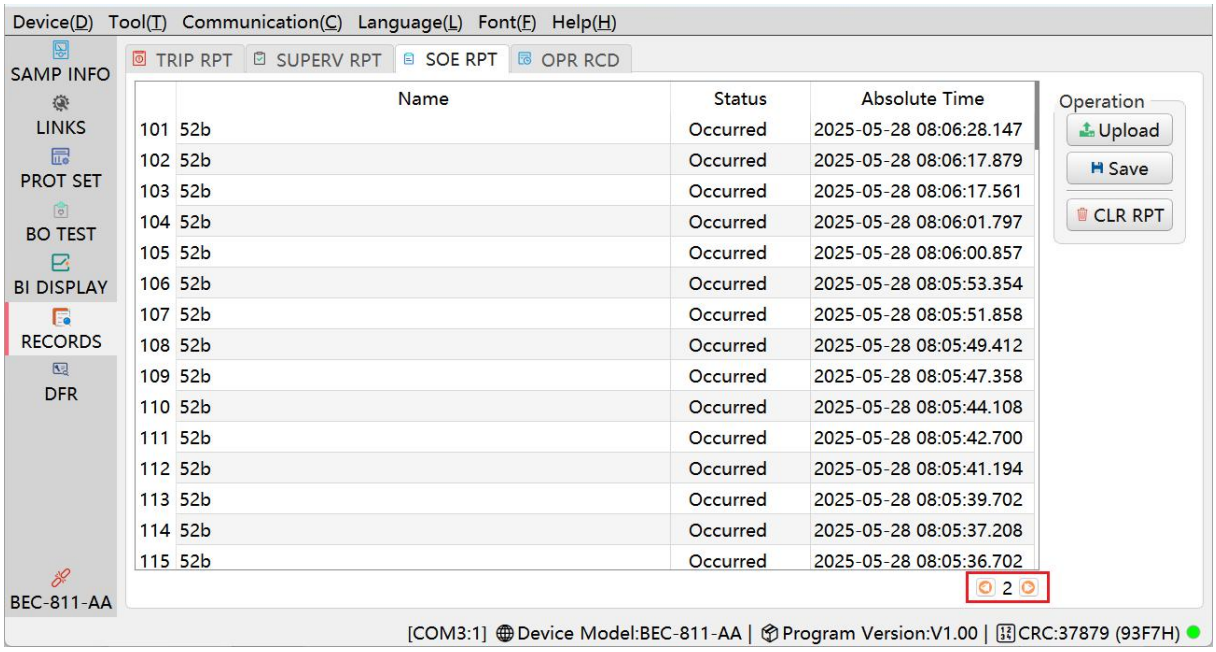


Figure 2-40 Pagination

2.11. Fault Recording

Click on “DFR” to directly open the recording file, or obtain the latest recording file, as shown in Figure 2-41.

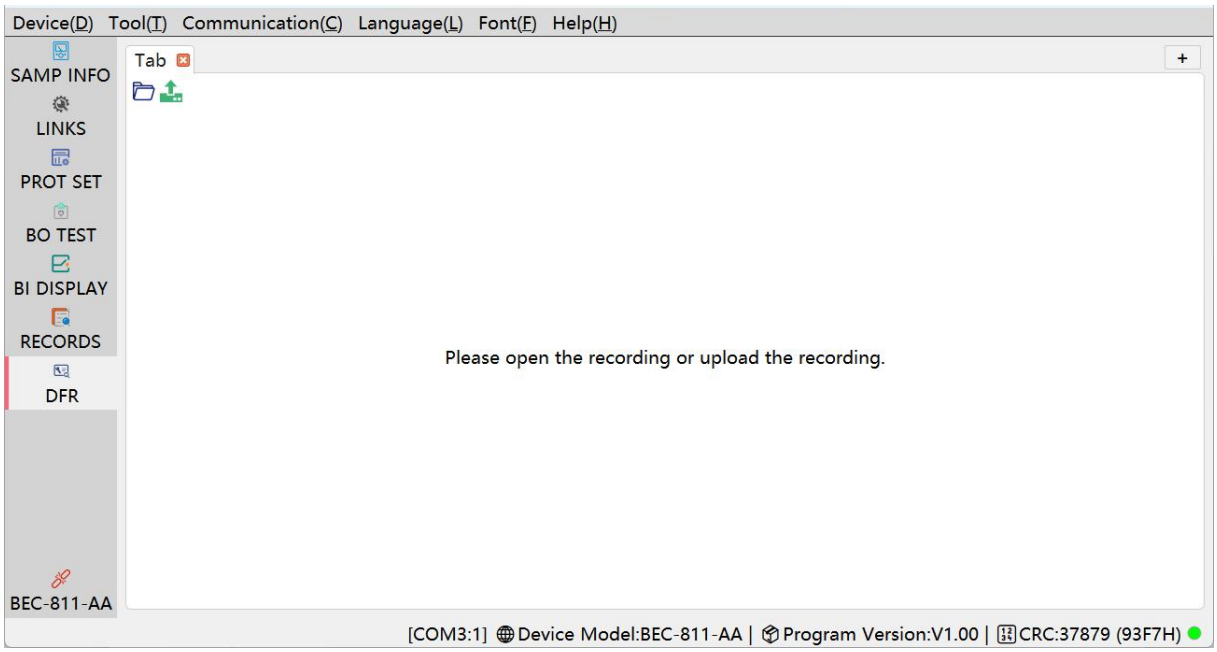


Figure 2-41 Fault Recording

A new page can be created by clicking the 'New Tab' button located at the top-right corner. Each page allows for independently opening a recording file or uploading a recording, as illustrated in Figure 2-42.

