**NetEco 1000S Inverter Management System
Smart I-V Curve Diagnosis**

User Manual

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About This Document

Overview

This document describes the Smart I-V Curve Diagnosis function of the NetEco 1000S inverter management system, and provides solutions to common faults.

Intended Audience

This document is intended for photovoltaic (PV) plant operating personnel and qualified electricians.

Symbol Conventions

The symbols that may be found in this document are defined as follows.

Symbol	Description
⚠ DANGER	Indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
⚠ WARNING	Indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
⚠ CAUTION	Indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
NOTICE	Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss, performance deterioration, or unanticipated results. NOTICE is used to address practices not related to personal injury.
📖 NOTE	Supplements the important information in the main text. NOTE is used to address information not related to personal injury, equipment damage, and environment deterioration.

Change History

Changes between document issues are cumulative. The latest document issue contains all updates made in previous issues.

Issue 03 (2019-10-30)

Updated 2 Solution Deployment.

Updated 4.1 Smart I-V Curve Diagnosis on the NetEco.

Updated 4.2 Smart I-V Curve Diagnosis Results and Troubleshooting Suggestions.

Issue 02 (2019-04-10)

Changed residential smart inverters to distributed smart inverters.

Issue 01 (2018-10-26)

This issue is used for first office application (FOA).

Contents

1 Function Description

Functions

Smart I-V Curve Diagnosis allows Huawei inverters to scan PV strings and generate an I-V curve, which is then analyzed simultaneously in the NetEco 1000S inverter management system (NetEco for short) to diagnose PV strings and generate alarms for faulty PV modules.

A large number of PV plant statistics show that PV module quality and faults are important factors that affect energy yields. As the PV industry is becoming mature, how to identify faulty PV modules in a convenient and efficient way and how to take appropriate measures to rectify faults are the key to increasing energy yields and decreasing investment risks, and are also the development trend of operation and maintenance (O&M).

Smart I-V Curve Diagnosis helps scan and check the health of PV strings in a PV plant or connected to the same solar inverter. In this way, potential risks and faults can be detected promptly, thereby improving the plant quality. The one-click operation facilitates O&M and improves O&M efficiency.

Features

- Promptly detecting faults and risks of PV modules
  - All PV modules in a PV plant are scanned periodically through annual inspection, which helps promptly detect faulty PV modules. Timely processing of faulty PV modules helps improve energy yields and prevents faults from escalating.
  - The PV string with an abnormal output can be detected at any time to locate hidden faults promptly.
  - The NetEco analyzes the data simultaneously, which has little impact on energy yields and ensures high reliability.
- Improving the O&M efficiency
  - Remote operations can be performed by one click.
  - I-V curves are analyzed automatically.
  - Reports are generated automatically.
  - PV strings can be diagnosed according to alarms, which improves O&M quality and efficiency.

Key Performance

- Huawei inverter I-V scanning duration (string open circuit to short circuit) < 1s

- Huawei inverter I-V scanning resolution: 128 data points

- Huawei inverter I-V scanning voltage precision: 0.5%rdg. + 1dgt. (5 < rdg., dgt. = 0.3)

- Huawei inverter I-V scanning current precision: 0.5%rdg. + 2dgt. (0.3 < rdg., dgt. = 0.006)

- Scanning of a single inverter does not require the inverter to shut down, so energy yields will barely be affected.

2 Solution Deployment

2.1 Huawei Commercial Smart Inverter + Huawei SmartLogger + NetEco

Application scenarios: ground PV plants

Typical regions: China, Europe, Japan, the Middle East, Africa, and Asia Pacific

Solution deployment: Huawei commercial smart inverter authorizes Smart I-V Curve Diagnosis through the NetEco and Huawei SmartLogger (SmartLogger for short). The three work together to initiate Smart I-V Curve Diagnosis, monitor the process, and display the result.

Version Mapping 1

Device/Software	Model	Version
Huawei commercial smart inverter	SUN2000-50KTL	SUN2000 V200R002C00SPC113 and later
	SUN2000-50KTL-C1	
	SUN2000-33KTL-JP	
	SUN2000-40KTL-JP	
	SUN2000-36KTL	
	SUN2000-42KTL	
	SUN2000-43KTL-IN-C1	
	SUN2000-60KTL-HV-D1	SUN2000HA V100R001C00SPC101 and later
	SUN2000-60KTL-HV-D1-001	
	SUN2000-55KTL-HV-D1	
	SUN2000-55KTL-IN-HV-D1	
	SUN2000-55KTL-HV-D1-001	
	SUN2000-70KTL-C1	All versions

Device/Software	Model	Version
	SUN2000-75KTL-C1	
	SUN2000-65KTL-M0	
	SUN2000-60KTL-M0	
	SUN2000-50KTL-M0	
	SUN2000-70KTL-INM0	
	SUN2000-63KTL-JPM0	
	SUN2000-50KTL-JPM0	
	SUN2000-100KTL-USH0	All versions
	SUN2000-90KTL-H1	
	SUN2000-90KTL-H0	
	SUN2000-100KTL-H1	
	SUN2000-95KTL-INH0	
	SUN2000-100KTL-H0	
	SUN2000-63KTL-JPH0	
	SUN2000-90KTL-H2	
	SUN2000-100KTL-H2	
	SUN2000-105KTL-H1	
	SUN2000-95KTL-INH1	
SUN2000 APP	Android system	2.1.21.100 and later
	iOS system	2.1.20.100 and later
SmartLogger	SmartLogger1000-10	SmartLogger V100R001C00SPC113 and later
	SmartLogger2000-10	SmartLogger V200R002C10SPC101 and later
	SmartLogger2000-11	
NetEco	NetEco 1000S	iManagerNetEco1000S_V100R003C00SPC110 and later

Version Mapping 2

Device/Software	Model	Version
Huawei commercial	SUN2000-175KTL-H0	SUN2000HA

Device/Software	Model	Version
smart inverter	SUN2000-185KTL-INH0	V300R001C00SPC102 and later
	SUN2000-185KTL-H1	
SUN2000 APP	-	3.2.00.001 and later
SmartLogger	SmartLogger2000	SmartLogger V200R002C20SPC119 and later
	SmartLogger3000	All versions
	SmartLogger1000A	SmartLogger V100R002C00SPC030 and later
NetEco	NetEco 1000S	iManagerNetEco1000S_V100R003C00SPC160 and later

Version Mapping 3

Device/Software	Model	Version
Huawei commercial smart inverter	SUN2000-100KTL-M0	SUN2000 V500R001C00SPC102 and later
	SUN2000-100KTL-M1	
	SUN2000-100KTL-INM0	
	SUN2000-110KTL-M0	
	SUN2000-125KTL-M0	
SUN2000 APP	-	3.2.00.001 and later
SmartLogger	SmartLogger2000	SmartLogger V200R002C20SPC119 and later
	SmartLogger3000	All versions
	SmartLogger1000A	SmartLogger V100R002C00SPC030 and later
NetEco	NetEco 1000S	iManagerNetEco1000S_V100R003C00SPC160 and later

☐ NOTE

After the NetEco is installed, there is a trial period of 90 days. Obtain the license from Huawei technical service engineers and import it to the NetEco during the period, in case the NetEco cannot be used after the period.

