NICE2000new Integrated Escalator Controller User Manual

Inovance Technology

Preface

Thank you for purchasing the NICE2000new integrated escalator controller.

The NICE2000new is a new-generation high-performance modular escalator controller independently developed and manufacturered by Suzhou MONARCH Control Technology Co., Ltd.

The NICE2000new follows the future controller trend, and has the following advantages:

1) It features compact structure and easy installation.

2) It adopts the advanced motor control algorithm and automatic motor auto-tuning, RUN contactor control , and brake contactor control, and has many functions dedicated for escalator control, such as bypass variable frequency energey-saving control, full variable frequency energey-saving control, and motor speed catching.

3) It supports special functions to guarantee safe running of the escalator. This function includes RUN contactor contact detection, brake contactor contact detection, contact stuck detection, up/down photoelectric signal, left/right handrail signal, and step loss detection.

4) The external operation panel that can be connected to the controller through the RJ45 port makes the operation and commissioning simpler and easier.

This manual describes the correct use of the NICE2000new, including product features, safety information and precautions, installation, parameter setting, commissioning, and maintenance & inspection. Read and understand the manual before using the product, and keep it carefully for reference to future maintenance.

The personnel who involve in system installation, commissioning, and maintenance must receive necessary safety and use training, understand this manual thoroughly, and have related experience before performing operations.

Notes
● The drawings in the manual are sometimes shown without covers or protective guards. Remember to install the covers or protective guards as specified first, and then perform operations in accordance with the instructions. ● The drawings in the manual are shown for description only and may not match the product you purchased. ● The instructions are subject to change, without notice, due to product upgrade, specification modification as well as efforts to increase the accuracy and convenience of the manual.

- Contact our agents or customer service center if you need a new user manual or have problems during the use.
- Email: UM@inovance.cn

Introduction

The NICE2000new has the following features:

1. Integration

- Goood integration of drive and control

  The NICE2000new integrates motor drive and control logic to form the escaltor control system, which elimintes separate and complicated operations on the logic control and drive. It features compact structure and less peripheral wiring, reduces the cost, and improves safety and stability of the escalator.

- Support for both synchronous and asynchronous motors

  The NICE2000new supports V/F control on the asynchronous motor and sensorless vector control (SVC) on the synchronous and asynchronous motors. Switchover between different motors can be easily performed by setting the related parameter.

- No need for PLC or elecator control board

  As a replacement of the traditional control modes (PLC or eslecator control board + controller), the NICE2000new integrates motor control and escalator control. Without use of the PLC or elecator control board, the NICE2000new reduces the system electric cost to the mimimum.

- Compliant with international standards

  Developed based on many years' experience in the escalator industry, the NICE2000new complies with international standards, such as NEN115 European standard, AS1735 Australian standard, A17.1 U.S. standard, PUBEE Russian standard, K Korean standard, and special requirments of Hong Kong and Singapore.

2. Bypass variable frequency

- No need for regen. resistor

  The NICE2000new uses the unique bypass variable frequency control technology. It makes full use of the advantages of escalator mains frequency running and variable frequency running, eliminating the need of the regen. resistor and implementing energy-saving and cost reduction.

- Variable frequency/Mains frequency redundancy design

  The NICE2000new supports multiple running modes, full variable frequency control, bypass variable frequency control, and Y-Δ control. With rich built-in escalator control functions, it meets requirements of different customers and reduces probabilities of

escalator stop due to faults.

- Energy-saving at lower power rating

  In the bypass variable frequency control mode, the variable frequency control is used in standby and acceleration/deceleration states of the escalator, and the mains frequency control is used in stable running state of the escalator. The NICE2000new is in intermittent working state, and therefore a lower power rating is sufficient to meet the requirements.

3. Professional quality

- Professional manufacturing platform

  The NICE2000new manufacturing platform adopts the professional assembly line. The international advanced manufacturing platform guarantees reliable quality of the product.

- Separate air duct with conformal coating process

  All PCBs inside the NICE2000new are manufactured with the conformal coating process. The separated air duct improvides long-term reliability of the NICE2000new in different applications such as escalator and moving walkway.

- Compliant with EMC standard

  The NICE2000new has the lightning protection design and the strong anti-interface capability, and is compliant with the EMC standard.

Contents

Chapter 1 Safety Information and Precautions

In this manual, the notices are graded based on the degree of danger:

- ⚠DANGER indicates that failure to comply with the notice will result in severe personal injury or even death.
- ⚠WARNING indicates that failure to comply with the notice will result in potential risk of severe personal injury or even death.
- ⚠CAUTION indicates that failure to comply with the notice will result in minor or moderate personal injury or equipment damage.

In addition, **NOTE** appearing in other chapters indicates that an unintended result or situation may occur if the notice is not complied with.

The notices in this manual you have to observe are aimed at guaranteeing your personal safety, as well as to prevent damage to the controller or the parts connected to it. Read this chapter carefully so that you have a thorough understanding and perform all operations by following the notices in this chapter. Monarch will assume no liability or responsibility for any injury or loss caused by improper operation.

1.1 Safety Precautions

Use Stage	Safety Grade	Precautions
Warning	⚠WARNING	● This controller has hazardous voltage and the controlled motor is a dangerous rotating device. Failure to comply with the notices may result in personal injury or damage to the property. ● Transportation, installation, operation and maintenance of the controller can be performed only by qualified personnel after they get familiar with the safety information in this manual. This is the prerequisite of safe and stable running of the equipment. ● Do not open the front cover or touch the power terminals on the main circuit within 10 minutes after the controller is powered off. The capacitor on the DC circuit still has residual voltage even after power-off. Failure to comply will result in electric shock.
During installation	⚠DANGER	● Do not install the equipment if you find water seepage, component missing or damage upon unpacking. ● Do not install the equipment if the packing list does not conform to the product you received. ● Install the equipment on incombustible objects such as metal, and keep it away from combustible materials. Failure to comply may result in a fire.
	⚠WARNING	● Do not loosen the fixed screws of the components, especially the screws with red mark. ● Do not install the controller on vibrating parts. Failure to comply may result in damage to the equipment or unexpected accidents.

	⚠CAUTION	● Handle the equipment with care during transportation to prevent damage to the equipment. ● Do not drop wire end or screw into the controller. Failure to comply will result in damage to the controller. ● Do not use the equipment with damaged or missing components. Failure to comply will result in personal injury. ● Do not touch the components with your hands. Failure to comply will result in static electricity damage. ● Install the controller in places free of vibration and direct sunlight.
At wiring	⚠DANGER	● Wiring must be performed only by qualified personnel under instructions described in this manual. Failure to comply may result in unexpected accidents. ● A circuit breaker must be used to isolate the power supply and the controller. Failure to comply may result in a fire. ● Ensure that the power supply is cut off before wiring. Failure to comply may result in electric shock. ● Tie the controller to ground properly according to the standard. Failure to comply may result in electric shock.
	⚠WARNING	● Never connect the power cables to the output terminals (U, V, W) of the controller. Pay attention to the marks of the wiring terminals and ensure correct wiring. Failure to comply will result in damage to the controller. ● Never connect the regen. resistor between the DC bus terminals (+) and (-). Failure to comply may result in a fire.

	⚠CAUTION	● Ensure that the cabling satisfies the EMC requirements and the local codes. Use wire sizes recommended in the manual. Failure to comply may result in accidents. ● Use the shielded cable for the encoder, and ensure that the shield is reliably grounded at one end. ● Use a twisted cable with twisted distance of 20−30 mm as the communication cable, and ensure that the shield is reliably grounded.
During running	⚠DANGER	● All peripheral devices must be connected properly according to the circuit wiring instructions provided in this manual. Failure to comply will result in accidents ● Cover the controller properly before power-on to prevent electric shock. ● Do not open the controller's cover after power-on. Failure to comply may result in electric shock. ● Do not touch the controller and peripheral circuits with wet hand. Failure to comply may result in electric shock. ● Do not touch any I/O terminal of the controller. Failure to comply may result in electric shock. ● The controller performs safety detection on external strong power circuits automatically at the beginning of power-on. Do not touch the U, V, W terminals of the controller or the motor terminals at the moment. Failure to comply may result in electric shock. ● Do not touch the fan or the discharging resistor to check the temperature. Failure to comply will result in personal burnt. ● Signal detection must be performed only by qualified personnel during operation. Failure to comply will result in personal injury or damage to the controller.

	⚠WARNING	● Do not touch the rotating part of the motor during the motor auto-tuning or running. Failure to comply will result in accidents. ● Check that the following requirements are met: − The voltage class of the power supply is consistent with the rated voltage class of the controller. − The input terminals (R, S, T) and output terminals (U, V, W) are properly connected. − No short-circuit exists in the peripheral circuit. − The wiring is secured. Failure to comply will result in damage to the controller.
	⚠CAUTION	● For synchronous motor, ensure that motor auto-tuning is performed successfully. Perform trial running before resuming the steel rope so as to make the motor run properly. ● Avoid objects falling into the controller when it is running. Failure to comply will result in damage to the controller. ● Do not perform the voltage resistance test on any part of the controller because such test has been done in the factory. Failure to comply will result in accidents. ● Do not change the default settings of the controller. Failure to comply may result in damage to the controller. ● Do not start/stop the controller by turning on or off the contactor. Failure to comply will result in damage to the controller.
During maintenance	⚠DANGER	● Do not repair or maintain the controller at power-on. Failure to comply will result in electric shock. ● Repair or maintain the controller when its voltage is lower than 36 VAC, about 10 minutes after the controller is powered off. Otherwise, the residual voltage in the capacitor may result in personal injury. ● Do not allow unqualified personnel to repair or maintain the controller. Failure to comply will result in personal injury or damage to the controller.

	⚠WARNING	● Repair or maintenance of the controller can be performed only by the warranty center or qualified personnel authorized by Monarch. ● Power supply must be cut off before repair or maintenance of the controller.
	⚠CAUTION	● Set the parameters again after the controller is replaced. All the pluggable components must be plugged or removed only after power-off. ● Strictly obey the laws and regulations and repair and maintain the escalator equipment periodically. Only timely troubleshooting can ensure the safety of passengers.
Disposal	⚠CAUTION	The packaging materials, screws and terminal blocks can be re-used and it is suggested that you keep them well for future use.
	⚠WARNING	The electrolytic capacitors on the main circuits and PCB may explode when they are burnt. Poisonous gas is generated when the plastic parts are burnt. Treat them as ordinary industrial waste.

1.2 General Precautions

1. Requirement on the residual current device (RCD)

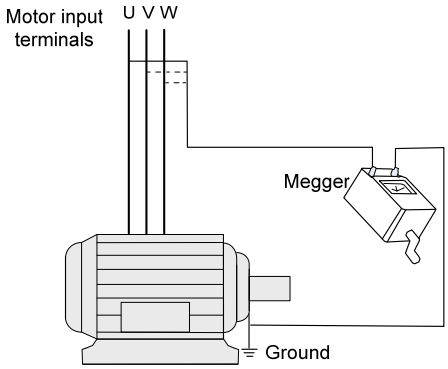
The controller generates high leakage current during running, which flows through the protective earthing conductor. Thus install a type-B RCD at primary side of the power supply. When selecting the RCD, you should consider the transient and steady-state leakage current to ground that may be generated at startup and during running of the controller. You can select a specialized RCD with the function of suppressing high harmonics or a general-purpose RCD with relatively large residual current.

2. High leakage current warning

The controller generates high leakage current during running, which flows through the protective earthing conductor. Earth connection must be done before connection of power supply. Earthing shall comply with local regulations and related IEC standards.

3. Motor insulation test

Perform the insulation test when the motor is used for the first time, or when it is reused after being stored for a long time, or in a regular check-up, in order to prevent the poor insulation of motor windings from damaging the controller. The motor must be disconnected from the controller during the insulation test. A 500-V mega-Ohm meter is recommended for the test. Ensure that the insulation resistance is not less than 5 MΩ.



4. Thermal protection of motor

If the rated capacity of the motor selected does not match that of the controller, especially when the rated power of the controller is greater than that of the motor, adjust the motor protection parameters on the operation panel of the controller or install a thermal relay before the motor for protection.

5. Running above mains frequency

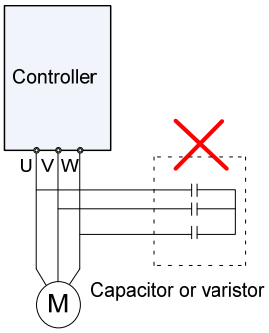
   Do not use the controller above the mains frequency (default: 50 Hz). If such use is required, consider the strength and lifetime of all mechanical mechanism.

6. Motor heat and noise

The output of the controller is pulse width modulation (PWM) wave with certain harmonic wave, and therefore, the motor temperature rise, noise, and vibration are slightly greater than those at running with the mains frequency.

7. Voltage-sensitive device or capacitor on the output side of the controller

The controller outputs PWM waves, and therefore, do not install the capacitor for improving power factor or lightning protection voltage-sensitive resistor on the output side of the controller. Otherwise, the controller may suffer transient overcurrent or even be damaged.

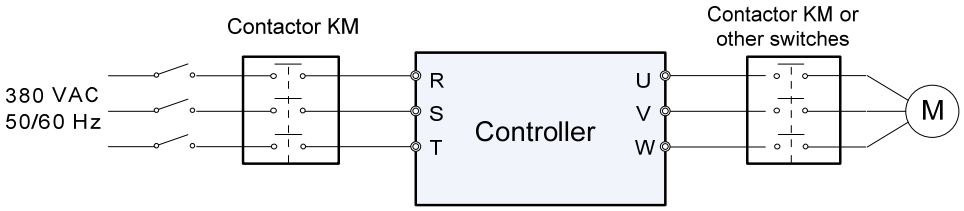


8. Contactor on the input and output sides of the controller

When a contactor is installed between the input side of the controller and the power supply, the controller must not be started or stopped by turning on or off the contactor.

If the controller has to be operated by the contactor, ensure that the time interval between switching is at least one hour because frequent charge and discharge will shorten the service life of the capacitor inside the controller.

When a contactor is installed between the output side of the controller and the motor, do not close he contactor when the controller is active. Otherwise, modules inside the controller may be damaged.



9. Use outside the rated voltage

The controller must not be used outside the allowable voltage range specified in this manual. Otherwise, components inside the controller may be damaged. If required, use a corresponding voltage step-up or step-down device.

10. Prohibition of changing three-phase input into two-phase input

Do not change the three-phase input of the controller into two-phase input. Otherwise, a

fault will result or the servo drive will be damaged.

11. Surge suppressor

The controller has a built-in voltage dependent resistor (VDR) for suppressing the surge voltage generated when the inductive loads (electromagnetic contactor, electromagnetic relay, solenoid valve, electromagnetic coil and electromagnetic brake) around the controller are switched on or off. If the inductive loads generate very high surge voltage, use a surge suppressor for the inductive load or use a surge suppressor together with a diode.

Note

Do not connect the surge suppressor on the output side of the controller.

12. Altitude and de-rating

In places where the altitude is above 1000 m and the cooling effect reduces due to thin air, it is necessary to de-rate the controller. Contact Monarch for technical support.

13. Special usage

If wiring that is not described in this manual such as common DC bus is applied, contact Monarch for technical support.

14. Disposal

The electrolytic capacitors on the main circuits and PCB may explode when they are burnt. Poisonous gas is generated when the plastic parts are burnt. Treat them as ordinary industrial waste.

15. Adaptable motor

The controller is adaptable to squirrel-cage asynchronous motor or AC PMSM. Select a proper controller according to the motor nameplate.

The default parameters configured inside the controller are squirrel-cage asynchronous motor parameters. It is still necessary to perform motor auto-tuning or modify the default values based on actual conditions. Otherwise, the running effect and protection performance will be affected. For PMSM, motor auto-tuning must be performed.

16. Precautions on selecting residual-current circuit breaker (RCCB)

Tripping may be caused if an improper RCCB is selected when the controller drives the motor. This is because the output wave of the controller has high harmonics and the motor and the cables connecting the controller and the motor produce leakage current, which is much larger than the current when the motor runs at the mains frequency.

Thus, it is necessary to determine the proper RCCB sensitivity based on the general leakage current of the cables and the motor. The leakage current is dependent on the

motor capacity, cable length, insulation class and wiring method. Generally, the leakage current on the output side of the controller is three times of the current when the motor runs at the mains frequency.

1.3 Protective Functions

Adopting different protective functions for different levels of faults, the NICE2000NICE2000new provides the escalator running system with full abnormality protection. For detailed solutions to the faults, see chapter 8 "Troubleshooting".

These drive control abnormalities include overcurrent, overvoltage/undervoltage, input/output phase loss, overload and control storage abnormality. Once a fault occurs, the controller performs protection immediately, cuts off the output, block the brake and prohibits running.

Chapter 2 Product Information

2.1 System Configuration

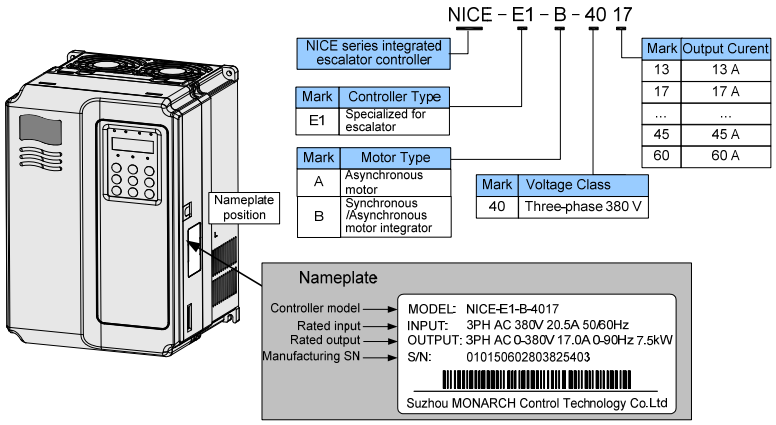
The NICE2000new integrates functions of the escalator controller and high-performance vector control AC drive; with the controller as the core, the escalator drive control system is constructed. The following figure shows the system components of the NICE2000new.

