INOVANCE

User Guide

CV800 Three-in-One Drive for Bus Air Conditioners

A00

19010912

1

Safety Instructions

Installation

DANGER

- Do not install the drive if you find water seepage, component missing or damage upon unpacking.
- Install the drive on fire-resistant objects such as metal, and keep it away from combustible materials. Failure to comply may result in a fire.
- Do not use the drive with damage or missing components. Failure to comply may result in personal injury.

CAUTION

- Do not touch the components of the drive with your hands. Failure to comply may result in static electricity damage.
- Fix the drive and frame using the specified four holes to avoid drive damage caused by strong vibration.
- Install the drive in a position with good ventilation and heat dissipation to ensure the cooling effect during bus running and avoid overtemperature caused by sun exposure.
- Fix specified terminals with stainless steel screws when installing the drive.
- Before installing the cover plate, check that the seal ring is installed properly.
- Equip an overcurrent protector (recommended: 1000 V/70 A automotive fuse) at the high voltage input side to avoid a fire caused by equipment faults.

Wiring

DANGER

- Ensure that the power supply is cut off before wiring. Failure to comply may result in an electric shock.
- Ground the drive properly according to the requirements. Failure to comply may result in an electric shock.
- Never connect the power cable to output terminals (U, V, and W) of the drive. Check the terminal mark before wiring. Failure to comply will cause drive damage or even a fire.
- Install the cover plate of the drive properly before power-on to prevent electric shocks.

CAUTION

- Unreliable grounding or grounding failure will lead to the high pressure of the drive housing, which may result in personal injuries and failure of drive components.
- Use copper conductors of a proper size as power cable wirings according to the recommended values of power cable selection in this user guide.
- The specifications and installation method of main circuit cables must comply with local regulations and related IEC requirements.

Operation

DANGER

- Do not touch any input/output terminal and peripheral circuits of the drive. Failure to comply will result in an electric shock.
- Do not touch the drive shell for temperature detection. Failure to comply will result in heat injuries.
- After the drive is powered on, do not forcibly cut off external high voltage and low voltage power supply. Power off the bus and drive in sequence as required.

CAUTION

- Do not start or stop the drive using the contactor. Failure to comply may result in equipment damage.
- Do not change factory parameters of the drive without permission. Failure to comply may result in equipment damage.

Maintenance and Repair

DANGER

- Power off the drive before maintenance or repair. Failure to comply will result in an electric shock.

1. Product Information

The CV800 drive consists of three independent components, including the PLC, DC-DC unit, and AC drive. Internal communication is realized using CAN network.

It is specially designed for electric bus air conditioner with die-casting aluminum housing, which has excellent waterproof and dust-proof capability. The drive body excluding cooling fan meets with IP65 rating, and it can reach IP67 if seal capability tests/inspections (water/air tightness) are performed in INOVANCE.

■ Product Model Definition

CV800 - D 032 P

ID	Product Name
CV800	Three-in-one drive

ID	Voltage Class
D	250–880 VDC

ID	Description
P	Three-in-one with PLC

ID	AC Drive Output Current (A)	DC-DC Unit Output Current (A)
025	25	74
032	32	110

■ Technical Specifications

Item		Specification
AC drive		
Standard functions	Maximum output frequency	Vector control: 0–500 Hz; V/F control: 0–500 Hz
	Carrier frequency	0.8–12 kHz (adjusted automatically based on the load features)
	Input frequency resolution	Digital setting: 0.01 Hz; Analog setting: maximum frequency x 0.025%
	Control mode	Sensorless vector control (SVC) (synchronous motor); V/F control (asynchronous motor)
	Acceleration/ Deceleration curve	Straight-line or S-curve acceleration/ deceleration
		Four groups of acceleration/deceleration time ranging from 0.0 to 6500.0s
	Auto voltage regulation (AVR)	Keeps constant output voltage automatically when the mains voltage changes.
	Overvoltage/ Overcurrent stall control	Automatically limits the current and voltage during running to avoid frequent tripping due to overvoltage/overcurrent.
	Fast current limit	Reduces the overcurrent faults to the minimum and ensures normal running of the AC drive.
	Torque limit and control	Automatically limits the torque during running to avoid frequent tripping due to overcurrent and realizes torque control in feedback vector control (FVC) mode.
	Advanced commissioning software	Supports operations of AC drive parameters and virtual oscilloscope functions.
		Using the virtual oscilloscope function, the state inside the AC drive is monitored.
Running	Command source	Allows operation panel and CAN setting, which can be switched over in various ways.
	Frequency source	Allows digital setting and CAN setting, which can be switched over in various ways.

Item		Specification
Display and operation on the operating panel	LCD display	Optional, displayed in English or Chinese.
	Parameter copy	Allows quick parameter copy using the LCD operating panel (optional).
	Program download	Allows underlayer program download using the LCD operating panel.
Protection	Protection function	Provides motor short-circuit detection at power-on, output phase loss protection, overcurrent protection, overvoltage protection, undervoltage protection, overheat protection, and overload protection.
Communication	CAN	Supports CAN communication with SAE1939.
Load capacity	Full-load voltage range	For 220 V motor: 311–880 V For 380 V motor: 540–880 V
Output derating	Derating voltage range	For 220 V motor: 250–311 V For 380 V motor: 250–540 V
DC-DC unit		
Standard functions	Adjustable output voltage	Adjusts the output voltage in the range of 14 to 27.5 V.
	Two-channel output	Allows two-channel output with common ground.
	Fast current limit	Quickly limits current at startup of the brushed fan.
Display and operation on the operating panel	LCD display	Optional, displayed in English.
	Parameter modification program burning	Allows parameter modification and program burning.
Protection	Protection function	Provides overcurrent protection, overvoltage protection, undervoltage protection, overheat protection, and overload protection.
Communication	CAN	Supports CAN communication with SAE1939.
Load capacity	Full-load voltage range	380–800 V
Output derating	Derating voltage range	250–380 V, 800–880 V

Item		Specification
PLC		
I/O	Input terminal	9 digital inputs, 6 temperature inputs, and two analog inputs
	Output terminal	Five digital outputs, three relay outputs, and two analog outputs
	Electronic expansion valve	Four-wire/Six-wire 12 V/6 W electronic expansion valve (optional)
Communication	Communication	One channel for each of CAN, RS-485, and USB
Display and operation on the operating panel	LCD display	Optional, displayed in English.
	Monitoring and download	Allows status monitoring of I/O terminals and underlying and application program download.

■ Product Components

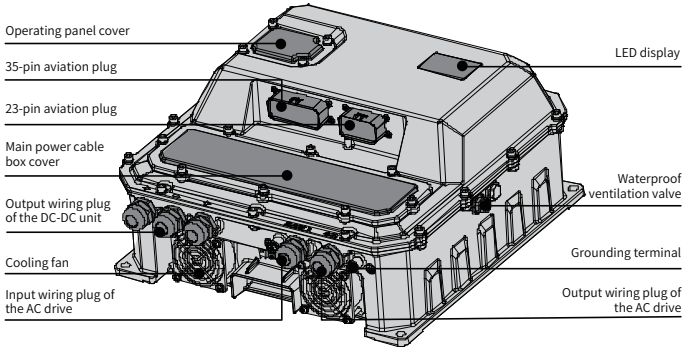


Figure 1 CV800 components

Component Name	Function Description
LED display	Displays the running state and fault information of the AC drive.
Operating panel cover	Covers the RJ45 and USB terminals, communication DIP switch, 24 V control circuit fuse, RUN/STOP switch, and PLC JLINK burning terminal.
35-pin aviation plug	Used as external aviation plugs of the PLC board.
23-pin aviation plug	
Main power cable box cover	Covers the connectors of the high-voltage input cable of the drive, motor output cable of the AC drive, and 24 V output cable of the DC-DC unit.
Output wiring plug of the DC-DC unit	Used for DC-DC unit output (one negative terminal and two positive terminals).
Waterproof ventilation valve	Ensures that the internal air pressure and external air pressure are consistent with ventilation and waterproof functions.

Component Name	Function Description
Input wiring plug of the AC drive	Used for positive and negative high-voltage input.
Output wiring plug of the AC drive	Used for U, V, and W phase output of the motor.

■ Operating panel

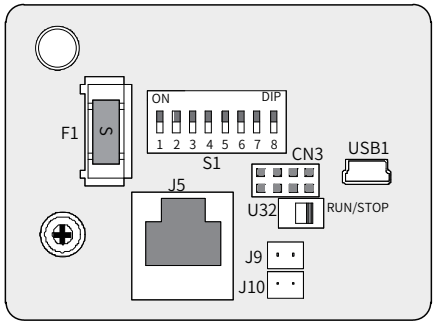
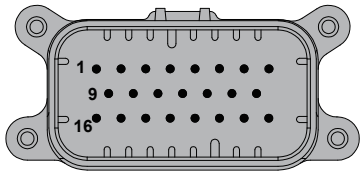


Figure 2 Operating panel of the drive with cover opened

Terminal ID	Terminal Name		Description
J5	RJ45		Used as the operating panel interface of the AC drive, PLC, and DC-DC unit. The SOP-20-810 operating panel is required.
S1	1	AI1	Used for DIP switch mode selection (AI current/voltage mode available). The voltage mode is selected by default. If the switches are set to ON, the current mode is selected.
	2	AI2	
	5	485B+	If the switches are set to ON, the 120 Ω termination resistor is valid.
	6	485B-	
	7	CANH	If the switches are set to ON, the 120 Ω termination resistor is valid.
	8	CANHL	
F1	24 V fuse		Used as the fuse of the 24 V control system with the rated current of 5 A. The inserted mini automotive fuse is used.
USB1	USB port		Used for program download of the PLC board and monitoring.
U32	RUN/STOP switch		Used as the PLC board running switch.
J9/J10	5 V power supply jumper for AC drive control		

■ PLC Aviation Plugs

◆ Communication Definition of the 23-pin Aviation Plug

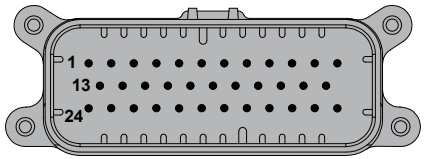


No.	Signal	Description	Remarks
1	RT1+	Temperature sampling 1	Corresponds to the soft element D8400.
2	RT2+	Temperature sampling 2	Corresponds to the soft element D8401.
3	RT3+	Temperature sampling 3	Corresponds to the soft element D8402.
9	RT4+	Temperature sampling 4	Corresponds to the soft element D8403.
10	RT5+	Temperature sampling 5	Corresponds to the soft element D8404.
16	RT6+	Temperature sampling 6	Corresponds to the soft element D8405.
17	RT-	Temperature sampling common ground	
18	RT-	Temperature sampling common ground	
4	AD1	Analog input 1	Corresponds to the soft element D8406.
11	AD2	Analog input 2	Corresponds to the soft element D8407.
19	AGND	Analog common ground	
8	CANH	CAN communication+	Fixed to 250 kbps baud rate.
15	CANL	CAN communication-	
7	485B+	Second 485+	
14	485B-	Second 485-	
22	CGND	Communication reference ground	
23	CGND	Communication reference ground	
12	5 V	5 V power supply	Optional, none by default.
5	5V_GND	Reference ground of 5 V power supply	

NOTE

◆ For details about the PLC board with the 23-pin communication aviation plug, see Appendix B.

◆ Communication Definition of the 35-pin Aviation Plug



No.	Signal	Description	Remarks
1	24 V	PLC board power supply	
2	0 V	PLC board power supply ground	
7	DA1	Analog output 1	Corresponds to the soft element D8410.
17	DA2	Analog output 2	Corresponds to the soft element D8411.
30	AGND	Analog reference ground	
19	EEV1+	Electronic expansion valve coil+ 1	Optional, none by default.
20	EEV1-	Electronic expansion valve coil- 1	
31	EEV2+	Electronic expansion valve coil+ 2	
32	EEV2-	Electronic expansion valve coil- 2	
24	12 V	Power supply of the electronic expansion valve	
25	12V_GND	Power supply ground of the electronic expansion valve	
3	X00	X input 0	Corresponds to the soft element X00.
4	X01	X input 1	Corresponds to the soft element X01.
5	X02	X input 2	Corresponds to the soft element X02.
14	X03	X input 3	Corresponds to the soft element X03.
15	X04	X input 4	Corresponds to the soft element X04.
26	SS0	X input common terminal	Used as the common terminal of X00 to X04.
16	X05	X input 5	Corresponds to the soft element X05.
28	X06	X input 6	Corresponds to the soft element X06.

No.	Signal	Description	Remarks
13	X07	X input 7	Corresponds to the soft element X07.
6	X10	X input 8	Corresponds to the soft element X10.
27	SS1	X input common terminal	Used as the common terminal of X00 to X10.
11	Y10	Relay output 0	Corresponds to the soft element Y10.
12	COM0	Relay ground 0	
22	Y11	Relay 1	Corresponds to the soft element Y11.
23	Y12	Relay 2	Corresponds to the soft element Y12.
35	COM1	Reference ground of relays 1 and 2	
9	Y01	PWM output 1	Corresponds to soft element Y01.
8	Y02	PWM output 2	Corresponds to soft element Y02.
10	Y13	Y output 1	Corresponds to the soft element Y13.
21	Y14	Y output 2	Corresponds to the soft element Y14.
34	Y15	Y output 3	Corresponds to the soft element Y15.
33	COM2	Y output common terminal	Used as the common terminal of Y01, Y02, and Y13 to Y15.

NOTE

◆ Currently, optional terminals are not soldered on the board and cannot be used.