2.2 Huawei Distributed Smart Inverters + Huawei SmartLogger + NetEco

Application scenario: distributed PV plants in Japan

Solution deployment: Huawei distributed smart inverters authorizes Smart I-V Curve Diagnosis through the NetEco and SmartLogger1000. The three work together to initiate Smart I-V Curve Diagnosis, monitor the process, and display the result.

Version Mapping

Device/Software	Model	Version
Huawei distributed smart inverters	SUN2000L-4.95KTL-JP	SUN2000L V100R001C12SPC106 and later
	SUN2000L-4.125KTL-JP	
SmartLogger	SmartLogger1000-10	SmartLogger V100R001C00SPC113 and later
NetEco	NetEco 1000S	NetEco 1000S V100R003C00SPC110 and later

☐ NOTE

After the NetEco is installed, there is a trial period of 90 days. Obtain the license from Huawei technical service engineers and import it to the NetEco during the period, in case the NetEco cannot be used after the period.

3 Smart I-V Curve Diagnosis License Management

3.1 License Description

Description

Smart I-V Curve Diagnosis can be used only after a license is purchased. The license file for Smart I-V Curve Diagnosis is stored in a Huawei inverter. The inverter SN uniquely maps to the license.

The license for Smart I-V Curve Diagnosis is a fixed-term license. When the license goes beyond **License Expiration Date**, the system provides a warning asking the customer to replace it with a new license.

The license can still be used for 60 days (grace period) after the **License Expiration Date**. After the **Grace period** expires, the Smart I-V Curve Diagnosis function will be disabled.

> **NOTICE**
>
> - The NetEco can be used to manage licenses for all inverters in multiple PV plants.
> - The SmartLogger can be used to manage licenses for all inverters in a PV array.
> - The SUN2000 app can be used to manage the license for a single Huawei commercial inverter.

License Application Procedure (Huawei Commercial Smart Inverter + Huawei SmartLogger + NetEco)

1. The customer exports a license application file and sends it to a technical service engineer.
2. The technical service engineer transfers the obtained license file to the customer.
3. The customer imports and loads the license file to an inverter, thereby obtaining the permission to use the Smart I-V Curve Diagnosis function.

License Application Procedure (Huawei distributed smart inverters + Huawei SmartLogger + NetEco)

The customer provides the plant name and combiner box SN to technical service engineers, who then manage the license.

3.2 License Management on the NetEco

Prerequisites

- A user has logged in to the NetEco.
- Devices have been added to the NetEco and operate normally.
- The current login user is the system administrator.

◻ NOTE

The app software version corresponding to the user interface (UI) snapshots in this section is iManagerNetEco1000S_V100R003C00SPC140. The snapshots vary with the software version and are for reference only.
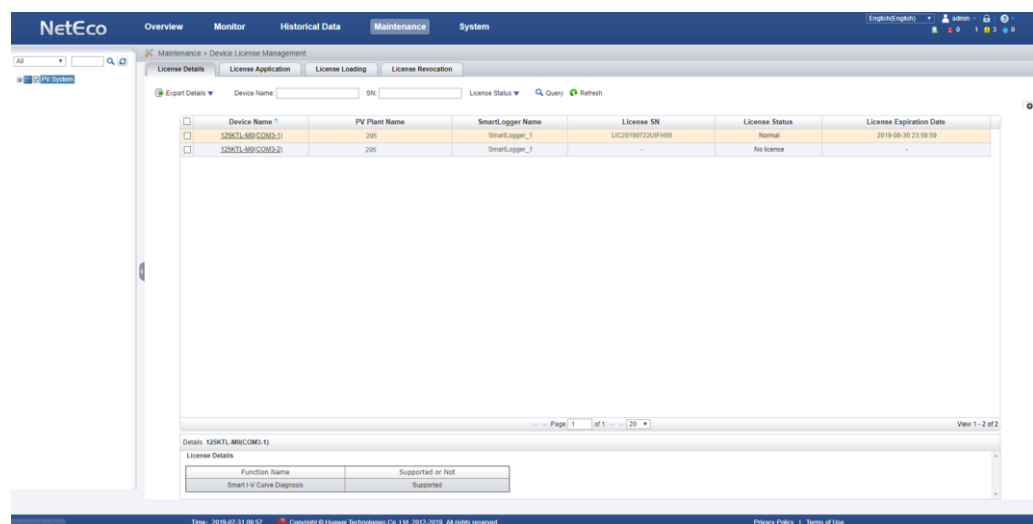
Procedure

Step 1 Choose **Maintenance** > **Device License Management** on the main menu.

Step 2 Select the target device in the navigation tree on the left.

You can also set **Device name**, **SN**, and **License Status** and click **Query** on the **License Details**, **License Application**, **License Loading**, or **License Revocation** tab page to filter out the devices that meet the search criteria.

Figure 3-1 License management

Step 3 Perform operations according to Table 3-1.

Table 3-1 Operations related to license management

Task Name	Task Description	Procedure

Viewing license information	For routine O&M, the license validity and function usage are queried routinely to check whether the license is about to expire and solve the problems in a time manner. In this way, the device can function properly.	Select the **License Details** tab to view the license information about the target device.
		• Click **Device name** of the target device. Then the function control information about the device will be displayed in the lower part of the page.
		
		Figure 3-2 Function control information
		
		• Select the target device and click **Refresh**. The license information is refreshed.
		• Export license details.
		  – Select **Export All** from the **Export Details** drop-down list box and save the license information about all devices selected in the navigation tree on the left to the PC.
		  – Select the target device in the displayed operation area. Select **Export Selected** from the **Export Details** drop-down list box and save the license information about the target device to the PC.
		NOTE
		The license information file is saved as a **.csv** file.

Exporting the license application file	The license application file contains the content required for applying the device license. Export the license application file to apply for a new device license if the license has expired.	1. Select the **License Application** tab. 2. Export the license application file. • Select **Export All** from the **Export License Application File** drop-down list box and save the license information about all devices selected in the navigation tree on the left to the PC. • Select the target device in the displayed operation area. Select **Export Selected** from the **Export License Application File** drop-down list box and save the license information about the target device to the PC. **NOTE** The device license application file is saved as an **.xls** file.