Figure 2-1 System components of the NICE2000new

2.2 Designation Rules and Model Description

2.2.1 Designation Rules and Nameplate

Figure 2-2 Designation rules and nameplate of the NICE2000new



2.3 Models and Specifications

Table 2-1 NICE2000new models and specifications

Controller Model	Input Voltage	Power Capacity (kVA)	Input Current (A)	Output Current (A)	Output Power (kW)
NICE-E1-B-4013	Three phase 380 V, range: -15% to 20%	8.9	14.6	13.0	5.5
NICE-E1-B-4017		11.0	20.5	17.0	7.5
NICE-E1-B-4025		17.0	26.0	25.0	11
NICE-E1-B-4032		21.0	35.0	32.0	15
NICE-E1-B-4037		24.0	38.5	37.0	18.5
NICE-E1-B-4045		30.0	46.5	45.0	22
NICE-E1-B-4060		40.0	62.0	60.0	30

2.4 Technical Specifications

Table 2-2 Technical specifications of the NICE2000new

Item		Specification
Basic specifications	Maximum frequency	90 Hz
	Carrier frequency	0.5–16 kHz, adjusted automatically based on the load features
	Motor control mode	Control mode special for escalator
	Startup torque	0.5 Hz: 180%
	Speed adjustment range	1:100
	Speed stability accuracy	±0.5%
	Torque control accuracy	±5%
	Overload	60s for 150% of the rated current, 1s for 180% of the rated current
	Motor auto-tuning	Static auto-tuning; complete auto-tuning
	Fault protection	Almost 40 protections such as power-on short-circuit detection, input/output phase loss protection, overcurrent protection, and anti-reversal
	Security check of peripheral devices after power-on	Security check of peripheral devices, such as grounding and short circuit, after power-on
	Status monitor	Monitoring the state of feedback signals to ensure that the escalator works properly
I/O interface	Digital input (DI)	19 x DI Input specification: 24 V, 5 mA
	Digital output (DO)	12 relay outputs, functions of which can be set flexibly
	Analog input (AI)	2 x AI
Operation and display	LED operation panel	5-digit LED display, querying/modifying parameters
	Status monitor	Monitoring all status parameters of the escalator
Environment	Altitude	Below 1000 m
	Ambient temperature	–10°C to 40°C (de-rated if the ambient temperature is above 40°C, maximum temperature: 50°C)
	Humidity	Maximum relative humidity 95%, non-condensing
	Vibration	Maximum vibration: 5.9 m/s^2
	Storage temperature	–20°C to 60°C

2.5 Physical Appearance and Mounting Dimensions

2.5.1 Product Appearance

Figure 2-3 Exploded view of the plastic structure (5.5–15 kW)

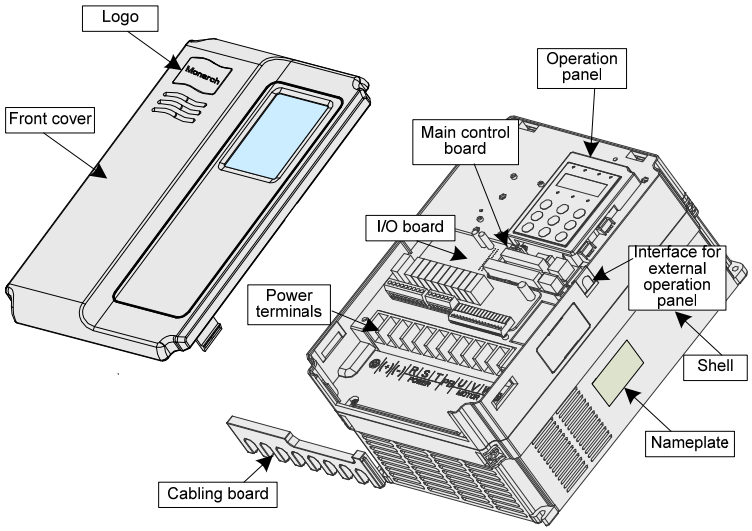
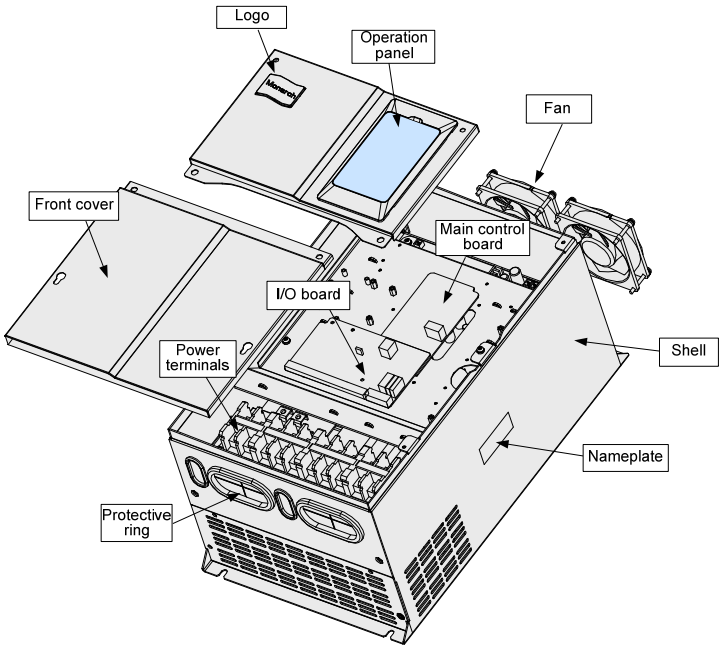


Figure 2-4 Exploded view of the sheet metal structure (18.5–30 kW)



2.5.2 Mounting dimensions

Figure 2-5 Mounting dimensions of the plastic structure (5.5–15 kW)

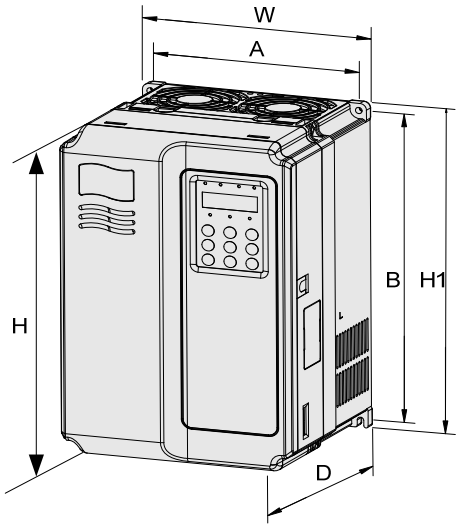
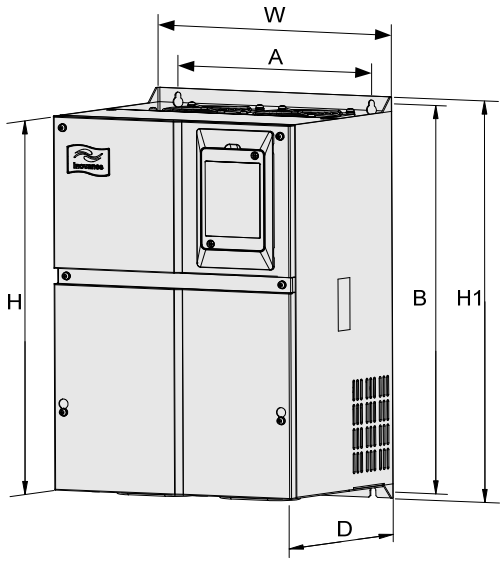


Figure 2-6 Mounting dimensions of the sheet metal structure (18.5–30 kW)



The following table lists the mounting dimensions of the NICE2000new.

Table 2-3 Mounting dimensions of the NICE2000new

Controller Model	Hole Distance (mm)		Physical Dimensions (mm)				Hole Diameter (mm)	Gross Weight (kg)
	A	B	H	H1	W	D		
NICE-E1-B-4013	148	236	248	/	160	183	Ø5.0	2.5

Controller Model	Hole Distance (mm)		Physical Dimensions (mm)				Hole Diameter (mm)	Gross Weight (kg)
	A	B	H	H1	W	D		
NICE-E1-B-4017	190	305	322	/	208	192	Ø6	6.5
NICE-E1-B-4025								
NICE-E1-B-4032								
NICE-E1-B-4037	235	447	432	463	285	228	Ø6.5	20
NICE-E1-B-4045								
NICE-E1-B-4060								

2.5.3 Wiring Dimensions of Main Circuit Terminals

The data and models recommended in the tables are only for reference. The actually used cable diameter must not be larger than the terminal width shown in the figures.

Figure 2-7 Wiring dimensions of main circuit terminals (NICE-E1-B-4013)

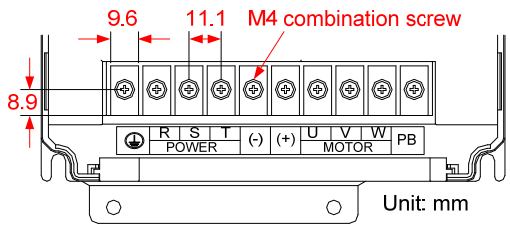


Table 2-4 Recommended cable diameter and cable lug model (NICE-E1-B-4013)

Controller Model	Rated Input Current (A)	Recommended I/O Power Cable Diameter (mm^2)	Output Power (kW)	Torque of Torque Driver (N.m)	Recommended Cable Lug Model
NICE-E1-B-4013	14.60	2.5	5.5	1.2	GTNR2.5-4

Figure 2-8 Wiring dimensions of main circuit terminals (NICE-E1-B-4017, NICE-E1-B-4025, NICE-E1-B-4032)

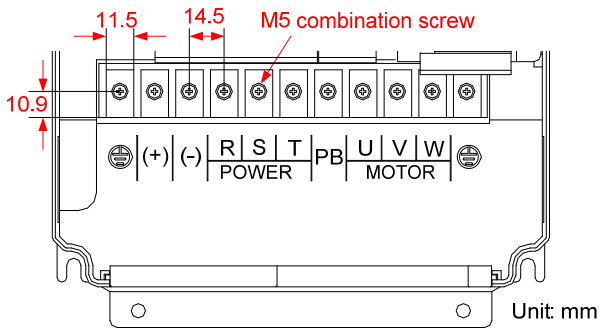


Table 2-5 Recommended cable diameter and cable lug model (NICE-E1-B-4017, NICE-E1-B-4025, NICE-E1-B-4032)

Controller Model	Rated Input Current (A)	Recommended I/O Power Cable Diameter (mm^2)	Output Power (kW)	Torque of Torque Driver (N.m)	Recommended Cable Lug Model
NICE-E1-B-4017	20.50	4	7.5	2.5	GTNR4-5
NICE-E1-B-4025	26.00	4	11	2.5	GTNR6-5
NICE-E1-B-4032	35.00	6	15	2.5	GTNR6-5

Figure 2-9 Wiring dimensions of main circuit terminals (NICE-E1-B-4037, NICE-E1-B-4045, NICE-E1-B-4060)

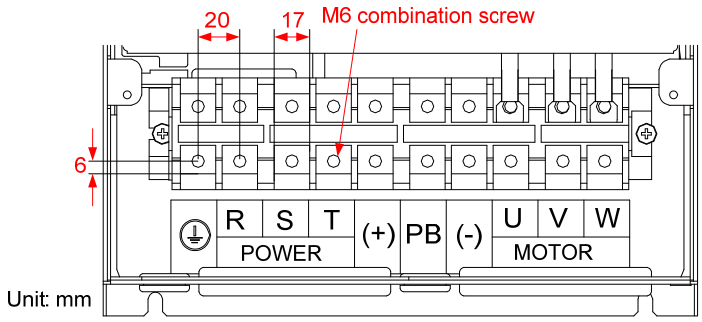


Table 2-6 Recommended cable diameter and cable lug model (NICE-E1-B-4037, NICE-E1-B-4045, NICE-E1-B-4060)

Controller Model	Rated Input Current (A)	Recommended I/O Power Cable Diameter (mm^2)	Output Power (kW)	Torque of Torque Driver (N.m)	Recommended Cable Lug Model
NICE-E1-B-4037	38.50	10	18.5	4.0	GTNR10-6

Controller Model	Rated Input Current (A)	Recommended I/O Power Cable Diameter (mm^2)	Output Power (kW)	Torque of Torque Driver (N.m)	Recommended Cable Lug Model
NICE-E1-B-4045	46.50	10	22	4.0	GTNR10-6
NICE-E1-B-4060	62.00	16	30	4.0	GTNR16-6

2.5.4 Cable Lug Model Selection

Figure 2-10 Appearance of GTNR series cable lugs

Figure 2-11 Dimensions of GTNR series cable lugs

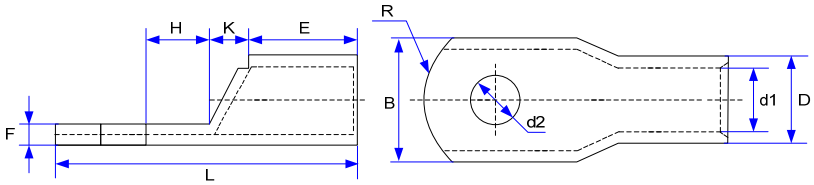


Table 2-7 Models and dimensions of GTNR series cable lugs (unit: mm)

Model	D	d1	E	H	K	B	d2	F	L	R	Crimping Tool
GTNR1.5-5	4.0	2.2	5.0	5.0	2.0	8.0	5.3	1.0	16.0	5	RYO-8 YYT-8 RYO-14
GTNR2.5-4	4.5	2.9	7.0	5.0	2.0	8.0	4.3	1.0	18.0	5	
GTNR2.5-5				6.0			5.3		20.0	7	
GTNR2.5-6						10.2	6.4	0.8			
GTNR4-5	5.2	3.6	7.0	6.0	2.0	10.0	5.3	1.0	20.0	7	
GTNR4-6							6.4				
GTNR6-5	6.0	4.2	9.0	6.0	3.0	10.0	5.3	1.2	23.0	7	
GTNR6-6				7.5			6.4		26.0	7	

Model	D	d1	E	H	K	B	d2	F	L	R	Crimping Tool
GTNR6-8						12.0	8.4	1.0			
GTNR10-6	7.0	5.0	9.0	8.0	3.5	12.4	6.4	1.3	26.5		
GTNR10-8							8.4		27.5		
GTNR16-6	7.8	5.8	12.0	8.0	4.0	12.4	6.4	1.3	31.0		
GTNR16-8							8.4				
GTNR25-6	9.5	7.5	12.0	8.0	4.5	14.0	6.4	2.0	32.0	10	CT-38 CT-100
GTNR25-8				9.0		15.5	8.4	1.6	34.0		
GTNR25-10				10.5		17.5	10.5	1.4	37.0		
GTNR35-6	11.4	8.6	15.0	9.0	5.0	15.5	6.4	2.8	38.0		
GTNR35-8							8.4				
GTNR35-10				10.5		17.5	10.5	2.5	40.5		
GTNR50-8	12.6	9.6	16.0	11.0	6.0	18.0	8.4	2.8	43.5		CT-100
GTNR50-10							10.5				
GTNR70-8	15.0	12.0	18.0	13.0	7.0	21.0	8.4	2.8	50.0	14	
GTNR70-10							10.5				
GTNR70-12							13.0				
GTNR95-10	17.4	13.5	20.0	13.0	9.0	25.0	10.5	3.9	55.0		
GTNR95-12							13.0				
GTNR120-12	19.8	15.0	22.0	14.0	10.0	28.0	13.0	4.7	60.0	16	RYC-150
GTNR120-16				16.0			17.0		64.0		
GTNR150-12	21.2	16.5	26.0	16.0	11.0	30.0	13.0	4.7	69.0	24	

Model	D	d1	E	H	K	B	d2	F	L	R	Crimping Tool
GTNR150-16							17.0				
GTNR185-16	23.5	18.5	32.0	17.0	12.0	34.0	17.0	5.0	78.0		
GTNR240-16	26.5	21.5	38.0	20.0	14.0	38.0	17.0	5.5	92.0		
GTNR240-20							21.0				

2.6 Maintenance

2.6.1 Routine Maintenance

The influence of the ambient temperature, humidity, dust and vibration will cause the aging of the components inside the controller, which may cause potential faults or reduce the service life of the controller. Therefore, it is necessary to carry out routine and periodic maintenance.

⚠DANGER
There is still hazardous residual voltage on the filter capacitor after power-off. Repair or maintain the controller only after the CHARGE indicator is OFF and the bus voltage measured by the multimeter is lower than 36 VAC.

Routine maintenance involves checking:

- Whether abnormal noise exists during motor running
- Whether the motor vibrates excessively
- Whether the installation environment of the controller changes
- Whether the cooling fan works properly
- Whether the controller overheats

Routine cleaning involves:

- Keep the controller clean all the time.
- Remove the dust, especially metal powder on the surface of the controller, to prevent the dust from entering the controller.
- Clear the oil stain on the cooling fan of the controller.

2.6.2 Periodic Inspection

Perform periodic inspection on the items that are difficult to check during running. Periodic inspection involves:

- Check and clean the air filter periodically.
- Check whether the screws become loose.
- Check whether the controller is corroded.
- Check whether the wiring terminals have arc signs.
- Carry out the main circuit insulation test.

Note

Before measuring the insulating resistance with megameter (500 VDC megameter recommended), disconnect the main circuit from the controller. Do not use the insulating resistance meter to test the insulation of the control circuit. The high voltage test need not be performed again because it has been completed before delivery.

2.6.3 Replacement of Vulnerable Components

Vulnerable components of the controller include the cooling fan and filter electrolytic capacitor. Their service life is related to the operating environment and maintenance.

The service life of the two components is listed in the following table.

Table 2-8 Service life of cooling fan and filter electrolytic capacitor

Component	Service Life	Possible Damage Cause	Judging Criteria
Fan	2 to 3 years	● Bearing worn ● Blade aging	● Check whether there is crack on the blade. ● Check whether there is abnormal vibration noise upon startup.
Electrolytic capacitor	4 to 5 years	● Input power supply in poor quality ● High ambient temperature ● Frequent load jumping ● Electrolytic aging	● Check whether there is liquid leakage. ● Check whether the safety valve has projected. ● Measure the static capacitance. ● Measure the insulating resistance.

2.6.4 Storage of the Controller

For storage of the controller, pay attention to the following two aspects:

1. Pack the controller with the original packing box provided by Monarch.

2. Long-term storage degrades the electrolytic capacitor. Thus, the controller must be energized once every 2 years, each time lasting at least 5 hours. The input voltage must be increased slowly to the rated value with the regulator.

Chapter 3 Mechanical and Electrical Installation

Before installing the controller, check:

- Whether the nameplate model and controller ratings are consistent with your order. The box contains the controller, certificate of conformity, user manual and warranty card.
- Whether the controller is damaged during transportation. If you find any omission or damage, contact your supplier or Monarch immediately.

Strictly follow the instructions in Chapter 1 during installation and wiring.

3.1 Mechanical Installation

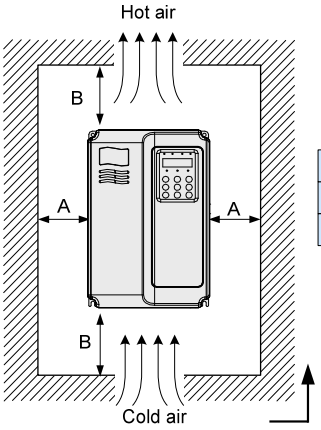
3.1.1 Installation Environment Requirements

Item	Requirements
Ambient temperature	-10°C to 50°C
Heat dissipation	Install the controller on the surface of an incombustible object, and ensure that there is sufficient space around for heat dissipation. Install the controller vertically on the support using screws.
Mounting location	Free from direct sunlight, high humidity and condensation
	Free from corrosive, explosive and combustible gas
	Free from oil dirt, dust and metal powder
Vibration	Less than 0.6 g

3.1.2 Installation Clearance Requirements

The clearance that needs to be reserved varies with the power class of the NICE2000new, as shown in the following figure.

Figure 3-1 Clearance around the NICE2000new for installation



Installation Clearance requirements on the NICE2000new of different power ratings

Power Rating	Clearance Requirements	
5.5-18.5 kW	A ≥ 10 mm	B ≥ 100 mm
22-30 kW	A ≥ 50 mm	B ≥ 100 mm

When the controller power is not larger than 22 kW, the space "A" may not be considered. When the controller power is larger than 22 kW, "A" must be larger than 50 mm.

Pay attention to the following points during installation:

1. Install the controller upright to facilitate heat dissipation.

2. Reserve the installation clearances as specified in Figure 3-1 to ensure sufficient space for heat dissipation. Take heat dissipation of other components in the cabinet into consideration.

3. Use the incombustible hanging bracket.

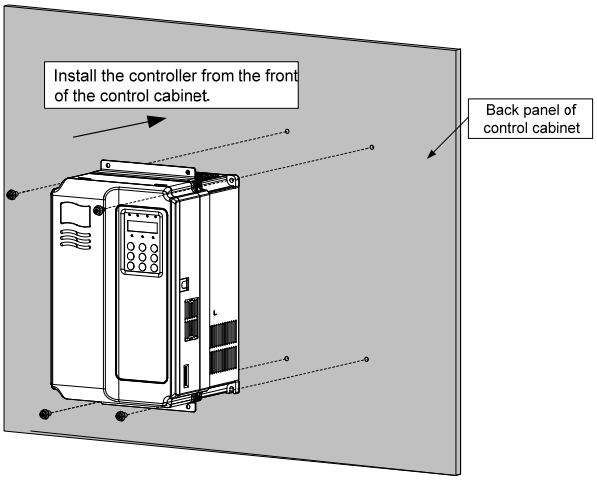
4. In scenarios with heavy metal powder, install the heatsink outside the cabinet, and ensure that the room inside the fully-sealed cabinet is as large as possible.

3.1.3 Mechanical Installation Method and Procedure

The NICE2000new provides two structures, plastic and sheet metal for different power ratings and voltage classes. The NICE2000new can be installed using the wall-mounting installation or embedded installation method based on the application scenario.

