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MD880 (LC) -40 Series Active Rectifier

Commissioning Guide

Industrial Automation | New Energy Vehicle | Intelligent Elevator | Intelligent Robot | Digital Energy | Rail Transit

Data code 19012453A03

Legal Information

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Due to continuous updates and improvements of products and technologies, the content of this documentation may not fully match the actual products. In the event of any discrepancies, the actual products shall prevail.

The contents are subject to change without notice due to product upgrade.

Waste Disposal

The storage, use, and disposal of this product (including optional accessories) must comply with local laws and regulations.

Qualified Personnel

The product/system described in this documentation may be operated only by personnel qualified for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel can identify the risks of the product/system and prevent possible dangers.

Proper Use of the Product

Proper transportation, storage, assembly, installation, commissioning, operation, and maintenance are required to ensure the safe operation of the product without any problems. The required ambient conditions must be met. All operations must follow the guidelines provided in this documentation.

Preface

Introduction

This product targets at high-end transmission applications and features high-performance speed and torque control, high reliability, flexible system integration, easy commissioning and maintenance, and high power density. The MD880 series products are divided into two topological structures, namely single-drive system and multi-drive system, which can be air-cooled and water-cooled. The product is applicable to a wide range of industries, including metallurgy, oil, paper making, cranes, vessels, shield machines, and test benches.

This user guide describes the commissioning tools, commissioning process, detailed commissioning procedure, and product-related parameters. For a complete list of parameters and fault codes, see MD880 (LC) -40 Series Active Rectifier Parameter Guide.

Note

- The drawings in the user guide are shown for illustration only and may be different from the product. Actual products may vary.
- The user guide is subject to change due to product upgrade, specification modification as well as efforts to the accuracy and convenience of the guide.

More documents

Document	Code	Description
MD880 (LC)-40 Series Active Rectifier Function Guide	19012452	Presents function application and troubleshooting methods of the product.
MD880 (LC)-40 Series Active Rectifier Commissioning Guide	19012453	Presents the commissioning tool, commissioning flowchart, specific commissioning procedure, and parameters of the product.
MD880 (LC)-40 Series Active Rectifier Parameter Guide	19012640	This guide describes parameters and fault codes of the drive.
MD880 Series Variable Frequency Drive Communication Guide	19012451	Presents the specifications, networking, and communication configuration of the product.
MD880LC Series AC Drive (Multi-drive System) Hardware Guide	19012447	Presents the system composition, technical specifications, components, dimensions, options (including installation accessories, cables, and peripheral electrical components), expansion cards, certifications, and standards.

Document	Code	Description
MD880LC Series AC Drive (Multi-drive System) Installation Guide	19012448	Presents preparations before installation, unpacking and transportation, mechanical installation, electrical installation, daily maintenance, and component replacement.
MD880-40 Series Active Rectifier Hardware Guide	19011311	Presents technical specifications, components, dimensions, mechanical installation, electrical installation, routine maintenance, and component replacement.

Revision history

Date	Version	Revision
August 2026	A03	Updated the safety precautions. Updated *"5.2 Fault Reset" on page 79*
May 2026	A02	Added the HPFN-20 communication expansion module.
February 2025	A01	Made minor corrections.
January 2024	A00	First release.

Access to the guide

This guide is not delivered with the product. You can download the PDF version in the following ways:

- Visit https://www.inovance.com/global, and choose Support > Documentation Download.
- Scan the QR code on the product with your smartphone.
- Scan the QR code below to install the My Inovance app, where you can search for and download the guide.

Warranty disclaimer

Inovance provides warranty service within the warranty period (as specified in your order) for any fault or damage that is not caused by improper operation of the user. Maintenance will be charged after the warranty expires.

Even within the warranty period, maintenance can be charged for the following product damage:

- Damage caused by operations not following the instructions in the guide
- Damage caused by fire, flood, or abnormal voltage

- Damage caused by using the product for unintended functions
- Damage caused by using the product outside the specified scope
- Damage or secondary damage caused by force majeure (natural disaster, earthquake, and lightning strike)

When applicable, relevant maintenance fee will be charged according to the latest Price List of Inovance. If otherwise agreed upon, the agreed terms and conditions shall prevail.

For details, see the Warranty Card.

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1 Fundamental Safety Instructions

1.1 General Safety Instructions

Safety disclaimer

- This chapter provides essential safety instructions for proper use of the product. Before using this product, read through the guide and comprehend all the safety instructions. Failure to comply with the safety instructions may result in death, severe injury, or equipment damage.
- "DANGER", "WARNING", and "CAUTION" signs in this guide are only supplements to the safety instructions, and do not reflect all safety instructions to be followed.
- Use this product according to the designated environment requirements. Damage caused by improper use is not covered by warranty.
- Inovance shall take no responsibility for any personal injury or property damage caused by improper use.

Safety levels and definitions



Indicates that failure to comply with the notice can result in death or severe personal injury.



Indicates that failure to comply with the notice may result in severe personal injury or death.



Indicates that failure to comply with the notice may result in minor or moderate injury or equipment damage.

Safety precautions

- Drawings in the user guide are sometimes shown without covers or protective guards. Install the covers or protective guards as specified, and then perform operations in accordance with the instructions.
- The drawings in the guide are shown for illustration only and may be different from the product you purchased.
- Operators must take mechanical protection measures to protect their safety. For example, they must wear safety shoes, safety clothing, safety glasses, protective gloves and sleeves, or other protective equipment.

Unpacking
 • Do not install the product in the case of any damage, rust, or signs of use on the product or accessories upon unpacking. • Do not install the product in the case of water seepage into the product or missing or damaged components upon unpacking. • Do not install the product in the case of any discrepancy between the product you received and the product name on the packing list.
 • Check whether the packing is intact and whether there is damage, water seepage, dampness, and deformation before unpacking. • Unpack the package layer by layer. Do not strike the package violently. • Check for damage, rust, or dents on the surfaces of the product and accessories upon unpacking. • After unpacking, check the contents against the packing list to ensure that the equipment and accessories are in the correct quantities, and that all documentation is complete.

Storage and transportation



- Large or heavy equipment must be handled by qualified professionals using specialized hoisting equipment. Failure to comply could result in personal injury or equipment damage.
- Before hoisting the equipment, ensure that components such as the front cover and terminal blocks are secured firmly with screws. Loosely connected components may fall off and result in personal injury or equipment damage.
- Do not stand or stay below the product which is being hoisted.
- When hoisting the equipment with a steel rope, ensure the equipment is hoisted at a constant speed without suffering from vibration or shock. Do not turn the equipment over or let the equipment stay hanging in the air. Failure to comply could result in personal injury or equipment damage.



- Handle the equipment with care and mind your step during transportation to prevent personal injury or equipment damage.
- When carrying the equipment with bare hands, hold the equipment casing firmly with care to prevent parts from falling. Failure to comply could result in personal injury.
- Store and transport the equipment based on the storage and transportation requirements. Failure to comply could result in equipment damage.
- Do not store or transport the equipment in locations where the equipment may be exposed to splashing water or rain, direct sunlight, strong electric field, strong magnetic field, or strong vibration.
- Store the equipment for up to three months. Take stricter protective measures and carry out the necessary inspections for a longer storage time.
- Pack the equipment securely and properly before transportation. Use a fully enclosed container for long-distance transportation.
- Do not transport the equipment with other devices or items that may impact or cause harm to the equipment.

Installation



- Ensure peripheral power distribution requirements are met, and select circuit breakers, fuses, cables, and cable terminals correctly.
- Use standard torque for screw fastening, and use appropriate terminal crimping tools for crimping terminals.
- Ensure heat dissipation requirements are met and design inlet and outlet airflow duct properly.
- Avoid environments with dripping water, conductive foreign objects (such as carbon fiber filaments, conductive metal dust, metal chips), and salt spray.

Failure to follow the above instructions will pose a fire risk.

- This equipment must be operated only by trained and qualified electrical personnel. Operations can be performed by professionals only.



- Read through the guide and safety instructions before installation.
- Do not install this equipment in places with strong electric or magnetic field.
- Before installation, check that the mechanical strength of the installation site can bear the weight of the equipment. Failure to comply may result in mechanical hazards.
- Do not wear loose clothes or accessories during installation. Failure to comply may result in an electric shock.
- When installing the equipment in an enclosed environment (such as a cabinet or case), use cooling devices (such as fans or air conditioners) to cool the space and meet the installation environment requirements. Failure to do so can result in equipment overtemperature or fire accidents.
- Do not retrofit the equipment.
- Do not fiddle with the bolts used to fix equipment components or the bolts marked in red.
- When the equipment is installed in a cabinet or terminal device, appropriate guard devices (guards for fire, electrical, and mechanical protection) meeting applicable IEC standards and local laws and regulations must be provided.
- Before installing devices with strong electromagnetic interference, such as a transformer, install a shielding device for the equipment to prevent malfunction.
- Install the equipment onto an incombustible object such as a metal. Keep the equipment away from combustible objects. Failure to comply may result in a fire.

The edges of the equipment metal enclosure are sharp. Note the following precautions during installation to avoid personal injury or cable damage:

- When performing installation, handling, or maintenance operations, always wear cut-resistant gloves.
- Avoid direct skin contact with enclosure edges and cut surfaces during operation.

Installation

• Cover the top of the product with a piece of cloth or paper during installation. This is to prevent unwanted objects such as metal chippings, oil, and water from falling into the product and causing faults. After installation, remove the cloth or paper on top of the product to prevent over-temperature caused by poor ventilation due to blocked ventilation holes. • Resonance may occur when the equipment operating at a constant speed executes variable speed operations. In this case, install the vibration-proof rubber under the motor frame or use the vibration suppression function to reduce resonance.

Wiring



- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Before wiring, switch off all power supplies of the device. Wait for at least the time designated on the warning label before further operations because residual voltage still exists after power-off. After waiting for the designated time, measure the DC voltage in the main circuit to ensure the DC voltage is within the safe voltage range. Failure to comply can result in electric shock.
- Do not perform wiring, remove the equipment cover, or touch the circuit board and other exposed live parts with power on. Failure to comply can result in electric shock.
- Make sure that the equipment and product are grounded properly. Failure to comply can result in the risk of electric shock.



- Do not connect the power cable to output terminals of the equipment or product. Failure to comply may cause equipment damage or even a fire.
- When connecting a drive with the motor, make sure that the phase sequences of the drive and motor terminals are consistent to prevent reverse motor rotation.
- Cables used must comply with corresponding cross-sectional area and shielding requirements. The shield of the shielded cable must be grounded at one end properly.
- Tighten the terminal screws with the torque specified in the user guide. Insufficient or excessive torque may cause overheating and damage to the joint, which could result in fire.
- After wiring is done, ensure that all cables are connected properly and no screws, washers or exposed cables are left inside the equipment. Failure to comply could result in electric shock or equipment damage.
- Avoid direct skin contact with enclosure edges and cut surfaces during operation.
- Route cables carefully during wiring. Avoid pressing them against sharp edges, which may cause squeezing or cutting. It is recommended to use protective sleeves or route cables away from such edges.
- If the enclosure has a protective film, remove it only after installation is completed and all work involving sharp edges has been finished.



- During wiring, follow the proper electrostatic discharge (ESD) procedures, and wear an antistatic wrist strap. Failure to comply may result in damage to the equipment or internal circuits.
- Use the shielded twisted pair cable to wire the control circuit, and connect the shield to the grounding terminal of the equipment. Failure to comply may result in equipment malfunction.

Power-on



- Before power-on, check that the equipment is installed properly with reliable wiring and the motor can be restarted.
- Before power-on, make sure that the power supply meets equipment requirements to prevent equipment damage or even a fire.
- After power-on, do not open the cabinet door or protective cover of the equipment. Do not touch any terminals, or remove any part of the equipment at power-on. Failure to comply will result in an electric shock.



- Perform a trial run after wiring and parameter setting to ensure that the equipment operates safely. Failure to comply may result in personal injuries or equipment damage.
- Before power-on, check that the rated voltage of the equipment is consistent with that of the power supply. Failure to comply may result in a fire. Using an incorrect supply voltage may cause a fire.
- Before power-on, check that no one is near the equipment, motor, or other mechanical parts. Failure to comply may result in personal injury or even death.

Operation



- The equipment must be operated only by professionals. Failure to comply can result in injury or death.
- Do not touch any connecting terminals or disassemble any unit or component of the equipment during operation. Failure to comply can result in electric shock.

The equipment is equipped with the automatic restart function. After power supply recovery or fault clearance, do not enable this function when the equipment is running, being inspected, or when personnel are in contact with the drive mechanism. Before enabling the automatic restart function, check the following:

- No personnel are working on the load side, and no foreign objects cause blockages.
- All safety protection devices (such as safety doors, emergency stop circuits) are properly engaged.
- Prominent "Automatic restart" safety warning signs have been posted on the equipment and the site.



- Do not touch the enclosure, fan, or resistor with bare hands. Failure to comply may result in burns.
- Prevent metal or other objects from falling into the equipment during operation. Failure to comply may result in a fire or equipment damage.

Maintenance



- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not perform maintenance on the equipment with power-on. Failure to comply may result in an electric shock.
- Before maintenance, disconnect all the power supplies of the equipment and wait for at least the time specified on the warning label.
- When using a permanent magnet (PM) motor, do not touch the motor terminals while the motor is rotating, because induced voltage may be present at the terminals even after the product is powered off. Failure to comply may result in electric shock.



- Perform routine and periodic inspection and maintenance on the equipment according to maintenance requirements and keep a maintenance record.

Repair



- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not repair the equipment with power-on. Failure to comply may result in electric shock.
- Before inspection or repair, disconnect all the power supplies of the equipment and wait for at least the time specified on the warning label.



- Submit a request for repair based on the warranty agreement.
- When the fuse is blown or the circuit breaker or earth leakage current breaker (ELCB) trips, wait for at least the time specified on the warning label before power-on or other operations. Failure to comply may result in personal injury or death and equipment damage.
- Troubleshooting and repair of a faulty or damaged equipment must be performed by professionals based on the repair instructions, with the repair records kept properly.
- Replace quick-wear parts of the equipment according to the replacement instructions.
- Do not use damaged equipment. Failure to comply can result in death, personal injury, or severe equipment damage.
- Recheck the wiring and reset the parameters after equipment replacement.

Disposal
WARNING • Dispose of the retired equipment in accordance with applicable national regulations and standards. Failure to comply can result in property damage, personal injury, or death. • Recycle retired equipment in accordance with industry waste disposal standards to avoid environmental pollution.

Safety Label

To ensure safe operation, comply with equipment-related safety labels. The following table describes the meanings of the safety labels.

Safety Label	Description
	DC bus voltage indicator • ON: Bus energized • OFF: Bus de-energized
	DC bus voltage indicator • ON: Hazardous voltage exists, which may result in electric shock.
	• Maintenance can be performed by professionals only. • Disconnect all the power supplies before maintenance and wait for at least 15 minutes before opening the cover. (Different devices have different time, subject to the actual label on the device.) • Read the maintenance instructions before maintenance.

1.2 Industrial Information Security

The product provides interfaces for network connection and data transmission. To protect factories, systems, machines, and networks from cyberattacks, it is essential to implement proper protection mechanism for industrial security.

Customers are responsible for providing and maintaining a secure connection between the product and their network or any other network to protect their factories, systems, machines, and networks from unauthorized access. Such systems or machines can be connected to an enterprise network or the Internet only when a secure connection is established and appropriate security measures (such as using antivirus software or installing firewalls) are in place.

Inovance continuously develops and improves its products and solutions to enhance safety. It is strongly recommended that you update the product promptly and always use the latest version.

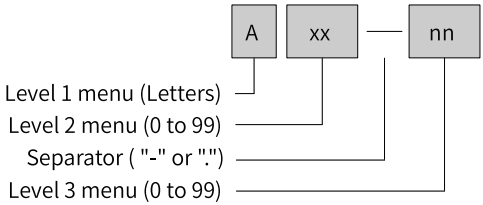


Malware (such as viruses, Trojans, and worms) can bring the device into an unsafe operating state, resulting in death, serious injury, and property damage. Observe the following precautions:

- It is recommended to use the latest software version based on actual operation conditions. If the product version is no longer supported or the latest version is not used, customers will be exposed to increased risk of cyber attacks.
- Develop and maintain appropriate protective measures (including but not limited to antivirus software, firewalls, WAF, IPS/IDS, situational awareness system, identity authentication, data encryption) to prevent the files in mobile storage devices from being damaged by malware, and to protect the products, networks, systems, and interfaces from unauthorized access, tampering, hacking, data leakage, or information theft.
- Check all safety-related interfaces and settings after commissioning.