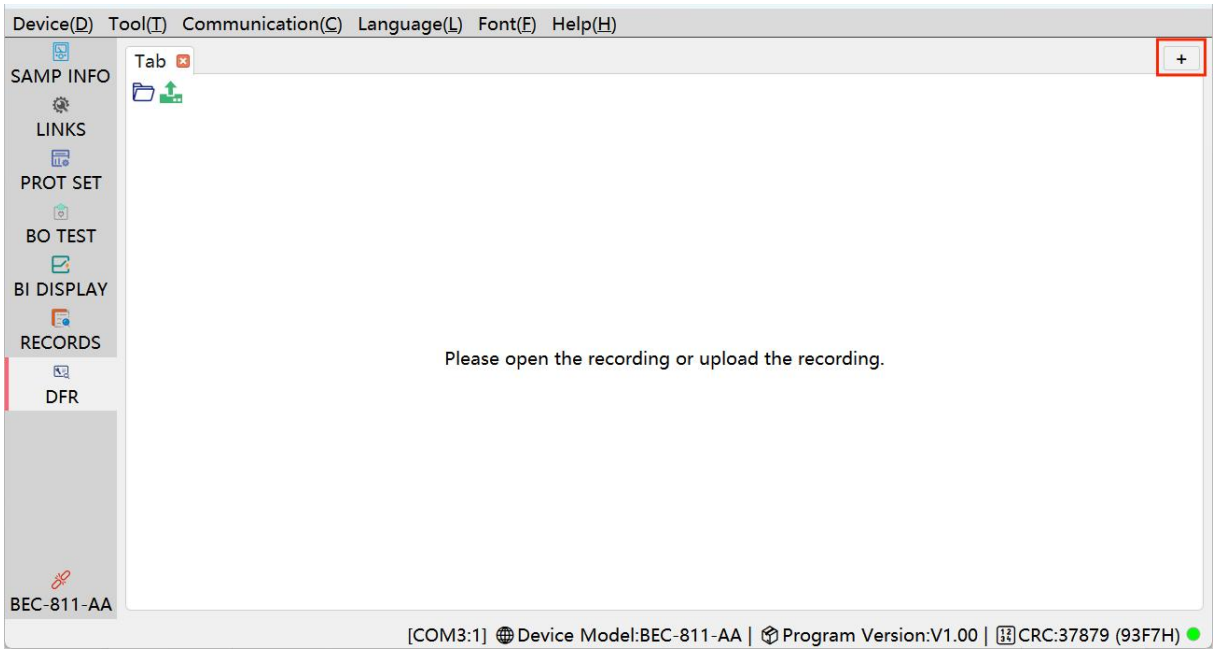


Figure 2-42 New Tab

2.11.1. Open the recording

Click the “Open” tool button and select the recording file to directly open the recording file, as shown in Figure 2-43.