Task Name	Task Description	Procedure
Loading a device license	If the license has not been loaded for the device or the license is about to expire, you need to load a new license file to the device so that the device functions properly.	1. Select the **License Loading** tab. 2. Click **Upload License**. 3. Click **Browse** and select the license file to be imported. 4. Click **Upload**. 5. Load the device license. • Select **Load All** from the **Load License** drop-down list box to load the licenses for all devices selected in the navigation tree on the left. • Select the target device in the displayed operation area. Select **Load Selected** from the **Load License** drop-down list box to load the license to the target device. • To stop license loading, click **Cancel Loading**. **NOTE** A license file uniquely maps to a device SN. The license can be successfully loaded only if the license file uniquely maps to the device SN.
Revoking a license	Before a device is replaced, the current device license needs to be revoked so that the revocation code can be generated and used for applying for a new device license. After the device is replaced, you can load the new license file to the device, and then the device functions properly.	1. Select the **License Revocation** tab. 2. Select the device whose license needs to be revoked. 3. Click **Revoke License**. 4. Enter the user password and click **OK**. 5. Export the revocation code file. • Select **Export All** from the **Export Revocation Code File** drop-down list box and save the license revocation code file of all devices selected in the navigation tree on the left to the PC. • Select the target device in the displayed operation area. Select **Export Selected** from the **Export Revocation Code File** drop-down list box and save the license revocation code file of the target device to the PC. **NOTE** • The revocation code file is saved as a **.csv** file. • You need to log in as an admin user to export the revocation code file. • If you select **Export All** to export the revocation code file, **Revocation Code** is empty for devices whose **License Status** is not **Revoked** in the exported file. If you select **Export Selected** and the target devices you selected include the devices whose **License Status** are not **Revoked**, the system will prompt you to select devices again.

----End

3.3 License Management Through the SmartLogger

Prerequisites

- A user has logged in to the SmartLogger WebUI.
- Devices have been added to the SmartLogger and operate normally.
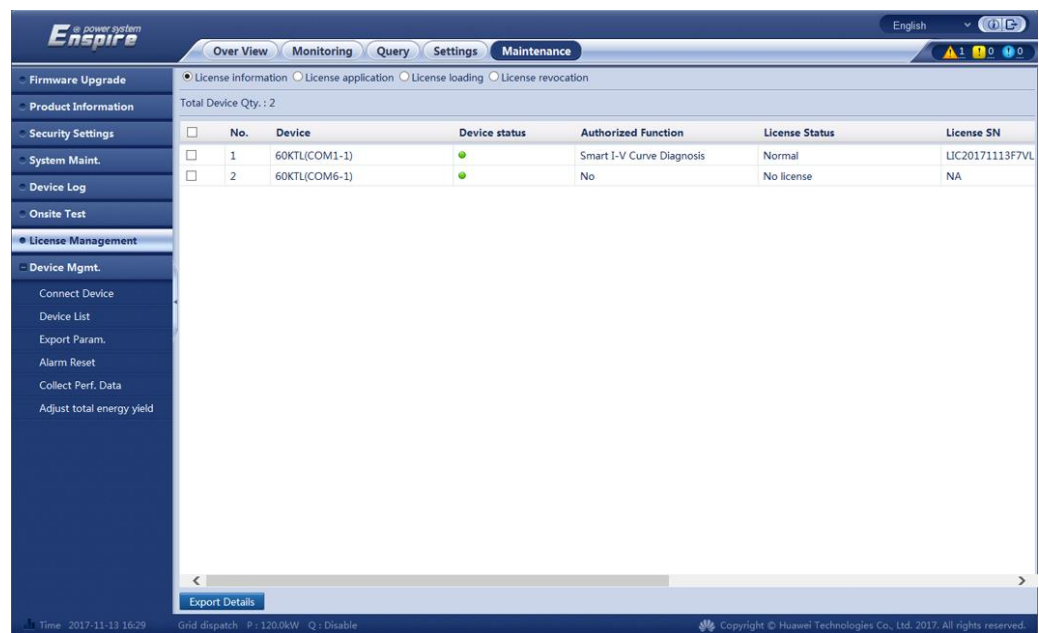- The current login user is an advanced or special user.

> 📖 NOTE
>
> The software version corresponding to the user interface (UI) snapshots in this section is SmartLogger2000 V200R002C20SPC119. The UIs could vary with software versions and are for reference only.

Procedure

Step 1 Choose **Maintenance** > **License Management** on the main menu.

Figure 3-3 License management

Step 2 Perform operations according to Table 3-2.

Table 3-2 Operations related to license management

Task Name	Task Description	Procedure
Querying license information	For routine O&M, the license validity and function usage are queried routinely to check whether the license is about to expire and solve the problems in a time manner. In this way, the device can function properly.	Choose **License information** to view the license information about the target device. Select the target device and click **Export Details** to save the license information about the target device to the PC. **NOTE** The license information file is saved as a **.tar** file.
Exporting the license application file	The license application file contains the content required for applying the device license. Export the license application file to apply for a new device license if the license has expired.	1. Choose **License application**. 2. Select the target device (multiple devices can be selected) and click **Export License Application File**. **NOTE** The device license application file is saved as a **.tar** file.
Loading a device license	If the license has not been imported for the device or the license is about to expire, you need to import the new license file to the device, ensuring that the device functions properly.	1. Choose **License loading**. 2. Click **Upload License**. 3. Click **Browse** and select the license file to be imported. 4. Select the target device (multiple devices can be selected) and click **Load License** to load the device license. **NOTE** A license file uniquely maps to a device SN. The license can be successfully loaded only if the license file uniquely maps to the device SN.
Revoking a license	Before a device is replaced, the current device license needs to be revoked so that the revocation code can be generated and used for applying for a new device license. After the device is replaced, you can import the new license file to the device, and then the device functions properly.	1. Choose **License revocation**. 2. Select the target device (multiple devices can be selected) whose license needs to be revoked. 3. Click **Revoke License**. 4. Enter the user password and click **Submit**. 5. Click **Export Revo Code File**. **NOTE** • The revocation code file is saved as a **.tar** file. • If you perform **Export Revo Code File** on the devices whose **License Status** are not **Revoked**, the system will prompt you to select devices again.

----End

3.4 License Management on the SUN2000 App

Prerequisites

- The solar inverter has been connected to the mobile phone installed with the SUN2000 app.
- The current login user is an advanced user.
- The SUN2000 app can be used only to manage the license for a single inverter.