2 Parameter Setpoints and Output Values

The parameters of HCU-40 are represented by a three-level menu, as shown in the following figure.



- A is the level 1 menu, which is indicated by one letter and corresponds to a group of functions. The level 1 menu uses English letters including A/b/C/d/E/F/H/L/n/o/P/U, which are case-sensitive for easy display on the LED panel. Groups A to P contain common parameters. Group U contains connector parameters, which are divided into bit (B) connector and word (K) connector parameters.
- XX is the level 2 menu, which uses one or two digits. The first and second level menus are combined to represent a specific set of functions.
- nn is the level 3 menu, which uses two digits. The first, second, and third level menus are combined to represent a specific parameter or a connector parameter.

Note

- The separator for the parameter menu can be a hyphen (-) or dot (.), which have the same meaning. That is, A0-00 and A0.00 have the same meaning. Hyphen (-) is usually used in user guides, whereas dot (.) is usually used in the LED panel.
- Level 1 menus can contain the following letters: A, b, C, d, E, F, H, L, n, o, P, and U. The letters are case sensitive for the purpose of display on the LED panel.

- The set value of a parameter is the value of the parameter set by the user for the parameter.
- The output value of a parameter is the value obtained by the drive reading the parameter.

For most parameters, the output value is equal to the setpoint. However, in HCU-40 control module parameters, a certain type of reference source parameter setpoints are taken from another parameter B and the output value of parameter A is equal to that of parameter B.

In this guide, the value of the parameter represents the set value, and the value of the [parameter] represents the output value, as shown in the following examples.

- U9-32 = 100%
- C0-00 = 1932

- [C0-00] = 100%

C0-00 represents the channel 1 voltage setting source. It comes from the value of U9-32. When U9-32 is 100%, the actual output value of [C0-00] is 100%.

For reference source parameter C0-00, the setpoint 1932 only indicates the setpoint source and U9-32 connector value. In this case, [C0-00] is used to indicate the actual output value of the parameter, which is 100%.

3 Commissioning Tool

3.1 Commissioning Tool List

The HCU-40 series products support the following commissioning tools.

- SOP-20-880 smart operating panel (later referred to as SOP-20-880)
- InoDriveStudio commissioning software

For HCU-40 series products, you can use SOP-20-880 to modify and view parameters, perform simple commissioning and view operation status.

Note

You may also need to confirm and record the operating waveform, perform visualized commissioning, and view fault information and black box. Therefore, it is recommended to use InoDriveStudio together for commissioning.

3.2 SOP-20-880 Operating Panel

3.2.1 Overview

SOP-20-880 is a new-generation commissioning tool of Inovance that applicable to single-drive/multi-drive systems.

- It features a wide power supply range and LCD display.
- It provides rich functions, such as parameter setting, status monitoring, parameter copy, fault analysis and diagnosis, parameter upload and download, and USB relay/mass storage.

3.2.2 Components

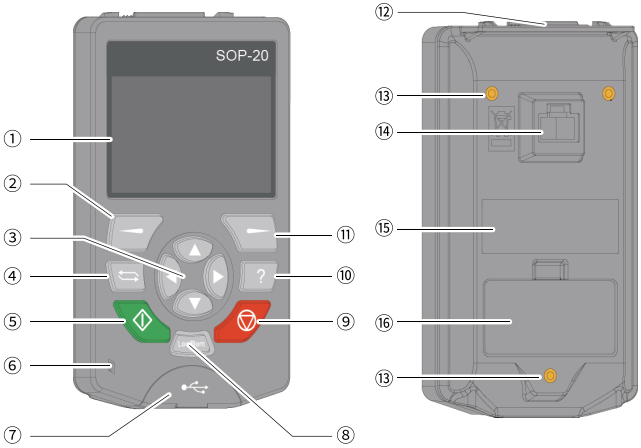


Figure 3-1 Appearance and keys of SOP-20-880

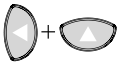
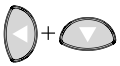
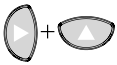
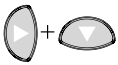
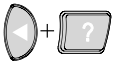
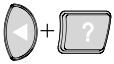
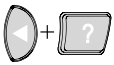
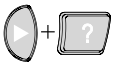
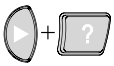
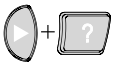
Table 3–1 Components of SOP-20-880

No.	Name
①	Display
②	Left soft key
③	Direction keys
④	Shift key
⑤	Run key
⑥	Status indicator
⑦	USB port
⑧	Loc/Rem key
⑨	Stop/Reset key
⑩	Help key
⑪	Right soft key
⑫	Snap-fit joint
⑬	Fixing screw
⑭	RJ45 port
⑮	Product nameplate
⑯	Battery cover

Table 3–2 Description of keys

Key	Name	Description
	Left soft key	Used to exit or deactivate operations. The soft key in the lower left corner on the display features different functions in different interfaces. For example, this key on the homepage is used to enter the device selection page.
	Right soft key	Used to enter or acknowledge operation. The soft key in the lower right corner on the display features different functions in different interfaces. For example, this key on the homepage is used to enter the menu interface.
	Shift key	Used to quickly enter the device selection page. In interfaces that do not allow operations to be interrupted, the quick device switchover function is inhibited. In this case, the shift key is inactive.
	Help key	Used to open the help page. The help interface varies with the context.
	Run key	Used to start the device in the local control mode.
	Stop/Reset key	Used to stop the device in the local control mode. When the device is in the fault state, use this key to reset the fault.
	Loc/Rem key	Used to switch the control permission of the device. Local: The device start/stop is controlled by SOP-20-880 (local control). Remote: The device start/stop is controlled by the parameters and functions of the device.
	Direction keys	The up and down keys are used to select options in a displayed menu and list, scroll up and down a text page, and adjust the value (such as setting time, entering a password, or changing a parameter value). The left and right keys are used to move the cursor left and right.

Table 3–3 Description of shortcuts

Shortcut	Keys	Available in	Function
Left+Up		Any view	Adjusts the backlight brightness.
Left+Down			
Right+Up		Any view	Adjusts the contrast.
Right+Down			
Left+Help		Parameter list view	Adds the parameter where the cursor is directed at to the shortcut interface.
Left+Help		Shortcut view	Deletes the parameter from the shortcut interface.
Left+Help		Startup view	Deletes the parameter from the startup interface.
Right+Help		Parameter list view	Adds the parameter where the cursor is directed at to the startup interface.
Right+Help		Shortcut view	Deletes all the parameters in the shortcut interface.
Right+Help		Startup view	Clears all parameters in the startup interface.

3.2.3 Operating Panel Display

SOP-20-880 adopts the monocolour LCD with white backlight and a resolution of 240x160 pixels.

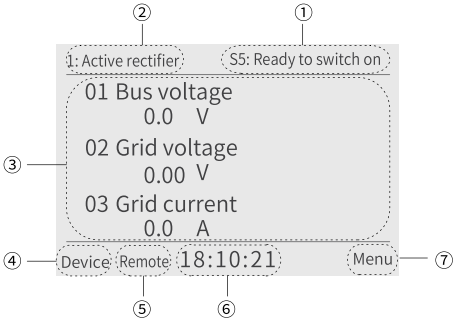


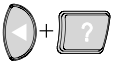
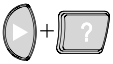
Figure 3-2 Homepage

Table 3–4 Descriptions of the homepage

No.	Display	Remark
①	Device status and fault information	Displays information about the operating status of the device, including the state machine, fault, and alarm. When a fault occurs on the device, the fault information and operating status are displayed alternately.
②	Current device information	1: Current device station number Active rectifier: Current device name
③	Content	Real-time display of monitored information
④	Device list	Used to display the device list of the current network.
⑤	Local/remote	Local: The device is controlled by SOP-20-880 (local control). Remote: The device is controlled by I/O or bus (remote control). Blank: This function is unavailable on the equipment.
⑥	SOP-20-880 time	Displays the clock time in SOP-20-880.
⑦	Menu	Used to access the function menu of current device.

3.2.4 Parameter Setting

Table 3–5 Description of parameter setting

Function	Key	Description
Viewing or modifying parameters	Key operations	Go to "Menu"→"Parameter setting"→select the parameter group to be changed→select the parameter to be changed→view or modify the parameter→click "Back" or "OK".
Adding or deleting quick commissioning parameters		• Adding a parameter to the quick commissioning interface: In the parameter setting interface, enter any parameter group, move the cursor to the specific parameter, and press the Left key and Help key at the same time for more than 1.5 seconds to add the parameter to the quick commissioning interface. • Deleting a parameter from the quick commissioning interface: In the quick commissioning interface, move the cursor to the parameter to be deleted, press  and  at the same time for more than 1.5 seconds to delete the parameter from the quick commissioning interface.
Clearing parameters from the shortcut interface		Clearing parameters from the quick commissioning interface: In the quick commissioning interface, press and at the same time for more than 1.5s to clear all the parameters in the quick commissioning interface.
Viewing quick commissioning parameters	Go to "Menu" → "Quick commissioning".	-

Modifying parameters that used to set values

For example, set C6-05 to 200%, that is, the multi-reference value 1 is 200%.

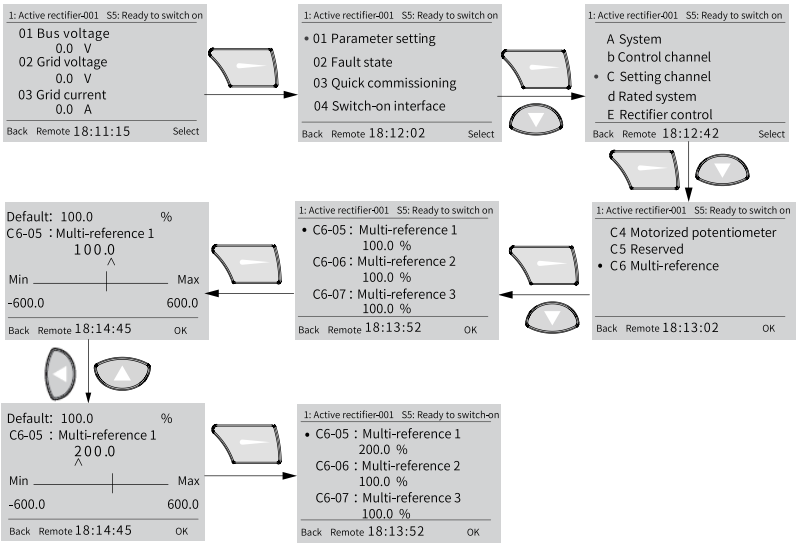


Figure 3-3 Modifying parameters that used to set values

After setting the parameter, press  to save the setting and exit or press  to quit and exit.

Press  and  at the same time for more than 1.5 seconds to restore the parameter to default value and then press  to activate the default value.

3.2.5 Viewing Parameters

Parameter groups are arranged by name. If you select a parameter group, all the parameters in this group will be displayed, and you can view and edit these parameters.

Press  to display the help information.

When the cursor points at a read-only parameter, the right soft key  is disabled, and the "SELECT" button is not displayed in the lower right corner on the screen.

If "0x" is displayed before a parameter, the parameter setpoint is a hexadecimal value.

3.2.6 Status Indicator

The status indicator on SOP-20-880 is used to indicate whether a fault or alarm exists.

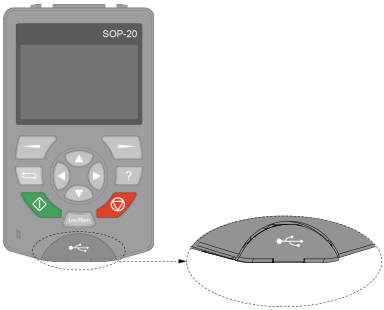
Table 3–6 Status indicator

Indicator	Illustration	Meaning
Steady green		The device is running properly.
Flashing green		Data is being transmitted between the SOP-20-880 and PC with USB.
Steady red		Communication between SOP-20-880 and device is proper, but the device is faulty.
Flashing red		Communication between SOP-20-880 and device has been interrupted.

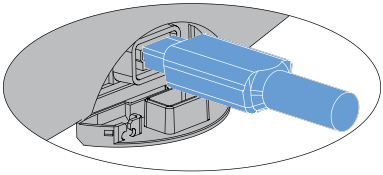
3.2.7 Connecting the Relay to PC

The B-type mini USB terminal on the lower part of SOP-20-880 is used to connect to PC. The connection cable cannot exceed 3 m. The USB2.0 communication protocol is used between the SOP-20-880 and the PC.

1. Open the USB terminal cover.

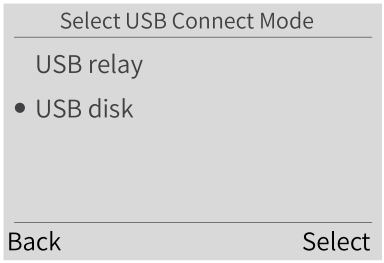


2. Insert the USB cable and connect the cable with ferrite core (recommended) to the PC.



3. After the SOP-20-880 is connected to the PC, you can select the USB relay mode or USB mass storage mode.

- When "USB relay mode" is selected, the SOP-20-880 can be used as a relay to enable communication between the device and the PC. To perform commissioning with InoDriveStudio, select "USB relay mode".
- In the “USB mass storage mode”, the SOP-20-880 can be used as a memory.



Note

For details, see *SOP-20-880 Series Smart Operating Panel User Guide*.

3.3 InoDriveStudio Software

The InoDriveStudio (hereinafter referred to as IDS) is a commissioning software developed by Inovance for high-performance engineering drives. It can be used to commission, troubleshoot, and monitor the operating status of devices.

InoDriveStudio supports only the Windows platform. Supported operating systems include, but are not limited to, the following: Windows 7, Windows 8, Windows 10, and Windows 11.

3.3.1 Installation

1. To obtain InoDriveStudio, do as follows:

   a. Visit the official website of Inovance as shown below.
   Website: *www.inovance.com*

   b. Go to Support > Download > Search, and then enter "InoDriveStudio".

   c. Click Download.

2. Unzip the package downloaded.
3. Install the InoDriveStudio according to the instructions.

3.3.2 Common Functions

3.3.2.1 Main Interface

Double-click the icon 

to open the InoDriveStudio. The following interface appears.

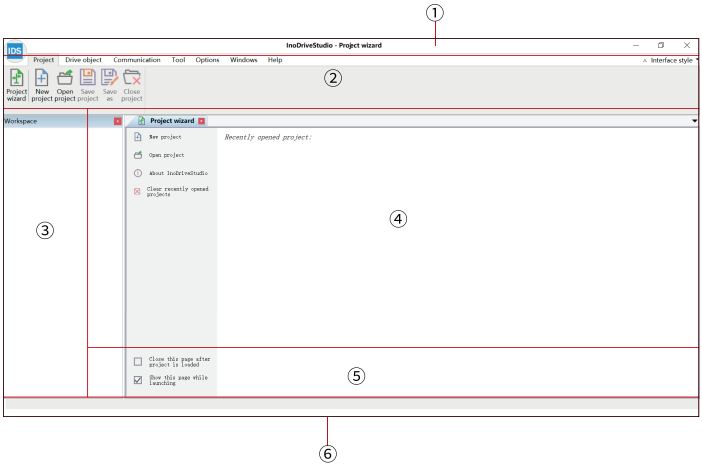


Figure 3-4 Start page

No.	Name	Description
①	Title bar	Displays information such as the window title or file that is opened.
②	Menu bar	Displays function modules by category.
③	Workspace	Displays navigation information such as the current project.
④	Window area	Displays the specific content of an item specified in the workspace.

No.	Name	Description
⑤	Multi-function area	Displays panes including the log pane, monitoring pane, control panel pane, and fault pane.
⑥	Status bar	Displays the current project status.

3.3.2.2 Main Interface

3.3.2.3 Control Panel

You can use the control panel of InoDriveStudio to start and stop the drive, reset faults, and so on. Go to "Active rectifier"→"Diagnostic and debug"→"Debug"→"Control panel" to open the control panel.