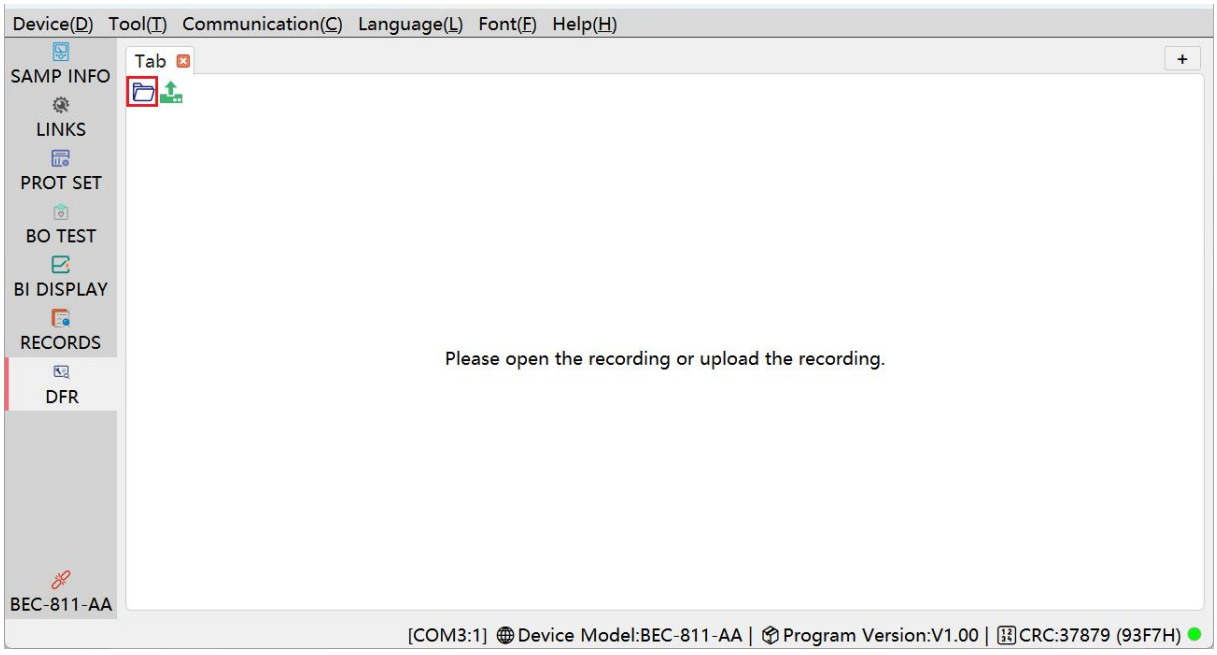


Figure 2-43 Open the recording file

2.11.2. Upload the recording

Click the "Upload" tool button and a fault list will pop up, as shown in Figure 2-44.

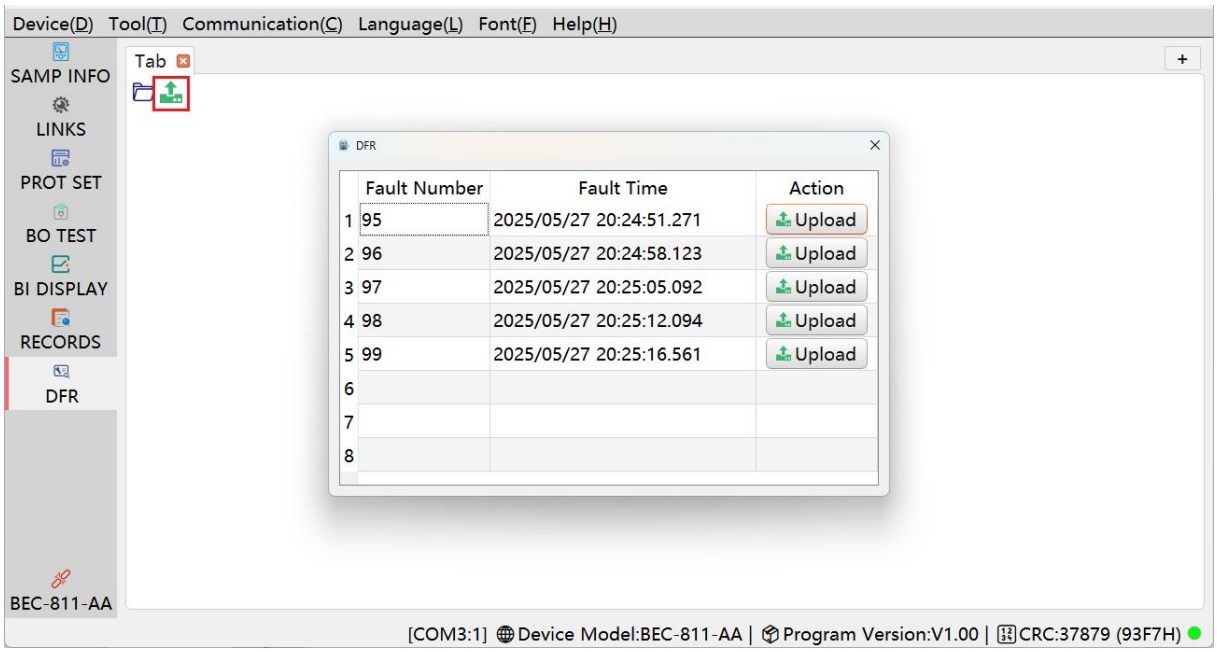


Figure 2-44 Upload the recordings

In the fault list, select the corresponding fault number for uploading. During the request process, a progress bar will be displayed, indicating the current progress, as shown in Figure 2-45.