Procedure

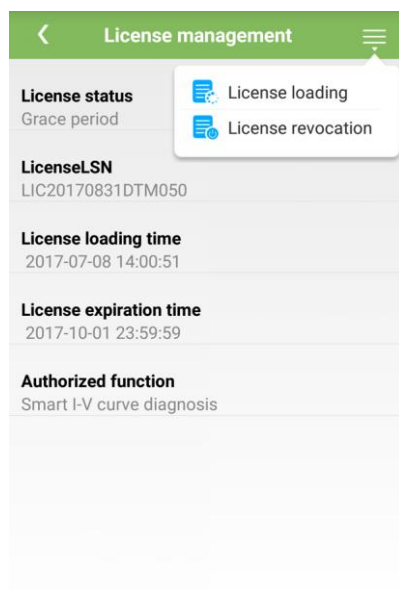**Step 1** Choose **Maintenance** > **License management** on the main menu.

Step 2 Tap ☰ in the upper right corner of the screen.

Figure 3-4 License management

Step 3 Tap **License loading**.

Step 4 Select the license file to be loaded and confirm the loading.

----End

Follow-up Procedure

Before a device is replaced, the current device license needs to be revoked so that the revocation code can be generated and used for applying for a new device license.

Step 1   Tap **License revocation**.

Step 2   Tap **Export revocation code**.

----End

4 Smart I-V Curve Diagnosis

4.1 Smart I-V Curve Diagnosis on the NetEco

Prerequisites

- A user has logged in to the NetEco.
- The current login user is the system administrator.
- The NetEco license has been loaded and is valid.
- The Smart I-V Curve Diagnosis license has been loaded and is valid.

📖 **NOTE**

The app software version corresponding to the user interface (UI) snapshots in this section is iManagerNetEco1000S_V100R003C00SPC140. The snapshots vary with the software version and are for reference only.

Diagnosis requirements and suggestions

- Diagnosis requirements
  a. The cleaning status of the PV modules in one subarray in one diagnosis task must be consistent.
  b. The irradiance during the diagnosis must be at least 400 W/㎡ (minimum irradiance requirement); otherwise, the system terminates the diagnosis automatically.
- Diagnosis suggestions
  a. You are advised to clean the PV modules before the diagnosis to ensure that the test data reflects the actual status of the PV modules.
  b. You are advised to perform the diagnosis between 11:00 and 13:00 to avoid shading.

Setting string details

Step 1 Select the **Monitor** tab page and then the target device on the left side. Choose **Settings** > **String Details Setup**.

Figure 4-1 String details setup (Huawei commercial smart inverter)
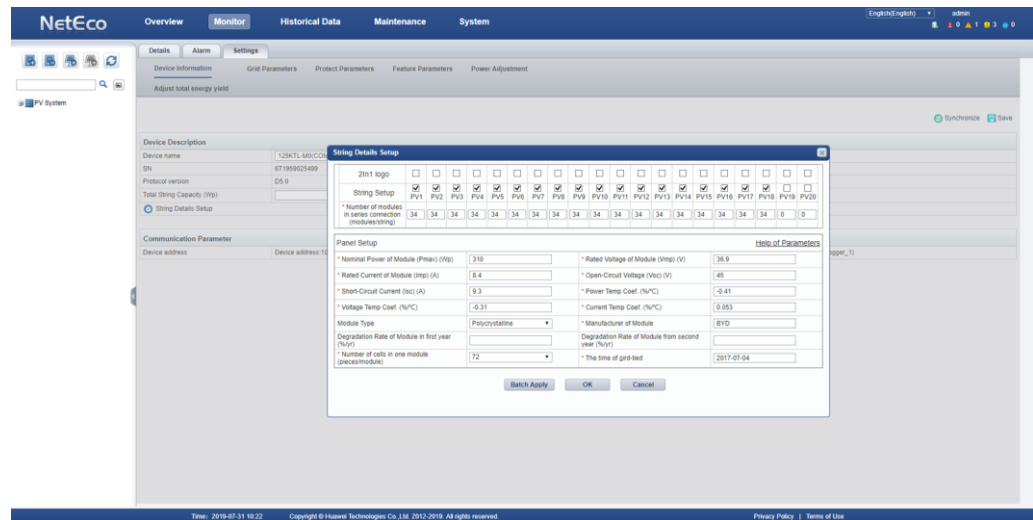
☐ NOTE

- If **PV String Access Detection** is set to **Enable** for the solar inverter on the SmartLogger WebUI, the checkboxes in the **2In1 logo** area will be automatically set based on the detection result and cannot be manually selected.

- If the version of the management system is earlier than iManagerNetEco1000S_V100R003C00SPC160, a PV string voltage alarm may be generated when the PV strings connected to the same solar inverter or to different solar inverters in a PV array have different numbers of PV modules. In this case, upgrade the management system to iManagerNetEco1000S_V100R003C00SPC160 or later.

Figure 4-2 String details setup (Huawei distributed smart inverters)
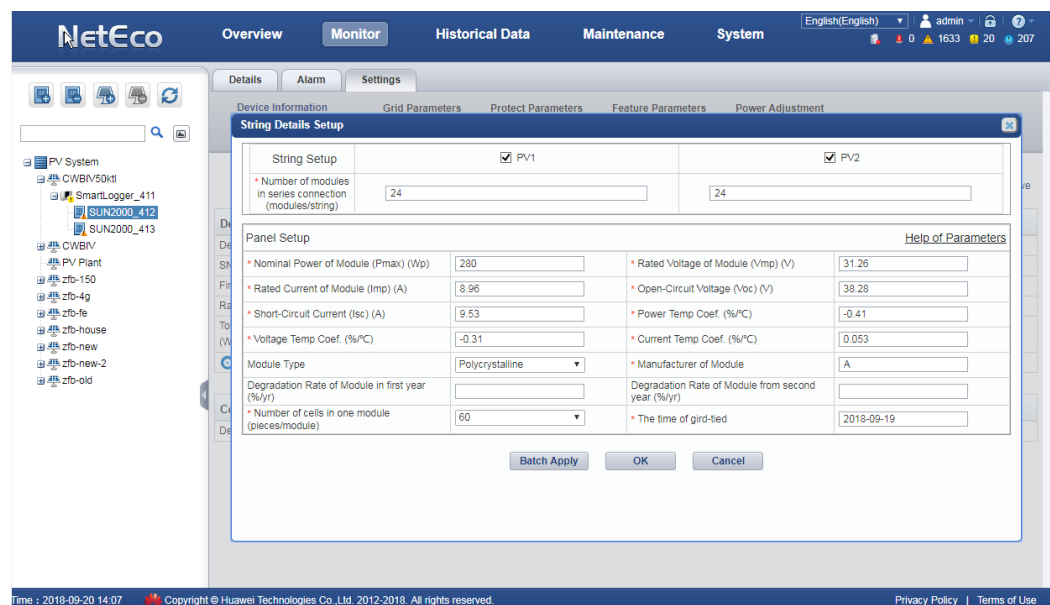
Click **Help of Parameters** to view the parameter setting requirements.