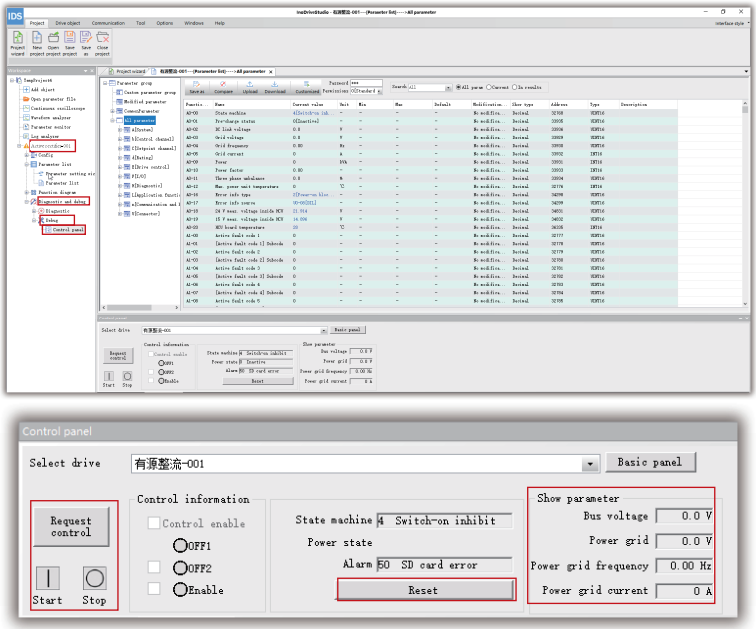


Figure 3-5 Control panel

- You can start or stop the device and monitor the device status on the control panel.
- Before controlling a device through the control panel, click "Request control" to gain control permission of the device.
- After you obtain control permission, you can click "Start" or "Stop" to start or stop the device.
- After the "Input control bit" is checked, you can click "OFF2", "Start CMD" to switch the control word directly, achieving control of the device.

3.3.2.4 Fault View

There are two ways to view faults through InoDriveStudio.

- Viewing active fault
  - Method 1: Go to "Active rectifier"→"Diagnostic and debug"→"Diagnostic"→"Faults and alarms" to open the alarm/fault list, as shown below.

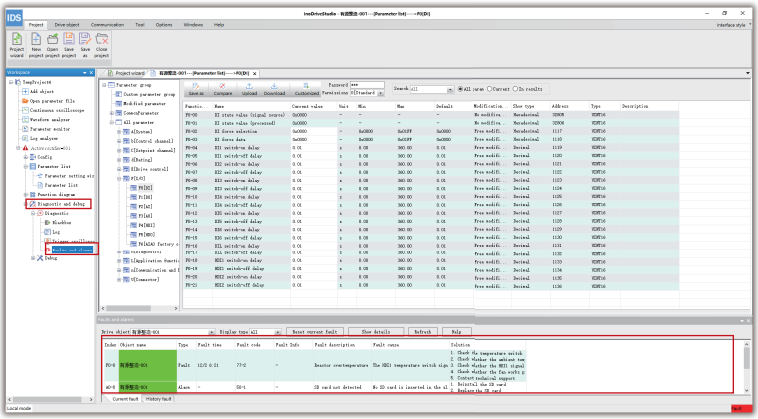


Figure 3-6 List of Faults and Alarms

  - Method 2: Click parameters in groups H2 to H7 to view previous faults and alarms, as shown below.

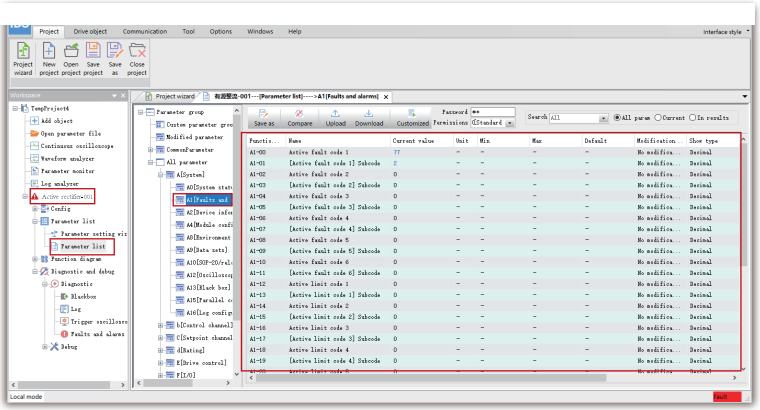


Figure 3-7 Viewing previous faults

3.3.2.5 Viewing and Modifying Parameters

You can view and modify parameters through InoDriveStudio. After the device is connected, go to "Active rectifier"→"Parameters"→"Parameter list" to display the parameter list of current device, as shown below.

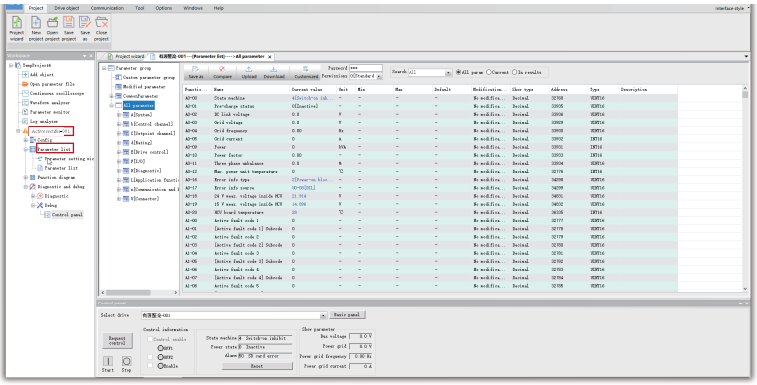


Figure 3-8 Parameter list

- Parameter groups are displayed on the left, and parameters in a selected parameter group are displayed on the right.
- You can view information such as the parameter name, current value, default value, unit, modification method, and communication address of a parameter.
- After the parameters have been modified, they are downloaded to the device.
- When the current value of a parameter does not match the default value, the current value is displayed in blue.
- When the parameter is changed to a value outside the allowable range, the modification does not take effect.
- During operation, if you change a parameter that should be modified at stop, the modification does not take effect.

3.3.2.6 Parameter Comparison

InoDriveStudio supports comparison of parameters. You can access the Compare function in either of the following two ways.

- Go to "Drive object" > "Compare".
- Click "Compare" in the parameter list interface.

The figure below shows two ways to access the Compare function.

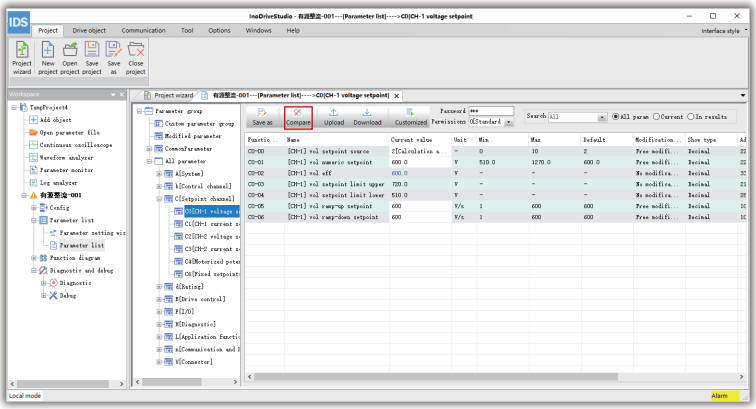


Figure 3-9 Accessing the Compare function

As shown in the figure below, you can compare two offline parameter files. Also, you can compare the current parameters and the default parameters of the active rectifier module. You can select to show different parameters, the same parameters, or all parameters.

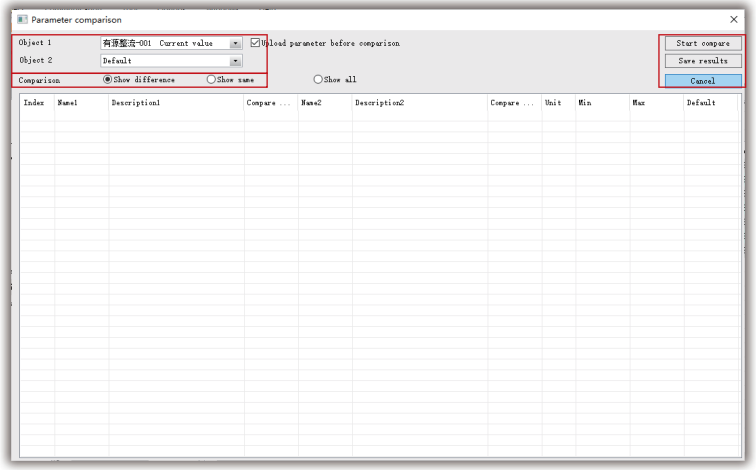


Figure 3-10 Compare page

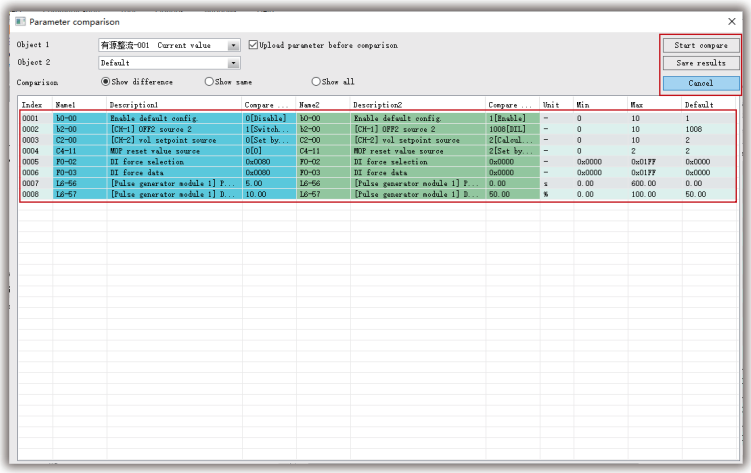


Figure 3-11 Example of comparison between current values and default values

3.3.2.7 Parameter Backup and Download

You can use InoDriveStudio to back up the parameters to your PC through the "Upload" or "Save as" function. Also, you can restore the backup parameters from your PC to the drive through the "Download" function.

- Go to "Parameter list"→"Upload"→enter the file name→select the save type as "Parameter file (*.inoprm)"→click "Save". Then wait for uploading to be done.

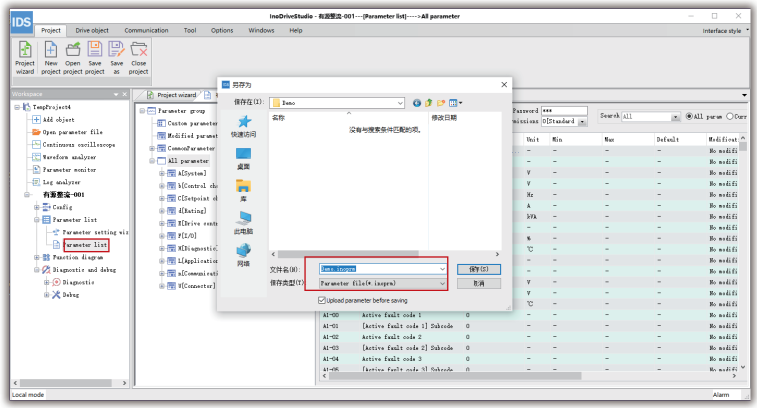


Figure 3-12 Parameter backup through parameter upload

- Go to "Parameter list"→select the parameter group to be backed up→"Save as"→enter the file name to be saved→select the save type as "Parameter file (*.

inoprm)"→check "Upload parameters before saving"→click "Save". Then wait for uploading to be done.

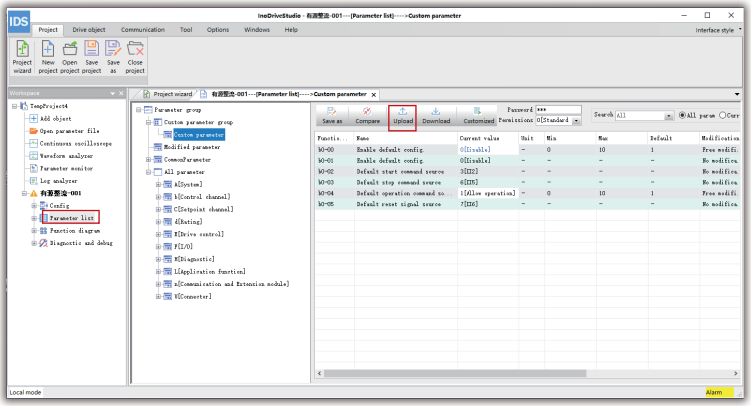


Figure 3-13 Parameter backup through the "Save as" button

Note

- When you click "Upload" to back up parameters, all parameters are backed up.
- When you need to back up custom parameters, see *"3.3.2.8 Custom Parameter Group" on page 35*.
- When you click "Save as" to back up parameters, select "Parameter file (*.inoprm)" as the file type and check "Upload parameters before saving".

- The following shows how to download parameters. Go to "Parameter list"→click "Download"→select the file to be downloaded→select the download mode→click "Open". Then, wait until the download operation is done.

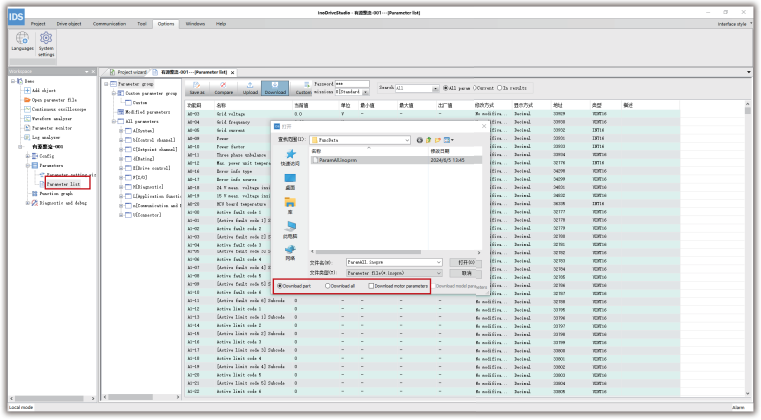


Figure 3-14 Parameter download

Two download modes are available.

- Download part: All parameters are downloaded, except model-related parameters, A10-04 (Communication baud rate), and A10-03 (Communication address). This mode applies to most applications.
- Download all: Download all the parameters except model-related parameters. If A10-04 (Communication baud rate) and A10-03 (Communication address) differ from current parameters, the system informs you to make necessary modification (take caution during modification to prevent communication failure caused by repetitive station number). You can check "Download model parameter" to download all parameters.

Note

Be cautious when downloading model parameters. Model parameters can be downloaded by professionals only.

3.3.2.8 Custom Parameter Group

InoDriveStudio allows you to form multiple parameters into a new group. You can save the custom parameter group as a parameter file or a configuration file.

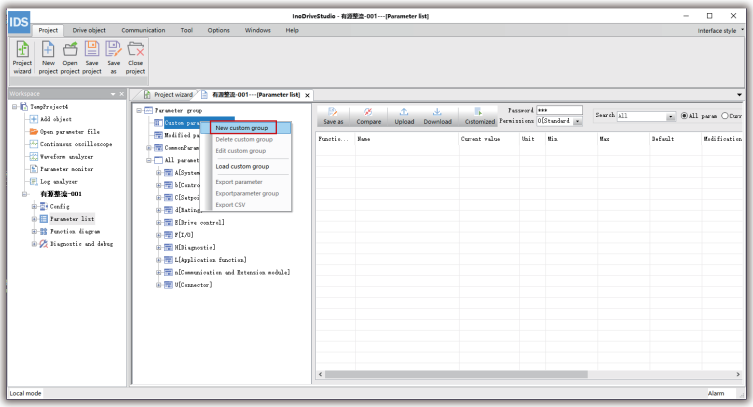


Figure 3-15 Entering the custom parameter group

The following shows the procedure for customizing the parameter group.

1. Click "Parameter list"→"Custom parameter group", then create or load the saved custom group→set custom group→set the custom group name→click "Add" button→add or delete the parameters need to be customized→click "OK" to generate custom parameter group.

