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MD880-61 Series Single-Phase Braking Unit

User Guide

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

Data code 19012239A06

Preface

Introduction

The MD880-61M series single-phase braking modules offer comprehensive protective functions, including protection against overcurrent, overvoltage, overtemperature, as well as open circuit and short circuit of braking resistors. You can set the braking start/stop voltage and braking rate. You can also use the master/slave configuration to meet the braking requirements of high-power starters. During braking, due to the mechanical inertia of the load, kinetic energy is converted to electrical energy which is fed back to the drive, causing the drive DC bus voltage to rise. To ensure uninterrupted operation, a braking unit is essential. The regenerative energy can be dissipated through the braking resistor, preventing the drive from shutting down due to overvoltage protection. These single-phase braking units mainly apply to applications where AC drives or servo drives (collectively referred to as drives) require rapid speed reduction, positioning, or braking.

This guide describes the product information, mechanical installation, electrical installation, and routine maintenance. For details of parameters and fault codes, see the *MD880-61 Series Single-Phase Braking Unit Parameter* (data code: 19012489).

Note

- The drawings in this 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 Data

Name	Data Code	Description
MD880-61 Series Single-Phase Braking Unit Parameter Guide	19012489	Describes the parameters and fault codes of the product.
MD880-61 Series Single-Phase Braking Unit User Guide (this guide)	19012239	Describes the product information, mechanical installation, electrical installation, and routine maintenance.

Revision History

Date	Version	Description
November 2024	A06	Revised for improvement.
March 2024	A05	**Deletion:** • Deleted the "Parameter List" section. • Deleted the "Fault List" section. **Update:** • Minor error corrections. • Updated the company address on the back cover.
December 2022	A04	Updated Section 5.2 "Fault List".
June 2021	A03	Added warning signs; modified the parameter list.
November 2020	A02	Minor error corrections.
May 2020	A01	Changed the printing style to saddle stitching.
October 2019	A00	First release.

Access to the Guide

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

- **Inovance website:** Visit *www.inovance.com*, go to Support > Download, search by keyword, and then download the PDF file.
- **QR code**: Scan the QR code on the product with your smart phone.
- **My Inovance app:** Scan the QR code below to install the My Inovance app, and search for the file in the app.

Warranty

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. A maintenance fee will be charged beyond the warranty period.

Even in the warranty period, a maintenance fee will be charged for repair of the following damage:

- Damage caused by operations not following the instructions in the guide
- Damage caused by fire, flood, or abnormal voltage
- Damage caused by unintended use of the product
- Damage caused by use beyond the specified scope of application of the product
- Damage or secondary damage caused by force majeure (such as natural disaster, earthquake, and lightning strike)

The maintenance fee will be charged according to our latest Price List if not otherwise agreed upon.

For details, see the Product Warranty Card.

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Safety Precautions

Safety Disclaimer

- This chapter provides essential safety instructions for proper use of the product. Before using this product, read through the user guide, especially the safety instructions. Failure to observe the safety instructions may result in equipment damage, personal injuries, or even death.
- "DANGER", "WARNING", and "CAUTION" items in this guide do not indicate all safety precautions that need to be followed; instead, they just supplement the safety precautions.
- 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 injuries or property damage caused by improper usage.

Safety Categories and Definitions



indicates that failure to comply with the notice will result in severe personal injuries or even death.



indicates that failure to comply with the notice may result in severe personal injuries or even death.



indicates that failure to comply with the notice may result in minor or moderate personal injuries or equipment damage.

Safety Precautions

- Some drawings in the guide show the product without covers or protective guards to display more details. Remember to install the covers or protective guards as specified first, and then perform operations in accordance with the instructions.
- Product illustrations in this guide are for reference only. Actual products may vary.
- Operators must take mechanical precautions to protect personal safety and wear protective equipment, such as anti-smashing shoes, safety clothing, safety glasses, protective gloves, and protective sleeves.

Unpacking



- Do not install the equipment if you find damage, rust, or signs of use on the equipment or accessories upon unpacking.
- Do not install the product if you find water seepage or any components being missing or damaged upon unpacking.
- Do not install the equipment if you find the packing list does not conform to the equipment you received.



- Check whether the packing is intact and whether there is damage, water seepage, dampness, and deformation before unpacking.
- Unpack the package in accordance with the package sequence. Do not hit the package with force.
- Check whether there is damage, rust, or signs of bumping on the surface of the equipment and equipment accessories before unpacking.
- Check whether the package contents are consistent with the packing list before unpacking.

Storage and Transportation



- Large-scale or heavy equipment must be transported by qualified professionals using specialized hoisting equipment. Failure to comply may result in personal injuries 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 injuries or equipment damage.
- Never stand or stay below the equipment when the equipment 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 may result in personal injuries or equipment damage.



- Handle the equipment with care during transportation and mind your steps to prevent personal injuries 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 may result in personal injuries.
- Store and transport the equipment based on the storage and transportation requirements. Failure to comply will result in equipment damage.
- Avoid storing or transporting the equipment in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Avoid storing the product for more than three months. When the product needs to be stored for an extended period, take more strict protection and necessary inspection.
- Pack the equipment strictly before transportation. Use a sealed box for long-distance transportation.
- Never transport the product with devices or materials that may damage or negatively impact the product.

Installation



- The equipment must be operated only by professionals with electrical knowledge. Non-professionals are not allowed to perform operations on the equipment.



- Read through the guide and safety instructions before installation.
- Do not install this equipment in places with strong electric or magnetic fields.
- Before installation, check that the mechanical strength of the installation site can bear the weight of the equipment. Failure to comply will result in mechanical hazards.
- Do not wear loose clothes or accessories during installation. Failure to comply may result in electric shock.
- When installing the equipment in a closed environment (such as a cabinet or casing), use a cooling device (such as a fan or air conditioner) to cool the environment down to the required temperature. Failure to comply may result in equipment over-temperature or fire.
- 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 final assembly, fireproof enclosure providing both electrical and mechanical protections must be provided. The IP rating must meet IEC standards and local laws and regulations.
- Before installing devices with strong electromagnetic interference, such as a transformer, install a shielding device for the equipment to prevent malfunction.
- Install the product on an incombustible object, such as metal, and do not touch or attach the product to combustibles. Failure to comply may result in fire accidents.