1) Wall-mounting installation

Figure 3-2 Wall-mounting installation of NICE2000new (plastic housing)



2) Embedded installation of the NICE2000new (plastic housing)

Figure 3-3 External hanging bracket for the NICE2000new

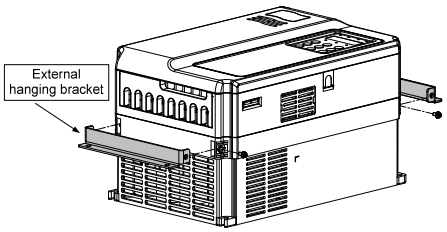


Figure 3-4 Embedded installation of the NICE2000new (plastic housing)

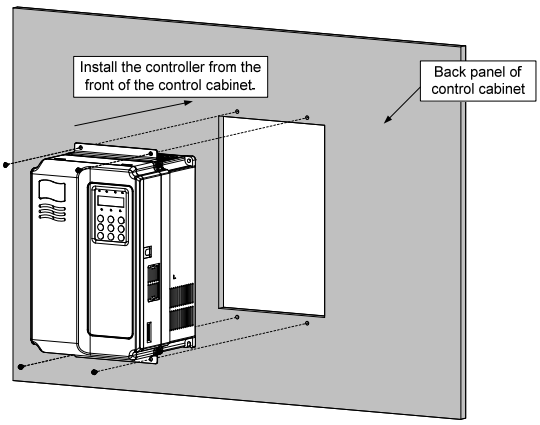
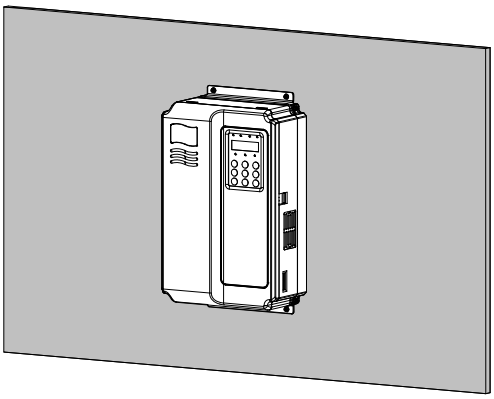


Figure 3-5 Embedded installation effect of the NICE2000new (plastic housing)



3) Wall-mounting installation of the NICE2000new (sheet metal housing)

Figure 3-6 Wall-mounting installation of NICE2000new (sheet metal housing)

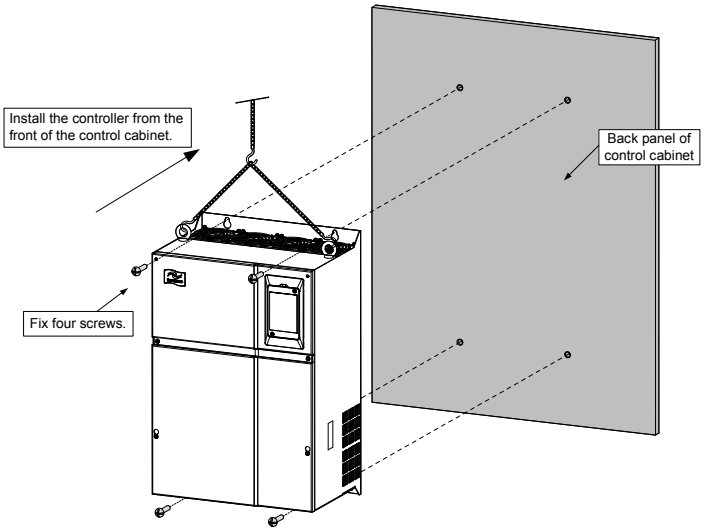
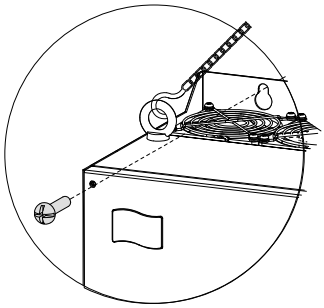


Figure 3-7 Hoisting the NICE2000new (sheet metal housing)



4) Embedded installation of the NICE2000new (sheet metal housing)

Figure 3-8 External hanging bracket for the NICE2000new (sheet metal housing)

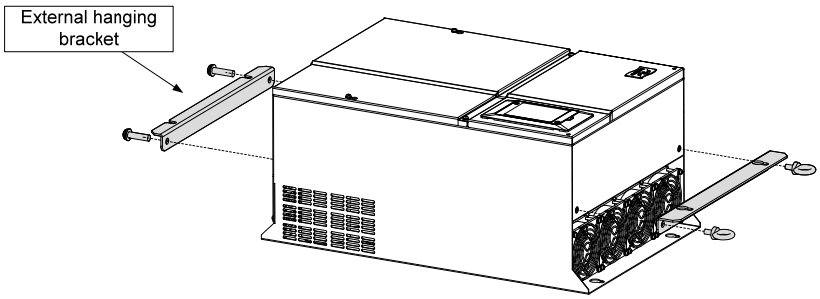


Figure 3-9 Embedded installation of the NICE2000new (sheet metal housing)

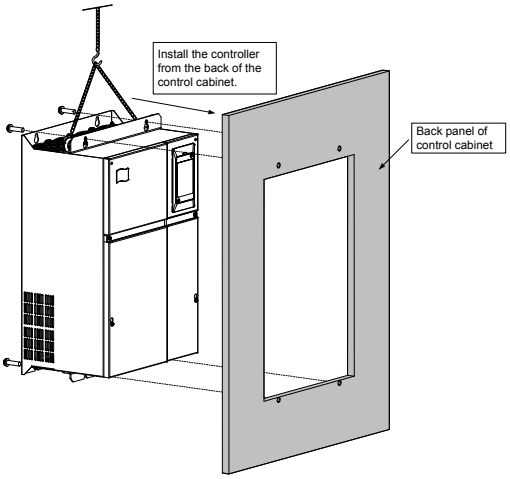
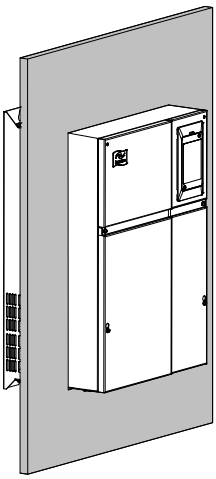


Figure 3-10 Embedded installation effect of the NICE2000new (sheet metal housing)



3.1.4 Removal of the Front Cover

You need to remove the front cover and before wiring the main circuit and control circuit.

Figure 3-11 Removal of the front cover of the NICE2000new (plastic housing)

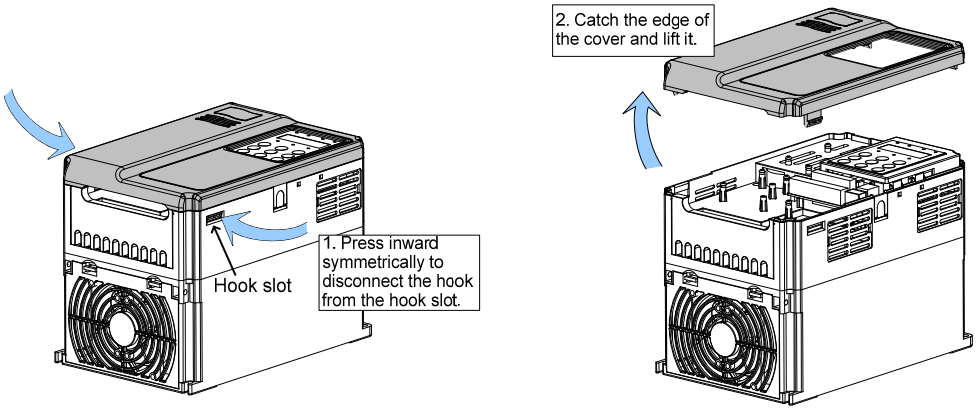
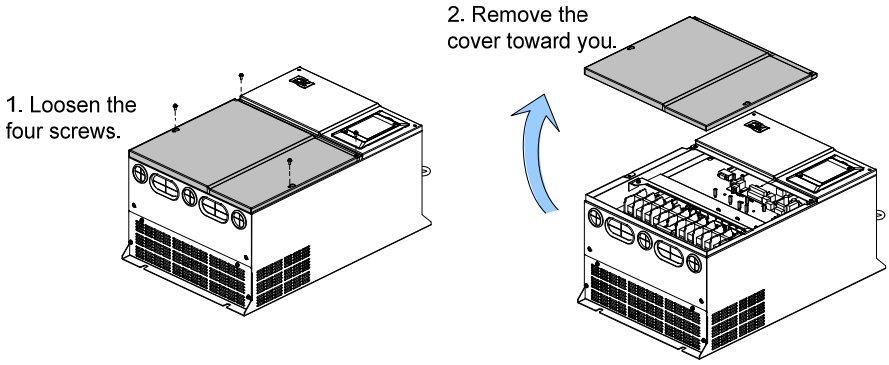


Figure 3-12 Removal of the front cover of the NICE2000new (sheet metal housing)



⚠CAUTION
Be careful when removing the front cover of the controller. Falling off of the cover may cause damage to the controller or personal injury.

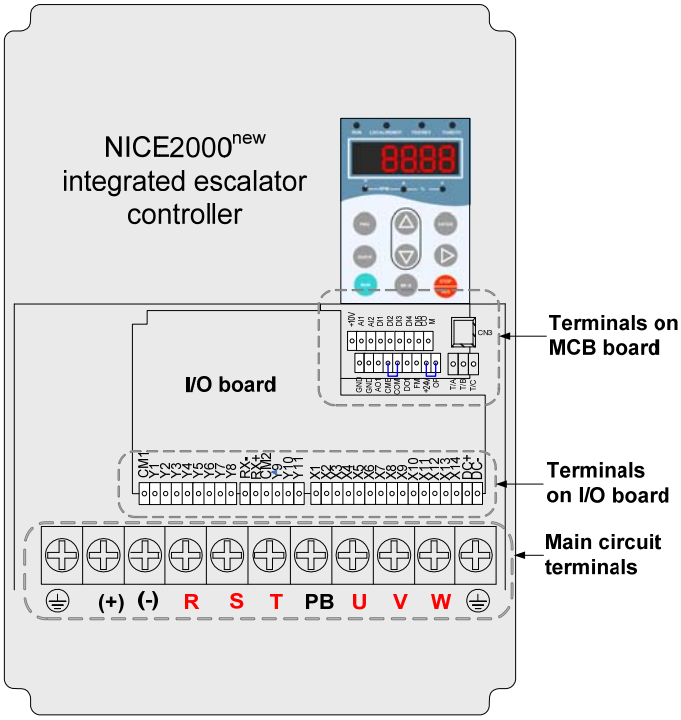
3.2 Electrical Installation

⚠DANGER
● Ensure that the power supply is cut off before wiring. Failure to comply may result in electric shock. ● Wiring must be performed only by qualified personnel under instructions described in this

DANGER
manual. Failure to comply may result in unexpected accidents. ● The grounding must be reliable and meet the requirements.

WARNING
● The power supply must meet the input power requirements of the controller. Otherwise, the controller will be damaged. ● The motor to be connected must adapt to the controller. Otherwise, it may cause damage to the motor or cause controller protection. ● Never connect the power cables to the output terminals (U, V, W) of the controller. Failure to comply will result in damage to the controller.

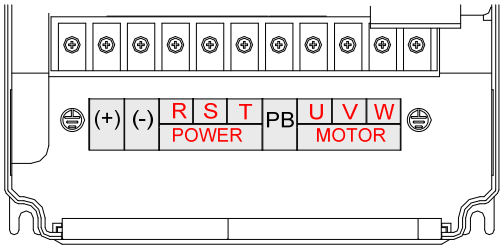
Figure 3-13 Terminal arrangement of the NICE2000new



3.2.1 Description and Wiring of Main Circuit Terminals

The following figure shows main circuit terminal arrangement of the NICE2000new.

Figure 3-14 Main circuit terminal arrangement (example)



Note that the preceding figure is the terminal arrangement diagram of NICE-E1-B-4017, NICE-E1-B-4025, and NICE-E1-B-4032. For other terminal arrangement diagrams of other power ratings, see Figure 2-7 and Figure 2-9.

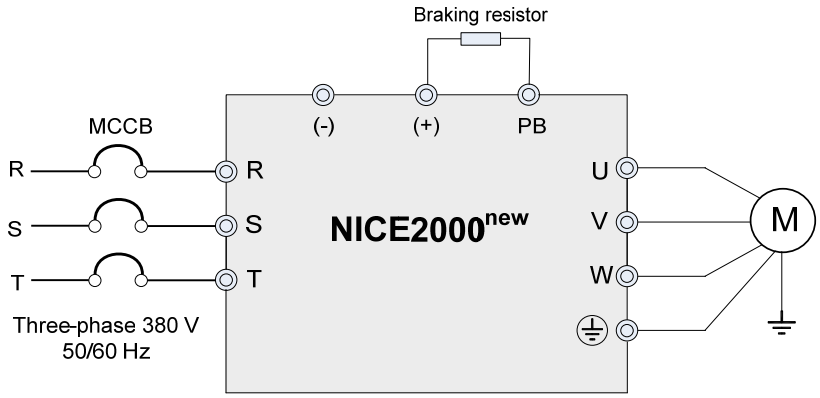
1. Description of main circuit terminals

Table 3-1 Description of main circuit terminals

Terminal	Name	Description
R, S, T	Three-phase power input terminals	Provide three-phase 380 V power supply.
(+), (-)	Positive and negative terminals of DC bus	Connect the external braking unit for models of 37 kW and above.
(+), PB	Terminals for connecting regen. resistor	Connect the regen. resistor for models of below 37 kW.
U, V, W	Controller output terminals	Connect the three-phase motor.
⏚	Grounding terminal	Must be grounded.

2. Wiring of the main circuit

Figure 3-15 Wiring of the main circuit



3. Wiring precautions:

- DC bus terminals (+), (-)

  Terminals (+) and (-) of DC bus have residual voltage after the controller is switched off. Before touching the terminals, wait until the CHARGE indicator becomes OFF and ensure that the voltage measured with a multimeter is smaller than 36 V.

  Do not connect the regen. resistor directly to the DC bus. Otherwise, it may damage the controller and even cause fire.

- Controller output terminals U, V, W

  The terminals are used to connect the three-phase motor. When the motor rotating direction is reverse to the required direction, exchange any two of the UVW cables.

  Do not connect a capacitor or surge absorber to the output side of the controller. Otherwise, it may cause frequent controller faults or even damage the controller.

  The output must not be short-circuited or grounded.

  Put the UVW cables through the grounded metal pipes and separate these cables from the signal cables or lay them vertical to the signal cables.

  If the motor cable is too long, electrical resonance will be generated due to the impact of distributed capacitance. This will damage the motor insulation or generate higher leakage current, causing the controller to trip in overcurrent protection. If the motor cable is greater than 100 m long, an AC output reactor must be installed close to the controller.

- Grounding terminal ⏚

This terminal must be reliably grounded with thick and short main protective earthing (PE) conductor.

The yellow-green multi-strain copper PE conductor above 4 mm^2 is recommended.

Ensure that the grounding resistance must not be larger than 5 Ω.

The neutral wire must not be the PE conductor.

3.2.2 Description of MCB Terminals

1. Terminal arrangement of the MCB

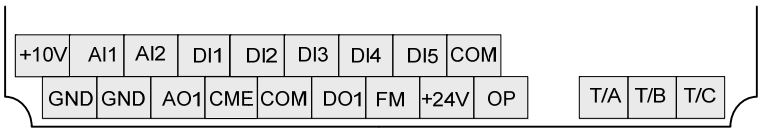


Table 3-2 Description of control circuit terminals

Type	Mark	Terminal Name	Function Description
Power supply	+10V-GND	External +10 VDC power supply	Provide +10 V power supply externally. Generally, it provides power supply to the external potentiometer with resistance range of 1–5 kΩ. Maximum output current: 10 mA
	+24V-COM	External +24 V power supply	Provide +24 V power supply externally. Generally, it provides power supply to DI/DO terminals. Maximum output current: 200 mA
	OP	External power supply	It is shorted with +24V by a jumper by default. When DI1 to DI5 need to be driven by external signal, OP needs to be connected to external power supply and be disconnected from +24 V.
Analog input	AI1-GND	AI1	Input voltage range: 0–10 VDC Input impedance: 100 kΩ
	AI2-GND	AI2	1. Input range: 0–10 VDC or 4–20 mA, determined by jumper J3 on the MCB 2. Input impedance: 100 kΩ for voltage input, 500 Ω for

Type	Mark	Terminal Name	Function Description
			current input
Digital input	DI1-COM	DI1	1. Optical coupling isolation, compatible with dual polarity input 2. Input impedance: 3.3 kΩ 3. Voltage range at level input: 0–30 V
	DI2-COM	DI2	
	DI3-COM	DI3	
	DI4-COM	DI4	
	DI5-COM	DI5 (high-speed pulse)	Besides features of DI1–DI4, it can be used for high-speed pulse input.
Digital output	DO1-CME	DO	Optical coupling isolation, dual polarity open collector output Output voltage range: 0–24 V Output current range: 0–50 mA
	FM-COM	Reserved	Note that CME and COM are internally insulated, but they are shorted externally when delivery. In this case, DO1 is driven by +24V by default. If you want to apply external power to DO1, remove the jumper between CME and COM.
Relay output	T/A-T/B	Normally closed (NC) terminal	Contact driving capacity: 250 VAC, 3 A, COSφ = 0.4; 30 VDC, 1 A
	T/A-T/C	Normally open (NO) terminal	Function of Y2 set in F5-12.
Auxiliary interface	J1	I/O board interface	28-pin terminal, industrial standard for special card interface
	CN3	Operation panel interface	Connect to the external operation panel.

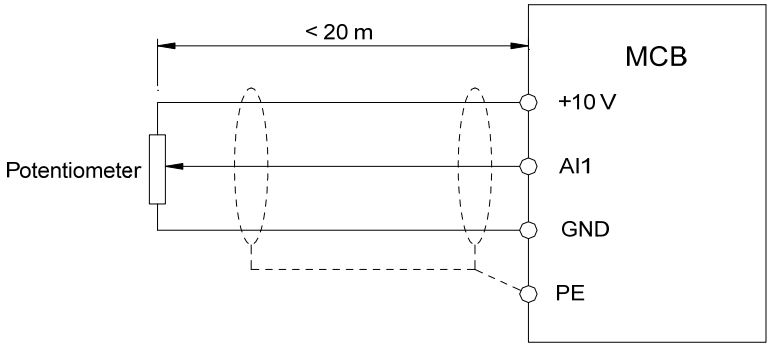
3.2.3 Wiring of Input/Output Terminals

1. Wiring of AI terminals

Weak analog voltage signals are easy to suffer external interference, and therefore the

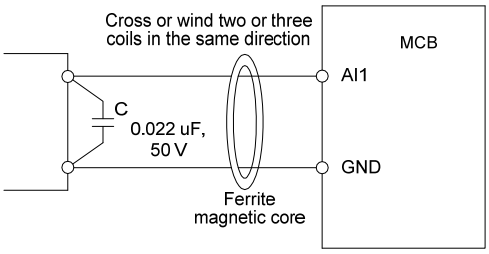
shielded cable must be used and the cable length must be less than 20 m, as shown in following figure.

Figure 3-16 Wiring of AI terminals



In applications where the analog signal suffers severe interference, install filter capacitor or ferrite magnetic core at the analog signal source, as shown in the following figure.

Figure 3-17 Install filter capacitor or ferrite magnetic core

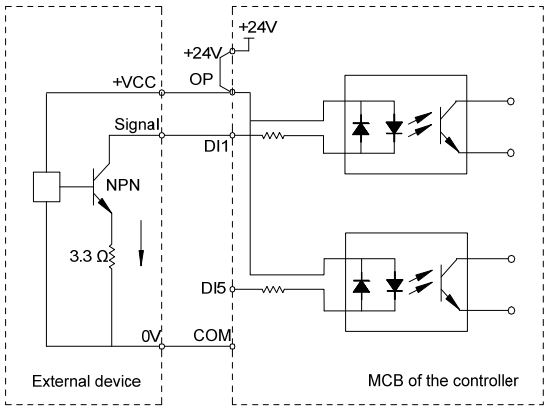


2. Wiring of DI terminals

Generally, use the shielded cable not longer than 20 m. When active driving is adopted, necessary filtering measures shall be taken to prevent the interference to the power supply. The contact control mode is recommended.