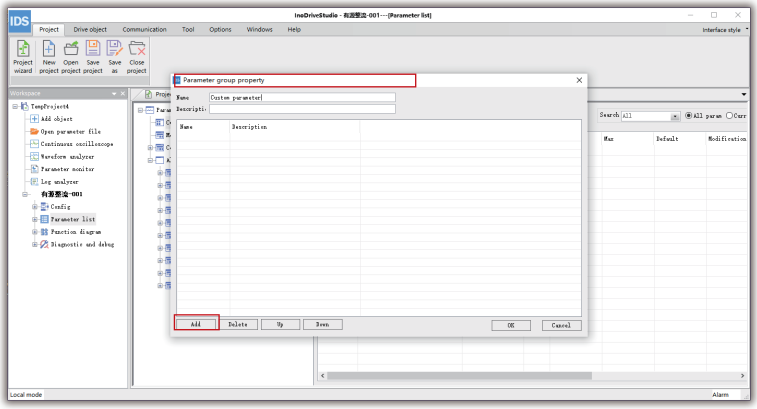


Figure 3-16 Customizing parameter groups

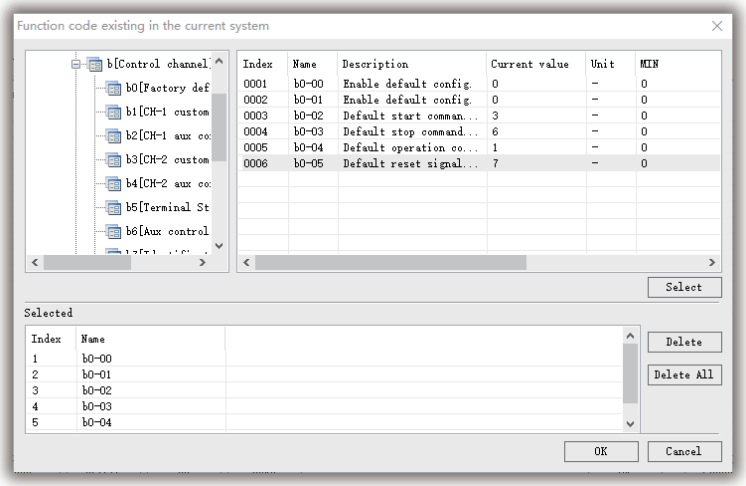


Figure 3-17 Customizing configuration parameters

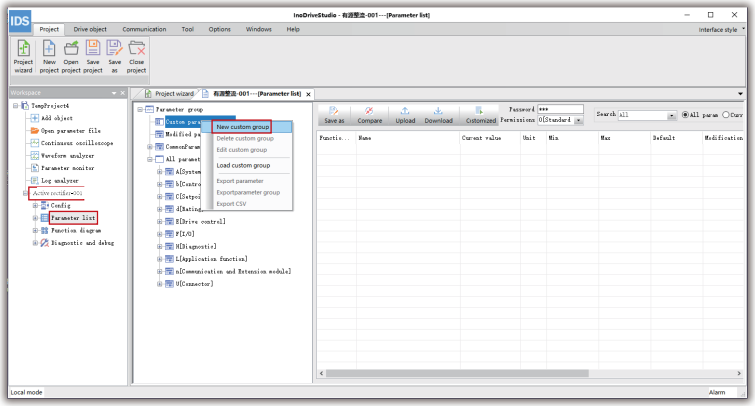


Figure 3-18 New custom parameter group file

2. Right-click on the new custom parameter group and select "Delete", "Edit", "Load" or "Save as" on custom parameter group.

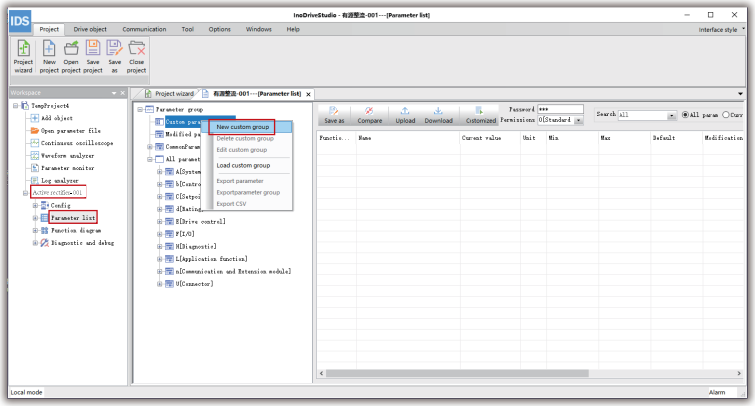
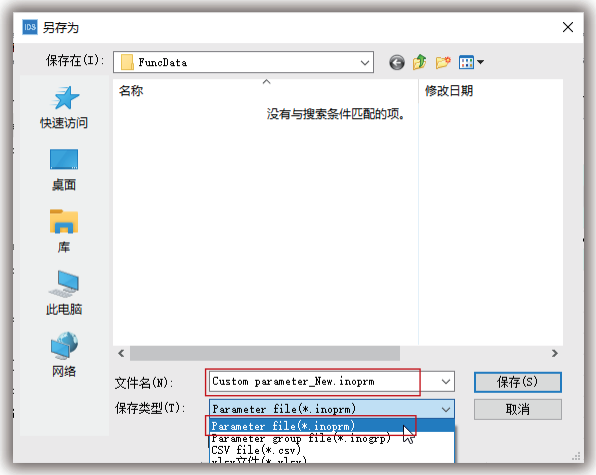


Figure 3-19 Procedure for customizing the parameter group

When saving a custom parameter group or other parameters, you can select the following file types:

- Parameter file (*.inoprm): The "Save as" files support parameter download. The parameter values in the file can be downloaded to other device.
- Parameter group file (*.inogrp): The "Save as" file is the parameter group configuration file that only contains parameter group information, which can be re-loaded to the custom group.
- CSV file (*.csv): The "Save as" file can be opened and viewed directly.



3.3.2.9 Viewing Modified Parameters

The InoDriveStudio allows you to view parameters with default values changed. Go to "Active rectifier-001"→"Parameter list"→"Parameter group"→"Modified parameters". Double-click Modified Parameters. The Uploading parameters, please wait… dialog box pops up. After the upload is complete, all modified parameters will be displayed.

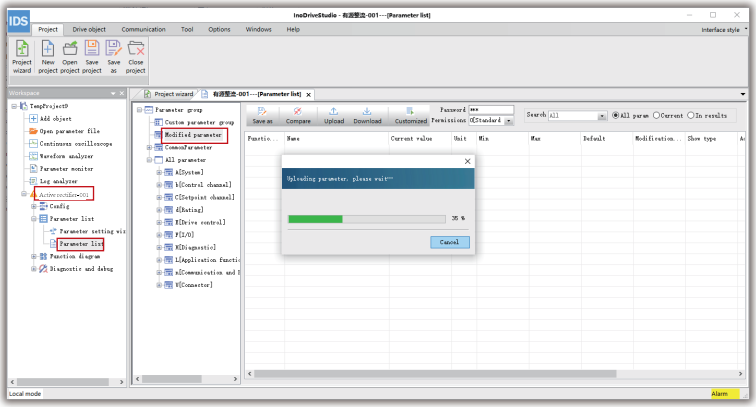


Figure 3-20 Double-clicking modified parameters

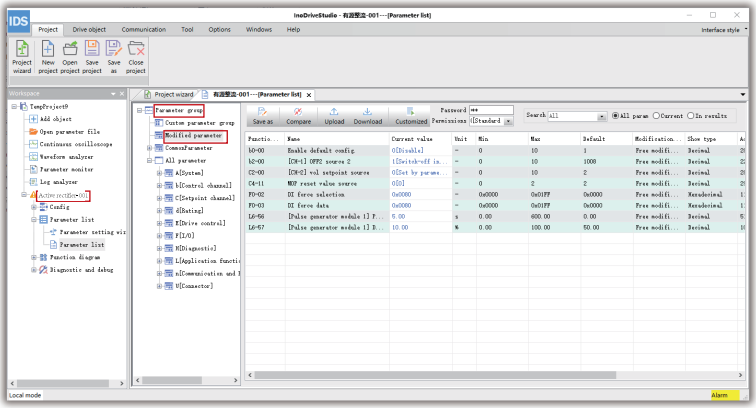


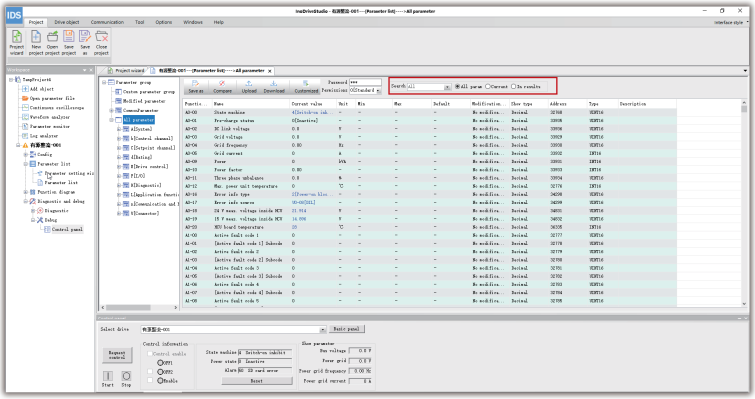
Figure 3-21 Modified parameters

3.3.2.10 Search Function

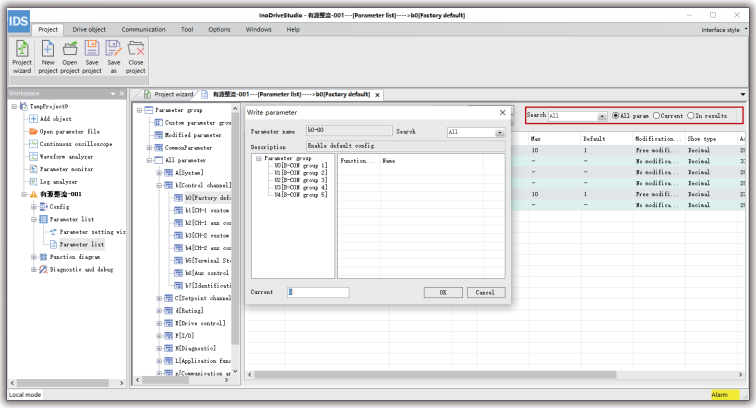
The InoDriveStudio supports search for parameters and connectors. You can search for parameters and connectors by key word.

You can search for parameters by the following methods:

- "All parameters": Used to search for all parameters in the parameter list.
- "Current group": Used to search for parameters in the current parameter group.
- "Search the current results": Used to search for parameters in the current list.



When a parameter is set to a connector, you can search for required connectors quickly, as shown below.



3.3.3 Waveform Record and Analysis

Real-time analysis of data curves is key for commissioning performance. InoDriveStudio provides three ways for online recording of data curves in real time, recording of conditional triggering events, and offline view of waveforms.

3.3.3.1 Continuous Oscilloscope

The operation status of the equipment needs to be monitored in real time during on-site commissioning. The continuous oscilloscopes in InoDriveStudio can be used to monitor

and record relevant data or status of the equipment in real time. Click Continuous Oscilloscope in the Workspace pane to open the oscilloscope. The oscilloscope consists of the channel selection area, waveform display area, waveform configuration area, and toolbar, as shown in the following figure.

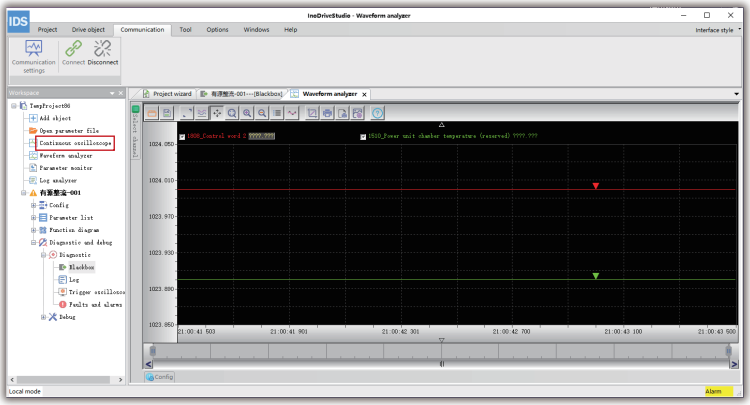


Figure 3-22 Opening the continuous oscilloscope

Only one continuous oscilloscope can be opened for each project. The oscilloscope is used to record and analyze waveform of all equipment in the current project. In the continuous oscilloscope tab, area ① is the channel selection area, area ② is the main interface of the waveform display, area ③ is the waveform configuration area, and area ④ is the toolbar. You can perform operations such as start, stop, pause, and zooming. In area ③, set the group number to the same value to show the connectors with the same physical meanings in the same coordinate system. To delete the selected channel, click the "Stop" button in the toolbar ④ and then select "Channel Parameter", as shown below.

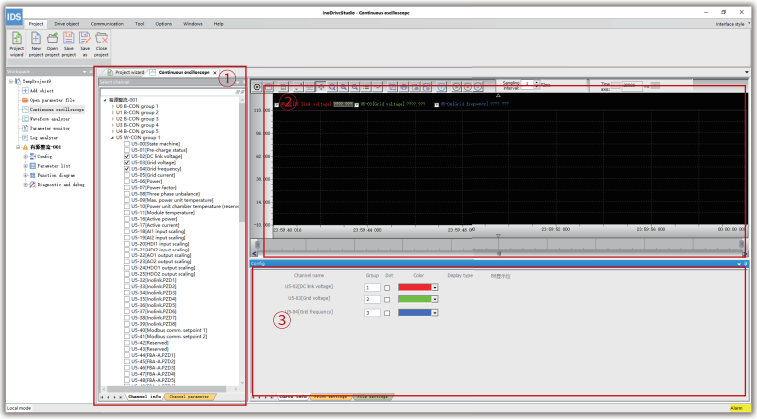


Figure 3-23 Continuous oscilloscope interface

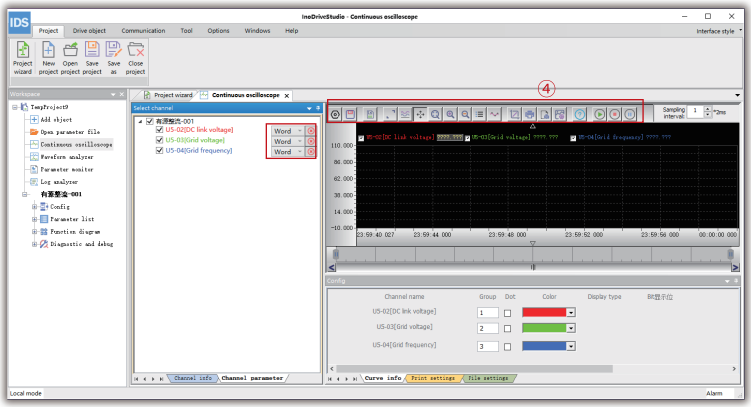


Figure 3-24 Deleting channels from the continuous oscilloscope

In the Select channel pane, customize the data channel to be monitored. All parameters in the U group can be used as the data source to record curves, wherein:

- When U5 to U8 and U15 to U18 are used as the data source to record curves, each data occupies one recording channel.
- When U9, and U19 are used as the data source to record curves by default, each data occupies one recording channel. If you want to obtain more accurate waveform, you can also modify the configuration to double-word recording, with each data occupying two recording channels.
- Parameters U0 to U4 and U10 to U14 are digital values. Up to eight digital values can be recorded in a device. All digital waveforms in a device only occupy one recording channel.

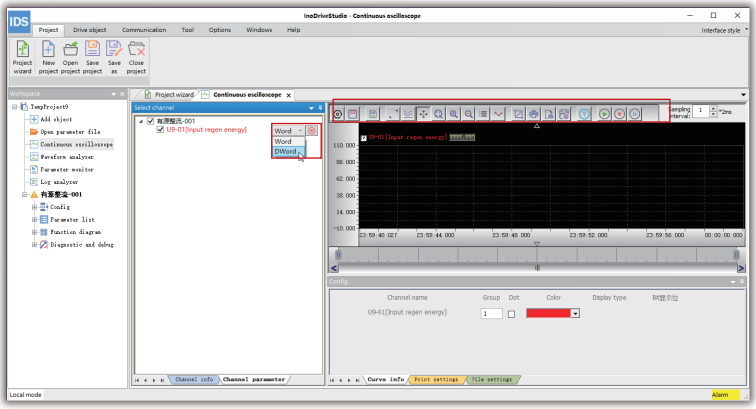


Figure 3-25 Word or double-word display of connectors

The number of channels is related to the communication baud rate and sampling interval, as shown in the following table.

Table 3–7 Baud rate and sampling interval

Baud rate	Sampling interval	Max. number of channels	Sampling interval	Max. number of channels	Sampling interval	Max. number of channels
115200 bps	2 ms	4	4 ms	8	> 4 ms	8
1 Mbps	2 ms	8	4 ms	8	> 4 ms	8
2 Mbps	2 ms	8	4 ms	8	> 4 ms	8
4 Mbps	2 ms	8	4 ms	8	> 4 ms	8

For details on waveform configuration and toolbar usage, see the help documentation of the InoDriveStudio software.