- Cover the top of the equipment 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 equipment and causing faults. After installation, remove the cloth or paper on the top of the equipment 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, and component replacement must be performed only by professionals. • Before wiring, cut off all the power supplies of the equipment. Wait for at least the time designated on the equipment warning label before further operations because residual voltage still exists after power-off. Measure the DC voltage in the main circuit and ensure the DC voltage is in the safe range. Failure to comply will result in electric shock. • Do not perform wiring, remove the equipment cover, or touch the circuit board while power is on. Failure to comply will result in electric shock. • Check that the equipment is grounded properly. Failure to comply can result in electric shock.
 • Do not connect the input power supply to the output end of the equipment. Failure to comply can result in equipment damage or even fire. • When connecting a drive to a motor, check that the phase sequences of the drive and motor terminals are consistent to prevent reverse motor rotation. • Cables used for wiring must meet cross-sectional area and shielding requirements. The shield of the cable must be reliably grounded at one end. • Fix the terminal screws with the tightening torque specified in the guide. Improper tightening torque may overheat or damage the connecting part, resulting in fire. • After wiring, check that all cables are connected properly and no screws, washers, or exposed cables are left inside the equipment. Failure to comply may result in electric shock or equipment damage.
 • During wiring, follow proper electrostatic discharge (ESD) procedures and wear an anti-static wrist strap. Failure to comply can result in damage to the equipment or internal product circuits. • Use shielded twisted pairs for the control circuit. Connect the shield to the grounding terminal of the equipment for grounding purpose. Failure to comply will 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 product requirements to prevent product damage or even fire.
- After power-on, do not open the cabinet door or protective cover of the equipment, touch any terminal, or disassemble any unit or component of the equipment. Failure to comply will result in electric shock.



- Perform a trial run after wiring and parameter setting to ensure 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 fire accidents.
- Before power-on, check that no one is near the equipment, motor, or machine. Failure to comply may result in personal injuries or even death.

Operation



- The equipment must be operated only by professionals. Failure to comply can result in personal injuries or even death.
- Do not touch any terminal of the device or remove any part of the device during operation. Failure to comply will result in electric shock.



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

Maintenance



- Equipment installation, wiring, maintenance, inspection, and component replacement must be performed only by professionals.
- Do not maintain the equipment while power is on. Failure to comply can result in electric shock.
- Before maintenance, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.
- In case of a permanent magnet motor, do not touch the motor terminals even after power-off because there is still induced voltage generated during rotation. Failure to comply will 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, and component replacement must be performed only by professionals.
- Do not repair the equipment while power is on. Failure to comply can result in electric shock.
- Before inspection and repair, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.



- Submit the repair request according to 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 designated on the equipment warning label before power-on or further operations. Failure to comply may result in equipment damage, personal injuries, or even death.
- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- Replace quick-wear parts of the equipment in according with the replacement instructions.
- Do not perform operations on damaged equipment. Failure to comply may result in severe equipment damage, personal injuries, or even death.
- After the equipment is replaced, check the wiring and set parameters again.

Disposal
WARNING • Dispose of retired equipment in accordance with local regulations and standards. Failure to comply may result in property damage, personal injuries, or even death. • Recycle retired equipment by observing industry waste disposal standards to avoid environmental pollution.

Safety Signs

To ensure safe operations, comply with safety signs on the device and do not damage or remove the safety signs. See the following table for descriptions of the safety signs.

To ensure safe operation, comply with equipment-related safety signs. See the following table for descriptions of the safety signs.

Safety Sign	Description
	• Read through the safety instructions before operating the equipment. Failure to comply may result in equipment damage, personal injuries, or even death. • Do not touch the terminals or remove the cover while power is on or within 10 minutes after power-off. Failure to comply will result in electric shock.

1 Product Information

1.1 Model Number and Nameplate

MD880 - 61M – 0400 - 7
① ② ③ ④

① **Product series** MD880: MD880 series	③ **Rated braking power** 0400: 404 kW
② **Module name** 61M: Single-phase braking unit	④ **Voltage class** 7: 690 VAC system

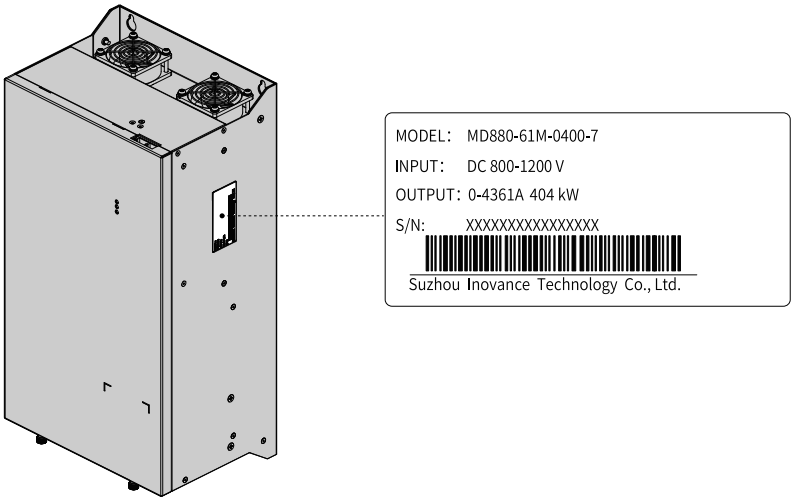


Figure 1-1 Nameplate of the single-phase braking module

1.2 Technical Specifications

Table 1–1 MD880 series single-phase braking unit model and technical specifications

Product Model	Min. Braking Resistance (Rmin) (Ω)	No Overload		1 min/5 min[1] Overload		10s/60s[2] Overload	
		I rms (A)	P cont (kW)	I rms (A)	P br (kW)	I rms (A)	P br (kW)
MD880-61M-0400-7	2.72	131	147	267	298	361	404

1.3 Load Curve

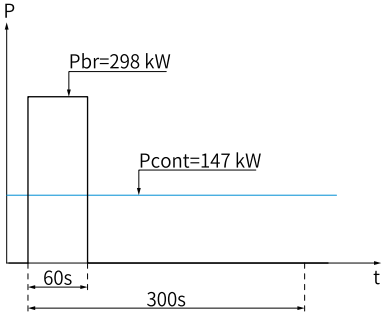


Figure 1-2 1 min/5 min load curve

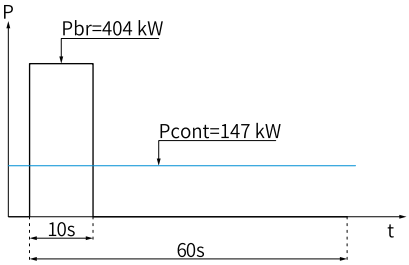


Figure 1-3 10s/60s load curve

1.4 Operating Principle

The braking unit consumes the electric energy fed back from the external load to the drive to limit the voltage of the drive within a secure range, which ensures the normal operation of the drive. The following diagram shows the operating principle.