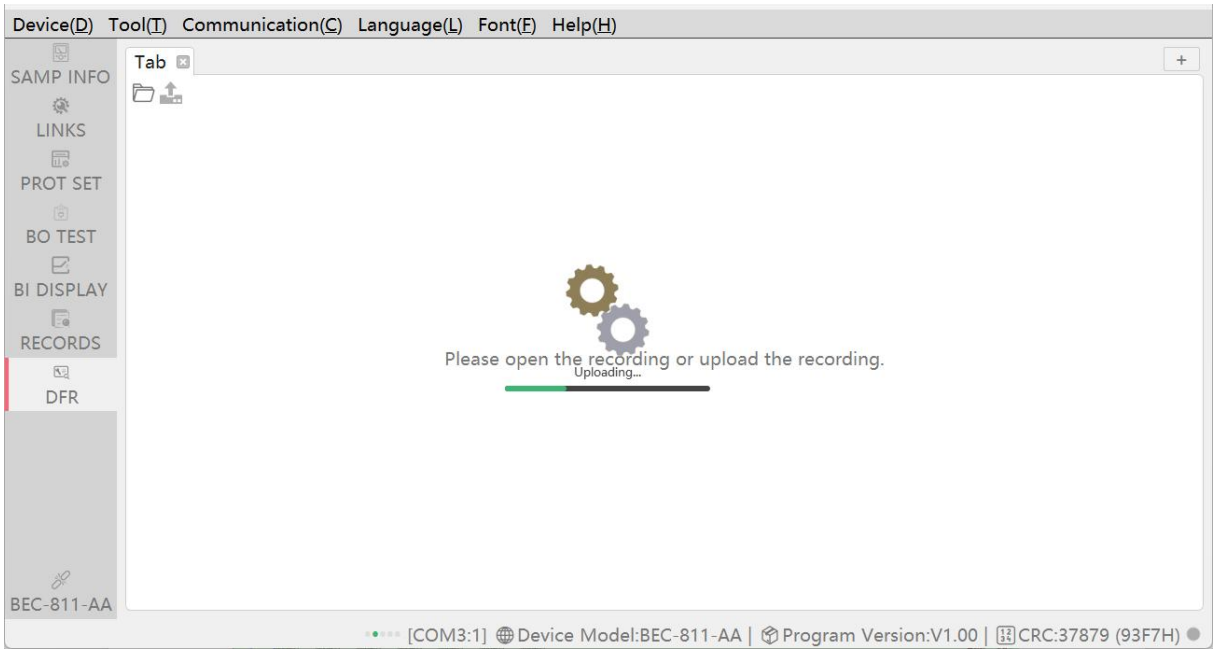


Figure 2-45 Upload progress

2.11.3. View the recording

After completing the above operation, the corresponding recording file will be opened immediately, as shown in Figure 2-46.

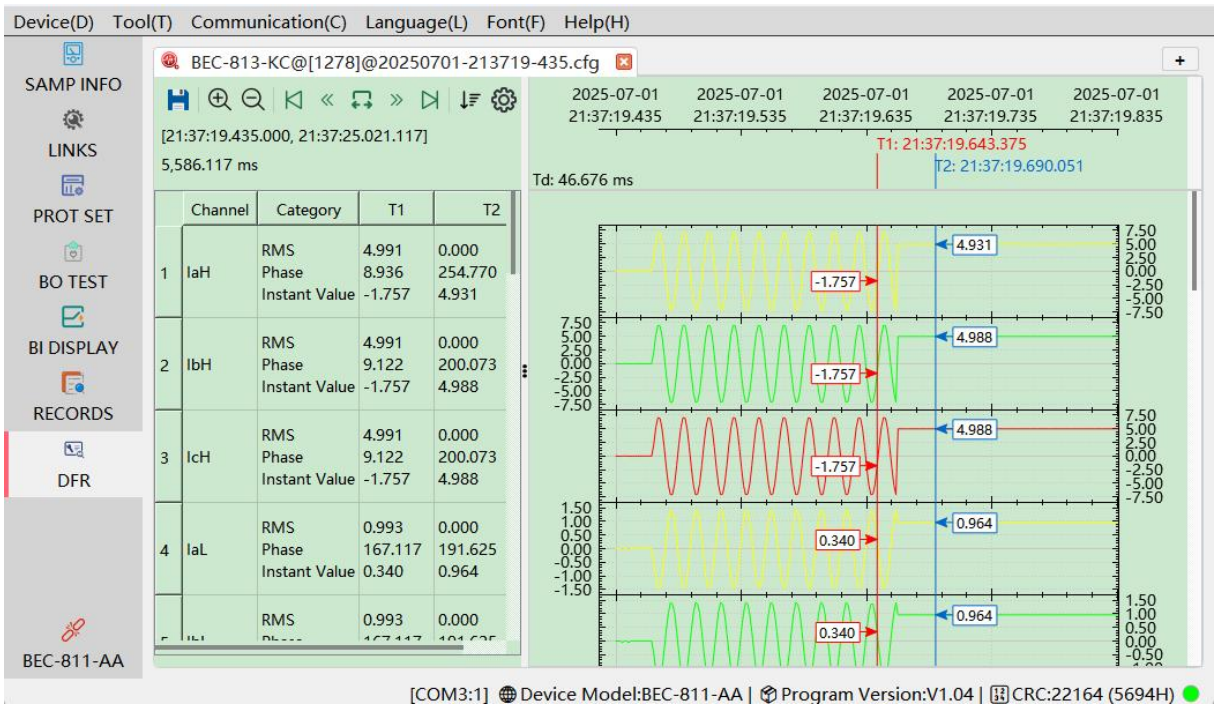


Figure 2-46 View the recording file

Double-click the channel name to open the channel list, where you can select different channels to display, as shown in Figure 2-47.