Button descriptions:

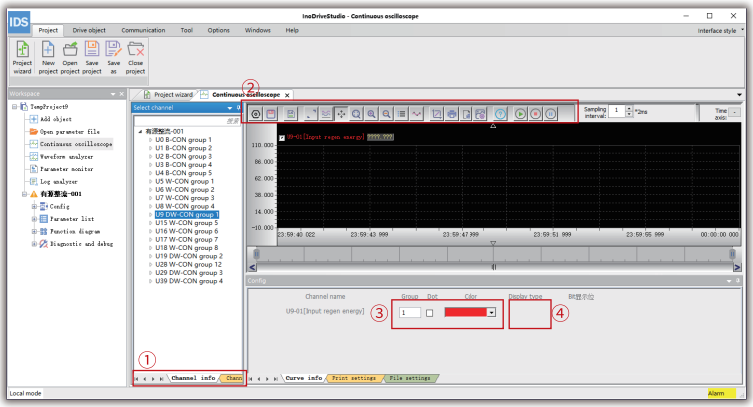


Figure 3-26 Using the continuous oscilloscope

In the lower part of the Select channel pane, click the Channel info tab to select a device and configure the oscilloscope channel for the device. Click the Channel Parameter tab to show the current and configured oscilloscope channels. You can also select the recording accuracy of the 32-bit connector. Dword features higher accuracy, but occupies two oscilloscope channels.

The following table describes buttons in the oscilloscope tool bar.

Button	Function description
	Used to save the waveform. Waveforms are automatically saved in the engineering directory during running of the continuous oscilloscope. However, the previous waveform is automatically deleted when the waveform file exceeds the limit. It is recommended that important waveforms be manually saved to another directory for backup.
	Used to scale the ordinate. It is used to scale the ordinate of all curves based on the displayed value to ensure that all curve points are displayed.
	Used to translate the current curve by the left mouse button.
	Click the button and select an area to enlarge the area to the current screen. When the ordinate range of the current curve changes, the timeline of all curves changes simultaneously. Scaling of a single axis can be achieved on the abscissa.
	Used to zoom in or out. When the ordinate range of the current curve changes, the timeline of all curves changes simultaneously.
	Used to show or hide the cursor. Measurement of curve data can be achieved using two cursors.
	Used to capture the entire interface and save the file as the *.Bmp, *.jpg, or *.png files.
	Used to set the background. You can set the background color, axis color, font size, grid color, and cursor color of the oscilloscope. After setting the background, click the saving button to save the settings.

③ Modify the color of each curve in curve information. After you check the curve point, each sampling point of the curve is displayed in bold. When the group numbers of both curves are set to the same, the two curves share the same set of ordinates, which will be zoomed simultaneously.

④ The display type of certain signals can be changed. For example, the speed can be displayed as the per unit value by percentage, frequency, or speed unit.

Table 3–8 Common shortcut descriptions

Shortcut key	Function
Right button of the mouse	Used to scale the ordinates of all curves.
Mouse wheel	Used to zoom in or out the curve. In the waveform area, the mouse wheel can be used to zoom in or out the coordinates. In the coordinate area, the mouse wheel can be used only to zoom in or out the current coordinate. When the ordinate of the current curve changes, the timeline of all curves changes simultaneously.
Ctrl+mouse wheel	Used to pan the curve. In the waveform area, pressing the Ctrl key+mouse wheel can be used to pan the coordinates. In the coordinate area, pressing the Ctrl key+mouse wheel can be used only to pan the current coordinate. When the ordinate of the current curve changes, the timeline of all curves changes simultaneously.
Up and down arrows (↑ ↓)	Used to pan the current curve up and down.
Alt	Used to perform operations on all curves forcibly. For example, pressing the Alt key+up arrow can move all curves up.
Shift	Used to force the operation to zooming. For example, pressing the Shift key+up arrow can zoom in or out the current curve ordinate.
Ctrl	Used to force the operation to panning. For example, pressing the Ctrl key+mouse wheel can translate the curve.

3.3.3.2 Black Box Function

The HCU-40 series products are equipped with the built-in black box function. The black box function is enabled automatically upon power-on. The black box records when a fault occurs or when user-defined conditions are met.

When a fault occurs, the HCU-40 controller collects the data generated 1.5 seconds before the fault and 0.5 seconds after the fault. The data includes 16 entries of ADC internal interruption data, 48 entries of internal data collected at a cycle of 2 ms, and 16 entries of customized data collected at a cycle of 2 ms. The data collected will be automatically saved to the SD of the HCU. Up to 1000 groups of fault data can be saved.

- Automatic fault trigger condition: When the active rectifier module enters to the fault state, black box record will be triggered once automatically.
- Customized command trigger condition: You can set H0-06 to trigger the black box record once at the rising edge. Parameters related to customized command trigger are shown in *"Table 3-9 Parameters related to customized command trigger" on page 46*.

Table 3-9 Parameters related to customized command trigger

Param.	Name	Setpoint
H0-06	Custom black box trigger command source	0: Inactive Others: B connector

To view the waveform recorded by the black box, do as follows:

1. Go to "Active rectification-001"→"Diagnostic and debug"→"Diagnostic"→"Black box" to open the black box interface. Click "Refresh" to view the faults list and the occurrence time.

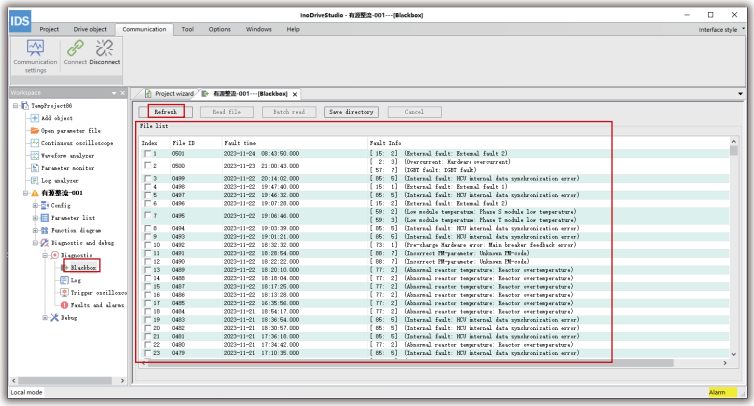


Figure 3-27 Black box interface

2. Select one of the faults, such as fault 73, select the file to be read, and save it.

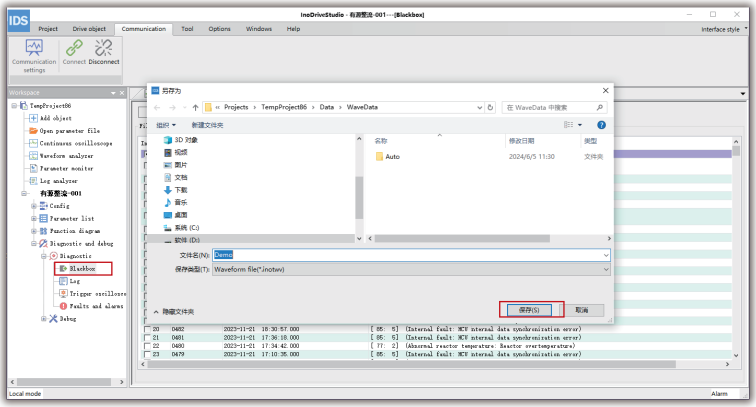


Figure 3-28 Saving interface of the black box

3. After you click Save, InoDriveStudio automatically opens the waveform that has been saved. Select the channel to be viewed, and the corresponding waveform will be shown.

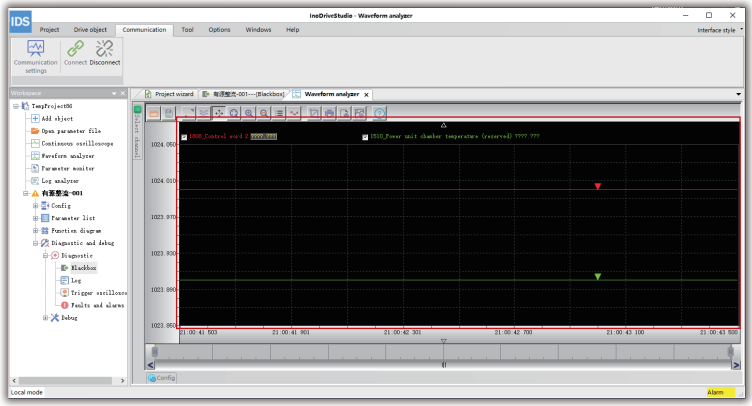


Figure 3-29 Black box waveform

Batch reading of black box files is supported, as shown below. Click "Batch read" and select the directory for saving the files. You can multiple black box files consecutively. Note that the progress bar only represents the reading process of an individual black box file.

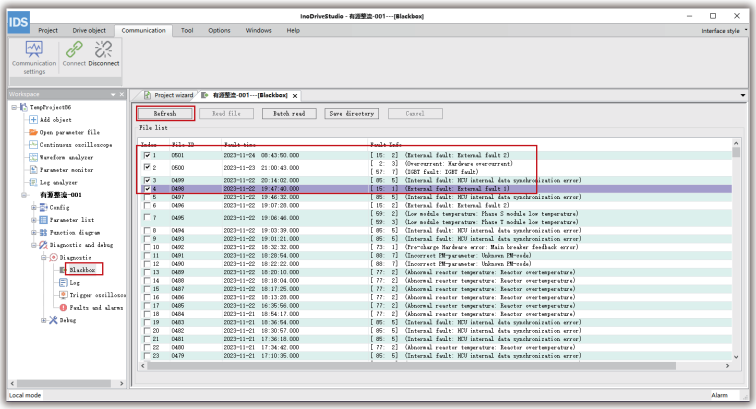


Figure 3-30 Batch reading of black box files

The following shows how to clear the black box records.

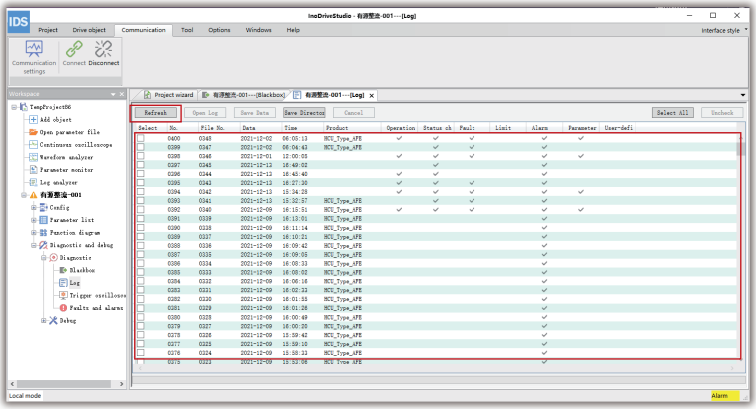
1. Set A8-00 to 4 to select "Clear black box record".
2. Set A8-01 to 1 to confirm the operation of A8-00.
3. The parameter file backed up on the SD card of HCU-40 is deleted. No parameters are affected.

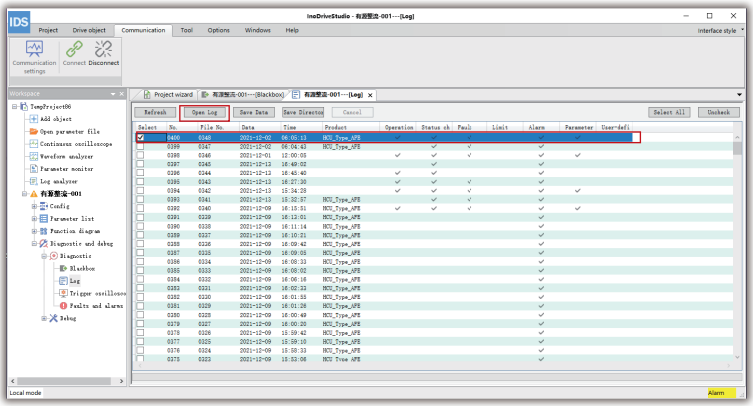
3.3.3.3 Log Function

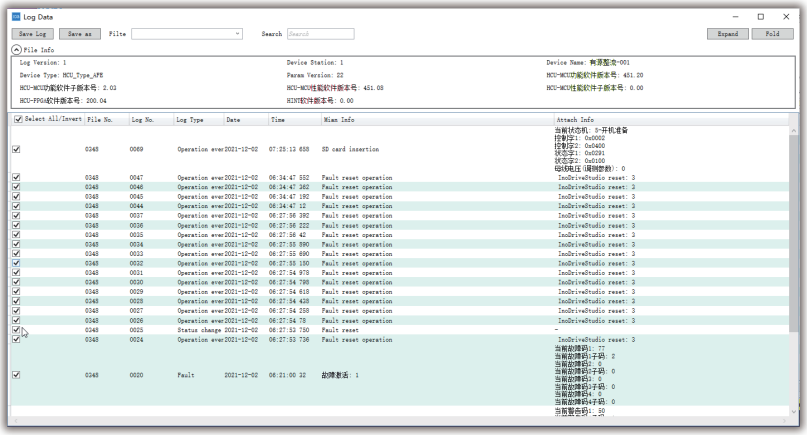
The system log records information about software, hardware, and system problems in the system, including specific data and time of occurrence. You can monitor related events such as operating events, state changes, faults, minor faults, and alarms in the system. Users and manufacturers can locate the fault causes through the log for easy fault tracking and equipment maintenance. It includes the changing of important system state (including power-on/power-off, state machine state change, command setting, fault reset), restore factory parameters, and so on.

Reading the log

Connect InDriverStudio to HCU-40. Go to "Active rectification-001"→"Diagnostic and debug"→"Diagnostic"→"Log reading" to open the log interface. Click "Refresh" to view the log files and date of establishment generated. The time in the following figure refers to the power-on time of HCU-40. You can only see the time of each event after the log is opened. After the HCU-40 is powered on again, a log file will be created. You can make records in the new log file. All records exist in the newly created log file during power-on. A log file will be created only after its memory is full occupied. The system can save up to 400 log files, with 1000 records saved in each file log.







Clearing the log

Do as follows:

1. Set A8-00 to 5 to select "Clear log record".
2. Set A8-01 to 1 to confirm the operation of A8-00.
3. All the log records will be cleared.

Note

Once cleared, the log records cannot be restored.

Triggering custom log

The log supports custom triggering, analog triggering, and digital triggering. When digital triggering is used, the log record can be triggered once at the edge of the digital

signal. The edge signal type can be configured by parameters. When analog triggering is used, a log record can be triggered by comparing with the source value setpoint. Four groups of custom log triggering are supported. The following table describes the parameters of custom log 1 only. The configurations of custom log 2 to custom log 4 are the same.

Table 3–10 Related parameters

Param.	Name	Setpoint	Remark
A16-03	Custom log reset function	0: No action 1: Reset the number of custom log 1 trigger events 2: Reset the number of custom log 2 trigger events 3: Reset the number of custom log 3 trigger events 4: Reset the number of custom log 4 trigger events 5: Reset the number of all the custom log trigger events 6: Restore custom log configuration parameters	-
A16-04	Reset of custom log	0: Cancel 1: Confirm	-
A16-05	Number of custom log 1 trigger events	-	Displays the number of trigger events, which cannot be written.
A16-15	Trigger mode of custom log 1	0: Inactive 1: Triggered by analog values 2: Triggered by digital values 3: Triggered by analog or digital values 4: Triggered by analog and digital values	When the setpoint is 3, a log record will be triggered when only one of the trigger conditions (analog and digital values) is met. When the setpoint is 4, a log record will be triggered when both of the trigger conditions (analog and digital values) are met.
A16-16	Analog trigger source of custom log 1	0: Inactive Others: K connector	-

Param.	Name	Setpoint	Remark
A16-17	Analog trigger comparison condition for custom log 1	0: > 1: < 2: = 3: ≥ 4: ≤	-
A16-18	Analog trigger comparison value source of custom log 1	0: Inactive Others: K connector	-
A16-19	Digital trigger source of custom log 1	0: Inactive Others: B connector	-
A16-20	Digital trigger comparison condition for custom log 1	0: Rising edge (0->1) 1: Falling edge (1->0) 2: Edge (0->1 or 1->0)	-
A16-21	Channel 1 of custom log 1	0: 0 Others: K connector	Defines the data value to be recorded when the log is triggered, which is bound through the connector.
A16-22	Channel 2 of custom log 1		
A16-23	Channel 3 of custom log 1		
A16-24	Channel 4 of custom log 1		
A16-25	Channel 5 of custom log 1		
A16-26	Channel 6 of custom log 1		
A16-27	Channel 7 of custom log 1		
A16-28	Channel 8 of custom log 1		

Enabling the log function

The log function can be clipped. You can set this function through A16-85...A16-91. You can disable or turn on specific log functions to mask or turn on related event records. The following takes A16-85 as an example.