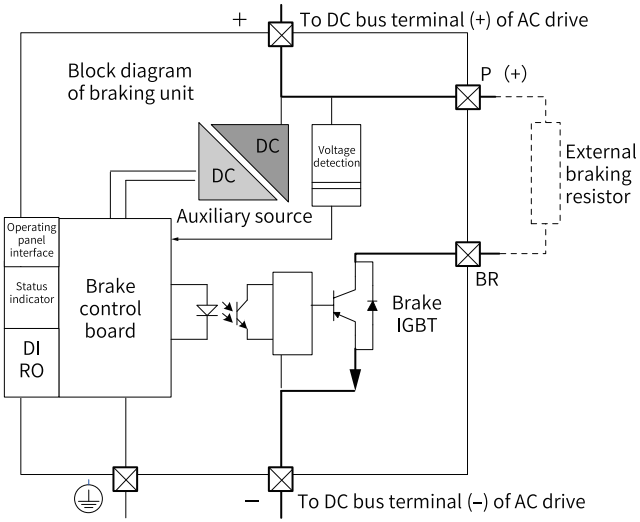


Figure 1-4 Application schematics of the braking unit

Before normal operation of the braking unit, set the braking start voltage (A5-07) and braking stop hysteresis voltage (A5-08) based on the AC power supply voltage class of the drive. The following diagram shows the voltage relationship.

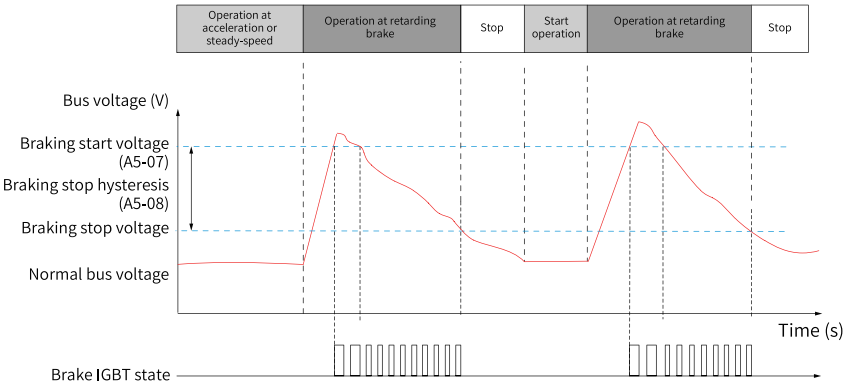


Figure 1-5 Operation schematics of MD880 series single-phase braking unit

As shown in the operation schematics:

- Braking start voltage > Braking stop voltage > Normal bus voltage.
- When the braking unit is in the master mode, the control circuit detects the bus voltage in real time. If the bus voltage reaches the set braking start voltage, the braking IGBT

starts to work and discharges the electricity in the main capacitor of the drive through the external braking resistor until the bus voltage drops below the braking stop voltage.

1.5 Product Dimensions

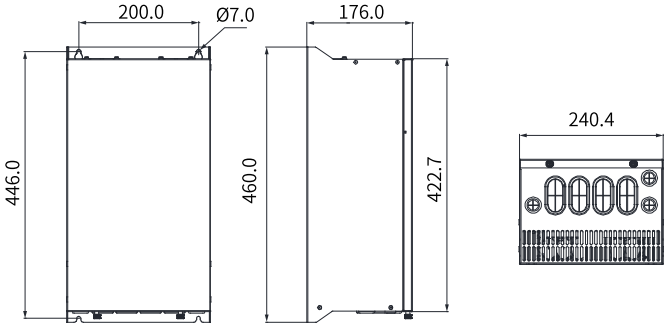


Figure 1-6 Braking unit outline and installation dimensions (unit: mm)

1.6 Selection of Braking Units and Braking Resistors

1.6.1 Selecting a Braking Unit

Basis for selecting a braking unit

Select a braking unit based on the following principles.

- Select a braking unit with voltage class matching the input voltage class of the drive.
- Select a braking unit with power rating matching the power required by the drive.

Power of the braking unit

The power of the braking unit (Pb_{max}) must be higher than the braking power required by the drive (P_{max}).

Pbmax represents the maximum power of the braking unit under the following two conditions:

- 1 min/5 min overload condition (1 min braking, 4 min stopped)
- 10s/60s overload condition (10s braking, 50s stopped)

If the actual braking cycle is different from the reference cycle, the maximum braking power (Pbr) must be defined bases on these criteria:

- The braking energy delivered within 5 min must be less than the energy delivered within the reference braking cycle: $n \times Pbr \times Tbr < Pbr_{max} \times 5\ min$
- The braking power is less than the maximum braking power within the reference cycle: $Pbr < Pbr_{max}$

See details in the following table.

Item	Description
n	Number of braking pulses within 5 min
Pbr	Maximum braking power allowed
Tbr	Braking time
Pbr_{max}	Maximum braking power within reference cycle

If the braking power is unknown, estimate the braking power based on this formula: Pb = P x Td x K.

See details in the following table.

Item	Description
Pb	Braking power
P	Motor power
K	Mechanical energy conversion efficiency (typically K = 0.7)
Td	Ratio of braking torque to rated torque of the motor. The value of Td varies with the system: • Elevators, hoists, and cranes: 100% • Unwinding/Winding devices: 120% • Large-inertia devices that require quick stop: 120% • Ordinary inertia load: 80%

1.6.2 Selecting a Braking Resistor

Resistance of the braking resistor

During braking, most regenerative energy of the motor is dissipated by the braking resistor.

The required resistance of the braking resistor can be calculated according to the formula "U x U/R = Pb", as detailed in the following table.

Item	Description
U	Braking voltage during stable braking of the system. The value of U varies with the system: • 220 VAC system: 380 V • 380 VAC system: 700 V • 690 VAC system: 1100 V

Power of the braking resistor

In theory, the power of the braking resistor is the same as the braking power, but generally the power should be derated to 70% during actual use, as shown in the following formula.

The power of the braking resistor can be calculated according to the formula "0.7 x Pr = Pb x ED", as detailed in the following table.