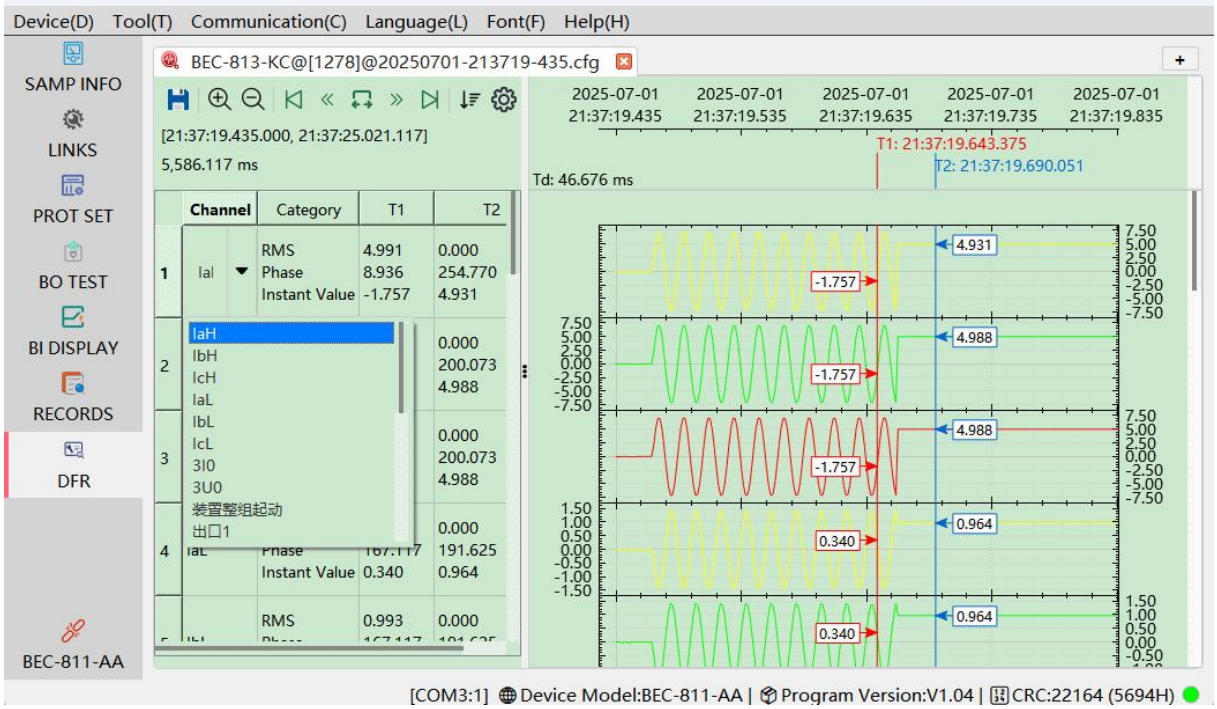


Figure 2-47 Switch Channels

The functions and corresponding shortcut keys of the toolbar in the upper left corner are as follows:

1. Export as Image (Ctrl + E): Export and save the channel graph as a PNG or JPEG image.
2. Zoom In (Ctrl + +): Zoom in on the waveforms of each channel.
3. Zoom Out (Ctrl + -): Zoom out on the waveforms of each channel.
4. Move to Start (Home): Move the start point of the time axis to the time of the first sampling point.
5. Move Backward (←): Shift the time axis backward by a certain time interval.
6. Reset View (Ctrl + R): Reset the time axis to cover the full sampling time range.
7. Move Forward (→): Shift the time axis forward by a certain time interval.
8. Move to End (End): Move the end point of the time axis to the time of the last sampling point.
9. Sort Channels (Ctrl + S): Open a window to sort the display order of channels by dragging their names, as shown in Figure 2-48.

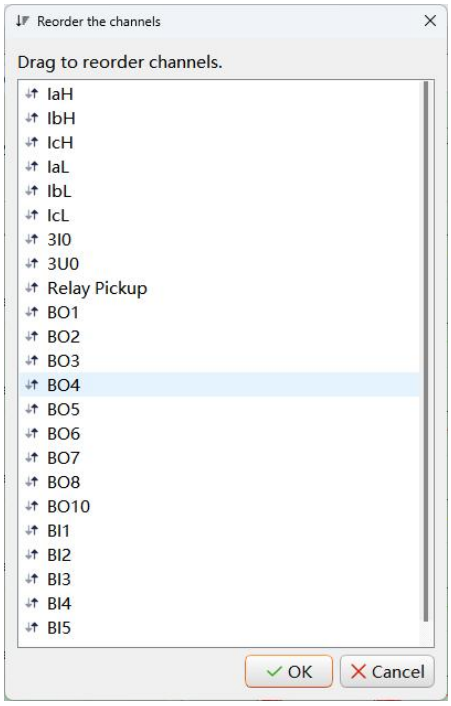


Figure 2-48 Resort Channels

10. Settings (Ctrl + P): Open a window to sort the display order of value types by dragging their names, as shown in Figure 2-49.