Table 3–11 Related parameters

Param.	Name	Setpoint
A16-85	Log function enable selection 1	Ones-: Brake released 0: Disable 1: Enable Tens-: Brake applied 0: Disable 1: Enable Hundreds-: AI1 disconnected 0: Disable 1: Enable Thousands-: AI2 disconnected 0: Disable 1: Enable Ten thousands-: Jog operation 0: Disable 1: Enable

4 Commissioning and Operation

4.1 Overview

4.1.1 Overview of the Typical Topology

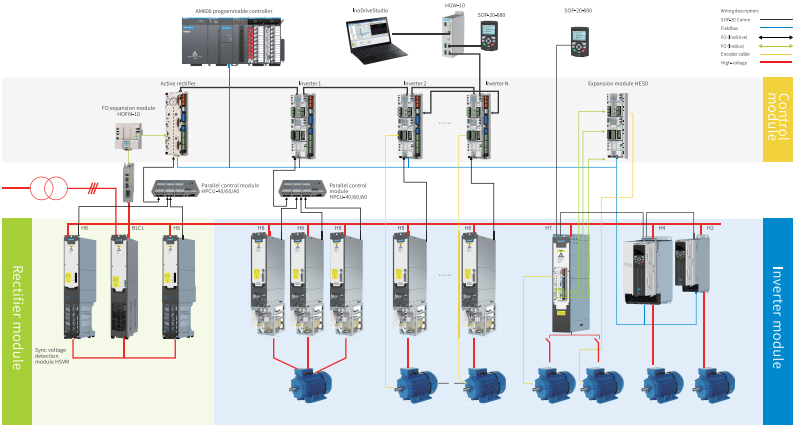


Figure 4-1 Typical topology of MD880

The typical topology of the MD880 multi-drive system is shown in *"Figure 4-1 Typical topology of MD880" on page 53*. The system mainly consists of two parts: control module and power module. The control module can be connected to the PLC through the fieldbus for centralized control, and the RS485 bus can also be used for centralized commissioning and monitoring between control modules. The power module can be expanded in parallel by using the HPCU parallel control module.

4.1.2 Electrical Diagram of a Single Active Rectifier

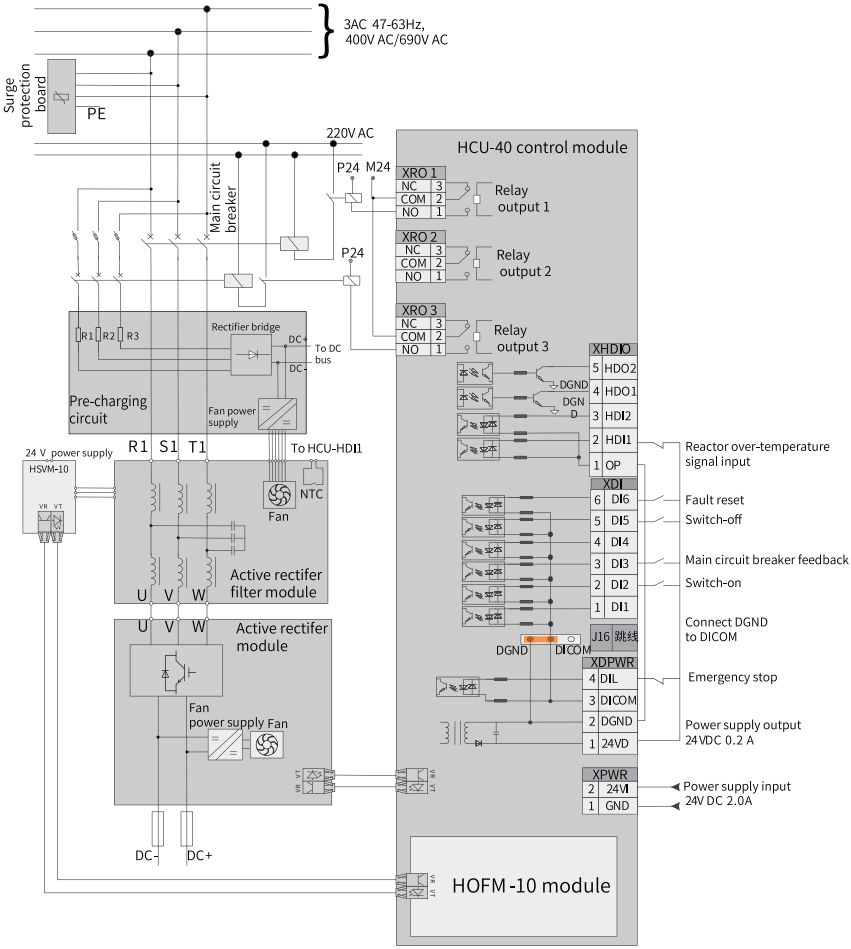


Figure 4-2 Electrical diagram of a single water-cooled active rectifier

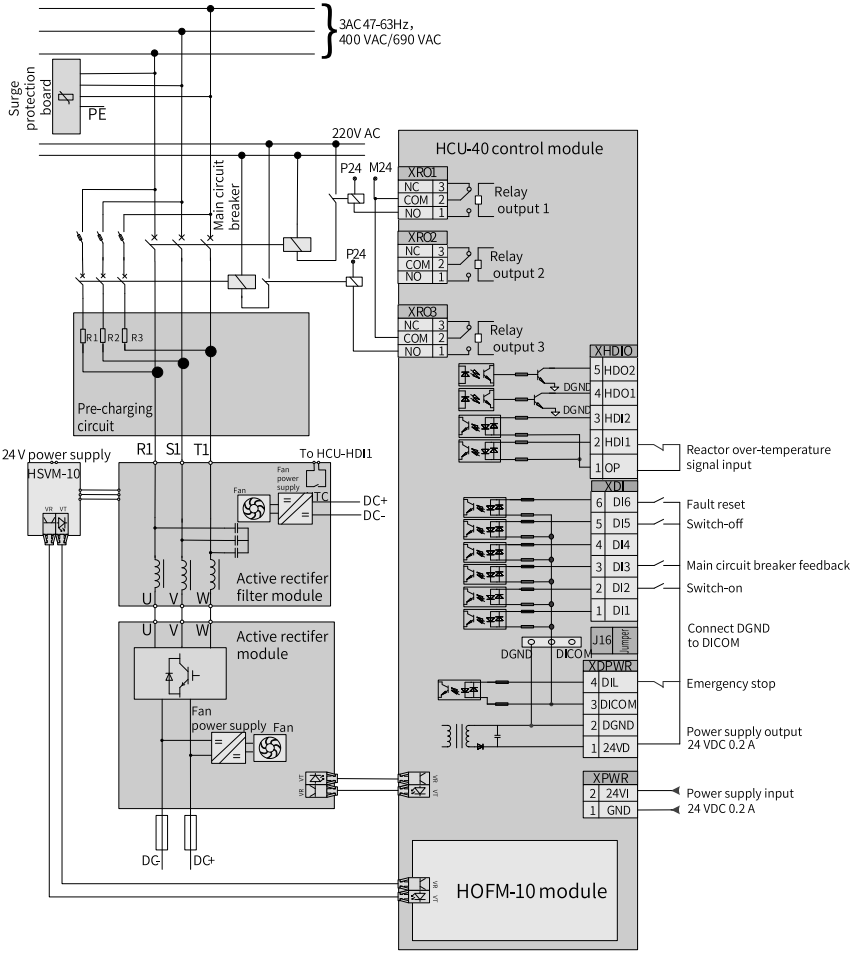


Figure 4-3 Electrical diagram of a single air-cooled active rectifier

Note

The figure shows the default port assignment of HCU-40. For details, see *HCU Control Unit Hardware Guide*.

4.1.3 Electrical Diagram of Parallel Active Rectifiers

Active rectifier modules are connected in parallel through HPCU. Up to 10 active rectifiers can be connected. The topology of parallel mode is shown below.

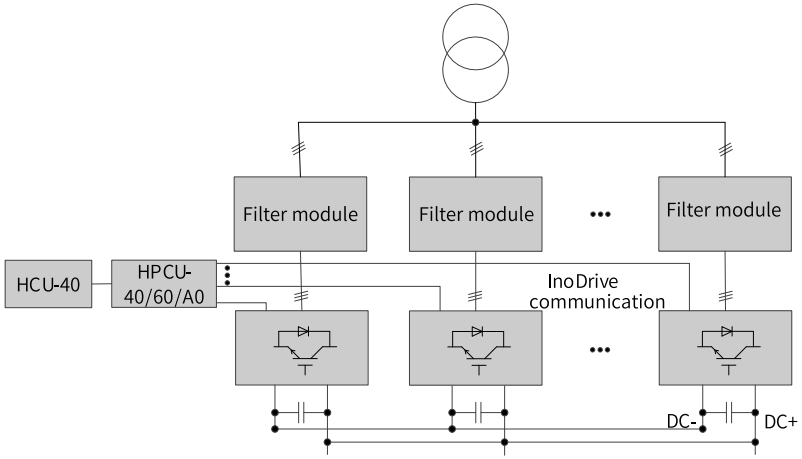


Figure 4-4 Electrical Diagram of the parallel active rectifier

For the setting of power modules and parameters related to parallel connection, see *"4.7.1 Parameter Setting in Single and Parallel Modes" on page 61*. You can view the basic information of the device through the parameters in the following table.

Table 4–1 Viewing the module information

Param,	Name	Description
A2-00	Product type	Displays the device type. Normal display: 2 [Active rectifier]
A2-01	Module rated power	Displays the rated power of a single module.
A2-02	Module rated voltage	Displays the rated voltage of the module.
A2-03	Module rated current	Displays the rated current of the module.
A2-04	Total rated device power	Displays the aggregate rated power of parallel modules.
A2-05	Total rated device current	Displays the aggregate rated current of parallel modules.

Note

- When the modules are operating in parallel, the aggregate power and current are derated after the parallel modules are superposed directly. For derating coefficient, see *MD880LC Series AC Drive (Multidrive System) Hardware Guide* and *MD880–40 Series Active Rectifier Hardware Guide.*
- For example, when two active rectifier modules with rated power (A2-01) 556 kW and rated current (A2-03) 810 A are connected in parallel, the aggregate rated power (A2-04) is 1056 kW and the aggregate rated current (A2-05) is 1539 A.

4.2 HCU Control Module

4.2.1 Description of Indicators

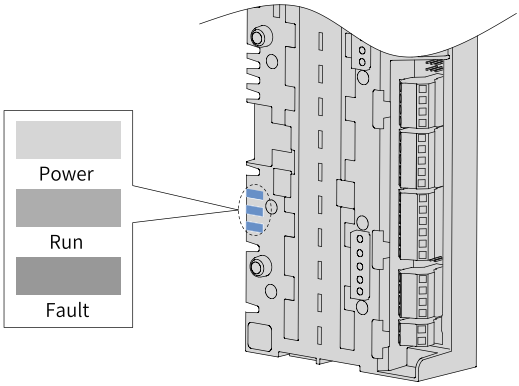


Figure 4-5 Location and definition of the LED indicators

No.	Name	State	Description
1	Power	Steady on	The HCU power supply is normal.
		Off	The HCU is not energized or the power supply is faulty.
2	Run	Steady on	The power module is in the operation state.
		Off	The power module is in the stop state.
3	Fault	Steady red	System fault
		Steady yellow	System alarm
		Off	The system is normal.
		Flashing red	HCU auxiliary power supply fault (Check whether 24 V power supply is short-circuited or overloaded.)

No.	Name	State	Description
4	Fault, Run	Flashing yellow (FAULT) and green (RUN) simultaneously	This HCU is selected by the PC or SOP-20-880, which ends after 10 seconds.
		Flashing red (FAULT) and green (RUN) alternately	The FPGA of the HCU is abnormal.

4.2.2 Peripheral Terminals and Parameter Setting

For use of the standard peripheral terminals, see *HCU Control Module User Guide*. This section only describes terminals and related parameter groups, as shown in the following table.

Name	Param. group	Remark
RS485	A10	Used to set the communication rate and address.
DI	F0	Used to view the DI status and set switch-on/switch-off delay.
RO	F1	Output source selection Displayed in U0-21 to U0-23.
AI	F2	The final result is displayed in U5-18/U5-19.
AO	F3	Output source selection Displayed in U5-22/U5-23.
HDI	F4	High-speed DI setting
HDO	F5	High-speed DO setting
InoLink	n0	Used to transmit data between HCUs. U5-32 to U5-39 are used to display PZD1 to PZD8 data. U2-32 to U2-47 are used to display bit 0 to bit 15 data of PZD1.

4.2.3 Descriptions of HCU Expansion Module

For details of the expansion module hardware, see the related user guides. Observe the following procedure when using the expansion module.

1. Check the module type.
2. Select the slot in which the module is located. For I/O modules, a maximum of three modules can be used simultaneously. Configure each module separately.
3. Configure other parameters of the module. For communication expansion modules, set parameters in n1/n2 fieldbus adapters.

Table 4–2 Common expansion modules

Model	Name	Type	Parameter group	Related parameter group
HIO-10/20	Digital analog expansion module	I/O module	n7/n8/n9	-
HMBA-10	Modbus-RTU module	Fieldbus module	n10	n1/n2/n3
HDP-10	PROFIBUS-DP fieldbus module		n16	n1/n2/n3
HCAN-10	CANopen fieldbus module		n12	n1/n2/n3
HETC-10/20	EtherCAT industrial Ethernet module	Industrial Ethernet module	n14	n1/n2/n3
HPFN-10	PROFINET I/O industrial Ethernet module		n17	n1/n2/n3
HPFN-20	HPFN-20 PROFINET IRT Industrial Ethernet Adapter Module		n17	n1/n2/n3
HMBT-10	Modbus TCP industrial Ethernet module		n18	n1/n2/n3
HETN-10	EtherNet commissioning module	Ethernet module	n13	n1/n2/n3
HSVM-10	Synchronous voltage detection module	Voltage detection module	n19	-

You can view the inserted communication expansion modules and their versions through parameters in group A2.

Table 4–3 Viewing the expansion module

Expansion slot	Module type parameter	Software version parameter	Expansion slot	Module type parameter	Software version parameter
SLOT1_1	A2-24	A2-25	SLOT2_1	A2-30	A2-31
SLOT1_2	A2-26	A2-27	SLOT2_2	A2-32	A2-33
SLOT1_3	A2-28	A2-29	SLOT2_3	A2-34	A2-35
SLOT3_1	A2-36	A2-37	-	-	-

4.3 Commissioning Flowchart

The following figure shows the system commissioning flowchart.

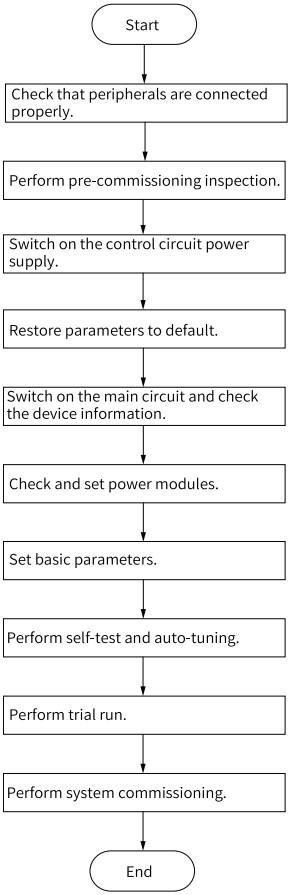


Figure 4-6 Commissioning flowchart upon initial power-on

Note

- Observe the preceding commissioning procedure during use.
- Parameters of the MD880-40 series active rectifier are modified through SOP-20-880 or InoDriveStudio.

4.4 Pre-commissioning Inspection

Before power-on and commissioning, ensure that all preparations are done and check the following items.

No.	Item	Compliance
1	The power input of the main circuit is correctly connected based on terminal labels (R1, S1, and T1).	□
2	The output terminals (DC+, DC-) of the main circuit are connected properly.	□
3	Connect the input (R1, S1, T1) and output (U, V, W) terminals of the active rectifier filter module in the same phase sequence as the active rectifier module.	□
4	Ground the active rectifier filter module and active rectifier module properly.	□
5	Connect the power supply of the auxiliary circuit based on the terminal labels (L/N) properly.	□
6	Connect the communication cables properly.	□
7	Connect external interfaces such as I/O interfaces properly.	□

4.5 Switching on the Control Circuit Power Supply

Check the power supply of the control circuit of the active rectifier and switch on the power supply.