- SINK wiring

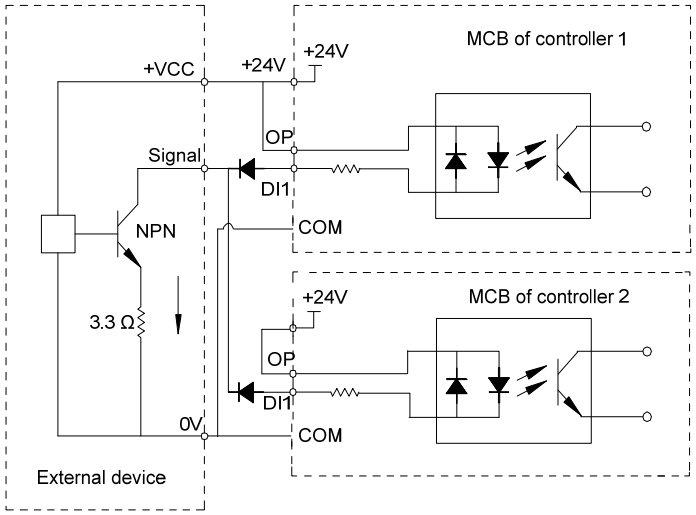
Figure 3-18 Wiring in SINK mode



This is the most commonly used wiring mode. To apply external power supply, remove the jumper between terminals +24V and OP, and connect the positive pole of external power supply to OP, and 0V of external power supply to the corresponding DI through the control contact on the controller.

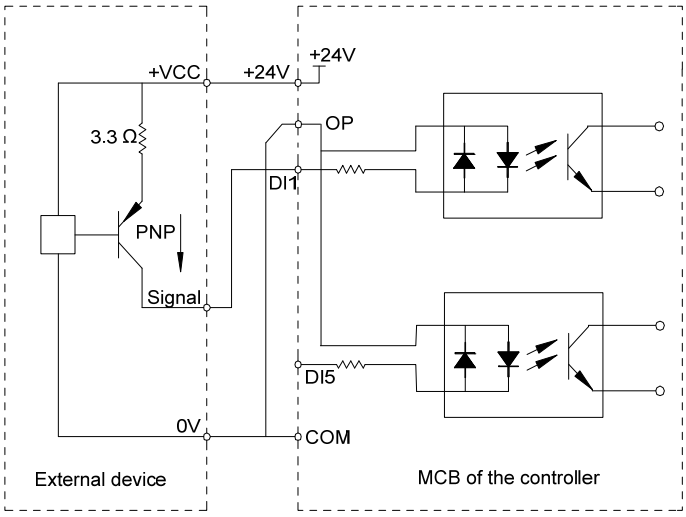
In such wiring mode, the DI terminals of different controllers must not be connected in parallel. Otherwise, DI mal-function may result. If parallel connection (different controllers) is required, connect a diode in series at the DI and the diode needs to satisfy the requirement: IF > 10 mA, UF < 1 V.

Figure 3-19 DI terminals connected in parallel in SINK mode



- SOURCE wiring

Figure 3-20 Wiring in SOURCE mode



In such wiring mode, remove the jumper between +24V and OP, and connect +24V to the

common terminal of the external controller and meanwhile connect OP to COM.

To apply external power supply, remove the jumper between terminals +24V and OP, and connect OP to 0V of external power supply, can connect 24V to the corresponding DI through the control contact on the controller.

3. Wiring description of signal output terminals

- Wiring of DO terminal

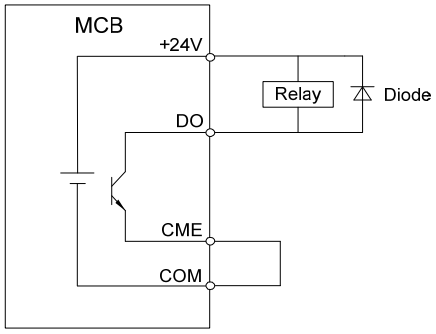
When the DO terminal needs to drive the relay, an absorption diode shall be installed on both sides of the relay coil. The driving capacity is not more than 50 mA. Otherwise, it may cause damage to the 24 VDC power supply.

Note

Do not reverse the polarity of the absorption diode during installation, as shown in Figure 3-21. Otherwise, the 24 VDC power supply will be damaged immediately once there is digital output.

CME and COM are internally isolated, but they are shorted by jumper externally at delivery. In this case, DO1 is driven by +24V by default. If you want to apply external power to DO1, remove the jumper between CME and COM.

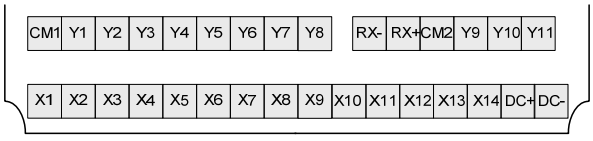
Figure 3-21 DO terminal wiring diagram



3.2.4 Description and Wiring of Terminals on I/O Board

1. Terminal arrangement of I/O board

Figure 3-22 Terminal arrangement of I/O board



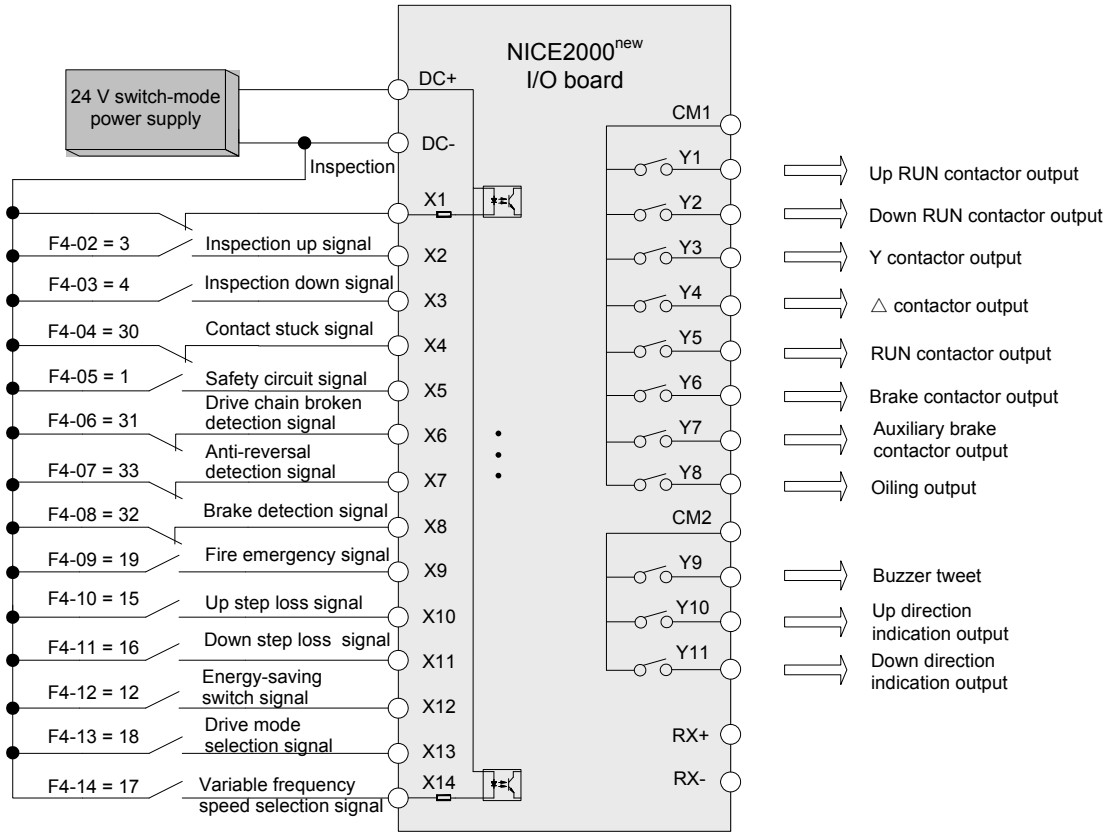
2. Function description of terminals on I/O board

Type	Mark	Terminal Name	Function Description
Power supply	DC+/DC-	External +24 V power supply	External power supply for DI terminals of NICE2000new
Digital input terminals	X1	Digital input 1	1. Optical coupling isolation, compatible with dual polarity input 2. Input impedance: 3.3 kΩ 3. Voltage range at level input: 0–30 V
	X2	Digital input 2	
	X3	Digital input 3	
	X4	Digital input 4	
	X5	Digital input 5	
	X6	Digital input 6	
	X7	Digital input 7	
	X8	Digital input 8	
	X9	Digital input 9	
	X10	Digital input 10	
	X11	Digital input 11	
	X12	Digital input 12	
	X13	Digital input 13	
	X14	Digital input 14	
Relay output terminals	Y1-CM1	Relay output 1	Contact driving capacity: 250 VAC, 3 A, COSφ = 0.4; 30 VDC, 1 A CM1 and CM2 isolated internally
	Y2-CM1	Relay output 2	
	Y3-CM1	Relay output 3	
	Y4-CM1	Relay output 4	
	Y5-CM1	Relay output 5	
	Y6-CM1	Relay output 6	
	Y7-CM1	Relay output 7	
	Y8-CM1	Relay output 8	
	Y9-CM2	Relay output 9	
	Y10-CM2	Relay output 10	

	Y11-CM2	Relay output 11	
Communication terminals	RX-	Modbus communication	The shielded twisted pair is recommended.
	RX+		

3. Wiring of terminals on I/O board

Figure 3-23 Wiring of terminals on I/O board



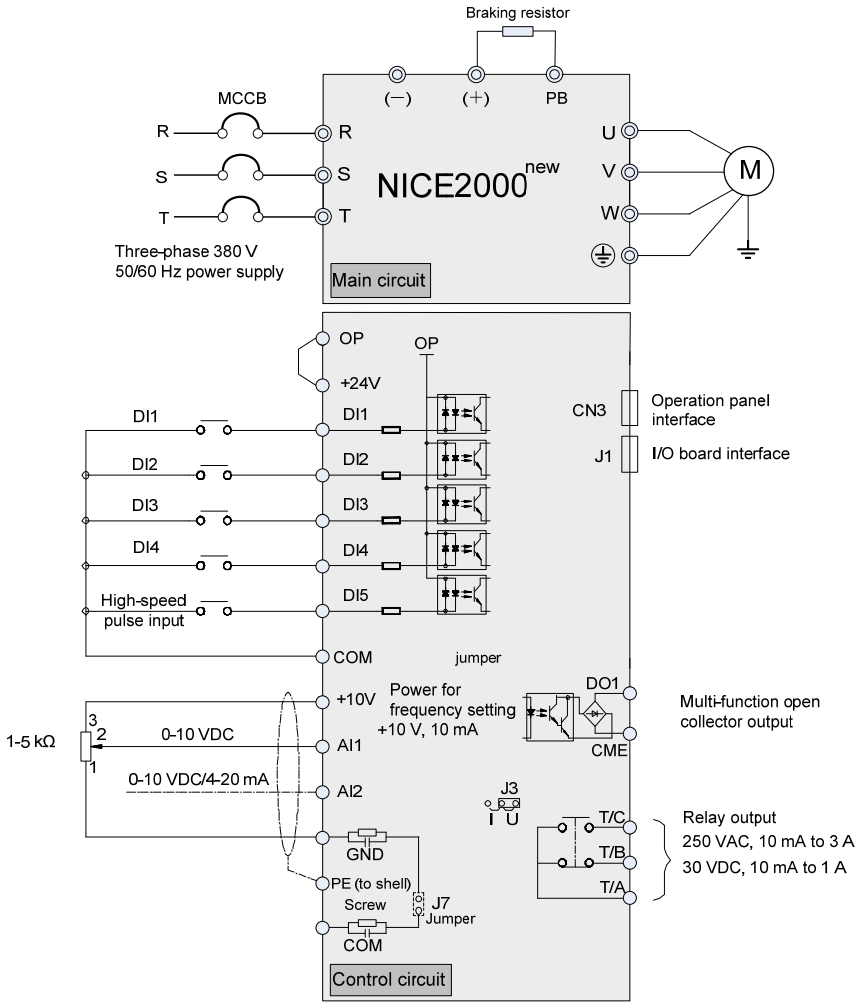
External +24 VDC power needs to be supplied to the I/O board.

X1 to X14 are optical coupling isolation input, and low level active. The setting of X1 to X14 in the preceding figure is default setting, and you can change the setting by referring to Chapter 6.

Y1 to Y11 are all relay NO output; CM1 is the common for Y1 to Y8, and CM2 is the common for Y9 to Y11.

3.2.4 Overall Wiring

Figure 3-24 Overall wiring of the NICE2000new



Note

◎ indicates the main circuit terminal, and ○ indicates terminal on the MCB.

3.3 Selection of Peripheral Electrical Devices

Table 3-3 Specifications of peripheral electrical devices

Controller Model	MCCB (A)	Contactor (A)	Main Circuit Cable on Input Side (mm²)	Main Circuit Cable on Output Side (mm²)	Control Circuit Cable (mm²)	Grounding Cable (mm²)
NICE-E1-B-4013	20	18	2.5	2.5	0.75	2.5
NICE-E1-B-4017	32	25	4	4	0.75	4
NICE-E1-B-4025	40	32	6	6	0.75	6
NICE-E1-B-4032	50	38	6	6	0.75	6
NICE-E1-B-4037	50	40	10	10	0.75	10
NICE-E1-B-4045	63	50	10	10	0.75	10
NICE-E1-B-4060	80	65	16	16	0.75	16

Table 3-4 Description of peripheral electrical devices

Part	Mounting Location	Function Description
MCCB	Forefront of controller power input side	Cut off the power supply of the controller and provide short-circuit protection.
Safety contactor	Between MCCB and the controller input side	Apply/Cut off the power supply of the controller. The close/open of the contactor is controlled by the external safety circuit.

Part	Mounting Location	Function Description
AC input reactor	Controller input side	1) Improve the power factor of the input side. 2) Eliminate the higher harmonics on the input side to provide effective protection on the rectifier bridge. 3) Eliminate the input current unbalance due to unbalance between the power phases.
DC input reactor	Built-in as standard configuration for models 7.5 kW to 30 kW	1) Improve input power factor 2) eliminate high frequency harmonics on input side and protect the rectifier bridge 3) Eliminate current unbalance due to input phase unbalance (effect not as good as AC input reactor) 4) Small size without causing voltage dip
AC output reactor	Between the controller output side and the motor, close to the controller	The output side of the controller has much high harmonics, as when the motor is far from the controller, there is much distributed capacitance in the circuit. Certain harmonics may cause resonance in the circuit, causing two impacts: ● Degrade the motor insulation performance and damage the motor in the long run. ● Generate large leakage current and cause frequent controller protection trips. If the distance between the controller and the motor is greater than 100 m, install an AC output reactor.

Chapter 4 Operation and Trial Running

4.1 Description of Running Modes and States

4.1.1 Running Mode

1. Operation panel mode

The action commands are given by using keys 

or 

on the operation panel.

2. Bypass variable frequency

The action commands are given by multi-functional I/O terminals. After the frequency reaches the mains frequency, the controller automatically switches over to the running at mains frequency. If the energy saving function is enabled, the controller automatically switches over to the running at variable frequency low speed if the escalator becomes idle.

3. Full variable frequency

The action commands and running speed are given by multi-functional I/O terminals.

4. Y-Δ direct startup

The action commands are given by multi-functional I/O terminals. After startup, the controller runs at mains frequency (Y connection), and switches over to the running at mains frequency of Δ connection. The controller does not output drive current during the process.

Note that the controller can run only at one mode at the same moment.

4.1.2 System State

The NICE2000new has five states, fault and alarm, inspection, normal running, auto-tuning, and operation panel states.

- Fault and alarm state

The controller becomes faulty and displays the fault code

- Inspection state

If there is no fault, the controller enters the inspection state after the inspection signal becomes active. You can press the inspection up or down button to make the controller jog in this state.

- Normal running state

The controller can respond to up/down running signals and escalator entry photo-electric signals, and accelerate and decelerate automatically according to the set running mode and energy-saving function.

- Auto-tuning state

The NICE2000new supports two auto-tuning modes, static and complete. For details, see the description of F1-11.

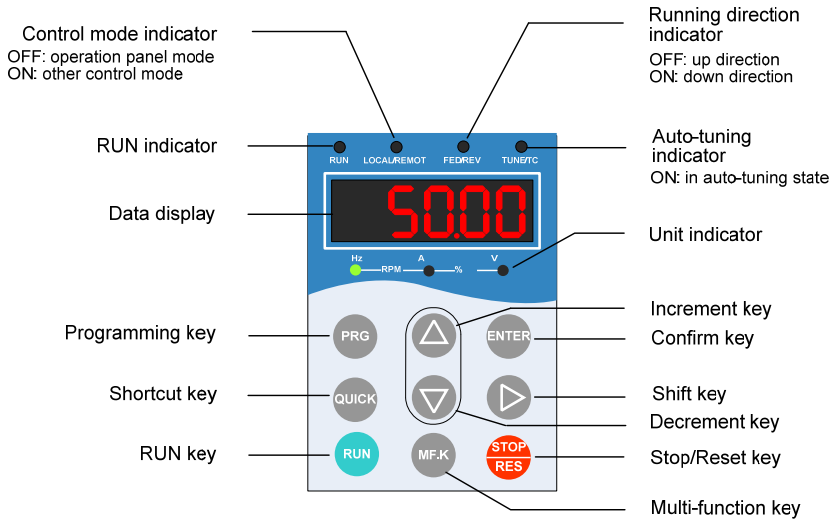
- Operation panel state

The output of the controller is controlled by using keys RUN or STOP RES on the operation panel.

4.2 Use of the LED Operation Panel

You can modify the parameters, monitor the working status and start or stop the controller by operating the operation panel. The following figure shows the LED operation panel.

Figure 4-1 Diagram of the LED operation panel



1. Function indicators

- **RUN**

  ON indicates that the controller is in the running state, and OFF indicates that the controller is in the stop state.

- **LOCAL/REMOT**

  OFF indicates that the controller is in the operation panel running mode, and ON indicates that the controller is in other running mode.

- **FWD/REV**

  ON indicates up direction of the escalator, and OFF indicates down direction of the escalator.

- **TUNE/TC**

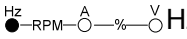
  ON indicates the auto-tuning state.

2. Data display

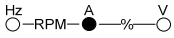
   The 5-segment LED display can display the monitoring data such as frequency reference and output frequency, and fault codes.

3. Unit indicators

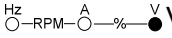
   ● means that the indicator is ON, and ○ means that the indicator is OFF.

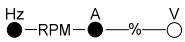
   Hz: unit of frequency

   A: unit of current

   V: unit of voltage

   RPM: unit of rotational speed

   %: percentage

4. Keys

Table 4-1 Description of keys on the operation panel

Key	Name	Function
PRG	Programming	Enter or exit Level-I menu.
ENTER	Confirm	Enter the menu interfaces level by level, and confirm the parameter setting.
△	Increment	Increase data or function code.
▽	Decrement	Decrease data or function code.
▷	Shift	Select the displayed parameters in turn in the stop or running state, and select the digit to be modified when modifying parameters.
RUN	Run	Start the controller in the operation panel running mode.

Key	Name	Function
STOP RES	Stop/Reset	Stop the controller when it is in the running state and perform the reset operation when it is in the fault state.
QUICK	Quick	Enter or exit Level-I quick menu.
MF.K	Multi-function	Press this key to display or hide the fault information in the fault state, which facilitates parameter viewing.

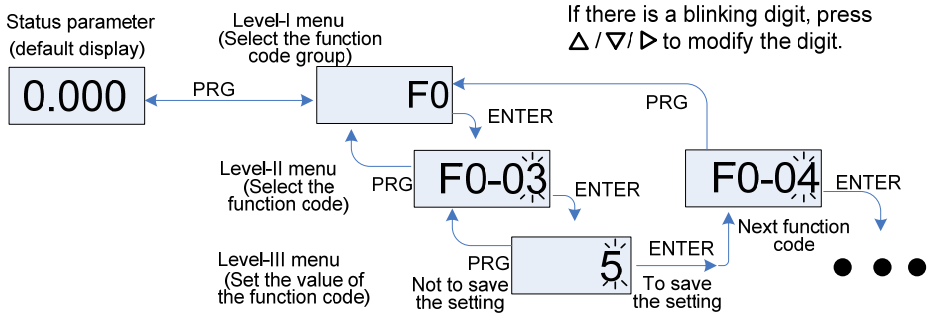
4.3 Viewing and Operation

4.3.1 Operation Procedure

The LED operation panel adopts three-level menu.