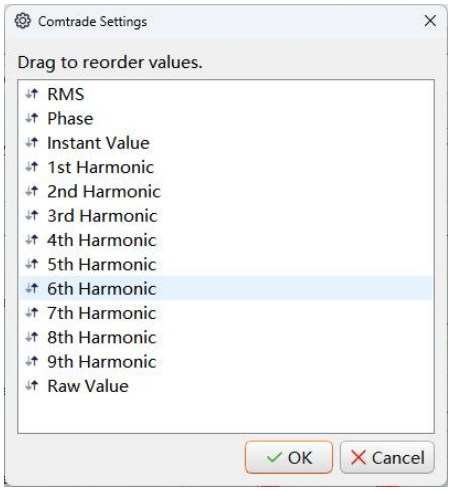


Figure 2-49 Resort Values

With these toolbar buttons, you can perform various functions such as exporting images, zooming, panning, and sorting channels. In addition, you can also zoom in and out by scrolling the mouse wheel on the channel graph, and pan the time axis by holding and dragging the left mouse button.

T1 and T2 are two vertical lines representing two points in time, distinguished by red and blue colors on the channel graph. The intersection points between these lines and the waveforms of

each channel are marked with the instantaneous values at those moments. The specific times of T1 and T2, as well as their time difference (Td), are displayed on the top time axis.

2.11.4. Modify Cursor Time

You can modify the time of T1 by left-clicking any point on the channel graph, and modify the time of T2 by right-clicking any point on the channel graph. You can also fine-tune the time of T1 using the shortcut keys (Ctrl + ←) and (Ctrl + →), and fine-tune the time of T2 using the shortcut keys (Shift + ←) and (Shift + →). The fine-tuning step size is equal to one sampling interval. After adjusting the times of T1 and T2, the corresponding values at those moments will be automatically updated.

The values of T1 and T2 in the table are displayed according to the order of value types, with up to three types shown. To view all value types, you can hover the mouse over the table, as shown in Figure 2-50.

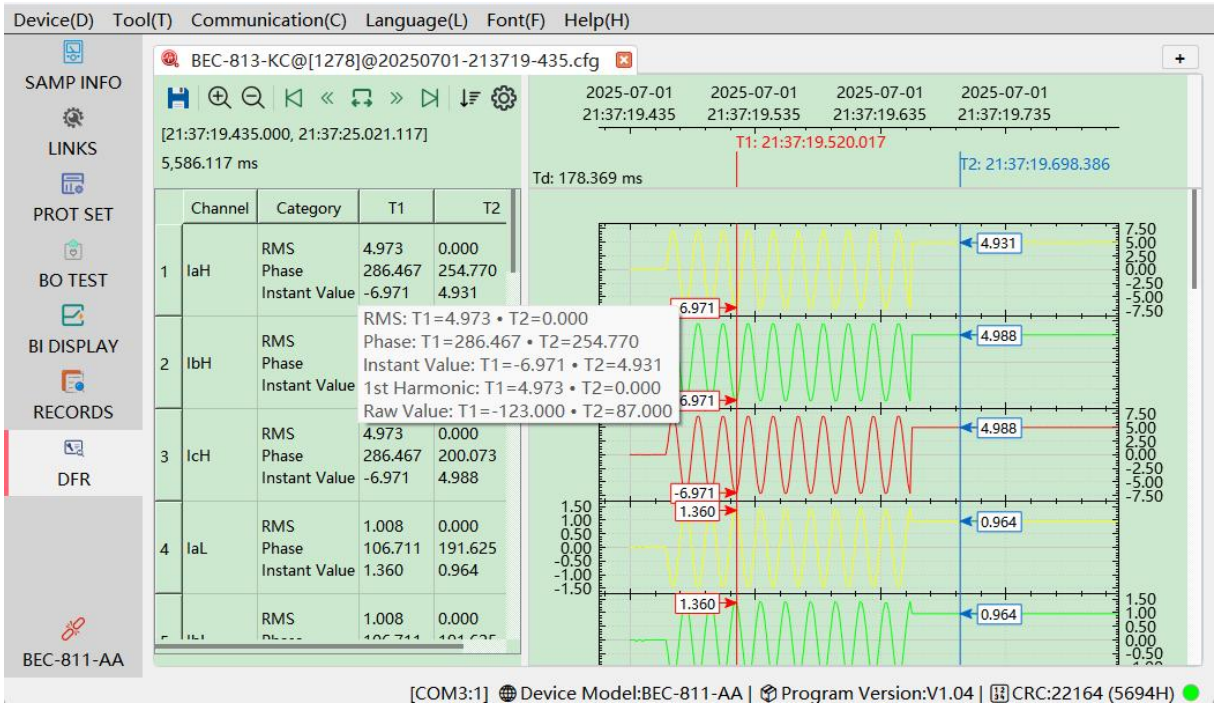


Figure 2-50 View all values of T1 & T2

2.12. Device Upgrade

Click "Device Upgrade" to enter the program download tool, as shown in Figure 2-51.