Item	Description
Pr	Power of the braking resistor
ED	Braking frequency (ratio of the braking process to the whole working process), which varies with the system: • Elevators: 20% to 30% • Winding/Unwinding machinery: 20% to 30% • Hoisting machinery: 50% to 60% • Centrifuges: 50% to 60% • Injection molding machines: 5% to 10% • Occasional braking load: 5% • Normally, the value is 10%.

2 Mechanical Installation

2.1 Installation Environment Requirements

- The environment requirements for the braking unit and the drive are the same. The ambient temperature and humidity the braking unit cannot exceed the permitted range of the design, as shown in the following table.
- Install the braking unit and external braking resistor on the surface of incombustible objects with sufficient space reserved for heat dissipation.
- Install at a place free from corrosive, explosive, and combustible gases.
- Ensure that the installation environment is free from excessive dust and metal powder.

Table 2–1 Environment requirements for the MD880 series single-phase braking unit

Operating Condition	Requirement
Altitude	⩽ 1000 m; derate by 1% per 100 m above 1000 m; maximum altitude 3000 m
Ambient temperature	−10°C to +40°C; derate by 1% per 1°C increase above 40°C; maximum ambient temperature 50°C
Humidity	< 95% RH, non-condensing
Vibration	< 10 m/s^2 (1 · g)
Storage temperature	−20°C to +60°C
Pollution degree	2
Cooling method	Air cooling
Protection rating	IP20

2.2 Installation Space Requirements

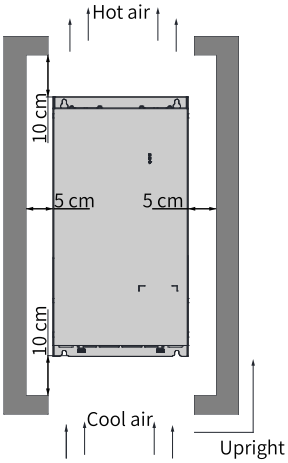


Figure 2-1 Installation space of the braking unit

2.3 Installation Precautions

- Install the braking resistor in a place with good ventilation. The braking resistor will be heated when consuming the regenerative energy generated during braking.
- Install the braking unit vertically to facilitate heat dissipation. Do not lay it upside-down or horizontally.
- If multiple braking units are connected to the drive, it is recommended to install them side by side. In applications requiring braking units to be installed in rows, install an air guide plate to prevent damage that may occur due to heat dissipated from the lower row to the upper row.
- Make sure that the distance between the braking unit and the drive or other electrical equipment meets the requirements shown in *"Figure 2–1 Installation space of the braking unit" on page 21*.

3 Electrical Installation

Remove the braking unit cover and then wire the main circuit and control circuit of the braking unit.

3.1 Terminal Layout

3.1.1 Main Circuit Terminals

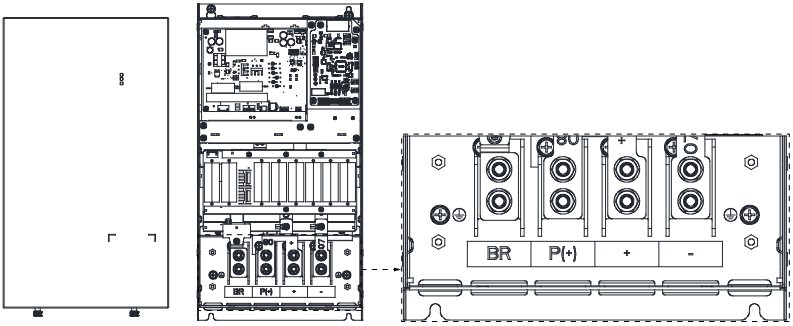


Figure 3-1 Power terminal layout of the braking unit

Table 3–1 Functions of power terminals

Terminal Mark	Name	Description
+, –	DC bus positive and negative terminals	Connected to the common DC busbar
P(+), BR	Braking resistor connection terminals	Connected to the braking resistor
⏚	Grounding terminal	Grounding terminal

3.1.2 Control Circuit Terminals

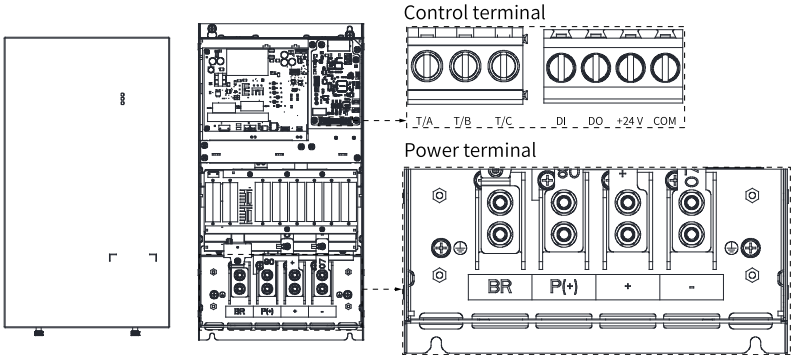


Figure 3-2 Control terminal layout of the braking unit

Terminal Mark	Name	Description
DI	Digital input	Input inhibited upon external faults
TA/TB/TC	Relay fault signal output	Normally open/Normally closed contact that acts upon braking unit faults
COM	Common terminal	Reference GND of internal auxiliary power supply

The following figure shows the internal equivalent circuit of the control signal terminal.

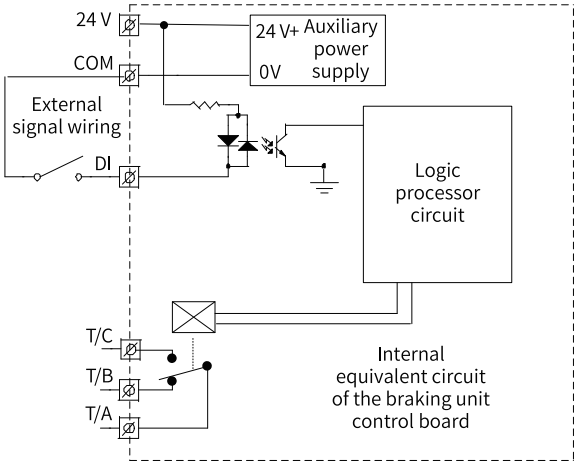


Figure 3-3 Internal equivalent circuit of the control signal terminal

3.2 DIP Function

The following figure shows where the DIP switches are located.