The three-level menu consists of function code group (Level I), function code (Level II), and function code setting value (level III), as shown in the following figure.

Figure 4-2 Operation procedure on the operation panel

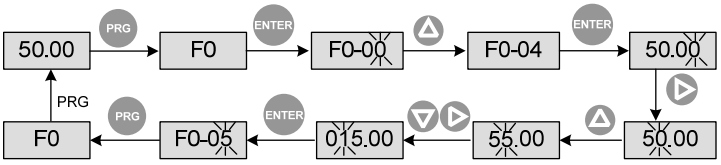


You can return to Level II menu from Level III menu by pressing PRG or ENTER. The difference between the two is as follows:

- After you press ENTER, the system saves the parameter setting first, and then goes back to Level II menu and shifts to the next function code.
- After you press PRG, the system does not save the parameter setting, but directly returns to Level II menu and remains at the current function code.

Here is an example of changing the value of F0-04 from 50.00 Hz to 15.00 Hz.

Figure 4-3 Example of changing the parameter value



In Level III menu, if the parameter has no blinking digit, it means that the parameter cannot be modified. This may be because:

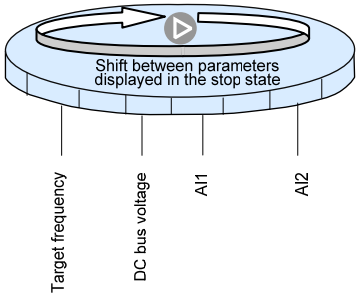
- Such a parameter is only readable, such as actually detected parameters and running record parameters.
- Such a parameter cannot be modified in the running state and can only be changed at stop.

4.3.2 Viewing Status Parameters

In the stop state, a total of four parameters can be displayed circularly by pressing .

You can select the parameters to be displayed by setting F7-01 (each bit of F7-01 indicates a parameter).

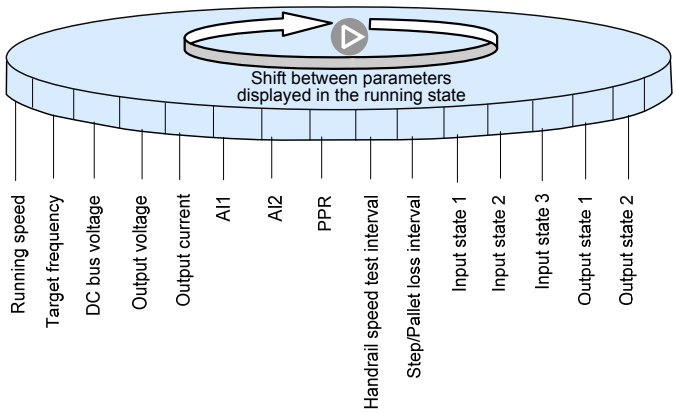
Figure 4-4 Shift between parameters displayed in the stop state



In the running state, a total of 15 parameters can be displayed circularly by pressing .

You can select the parameters to be displayed by setting F7-00 (each bit of F7-00 indicates a parameter).

Figure 4-5 Shift between parameters displayed in the running state



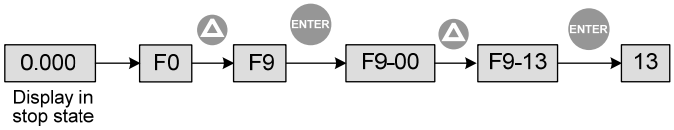
For details, see the description of corresponding parameters in Chapter 6.

4.3.3 Reading Fault Information

When a fault occurs on the controller, the operation panel displays the fault code. Based on the fault code, you can check the fault causes listed in chapter 8 to rectify the fault quickly.

The NICE2000new records the latest 11 faults and the frequency, current, bus voltage, DI/DO terminal state of the latest three faults.

Figure 4-6 Viewing fault code



4.3.4 Monitoring DI/DO Terminal State

The DI/DO terminal state needs to be monitored during running. For details, see the descriptions of F7-11 and F7-12 in chapter 6.

4.4 Password Setting

The NICE2000new provides the user password protection function.

When FP-00 is set to a non-zero value, the password function is enabled. The password takes effect after you exit the function code editing state. When you press PRG again, "------" will be displayed, and you must enter the correct user password to enter the menu.

To view factory parameters, you also need to enter the factory password. Do not try to modify factory parameters because incorrect setting will easily cause abnormality or

damage to the controller.

During password setting, you can change the password and the last input is considered as the set password.

To cancel the password protection function, enter the menu with the correct password and then set FP-00 to 0.

Chapter 5 Function Code Table

5.1 Brief Introduction

1. There are a total of 13 function code groups, each of which includes several function codes. The function codes adopt the three-level menu. The function code group number is Level-I menu; the function code number is Level-II menu; the function code setting is Level-III menu.

2. The meaning of each column in the function code table is as follows:

Item	Definition
Function code	Indicates the function code number.
Parameter name	Indicates the parameter name of the function code.
Setting range	Indicates the setting range of the parameter.
Min. unit	Indicates the minimum measurement unit of the parameter.
Default	Indicates the default setting of the parameter at factory.
Property	Indicates whether the parameter can be modified (including the modification conditions).

The modification property of the parameters includes three types, described as follows:

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

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

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

The system automatically restricts the modification property of all parameters to prevent mal-function.

5.2 Function Code Groups

On the operation panel, press PRG and then △ or ▽, and you can view the function code groups. The function code groups are classified as follows:

F0	Basic parameters	F8	Auxiliary management parameters

F1	Motor parameters	F9	Protection function parameters
F2	Vector control parameters	FA	Communication parameters
F3	V/F control parameters	Fb	Escalator-related parameters
F4	Input function parameters	FC	Additional parameters
F5	Output function parameters	FF	Factory parameters
F6	Startup/Stop control parameters	FP	User parameters
F7	Auxiliary function parameters		

5.3 Function Code Table

Function Code	Parameter Name	Setting Range	Min. Unit	Default	Property
Group F0: Basic parameters					
F0-00	Control mode	0: Sensorless vector control (SVC) 1: Voltage/Frequency (V/F) control	1	1	★
F0-01	Running mode	0: Operation panel control 1: Bypass variable frequency 2: Full variable frequency 3: Y-Δ direct startup	1	1	★
F0-02	Reserved	-	-	-	★
F0-03	Running frequency under operation panel control	0.00 to F0-04	0.01 Hz	0	☆
F0-04	Maximum frequency	10.00–99.00	0.01 Hz	60.00 Hz	★
F0-05	Carrier frequency	0.5–16.0	0.1 kHz	Model dependent	☆
F0-06	Running direction	0: Disabled	1	0	★

Function Code	Parameter Name	Setting Range	Min. Unit	Default	Property
	reversed	1: Enabled			
Group F1: Motor parameters					
F1-00	Reserved	-	-	-	★
F1-01	Rated motor power	0.2–75.0	0.1 kW	Model dependent	★
F1-02	Rated motor voltage	0–440	1 V	380V	★
F1-03	Rated motor current	0.00–655.00	0.01 A	Model dependent	★
F1-04	Rated motor frequency	0.00–99.00	0.01 Hz	50.00Hz	★
F1-05	Rated motor speed	0–3000	1 RPM	960 RPM	★
F1-06	Stator resistance	0.001–30.000	0.001 Ω	Model dependent	★
F1-07	Rotor resistance (asynchronous motor)	0.001–30.000	0.001 Ω	Model dependent	★
F1-08	Leakage inductance (asynchronous motor)	0.01–300.00 mH	0.01 mH	Model dependent	★
F1-09	Mutual inductance (asynchronous motor)	0.1–3000.0	0.1 mH	Model dependent	★
F1-10	Magnetizing current (asynchronous motor)	0.01–300.00	0.01 A	Model dependent	★
F1-11	Auto-tuning mode	0: No operation 1: Static auto-tuning 2: Complete auto-tuning	1	0	★
F1-12	Shaft D inductance (synchronous motor)	0.01–300.00	0.01 mH	0.01 mH	★
F1-13	Shaft Q inductance	0.01–300.00	0.01 mH	0.01 mH	★

Function Code	Parameter Name	Setting Range	Min. Unit	Default	Property
	(synchronous motor)				
F1-14	Back EMF (synchronous motor)	0–65535	1 V	266 V	★
F1-25	Motor type	0: Asynchronous motor 1: Synchronous motor	1	0	★
Group F2: Vector control parameters					
F2-00	Speed loop proportional gain 1	0–100	1	30	☆
F2-01	Speed loop integral time 1	0.01–10.00	0.01s	0.60s	☆
F2-02	Switchover frequency 1	0.00 to F2-05	0.01 Hz	2.00 Hz	☆
F2-03	Speed loop proportional gain 2	0–100	1	30	☆
F2-04	Speed loop integral time 2	0.01–10.00	0.01s	0.80s	☆
F2-05	Switchover frequency 2	F2-02 to F0-04	0.01 Hz	5.00 Hz	☆
F2-06	Reserved	-	-	-	☆
F2-07	Speed loop filter coefficient	1–30	1	10	☆
F2-08	Torque upper limit	0.0–200.0%	0.1%	150.0%	☆
F2-09	Current loop proportional gain	10–500	1	60	☆
F2-10	Current loop integral gain	10–500	1	30	☆
F2-11	Synchronous motor magnetic pole identification current	30%–100%	1%	60%	☆

Function Code	Parameter Name	Setting Range	Min. Unit	Default	Property
F2-12	Synchronous motor V/F parameter 1	1–100	1	20	☆
F2-13	Synchronous motor V/F parameter 2	1–100	1	30	☆
F2-14	ADC sampling delay	0–30	1	0	☆
F2-15	Reserved	-	-	-	☆
F2-16	Asynchronous motor SVC parameter 1	0–200%	1	100%	☆
F2-17	Asynchronous motor SVC parameter 2	100–2000	1	800	☆
F2-18	Asynchronous motor SVC parameter 3	0–500	1	200	☆
F2-19	Asynchronous motor SVC parameter 4	0–500	1	0	☆
F2-20	Asynchronous motor SVC parameter 5	0.0–50.0%	1	10.0%	☆
F2-21	Asynchronous motor SVC parameter 6	1–31	1	30	☆
F2-22	Asynchronous motor SVC parameter 7	0–65535	1	0	☆
F2-23	Asynchronous motor SVC parameter 8	0–65535	1	0	☆
F2-24	Asynchronous motor SVC parameter 9	0–65535	1	0	☆
F2-25	Asynchronous motor SVC parameter 10	0–65535	1	0	☆
Group F3: V/F control parameters					

Function Code	Parameter Name	Setting Range	Min. Unit	Default	Property
F3-00	V/F torque boost	0.0: Automatic 0.1%–30.0%	0.1%	1.0%	★
F3-01	Frequency limit of torque boost	0 to F0-04	0.01 Hz	50.00 Hz	★
F3-02	V/F slip compensation	0. 0–200.0%	0.1%	0	★
F3-03	AVR selection	0: Invalid 1: Always valid 2: Valid only at deceleration	1	1	★
F3-04	V/F oscillation suppression gain	0–200	1	20	★
F3-05	V/F over-excitation gain	0–200	1	0	★
F3-06	Speed of catching a spinning motor	20–100	1	30	☆
F3-07	Constant speed holding time at catching a spinning motor	0.01–10.00	0.01s	0.60s	☆
F3-08	Escalator auxiliary function selection 2	0–65535	1	2048	★
F3-09	Current for frequency tracing	30–130%	1%	Model dependent	★
F3-10	Oscillation suppression function	0: Disabled 1: Enabled	-	1	★
Group F4: Input function parameters					
F4-00	Input filter time	1–100	1 ms	10 ms	★
F4-01	X01 function selection	0: Invalid 1/25: Safety circuit signal NO/NC	1	26	★
F4-02	X02 function selection		1	3	★

Function Code	Parameter Name	Setting Range	Min. Unit	Default	Property
F4-03	X03 function selection	2/26: Inspection signal NO/NC	1	4	★
F4-04	X04 function selection	3/27: Inspection up signal NO/NC	1	30	★
F4-05	X05 function selection	4/28: Inspection down signal NO/NC	1	1	★
F4-06	X06 function selection	5/29: Motor speed detection signal NO/NC	1	31	★
F4-07	X07 function selection	6/30: Contact stuck signal NO/NC	1	33	★
F4-08	X08 function selection	7/31: Drive chain broken detection signal NO/NC	1	8	★
F4-09	X09 function selection	8/32: Brake detection signal NO/NC	1	19	★
F4-10	X10 function selection	9/33: Anti-reversal detection signal NO/NC	1	0	★
F4-11	X11 function selection	10/34: Up photoelectric signal NO/NC	1	0	★
F4-12	X12 function selection	11/35: Down photoelectric signal NO/NC	1	12	★
F4-13	X13 function selection	12/36: Energy-saving switch signal NO/NC	1	18	★
F4-14	X14 function selection	13/37: Left handrail speed detection signal NO/NC	1	17	★
F4-15	DI1 function selection	14/38: Right handrail speed detection signal NO/NC	1	0	★
F4-16	DI2 function selection	15/39: Up step loss signal NO/NC	1	0	★
F4-17	DI3 function selection	16/40: Down step loss signal NO/NC	1	10	★
F4-18	DI4 function selection	17/41: Variable frequency speed selection signal NO/NC	1	11	★
F4-19	DI5 function selection	18/42: Drive mode selection signal NO/NC 19/43: Fire emergency signal NO/NC 20/44: Fault reset signal NO/NC 21/45: Stop signal NO/NC	1	0	★

Function Code	Parameter Name	Setting Range	Min. Unit	Default	Property
		22/46: Reserved 23/47: Motor overheat signal NO/NC 24/48: Reserved 49/100: RUN contactor (or up/down contactor) feedback NO/NC 50/101: Δ contactor feedback NO/NC 51/102: Special-purpose reversal detection signal NO/NC 52/103: Reserved 53/104: Reserved 54/105: Auxiliary brake micro switch feedback NO/NC			
F4-20	Reserved	-	-	-	
F4-21	AB pulse input selection	0–55	1	0	★
F4-22	Safety brake action delay	0–60000	1 ms	1500 ms	★
F4-23	Reserved	1–10	1	3	★
F4-24	Time limit of catching a spinning motor	5–20	1s	15s	★
F4-25	Initial running time multiple	1–20	1	5	☆
F4-26	Reserved	-	-	-	☆
F4-27	Escalator auxiliary function selection	0–65535	1	21	★
F4-28	Synchronization switchover maximum delay	2.000–10.000	0.001s	5.000s	☆
F4-29	Synchronous switchover	0–5.000	0.001s	1.500s	☆

Function Code	Parameter Name	Setting Range	Min. Unit	Default	Property
	constant speed delay				
F4-30	Synchronization switchover card analog sampling filter coefficient	0–999	1	15	☆
F4-31	Analog calibration value	0–65535	1	1000	☆
Group F5: Output function parameters					
F5-00	DO function selection	0: Invalid	1	0	★
F5-01	Y1 function selection	1: RUN contactor output	1	2	★
F5-02	Y2 function selection	2: Up (NET) contactor output	1	3	★
F5-03	Y3 function selection	3: Down (NET) contactor output	1	4	★
F5-04	Y4 function selection	4: Y contactor output	1	5	★
F5-05	Y5 function selection	5: Δ contactor output	1	1	★
F5-06	Y6 function selection	6: Brake contactor output	1	6	★
F5-07	Y7 function selection	7: Auxiliary brake contactor output	1	7	★
F5-08	Y8 function selection	8: Safety brake contactor output	1	12	★
F5-09	Y9 function selection	9: Up direction indication output	1	11	★
F5-10	Y10 function selection	10: Down direction indication output	1	9	★
F5-11	Y11 function selection	11: Buzzer tweet	1	10	★
F5-12	Y12 function selection (base board)	12: Oiling output	1	8	★
F5-13	Reserved	13: Fault output	1	0	★
F5-14	Reserved	14: Controller ready output	1	0	★
F5-15	Reserved	15: Controller running start output 16: Normal speed running output 17: Low speed running output 18: Special-purpose anti-reversal relay output	1	0	★

Function Code	Parameter Name	Setting Range	Min. Unit	Default	Property
F5-16	Output type selection	0–65535	1	65535	★
F5-17	Reserved	-	-	-	☆
F5-18	Reserved	-	-	-	☆
F5-19	Reserved	-	-	-	☆
Group F6: Escalator Startup/Stop control parameters					
F6-00	Time for switchover from variable frequency to mains frequency	0–2.0	0.1s	0.5s	★
F6-01	Time for switchover from mains frequency to variable frequency	0–5.0	0.1s	0	★
F6-02	Catching frequency	0–99.0	0.1 Hz	50.0 Hz	★
F6-03	Normal speed 1 running frequency	1.00 to F0-04	0.01 Hz	50.00 Hz	★
F6-04	Normal speed 2 running frequency	1.00 to F0-04	0.01 Hz	30.00 Hz	★
F6-05	Low speed running frequency	1.00 to F0-04	0.01 Hz	12.00 Hz	★
F6-06	Y-Δ switchover delay	0–500	1 ms	100 ms	★
F6-07	Acceleration time	0.0–3000.0	0.1s	4.0s	★
F6-08	Deceleration time	0.0–3000.0	0.1s	60.0s	★
F6-09	Inspection frequency	0.00 to F0-04	0.01 Hz	25.00 Hz	★
F6-10	Inspection acceleration time	0.0–3000.0	0.1s	20.0s	★
F6-11	Inspection method selection	0: Determined by F0-01 1: Y running	1	0	★

Function Code	Parameter Name	Setting Range	Min. Unit	Default	Property
F6-12	Up frequency switchover allowance	0–10.00	0.01 Hz	1.50 Hz	★
F6-13	Down frequency switchover allowance	0–10.00	0.0 1 Hz	1.50 Hz	★
F6-14	Special deceleration time	0.0–3000.0	0.1s	30.0s	★
F6-15	Startup frequency	0.00–10.00	0.01 Hz	0	★
F6-16	Startup time	0.00–10.00	0.01s	0	★
F6-17	Special frequency holding time	0.00–10.00	0.01s	0	★
F6-18	Stop frequency	0.00–10.00	0.01 Hz	5.00 Hz	★
Group F7: Auxiliary function parameters					
F7-00	Display in running state	1–32767 Bit0: Frequency reference Bit1: Target frequency Bit2: DC bus voltage Bit3: Output voltage Bit4: Output current Bit5: AI1 Bit6: AI2 Bit7: Motor pulses per second Bit8: Handrail speed detection time interval Bit9: Step loss time interval Bit10: Input state 1 Bit11: Input state 2 Bit12: Input state 3	1	32767	☆

Function Code	Parameter Name	Setting Range	Min. Unit	Default	Property
		Bit13: Output state 1 Bit14: Output state 2 Bit15: Reserved			
F7-01	Display in stop state	1–255 Bit0: Target frequency Bit1: DC bus voltage Bit2: AI1 Bit3: AI2 Bit4–Bit15: Reserved	1	15	☆
F7-02	Running time limit	0–60000	1 h	0 h	☆
F7-03	Accumulative working hours	0–65535	1 h	0	●
F7-04	Accumulative working minutes	0–60	1 min.	0	●
F7-05	Reserved	0–65535	1	0	☆
F7-06	Power-on short circuit to-ground detection	0: Disabled 1: Enabled	1	1	★
F7-07	Brake use ratio	0–100%	1%	100%	★
F7-08	Software version (ZK) 1	00.00–99.99	0.01	-	●
F7-09	Software version (DSP) 2	000.00–99999	1	-	●
F7-10	Heatsink temperature	0–100	1°C	-	●
F7-11	Input state	-	-	-	●
F7-12	Output state	-	-	-	●
F7-13	High byte of running	0–9999	-	0	●