◆ Only the NTC (recommended model: Dong Kwang 502F3470F) is supported. The NTC specifications are: R25 = 5 kΩ ± 1%, B25/50 = 3470 ± 1%

◆ For the electronic expansion valve, the soft element are used as follows:
Y00: outputting motor PWM signals
Y03: controlling the motor rotation direction
Y04: controlling the enabling signal of the motor drive chip
X11: detecting the alarm signal of the motor drive chip
The normal signal is high level.

◆ X input supports SINK/SOURCE, but Y transistor output allows only SOURCE output.

2. Installation and Wiring

■ Mounting Dimensions and Weight

◆ Maximum physical dimensions of the whole drive: 351 x 372 x 166 mm (waterproof connector included)

◆ Baseplate dimensions: 340 x 340 mm

◆ Mounting dimensions: 320 x 320 mm (recommended: M8 screw)

◆ Net weight: 12.3 kg

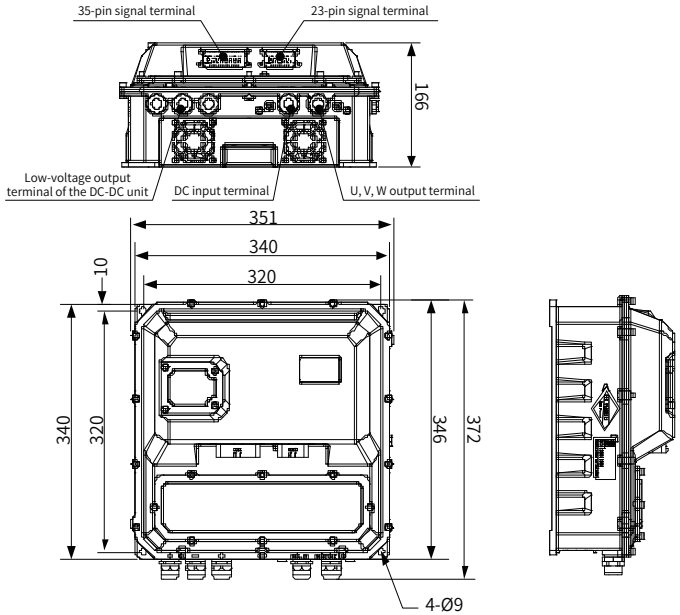


Figure 3 CV800 dimensions (unit: mm)

■ Recommended Cables and Lugs

Table 2-1 Recommended cables and lugs for the DC-DC unit

Category	Name	Positive Output Cable (Two Sets)	Negative Output Cable
Lug	Wiring terminal	M6 OT	M6 OT
	Recommended model	GTNR16-6	GTNR25-6
	Recommended manufacturer	Suzhou Yuanli	Suzhou Yuanli
Cable	Cable diameter	16 mm²	25 mm²
	Current	65 A	110 A
	Voltage	27 VDC	27 VDC
	Ambient temperature	70°C	70°C
	Number of cores	Single-core	Single-core
	Automotive grade	Yes	Yes
	Cable temperature	125°C	125°C
	Applicable cable diameter for the waterproof connector	9–14 mm	9–14 mm

Table 2-2 Recommended cables and lugs for the AC drive

Category	Name	High-voltage Input Cable	Motor Output Cable	PE Output Cable
Lug	Wiring terminal	M5 OT	M5 OT	M5 OT
	Recommended model	TVR5.5-5	TVR5.5-5	TVR5.5-5
	Recommended manufacturer	Suzhou Yuanli	Suzhou Yuanli	Suzhou Yuanli
Cable	Cable diameter	6 mm²	4 mm²	6 mm²
	Current	40 A	32 A	32 A
	Voltage	750 VDC	400 VAC	400 VAC
	Ambient temperature	70°C	70°C	70°C
	Number of cores	Dual-core single-strand cable	Three-core single-strand cable	Single-core
	Automotive grade	Yes	Yes	Yes
	Cable temperature	125°C	125°C	125°C
	Applicable cable diameter for the waterproof connector	9–14 mm	9–14 mm	-

Table 2-3 Control terminal specifications of 23-pin and 35-pin aviation plugs

Category	Model	Quantity for One Drive	Manufacturer
23-pin plug	770680-1	1	Tyco/TE
35-pin plug	776164-1	1	
Crimping lug	770520-1	58	

■ Cable Requirements for 23-pin and 35-pin Aviation Plugs

Cable specifications: 16–20 AWG

Outside diameter: Φ1.7–2.7 mm

NOTE

The idle pins of the 35-pin and 23-pin aviation plugs must be closed with specified blind plugs.

Blind plug model: 770678-1

The following figure shows an example blind plug.

■ Adapter Cable for On-board Commissioning

To view status, modify parameters, and perform program burning and download for CV800 in the cab during on-board air conditioner commissioning, it is recommended that the external operating panel SOP-20-810 be used.

It is recommended that the commissioning adapter cable be made by the user, as shown in the following figure. SOP-20-810 adopts the RJ45 network cable interface.

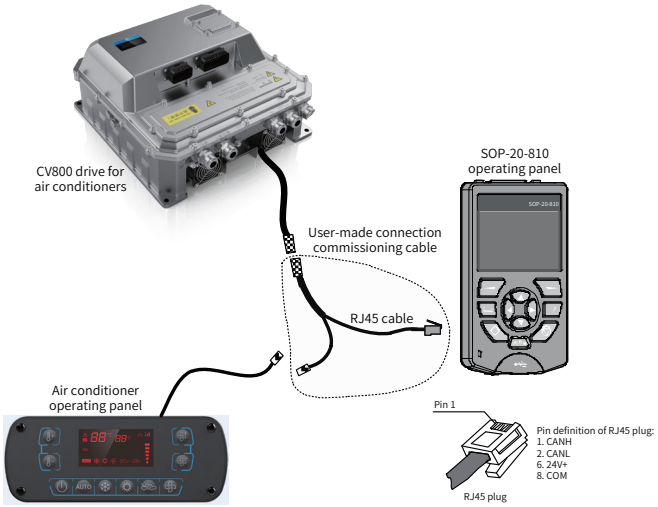
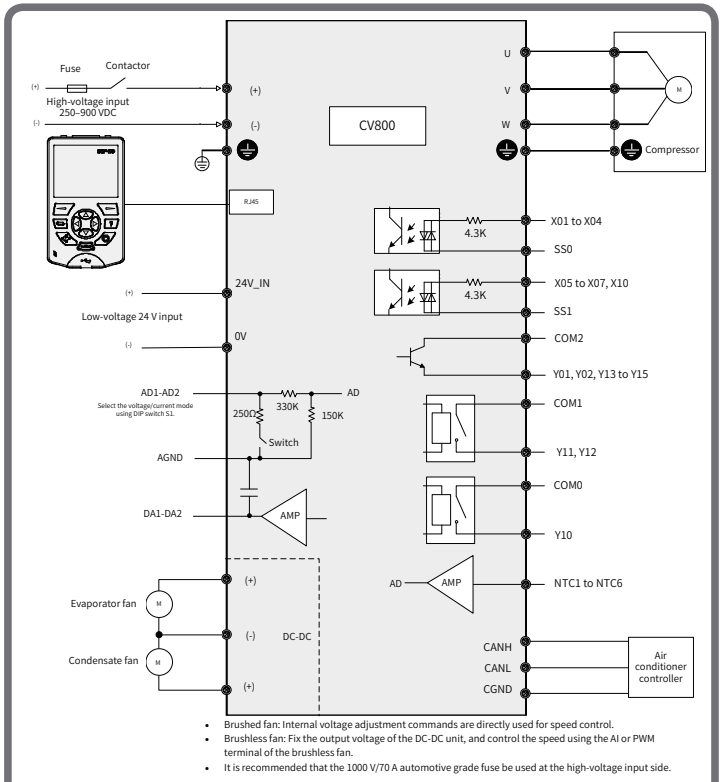


Figure 4 Adapter cable

■ System Wiring

Perform wiring by following the figure below. Automotive-grade cables are recommended. The DC-DC unit has three output terminals, in which the negative terminal is common.



- Brushed fan: Internal voltage adjustment commands are directly used for speed control.
- Brushless fan: Fix the output voltage of the DC-DC unit, and control the speed using the AI or PWM terminal of the brushless fan.
- It is recommended that the 1000 V/70 A automotive grade fuse be used at the high-voltage input side.

Figure 5 CV800 system wiring

NOTE

◆ Install the waterproof connectors properly in sequence for the DC-DC unit. Otherwise, the waterproof connector in the middle will interfere with the other two nearby.

3. Drive Commissioning

1) Connect the compressor and fan properly. Then, supply DC power for high-voltage input.
2) If an external operating panel is required for commissioning, use the SOP-20-810 operating panel.
3) Perform commissioning for the AC drive, and modify AC drive parameters.
4) Perform commissioning for the DC-DC unit, and modify parameters of the DC-DC unit.
5) Write the PLC program. Then, perform PLC commissioning.
6) Start the air conditioner.
7) Check that the running is normal. Then, power off the air conditioner, and check whether the CAN pull-up resistor is normal. Lock the operating panel cover and main power cable cover properly.

■ Running Mode and Speed Adjustment Mode of the AC Drive

F0-02: Command source

0: External LCD panel/Commissioning software

2: Communication command (CAN), default

F0-03: Main frequency source

0: Digital setting (F0-08), non-retentive at power failure

1: Digital setting (F0-08), retentive at power failure

9: Communication setting (CAN), default

Other values of the two parameters are unavailable. If a PLC is used, set F0-02 to 2 and F0-03 to 9.

■ Startup Mode and Pressure Adjustment Mode of the DC-DC Unit

F4-00: Startup mode (take effect upon next power-on)

1: Startup with DI enabled, stop with DI disabled

2: Startup with DI enabled and CAN startup command effective, stop with DI disabled or CAN stop command effective (default)

3: Startup and stop with SOP-20-810 operating panel and DI enabled

F4-01: Speed adjustment mode (take effect upon next power-on)

1: Output voltage adjusted by the operating panel (27.5 V by default)

2: CAN control (default)

If the operating panel is used for pressure adjustment, set F4-11 (M1 output voltage reference) for the first output module and F4-12 (M2 output voltage reference) for the second output module within the range of 14 to 27.5 V.

■ Separate Mode and Parallel Mode of the DC-DC Unit

1) Separate mode

The separate mode is available for both brushless and brushed cooling fans. By default, this mode is selected. In this mode, the maximum single-channel and dual-channel output current of the DC-DC unit is 65 A and 110 A, respectively. The drive can control the evaporator fan and condensate fan independently.

In the separate mode, set F8-14 (Model setting) to 1 for the DC-DC unit, as described in Table 3-1. To display all parameters in group F8, enter the password of the DC-DC unit for F8-00, exit group F8, and then access group F8 again.

Table 3-1 Parameter setting for the DC-DC unit in separate mode

Param. No.	Param. Name	Setting	Description	Remarks
F8-14	Model setting	1	Dual-channel 1.5 kW output	This parameter is set to 1 by default. Its modification takes effect upon next 24 V power-on.

Before parameter setting, check that the two positive output terminals are not shorted. For details about the fan wiring, see Figure 6.

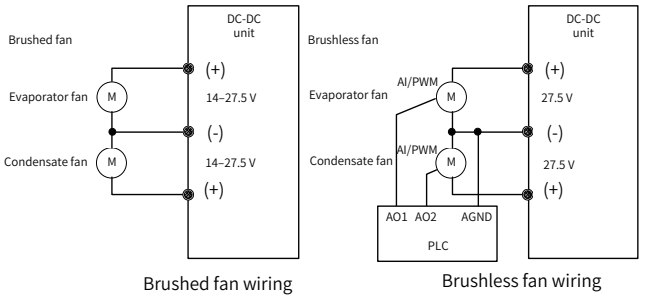


Figure 6 Fan wiring in separate mode

2) Parallel mode

The parallel mode is available for the DC-DC unit. If only one-channel power output is required, use a shorting copper busbar (ordering code: 01040080) to short the two positive output terminals. Do not use a cable to short them.

In the parallel mode, set F8-14 (Model setting) to 2 for the DC-DC unit, as described in Table 3-2.

Table 3-2 Parameter setting for the DC-DC unit in parallel mode

Param. No.	Param. Name	Setting	Description	Remarks
F8-14	Model setting	2	Single-channel 3 kW output	Takes effect upon next 24 V power-on.

Before parameter setting, check that the two positive output terminals are shorted. For details about the fan wiring, see Figure 7.

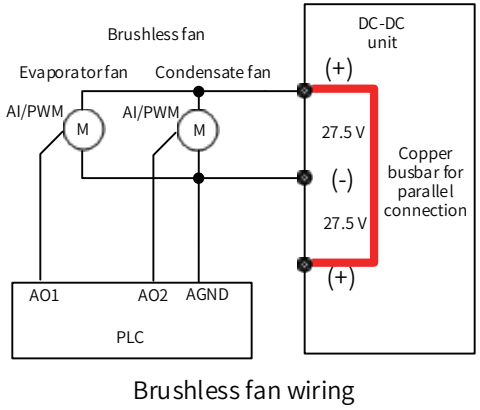


Figure 7 Fan wiring in parallel mode

NOTE

Note the following in the parallel mode:

- The running mode must be set to the parallel mode for the DC-DC units. Otherwise, the DC-DC units may be damaged due to unbalanced current.
- The CAN startup and pressure adjustment commands for the first channel are used.

4. External Operating Panel

If the external SOP-20-810 operating panel is used for commissioning, the CV800 HEX configuration file must be configured. SOP-20-810 is equipped with a termination resistor and pull-up resistor.