Figure 4-3 Help of parameters

Configuration parameters	Help of Parameters
Nominal Power of Module (Pmax)	reference the datasheet,Nominal Power of Module at STC Condition,[Wp]
Rated Voltage of Module (Vmp)	reference the datasheet,Rated Voltage of Module at STC Condition,[V]
Rated Current of Module (Imp)	reference the datasheet,Rated Current of Module at STC Condition,[A]
Open-Circuit Voltage (Voc)	reference the datasheet,Open-Circuit Voltage of Module at STC Condition,[V]
Short-Circuit Current (Isc)	reference the datasheet,Short-Circuit Current of Module at STC Condition,[A]
Power Temp Coef.	reference the datasheet,the relation between Pmax and temperature of panel,[%/°C]
Voltage Temp Coef.	reference the datasheet,the relation between Voc and temperature of panel,[%/°C]
Current Temp Coef.	reference the datasheet,the relation between Isc and temperature of panel,[%/°C]
Module Type	Cell type of a module(only monocrystalline and polycrystalline supported)
Manufacturer of Module	name of Module Manufacturer
Degradation Rate of Module in first year	Consult the Manufacturer, the degradation rate of module in first year,[%/y]
Degradation Rate of Module from second year	Consult the Manufacturer, the annual degradation rate of module from second year,[%/y]
Number of cells in one module	Number of cells in one module, mainly 60 of 72pieces/module in market
Number of modules in series connection	Number of modules in series connection(pieces)
The time of gird-tied	Running date of PV Plant

Step 2 (Optional) Click **Batch Apply** to apply the PV string settings to all inverters in the PV plant.
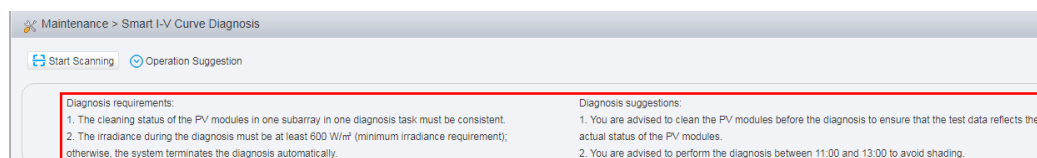
----End

Smart I-V Curve Diagnosis

Step 1 Choose **Maintenance** > **Smart I-V Curve Diagnosis** on the main menu.

NOTICE

The content in the red frame below shows the conditions and suggestions for I-V Curve Diagnosis. Read the content carefully and ensure that the conditions are met.

Figure 4-4 Conditions and suggestions

Maintenance > Smart I-V Curve Diagnosis

Start Scanning   Operation Suggestion

Diagnosis requirements:
1. The cleaning status of the PV modules in one subarray in one diagnosis task must be consistent.
2. The irradiance during the diagnosis must be at least 600 W/㎡ (minimum irradiance requirement); otherwise, the system terminates the diagnosis automatically.

Diagnosis suggestions:
1. You are advised to clean the PV modules before the diagnosis to ensure that the test data reflects the actual status of the PV modules.
2. You are advised to perform the diagnosis between 11:00 and 13:00 to avoid shading.

Step 2 Click **Start Scanning**.

Figure 4-5 Task settings

Step 3 Set the I-V Curve Diagnosis task.

Table 4-1 Diagnosis task parameters

Parameter	Description
Task name	Enter a task name with a maximum of 64 characters.
Task type	Value range: • **Task on Plant-Level**: Health checks for all PV strings connected to the inverters in the plant. • **Task on Inverter-Level**: Health checks for PV strings connected to an inverter.
PV plant	In the **PV plant** area, select the object to be scanned. Enter search criteria in the text box, and click to search for the object that meets search criteria. **NOTE** • If **Task on Plant-Level** is selected in **Task type**, the object should be SmartLoggers. A maximum of 10 SmartLoggers can be scanned simultaneously, and the SmartLoggers must be connected to the same plant. After the task is created, the diagnosis of this type will be displayed on the **Plant-Level Task** tab of the **Smart I-V Curve Diagnosis** page. • If **Task on Inverter-Level** is selected in **Task type**, the object should be inverters. A maximum of 10 inverters can be scanned simultaneously, and the inverters must be connected to the same plant. After the task is created, the diagnosis of this type will be displayed on the **Inverter-Level Task** tab of the **Smart I-V Curve Diagnosis** page.
Cleaning status	Specify the cleaning status of a string. Select a value as required.

Parameter	Description
Environmental data	Select a mode from the drop-down list box. Value range: • Auto: The system automatically calculates **Irradiance** and **Temperature Of Panel**. • Manually: **Irradiance** and **Temperature Of Panel** need to be set manually.
Irradiance	This parameter is displayed only when **Environmental data** is set to **Manually**. Value range: 200.0000 to 9999.9999
Temperature Of Panel	This parameter is displayed only when **Environmental data** is set to **Manually**. Value range: -100.0000 to 100.0000

Step 4 Click **Save**.

Figure 4-6 Executing a diagnosis task
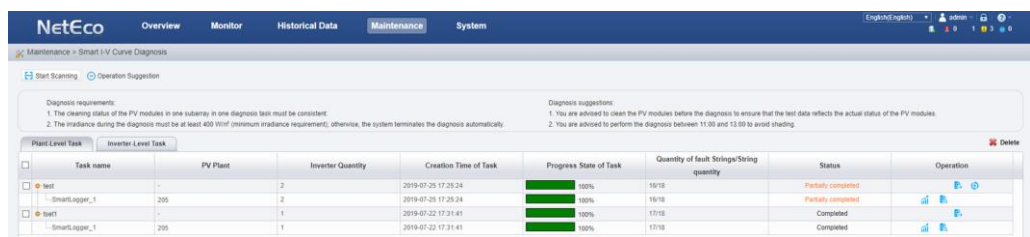
Click ◯ in **Operation** to stop the diagnosis task.

----End

Troubleshooting

If an error message dialog box is displayed when you attempt to start Smart I-V Curve Diagnosis, rectify the fault and then start Smart I-V Curve Diagnosis.

● If the message indicates that the parameter settings for the diagnostic object are incomplete, click **String Details Setup** and set string parameters as required.