4.6 Restoring Default Parameters

Restore parameters to default setting before initial commissioning according to the following procedure.

1. Set A8-00 to 2 to restore all parameters to default values.
2. Set A8-00 to 1 to confirm the restoration operation.

After execution, the state machine A0-00 enters the S20 state (parameter recovery) and exits this state upon completion.

4.7 Checking and Setting the Power Module

4.7.1 Parameter Setting in Single and Parallel Modes

Parameters are set as follows in the single and parallel modes.

No.	Param.	Definition	Remark
1	A15-00	Parallel function selection	0: Single unit 1: Parallel units
2	A15-01	HPCU online flag	0: Offline 1: Online Ready-only, unchangeable

No.	Param.	Definition	Remark
3	A15-02	Parallel module enable selection 1	The ones to ten-thousands places are used to enable module 1 to module 5. 0: Disable 1: Enable
4	A15-03	Parallel module enable selection 2	The ones to ten-thousands places are used to enable module 6 to module 10. 0: Disable 1: Enable
5	A15-04	Number of enabled parallel modules	Read-only After setting A15-01 and A15-02, the number of enabled modules are calculated automatically.
6	A15-05	Parallel module online display 1	Read-only
7	A15-06	Parallel module online display 2	Read-only
8	A15-07	Number of online parallel modules	0-10
9	A15-15 to A15-24	Status of parallel modules 1 to 10	0: Offline 1: Online Ready-only, unchangeable

Note

- For enabling parallel modules, make sure that parallel modules 1 to 10 match CH1 to CH10 on the HPCU.
- Take two active rectifiers as an example. The power module is connected to CH1 and CH2 of the HPCU.
  - Set A15-00 to 1 (Enable parallel mode).
  - Set A15-02 to 00011 and A15-03 to 00000 to enable CH1 and CH2 ports.

4.7.2 Equipment Information Check

The following table describes parameters used to check device information.

Param.	Name	Description
A2-00	Product type	Displays the product type. The setpoint 2 [Active rectifier] is displayed normally.
A2-01	Module rated power	-
A2-02	Module rated voltage	-

Param.	Name	Description
A2-03	Module rated current	-
A2-04	Total rated device power	-
A2-05	Total rated device current	-
A2-07	HCU software type	Displays the HCU software type. The setpoint 2 [Active rectifier] is displayed normally.
A2-08	HCU-MCU function software version	-
A2-10	HCU-MCU performance software version	-
A2-16	HCU-FPGA software version	-
A2-18	HINT Type	Displays the HINT type. The setpoint 2 [Active rectifier] is displayed normally during operation. The setpoint 100 [Offline] is displayed when HINT is operating improperly.
A2-19	HINT software version	0.0 to 655.35
A2-22	HPCU software version	0.0 to 655.35

Note

If the rated power, rated voltage, and rated current of the power module do not match the module nameplate information, contact Inovance technical support to reset and download the model.

4.7.3 HSVM Module Setting

The HSVM voltage detection module must be set correctly before the active rectifier starts. If the HSVM voltage detection module is set improperly or offline, the fault F80-4 will be reported after the active rectifier starts.

- Check the position of the expansion slot connected to the HSVM module in A2-24 to A2-37. The default position of the expansion slot of the HSVM module is slot 1-2.
- If the HSVM module is not displayed in A2-24 to A2-37, check whether the HSVM module is connected properly or whether the HSVM module is powered up properly.
- If the HSVM module is displayed in A2-24 to A2-37, set n19-00 to the corresponding expansion slot.
- If the setting is normal, n19-01 displays 1 [online] and n19-04 to n19-09 display the related sampling data in real time.

4.7.4 Load Mode Setting

For more information about the load mode, see related sections in MD880LC Series AC Drive Hardware Guide and MD880-40 Series Active Rectifier Hardware Guide. The controller automatically records the real-time output current of the power module and calculates the load rate. When the module exceeds the allowable load, the fault "Err10-1 Drive overload" is reported. Check whether the drive matches the load and whether the output current exceeds the allowable specifications of the module.

Typical operating conditions:

- No overload mode: The maximum output current always does not exceed the no-overload current of the drive. This mode can be used for a long time.
- Low overload mode: Operating for 240s at a current not exceeding the low-load current, then operating for 60s at a current not exceeding 110% of low-load current within every 300s. A cyclic operation at an interval of 300s is supported.
- High overload mode: Operating for 240s at a current not exceeding the high-load current, then operating for 60s at a current not exceeding 150% of high-load current every 300s. A cyclic operation at an interval of 300s is supported.

4.8 Setting Basic Parameters

4.8.1 Setting Power Grid Voltage

If measurement conditions are met, measure the actual grid voltage first and input the measured value into E0-15 (Preset incoming voltage).

If the measurement conditions are not available, skip this step to start the device first and input E0-15 based on the grid voltage detected by HCU-40. The preset incoming voltage is shown below.

Table 4–4 Default preset incoming voltage

Model	Default preset incoming voltage (E0-15)
400 V model	400V
690 V model	690V

4.8.2 Setting the Power Grid Frequency

The HCU-40 supports operation under power grids with rated frequency 50 Hz or 60 Hz. The rated frequency of the power grid can be set in d0-01.

Param.	Name	Value range
d0-01	Rated frequency of power grid	0: 50 Hz (default) 1: 60 Hz

4.8.3 Setting the Operation Mode

The default operation mode of HCU-40 is the voltage mode. You can set different operation modes through E0-01.

Param.	Name	Value Range
E0-01	Active rectifier mode	0: Voltage mode 1: Current mode

To set the operation mode according to the actual operating conditions, see section "Operation Mode"in MD880 Series Active Rectifier Function Guide.

4.8.4 Setting the Voltage or Current Reference

The voltage or current setting is related to the operation mode set in *"4.8.3 Setting the Operation Mode" on page 65*.

- In the voltage mode, set a proper target voltage.
- In the current mode, set a proper current reference.

The voltage and current settings belong to the setpoint channel. When the selected setpoint channel is different, the corresponding parameter groups are different. For details, see section "Setting Channels" in the MD880 Series Active Rectifier Function Guide. The following takes the setpoint channel 1 as an example.

Voltage reference

By default, the voltage is set to 1.5 x preset incoming voltage. The preset incoming voltage can be set through E0-15 and the coefficient through E0-16.

The voltage setpoint source can be changed through C0-00. When C0-00 is set to 0, the desired target voltage can be set directly through C0-01.

The actual target voltage can be viewed through C0-02.

Current reference

By default, the current reference is 0, which can be changed directly through C1-01.

The current setpoint source can be changed through C1-00.

The actual effective target current value can be viewed in C1-02.

4.9 Self-Test and Auto-tuning

4.9.1 Phase Sequence Self-test

During on-site application or production assembly, the three-phase AC voltage sampling RST and three-phase current sampling RST are often incorrectly mapped. As a result, overcurrent or overvoltage occurs upon startup of the active rectifier, making it difficult to quickly and accurately troubleshoot the problem. In this case, start phase sequence self-

test. The software detects the sampling relationship between the three-phase power supply voltage and three-phase current, and automatically adjusts the corresponding relationship to reduce commissioning time and difficulty.

Three different self-test modes can be set through b7-02, as shown below.

- If phase sequence self-test has been performed and the wiring is not changed, self-test is not necessary. In this case, set b7-02 to 0.
- If phase sequence self-test is not performed or the correctness of wiring cannot be verified, set b7-02 to 1 to perform self-test once before operation.
- If wiring needs to be changed frequently during use of the active rectifier, set b7-02 to 2 to perform self-test every time before operation.

Param.	Setpoint	Description
b7-02	0	No self-test
	1	Self-test performed only once
	2	Self-test performed continuously

During phase sequence self-test, the state machine is S9 (Pre-operational detection). A single-shot self-test lasts about 8 seconds. The self-test results can be viewed through d1-00. After self-test is done, normal operation applies. In this case, the state machine enters S12 (Operational).

4.9.2 Capacitor Auto-tuning

In multi-drive applications with a common DC bus, the power and quantity of drives are variable. The active rectifier operates in voltage mode, regulating the common DC bus voltage to the setpoint. The regulator parameters of the outer voltage loop are directly related to the capacitance on the DC bus.

The software detects the total capacitance on the DC bus (including the rated capacity configured by the rectifier and the capacitance of other drives) and automatically adjusts the regulator parameters of the voltage loop to improve the dynamic response performance.

Three different auto-tuning modes can be set through b7-08:

- If capacitor auto-tuning is performed and the rear load capacitance does not change, set b7-08 to 0. In this case, capacitor auto-tuning is not required.
- If capacitor auto-tuning is not performed or the rear load capacitance is uncertain, b7-08 is set to 1 to enable capacitor auto-tuning before initial operation.
- If the downstream load capacitance may change during operation, set b7-08 to 2 to enable capacitor auto-tuning every time before operation.

If the load changes slowly and fast dynamic response is not required, set b7-08 to 0 to skip capacitor auto-tuning.

The rated capacity of the DC bus of the active rectifier can be viewed in d2-00, and the capacitor auto-tuning result can be viewed in d2-01.

If the total capacitance in the DC bus is known, you can manually set d2-01 based on the total capacitance on the DC bus without capacitor auto-tuning.

Param.	Value range	Description
b7-08	0	Not perform auto-tuning
	1	Perform auto-tuning once
	2	Perform auto-tuning each time before operation

If the auto-tuned capacitance deviates greatly from the actual bus capacitance, you can switch the auto-tuning scheme by setting E0-45 to 1 [New scheme] and perform auto-tuning again to improve the auto-tuning accuracy.

Note

- The active rectifier can be configured with an inverter with rated power not higher than 4 x rectifier power.
- The capacitance d2-01 auto-tuned or manually set must be within the range of 0.5 to 10 x rated capacitance d2-00 of the active rectifier. If this range is exceeded, F87-3 (DC bus capacitance out of range) can be triggered. If the total capacitance on the DC bus exceeds 10 x rated capacitance, capacitor auto-tuning is not required. The capacitance set manually (d2-01) cannot exceed 10 x rated capacitance.
- The capacitor auto-tuning function is active only in the voltage mode.

4.10 Trial Run

4.10.1 Local Control and Default Terminal Start Device

For initial trial operation, it is recommended to use the InoDriveStudio or SOP-20-880 operating panel. For details, see *" Overview" on page 27* and SOP-20-880 Smart Operating Panel User Guide.

4.10.2 Starting the Device as Configured By Default

The active rectifier cabinet provided by the manufacturer has start, switch-off, and reset buttons. As long as the default configuration is enabled (b0-00 = 1), the device can be started directly. The following table lists the default configuration parameters.

Table 4–5 Default configuration parameters

Param.	Name	Setpoint	Status
b0-00	Default configuration	0: Disable 1: Enable	Set this parameter to 1.
b0-01	Default configuration state	0: Inactive 1: Active	Displays whether the current factory configuration is active and read-only.
b0-02	Default startup command source	3 [DI2]	The device is started by DI2 by default, which cannot be changed. When DI5 is low level and the DI2 rising edge changes, the startup command is active.
b0-03	Default stop command source	6 [DI5]	The device is stopped by DI5 by default, which cannot be changed. When DI5 is high level, the stop command is active.
b0-04	Default operation command source	0: Inhibited 1: Operation allowed	The default value is 1, which can be changed.
b0-05	Default reset signal source	7 [DI6]	The fault is reset by DI6 by default, which cannot be changed.

Note

When you need to control the start/stop of the device remotely, the default configuration must be disabled ([b0-00] = 0).

4.10.3Start/Stop with the Digital Input Control Unit

The HCU-40 control module supports start/stop control through digital input terminals. For example, DI1 is used to trigger start/stop, DI2 is used to block output, and DI3 is used to reset faults.

Param.	Name	Setpoint	Description
b0-00	Default configuration	0	Default configurations not enabled
b1-00	[Channel 1] control source	1	Custom start/stop control word
b1-01	[Channel 1] custom OFF1 source	2	Select DI1 as the source of OFF1 command.

Param.	Name	Setpoint	Description
b1-02	[Channel 1] custom OFF2 source	3	Select DI2 as the source of OFF2 command.
b1-03	[Channel 1] custom running command source	1	Operation permitted
b1-04	[Channel 1] custom reset signal source	4	Select DI3 as the source of the fault reset command.

4.10.4Starting Through Fieldbus

This section only describes the start, stop, reset command source and setting of the device through the fieldbus.

Use of custom mode

When starting the drive through fieldbus communication, select a protocol for data interaction with the automation system and set parameters according to the protocol. The following describes the configuration in which the fieldbus adapter A is started through PROFIBUS-DP bus.

For example, the following table defines the control word received by the active rectifier.

Table 4–6 Control words

Bit	1	0	Description
bit0	Start	Stop	Starting at the rising edge, and status unchanged
bit1	Lockout inactive	Lockout active	Mandatory condition 1 for start
bit2	Reserved	Reserved	-
bit3	Operation permitted	Operation permission inhibited	-
bit4	-	-	-
bit5	-	-	-
bit6	-	-	-
bit7	Fault reset	No	Rising edge-triggered
bit8	-	-	-
bit9	-	-	-
bit10	Valid PZD data	Invalid PZD data	Always high level
bit11	-	-	-
bit12	-	-	-
bit13	-	-	-
bit14	-	-	-
bit15	-	-	-

The status word sent by the active rectifier is shown in the following table.

Table 4–7 Status word

Data	Value range	Meaning	Remark
PZD1	0 to 0xFFFF	Status word 1	For details, see section Status Word in MD880 Series Active Rectifier Function Guide.
PZD2	0 to 15000	DC bus voltage	For calibration of base values, see section Communication Module in MD880 Series Active Rectifier Function Guide. The value 1000 indicates a voltage of 100.0 V.

Parameters are set as follows.

Table 4–8 Setting the bus

Param.	Name	Setpoint	Description
n1-00	Bus type of bus adapter	7	The bus adapter A is defined as the PROFIBUS-DP type.
n1-01	Communication disconnection detection delay	1	A communication failure is reported 1s after communication is interrupted.
n1-03	Continuous CRC error detection setting	0	No CRC
n1-04	Process data output 1	1809	The process data 1 is set to TX status word 1.
n1-05	Process data output 2	1502	The process data 2 is defined as DC bus voltage.
n1-20	Communication base value of process data output 1	0	The default setting applies, namely 4096 corresponds to 100% of the rated value.
n1-21	Communication base value of process data output 2	0	The default setting applies, namely 4096 corresponds to 100% of the rated value.
n1-36	Communication base value of process data input 1	0	The default setting applies, namely 4096 corresponds to 100% of the rated value.
n1-37	Communication base value of process data input 2	0	The default setting applies, namely 4096 corresponds to 100% of the rated value.

Param.	Name	Setpoint	Description
n16-00	Expansion slot	7	The PROFIBUS-DP communication module is installed in expansion slot 3_1.
n16-02	Expansion card station number	2	Set the PROFIBUS-DP address to 2.

Set the control channel based on the control word definition.

Param.	Name	Setpoint	Description
b0-00	Default configuration enabled	0	Default configurations not enabled
b1-00	[Channel 1] control source	1	User-defined start/stop control word
b1-01	[Channel 1] user-defined OFF1 source	1200	Select bit0 of PZD1 for bus adapter A as the OFF1 command source.
b1-02	[Channel 1] user-defined OFF2 source	1201	Select bit1 of PZD1 for bus adapter A as the OFF2 command source.
b1-03	[Channel 1] user-defined operation command source	1203	Select bit3 of PZD1 for bus adapter A as the operation permission command source.
b1-04	[Channel 1] user-defined reset signal source	1207	Select bit7 of PZD1 for bus adapter A as the fault reset command source.

4.10.5Control Through Modbus (Mailbox Data)

Control through special address

As specified by the Modbus communication protocol, parameters are read and written directly through the communication address, without generating process data.

To start/stop through Modbus communication, the HCU-40 control module provides several special communication addresses for accessing Modbus, and updates the written data to a specific connector for reading the source parameters.