The external operating panel adopts CAN communication in the same network with the operating panel of the air conditioner. When the 35-pin aviation plug is connected to the 24 V power supply, CV800-DCDC can be searched on the operating panel. When the 35-pin aviation plug is connected to the 24 V and 540 VDC power supply, CV800-INV can be searched on the external operating panel. When 540 VDC power supply is disconnected, CV800-INV is displayed in communication dropping state. To display CV800-INV properly again, re-power on the drive, disconnect and then connect the operating panel. (The operating panel scan devices only once at power-on. The initial scanning time may last 1 to 2 minutes.) The SOP-20-810 operating panel adopts a specialized communication protocol to communicate with the three main components in CV800. For details about upgrade and model file configuration of the operating panel, see Appendix A.

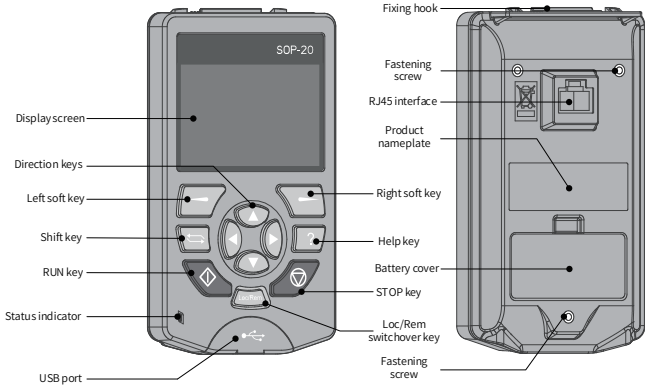


Figure 8 SOP-20-810 operating panel

NOTE

- CV800 does not support common LED operating panels.
- The RJ45 interface of the drive shares the same CAN network with the aviation plug. Therefore, you can connect the operating panel using an aviation plug adapter cable.

If a termination resistor is built in the operating panel of the air conditioner, set the CAN termination resistor of the PLC to OFF before performing factory commissioning for the SOP-20-810 operating panel. Otherwise, communication failures may be caused. If the SOP-20-810 operating panel is not used, ensure that the PLC is ON (that is, a 120 Ω termination resistor is used at both ends of the CAN bus of the air conditioner) before air conditioner delivery.

Station number of the DC-DC unit: 7; Station number of the PLC: 32; Station number of INV: 33

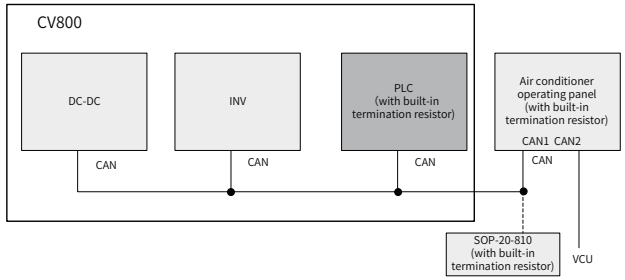


Figure 9 CV800's CAN communication network

5. Program Burning

■ CV800 Underlying Program Burning on the Operating Panel

Connect the SOP-20-810 operating panel to a computer using a Micro USB cable. Then, select "USB disk" on the operating panel to display it on the computer. Copy the underlayer drive program (suffixed with .bin) of the DC-DC unit, AC drive, and PLC to be burnt to the SYS/PROGRAM directory of the operating panel's SD card.

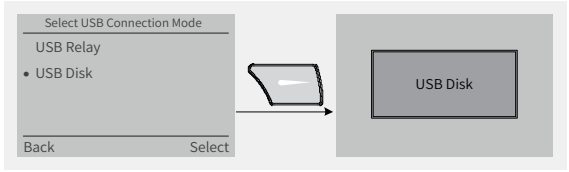


Figure 10 USB connected

When CV800 is connected to the 24 V and 540 VDC power supply, you can search the DC-DC unit, AC drive, and PLC on the operating panel and perform underlying program upgrade for them. For details, see Appendix A.

NOTE

- Risks exist during program burning. Therefore, ensure that the operating panel is online during burning. If a power failure occurs during burning, equipment may be damaged.

■ PLC Application Generation and Download

Start AutoShop, choose Tool > Generate CV800-PLC download file, and click OK. Then, in the displayed dialog box, select the storage location and name the generated file suffixed with .bin. The burning method is similar to that for underlayer program burning.

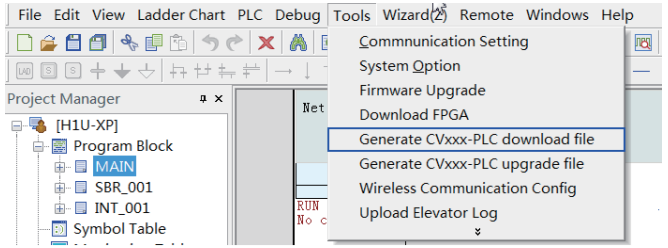


Figure 11 PLC application generation

Appendix A Operating Panel Program Upgrade

■ Operating Panel Upgrade Procedure

1) Connect the SOP-20-810 operating panel to the computer using USB.
2) Prepare the .bin file to be burnt, and copy it to the 0:/SYS/update directory of the SD card.
3) Log in to the operating panel.

   Select Menu, Authority, and Login in sequence. Then, enter the login password 37421.

   Then, select Menu, System Control, and Update in sequence, as shown below.

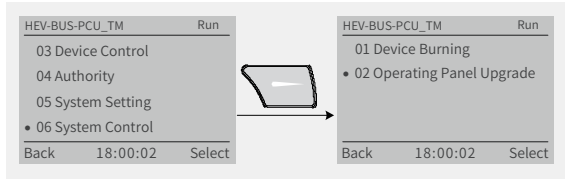


Figure 12 Operating panel upgrade menu

4) Select the files to be upgraded from the file list.

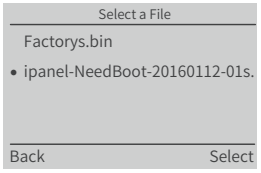


Figure 13 Selecting the file to be upgraded

5) Press when the pop-up window is displayed.

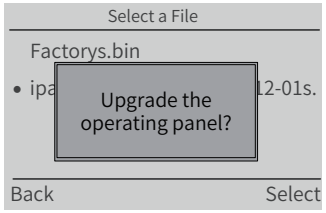


Figure 14 Confirming operating panel upgrade

6) Wait until the operating panel restarts.

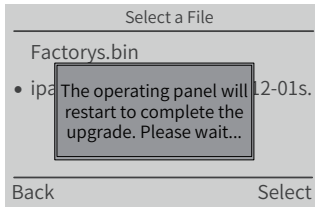


Figure 15 Waiting for upgrade

■ Importing Operating Panel Model Configuration Files

1) Connect the operating panel to a computer using USB. Files suffixed with .hex are displayed on the computer.

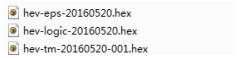


Figure 16 Files suffixed with .hex displayed

2) Copy the .hex files to the 0:/iPanelCfg/ directory on the SD card. Note that only one model file exists for each electronic tag in the iPanelCfg folder. Otherwise, the earliest imported file will be used by default.

3) Disconnect the power supply of the operating panel. Then, press and hold the Loc/Rem key and re-power on the operating panel. After "Backup Files xx" is displayed, release the Loc/Rem key, and wait until the model files are imported.

4) After the model files are imported, the device searching page is automatically displayed.

Appendix B CV800 PLC Board

■ Functional Specifications

1) Power input

Item	Unit	Minimum Value	Typical Value	Maximum Value	Remarks
Rated operating voltage	VDC	16 V	24 V	32 V	External 24 V power supply connected by the user

2) Digital input

Table B-1 Basic digital input specifications

Item	Specification	Item	Specification
Input channel	9	ON voltage	> 15 VDC
Input connection mode	Pluggable aviation plug	OFF voltage	< 5 VDC
Input mode	Digital input	Port filter time	10 ms
Input mode	SINK/SOURCE	Input impedance	4.3 kΩ
Input voltage class	24 VDC (maximum: 30 V)	Input signal form	SINK/SOURCE DC voltage input
Input current (typical)	5.3 mA	Isolation method	Photocoupler isolation

Table B-2 Digital input user interfaces

Network Name	Category	Function	Remarks
X00 to X04	Input	User input X00 to X04	SINK/SOURCE input
SS0	Power supply	Common terminal of X00 to X04	
X05 to X10	Input	User input X05 to X10	SINK/SOURCE input
SS1	Power supply	Common terminal of X00 to X10	

3) Digital output

Table B-3 Basic digital output specifications

Item		Specification
Output channel		3
Output connection mode		Pluggable aviation plug
Output type		Relay output
Rated relay current		3 A @ 24 VDC
ON response time		Less than 20 ms (for hardware)
OFF response time		Less than 20 ms (for hardware)
Maximum load	Resistive load	Single-point 3 A/point
	Lamp load	Single-point 30 W
	Inductive load	Single-point 5 A @ 24 VDC
	Capacitive load	Not recommended
Isolation method		Mechanical isolation

Table B-4 Digital output user interfaces

Network Name	Category	Function	Remarks	
Y10	Output	Relay user output 0	Dry contact	Only 24 VDC supported
COM0	Output common	Common terminal	Y10 common terminal	
Y11	Output	Relay user output 1	Dry contact	Only 24 VDC supported
Y12	Output	Relay user output 2	Dry contact	
COM1	Output common	Common terminal	Y11 and Y12 common terminal	

■ Special Load Usage

◆ Contact protection when inductive load used

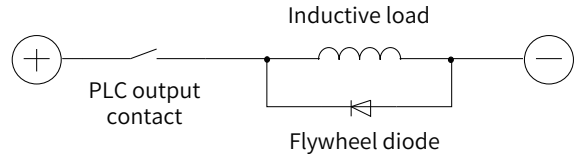
No internal protection circuit for relays is designed. When the inductive load is applied, large back EMF will be produced between contacts and arc discharge is also caused when the inductive load stops. This may result in contact failure or contact sag, shortening the contact lifetime. Therefore, it is recommended to use the products with built-in relay protection circuits. For the products without built-in relay protection circuits, an external electric shock protection circuit can be used to reduce noises and prolong the product lifetime.

Relay DC circuit (Y10/COM0, Y11/Y12/COM1)

Connect a flywheel diode in parallel with the load. The flywheel diode must meet the following requirements:

1) Reverse voltage: 5 to 10 times of load voltage

2) Forward current: larger than load current



◆ Contact protection when capacitive load used

When the capacitive load is applied, the impulse current on the contact may be 20 to 40 times the normal current. Note that impulse current cannot exceed the current generated when the maximum resistive load is used.

When the electronic circuit load such as an AC drive is used, capacitive loads may also exist due to capacitors and others.

1) Transistor output

Table B-5 Basic transistor output specifications

Item		Specification
Output channel		5
Output connection mode		Pluggable aviation plug
Output type		Transistor, high-side output
Output mode		SOURCE
Output voltage class		5V to 24 V (-5% to 20%)
Maximum leakage current upon OFF		Less than 0.5 mA
ON response time		Less than 0.5 ms (for hardware)
OFF response time		Less than 0.5 ms (for hardware)
Maximum load	Resistive load	0.5 A/point
	Inductive load	12 W/24 VDC (total)
	Lamp load	2 W/24 VDC (total)
Isolation method		Photocoupler isolation

Table B-6 Transistor output user interfaces

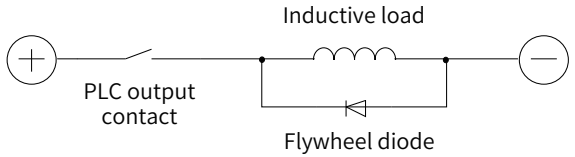
Signal Name	Category	Function	Remarks
Y01 to Y02	Output	PWM user output Y01 to Y02	SOURCE output, active at high level
Y13 to Y15	Output	Y user output Y13 to Y15	SOURCE output, active at high level
COM2	Output common	Used as the common terminal of Y01, Y02, and Y13 to Y15.	Transistor output common terminal 2

■ Special Load Usage

◆ Contact protection when inductive load used

When the inductive load is applied, large back EMF will be produced between contacts and arc discharge is also caused when the inductive load stops. This may result in contact failure or contact sag, shortening the contact lifetime. Therefore, you can connect a flywheel diode in parallel with the load based on the product usage to prolong the product lifetime.