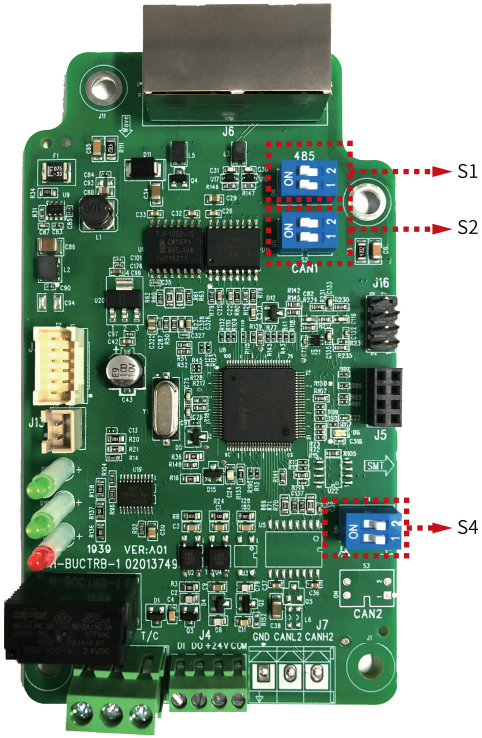


Figure 3-4 Position of the DIP switches

Table 3–2 DIP function of the braking unit

Terminal Mark	Name	Description
S1	RS485 termination resistor	Set 1 and 2 of the DIP switch to ON when connecting the braking unit to the operating panel.
S2	CAN1 termination resistor	Set 1 and 2 of the DIP switch on the first and the last units to ON when two or more braking units are connected in parallel.
S4	Master/Slave selection	The slave applies when you set 1 and 2 of the DIP switch to ON. Otherwise, the master applies.

3.3 Braking Unit Wiring Schemes

Standard wiring scheme 1 (single machine scheme)

- Install a fuse to where the bus is connected when using the braking unit.
- TA/TB/TC on the drive side are used for relay fault signal output of the drive, and TA/TB/TC on the braking unit side are used for relay fault signal output of the braking unit.
- The temperature switch is a NC temperature switch used for overtemperature protection of the braking resistor.
- The input voltage class of the contactor control coil is 220 VAC.

See the single-machine wiring scheme in the following figure.

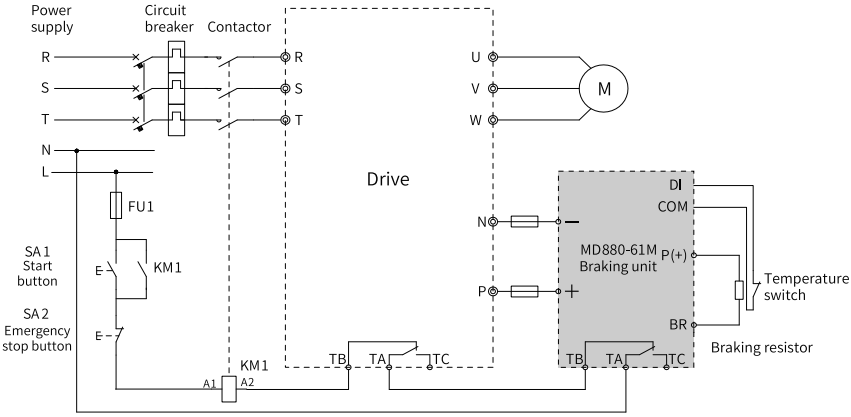


Figure 3-5 Single-machine wiring scheme

Standard wiring scheme 2 (parallel scheme)

- Each braking unit must be configured with a separate fuse.
- Each braking unit must be equipped with a separate braking resistor. Do not connect the output terminals of the braking unit together.
- This wiring scheme is applicable to scenarios where multiple braking units are connected in parallel. Wire the braking resistor and temperature switch based on Standard wiring scheme 1.
- The input voltage class of the contactor control coil is 220 VAC.
- One of the braking units must be set as the master and the other braking units must be set as the slaves. The master and slaves must be connected in the ring mode using network cables.
- The maximum number of paralleled units is 6.

See the parallel wiring scheme in the following figure.

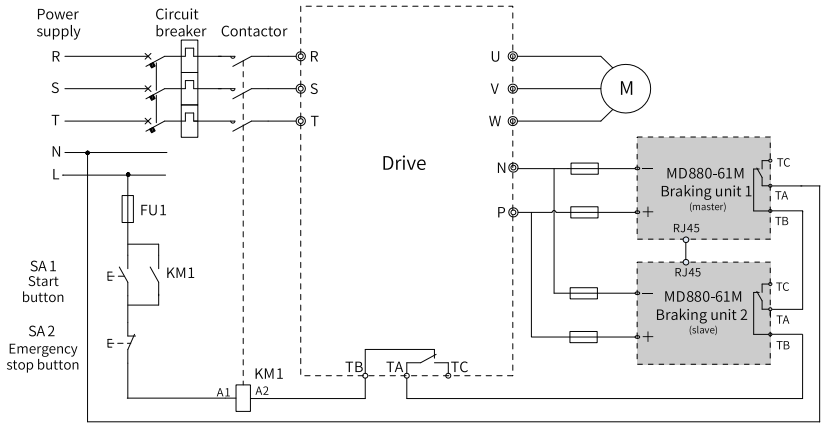


Figure 3-6 Parallel wiring scheme

3.4 Recommended Power Cables and Fuses

See the following table for recommended power cables and fuses.

Product Model	Rmin (Ω)	Cable (Copper)	DC fuse			
		Single-Conductor (mm^2)	Model	Quantity	U_n (V)	I_n (A)
MD880-61M-0400-7	2.72	70	170M5146	2	1250	630

4 Commissioning

4.1 SOP-20-880 Smart Operating Panel

The braking unit can be equipped with an external SOP-20-880 smart operating panel, which allows you to set parameters, monitor status, and locate fault causes, and other operations like USB relay or mass storage. See the following figure for connection between the SOP-20-880 and braking unit.