Figure 4-7 Incomplete parameter settings
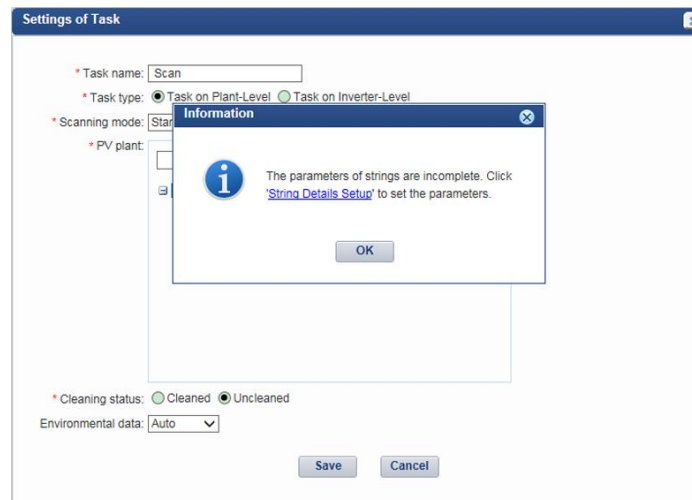
- If the message indicates that the irradiance is too low, you are advised to stop scanning and wait until the irradiance meets the requirement. If you continue scanning, a failure may occur.

Figure 4-8 Low irradiance
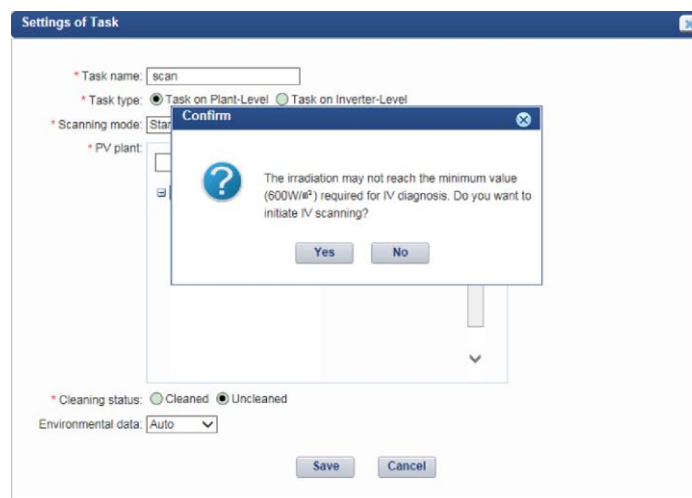
- If the message indicates that the weather is not sunny, you are advised to stop scanning and wait until the weather condition meets the requirement. If you continue scanning, a failure may occur.

Figure 4-9 Weather not meeting the requirement
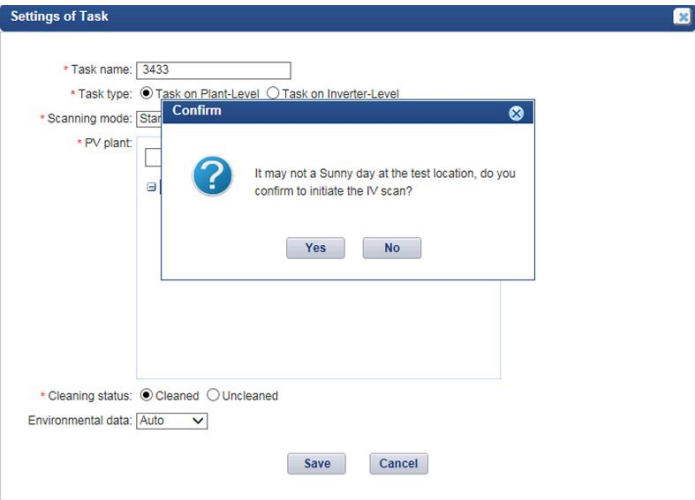
Viewing the Diagnosis Results and Diagnosis Details
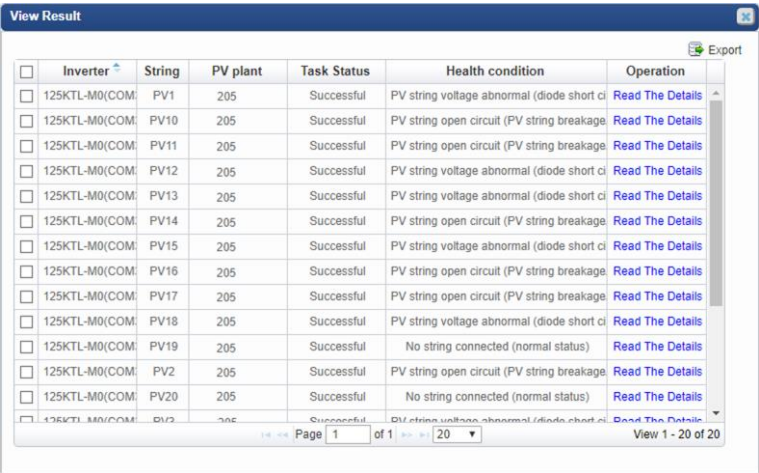
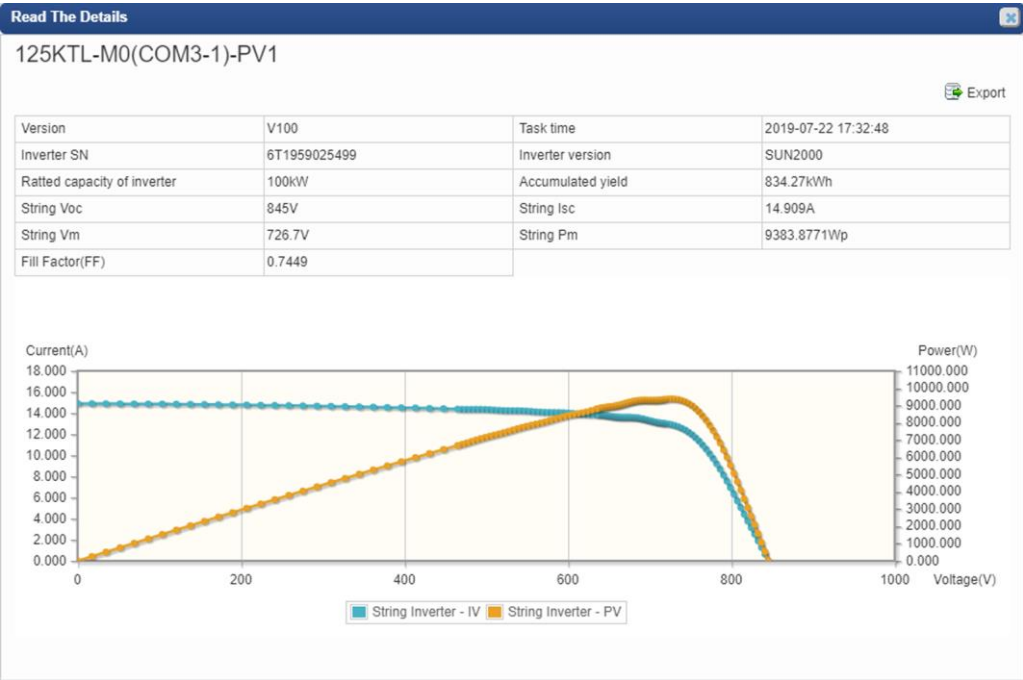**Step 1** Click [icon] to view diagnosis results.