The flywheel diode must meet the following requirements: ① Reverse voltage: 5 to 10 times of load voltage; ② Forward current: larger than load current



1) NTC temperature sampling

Table B-7 Basic temperature sampling specifications

Item	Specification	Item	Specification
Input channel	6	Sensitivity	0.1℃
Input connection mode	Pluggable aviation plug	Accuracy (normal temperature: 25°C)	Full range * (±0.5%)
Sensor type	Thermal resistor: NTC	Accuracy (ambient temperature: -25°C to 65°C)	Full range * (±1%)
Detection mode	℃	Temperature detection range	-40°C to 105°C
Thermal resistor wiring mode	Two-wire mode	Isolation method	Non-isolation between channels
Resolution	12-bit		

Table B-8 Temperature sampling user interfaces

Network Name	Category	Function
RT1+	Input	Positive NTC thermal resistor input of channel 1
RT2+	Input	Positive NTC thermal resistor input of channel 2
RT3+	Input	Positive NTC thermal resistor input of channel 3
RT4+	Input	Positive NTC thermal resistor input of channel 4
RT5+	Input	Positive NTC thermal resistor input of channel 5
RT6+	Input	Positive NTC thermal resistor input of channel 6
RT-	Input	Temperature sampling common ground

2) Analog input

Table B-9 Basic analog input specifications

Item	Specification	Item	Specification
Input channel	2	Current input range	0 mA to 20 mA
Input connection mode	Pluggable aviation plug	Resolution	12-bit
Voltage input impedance	> 400 kΩ	Accuracy (normal temperature: 25°C)	Voltage: ±1%, current: ±1% (full ranges)
Current sampling impedance	250 Ω	Accuracy (ambient temperature: -25°C to 65°C)	Voltage: ±3%, current: ±3% (full ranges)
Voltage input range	0 V to +10 V	Isolation method	Non-isolation

Table B-10 Analog input user interfaces

Network Name	Category	Function
AD1	Input	Positive analog voltage/current input
AD2	Input	Positive analog voltage/current input
AGND	Input	Analog voltage/current input ground

3) Analog output

Table B-11 Basic analog output specifications

Item	Specification	Item	Specification
Output channel	2	Accuracy (normal temperature: 25°C)	Voltage: ±1% (full range)
Input connection mode	Pluggable aviation plug	Accuracy (ambient temperature: -25°C to 65°C)	Voltage: ±5% (full range)
Voltage output load	500 Ω to 1 mΩ	Isolation method	Non-isolation

Item	Specification	Item	Specification
Output voltage range	0 V to +10 V	Output short-circuit protection	Yes

Table B-12 Analog output user interfaces

Network Name	Category	Function
DA1	Output	Positive analog voltage output of channel 1
DA2	Output	Positive analog voltage output of channel 2
AGND	Output	Analog voltage output ground

■ Function Description

1) Programming tool -- AutoShop

Use AutoShop V2.50 or above (obtain the latest version from Inovance's website http://www.inovance.com) as the programming software for application programming and download monitoring. Select H1U-XP for the engineering PLC type. The maximum program capacity is 16k.

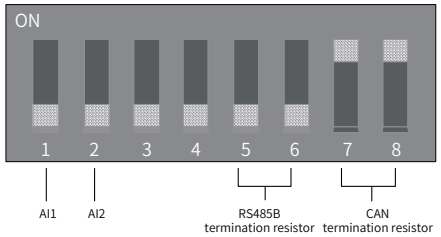
2) Soft element

Soft Element	Name	Quantity	Storage Feature	
X	Input relay	9 points	Not saved	X000 to X010 (octal)
Y	Output relay	8 points	Not saved	Y01, Y02, Y10, Y11, Y12, Y13, Y14, Y15
Y	PWM output	2 points	Not saved	Y01, Y02
M	Auxiliary relay	3328 points	Not saved	M0 to M1999
			Saved	M2000 to M2511
			Not saved	M2512 to M3071
			Saved for special use	M8000 to M8511
S	Status relay	1000 points	Not saved	S0-S899
				S900 to S999 (for signal alarms)
			Saved for special use	S0 to S9 (used for initialization)
				S10 to S19 (for homing)
T	Timer	256 points	Not saved	T0 to T199 (100 ms)
				T200 to T245 (10 ms)
				T246 to T249 (1 ms accumulative)
				T250 to T255 (100 ms accumulative)
C	Counter	235 points	Not saved	C0 to C199 (16-bit incremental)
			Saved	C200 to C234 (32-bit reversible counting)

Soft Element	Name	Quantity	Storage Feature	
D	Data register	8512 points	Not saved	D0 to D1999
			Saved	D2000 to D3023
			Not saved	D3024 to D7999
			Saved for special use	D8000 to D8511
V	Index register	32 points	Saved for special use	V0 to V31
Z	Index register	32 points	Saved for special use	Z0 to Z31
Constant K	16-bit [-32768 to +32767]		32-bit [-2147483648 to +2147483647]	
Constant H	16-bit [0 to 0XFFFF]		32-bit [0 to 0XFFFFFFFF]	

3) Communication function

The PLC supports the RS-485 (COM1) and CAN communication functions, meeting different communication requirements. Termination resistors are equipped for CAN and RS-485 (COM1) communication, which can be enabled or disabled using an 8-pin DIP switch on the PLC board. The following figure shows the definition of the DIP switch. By default, it is set to OFF.



◆ RS-485 (COM1) communication port

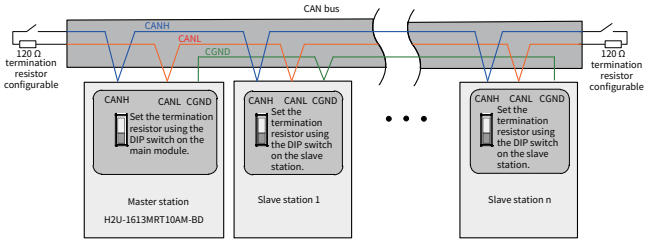
The COM1 port is similar to that of the general PLC.

◆ CAN communication function

The PLC supports free protocol for CAN communication, conforming to the CAN2.0 protocol.

CAN communication baud rate: fixed to 250 kbps

The following figure shows the CAN networking.



CANTX and CANRX free protocol commands are supported. The J1939 communication protocol is realized by the user program. CANLink is not supported. The following table describes special CAN communication elements.

M Element	Description	D Element	Description
M8285	Reserved	D8285	Current baud rate, unit: kbps
M8286	Reserved	D8286	Reserved
M8292	0: CANRX command received or idle 1: CANRX command receiving state	D8292	Data length received by CANRX
M8293	CANTX command sending failed	D8293	Reserved
M8294	CANRX command receiving succeeded	D8294	Reserved
M8298	0: CANRX command sent or idle 1: CANRX command sending state	D8298	Reserved
M8299	CANRX command receiving timeout	D8299	CANTX timeout setting (ms)

CANTX/CANRX commands are used to simplify communication with third-party devices that have the CAN communication function. You can write any CAN communication user protocol using the commands.

The command formats are as follows.

CAN data sending command	CANTX [S1 S2 D n]
CAN data sending command	CANRX [S1 S2 D n]

S1, S2: The CAN address is expressed by these two parameters.

Bit15 and bit14 of S1 are reserved. Bit13 of S1 sets the number of bits of the CAN address. 0 indicates a standard CAN address (11-bit), and 1 indicates the extended CAN address (29-bit). If an 11-bit address is used, bit 0 to bit10 of S2 indicate the address and S1 is 0. S2 cannot be greater than H7FF. If a 29-bit address is used, S2 (low 16-bit address) and bit0 to bit12 of S1 (high 13-bit address) are combined as the address. In this case, bit13 of S1 is 1.

D: Indicates the sending buffer zone in the CANTX command and receiving buffer zone in the CANRX command. The largest four D elements starting from this D element are used as the sending or receiving buffer zone.

n: Indicates the data sent quantity in the CANTX command and data receiving quantity in the CANRX command. Its maximum value is 8, in the unit of byte.

4) Analog input/output function

Six NTC inputs, two analog voltage/current inputs, and two analog voltage outputs are supported. The following table describes special elements.

M Element	Description	D Element	Description	
Input filter coefficient				
M8390	Reserved	D8390	Temperature sensor 1 input	Input filter coefficient Setting range: 1 to 64 Default: 8 To restore default settings, clear the PLC program or data element.
M8391	Reserved	D8391	Temperature sensor 2 input	
M8392	Reserved	D8392	Temperature sensor 3 input	
M8393	Reserved	D8393	Temperature sensor 4 input	
M8394	Reserved	D8394	Temperature sensor 5 input	
M8395	Reserved	D8395	Temperature sensor 6 input	
M8396	Reserved	D8396	Voltage/ Current input	
M8397	Reserved	D8397	Voltage/ Current input	
Temperature sensor NTC thermal resistor temperature				
M8400	Temperature sensor 1 input	D8400	Temperature sensor 1 input	Temperature sensor input temperature -400 to +1050: -40.0°C to +105.0°C Disconnection value: -32768
M8401	Temperature sensor 2 input	D8401	Temperature sensor 2 input	
M8402	Temperature sensor 3 input	D8402	Temperature sensor 3 input	
M8403	Temperature sensor 4 input	D8403	Temperature sensor 4 input	
M8404	Temperature sensor 5 input	D8404	Temperature sensor 5 input	
M8405	Temperature sensor 6 input	D8405	Temperature sensor 6 input	
	Temperature sensor status ON: normal; OFF: faulty			
Analog input				
M8406	Reserved	D8406	Voltage/ Current input 1	Voltage: 0 to 20000: 0 to 10 V Current: 0 to 10000: 0 to 20 mA
M8407	Reserved	D8407	Voltage/ Current input 2	
Analog output				
M8410	Reserved	D8410	Voltage 1 output	0 to 10000: 0 to 10 V
M8411	Reserved	D8411	Voltage 2 output	

Appendix C EMC

The CV800 drive EMI (high-voltage conduction, low-voltage input conduction, and equipment radiation) meets class 3 requirements of CISPR25:2016 and GB/T18655-2010 (high-voltage conduction excluded). To meet the preceding EMI requirements, strictly follow the user guide to install the drive and perform wiring with specified cables in the air conditioning system. Otherwise, electromagnetic interference may be caused.

■ Shielded Cable Requirements

If shielded waterproof connectors (with spring calipers inside) are used for high-voltage input and motor output, high-voltage input cables and output cables (U, V, and W) must be shielded cables.

> ⚠ DANGER
>
> Do not use non-shielded cables when shielded waterproof connectors are used. Otherwise, the cables may be damaged, causing electric shocks.

■ High-voltage Input Shielded Cable

1) Two-core single-layer cables can be used as high-voltage input cables. The density of the shielding layer must be greater than or equal to 90%.
2) To ensure conductive continuity of the shielding layer, the shielding layer must be well connected with the high-voltage input shielded waterproof connector of the drive in 360°, as shown in Figure 17. The connection method for two-core shielded cables is similar to that for three-core shielded cables.
3) The shielding layer of high-voltage input cables must be grounded at both ends, that is, connect one end of the shielding layer to the ground of the drive (the shielding terminal has been grounded) and connect the other end to the ground of the power distribution system in 360°. Shielding terminals are recommended.

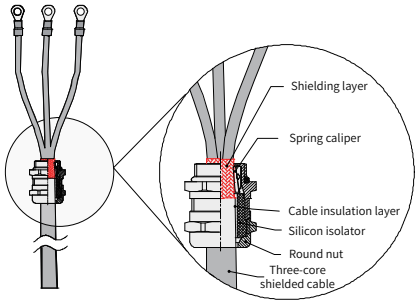


Figure 17 Connecting the shielding layer and shielded waterproof connector

■ Output Shielded Cables (U, V, and W)

1) Use dual-layer shielded cables as the U, V, and W output shielded cables.
2) To ensure conductive continuity of the shielding layer, the shielding layer must be well connected with the U, V, and W output shielded waterproof

connector of the drive in 360°, as shown in Figure 17.

3) The shielding layer of U, V, and W output shielded cables must be grounded at both ends, that is, connect one end of the shielding layer to the ground of the drive and connect the other end to the ground of the compressor in 360°. Shielding terminals are recommended.

■ Drive Grounding Requirements

1) The drive must be well grounded. Therefore, connect the PE cable of the drive to the ground system of the air conditioning system. The grounding cable of the drive must be less than 30 cm. For details about the cable diameter, see Table 2-2.
2) It is recommended that the die-casting housing of the drive be directly connected to the metal rack surface of the air-conditioning system when installing the drive. Ensure that the metal rack surface connected to the drive housing is a good conductor.

■ Wiring Requirements

1) The high-voltage input cables, U, V, and W output cables, and fan power cables are strong interference sources. It is recommended that the wiring distance of such cables be at least 20 cm away from the air conditioning system to reduce the interference coupling between cables.
2) Do not wire low-voltage cables (including control cables, signal cables, and communication cables) with strong interference source cables in parallel. If parallel wiring is required, the recommended wiring distance is at less 40 cm. These two types of cables can be wired vertically and crosswise.
3) To reduce interference signals, keep all cables with the minimum length under the condition that all cables are wired properly.

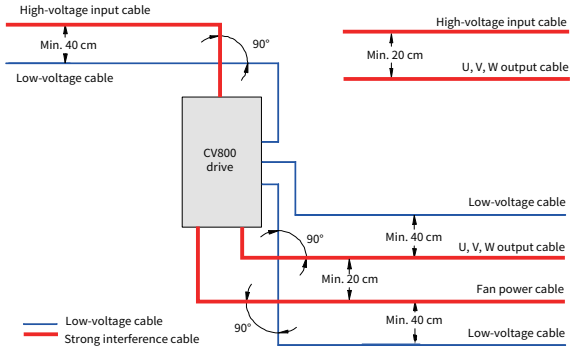


Figure 18 Wiring

Appendix D AC Drive Troubleshooting and Parameter Tables

■ AC Drive Troubleshooting

Fault Code	Fault Description	Possible Cause	Solution
E01.01	Current detection fault	The voltage sampling of the AC drive is abnormal.	Check whether the main circuit is powered on. If the current sampling circuit is damaged, contact the agent or Inovance.
E02.00	Overcurrent during acceleration	The output circuit of the AC drive is grounded or short-circuited.	Eliminate external faults. Check whether short-circuit occurs on the motor or relay contactor.
		The control mode is SVC but motor auto-tuning is not performed.	Set the motor parameters according to the motor nameplate and perform motor auto-tuning.
		The acceleration time is too short.	Increase the acceleration time.
		The overcurrent stall prevention parameters are set improperly.	Ensure that current limit is enabled (F3-19 = 1). The setting of F3-18 (V/F current limit level) is too large. Adjust it between 120% and 160%. The setting of F3-20 (V/F current limit gain) is too small. Adjust it between 20 and 40.
		Customized torque boost or V/F curve is not appropriate.	Adjust the customized torque boost or V/F curve.
		The spinning motor is started.	Enable the catching a spinning motor function or start the motor after it stops.
		The AC drive suffers external interference.	View historical fault records. If the current value is far from the overcurrent level, find interference source. If no external interference exists, the drive board may be faulty.