Function Code	Parameter Name	Setting Range	Min. Unit	Default	Property
	times				
F7-14	Low byte or running times	0–9999	-	0	●
F7-15	Escalator function selection 3	0–65535	1	0	☆
Group F8: Auxiliary management parameters					
F8-00	Clock: year	2013–2100	Y	2013	☆
F8-01	Clock: month	1–12	M	1	☆
F8-02	Clock: day	1–31	D	1	☆
F8-03	Clock: hour	0–23	H	0	☆
F8-04	Clock: minute	0–59	Min	0	☆
F8-13	Software version (ZK) 2	00.00–99.99	-	-	●
F8-14	Software version (ZK) 3	00.00–99.99	-	-	●
Group F9: Protection function parameters					
F9-00	Protection function selection	0–65535	1	31	☆
F9-01	Overload protection coefficient	0.20–10.00	0.01	1.00	☆
F9-02	Overload pre-warning coefficient	50–100	1%	80%	☆
F9-03	Overvoltage stall proportional gain	0: No overvoltage stall 1–100	1	0	☆
F9-04	Overvoltage stall protection threshold	100–200	1%	130%	☆
F9-05	Overcurrent stall proportional gain	0–100	1	20	☆

Function Code	Parameter Name	Setting Range	Min. Unit	Default	Property
F9-06	Overcurrent stall protection threshold	100–200%	1%	150%	☆
F9-07	Power dip ride-through	0: Forbidden 1: Allowed	1	0	☆
F9-08	Frequency reduction rate at power dip ride-through	0.00 to (F0-04)	0.01 Hz/s	10.00 Hz/s	☆
F9-09	Overvoltage stall integral time	0–100	1	50	☆
F9-10	Overcurrent stall integral time	0–100	1	50	☆
F9-11	Rise frequency upper limit at overvoltage stall	0–31	1 Hz	5 Hz	☆
F9-12	Overcurrent stall suppression mode	0–3	1	3	☆
F9-13	1st fault code	0–50	-	0	●
F9-14	1st fault subcode	0–999	-	0	●
F9-15	1st fault month and day	00.00–12.31	-	0	●
F9-16	1st fault hour and minute	00.00–23.59	-	0	●
F9-17	2nd fault code	0–50	-	0	●
F9-18	2nd fault subcode	0–999	-	0	●
F9-19	2nd fault month and day	00.00–12.31	-	0	●
F9-20	2nd fault hour and minute	00.00–23.59	-	0	●
F9-21	3rd fault code	0–50	-	0	●

Function Code	Parameter Name	Setting Range	Min. Unit	Default	Property
F9-22	3rd fault subcode	0–999	-	0	●
F9-23	3rd fault month and day	00.00–12.31	-	0	●
F9-24	3rd fault hour and minute	00.00–23.59	-	0	●
F9-25	4th fault code	0–50	-	0	●
F9-26	4th fault subcode	0–999	-	0	●
F9-27	4th fault month and day	00.00–12.31	-	0	●
F9-28	4th fault hour and minute	00.00–23.59	-	0	●
F9-29	5th fault code	0–50	-	0	●
F9-30	5th fault subcode	0–999	-	0	●
F9-31	5th fault month and day	00.00–12.31	-	0	●
F9-32	5th fault hour and minute	00.00–23.59	-	0	●
F9-33	6th fault code	0–50	-	0	●
F9-34	6th fault subcode	0–999	-	0	●
F9-35	6th fault month and day	00.00–12.31	-	0	●
F9-36	6th fault hour and minute	00.00–23.59	-	0	●
F9-37	7th fault code	0–50	-	0	●
F9-38	7th fault subcode	0–999	-	0	●
F9-39	7th fault month and	00.00–12.31	-	0	●

Function Code	Parameter Name	Setting Range	Min. Unit	Default	Property
	day				
F9-40	7th fault hour and minute	00.00–23.59	-	0	●
F9-41	8th fault code	0–50	-	0	●
F9-42	8th fault subcode	0–999	-	0	●
F9-43	8th fault month and day	00.00–12.31	-	0	●
F9-44	8th fault hour and minute	00.00–23.59	-	0	●
F9-45	9th fault code	0–50	-	0	●
F9-46	9th fault subcode	0–999	-	0	●
F9-47	9th fault month and day	00.00–12.31	-	0	●
F9-48	9th fault hour and minute	00.00–23.59	-	0	●
F9-49	10th fault code	0–50	-	0	●
F9-50	10th fault subcode	0–999	-	0	●
F9-51	10th fault month and day	00.00–12.31	-	0	●
F9-52	10th fault hour and minute	00.00–23.59	-	0	●
F9-53	Latest fault code	0–50	-	0	●
F9-54	Latest fault subcode	0–999	-	0	●
F9-55	Latest fault month and day	00.00–12.31	-	0	●
F9-56	Latest fault hour and	00.00–23.59	-	0	●

Function Code	Parameter Name	Setting Range	Min. Unit	Default	Property
	minute				
F9-57	Input function state 1 upon latest fault	0–65535	-	0	●
F9-58	Terminal function state 2 upon latest fault	0–65535	-	0	●
F9-59	Terminal function state 3 upon latest fault	0–65535	-	0	●
F9-60	Output function state 1 upon latest fault	0–65535	-	0	●
F9-61	Output function state 2 upon latest fault	0–65535	-	0	●
F9-62	Output frequency upon latest fault	0.00–99.00	0.01 Hz	0	●
F9-63	Output current upon latest fault	0.00–99.99	0.01 A	0	●
F9-64	Bus voltage upon latest fault	0.0–999.9	0.1 V	0	●
F9-65	Logic information upon latest fault	0–65535	-	1	●
F9-66	Direction and speed change upon latest fault	0–65535	-	0	●
F9-67	Motor speed upon latest fault	0–65535	1	0	●
F9-68	Left handrail latest fault signal period	0.00–99.99	0.01s	0	●
F9-69	Right handrail latest fault signal period	0.00–99.99	0.01s	0	●

Function Code	Parameter Name	Setting Range	Min. Unit	Default	Property
F9-70	Up step latest fault signal period	0.00–99.99	0.01s	0	●
F9-71	Down step latest fault signal period	0.00–99.99	0.01s	0	●
Group FA: Communication parameters					
FA-00	Baud rate	0–4: Reserved 5–6: 9600 bps 7: 38400 bps	1	5	★
FA-02	Local address	0–127 0: Broadcast address	1	1	★
FA-03	Communication response delay	0–50 ms	1 ms	20 ms	★
Group Fb: Escalator-related function parameters					
Fb-00	Speed detection delay	0.0–9.9s 0: No detection	0.1s	0.0s	★
Fb-01	Motor speed detection error range	10–99%	1	20%	★
Fb-02	Error range of handrail speed detection/step loss detection	10–99%	1	15%	★
Fb-03	Rated motor pulses	0–200/s 0: No detection	1	32	★
Fb-04	Pulse interval of handrail speed detection	0.00–10.00s 0: No detection	0.01s	0	★
Fb-05	Pulse interval of step loss detection	0.00–10.00s 0: No detection	0.01s	0	★

Function Code	Parameter Name	Setting Range	Min. Unit	Default	Property
Fb-06	Automatic oiling holding time	0–999s	1s	72s	★
Fb-07	Automatic oiling cycling time	0–9999 h	1 h	167 h	★
Fb-08	Buzzer tweet holding time	0–99s	1s	5s	★
Fb-09	Normal speed running time	10–3000s	1s	40s	★
Fb-10	Low speed running time	10–3000s	1s	40s	★
Fb-11	Reversal time	10–30s	1s	10s	★
Fb-12	Auxiliary brake action time	0.1–9.9s	0.1s	0.5s	★
Fb-13	Brake release detection time	0.5–9.9s	0.1s	1.5s	★
Fb-14	Stop delay before entering inspection running	0–9.9s	0.1s	1.5s	★
Fb-15	Oiling mode	0–5	1	0	★
Fb-16	Energy saving mode	0: Invalid 1: Normal speed-stop cyclic 2: Normal speed-low speed cyclic 3: Normal speed-low speed-stop cyclic	1	2	★
Fb-17	Reserved	0–65535	1	0	★
Fb-18	Y running time	0.0–9.9s	0.1s	3.0s	★
Fb-19	Safety brake action selection	0–9999	1	0	★

Function Code	Parameter Name	Setting Range	Min. Unit	Default	Property
Fb-20	Safety brake action holding time	0–10s (effective to electromagnet working for short time)	1s	4s	★
Fb-21	Input/Output terminal state	*	*	*	●
Group FC: Additional function parameters					
FC-00	Motor pulse interval	0.00–10.00	0.01s	0.00s	★
FC-01	Handrail speed detection fault delay	0–15	1s	10s	★
FC-02	Input filter time 2	1–20	1 ms	2 ms	★
FC-03	Reversal detection delay	0–10	1s	3s	★
FC-04	Reversal detection judging times	0–10	1	5	★
FC-05	AB pulse loss time	0–6000 ms	1 ms	3000 ms	★
FC-06	Time from B pulse to A pulse	0–65535	1	0	●
FC-07	Time from A pulse to B pulse	0–65535	1	0	●
FC-08	Auto-tuning result	0–999	1	0	★
FC-09	Up switchover time compensation	0–200 ms	1 ms	80 ms	★
FC-10	Down switchover time compensation	0–200 ms	1 ms	80 ms	★
FC-11	Stop over-distance detection delay	0.0–5.0s	0.1s	3.0s	★
FC-12	Stop pulse limit	0–9999	1	0	★

Function Code	Parameter Name	Setting Range	Min. Unit	Default	Property
FC-13	Buzzer tweeting time	0–60	1s	0	★
FC-18	Manual test oiling	0–1	1	0	☆
FC-19	Logic state information	0–65535	-	0	●
FC-20	Direction and speed change	0–65535	-	0	●
FC-21	Frequency reference	0.00–99.00	0.01 Hz	0.01 Hz	●
FC-22	Feedback frequency	0.00–99.00	0.01 Hz	0.01 Hz	●
FC-23	Bus voltage	0–999.9	0.1 V	0.1 V	●
FC-24	Output voltage	0–999	1 V	1 V	●
FC-25	Output current	0.00–655.00	0.01 A	0.01 A	●
FC-26	AI1	0.00–10.00	0.01 V	0.01 V	●
FC-27	AI2	0.00–10.00	0.01 V	0.01 V	●
FC-28	Communication interference	0–9999	-	0	●
FC-29	Input state 1	0–65535	-	0	●
FC-30	Input state 2	0–65535	-	0	●
FC-31	Input state 3	0–65535	-	0	●
FC-32	Output state 1	0–65535	-	0	●
FC-33	Output state 2	0–65535	-	0	●
FC-34	Motor pulses	0–65535	-	0	●
FC-35	Motor pulse interval	0.00–655.35	0.01s	0	●
FC-36	Left handrail pulse interval	0.00–655.35	0.01s	0	●
FC-37	Right handrail pulse interval	0.00–655.35	0.01s	0	●

Function Code	Parameter Name	Setting Range	Min. Unit	Default	Property
FC-38	Up step pulse interval	0.00–655.35	0.01s	0	●
FC-39	Down step pulse interval	0.00–655.35	0.01s	0	●
FC-40	Up machine room fault code	0–65535	-	0	●
FC-41	Down machine room fault code	0–65535	-	0	●
FC-42	Safety board fault code	0–65535	-	0	●
FC-43	Modbus device communication state	0–65535	-	0	●
Group FP: User parameters					
FP-00	User password	0–65535 0: No password	1	0	☆
FP-01	Parameter update	0: No operation 1: Restore default setting 2: Clear fault records	1	0	★
FP-02	User-defined parameter display	0: Invalid 1: Valid	1	0	★

Chapter 6 Description of Function Codes

Group F0: Basic Parameters

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F0-00	Control mode	0, 1	1	1

0: Sensorless vector control (SVC)

It is applicable to synchronous motor running or asynchronous motor running with high toque requirements.

1: Voltage/Frequency (V/F) control

It is applicable to certain detection devices.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F0-01	Running mode	0–3	1	1

It is used to set the source of RUN commands and speed references.

0: Operation panel control

The controller is operated by pressing RUN and STOP RES on the operation panel, and the running speed is set by F0-03 (Running frequency under operation panel control). This mode is mainly used during NICE2000new commissioning.

During NICE2000new running, escalator control can be implemented with the following modes:

1: Bypass variable frequency

In this control mode, the NICE2000new automatically selects variable frequency drive or mains frequency drive based on the escalator state (for example, whether there is passenger). When there is no passenger, the escalator switches over from mains frequency drive to variable frequency drive. When there is a passenger, the escalator immediately accelerates to mains frequency running.

2: Full variable frequency

Regardless of whether the escalator is at normal or low speed, the NICE2000new keeps variable frequency drive. The NICE2000new automatically controls the escalator speed based on the load state of the escalator. When there is no passenger, the escalator runs at low speed to achieve energy saving; when there is a passenger, the escalator accelerates to normal speed.

3: Y-Δ direct startup

In this mode, the NICE2000new does not perform variable frequency drive. The escalator runs at mains frequency under control of the Y-Δ startup device. When a fault such as overcurrent occurs on the NICE2000new, Y-Δ control is still normal.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F0-03	Running frequency under operation panel control	0.00 to F0-04	0.01 Hz	0

This function is enabled only when F0-01 = 0 (Operation panel control).

It sets the initial value of the speed controlled by using the operation panel. The setting is retentive at power failure. You can change the setting during running.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F0-04	Maximum frequency	10.00–99.00	0.01 Hz	60.00 Hz

It is used to set the maximum frequency output by the system.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F0-05	Carrier frequency	0.5–16.0	0.1 kHz	Model dependent

It is used to set the carrier frequency of the controller.

The carrier frequency is closely related to the motor noise during running. When it is generally set above 10 kHz, mute running is achieved. It is recommended to set the carrier frequency to the lowest within the allowable noise, which reduces the controller loss and radio frequency interference.

When the carrier frequency increases, the following factors also increases:

- Harmonics of output current

- Motor power loss
- Motor temperature rise

If the carrier frequency is low, output current has high harmonics, and the power loss and temperature rise of the motor increase.

If the carrier frequency is high, power loss and temperature rise of the motor declines. However, the system has an increase in power loss, temperature rise and interference.

Adjusting the carrier frequency will exert influences on the aspects listed in the following table.

Table 6-1 Influences of carrier frequency adjustment

Carrier frequency	Low	High
Motor noise	Large	Small
Output current waveform	Bad	Good
Motor temperature rise	High	Low
Controller temperature rise	Low	High
Leakage current	Small	Large
External radiation interference	Small	Large

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F0-06	Running direction reversed	0: Disabled 1: Enabled	1	0

You can use this parameter to change the output direction of the controller.

Group F1: Motor Parameters

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F1-01	Rated motor power	0.2–75.0	0.1 kW	Model dependent
F1-02	Rated motor voltage	0–440	1 V	380V

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F1-03	Rated motor current	0.00–655.00	0.01 A	Model dependent
F1-04	Rated motor frequency	0.00–99.00	0.01 Hz	50.00Hz
F1-05	Rated motor speed	0–3000	1 RPM	960 RPM

Set these parameters according to the motor nameplate.

Ensure that these motor parameters are set correctly. Motor auto-tuning is successful only when these motor nameplate parameters are set correctly.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F1-06	Stator resistance	0.001–30.000	0.001 Ω	Model dependent
F1-07	Rotor resistance (asynchronous motor)	0.001–30.000	0.001 Ω	Model dependent
F1-08	Leakage inductance (asynchronous motor)	0.01–300.00 mH	0.01 mH	Model dependent
F1-09	Mutual inductance (asynchronous motor)	0.1–3000.0	0.1 mH	Model dependent
F1-10	Magnetizing current (asynchronous motor)	0.01–300.00	0.01 A	Model dependent
F1-12	Shaft D inductance (synchronous motor)	0.01–300.00	0.01 mH	0.01 mH
F1-13	Shaft Q inductance (synchronous motor)	0.01–300.00	0.01 mH	0.01 mH
F1-14	Back EMF (synchronous motor)	0–65535	1 V	266 V
F1-25	Motor type	0: Asynchronous	1	0

Function Code	Parameter Name	Setting Range	Min. Unit	Default
		motor 1: Synchronous motor		

To guarantee control performance, select the motor according to the recommended models. If the motor power is greatly different from the power of the standard adaptable motor, the system control performance will degrade.

F1-06 to F1-14 are automatically updated after successful motor auto-tuning.

If motor auto-tuning cannot be performed onsite, manually input the values of these parameters according to data provided by the motor manufacturer.

For the asynchronous motor, every time you change F1-01 (Rated motor power), the controller automatically restores values of F1-06 to F1-10 to the default parameter setting for the standard motor.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F1-11	Auto-tuning mode	0: No operation 1: Static auto-tuning 2: Complete auto-tuning	1	0

0: No operation

1: Static auto-tuning

In this mode, the motor does not rotate, and the controller automatically outputs the RUN contactor and Δ contactor signals. It obtains the values of the following parameters:
F1-06 (Stator resistance)
F1-07 (Rotor resistance) and F1-08 (Leakage inductance) for asynchronous motor or F1-12 (Shaft D inductance) and F1-13 (Shaft Q inductance) for synchronous motor.

2: Complete auto-tuning

This mode obtains all parameters of F1-06 to F1-14 based on the motor type. During the process, the motor accelerates to 80% of the rated frequency, retains this frequency for a certain time, and then decelerates to 0. The acceleration and deceleration time is set in F6-07 and F6-08. The controller automatically outputs the RUN contactor and Δ contactor signals, but does not output the brake contactor signal. Therefore, you need to manually

release the brake before performing complete auto-tuning.

The asynchronous motor must be disconnected from the load completely for this mode.

The synchronous motor can be connected with the load for this mode.

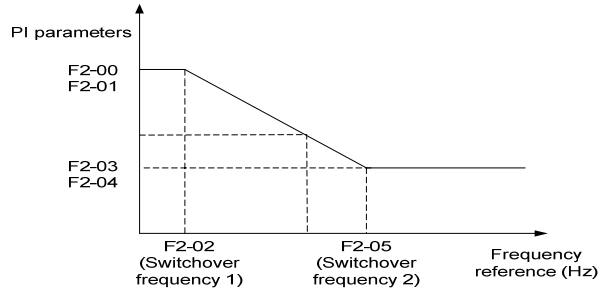
Group F2: Vector Control Parameters

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F2-00	Speed loop proportional gain 1	0–100	1	30
F2-01	Speed loop integral time 1	0.01–10.00	0.01s	0.60s
F2-02	Switchover frequency 1	0.00 to F2-05	0.01 Hz	2.00 Hz
F2-03	Speed loop proportional gain 2	0–100	1	30
F2-04	Speed loop integral time 2	0.01–10.00	0.01s	0.80s
F2-05	Switchover frequency 2	F2-02 to F0-04	0.01 Hz	5.00 Hz

F2-00 to F2-05 are used to adjust the speed loop performance in vector control.

F2-00 and F2-01 are PI regulation parameters when the running frequency is smaller than the value of F2-02 (Switchover frequency 1). F2-03 and F2-04 are PI regulation parameters when the running frequency is larger than the value of F2-05 (Switchover frequency 2). If the running frequency is between F2-02 and F2-05, the speed loop PI parameters are obtained from the weighted average value of the two groups of PI parameters (F2-00, F2-01 and F2-03, F2-04), as shown in the following figure.

Figure 6-1 Relationship between running frequencies and PI parameters



The speed dynamic response characteristics in the vector control mode can be adjusted by setting the proportional gain and integral time of the speed regulator. To achieve a faster system response, increase the proportional gain and reduce the integral time. Be aware that this may lead to system oscillation.

The recommended adjustment method is as follows:

If the default setting cannot meet the requirements, make proper adjustment. Increase the proportional gain first to ensure that the system does not oscillate, and then reduce the integral time to ensure that the system has quick response but small overshoot.

If both F2-02 (Switchover frequency 1) and F2-05 (Switchover frequency 2) are 0, only F2-03 and F2-04 are valid.

Note that improper setting of PI parameters may lead to large overshoot or event overvoltage at overshoot fall .

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F2-07	Speed loop filter coefficient	1–30	1	10

It is used to set the filter time of ASR output (torque current), current sampling, and speed feedback of the speed regulator. You need not modify it generally; if there is large interference, increase this parameter.