Figure 4-10 Diagnosis results

Step 2 Click **Read the Details**.

Figure 4-11 Diagnosis details

----End

Viewing a Diagnosis Report

Step 1 Click to view the string diagnosis report.

Step 2 View the information in **Overview on Diagnosis**

Figure 4-12 Overview on diagnosis

Step 3 View the information in **List of Defective Strings**.

Figure 4-13 List of defective strings

Step 4 Select strings under **Comparison** to view the I-V curve comparison analysis chart for the corresponding strings.

Figure 4-14 String I-V curve comparison analysis chart
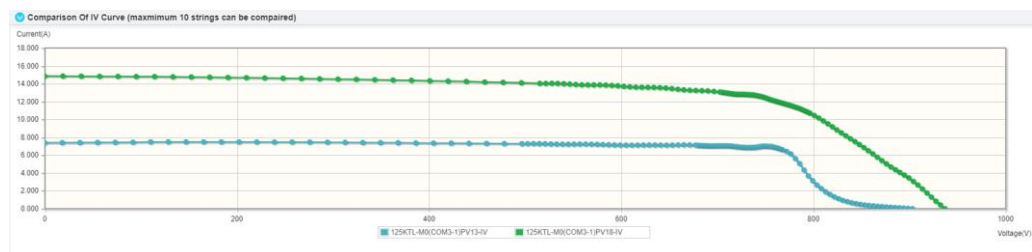
----End

4.2 Smart I-V Curve Diagnosis Results and Troubleshooting Suggestions

Fault ID	Fault Type	Troubleshooting Suggestion
10002	PV string open circuit (PV string breakage/PV string configured by mistake)	1. Check if the strings are connected correctly, if connections are loose, or not connected. 2. If the strings are connected to inverter, then switch off the inverter and pull off the connector between strings and inverter; then measure Voc of the strings with a multimeter and check whether the Voc is within correct parameters. 3. If the Voc is within correct parameters, then check whether the connector between string and inverter is broken, if everything is ok, then check if there is broken circuit inside of inverter. 4. If the Voc is abnormal, then check if there is broken circuit in strings.
10003	PV String Configuration Mistake (String 2in1 Label Mistake/2in1 Single String loss)	1. If string is labelled 2in1 connected, please check the string is truly 2in1 connected. 2. If the string is 2in1 connected, please check the 2in1 connected has string loss, or shading, orientation cause the current abnormal. 3. If string is not label 2in1 connect, please check whether the string is 2in1 connected.

Fault ID	Fault Type	Troubleshooting Suggestion
10005	Current mismatch in the PV string (shade/dust/PV module current inconsistent)	1. Please check if the scanning is done at a sunny day, current mismatch may occur when the irradiance changes dramatically. 2. Check if there is shadow, if yes, please measure again after removing the shadow. 3. If no, please check string was cleaned. 4. If the PV string has not been cleaned, clean the PV string and then measure again after the PV module surface is dry. 5. If string was cleaned, please check if there are panels with low Isc or from other power class by IV testing of each panel.
10006	PV module output current abnormal (shade/glass breakage/hidden crack)	1. Observe the PV string for shade. If there is shade, eliminate the shade and measure again. 2. If there is no shadow on panel, check if there are foreign matters or dirt on the surface of the panel, if yes, then measure again after removing the foreign matters. 3. If there is no shadow on the surface of panel, please check if there is broken glass, if yes, please measure again after replacing with same model of PV module. 4. If no PV module has a broken glass panel, check whether the PV string has been cleaned. If not, clean the PV string and then measure again after the PV module surface is dry. 5. If the PV string has been cleaned, scan the PV string using an infrared thermal imager to locate the abnormal PV module. 6. If there is no fault, please identify the module with abnormal current by IV tester.
10008	PV string voltage abnormal (diode short circuit/PV module invalid/PV module quantity incorrect)	1. Check whether the number of PV modules connected to the PV string is correc. 2. Observe whether there are traces of burning at the interconnection strip, backsheet, and wiring box. If so, replace the PV module with the same model. 3. If none of the above exists, please use IR camera to check if there is short circuited diode or broken ribbon for interconnection. 4. If there is no abnormal found on the module with IR camera, please use voltage meter to check the the voltage of the strings (from same MPPT), to see if it is too low. And if yes, please measure the temperature of panels in string to check whether there is abnormal temperature distribution.
10009	Low PV string short-circuit current (abnormal orientation/dust/PV module degradation)	1. Check whether the string direction differs greatly from the direction of other strings. 2. Please check if the panel was cleaned. 3. If the PV string has not been cleaned, clean the PV string and then measure again after the PV module surface is dry. 4. If yes, please check if there is shadow in the string area, which induces low Isc. 5. If there is no shadow area, please check if the orientation of string is correct. 6. If the orientation is correct, please check if there is **brown** material in the string.

Fault ID	Fault Type	Troubleshooting Suggestion
10010	Low PV string power (abnormal orientation/dust/PV module degradation)	1. Check whether the string direction differs greatly from the direction of other strings. 2. Please check if the panel was cleaned. 3. If the PV string has not been cleaned, clean the PV string and then measure again after the PV module surface is dry. 4. Check the PV string orientation. 5. If the orientation is correct, please check if there is **brown** modules in the string. 6. If there is no 'brown' modules in the string, please check if there is high temperature of module that induces the low output.
10011	No string connected (normal status)	-
10012	Missing configurations of PV strings	Check whether the parameter settings are correct.
10016	Excessively low PV string parallel resistance (PID degradation/dust/uneven PV module irradiance)	1. Please check if the scan was done in a sunny day, the rapid change of irradiance may induce IV curve become abnormal. 2. Please check if there is shadow in string, if yes please remove it. 3. If there is no shadow, please check if the string was cleaned. 4. If the PV string has not been cleaned, clean the PV string and then measure again after the PV module surface is dry. 5. If the PV string has been cleaned, test the I-V curve or EL on each PV module onsite to locate the PV module with PID.
10018	Slight current mismatch in the PV string (dust/slight shade)	1. Please check if the scan was done in a sunny day, the rapid change of irradiance may induce moderate current mismatch in the string. 2. Please check if there is shadow or dirt on the module, if yes, please remove or clean. 3. If there is no shadow, please check if string was cleaned. 4. If the PV string has not been cleaned, clean the PV string and then measure again after the PV module surface is dry. 5. If the array was cleaned, please use IR camera to check the temperature of modules. 6. If there is no abnormal found through IR camera, please identify the module with abnormal output current with IV tester.
10019	Abnormal curve near MPP in the PV string (hotspot/hidden crack/glass breakage)	1. Please check if the scan was done in a sunny day, the rapid change of irradiance may induce IV curve become abnormal. 2. Please check if the string was cleaned. 3. If the PV string has not been cleaned, clean the PV string and then measure again after the PV module surface is dry. 4. Scan the PV string using an infrared thermal imager to locate the abnormal PV module. 5. If no abnormal temperature was found, please use IV test to identify the module with abnormal output current.