Fault Code	Fault Description	Possible Cause	Solution
E03.00	Overcurrent during deceleration	The output circuit of the AC drive is grounded or short-circuited.	Eliminate external faults. Check whether the motor is disconnected or short-circuited.
		The control mode is SVC but motor auto-tuning is not performed.	Set the motor parameters according to the motor nameplate and perform motor auto-tuning.
		The deceleration time is too short.	Increase the deceleration time.
		The overcurrent stall prevention parameters are set improperly.	Ensure that current limit is enabled (F3-19 = 1). The setting of F3-18 (V/F current limit level) is too large. Adjust it between 120% and 150%. The setting of F3-20 (V/F current limit gain) is too small. Adjust it between 20 and 40.
		The AC drive suffers external interference.	View historical fault records. If the current value is far from the overcurrent level, find the interference source. If no external interference exists, the drive board may be faulty.

Fault Code	Fault Description	Possible Cause	Solution
E04.00	Overcurrent at constant speed	The output circuit of the AC drive is grounded or short-circuited.	Eliminate external faults. Check whether the motor is disconnected or short-circuited.
		The control mode is SVC but motor auto-tuning is not performed.	Set the motor parameters according to the motor nameplate and perform motor auto-tuning.
		The overcurrent stall prevention parameters are set improperly.	Ensure that current limit is enabled (F3-19 = 1). The setting of F3-18 (V/F current limit level) is too large. Adjust it between 120% and 150%. The setting of F3-20 (V/F current limit gain) is too small. Adjust it between 20 and 40.
		The AC drive power class is small.	If output current exceeds rated motor current or rated output current of the AC drive during stable running, replace an AC drive of larger power class.
		The AC drive suffers external interference.	View historical fault records. If the current value is far from the overcurrent level, find interference source. If no external interference exists, the drive board may be faulty.
E05.00	Overvoltage during acceleration	The input grid voltage is too high.	Adjust the voltage to the normal range.
		An external force drives the motor during acceleration.	F3-26 (Frequency rise threshold during voltage limit) is set to a small value. Its recommended range is 5 Hz to 15 Hz. Adjust this parameter when an external force is applied.
		The overvoltage stall prevention parameters are set improperly.	Ensure that the voltage limit function is enabled (F3-23 = 1). The setting of F3-22 (V/F voltage limit) is too large. Adjust it between 700 V and 770 V. The setting of F3-24 (V/F frequency gain for voltage limit) is too small. Adjust it between 30 and 50.
		The acceleration time is too short.	3: Increase the acceleration time.

Fault Code	Fault Description	Possible Cause	Solution
E06.00	Overvoltage during deceleration	The overvoltage stall prevention parameters are set improperly.	Ensure that the voltage limit function is enabled (F3-23 = 1). The setting of F3-22 (V/F voltage limit) is too large. Adjust it between 700 V and 770 V. The setting of F3-24 (V/F frequency gain for voltage limit) is too small. Adjust it between 30 and 50.
		An external force drives the motor during deceleration.	F3-26 (Frequency rise threshold during voltage limit) is set to a small value. Its recommended range is 5 Hz to 15 Hz. Adjust this parameter when an external force is applied.
		The deceleration time is too short.	Increase the deceleration time.
E07.00	Overvoltage at constant speed	The overvoltage stall prevention parameters are set improperly.	Ensure that the voltage limit function is enabled (F3-23 = 1). The setting of F3-22 (V/F voltage limit) is too large. Adjust it between 700 V and 770 V. The setting of F3-24 (V/F frequency gain for voltage limit) is too small. Adjust it between 30 and 50.
		An external force drives the motor during running.	F3-26 (Frequency rise threshold during voltage limit) is set to a small value. Its recommended range is 5 Hz to 15 Hz. Adjust this parameter when an external force is applied.
E09.00	Undervoltage	Instantaneous power failure occurs.	Enable the power dip ride through function (F9-59 ≠ 0).
		The AC drive's input voltage is not within the permissible range.	Adjust the voltage to within the normal range.
		The bus voltage is abnormal.	Contact the agent or Inovance.
		The rectifier unit or the drive/control board of the inverter unit is abnormal.	Contact the agent or Inovance.

Fault Code	Fault Description	Possible Cause	Solution
E10.00	AC drive overload	The load is too heavy or locked-rotor occurs on the motor.	Reduce the load and check the motor and mechanical conditions.
		The AC drive power class is small.	Replace an AC drive of larger power class.
		The control mode is SVC but motor auto-tuning is not performed.	Set the motor parameters according to the motor nameplate and perform motor auto-tuning.
		The control mode is V/F control.	The setting of F3-01 (Torque boost) is too large. Decrease the value by 1.0% each time until the fault is cleared, or set F3-01 to 0.0% (Automatic torque boost).
E11.00	Motor overload	F9-01 (Motor overload protection gain) is set improperly.	Increase the value of (Motor overload protection gain) to prolong the motor overload time.
		The load is too heavy or locked-rotor occurs on the motor.	Reduce the load and check the motor and mechanical conditions.
E13.00	Output phase loss	Motor overload	Check whether the motor is disconnected.
		The cable connecting the AC drive and the motor is abnormal.	Eliminate external faults.
		The AC drive's three-phase outputs are unbalanced when the motor is running.	Check whether the motor three-phase winding is normal.
		The drive board or the IGBT is abnormal.	Contact the agent or Inovance.
E14.00	IGBT overheat	The ambient temperature is too high.	Lower the ambient temperature.
		The ventilation is clogged.	Clean the ventilation.
		The fan is damaged.	Replace the cooling fan.
		The thermistor of IGBT is damaged.	Contact the agent or Inovance.
		The IGBT is damaged.	

Fault Code	Fault Description	Possible Cause	Solution
E19.02	Motor auto-tuning fault	The magnetic pole position angle auto-tuning of the synchronous motor is abnormal.	The motor may be disconnected or output phase loss occurs.
E19.04			
E19.05		The initial magnetic pole position angle auto-tuning of the synchronous motor is abnormal.	Increase the value of F2-29 (Initial position angle detection current of synchronous motor).
E19.06		Stator resistor auto-tuning fault	The motor is disconnected. Check that F1-03 (Rated motor current) is set according to the motor nameplate.
E19.07			
E19.08			
E19.09		Instantaneous leakage inductance auto-tuning fault of the asynchronous motor	The motor may be disconnected or output phase loss occurs. Check that the motor is connected properly.
E19.10			
E19.11		Inertia auto-tuning fault	Check that F1-03 (Rated motor current) is set according to the motor nameplate. Increase the value of F2-43 (Inertia auto-tuning and dynamic speed reference).
E19.12		The auto-tuning times out.	The motor may be disconnected or output phase loss occurs. Ensure that the motor is disconnected from the load.
E19.13			
E19.14			
E19.15			
E19.16			
E19.17			
E19.19		The auto-tuning times out.	The motor may be disconnected or output phase loss occurs. Ensure that the motor is disconnected from the load.
E19.23	Motor auto-tuning fault	The magnetic pole position auto-tuning of the synchronous motor is abnormal.	Check that F1-03 (Rated motor current) is set according to the motor nameplate. Reduce the value of F2-29 (Initial position angle detection current of synchronous motor).
E19.24		Instantaneous leakage inductance auto-tuning error of the asynchronous motor	The AC drive power class is small. Replace a suitable AC drive according to the motor power.

Fault Code	Fault Description	Possible Cause	Solution
E21.00	EEPROM read-write fault	EEPROM read-write is abnormal.	If the write operation is to write a parameter through communication, check whether the corresponding RAM address is operated. If the EEROM chip is damaged, contact the agent or Inovance to change the control board.
E22.00	Motor auto-tuning alarm	The stator resistance obtained from auto-tuning exceeds the permissible range.	The rated motor voltage and current are set improperly. Set F1-02 (Rated motor voltage) and F1-03 (Rated motor current) properly according to the motor nameplate. Check that auto-tuning is performed after the motor stops.
E22.01		The asynchronous motor resistance obtained from auto-tuning exceeds the permissible range.	
E22.02		The no-load current and mutual inductance of the asynchronous motor obtained from auto-tuning exceeds the permissible range. If this fault is reported, the AC drive calculates the mutual inductance and no-load current values according to known motor parameters. The calculated values may be different from optimal values.	Set motor parameters in group F1 properly according to the motor nameplate. Check that the motor is disconnected from the load before auto-tuning.
E22.03		The back EMF of the synchronous motor obtained from auto-tuning exceeds the permissible range.	Check that F1-02 (Rated motor voltage) is set according to the motor nameplate. Check that the motor is disconnected from the load before auto-tuning.
E22.04		Inertia auto-tuning fault	Check that F1-03 (Rated motor current) is set according to the motor nameplate.
E23.00	Short circuit to ground	The motor is short-circuited to the ground.	Check or replace the cables or motor.

Fault Code	Fault Description	Possible Cause	Solution
E24.00	Motor inter-phase short-circuit	Inter-phase short-circuit occurs on the motor.	Check whether short circuit exists in U, V, and W output.
E40.00	Pulse-by-pulse current limit fault	The load is too heavy or locked-rotor occurs on the motor.	Reduce the load and check the motor and mechanical conditions.
		The AC drive power class is small.	Replace an AC drive of larger power class.
E42.00	Large speed error	Encoder parameters are set improperly.	Set encoder parameters properly.
		Auto-tuning is not performed.	Perform motor auto-tuning.
		F9-69 (Detection value of excessive speed deviation) and F9-70 (Detection time of excessive speed deviation) are set improperly.	Set F9-69 and F9-70 properly based on actual conditions.

Alarm Code	Alarm Name	Possible Cause	Solution
A64	Back EMF exceeding permissible range during dynamic auto-tuning	The back EMF exceeds the permissible range during dynamic auto-tuning.	Compare the value of F1-19 (Synchronous motor back EMF) with the valid value of rated back EMF. If the deviation is less than or equal to 20%, ignore the alarm. If the deviation is greater than 20%, manually change the value of F1-19 to the rated value.

■ AC Drive Parameter Tables

☆: The parameter can be modified when the drive is in either stop or running state.

★: The parameter cannot be modified when the drive is in the running state.

●: The parameter value is the actual measured value and cannot be modified.

*: The parameter is a factory parameter and can be set only by the manufacturer.

Param. No.	Param. Name	Setting Range	Default	Property
Group F0: Standard Parameters				
F0-00	G/P type display	1: G type (constant torque load)	Model dependent	●
F0-01	Motor 1 control mode	0: Sensorless vector control (SVC) 1: Reserved 2: V/F control (synchronous motor not supported)	2	★
F0-02	Command source	0: External LCD panel/ Commissioning software 1: Terminal command 2: Communication command	2	★
F0-03	Main frequency source	0: Digital setting (Preset frequency F0-08, modified by keypad or terminal UP/ DOWN, non-retentive at power failure) 1: Digital setting (Preset frequency F0-08, modified by keypad or terminal UP/ DOWN, retentive at power failure) 2 to 8: Reserved 9: Communication setting 10: Synchronization control	9	★
F0-04	Auxiliary frequency source Y	Same as F0-03	0	★
F0-05	Base value of range of auxiliary frequency source Y for superposition	0: Relative to the maximum frequency 1: Relative to main frequency source X	0	☆
F0-06	Range of auxiliary frequency source Y for superposition	0% to 150%	100%	☆

Param. No.	Param. Name	Setting Range	Default	Property
F0-07	Frequency source superposition selection	Ones: (Frequency source selection) 0: Main frequency source X 1: Main and auxiliary calculation result (based on the tens place) 2: Switchover between main frequency source X and auxiliary frequency source Y 3: Switchover between main frequency source X and "main and auxiliary calculation result" 4: Switchover between auxiliary frequency source Y and "main and auxiliary calculation result" Tens (Calculation relationship between main and auxiliary frequency sources) 0: Main + Auxiliary 1: Main - Auxiliary 2: Max. (main, auxiliary) 3: Min. (main, auxiliary) 4: Main x Auxiliary	0	☆
F0-08	Preset frequency	0.00 Hz to F0-10 (Maximum frequency)	50.00 Hz	☆
F0-09	Running direction	0: Same direction 1: Reverse direction	0	☆
F0-10	Maximum frequency	5.00 Hz to 600.00 Hz	50.00 Hz	★
F0-11	Frequency source upper limit	0: Set by F0-12 1 to 2: Reserved 4: Reserved 5: Communication setting 6: Multi-reference	0	★
F0-12	Frequency upper limit	F0-14 (Frequency reference lower limit) to F0-10 (Maximum frequency)	50.00 Hz	☆
F0-13	Frequency upper limit offset	0.00 Hz to F0-10 (Maximum frequency)	0.00 Hz	☆