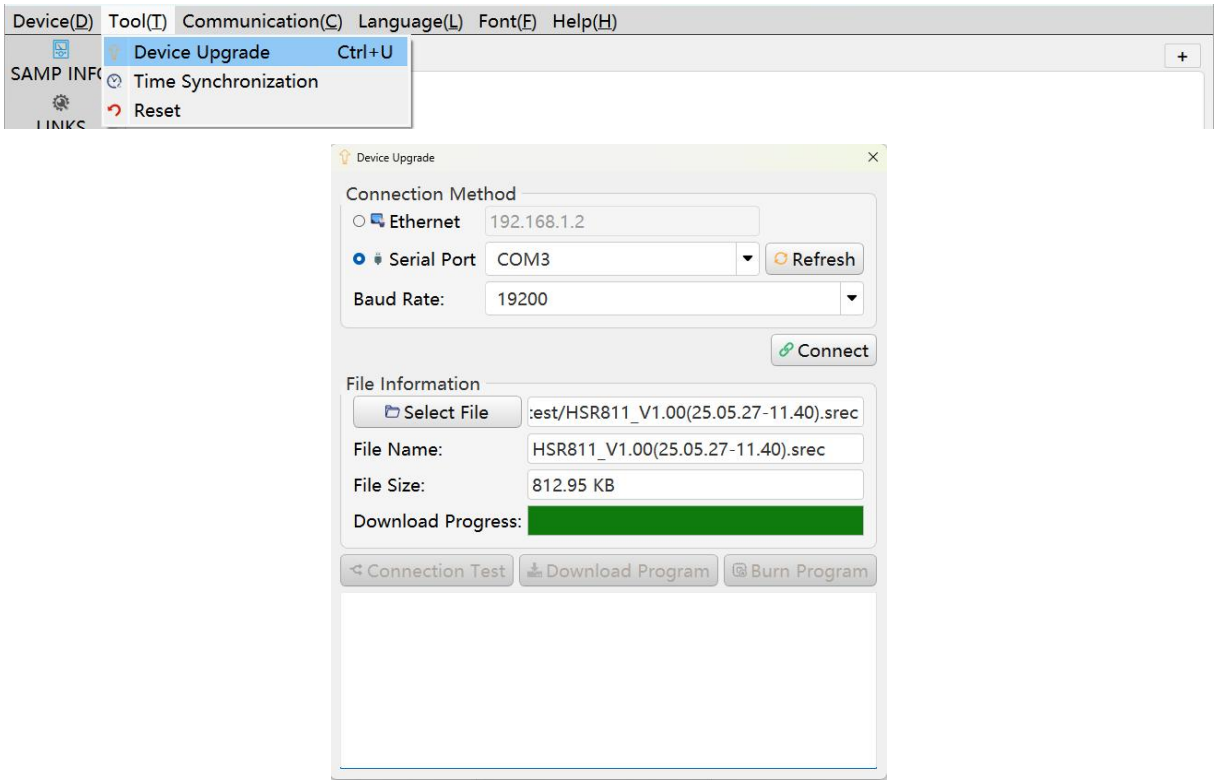


Figure 2-51 Device Upgrade

First, click the "Connect" button and wait for the device to connect successfully. Then, click the "Select File" button to open a dialog box and choose the new program file, as shown in Figure 2-52.

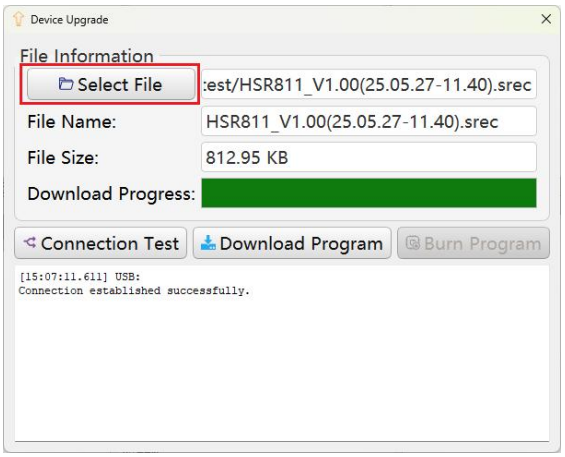


Figure 2-52 Device Upgrade

Next, click the "Connection Test," "Download Program," and "Burn Program" buttons in sequence. Wait for the device to complete the burning process, then close the window, as shown in Figure 2-53.