Fault ID	Fault Type	Troubleshooting Suggestion
10020	Excessively high PV string series resistance (high cable resistance/abnormal internal resistance of the PV module)	1. Please check if the scan was done in a sunny day, the rapid change of irradiance may induce IV curve become abnormal. 2. Scan the PV string using an infrared thermal imager to locate the abnormal PV module. 3. If no abnormal modules is found with IR camera, please inspect the modules with IV test to identify the one with abnormal Rs.
10000	PV string normal	-
11111	Excessively low irradiance	Scan again after the irradiance meets the requirements.
99999	Scanning data invalid (Environmental factors)	Scan again after the irradiance meets the requirements.

5 License Fault Management Table

No.	Fault Symptom	Cause Analysis	Troubleshooting Methods
1	**Device License Management** is not displayed on the NetEco WebUI.	The NetEco software version does not support the license management function.	Upgrade the NetEco.
2	Failed to export the license application file from the NetEco.	1. Communication between the NetEco client and server is abnormal. 2. The NetEco server is abnormal.	1. Repair the communication between the NetEco client and server. 2. Repair the NetEco server.
3	The device list in the license application file exported from the NetEco is incorrect.	The target device is incorrectly selected for exporting the license application file.	Select the correct target device and export the license application file again.
4	Failed to upload the license file to the NetEco.	1. Communication between the NetEco client and server is abnormal. 2. The NetEco server is abnormal.	1. Repair the communication between the NetEco client and server. 2. Repair the NetEco server.

No.	Fault Symptom	Cause Analysis	Troubleshooting Methods
5	Failed to load the license file on the NetEco.	1. The communication between the SmartLogger and the inverter is disconnected. 2. The communication between the SmartLogger and the NetEco is disconnected. 3. The license file does not match the inverter SN. 4. The inverter software version does not support the license management function. 5. The NetEco software version does not support the license management function.	1. Fix the communication between the SmartLogger and the inverter. 2. Fix the communication between the SmartLogger and the NetEco. 3. Contact the supplier or Huawei customer service center and purchase the Smart I-V Curve Diagnosis function or apply for a license. 4. Upgrade the inverter. 5. Upgrade the SmartLogger.
6	Failed to revoke the license on the NetEco.	1. The communication between the SmartLogger and the inverter is disconnected. 2. The communication between the SmartLogger and the NetEco is disconnected.	1. Fix the communication between the SmartLogger and the inverter. 2. Fix the communication between the SmartLogger and the NetEco.
7	Failed to export the license revocation code file from the NetEco.	1. Communication between the NetEco client and server is abnormal. 2. The NetEco server is abnormal.	1. Repair the communication between the NetEco client and server. 2. Repair the NetEco server.
8	The device list in the license revocation code file exported from the NetEco is incorrect.	The target device is incorrectly selected for exporting the license revocation code file.	Select the correct target device and export the license revocation code file again.
9	Failed to export the license information code file from the NetEco.	1. Communication between the NetEco client and server is abnormal. 2. The NetEco server is abnormal.	1. Repair the communication between the NetEco client and server. 2. Repair the NetEco server.
10	The device list in the license information file exported from the NetEco is incorrect.	The target device is incorrectly selected for exporting the license information file.	Select the correct target device and export the license information file again.
11	There is no **License Management** function on the WebUI of the SmartLogger.	The SmartLogger software version does not support the license management function.	Upgrade the SmartLogger.

No.	Fault Symptom	Cause Analysis	Troubleshooting Methods
12	Failed to export the license application file from the SmartLogger.	The SmartLogger is abnormal.	Fix the SmartLogger.
13	The device list in the license application file exported from the SmartLogger is incorrect.	The target device is incorrectly selected for exporting the license application file.	Select the correct target device and export the license application file again.
14	Failed to upload the license file on the SmartLogger.	• The SmartLogger is abnormal. • The license file (package) name or format is abnormal.	• Fix the SmartLogger. • Contact the supplier or Huawei customer service center to obtain the license file (package).
15	Failed to load the license file on the SmartLogger.	1. The communication between the SmartLogger and the inverter is disconnected. 2. The license file does not match the inverter SN. 3. The inverter software version does not support the license management function. 4. The NetEco software version does not support the license management function.	1. Fix the communication between the SmartLogger and the inverter. 2. Contact the supplier or Huawei customer service center and purchase the Smart I-V Curve Diagnosis function or apply for a license. 3. Upgrade the inverter. 4. Upgrade the SmartLogger.
16	Failed to revoke the license on the SmartLogger.	The communication between the SmartLogger and the inverter breaks down.	Fix the communication between the SmartLogger and the inverter.
17	Failed to export the license revocation code file from the SmartLogger.	The SmartLogger is abnormal.	Fix the SmartLogger.
18	The device list in the license revocation code file exported from the SmartLogger is incorrect.	The target device is incorrectly selected for exporting the license revocation code file.	Select the correct target device and export the license revocation code file again.
19	Failed to export the license information file from the SmartLogger.	The SmartLogger is abnormal.	Fix the SmartLogger.
20	The device list in the license information file exported from the SmartLogger is incorrect.	The target device is incorrectly selected for exporting the license information file.	Select the correct target device and export the license information file again.

No.	Fault Symptom	Cause Analysis	Troubleshooting Methods
21	Failed to load the license file on the app.	1. The inverter SN does not match the license file. 2. Communication between the app and inverter is disconnected.	1. Load the license file that matches the inverter SN. 2. Repair the communication between the app and inverter.
22	Failed to revoke the license file on the app.	1. The paired inverter is incorrect. 2. Communication between the app and inverter is disconnected.	1. Select the correct inverter for pairing. 2. Repair the communication between the app and inverter.