Param. No.	Param. Name	Setting Range	Default	Property
F0-14	Frequency reference lower limit	0.00 Hz to F0-12 (Frequency upper limit)	0.00 Hz	☆
F0-15	Carrier frequency	0.8 kHz to 12.0 kHz	Model dependent	☆
F0-16	Carrier frequency adjusted with temperature	0: Disabled 1: Enabled	1	☆
F0-17	Acceleration time 1	0.00s to 65000s	20.0s	☆
F0-18	Deceleration time 1	0.00s to 65000s	20.0s	☆
F0-19	Acceleration/ Deceleration time unit	0: 1s 1: 0.1s 2: 0.01s		★
F0-21	Frequency offset of auxiliary frequency source at superposition	0.00 Hz to F0-10 (Maximum frequency)	0.00 Hz	☆
F0-22	Frequency command resolution	1: 0.1 Hz 2: 0.01 Hz	2	★
F0-23	Retentive of digital setting frequency upon stop	0: Disabled 1: Enabled	0	☆
F0-25	Acceleration/ Deceleration time base frequency	0: Maximum frequency (F0-10) 1: Frequency reference 2: 100 Hz	0	★
F0-26	Base frequency for UP/DOWN modification during running	0: Running frequency 1: Frequency reference	0	★
F0-27	Main frequency coefficient	0.00% to 100.00%	10.00%	☆
F0-28	Auxiliary frequency coefficient	0.00% to 100.00%	10.00%	☆
Group F1: Motor 1 Parameters				
F1-00	Motor type selection	0: Common asynchronous motor 1: Variable frequency asynchronous motor 2: Synchronous motor	0	★
F1-01	Rated motor power	0.1 kW to 1000.0 kW	Model dependent	★
F1-02	Rated motor voltage	1 V to 2000 V	Model dependent	★

Param. No.	Param. Name	Setting Range	Default	Property
F1-03	Rated motor current	0.01 A to 655.35 A	Model dependent	★
F1-04	Rated motor frequency	0.01Hz to F0-10 (Maximum frequency)	Model dependent	★
F1-05	Rated motor rotation speed	1 rpm to 65535 rpm	Model dependent	★
F1-06	Asynchronous/ Synchronous motor stator resistance	0.001 Ω to 65.535 Ω	Auto-tuning parameter	★
F1-07	Asynchronous motor rotor resistance	0.001 Ω to 65.535 Ω	Auto-tuning parameter	★
F1-08	Leakage inductive reactance of asynchronous motor	0.01 mH to 655.35 mH	Auto-tuning parameter	★
F1-09	Mutual inductive reactance of asynchronous motor	0.1 mH to 6553.5 mH	Auto-tuning parameter	★
F1-10	No-load current of asynchronous motor	0.01 A to F1-03 (Rated motor current)	Auto-tuning parameter	★
F1-11	Asynchronous motor iron-core saturation coefficient 1	50.0% to 100.0%	86.0%	☆
F1-12	Asynchronous motor iron-core saturation coefficient 2	100.0% to 150.0%	130.0%	☆
F1-13	Asynchronous motor iron-core saturation coefficient 3	100.0% to 170.0%	140.0%	☆
F1-14	Asynchronous motor iron-core saturation coefficient 4	100.0% to 180.0%	150.0%	☆
F1-17	Synchronous motor axis D inductance	0.01 mH to 655.35 mH	Auto-tuning parameter	★
F1-18	Synchronous motor axis Q inductance	0.01 mH to 655.35 mH	Auto-tuning parameter	★
F1-19	Synchronous motor back EMF	0.1 V to 6553.5 V	Auto-tuning parameter	★

Param. No.	Param. Name	Setting Range	Default	Property
F1-26	Auto-tuning direction (inertia auto-tuning and synchronous motor)	0 to 1	1	★
F1-37	Auto-tuning selection	0: No operation 1: Asynchronous motor static auto-tuning 2: Asynchronous motor no-load complete auto-tuning 3: Asynchronous motor static complete auto-tuning 4: Reserved 11: Synchronous motor no-load partial auto-tuning (back EMF exclusive) 12: Synchronous motor dynamic no-load auto-tuning 13: Synchronous motor static complete auto-tuning 14: Reserved	0	★
Group F2: Motor 1 Vector Control Parameters				
F2-00	Speed loop proportional gain Kp at low speed	1 to 200	Asynchronous motor: 30 Synchronous motor: 20	☆
F2-01	Speed loop integral time Ti at low speed	0.001s to 10.000s	0.500s	☆
F2-02	Switchover frequency 1	0.00 to F2-05 (Switchover frequency 2)	5.00 Hz	☆
F2-03	Speed loop proportional gain Kp at high speed	1 to 200	20	☆
F2-04	Speed loop integral time Ti at high speed	0.001s to 10.000s	1.000s	☆
F2-05	Switchover frequency 2	F2-02 (Switchover frequency 1) to the maximum frequency	10.00 Hz	☆
F2-06	VC slip compensation tuning	50% to 200%	100%	☆

Param. No.	Param. Name	Setting Range	Default	Property
F2-07	Speed feedback filter time	0.000s to 0.100s	0.004s	☆
F2-08	VC deceleration over-excitation gain	0 to 200	64	☆
F2-09	Torque upper limit source in speed control (electric)	0: Digital setting (F2-10) 1 to 2: Reserved 4: Reserved 5: Communication setting (1000H) 6 to 7: Reserved 100% of the values 1 to 7 corresponding to F2-10	0	☆
F2-10	Torque upper limit setting in speed control (electric)	0.0% to 200.0%	150.0%	☆
F2-11	Torque upper limit source in speed control (generating)	0: Digital setting (F2-10) 1 to 2: Reserved 4: Reserved 5: Communication setting (1000H) 6 to 7: Reserved 8: Digital setting (F2-12)	0	☆
F2-12	Torque upper limit setting in speed control (generating)	0.0% to 200.0%	150.0%	☆
F2-13	Low speed current loop Kp tuning	0.1 to 10.0	1.0	☆
F2-14	Low speed current loop Ki tuning	0.1 to 10.0	1.0	☆
F2-15	High speed current loop Kp tuning	0.1 to 10.0	1.0	☆
F2-16	High speed current loop Ki tuning	0.1 to 10.0	1.0	☆
F2-17	Speed loop proportional gain Kp at zero speed lock	1 to 100	30	☆
F2-18	Speed loop integral time Ti at zero speed lock	0.001s to 10.000s	0.500s	☆

Param. No.	Param. Name	Setting Range	Default	Property
F2-19	Inertia compensation gain	1 to 200	0	☆
F2-20	Speed loop switchover frequency at zero speed lock	0.00 to F2-02 (Switchover frequency 2)	0.05 Hz	☆
F2-21	Maximum output voltage coefficient	100 to 110	100	☆
F2-22	Output voltage filter time	0.000 to 0.010s	0.000s	☆
F2-23	Zero speed lock	0: Disabled 1: Enabled	0	★
F2-24	Vector overvoltage suppression KP	0 to 1000	40	☆
F2-25	Acceleration rate compensation gain	0 to 200	0	☆
F2-26	Acceleration rate compensation filter	0 to 500	10	☆
F2-27	Vector overvoltage suppression	0: Disabled 1: Enabled	1	☆
F2-28	Torque reference filter cutoff frequency	50 Hz to 1000 Hz	500 Hz	☆
F2-29	Initial position angle detection current of synchronous motor	50% to 180%	80%	☆
F2-30	Automatic calculation of speed loop parameters	0: Disabled 1: Enabled	0	★
F2-31	Expected speed loop bandwidth (high speed)	1.0 Hz to 200.0 Hz	10.0 Hz	☆
F2-32	Expected speed loop bandwidth (low speed)	1.0 Hz to 200.0 Hz	10.0 Hz	☆
F2-33	Expected speed loop bandwidth (zero speed)	1.0 Hz to 200.0 Hz	10.0 Hz	☆
F2-34	Expected speed loop damping ratio	0.100 to 65.000	1.000	☆

Param. No.	Param. Name	Setting Range	Default	Property
F2-35	System inertia	0.001s to 50.000s (equivalent to start-up time, unit: s)	Model dependent	★
F2-36	Single motor inertia	0.001 to 50.000 (kg*m2)	Model dependent	★
F2-43	Inertia auto-tuning and dynamic speed reference	0% to 100% (base value: rated motor frequency)	30%	★
F2-47	Inertia auto-tuning	0: Disabled 1: Enabled	0	★
F2-48	Inertia auto-tuning speed loop bandwidth reference	0.1 Hz to 100.0 Hz	10.0 Hz	★
F2-50	Inertia auto-tuning mode	0: Acceleration/ Deceleration 1: Triangular wave	0	★
F2-51	Inertia auto-tuning acceleration/ deceleration coefficient	0.1 to 10.0	1.0	★
F2-52	Decoupling control	0 to 1	0	★
F2-53	Generating power limit selection	0: Disabled 1: Enabled	0	★
F2-54	Generating power limit	0.0% to 200.0%	Model dependent	★
Group F3: V/F Control Parameters				
F3-00	V/F curve setting	0: Linear V/F 1: Multi-point V/F 2: Square V/F 3: 1.2-power V/F 4: 1.4-power V/F 6: 1.6-power V/F 8: 1.8-power V/F 9: Reserved 10: V/F complete separation 11: V/F half separation	0	★
F3-01	Torque boost	0.0%: Automatic torque boost 0.1% to 30.0%	Model dependent	☆
F3-02	Cutoff frequency of torque boost	0.00 Hz to the maximum frequency	50.00 Hz	★

Param. No.	Param. Name	Setting Range	Default	Property
F3-03	Multi-point V/F frequency 1	0.00Hz to F3-05 (Carrier frequency)	0.00Hz	★
F3-04	Multi-point V/F voltage 1	0.0% to 100.0%	0.0%	★
F3-05	Multi-point V/F frequency 2	F3-03 (Multi-point V/F frequency 1) to F3-07 (Multi-point V/F frequency 3)	0.00 Hz	★
F3-06	Multi-point V/F voltage 2	0.0% to 100.0%	0.0%	★
F3-07	Multi-point V/F frequency 3	F3-05 to F1-04 (Rated motor frequency)	0.00 Hz	★
F3-08	Multi-point V/F voltage 3	0.0% to 100.0%	0.0%	★
F3-09	V/F slip compensation gain	0.0% to 200.0%	0.0%	☆
F3-10	V/F over-excitation gain	0 to 200	64	☆
F3-11	V/F oscillation suppression gain	0 to 100	Model dependent	☆
F3-12	Oscillation suppression gain mode	0: Disabled 3: Enabled	3	★
F3-13	Voltage source for V/F separation	0: Set by F3-14 1 to 2: Reserved 4 to 5: Reserved	0	☆
F3-14	Digital setting of voltage for V/F separation	0 V to the rated motor voltage	0 V	☆
F3-15	Voltage rise time of V/F separation	0.0s to 1000.0s Note: It sets the time for the output voltage to rise from 0 to the rated motor voltage.	0.0s	☆
F3-16	Voltage decline time of V/F separation	0.0s to 1000.0s Note: It sets the time for the output voltage to rise from 0 to the rated motor voltage.	0.0s	☆
F3-17	Stop mode for V/F separation	0: Frequency and voltage declining to 0 independently 1: Frequency declining after voltage declines to 0	0	★
F3-18	V/F current limit level	50% to 200%	150%	★
F3-19	V/F current limit	0: Disabled 1: Enabled	1	★

Param. No.	Param. Name	Setting Range	Default	Property
F3-20	V/F current limit gain	0 to 100	20	☆
F3-21	V/F compensation factor of speed multiplying current limit level	50 to 200	50	★
F3-22	V/F voltage limit	650.0 V to 800.0 V	770.0 V	★
F3-23	V/F voltage limit	0: Disabled 1: Enabled	1	★
F3-24	V/F frequency gain for voltage limit	0 to 100	30	☆
F3-25	V/F voltage gain for voltage limit	0 to 100	30	☆
F3-26	Frequency rise threshold during voltage limit	0 to 50	5	★
F3-27	Slip compensation time constant	0.1 to 10.0	0.5	☆
F3-28	Automatic frequency rise	0: Disabled 1: Enabled	0	★
F3-29	Minimum motoring torque current	10 to 100	50	★
F3-30	Maximum generating torque current	10 to 100	20	★
F3-31	Automatic frequency rise KP	0 to 100	50	☆
F3-32	Automatic frequency rise KI	0 to 100	50	☆
F3-33	Online torque compensation gain	80 to 150	100	★
Group F6: Start/Stop Control				
F6-00	Start mode	0: Direct start 1: Catching a spinning motor (asynchronous AC motor) 2: Pre-excitation startup (asynchronous AC motor)	0	☆
F6-01	Mode of catching a spinning motor	0: From stop frequency 1: From 50 Hz 2: From the maximum frequency	0	★

Param. No.	Param. Name	Setting Range	Default	Property
F6-02	Speed of catching a spinning motor	1 to 100	20	☆
F6-03	Startup frequency	0.00 Hz to 10.00 Hz	0.00 Hz	☆
F6-04	Start frequency holding time	0.0s to 100.0s	0.0s	★
F6-05	Startup DC injection braking current/pre-excitation current	0% to 100%	0%	★
F6-06	Startup DC injection braking active time/pre-excitation active time	0.0s to 100.0s	0.0s	★
F6-07	Acceleration/ Deceleration mode	0: Linear acceleration/ deceleration 1: S-curve acceleration/ deceleration	0	★
F6-08	Time proportion of S-curve start segment	0.0% to (100% - F6-09)	30.0%	★
F6-09	Time proportion of S-curve end segment	0.0% to (100% - F6-09)	30.0%	★
F6-10	Stop mode	0: Decelerate to stop 1: Coast to stop	0	☆
F6-11	Shutdown DC injection braking/Position lock start frequency	0.00 Hz to the maximum frequency	0.00 Hz	☆
F6-12	Shutdown DC injection braking delay	0.0s to 100.0s	0.0s	☆
F6-13	Shutdown DC injection braking current	0% to 100%	0%	☆
F6-14	Shutdown DC injection braking active time	0.0s to 100.0s	0.0s	☆
F6-15	Braking use ratio	0% to 100%	100%	★
F6-16	Closed-loop current Kp of catching a spinning motor	0 to 1000	500	☆