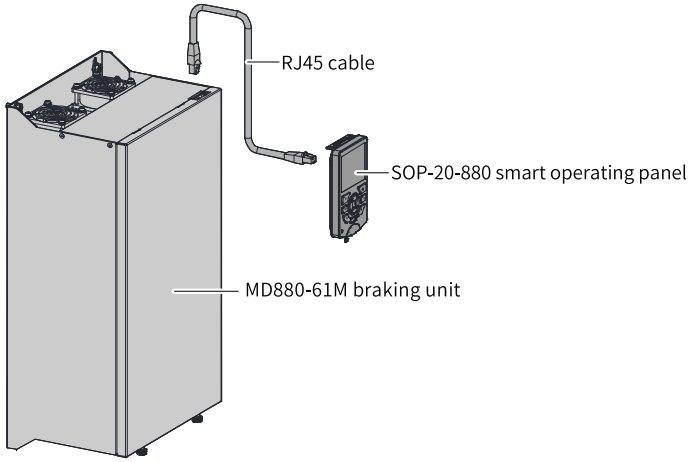


Figure 4-1 Connecting the operating panel

4.1.1 Components

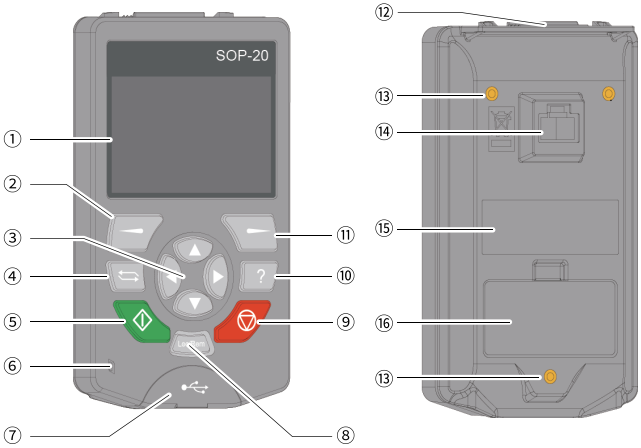


Figure 4-2 Appearance and keys of SOP-20-880

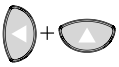
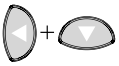
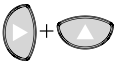
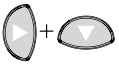
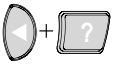
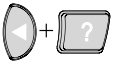
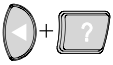
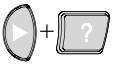
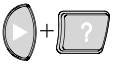
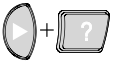
Table 4–1 SOP-20-880 components

No.	Name
①	Display
②	Left soft key
③	Arrow key
④	Shift key
⑤	Run key
⑥	Status indicator
⑦	USB port
⑧	LOC/REM switchover key
⑨	Stop/Reset key
⑩	Help key
⑪	Right soft key
⑫	Snap-fit joint
⑬	Fixing screw
⑭	RJ45 port
⑮	Nameplate
⑯	Battery cover

Table 4–2 Description of the keys

Key	Name	Description
	Left soft key	Used for exit or cancellation. This key is located on the left below the display. It corresponds to different functions in different situations. On the home page, pressing this key enters the device list.
	Right soft key	Used for enter or confirmation. This key is located on the right below the display. It corresponds to different functions in different situations. On the home page, pressing this key enters the menu page.
	Shift key	Used to quickly enter the device list. On pages that do not allow operations to be interrupted, quick device switchover is not allowed and this key is disabled.
	Help key	Used to open the help page. The content on the help page depends on the context, such as the current menu or page.
	Run key	Used in the local control mode to start the device.
	Stop/Reset key	Used in the local control mode to stop the device. When the device is in the fault state, use this key to reset the fault.
	LOC/REM switchover key	Used to switch the control permission of the device. Local: The device start/stop is controlled by SOP-20-880. Remote: The device start/stop is controlled by the parameters and functions of the device.
	Arrow key	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 a 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 4–3 Shortcuts

Shortcut	Illustration	Applicable Page	Function
Left+Up		All	Adjusts the backlight brightness.
Left+Down			
Right+Up		All	Adjusts the contrast ratio.
Right+Down			
Left+Help		Parameter list	Adds the parameter that the cursor is directed at to the quick commissioning page.
Left+Help		Quick commissioning	Deletes the parameter from the quick commissioning page.
Left+Help		Startup screen	Deletes the parameter from the startup screen.
Right+Help		Parameter list	Adds the parameter that the cursor is directed at to the startup screen.
Right+Help		Quick commissioning	Clears all parameters from the quick commissioning page.
Right+Help		Startup screen	Clears all parameters from the startup screen.

4.1.2 Display

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

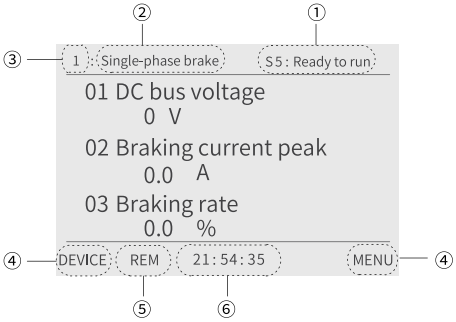


Figure 4-3 Homepage

Table 4–4 Descriptions of the homepage

No.	Display	Description
①	Device status and fault information	Displays information about the operation status of the device, including the state machine, fault, and alarm. When a fault occurs on the device, the fault information blinks and the operation status is no longer displayed.
②	Name of the controlled device	Displays the name of the device being controlled by SOP-20-880.
③	ID of the controlled device	Displays the ID of the device being controlled by SOP-20-880.
④	Function selection key	DEVICE: Displays the device list. MENU: Displays the menu list. SELECT: Selects an item. OK: Confirms the prompt. BACK: Returns to the previous menu.
⑤	Local/Remote switchover key	LOC: The device is controlled by SOP-20-880 (local control). REM: The device is controlled by I/O or bus (remote control). Blank: This function is unavailable on the device.
⑥	Internal clock time of the controller	Displays the clock time in the device controller.

4.1.3 Status Indicator

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

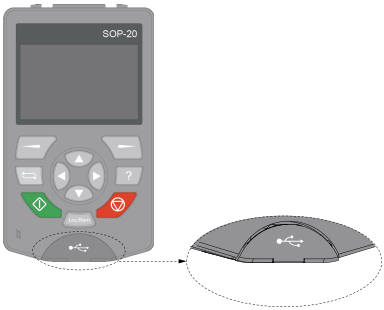
Table 4–5 Status indicator

Indicator	Illustration	Meaning
Green light steady ON		The equipment is running properly.
Green light flashing		Data is being transmitted between the SOP-20-880 and PC with USB.
Red light steady ON		Communication between SOP-20-880 and equipment is normal, but the equipment is faulty.
Red light flashing		Communication between SOP-20-880 and equipment is interrupted.

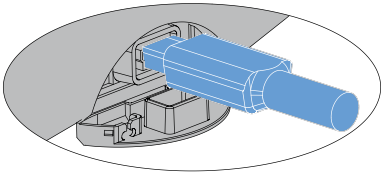
4.1.4 Connection to PC in Relay Mode

The type-B mini USB port on the lower part of SOP-20-880 is used to connect to PC. The connection cable cannot exceed 3 m. Communication between SOP-20-880 and PC is implemented using the USB 2.0 communication protocol.