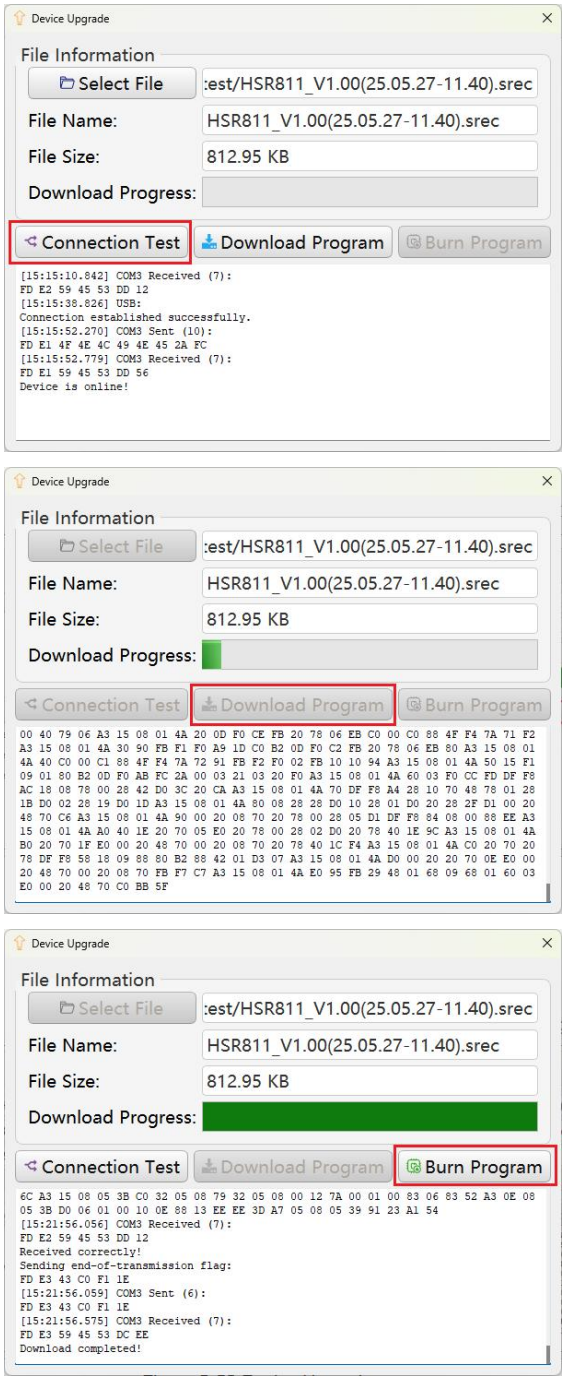


Figure 2-53 Device Upgrade

2.13. Time Synchronization

Click the "Time Synchronization" button to calibrate the time of the device, as shown in Figure 2-54.

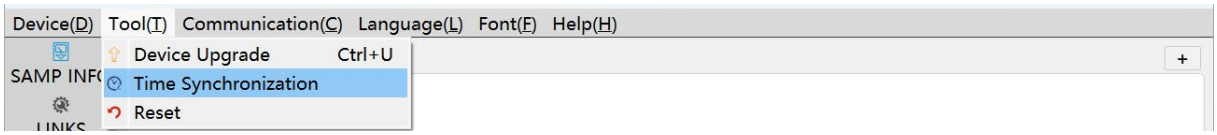


Figure 2-54 Time Synchronization

2.14. Action Reset

Click the Reset button under the Tools menu to perform the reset operation, as shown in Figure 2-55.

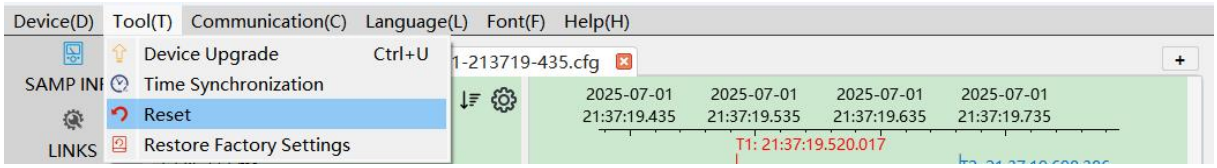


Figure 2-55 Action Reset

2.15. Restore Factory Settings

Click the Restore Factory Settings button under the Tools menu to reset the settings in the PROT SET to their factory defaults, as shown in Figure 2-56.

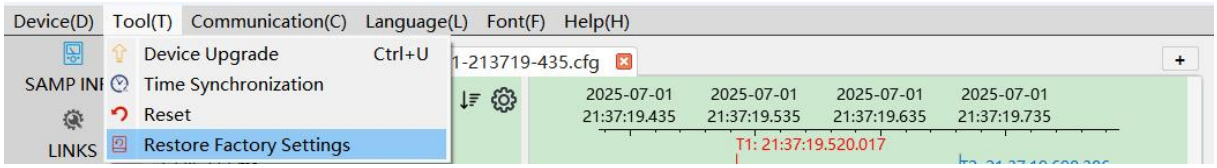


Figure 2-56 Restore Factory Settings