The output of the speed regulator is torque current references of the controller. A large value of F2-07 achieves smooth change of the output torque but slow response.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F2-08	Torque upper limit	0.0–200.0%	0.1%	150.0%

It is used to set the torque upper limit of the motor. The value 100% corresponds to the rated output torque of the adaptable motor.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F2-09	Current loop proportional gain	10–500	1	60
F2-10	Current loop integral gain	10–500	1	30

These are current loop regulating parameters in vector control. You need not modify them

generally.

If required, set these parameters according to the method of adjusting the speed loop regulator.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F2-11	Synchronous motor magnetic pole identification current	30–100	1%	60%

It is used to set the current for identifying the magnetic pole of the synchronous motor. You need not modify it generally.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F2-12	Synchronous motor V/F parameter 1	1–100	1	20
F2-13	Synchronous motor V/F parameter 2	1–100	1	30

These are vector control algorithm parameters for the synchronous motor. You need not modify them generally.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F2-16	Asynchronous motor SVC parameter 1	0–200%	1	100%
F2-17	Asynchronous motor SVC parameter 2	100–2000	1	800
F2-18	Asynchronous motor SVC parameter 3	0–500	1	200
F2-19	Asynchronous motor SVC parameter 4	0–500	1	0
F2-20	Asynchronous motor SVC parameter 5	0.0–50.0%	1	10.0%

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F2-21	Asynchronous motor SVC parameter 6	1–31	1	30
F2-22	Asynchronous motor SVC parameter 7	0–65535	1	0
F2-23	Asynchronous motor SVC parameter 8	0–65535	1	0
F2-24	Asynchronous motor SVC parameter 9	0–65535	1	0
F2-25	Asynchronous motor SVC parameter 10	0–65535	1	0

These are vector control algorithm parameters for the asynchronous motor. You need not modify them generally.

Group F3: V/F Control Parameters

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F3-00	V/F torque boost	0.0: Automatic 0.1%–30.0%	0.1%	1.0%
F3-01	Frequency limit of torque boost	0 to F0-04	0.01 Hz	50.00 Hz

F3-00 compensates for insufficient torque production by boosting output voltage of the controller at low frequency in V/F control.

But very large setting will result in motor overheat and controller overcurrent. Generally, F3-00 does not exceed 10%.

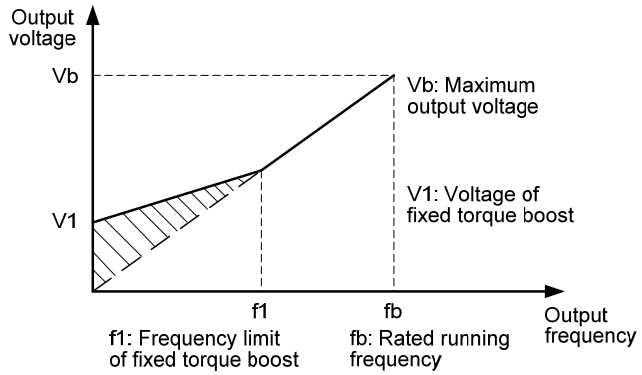
Proper setting of this parameter prevents overcurrent at startup. Increase this parameter when a heavy load is applied.

Decrease this parameter when a light load is applied.

If it is set to 0.0%, fixed torque boost is enabled.

F3-02 sets the cutoff frequency under which torque boost is active. If the frequency reference exceeds the value set in F3-02, torque boost becomes inactive.

Figure 6-2 Fixed torque boost



Function Code	Parameter Name	Setting Range	Min. Unit	Default
F3-02	V/F slip compensation	0. 0–200.0%	0.1%	0

It compensates for the motor speed slip when the load increases, stabilizing the motor speed in case of load change..

Setting 100.0% indicates compensation for rated motor speed slip when rated load is applied, and the motor speed is close to the set speed.

When the load is smaller than the rated load, set F3-02 to below 100%.

When the load is larger than the rated load, set F3-02 to slightly above 100%.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F3-03	AVR selection	0: Invalid 1: Always valid 2: Valid only at deceleration	1	1

It is used to set whether to enable the auto voltage regulator (AVR) function.

Set it to 2 if overcurrent occurs during frequency tracking and deceleration.

Set it to 1 if overvoltage occurs during frequency tracking and deceleration.

Function	Parameter Name	Setting Range	Min.	Default

Code			Unit	
F3-04	V/F oscillation suppression gain	0–200	1	20

Set this function parameter as small as possible in the prerequisite of ensuring good oscillation suppression result to avoid negative influence on V/F control.

- Set this parameter to 0 to disable oscillation suppression if there is no oscillation.
- Increase this parameter only when motor oscillation is obvious.

The larger the value is, the better the oscillation suppression result will be achieved.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F3-05	V/F over-excitation gain	0–200	1	0
F3-06	Speed of catching a spinning motor	20–100	1	30

F3-05 can restrain rise of the bus voltage during deceleration of the controller, preventing occurrence of overvoltage.

F3-06 is used to set the speed of catching the spinning motor. It is recommended that F6-02 be set to 50 Hz in this case, and F3-06 be set to 20 to 50.

Note that if F3-06 is set to 0, the frequency remains at the value of F6-02 until the controller catches the motor.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F3-07	Constant speed holding time at catching a spinning motor	0.01–10.00	0.01s	0.60s

After the escalator switches over from mains frequency drive to variable frequency drive, the controller holds constant speed running with the tracked frequency of the spinning motor. After the time set in this parameter, the controller decelerates. You need not modify this parameter generally.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F3-08	Esclator auxiliary function seelction 2	0–65535	1	2048

Each bit of the function code defines a function, as described in the following table.

Bit	Value	Description
Bit0	0	The system can run properly after the fault requiring action of the safety brake is reset.
	1	The system can run only in up direction at first-time running after the fault requiring action of the safety brake is reset.
Bit1	0	The system starts inspection running in normal state.
	1	The system alarms for 1s and then starts inspection running.
Bit2	0	The function of fault retentive at power failure is disabled.
	1	The function of fault retentive at power failure is enabled.
Bit4	0	The key switch becomes active properly.
	1	The system uses the key switch signal as the running signal after this signal remains active for 3s.
Bit5	0	Invalid
	1	The escalator stops when there is reverse direction startup signal during running.
Bit6	0	The function of brake release detection is disabled.
	1	The function of brake release detection is enabled.
Bit11	0	Detection of 1.4-times overspeed is enabled.
	1	Detection of 1.4-times overspeed is disabled.
Bit12	0	The motor speed is detected by using the software.
	1	The motor speed is detected by using the counter.
Bit13	0	There is no requirement for trial running after inspection.
	1	After switchover from inspection to normal running, the system must run in down direction for not less than 15s for the first-time

Bit	Value	Description
Bit15		running.
	0	The function of judging RST phase sequence is enabled.
	1	The function of judging RST phase sequence is disabled.

Group F4: Input Function Parameters

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F4-00	Input filter time	1–100	1 ms	10 ms

It sets the software filter time of DI terminals. If DI terminals are liable to interference, which may cause malfunction, increase this parameter to enhance the anti-interference capability. However, increase of this value will slow the response of DI terminals.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F4-01	X01 function selection	0–150	1	26
F4-02	X02 function selection	0–150	1	3
F4-03	X03 function selection	0–150	1	4
F4-04	X04 function selection	0–150	1	30
F4-05	X05 function selection	0–150	1	1
F4-06	X06 function selection	0–150	1	31
F4-07	X07 function selection	0–150	1	33
F4-08	X08 function selection	0–150	1	8
F4-09	X09 function selection	0–150	1	19
F4-10	X10 function selection	0–150	1	0
F4-11	X11 function selection	0–150	1	0

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F4-12	X12 function selection	0–150	1	12
F4-13	X13 function selection	0–150	1	18
F4-14	X14 function selection	0–150	1	17
F4-15	DI1 function selection	0–150	1	0
F4-16	DI2 function selection	0–150	1	0
F4-17	DI3 function selection	0–150	1	10
F4-18	DI4 function selection	0–150	1	11
F4-19	DI5 function selection	0–150	1	0

These parameters are used to set the signals of DI terminals X01 to X14 and DI1 to DI5.

A signal (safety circuit signal, brake feedback, and auxiliary brake feedback) must not allocated to DI terminals repeatedly. If a signal cannot be selected, view whether this signal has been allocated to another terminal or is being used.

00: Invalid

Even if there is signal input to the terminal, the system has no response. You can allocate this signal to terminals that are not used to prevent mis-function.

01: **Safety circuit signal NO** (25: NC)

The safety circuit is important to safe and reliable running of the escalator. The safety circuit comprises all safety switches. Any fault of the safety circuit will result in stop of the escalator.

02: Inspection signal NO (26: NC)

03: Inspection up signal NO (27: NC)

04: Inspection down signal NO (28: NC)

After you insert the inspection handle into the inspection interface of the up or down machine room, the escalator enters the inspection state. After receiving the inspection signal, the controller cancels all normal running and switches over to the inspection state. When there is inspection up or down signal input, the escalator runs in up or down direction at inspection speed.

05: Motor speed detection signal NO (29: NC)

The controller monitors the running speed of the motor to guarantee safe running of the escalator and prevent damage to the motor. When the detected motor pulses are abnormal, the controller performs protection. The controller judges the motor speed based on signals received from the motor speed sensor during running.

06: Contact stuck signal NO (30: NC)

The controller monitors all working contactors, and forbids escalator running when any contactor is stuck.

07: Drive chain broken detection signal NO (31: NC)

The drive chain directly determines safe running of the escalator, and is also an important condition for braking of the auxiliary safety brake. The controller judges whether the drive chain is normal or broken based on this signal input.

08: Brake detection signal NO (32: NC)

The controller detects whether the motor runs when the brake is not released based on this signal input.

09: Anti-reversal detection signal NO (33: NC)

This function prevents the condition of up direction running reversed to down direction running. Reversal does not occur when the escalator runs in down direction.

10: Up photoelectric signal NO (34: NC)

11: Down photoelectric signal NO (35: NC)

12: Energy-saving switch signal NO (36: NC)

The energy-saving switch is used to set whether the escalator is in manual or automatic running state. In low speed enable state, the up and down photoelectric switches are used to monitor the passenger loading condition.

If the energy-saving switch signal is active, the escalator is in automatic running state.

If this signal is inactive, the energy-saving function is set in Fb-16.

13: Left handrail speed detection signal NO (37: NC) 14: Right handrail speed detection signal NO (38: NC)

The controller monitors the speed of the left and right handrails so that it stops the escalator and alarms if any abnormality occurs.

15: Up step loss signal NO (39: NC) 16: Down step loss signal NO (40: NC)

The controller monitors the up and down steps so that it stops the escalator and alarms if step loss occurs.

17: Variable frequency speed selection signal NO (41: NC)

This signal is used to manually select the speed of the escalator when multi-speed is used (only in normal speed running state). When this signal is active, the setting of F6-04 (Normal speed 2 running frequency) is enabled for normal speed running. This function is supported only in full variable frequency control.

18: Drive mode selection signal NO (42: NC)

This signal is used to enable Y-Δ control. It has higher priority than F0-01. When this signal is active, the controller enters Y-Δ running state regardless of the setting of F0-01.

19: Fire emergency signal NO (43: NC)

After receiving this signal, the controller immediately decelerates to stop.

20: Fault reset signal NO (44: NC)

It is the signal from the external fault reset terminal.

21: Stop signal NO (45: NC)

When this signal is active, the escalator stops immediately or cannot be started. This signal has the highest priority.

23: Motor overheat signal NO (47: NC)

It is used to detect the motor temperature. When this signal becomes active, the controller reports fault Err29, and decelerates to stop. When this signal is inactive, the fault is reset automatically, and you can start the controller again manually.

49: RUN contactor (or up/down contactor) NO (100: NC)

It is used to detect the state of the RUN and up/down contactors. When any of the three contactors closes, this signal should be active; when all contactors open, this signal should be inactive. Otherwise, the controller reports fault Err44. You can also not use this signal so that the fault is not detected.

50: Δ contactor feedback NO (101: NC)

It is used to detect the state of the Δ contactor. This signal should be active when the Δ contactor closes and inactive when the Δ contactor opens. Otherwise, the system reports fault Err45. You can also not use this signal so that the fault is not detected.

51: Special-purpose reversal detection signal NO (102: NC)

The special-purpose reversal detection device must be installed additionally.

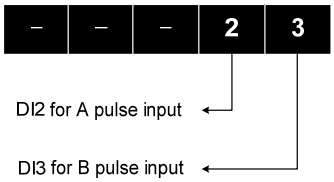
54: Auxiliary brake micro switch feedback NO (105: NC)

When the auxiliary brake is released, this signal should be active. Otherwise, the controller reports fault Err46 at startup or during running. You can also not use this signal so that the fault is not detected.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F4-21	AB pulse input selection	0–55	1	0

When the AB pulses are used for reversal detection, you can set this parameter to specify the DI terminals among DI1 to DI5 for AB pulse input.

The unit's digit specify the input terminal of B pulse and ten's digit specify the input terminal of A pulse. The following figure shows an example.



If you set F4-21 to 0, the function of reversal detection by using AB pulses is disabled.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F4-22	Safety brake action delay	0–60000	1 ms	1500 ms

If the drive chain broken, overspeed, or reversal fault occurs, the controller stops running of the escalator, and outputs the safety brake signal after the time set in this parameter.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F4-24	Time limit of catching a spinning motor	5–20	1s	15s

When there is no fault during motor catching, but the controller fails to catch the spinning motor within the time set in this parameter, the controller considers that this process has been completed by default and directly enters low speed running or reports the fault, determined by F4-27 Bit5.

Function	Parameter Name	Setting Range	Min. Unit	Default

Code				
F4-25	Initial running time multiple	1–20	1	5

After startup with the key switch, if there is no passenger within the time (Fb-09 x F4-25), the escalator switches over from normal speed from low speed.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F4-27	Escalator auxiliary function selection	0–65535	1	21

Each bit of the function code defines a function, as described in the following table.

Bit	Value	Description
Bit0	0	The reverse optoelectric signal is inactive. That is, if passengers ride the escalator during deceleration or low speed creeping, the escalator will not accelerate.
	1	The reverse optoelectric signal is active. That is, if passengers ride the escalator in the reverse direction, it will accelerate to the normal speed.
Bit1	0	After the key switch acts, the escalator runs at normal speed.
	1	After the key switch acts, the escalator runs at low speed.
Bit2	0	The system monitors the motor speed both in normal speed or low speed running of the escalator.
	1	The system monitors the motor speed only in normal speed running of the escalator.
Bit3	0	The buzzer tweets only once when there is a fault.
	1	The system reports the fault in pulse alarm mode, with the time set in FC-13.
Bit5	0	If the system fails to catch the spinning motor within the time set in F4-24, it reports fault Err41.
	1	After the time of catching the spinning motor exceeds the time set in F4-24, the system considers that the process is completed and enters low speed running.
Bit6	0	The energy saving function is enabled in Y-Δ mode.

Bit	Value	Description
Bit8	1	The energy saving function is disabled in Y-Δ mode.
	0	The escalator running can be enabled only with the up or down trigger signal.
	1	The escalator running is ensured only when the up or down signal remains active. When the key switch signal becomes inactive, the escalator stops running.
Bit10	0	The system judges only whether the handrail underspeed occurs.
	1	The system judges only whether the handrail underspeed and overspeed occur.
Bit12	0	The scrolling arrow by RS485 is disabled.
	1	The scrolling arrow by RS485 is enabled.
Bit13	0	The system detects only step loss.
	1	The system detects overspeed and step loss.
Bit14	0	The system starts up in the set mode.
	1	The bypass variable frequency mode is used. The system uses the Y-Δ mode for the first-time startup and then switches over to variable frequency running.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F4-28	Synchronization switchover maximum delay	2.000–10.000	0.001s	5.000s

In normal condition, the controller switches over from variable frequency drive to mains frequency drive after the constant-speed time set in F4-29. If the switchover conditions are not met within the time set in this parameter, the switchover is performed forcibly.

You need not modify this parameter generally.

Function Code	Parameter Name	Setting Range	Min. Unit	Default

F4-29	Synchronous switchover constant speed delay	0–5.000	0.001s	1.500s

After the controller runs from variable frequency to the rated constant frequency (default: 51.5 Hz) and remains at this frequency for the time set in this parameter, the controller considers that the speed is constant and judges the conditions for switchover from variable frequency drive to mains frequency drive.

You need not modify this parameter generally.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F4-31	Analog calibration value	0–65535	1	1000

This parameter is used to calibrate the analog input.

You need not modify this parameter generally.

Group F5: Output Function Parameters

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F5-00	DO function selection	00–18	1	0
F5-01	Y1 function selection	00–18	1	2
F5-02	Y2 function selection	00–18	1	3
F5-03	Y3 function selection	00–18	1	4
F5-04	Y4 function selection	00–18	1	5
F5-05	Y5 function selection	00–18	1	1
F5-06	Y6 function selection	00–18	1	6
F5-07	Y7 function selection	00–18	1	7
F5-08	Y8 function selection	00–18	1	12
F5-09	Y9 function selection	00–18	1	11

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F5-10	Y10 function selection	00–18	1	9
F5-11	Y11 function selection	00–18	1	10
F5-12	Y12 function selection	00–18	1	8

These parameters are used to set the signals of output terminals. DO1 is open-collector digital output terminal. Y1 to Y12 are relay output terminals, among which Y1 to Y11 are relay outputs on the I/O board and Y12 is relay output on the MCB of the controller.

A signal must not allocated to DI terminals repeatedly. If a signal cannot be selected, view whether this signal has been allocated to another terminal or is being used.

00: Invalid

Even if there is signal input to the terminal, the system has no response. You can allocate this signal to terminals that are not used to prevent mis-function.

01: RUN contactor output

This signal is used to control the contactor on the output side of the controller.

2: Up contactor output 3: Down contactor output

These signals are used to control the running direction of the escalator in mains frequency drive mode.

4: Y contactor output 5: Δ contactor output

These signals are used to control the wiring mode of the six-pole motor.

The Δ contactor signal is used for the dual-speed bypass variable frequency and standby Y-Δ system. The Y contactor signal is used only for the Y-Δ system.

6: Brake output contactor output

This signal is used to release the working brake of the motor so that the motor is allowed to run.

7: Auxiliary brake contactor output

This is the higher-voltage startup of the brake contactor.

8: Safety brake contactor output

When the escalator lifting height H is larger than 6 m, an additional safety brake is

required. It acts in any of the following conditions:

The drive chain breaks.

The anti-reversal switch acts.

The escalator runs in reverse direction.

The speed exceeds 1.4 times of the rated speed.

9: Up direction indication output 10: Down direction indication output

These signals are used for the direction indicator so that passengers identify the running direction of the escalator.

11: Buzzer tweet

This signal is active when the escalator starts up, a fault occurs or passengers ride the escalator in the reverse direction.

12: Oiling output

This signal is used to control the lubricating oil pump to oil the escalator manually or automatically.

13: Fault output

This signal is active when a fault occurs in the controller.

14: Controller ready output

When the controller is ready, the relay provides NC output. When power failure occurs or a fault occurs in the escalator, the relay stops output.

15: Controller running start output

This signal is active when the escalator runs and becomes inactive when it stops.

16: Normal speed running output

This signal is active when the escalator is in variable frequency normal-speed or △ running state.

17: Low speed running output

This signal is active when the escalator is in acceleration, deceleration, low speed creeping, and inspection state.

18: Special-purpose anti-reversal relay output

It is used together with the special-purpose reversal detection device.

Function Code	Parameter Name	Setting Range	Min. Unit	Default

F5-16	Output type selection	0–65535	1	65535

It is use to set the NO/NC type of all output terminals

Each bit of the function code defines a terminal output, as described in the following table.

If a bit is set to 1, it indicates NO output; if this bit is set to 0, it indicates NC output.

The terminals defined the binary bits of F5-16 are listed in the following table.