1. Open the USB port cover.

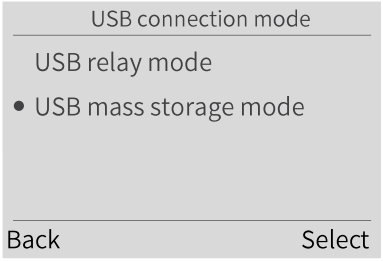


2. Insert a USB cable with ferrite core (recommended) and connect the cable to the PC.



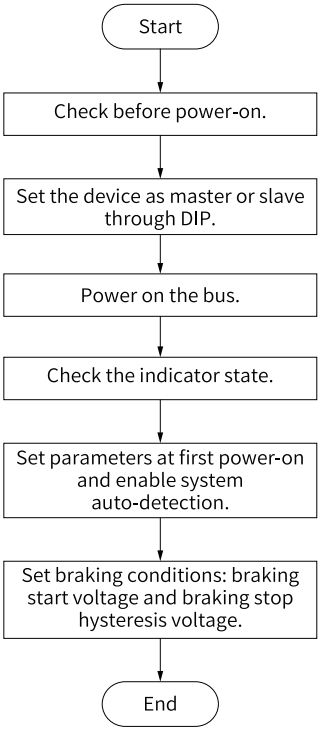
3. After SOP-20-880 is connected to the PC through the USB cable, the USB relay mode and the USB mass storage mode are displayed for selection.

- 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".
- When "USB mass storage" is selected, SOP-20-880 can be used for storage.



Note

For details about how to use SOP-20-880, see the *SOP-20-880 Smart Operating Panel User Guide*.



4.2 Wiring Check Before Power-on

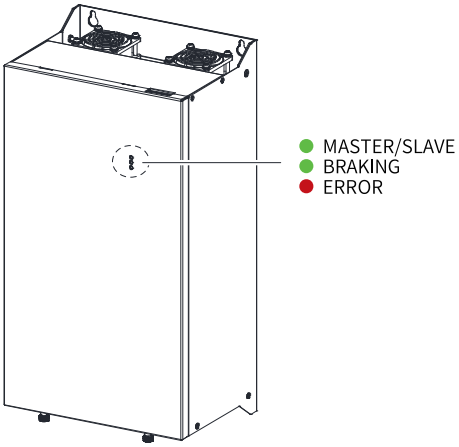
No.	Check Item	OK
1	Ensure that the user power line voltage range matches the braking unit voltage class.	☐
2	Check that the incoming line specifications and fuse specifications meet the requirements.	☐
3	Check that the bus input wiring (+/–) is wired properly.	☐
4	Check that the braking unit is connected to the resistor (P(+)/R) properly.	☐
5	Check the bus input (+/–) to ground and resistor (P(+)/R) to ground to prevent short circuit.	☐
6	Check the CAN/RS485 communication cable to ground to prevent short circuit.	☐
7	Check that the brake resistor temperature switch is wired properly.	☐

4.3 Master/Slave Setting Through DIP Switch

Terminal Mark	Name	Description
S1	RS485 termination resistor	Set 1 and 2 of the DIP switch to ON when connecting the braking unit to the operating panel.
S2	CAN1 termination resistor	Set 1 and 2 of the DIP switch on the first and the last units to ON when two or more braking units are connected in parallel.
S4	Master/Slave selection	The slave applies when you set 1 and 2 of the DIP switch to ON. Otherwise, the master applies.

4.4 LED Status Indicator

The following figure shows the panel of the braking unit.



See the following table for the meaning of the indicators.

Indicator		Meaning
MASTER/SLAVE	Flashing	The LED flashes quickly when the braking unit is a slave. The LED flashes slowly when the braking unit is in auto-detection/test mode.
	ON	The braking unit is the master.
BRAKING	OFF	The braking unit is in the stop state.
	ON	The braking unit is in the operational state.

Indicator		Meaning
ERROR	OFF	There is no fault or warning.
	Flashing	The LED flashes slowly when the braking unit is in the undervoltage state. The LED flashes quickly when there is no fault but a warning.
	ON	There is a fault.
Three LEDs flash simultaneously.		The device is being called.

4.5 Parameter Setting at First Power-on

Auto-detection

It is recommended that system auto-detection be performed before use for the first time. This is to check whether the braking unit and peripherals are connected properly and measure the resistance of the braking resistor.

When using the braking unit for the first time, connect the braking unit to the drive and braking resistor properly. Then power on the drive to energize the braking unit.

See the following table for auto-detection parameters.

Parameter	Name	Description
A5-10	Auto-detection/test mode enable	0: Disable 1: Enable
A5-13	Auto-detection mode	0: No operation 1: Braking resistance detection
A5-14	Auto-detection request	0: No operation 1: Request
A5-15	Braking resistance measured value	0.00 to 655.35

Set in the preparation state:

1. Check that the braking unit is not faulty and is in S5 (ready to run) state.
2. Set A5-10 to 1 to enable auto-detection /test mode.
3. Set A5-13 to 1 to detect the braking resistance.
4. Set A5-14 to 1 and auto-detection starts. After the auto-detection is done, the braking unit enters S5 (ready to run) state, and A5-15 displays the braking resistance measured value.
5. Set A5-10 to 0 to make the braking unit exit from the auto-detection mode and enter the master/slave operation mode.

Setting the actuating threshold of the braking unit

Before normal operation of the braking unit, set the braking start voltage and braking stop hysteresis voltage properly. The relationship between the actuating threshold of the braking unit and the duty cycle is shown below.

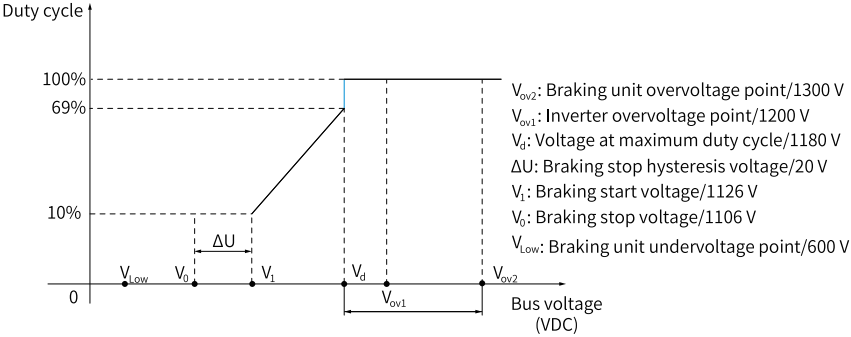


Figure 4-4 Actuating threshold of the braking unit and the duty cycle

See the following table for parameters of the actuating threshold.