Param. No.	Param. Name	Setting Range	Default	Property
F6-17	Closed-loop current Ki of catching a spinning motor	0 to 1000	800	☆
F6-18	Current of catching a spinning motor	30 to 200	100	☆
F6-20	Voltage rise time at catching a spinning motor	0.5s to 3.0s	1.0s	☆
F6-21	Demagnetization time	00.00s to 10.00s	1.00s	☆
F6-22	Startup pre-torque setting	000.0% to 200.0%	0.0%	☆
F6-23	Command running on power supply side	0: Stop according to F6-10 (Stop mode) 1: Ignore stop command on power supply side	0	★
F6-24	Position lock KP	0.0 to 100.0	10.0	☆
F6-25	Position lock end amplitude	0 to 16383	10	☆
Group F7: Operating Panel and LED Display				
F7-06	Load speed display coefficient	0.0001 to 6.5000	1	☆
F7-07	Heatsink temperature of IGBT	0.0°C to 100.0°C	-	●
F7-08	Product No.	80.00	-	●
F7-09	Accumulative running time	0h to 65535h	-	●
F7-10	Performance software version	-	-	●
F7-11	Function software version	-	-	●
F7-12	Number of decimal places for load speed display	0: 0 decimal places 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places	1	☆
F7-13	Accumulative power-on time	0h to 65535h	-	●
F7-14	Accumulative power consumption	0° to 65535°	-	●
F7-15	Temporary performance software version	0 to 65535	-	●

Param. No.	Param. Name	Setting Range	Default	Property
F7-16	Temporary function software version	0 to 65535	-	●
Group F9: Fault and Protection				
F9-00	AC drive overload suppression	0 to 1	0	☆
F9-01	Motor overload protection gain	0.20 to 10.00	1.00	☆
F9-02	Motor overload pre-warning coefficient	50% to 100%	80%	☆
F9-06	Output phase loss detection before startup	0: Disabled 1: Enabled	0:	☆
F9-07	Software short-circuit to ground detection	0: No detection 1: Detection before power-on 2: Detection during running 3: Detection before power-on and during running	1	★
F9-09	Auto fault reset times	0 to 20	0	☆
F9-10	DO action during auto fault reset	0: Not act 1: Act	0	☆
F9-11	Auto fault reset interval	0.1s to 100.0s	1.0s	☆

Param. No.	Param. Name	Setting Range	Default	Property
F9-14	1st fault type	0: No fault 1: Hardware fault 2: Overcurrent during acceleration 3: Overcurrent during deceleration 4: Overcurrent at constant speed 5: Overvoltage during acceleration 6: Overvoltage during deceleration 7: Overvoltage at constant speed 9: Undervoltage 10: AC drive overload 11: Motor overload 12: Reserved 13: Output phase loss 14: IGBT overheat 15: External fault 16: Communication fault 17 to 18: Reserved 19: Motor auto-tuning abnormal 20: Reserved 21: EEPROM read/write error 22: Motor auto-tuning abnormal 23: Motor short-circuited to ground 24: Inter-phase short circuit 25 to 31: Reserved 42: Excessive speed deviation 43: Motor overspeed 45: Reserved 80: Fan fault		●
F9-15	2nd fault type			●
F9-16	3rd (latest) fault type			●

Param. No.	Param. Name	Setting Range	Default	Property
F9-17	Frequency upon 3rd (latest) fault			●
F9-18	Current upon 3rd (latest) fault			●
F9-19	Bus voltage upon 3rd (latest) fault			●
F9-20	DI state upon 3rd (latest) fault			●
F9-21	DO state upon 3rd (latest) fault			●
F9-22	AC drive state upon 3rd (latest) fault			●
F9-23	Power-on time upon 3rd (latest) fault			●
F9-24	Running time upon 3rd (latest) fault			●
F9-25	IGBT temperature upon 3rd (latest) fault			●
F9-26	3rd (latest) fault subcode			●
F9-27	Frequency upon 2nd fault			●
F9-28	Current upon 2nd fault			●
F9-29	Bus voltage upon 2nd fault			●
F9-30	DI state upon 2nd fault			●
F9-31	DO state upon 2nd fault			●
F9-32	AC drive state upon 2nd fault			●
F9-33	Power-on time upon 2nd fault			●
F9-34	Running time upon 2nd fault			●
F9-35	IGBT temperature upon 2nd fault			●
F9-36	2nd fault subcode			●
F9-37	Frequency upon 1st fault			●
F9-38	Current upon 1st fault			●

Param. No.	Param. Name	Setting Range	Default	Property
F9-39	Bus voltage upon 1st fault			●
F9-40	DI state upon 1st fault			●
F9-41	DO state upon 1st fault			●
F9-42	AC drive state upon 1st fault			●
F9-43	Power-on time upon 1st fault			●
F9-44	Running time upon 1st fault			●
F9-45	IGBT temperature upon 1st fault			●
F9-46	1st fault subcode			●
F9-48	Fault protection action 1	Ones: Motor overload (Err11) Tens: Reserved Hundreds: Output phase loss (E13) Thousands: Heatsink overheat (E14) Ten thousands: External fault (E15) Note: Output phase loss is valid only in V/F control mode when decelerate to stop or alarm is selected.	10050 0: Coast to stop 1: Decelerate to stop 2 to 3: Reserved 4: Alarm 5: Canceled	★
F9-49	Fault protection action 2	Ones: Communication timeout (E16) Tens: Reserved Hundreds: Reserved Thousands: Motor auto-tuning fault (E19) Ten thousands: Reserved	00050 0: Coast to stop 1: Decelerate to stop 2 to 3: Reserved 4: Alarm 5: Canceled	★

Param. No.	Param. Name	Setting Range	Default	Property
F9-50	Fault protection action 3	Ones: EEPROM read/write error (E21) Tens: Motor auto-tuning abnormal (E22) Hundreds: Motor short-circuited to the ground (E23) Thousands: Inter-phase short-circuit (E24) Ten thousands: Reserved	25000 0: Coast to stop 1: Decelerate to stop 2 to 3: Reserved 4: Alarm 5: Canceled	★
F9-51	Fault protection action 4	Ones: Reserved Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	51111 0: Coast to stop 1: Decelerate to stop 2 to 3: Reserved 4: Alarm 5: Canceled	★
F9-52	Fault protection action 5	Ones: Reserved Tens: Reserved Hundreds: Reserved Thousands: Excessive speed deviation (E42) Ten thousands: Motor overspeed (E43)	00101 0: Coast to stop 1: Decelerate to stop 2 to 3: Reserved 4: Alarm 5: Canceled	★
F9-54	Frequency for continuing to run upon fault	0: Current running frequency 1: Frequency reference 2: Frequency upper limit 3: Frequency lower limit 4: Backup frequency upon abnormality	1	☆
F9-55	Backup frequency upon fault	0.0% to 100.0% The value 100.0% corresponds to F0-10 (Maximum frequency).	100.0%	☆
F9-59	Power dip ride-through function	0: Disabled 1: Decelerate 2: Decelerate to stop	0	★

Param. No.	Param. Name	Setting Range	Default	Property
F9-60	Threshold of power dip ride-through function disabled	80 to 100%	85%	☆
F9-61	Judging time of bus voltage recovering from power dip	0.0s to 100.0s	0.5s	☆
F9-62	Threshold of power dip ride-through function enabled	60% to 100.0% (standard bus voltage)	80%	☆
F9-64	Load loss detection level	0.0% to 100.0%	10.0%	☆
F9-65	Load loss detection time	0.0s to 60.0s	1.0s	☆
F9-67	Overspeed detection value	0.0% to 50.0% (maximum frequency) (Overspeed detection is disabled when it is set to 0.0%.)	5.0%	☆
F9-68	Overspeed detection time	0.0s to 60.0s	1.0s	☆
F9-69	Detection value of excessive speed deviation	0.0% to 50.0% (maximum frequency) (Excessive speed detection is disabled when it is set to 0.0%.)	20.0%	☆
F9-70	Detection time of excessive speed deviation	0.0s to 60.0s	5.0s	☆
F9-71	Power dip ride-through gain	0 to 100	40	☆
F9-72	Power dip ride-through integral	0 to 100	30	☆
F9-73	Deceleration time of power dip ride-through	0.0s to 300.0s	20.0s	☆
Group FC: Multi-Reference and Simple PLC Function				
FC-00	Reference 0	-100.0% to 100.0%	0.0%	☆
FC-01	Reference 1	-100.0% to 100.0%	0.0%	☆
FC-02	Reference 2	-100.0% to 100.0%	0.0%	☆
FC-03	Reference 3	-100.0% to 100.0%	0.0%	☆
FC-04	Reference 4	-100.0% to 100.0%	0.0%	☆
FC-05	Reference 5	-100.0% to 100.0%	0.0%	☆
FC-06	Reference 6	-100.0% to 100.0%	0.0%	☆
FC-07	Reference 7	-100.0% to 100.0%	0.0%	☆
FC-08	Reference 8	-100.0% to 100.0%	0.0%	☆
FC-09	Reference 9	-100.0% to 100.0%	0.0%	☆
FC-10	Reference 10	-100.0% to 100.0%	0.0%	☆

Param. No.	Param. Name	Setting Range	Default	Property
FC-11	Reference 11	-100.0% to 100.0%	0.0%	☆
FC-12	Reference 12	-100.0% to 100.0%	0.0%	☆
FC-13	Reference 13	-100.0% to 100.0%	0.0%	☆
FC-14	Reference 14	-100.0% to 100.0%	0.0%	☆
FC-15	Reference 15	-100.0% to 100.0%	0.0%	☆
Group Fd: Communication Parameters				
Fd-06	Automatic communication fault reset	0: Disabled 1: Enabled	1	☆
Fd-07	CAN communication timeout	0 to 65535 ms	5000	☆
Fd-09	Communication status	Ones (CANopen) 0: Stop 1: Initialization 2: Pre-operational 8: Operational Tens (CANlink) 0: Stop 1: Initialization 2: Pre-operational 8: Operational Hundreds digit (PROFIBUS-DP) 0: Stop 1: Initialization 8: Operational	0	●
Fd-10	CANopen/ CANlink switchover	1: CANopen 2: CANlink	1	★
Fd-11	CANopen 402	0: Disabled 1: Enabled	1	★
Fd-12	CAN baud rate	0: 20 Kbps 1: 50 Kbps 2: 100 Kbps 3: 125 Kbps 4: 250 Kbps 5: 500 Kbps 6: 1 MKbps	4	★
Fd-13	CAN station number	1 to 127 (Valid for CANlink and CANopen)	1	★
Fd-14	Number of CAN frames received within a period			●

Param. No.	Param. Name	Setting Range	Default	Property
Fd-15	Maximum value of node receiving error counter			●
Fd-16	Maximum value of node sending error counter			●
Fd-17	Bus disconnection times within a period			●
Fd-32	Group AF mapping mode change	0: Communication not saved 1: Communication saved	0	★
Fd-33	CANopen communication cycle	-	-	●
Fd-40	Address of J1939 control word 1	0 to 0xFFFF	0xF000	☆
Fd-41	Address of J1939 control word 2	0 to 0xFFFF	0xF000	☆
Fd-42	Address of J1939 monitor word 1	0 to 0xFFFF	0xF70A	☆
Fd-43	Address of J1939 monitor word 2	0 to 0xFFFF	0xF70B	☆
Fd-44	Address of J1939 monitor word 3	0 to 0xFFFF	0xF710	☆
Fd-45	Address of J1939 monitor word 4	0 to 0xFFFF	0xF709	☆
Fd-46	J1939 packet format modification verification	0 to 65535	0	☆
Fd-47	ID of received packet 1 (high 16 bits)	0 to 0x1FFF	0x1400	●
Fd-48	ID of received packet 1 (low 16 bits)	0 to 0xFFFF	0x9183	●
Fd-49	Sending period 1	1 to 6000 ms	10	●
Fd-50	ID of sent packet 1 (high 16 bits)	0 to 0x1FFF	0x1808	●
Fd-51	ID of sent packet 1 (high 16 bits)	0 to 0xFFFF	0x8391	●
Fd-52	ID of sent packet 2 (high 16 bits)	0 to 0x1FFF	0x1809	●
Fd-53	ID of sent packet 2 (high 16 bits)	0 to 0xFFFF	0x8391	●
Fd-54	ID of sent packet 3 (high 16 bits)	0 to 0x1FFF	0x180A	●

Param. No.	Param. Name	Setting Range	Default	Property
Fd-55	ID of sent packet 3 (high 16 bits)	0 to 0xFFFF	0x8391	●
Fd-56	Sending period 4	1 to 6000 ms	100	●
Fd-57	ID of sent packet 4 (high 16 bits)	0 to 0x1FFF	0x180B	●
Fd-58	ID of sent packet 4 (high 16 bits)	0 to 0xFFFF	0x8391	●
Group FP: Parameter Management				
FP-00	User password	0 to 65535	0	☆
FP-01	Parameter initialization	0: No operation 01: Restore default settings except motor parameters, encoder parameters, and F0-10 (Maximum frequency) 02: Clear records 04: Back up current user parameters 501: Restore user backup parameters 502: Restore default parameters (excluding communication parameter groups FD and AF)	0	★
FP-02	Parameter display property	Ones: Group U display 0: Hidden 1: Displayed Tens: Group A 0: Hidden 1: Displayed	111	☆
FP-03	Customized parameter group display	Ones: User-defined parameter group display 0: Hidden 1: Displayed Tens: User-modified parameter group display 0: Hidden 1: Displayed	11	☆
FP-04	Parameter modification property	0: Modification allowed 1: Modification prohibited	0	☆
Group A0: Torque Control Parameters				
A0-00	Speed/Torque control	0: Speed control 1: Torque control	0	★