Table 4–9 Description of the communication address

Comm. address	Written to connector	Name	Description
34230	U5-40	Modbus communication setpoint 1	Used to receive the control word or setpoint.
34231	U5-41	Modbus communication setpoint 2	
34232	U9-50	Modbus communication DWORD setpoint	The value range is -2^{31} to $+2^{31}$ - 1, which is used to receive high-precision setpoint. Write high-order 16 bits of the data to the communication address 34232. Write low-order 16 bits of the data to the communication address 34233.
34233			

You can configure the parameters as follows.

Table 4–10 Parameter configuration

Param.	Name	Setpoint	Description
b0-00	Default configuration enable	0	Default configurations is disabled.
n1-00	Bus type of bus adapter	1	The Modbus RTU module is selected for bus adapter A.
n10-00	Expansion slot selection	7	The Modbus RTU module is installed in expansion slot 3_1.
n10-04	Modbus local address	4	Set the address of the Modbus-RTU module to 4.
b1-00	[Channel 1] control source	1	User-defined start/stop control word
b1-01	[Channel 1] user-defined OFF1 source	1248	bit0 of word-to-bit output is used as the start/stop source of OFF1.
L0-00	Input of word-to-bit function 1	1540	The data 1 sent by Modbus is used as the word-to-bit input.

Write 0 to communication address 34230 through Modbus for shutdown and write 1 for operation control.

Control through continuous address

The Modbus RTU and Modbus TCP support writing of process data n1-68 to n1-83 (n2-68 to n2-83). After converted by communication base values of n1-36 to n2-51 (n2-36 to n2-51), the process data is updated to the corresponding connectors U5-44 to U5-59 (U5-60 to U5-75). Related parameters are as follows.

- Bus adapter A:

Comm. address	Writing parameter	Name	Description
33807	n1-68	Data display of process data input 1	Written through Modbus, converted by the base value of n1-36, and updated to connector U5-44
33808	n1-69	Data display of process data input 2	Written through Modbus, converted by the base value of n1-37, and updated to connector U5-45
33809	n1-70	Data display of process data input 3	Written through Modbus, converted by the base value of n1-38, and updated to connector U5-46
33810	n1-71	Data display of process data input 4	Written through Modbus, converted by the base value of n1-39, and updated to connector U5-47
33811	n1-72	Data display of process data input 5	Written through Modbus, converted by the base value of n1-40, and updated to connector U5-48
33812	n1-73	Data display of process data input 6	Written through Modbus, converted by the base value of n1-41, and updated to connector U5-49
33813	n1-74	Data display of process data input 7	Written through Modbus, converted by the base value of n1-42, and updated to connector U5-50
33814	n1-75	Data display of process data input 8	Written through Modbus, converted by the base value of n1-43, and updated to connector U5-51
33815	n1-76	Data display of process data input 9	Written through Modbus, converted by the base value of n1-44, and updated to connector U5-52
33816	n1-77	Data display of process data input 10	Written through Modbus, converted by the base value of n1-45, and updated to connector U5-53
33817	n1-78	Data display of process data input 11	Written through Modbus, converted by the base value of n1-46, and updated to connector U5-54

Comm. address	Writing parameter	Name	Description
33818	n1-79	Data display of process data input 12	Written through Modbus, converted by the base value of n1-47, and updated to connector U5-55
33819	n1-80	Data display of process data input 13	Written through Modbus, converted by the base value of n1-48, and updated to connector U5-56
33820	n1-81	Data display of process data input 14	Written through Modbus, converted by the base value of n1-49, and updated to connector U5-57
33821	n1-82	Data display of process data input 15	Written through Modbus, converted by the base value of n1-50, and updated to connector U5-58
33822	n1-83	Data display of process data input 16	Written through Modbus, converted by the base value of n1-51, and updated to connector U5-59

- Bus adapter B

Comm. address	Writing parameter	Name	Description
33839	n2-68	Data display of process data input 1	Written through Modbus, converted by the base value of n1-36, and updated to connector U5-60
33840	n2-69	Data display of process data input 2	Written through Modbus, converted by the base value of n1-37, and updated to connector U5-61
33841	n2-70	Data display of process data input 3	Written through Modbus, converted by the base value of n1-38, and updated to connector U5-62
33842	n2-71	Data display of process data input 4	Written through Modbus, converted by the base value of n1-39, and updated to connector U5-63
33843	n2-72	Data display of process data input 5	Written through Modbus, converted by the base value of n1-40, and updated to connector U5-64

Comm. address	Writing parameter	Name	Description
33844	n2-73	Data display of process data input 6	Written through Modbus, converted by the base value of n1-41, and updated to connector U5-65
33845	n2-74	Data display of process data input 7	Written through Modbus, converted by the base value of n1-42, and updated to connector U5-66
33846	n2-75	Data display of process data input 8	Written through Modbus, converted by the base value of n1-43, and updated to connector U5-67
33847	n2-76	Data display of process data input 9	Written through Modbus, converted by the base value of n1-44, and updated to connector U5-68
33848	n2-77	Data display of process data input 10	Written through Modbus, converted by the base value of n1-45, and updated to connector U5-69
33849	n2-78	Data display of process data input 11	Written through Modbus, converted by the base value of n1-46, and updated to connector U5-70
33850	n2-79	Data display of process data input 12	Written through Modbus, converted by the base value of n1-47, and updated to connector U5-71
33851	n2-80	Data display of process data input 13	Written through Modbus, converted by the base value of n1-48, and updated to connector U5-72
33852	n2-81	Data display of process data input 14	Written through Modbus, converted by the base value of n1-49, and updated to connector U5-73
33853	n2-82	Data display of process data input 15	Written through Modbus, converted by the base value of n1-50, and updated to connector U5-74
33854	n2-83	Data display of process data input 16	Written through Modbus, converted by the base value of n1-51, and updated to connector U5-75

Use continuous addresses as the start, stop, and reset command sources of the drive through Modbus communication. For details, see *"4.10.3 Start/Stop with the Digital Input Control Unit" on page 68*.

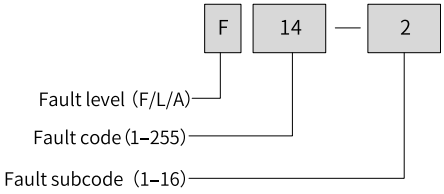
5 Troubleshooting

5.1 Access To Faults

Faults are divided into three types depending on the degree of severity.

- Fault: Used to indicate that a major fault or error has occurred and the device stops running immediately.
- Minor fault (Limit): The system is faulty and allowed to switch on without triggering IGBT.
- Alarm: Indicates that an alarm has occurred, which does not affect the operation state. You can handle alarms as needed.

A fault code is represented in three segments, as shown in the following figure. F indicates a fault, L indicates a minor fault, and A indicates an alarm.



Viewing active fault

The HCU-40 can record up to six faults that occur at the same time. When more than six faults occur at the same time, the subsequent faults will not be recorded. Faults activated currently can be viewed through parameters in group A1.

Active fault		Active minor fault		Active alarm	
Fault code	Fault subcode	Fault code	Fault subcode	Fault code	Fault subcode
A1-00	A1-01	A1-12	A1-13	A1-24	A1-25
A1-02	A1-03	A1-14	A1-15	A1-26	A1-27
A1-04	A1-05	A1-16	A1-17	A1-28	A1-29
A1-06	A1-07	A1-18	A1-19	A1-30	A1-31
A1-08	A1-09	A1-20	A1-21	A1-32	A1-33
A1-10	A1-11	A1-22	A1-23	A1-34	A1-35

Viewing previous faults

The HCU-40 can record the last five faults.

Last fault		2nd to last fault		3rd to last fault		4th to last fault		5th to last fault		Last minor fault		Last alarm	
Fault code	Sub code	Fault code	Sub code	Fault code	Sub code	Fault code	Sub code	Fault code	Sub code	Fault code	Sub code	Fault code	Sub code
H2-00	H2-01	H3-00	H3-01	H4-00	H4-01	H5-00	H5-01	H6-00	H6-01	H7-00	H7-01	H8-00	H8-01
H2-02	H2-03	H3-02	H3-03	H4-02	H4-03	H5-02	H5-03	H6-02	H6-03	H7-02	H7-03	H8-02	H8-03
H2-04	H2-05	H3-04	H3-05	H4-04	H4-05	H5-04	H5-05	H6-04	H6-05	H7-04	H7-05	H8-04	H8-05

Last fault		2nd to last fault		3rd to last fault		4th to last fault		5th to last fault		Last minor fault		Last alarm	
H2-06	H2-07	H3-06	H3-07	H4-06	H4-07	H5-06	H5-07	H6-06	H6-07	H7-06	H7-07	H8-06	H8-07
H2-08	H2-09	H3-08	H3-09	H4-08	H4-09	H5-08	H5-09	H6-08	H6-09	H7-08	H7-09	H8-08	H8-09
H2-10	H2-11	H3-10	H3-11	H4-10	H4-11	H5-10	H5-11	H6-10	H6-11	H7-10	H7-11	H8-10	H8-11

Viewing fault data log

The HCU-40 records data generated upon fault.

Fault data log	Last fault data	2nd to last fault data	3rd to last fault data	4th to last fault	5th to last fault
Bus voltage upon fault	H2-12	H3-12	H4-12	H5-12	H6-12
Power grid voltage upon fault	H2-13	H3-13	H4-13	H5-13	H6-13
Module current upon fault	H2-14	H3-14	H4-14	H5-14	H6-14
Power grid frequency upon fault	H2-15	H3-15	H4-15	H5-15	H6-15
Fault control word 1	H2-26	H3-26	H4-26	H5-26	H6-26
Fault control word 2	H2-27	H3-27	H4-27	H5-27	H6-27
Fault status word	H2-28	H3-28	H4-28	H5-28	H6-28
Fault state machine	H2-29	H3-29	H4-29	H5-29	H6-29
Moment of fault occurrence	H2-30	H3-30	H4-30	H5-30	H6-30
Date of fault occurrence	H2-31	H3-31	H4-31	H5-31	H6-31

Viewing faults through SOP-20-880

SOP-20-880 allows you to view the fault information through previous parameters or the fault menu.

Function	Key	Description
Viewing active fault	Key operations	Go to “Menu > Fault Records > Faults”.
Viewing active minor faults	Key operations	Go to “Menu > Fault Records > Limited Faults”.
Viewing active alarms	Key operations	Go to “Menu > Fault Records > Alarms”.

Function	Key	Description
Viewing the help information of the fault		Select a fault and press the help key to display the help information of the fault.
Viewing previous faults	Key operations	Go to “Menu > Fault Records > History Fault”.

It is recommended to view the fault information by the fault menu. All recorded faults and the related help information can be viewed.

Viewing faults through InoDriveStudio

When using InoDriveStudio, you can view the fault on the "Fault alarm table" interface. On the "Fault alarm table" interface, you can view the fault descriptions, fault causes and solutions, and data recorded when the fault occurs. It is recommended to view the fault information by the fault menu. All recorded faults and the related help information can be viewed.

5.2 Fault Reset

HCU-40 supports five fault reset modes, which are reset through SOP-20-880, reset through InoDriveStudio, reset through the control channel, reset through parameter setting, and reset at next power-on.

Mode	Description
SOP-20-880	After connection is done, press the "STOP" key in any interface to reset the fault.
InoDriveStudio	After connecting to the InoDriveStudio, click the Reset button in the "Control panel" to reset the fault. For details, see *"3.3.2.3 Control Panel" on page 29*
Control channel	Set parameters to reset the fault.
Parameter setting	Set H0-07 to 1 and set the fault reset time properly to allow automatic fault reset.
Reset at next power-on	Perform a power cycle on the HCU control circuit to reset the fault.

Multiple reset command sources are available. Only the reset command that corresponds to the selected command source is active. The relationship between the reset command source and the control channel is shown in the following table (SOP represents reset through SOP-20-880 and IDS represents reset through InoDriveStudio).

Effective control channel	Command word source	Reset command source								
		b0-05	b1-04	b2-02	b2-03	b3-04	b4-02	b4-03	SOP	IDS
A9-00 = 0	b0-00 = 0	X	X	0→1	0→1	X	X	X	0→1	0→1
	b0-00 = 1	0→1	X	0→1	0→1	X	X	X	0→1	0→1
	b1-00 = 0	X	X	0→1	0→1	X	X	X	0→1	0→1
	b1-00 = 1	X	0→1	0→1	0→1	X	X	X	0→1	0→1
	SOP control	X	X	0→1	0→1	X	X	X	0→1	0→1
	IDS control	X	X	0→1	0→1	X	X	X	0→1	0→1
A9-00 = 1	b0-00 = 0	X	X	X	X	X	0→1	0→1	0→1	0→1
	b0-00 = 1	0→1	X	X	X	X	0→1	0→1	0→1	0→1
	b3-00 = 0	X	X	X	X	X	0→1	0→1	0→1	0→1
	b3-00 = 1	X	X	X	X	0→1	0→1	0→1	0→1	0→1
	SOP control	X	X	X	X	X	0→1	0→1	0→1	0→1
	IDS control	X	X	X	X	X	0→1	0→1	0→1	0→1

Note

- X in the table indicates that the command source is inactive. The reset command is active only on the rising edge. Do not keep it at high level.
- The reset commands of SOP-20-880 and InoDriveStudio are always active after being connected, regardless of the control source.
- When automatic fault reset and automatic restart are enabled, ensure that unexpected equipment operation will not cause personal injury or mechanical damage. This function is strictly prohibited for vertical lifting applications; otherwise, heavy loads may fall out of control.
- Contact Inovance technical support if you need to enable the automatic restart function.

5.3 Fault List

For complete information on parameters and fault codes, see MD880(LC)-40 Series Active Rectifier Parameter Guide.

6 Terms and Abbreviations

Term	Meaning
HCU-40/41	Active rectifier control modules HCU-40 and HCU-41, which can be used to control MD880-40 and MD880LC-40 series products
SOP-20-880	Smart operating panel for HCU-40/41
InoDriveStudio	PC-based commissioning software for HCU-40/41
IDS	Abbreviation for InoDriveStudio
AI	Analog input
AO	Analog output
DI	Digital input
DO	Digital output
RO	Digital output with relay output
HDI	High-speed digital input
HDO	High-speed digital output
OFF1	Start/stop command, corresponding to bit0 of control word 1. The rising edge (0->1) corresponds to the start command. When bit0 is set to 0 (low level), OFF1 is the stop command.
OFF2	Emergency stop command, corresponding to bit1 of control word 1. The emergency stop command takes effect immediately in any state. Operation is allowed at high level and IGBT output is prohibited at low level.
Operation enable	Corresponds to bit3 of control word 1. Whether to enable the operation is determined after the OFF1 start command is activated. At high level, the device is allowed to enter the operation state to enable IGBT output. At low level, the device keeps in the operation ready state and IGBT output is prohibited.
Connector	It is a special read-only parameter that records data during operation of HCU-40/41. The read-only parameters can be read through specific source. You can also record the data change waveform through the oscilloscope.
Bit connector	It is a connector parameter that records one piece of bit data. The values are 0 and 1.
B connector	Bit connector
Word connector	It is a connector parameter that records one piece of analog data.
K connector	Word connector
Reference source parameter	It is a special parameter. The value of the connector parameter can be read for control by HCU-40/41 by setting the number of the connector parameter.
Bit reference source parameter	A reference source parameter of one bit connector is read and one piece of bit data is output.

Term	Meaning
Word reference source parameter	A reference source parameter of one word connector is read and an analog value is output.
Terminal start/ stop module	Used to start or stop the drive through terminals.
Motorized potentiometer	Refers to the virtual potentiometer implemented by software. The value of motorized potentiometers can be adjusted by the UP/DOWN commands.

Note

References to "word" and "bit" in this guide indicate the length of the data information, such as word connectors, bit connectors, and control words.

- "bit" refers to the bit information and its value is 0 or 1.
- "word" refers to a 16-bit message and its value range is 0 to 65535 as an unsigned number or -32768 to +32767 as a signed number.

Service and Support

Should you encounter a safety accident during the use or operation of the product, or face challenges in operating and maintaining the equipment, which remain unresolved after the relevant documentation is consulted, we provide multiple channels to ensure prompt resolution:

- Channel #1: Contact service@inovance.com.
- Channel #2: Visit https://www.inovance.com/global to access document downloads, after-sales support, spare parts ordering, repair applications, and authenticity verification services.
- Channel #3: Download My Inovance app (https://zshc-eu.inovance.com/download-pc/) where you can access products info and documentation, and query product parameters.

We are committed to providing you with quick and professional technical support, and we look forward to your satisfaction and trust.

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