No.	Parameter	Description
1	A5-07	Used in the stop state to set the braking start voltage (V1).
2	A5-08	Used in the stop state to set the braking stop hysteresis voltage (ΔU).
3	A8-08	Used to copy parameters from RAM to ROM<1>.

5 Parameter Categories

Parameters of the braking unit are grouped by function and displayed in three levels: Axx-nn.

- A indicates the level-I menu, which is represented by a letter, corresponding to a group of functions.
- xx indicates the level-II menu, which is represented by one or two digits, corresponding to the function category when combined with level-I menus.
- nn indicates the level-III menu, which is represented by a 2-digit number, corresponding to a specific parameter when combined with level-I and level-II menus.

Level-I Menu No.	Level-I Menu Name	Level-II Menu No.	Level-II Menu Name
A	System	A0	Status monitoring
		A1	Faults and alarms
		A2	Drive information
		A4	Power unit control
		A5	Brake control
		A6	Advanced parameters for brake control
		A8	Environment setting
		A10	Commissioning software and operating panel
F	Input and output	F0	DI
		F1	RO
H	Faults and protection	H0	Troubleshooting
		H1	Fault protection levels
		H2	Current fault record
		H3	Latest fault record
		H4	2nd latest fault record
		H5	3rd latest fault record
		H6	4th latest fault record
		H7	5th latest fault record
		H8	Monitoring parameters
U	Connector	U0	Bit connector 1
		U1	Bit connector 2
		U5	Word connector 1
		U9	Double-word connector 1

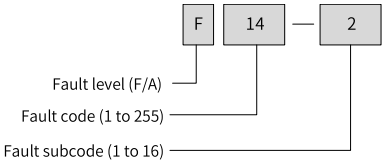
6 Troubleshooting

6.1 Viewing Fault Information

Depending on the degree of urgency, failures can be divided into faults and alarms:

- Fault: Indicates that a major fault or error has occurred and the device stops running immediately.
- Alarm: Indicates that an alarm has occurred, which does not affect the operation state. You can handle alarms as needed.

Fault codes are represented by three segments, in which F represents Fault, and A represents Alarm, as shown below:



Faults are represented by fault code and fault subcode:

- Fault code: Indicates the fault category.
- Fault subcode: Indicates the specific fault.

Current faults

Faults activated currently can be viewed through parameters in group A1.

The braking unit 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.

Parameter	Meaning
A1-00 to A1-17	Current faults
A1-36 to A1-53	Current alarms

Previous faults and fault data

The braking unit records the information, time, and operation data upon occurrence of the latest six faults.

Parameter	Meaning
Group H2	Information and data of the current fault
Group H3	Information and data of the latest fault
Group H4	Information and data of the 2nd latest fault
Group H5	Information and data of the 3rd latest fault
Group H6	Information and data of the 4th latest fault
Group H7	Information and data of the 5th latest fault

Viewing faults through SOP-20-880

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

Function	Key	Description
Viewing current faults	Key operations	Choose "Menu" > "Fault state" > "Current fault".
Viewing the current alarm	Key operations	Choose "Menu" > "Fault state" > "Current alarm".
Viewing fault-related help information		Select a fault and press this key, and the help information related to the fault will be displayed.
Viewing previous faults	Key operations	Choose "Menu" > "Fault state" > "History faults".

Viewing faults through InoDriveStudio

- When using InoDriveStudio, you can access the fault/alarm list to view faults.
- On the fault/alarm list screen, you can view the fault descriptions, fault causes and solutions, and data recorded when the fault occurs.

6.2 Fault Reset Methods

The braking unit provides four fault reset methods, as described in the following table.

Fault Reset Method	Description
Power cycle	Power off and on the device control board again to reset the fault.
SOP-20-880	After connection, press the STOP key on any interface to reset the fault.
InoDriveStudio	After connection, click the "Reset Current Fault" button in the fault/alarm list to reset the fault.
Parameter setting	Set A5-31 to 1 (Non-modifiable). Set A5-32 properly to enable automatic fault reset.

7 Maintenance

7.1 Daily Maintenance Checklist

The service life of components inside the braking unit is affected by the ambient temperature, humidity, dust, and vibration, which may result in potential faults and shorter service life. Therefore, it is necessary to carry out daily and periodic maintenance.

The following table lists the daily check items.

Table 7–1 Daily inspection checklist

No.	Check Item	OK
1	Check whether the installation environment of the braking unit changes.	☐
2	Check whether the cooling fan of the braking unit works properly.	☐
3	Check whether the barking unit vibrates improperly.	☐
4	Check whether the braking unit overheats.	☐

The following table lists the daily cleaning items.

Table 7–2 Daily cleaning checklist

No.	Cleaning Item	OK
1	Keep the braking unit clean all the time.	☐
2	Remove the dust, especially metal powder, on the surface of the braking unit, to prevent the dust from entering the braking unit.	☐
3	Remove the greasy dirt on the cooling fan of the braking unit.	☐

7.2 Periodic Maintenance Checklist

Perform periodic maintenance on the items that are difficult to check during daily operation and maintenance. The following table lists the periodic check items.

Table 7–3 Periodic inspection checklist

No.	Check Item
1	Check and clean the air filter periodically.
2	Check that all screws are secure.
3	Check whether the braking unit is corroded.
4	Check that terminals are free from arcing signs.
5	Perform insulation test on the main circuit.

Before measuring the insulation resistance with a megameter (500 VDC megameter recommended), disconnect the main circuit from the braking unit. Do not use an insulation resistance meter to test the insulation of the control circuit. The high voltage test is not required because it has been done before delivery.

7.3 Replacing Quick-Wear Parts

The quick-wear part of the braking unit is the cooling fan, whose service life is closely related to the operating environment and maintenance status.

Component	Service Life	Possible Cause	Criteria
Fan	2 to 3 years	• Bearing worn out • Blade aging	Check whether there is crack on the blade. Check whether there is unusual vibration noise at start.

7.4 Storing the Braking Unit

For temporary and long-term storage, observe the following requirements:

- Pack the equipment with the original packing box provided by Inovance whenever possible.
- Long-term storage degrades the electrolytic capacitor. Therefore, the unit must be energized once every two years, each time lasting for at least 5 hours. The input voltage must be increased slowly to the rated value with the regulator.

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