Param. No.	Param. Name	Setting Range	Default	Property
A0-01	Torque reference channel selection in torque control	0: Digital setting 1 (A0-03) 5: Communication setting (1000H)	0	★
A0-03	Torque digital setting	-200.0% to +200.0%	100.0%	☆
A0-04	Torque filter time	0 to 5.000s	0.000s	☆
A0-05	Speed limit digital setting	-120.0% to 120.0%	0.00%	☆
A0-07	Acceleration time (torque)	0.0s to 650.00s	1.00s	☆
A0-08	Deceleration time (torque)	0.0s to 650.00s	1.00s	☆
A0-09	Maximum speed reference source	0: Set by A0-05 1: Frequency reference	0	☆
A0-10	Speed limit offset	0 to F0-10 (Maximum frequency)	5.00 Hz	☆
A0-11	Effective mode of speed limit offset	0: Bidirectional offset 1: Unidirectional offset	1	★
A0-12	Frequency acceleration time	0.0s to 6500.0s	1.0s	☆
A0-13	Frequency deceleration time	0.0s to 6500.0s	1.0s	☆
A0-14	Torque mode switchover	0: No switchover 1: Switchover to speed control at stop 2: Target torque at stop being 0	1	★
Group A5: Control Optimization Parameters				
A5-00	DPWM switchover frequency upper limit	0.00 Hz to F0-10 (Maximum frequency)	12.00 Hz	☆
A5-01	PWM modulation mode	0: Asynchronous modulation 1: Synchronous modulation	0	☆
A5-02	Dead-zone compensation mode	0: Disabled 1: Enabled	1	★
A5-03	Random PWM depth	0: Random PWM invalid 1 to 10: PWM carrier random depth	0	☆
A5-04	Fast current limit	0: Disabled 1: Enabled	1 (0 for asynchronous motor in SVC mode)	☆
A5-05	Sampling delay	1 to 13	5	☆

Param. No.	Param. Name	Setting Range	Default	Property
A5-06	Undervoltage threshold	210.0 V to 600.0 V	230.0	☆
A5-07	SVC optimization	0: No optimization 1: Optimization mode 1 2: Optimization mode 2	1	☆
A5-09	Overvoltage threshold	310.0 V to 900.0 V	900.0	☆
Group A9: Vector Control Supplementary Parameters				
A9-00	Online auto-tuning of rotor time constant (asynchronous motor)	0: No auto-tuning 1: Auto-tuning	0	☆
A9-01	Reserved			
A9-02	Reserved			
A9-03	Reserved			
A9-04	Maximum torque limit coefficient of weaken flux field in SVC/FVC mode	30 to 150	80	☆
A9-05	SVC speed filter (asynchronous motor)	5 ms to 32 ms	15 ms	☆
A9-06	SVC speed feedback processing in speed control (asynchronous motor)	0: No processing 1: Minimum synchronization frequency limited based on load change 2 and 3: Output fixed current at low speed	0	☆
A9-07	SVC field regulating bandwidth (asynchronous motor)	0 Hz to 8.0 Hz	2.0 Hz	☆
A9-08	Current at low-speed running of asynchronous motor in SVC mode	30 to 170	100	☆
A9-09	Switchover frequency of fixed current output of asynchronous motor in SVC mode	2.0 Hz to 100.0 Hz	3.0 Hz	☆

Param. No.	Param. Name	Setting Range	Default	Property
A9-10	Speed fluctuation suppression coefficient of asynchronous motor in SVC mode	0 to 6	3	☆
A9-11	Acceleration/ Deceleration time of asynchronous motor in SVC mode	0.1s to 3000.0s	20.0s	☆
A9-12	Quick auto-tuning of stator resistance before asynchronous motor startup	0: Disabled 1: Enabled	0	☆
A9-13	Stator resistance coefficient 1 by asynchronous motor quick auto-tuning			★
A9-14	Stator resistance coefficient 2 by asynchronous motor quick auto-tuning			★
A9-15	Stator resistance coefficient 3 by asynchronous motor quick auto-tuning			★
A9-17	Synchronous motor real-time angle			☆
A9-18	Initial position angle detection of synchronous motor	0: Detection always 1: No detection 2: Detection at first-time running after power-on	0	☆
A9-20	Field weakening mode	0: Automatic 1: Synchronous motor adjustment 2: Synchronous motor mix mode 3: Disabled	1	★
A9-21	Synchronous motor field weakening gain	0 to 50	5	☆

Param. No.	Param. Name	Setting Range	Default	Property
A9-22	Synchronous motor output voltage upper limit margin	0% to 50%	5%	☆
A9-23	Synchronous motor maximum output gain	20% to 300%	100%	☆
A9-24	Calculated excitation current adjustment gain of synchronous motor	40% to 200%	100%	☆
A9-25	Speed evaluation integral gain of synchronous motor in SVC mode	5 to 1000	30	☆
A9-26	Speed evaluation proportional gain of synchronous motor in SVC mode	5 to 300	20	☆
A9-27	Estimated speed filter of synchronous motor in SVC mode	10 to 2000	100	☆
A9-28	Minimum carrier frequency of synchronous motor in SVC mode	0.8 kHz to F0-15 (Carrier frequency)	2.0 kHz	☆
A9-29	Synchronous motor excitation current at low-speed running	0% to 80%	30%	☆

■ AC Drive Monitoring Parameters

Param. No.	Param. Name	Min. Unit	Communication Address
Group U0: Standard Monitoring Parameters			
U0-00	Running frequency	0.01 Hz	7000H
U0-01	Frequency reference	0.01 Hz	7001H
U0-02	Bus voltage	0.1 V	7002H
U0-03	Output voltage	1 V	7003H
U0-04	Output current	0.1 A	7004H

Param. No.	Param. Name	Min. Unit	Communication Address
U0-05	Output power	0.1 kW	7005H
U0-06	Output torque	0.1%	7006H
U0-11	Motor rotation speed	1 rpm	700BH
U0-12	Count value	1	700CH
U0-13	Length value	1	700DH
U0-14	Load speed display	1	700EH
U0-15	PID reference	0.1%	700FH
U0-16	PID feedback	0.1%	7010H
U0-17	PLC stage	1	7011H
U0-18	Pulse input frequency	0.01 kHz	7012H
U0-19	Feedback frequency	0.01 Hz	7013H
U0-20	Remaining running time	0.1 min	7014H
U0-24	Linear speed	1 m/min	7018H
U0-25	Accumulative power-on time	1 min	7019H
U0-26	Accumulative running time	0.1 min	701AH
U0-28	Communication setting	0.01%	701CH
U0-30	Main frequency X display	0.01 Hz	701EH
U0-31	Auxiliary frequency Y display	0.01 Hz	701FH
U0-33	Synchronous motor rotor position	0.1°	7021H
U0-35	Target torque	0.1%	7023H
U0-37	Power factor angle	0.1°	7025H
U0-39	Target voltage upon V/F separation	1 V	7027H
U0-40	Output voltage upon V/F separation	1 V	7028H
U0-45	Fault subcode	1	702DH
U0-46	Heatsink temperature	1°C	702EH
U0-61	AC drive state	1: Forward 2: Reverse 3: Stop 4: Auto-tuning 5: Faulty	703DH
U0-62	Current fault code	1	703EH
U0-79	DC bus current	0.1 A	704FH

Appendix E DC-DC Unit Troubleshooting and Parameter Table

■ DC-DC Unit Troubleshooting

Fault Code	Fault Description	Possible Cause	Solution
E01	Input overvoltage	The input voltage is too high.	Reduce the input voltage.
E02	Input undervoltage	The input voltage is too low.	Increase the input voltage.
E03	Module 1 output overvoltage	The load is too light.	Apply the load within the permissible range.
E04	Module 1 output undervoltage	The load is too heavy. Output short-circuit occurs.	Reduce the load and check the load conditions.
E05	Baseplate overheat	The ambient temperature is too high. The fan is damaged.	Reduce the ambient temperature. Replace the fan.
E06	Module 1 output overcurrent	The load is too heavy. Output short-circuit occurs.	Reduce the load. Eliminates the short-circuit fault.
E07	Module 1 output overload	The load is too heavy. Output short-circuit occurs.	Reduce the load and check the load conditions.
E08	Auxiliary power supply undervoltage	The 24 V input power voltage is too low.	Increase the 24 V input power voltage.
E09	Auxiliary power supply overvoltage	The load is too light.	Apply the load within the permissible range.
E10	Module 2 output undervoltage	The load is too heavy. Output short-circuit occurs.	Reduce the load and check the load conditions.
E11	Module 2 output overcurrent	The load is too heavy. Output short-circuit occurs.	Reduce the load and check the load conditions.
E12	Module 2 output overload	The load is too heavy. Output short-circuit occurs.	Reduce the load and check the load conditions.
E13	System output overload	The load is too heavy.	Reduce the load.
E14	Module 1 output fast overcurrent	The short-time load is too high.	Reduce the load.

Fault Code	Fault Description	Possible Cause	Solution
E15	Module 2 output fast overcurrent	The short-time load is too high.	Reduce the load.
E20	EEPRROM fault	A correction parameter cyclic redundancy check (CRC) error occurs when configuration parameters are read at power-on.	Contact the agent or Inovance.
E21	EEPRROM1 fault	An EEPROM write operation error occurs during running.	Check whether the write operation is performed too frequently.
E22	CAN communication timeout	The CAN packet is not received.	The PLC is faulty or the PLC program is abnormal.
E23	Correction failure	The correction parameter is incorrect. The corrected value exceeds the permissible range.	Contact the agent or Inovance.

■ DC-DC Parameter Table

☆: The parameter can be modified when the drive is in either stop or running state.

★: The parameter cannot be modified when the drive is in the running state.

●: The parameter value is the actual measured value and cannot be modified.

*: The parameter is a factory parameter and can be set only by the manufacturer.

Param. No.	Param. Name	Setting Range	Default	Property
Group F1: General Function Parameter Settings				
F1-00	Module 1 output current		0	☆
F1-01	Module 2 output current		0	☆
F1-02	Module 1 output voltage		0	☆
F1-03	Module 2 output voltage		0	☆
F1-04	System input voltage		0	☆
F1-05	Auxiliary input voltage		0	☆
F1-06	Baseplate temperature		0	☆

Param. No.	Param. Name	Setting Range	Default	Property
F1-07	Bus voltage		0	☆
F1-08	System output current		0	☆
F1-10	Output power reference value of module 1		0	☆
F1-11	Output current reference value of module 1		0	☆
F1-12	Output voltage reference value of module 1		0	☆
F1-13	Output power reference value of module 2		0	☆
F1-14	Output current reference value of module 2		0	☆
F1-15	Output voltage reference value of module 2		0	☆
F1-17	Product version		0	☆
F1-18	Product phase level		0	☆
F1-19	Customer type		0	☆
F1-20	Software version		0	☆
F1-21	Software version consolidation time - year		0	☆
F1-22	Software version consolidation time - month		0	☆
F1-23	Software version consolidation time - day		0	☆
F1-24	Hardware version V		0	☆
F1-25	Hardware version B		0	☆
F1-26	Hardware version D		0	☆
F1-27	DC-DC software version V		0	☆
F1-28	DC-DC software version B		0	☆
F1-29	DC-DC software version D		0	☆
Group F3: Fault and Data Records				
F3-00	Total number of faults		0	☆
F3-01	Specified displayed fault times		0	☆

Param. No.	Param. Name	Setting Range	Default	Property
F3-02	Fault code	For details, see the DC-DC unit troubleshooting table.	0	☆
F3-03	Module 1 output current		0	☆
F3-04	Module 1 output voltage		0	☆
F3-05	Module 2 output current		0	☆
F3-06	Module 2 output voltage		0	☆
F3-07	System input voltage		0	☆
F3-08	Auxiliary power supply voltage		0	☆
F3-09	Baseplate temperature		0	☆
F3-11	Relative fault time		0	☆
Group F4: Commissioning Parameters				
F4-00	Startup mode	1: DI 2: DI&CAN 3: DI&SOP	2	☆
F4-01	Speed adjustment mode	1: SOP keypad 2: CAN	2	☆
F4-11	M1 output voltage reference	14.0 V to 27.5 V	27.5 V	☆
F4-12	M2 output voltage reference	14.0 V to 27.5 V	27.5 V	☆

INOVANCE Warranty Agreement

1) Inovance provides an 18-month free warranty to the equipment itself from the date of manufacturing for the failure or damage under normal use conditions.
2) Within the warranty period, maintenance will be charged for the damage caused by the following reasons:
   a. Improper use or repair/modification without prior permission
   b. Fire, flood, abnormal voltage, natural disasters, and secondary disasters
   c. Hardware damage caused by dropping or transportation after procurement
   d. Operations not following the user instructions
   e. Damage out of the equipment (for example, external device factors)
3) The maintenance fee is charged according to the latest Maintenance Price List of Inovance.
4) If there is any problem during the service, contact Inovance's agent or Inovance directly.
5) Inovance reserves the rights for explanation of this agreement.

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