Bit	Meaning	Bit	Meaning
Bit0	Reserved	Bit8	Y8 output
Bit1	Y1 output	Bit9	Y9 output
Bit2	Y2 output	Bit10	Y10 output
Bit3	Y3 output	Bit11	Y11 output
Bit4	Y4 output	Bit12	Reserved
Bit5	Y5 output	Bit13	Reserved
Bit6	Y6 output	Bit14	Reserved
Bit7	Y7 output	Bit15	Reserved

Group F6: Escalator Startup/Stop Control Parameters

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F6-00	Time for switchover from variable frequency to mains frequency	0–2.0	0.1s	0.5s

It reduces jitter caused by forcible switchover during synchronization switchover auto-tuning. You need not modify it generally.

Function Code	Parameter Name	Setting Range	Min. Unit	Default

F6-01	Time for switchover from mains frequency to variable frequency	0–5.0	0.1s	0

It is used in bypass variable frequency control.

During switchover from mains frequency to variable frequency to save energy, the mains frequency contactor opens and the variable frequency contactor closes after the time (F6-01 + 0.2s).

You need not modify it generally.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F6-02	Catching frequency	0–99.0	0.1 Hz	50.0 Hz

It is used only in bypass variable frequency control. When the escalator needs to switch over from mains frequency drive to variable frequency drive, the system catches the spinning motor from a certain frequency and switches over to variable frequency control after the process is completed, and then the motor runs in uniform deceleration running state.

If F3-06 ≠ 0, the system catches the spinning motor from below the frequency set in this parameter.

If F3-06 = 0, the system catches the spinning motor from just the frequency set in this parameter.

You need not modify this parameter generally.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F6-03	Normal speed 1 running frequency	1.00 to F0-04	0.01 Hz	50.00 Hz
F6-04	Normal speed 2 running frequency	1.00 to F0-04	0.01 Hz	30.00 Hz
F6-05	Low speed running frequency	1.00 to F0-04	0.01 Hz	12.00 Hz

F6-03 and F6-05 are valid both for bypass variable frequency control and full variable

frequency control. F6-04 is valid only for full variable frequency control, meeting the requirements of traditional multi-speed full variable frequency system.

Generally F6-03 is set to the mains frequency, and F6-04 is set to the alternative frequency. In full variable frequency control mode, if the input terminal with signal 17 "Variable frequency speed selection signal" is active, the controller uses the value of F6-04 as the target normal speed frequency. If the input terminal with signal 17 "Variable frequency speed selection signal" is inactive, the controller uses the value of F6-03 as the target normal speed frequency. In bypass variable frequency control mode, the escalator is in low speed running state at the frequency set in F6-05 if there is no passenger.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F6-06	Y-Δ switchover delay	0–500	1 ms	100 ms

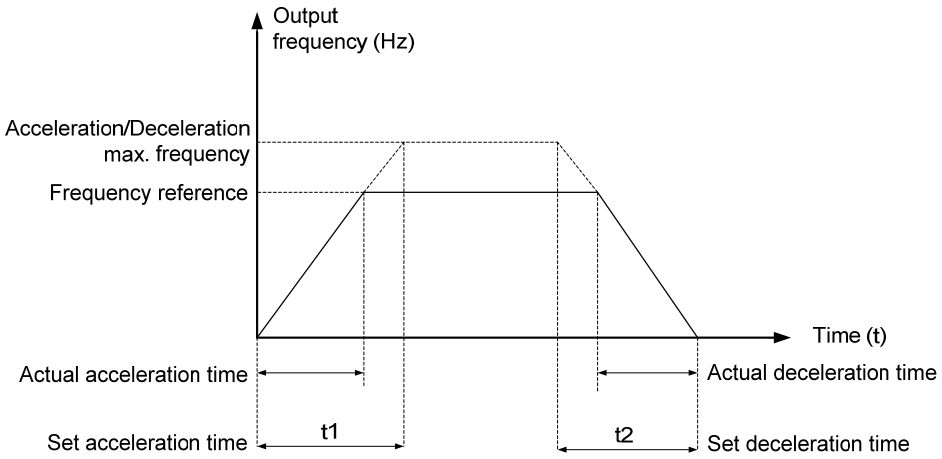
In Y-Δ running mode, the controller starts up and closes Y the contactor, and then outputs the Δ contactor signal after the time set in this parameter.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F6-07	Acceleration time	0.0–3000.0	0.1s	4.0s
F6-08	Deceleration time	0.0–3000.0	0.1s	60.0s

The acceleration time sets the time for the escalator to accelerate from zero speed to the maximum frequency.

The deceleration time sets the time for the escalator to decelerate from the maximum frequency to zero speed.

Figure 6-3 Acceleration/Deceleration time



If the frequency reference = maximum frequency, actual acceleration/deceleration time = set acceleration/deceleration time.

If the frequency reference < maximum frequency, actual acceleration/deceleration time = set acceleration/deceleration time x (frequency reference/maximum frequency).

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F6-09	Inspection frequency	0.00 to F0-04	0.01 Hz	25.00 Hz
F6-10	Inspection acceleration time	0.0–3000.0	0.1s	20.0s

These parameters respectively set the target frequency and acceleration time during inspection.

F0-10 specifies the time for the escalator to accelerate from zero speed to the maximum frequency.

If F0-09 < maximum frequency, actual acceleration/deceleration time = F6-10 x (F6-09/maximum frequency).

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F6-12	Up frequency switchover allowance	0–10.00	0.01 Hz	1.50 Hz
F6-13	Down frequency switchover	0–10.00	0.0 1 Hz	1.50 Hz

	allowance			

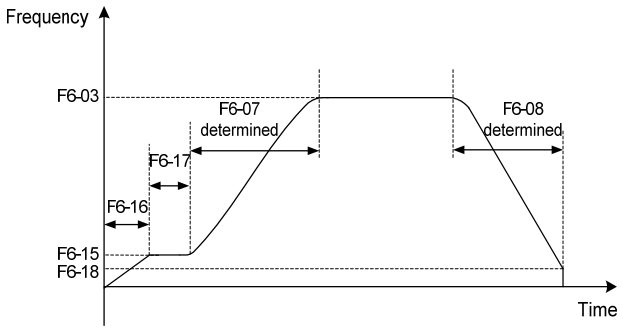
During switchover from variable frequency to mains frequency, if the effect is not satisfactory after you adjust FC-09 and FC-10 and the mechanical friction is large, increase these parameters slightly.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F6-14	Special deceleration time	0.0–3000.0	0.1s	30.0s

It sets the time for the escalator to decelerate from the maximum frequency to zero speed when the fire emergency signal is active or a fault that requires deceleration to stop occurs.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F6-15	Startup frequency	0.00–10.00	0.01 Hz	0
F6-16	Startup time	0.00–10.00	0.01s	0
F6-17	Special frequency holding time	0.00–10.00	0.01s	0
F6-18	Stop frequency	0.00–10.00	0.01 Hz	5.00 Hz

Figure 6-4 Acceleration/Deceleration curve



F6-15, F6-16 and F6-17 sets the speed and time at system startup, and are mainly used in applications with large obstruction or load at startup. In general applications, set F6-17 to 0 to allow the escalator to directly accelerate to the normal speed stage.

F6-07 and F6-08 sets the acceleration/deceleration time from zero speed to the maximum frequency, and the actual acceleration/deceleration time is also affected by F6-03.

F6-18 sets the stop frequency. When the output frequency decreases gradually and becomes equal to or smaller than F6-18 during deceleration to stop, the controller directly stops output and applies the brake. Set this parameter to 5.00 Hz for the asynchronous motor and a smaller value for the synchronous motor.

Group F7: Auxiliary Function Parameters

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F7-00	Display in running state	1–32767	1	32767

It sets the running parameters displayed on the operation panel when the escalator is in the running state.

F7-00 includes 16 binary bits, each defining a parameter. A total of 15 parameters can be can be displayed during running. If a bit is set to 1, the parameter indicated by this bit is displayed; if this bit is set to 0, the parameter is not displayed. You can press ▷ to view the parameter indicated by each bit circularly.

The 16 binary bits correspond to the running parameters listed in the following table.

Bit	Parameter Name	Bit	Parameter Name
Bit0	Frequency reference	Bit1	Target frequency
Bit2	DC bus voltage	Bit3	Output voltage
Bit4	Output current	Bit5	AI1
Bit6	AI2	Bit7	Motor pulses per second
Bit8	Handrail speed detection time interval	Bit9	Step loss time interval
Bit10	Input state 1	Bit11	Input state 2
Bit12	Input state 3	Bit13	Output state 1
Bit14	Output state 2	Bit15	Reserved

Function	Parameter Name	Setting Range	Min. Unit	Default

Code				
F7-01	Display in stop state	1–255	1	15

F7-01 includes 16 binary bits, each defining a parameter. A total of 4 parameters can be can be displayed at stop.

If a bit is set to 1, the parameter indicated by this bit is displayed; if this bit is set to 0, the parameter is not displayed. You can press ▷ to view the parameter indicated by each bit circularly.

The 16 binary bits correspond to the parameters listed in the following table.

Bit	Parameter Name	Bit	Parameter Name
Bit0	Target frequency	Bit1	DC bus voltage
Bit2	AI1	Bit3	AI2
Bit4 to Bit15	Reserved		

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F7-02	Running time limit	0–60000	1 h	0 h

When the accumulative working time exceeds F7-02, the escalator decelerates to stop. If it is set to 0, this function is disabled.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F7-03	Accumulative working hours	0–65535	1 h	0
F7-04	Accumulative working mininutes	0–60	1 min.	0

These parameters record the actual running time of the escalator, and are readable only.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F7-06	Power-on short circuit to-ground	0: Disabled	1	1

	detection	1: Enabled		

It sets whether to detect the motor short circuit to-ground fault at power-on. If it is set to 1, the controller detects whether the motor is short circuited to ground at power-on, and blocks output and reports fault Err23 if the fault occurs.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F7-07	Brake use ratio	0–100%	1%	100%

In full variable frequency control mode, the motor provides energy feedback when the escalator runs in down direction, causing rise of the bus voltage. A braking unit and regen. resistor are required to consume the energy. F7-07 sets the braking effect of the braking components.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F7-08	Software version (ZK) 1	00.00–99.99	0.01	-
F7-09	Software version (DSP) 2	000.00–99999	1	-
F7-10	Heatsink temperature	0–100	1°C	-

F7-08 and F7-09 display the software version numbers. F7-10 displays the current heatsink temperature.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F7-11	Input state	-	-	-
F7-12	Output state	-	-	-

It displays the input and output states of the controller.

The LEDs are arranged as 5, 4, 3, 2, 1 from left to right. Each segment expresses a signal, and ON indicates that the signal expressed by this segment is active.

Figure 6-5 LED display

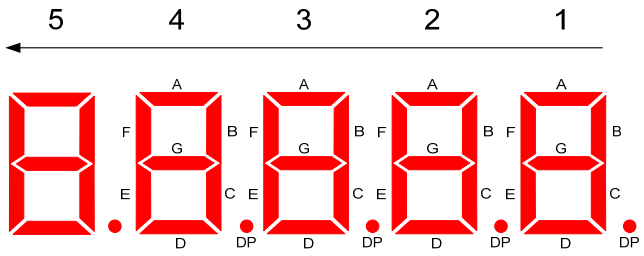


Table 6-? Input terminal state defined in F7-11

	LED5	LED4	LED3	LED2	LED1
A	Reserved	Reserved	Up step loss	Brake detection	Safety circuit signal
B	Auxiliary brake feedback	Motor overheat	Down step loss	Anti-reversal detection	Inspection signal
C	Reserved	Reserved	Variable frequency speed selection	Up photoelectric signal	Inspection up signal
D	Reserved	RUN contactor feedback	Drive mode selection	Down photoelectric signal	Inspection down signal
E	Reserved	Δ contactor feedback	Fire emergency signal	Energy-saving switch signal	Motor speed detection signal
F	Reserved	Special-purpose reversal signal	Fault reset	Left handrail speed detection signal	Contact stuck signal
G	Reserved	Reserved	Stop signal	Right handrail speed detection signal	Drive chain broken detection signal

Table 6-? Output terminal state defined in F7-12

	LED5	LED4	LED3	LED2	LED1
A	-	-	Running start of system	Safety brake contactor output	RUN contactor output
B	-	-	Normal speed running	Up direction indication contactor output	Up contactor output

	LED5	LED4	LED3	LED2	LED1
C	-	-	Low speed running	Down direction indication contactor output	Down contactor output
D	-	-	Special-purpose reversal detection	Buzzer tweet	Y contactor output
E	-	-	Reserved	Oiling output	Δ contactor output
F	-	-	Reserved	Fault output	Brake output contactor
G	-	-	Reserved	Controller ready output	Auxiliary brake contactor

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F7-15	Escalator function selection 3	0–65535	1	0

Each bit of the function code defines a function, as described in the following table.

Bit	Value	Description
Bit0	0	The system does not detect whether the mains frequency contactor is stuck.
	1	The system detects whether the mains frequency contactor is stuck during switchover from mains frequency to variable frequency in bypass variable frequency control mode.
Bit1	0	The system does not detect whether the variable frequency contactor is stuck.
	1	The system detects whether the variable frequency contactor is stuck during switchover from variable frequency to mains frequency in bypass variable frequency control mode.

Group F8: Auxiliary Management Parameters

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F8-00	Clock: year	2013–2100	Y	2013
F8-01	Clock: month	1–12	M	1
F8-02	Clock: day	1–31	D	1
F8-03	Clock: hour	0–23	H	0
F8-04	Clock: minute	0–59	Min	0

F8-00 to F8-04 sets the controller time. The time is normal even at power failure.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F8-13	Software version (ZK) 2	00.00–99.99	-	-
F8-14	Software version (ZK) 3	00.00–99.99	-	-

These two parameters are used to distinguish the customized software version based on the standard version and customer special-use software version.

Group F9: Protection Function Parameters

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F9-00	Protection function selection	0–65535	1	31

Each bit of the function code defines a function, as described in the following table.

If a bit is set to 1, the function indicated by this bit is enabled; if this bit is set to 0, the function is disabled.

Bit	Function
Bit0	Motor overload
Bit1	Overcurrent stall

Bit2	Overvoltage stall
Bit3	Input phase loss detection
Bit4	Output phase loss detection

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F9-01	Overload protection coefficient	0.20–10.00	0.01	1.00

After detecting that the output current exceeds (F9-01 x Rated motor current) and the duration lasts the time specified in the inverse time lag curve, the controller outputs fault Err11 indicating motor overload.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F9-02	Overload pre-warning coefficient	50–100	1%	80%

After detecting that the output current exceeds (F9-02 x Rated motor current) and the duration lasts the time specified in the inverse time lag curve, the controller outputs a pre-warning signal.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F9-03	Overvoltage stall proportional gain	0: No overvoltage stall 1–100	1	0
F9-04	Overvoltage stall protection threshold	100–200	1%	130%
F9-05	Overcurrent stall proportional gain	0–100	1	20
F9-06	Overcurrent stall protection threshold	100–200%	1%	150%
F9-09	Overvoltage stall integral time	0–100	1	50
F9-10	Overcurrent stall integral time	0–100	1	50

F9-03 (Overvoltage stall proportional gain): It adjusts the capability of the controller for suppressing overvoltage stall. The larger the value is, the better the suppression result is.

- For small-inertia load, set it to a small value; otherwise, the system dynamic response is slow.
- For large-inertia load, set it to a large value; otherwise, the suppression result is poor, probably causing overvoltage.

F9-04 (Overvoltage stall protection threshold): The controller performs overvoltage stall protection after the voltage exceeds the value of this parameter.

F9-05 (Overcurrent stall proportional gain): It adjusts the capability of the controller for suppressing overcurrent stall. The larger the value is, the better the suppression result is.

- For small-inertia load, set it to a small value; otherwise, the system dynamic response is slow.
- For large-inertia load, set it to a large value; otherwise, the suppression result is poor, probably causing overcurrent.

F9-06 (Overcurrent stall protection threshold): The controller performs overcurrent stall protection after the current exceeds the value of this parameter.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F9-12	Overcurrent stall suppression mode	0–3	1	3

0: Invalid

1: Constant frequency voltage regulating mode (application where there is transformer isolation between controller and motor)

2: Voltage regulating mode

3: Voltage and frequency regulating mode (general applications)

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F9-13	1st fault code	0–50	-	0
F9-14	1st fault subcode	0–999	-	0
F9-15	1st fault month and day	00.00–12.31	-	0
F9-16	1st fault hour and minute	00.00–23.59	-	0
F9-17	2nd fault code	0–50	-	0

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F9-18	2nd fault subcode	0–999	-	0
F9-19	2nd fault month and day	00.00–12.31	-	0
F9-20	2nd fault hour and minute	00.00–23.59	-	0
…	…	…	…	…
F9-50	10th fault subcode	0–999	-	0
F9-51	10th fault month and day	00.00–12.31	-	0
F9-52	10th fault hour and minute	00.00–23.59	-	0
F9-53	Latest fault code	0–50	-	0
F9-54	Latest fault subcode	0–999	-	0
F9-55	Latest fault month and day	00.00–12.31	-	0
F9-56	Latest fault hour and minute	00.00–23.59	-	0
F9-57	Input function state 1 upon latest fault	0–65535	-	0
F9-58	Terminal function state 2 upon latest fault	0–65535	-	0
F9-59	Terminal function state 3 upon latest fault	0–65535	-	0
F9-60	Output function state 1 upon latest fault	0–65535	-	0
F9-61	Output function state 2 upon latest fault	0–65535	-	0
F9-62	Output frequency upon latest fault	0.00–99.00	0.01 Hz	0

Function Code	Parameter Name	Setting Range	Min. Unit	Default
F9-63	Output current upon latest fault	0.00–99.99	0.01 A	0
F9-64	Bus voltage upon latest fault	0.0–999.9	0.1 V	0
F9-65	Logic information upon latest fault	0–65535	-	1
F9-66	Direction and speed change upon latest fault	0–65535	-	0
F9-67	Motor speed upon latest fault	0–65535	1	0
F9-68	Left handrail latest fault signal period	0.00–99.99	0.01s	0
F9-69	Right handrail latest fault signal period	0.00–99.99	0.01s	0
F9-70	Up step latest fault signal period	0.00–99.99	0.01s	0
F9-71	Down step latest fault signal period	0.00–99.99	0.01s	0

These parameter record the fault information of the latest 11 faults.

For details on the faults, refer to chapter 8.

Group FA: Communication Parameters

If your device needs to communicate with the controller, contact us for technical support.

Group Fb: Escalator-Related Function Parameters

Function Code	Parameter Name	Setting Range	Min. Unit	Default

Fb-00	Speed detection delay	0.0–9.9s 0: No detection	0.1s	5.0s

After power-on, the controller detects the motor pulses, step loss pulses, and handrail pulses to find out the safety hazard in time.

When the speed becomes stable after startup, the controller starts the detection after the time set in this parameter, prevent false alarm.

If Fb-00 is 0, the controller does not detect these pulse signals.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
Fb-01	Motor speed detection error range	10–99%	1	20%
Fb-02	Error range of handrail speed detection/step loss detection	10–99%	1	15%

These parameters set the motor speed and handrail speed/step loss detection error ranges. They are used together with Fb-03 and Fb-04 respectively.

If Fb-01 = 30% and Fb-03 = 32, the controller does not alarm if it detects 23 to 41 pulses per second. It alarms when the detected pulses are outside this range.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
Fb-03	Rated motor pulses	0–200/s 0: No detection	1	32

Fb-03 sets the pulses per second of the motor at rated speed. Based on this value, the controller detects whether the motor works in normal state.

The controller considers that the motor is in normal state if the detected pulses per second are within ±20% of this value. Otherwise, the controller will report a fault.

If Fb-03 is 0, the controller does not detect the motor pulse signal.

In bypass variable frequency mode, you can press ▷ to view the detected motor pulses per second after the controller enters normal speed running state.

Function	Parameter Name	Setting Range	Min. Unit	Default

Code				
Fb-04	Pulse interval of handrail speed detection	0.00–10.00s 0: No detection	0.01s	0

This parameter is set based on the rated escalator speed. If the interval exceeds the value of this parameter, the controller alarms.

If Fb-04 is 0, the controller does not detect the handrail pulse signal.

In bypass variable frequency mode, you can press ▷ to view the actual pulse interval of handrail speed detection after the controller enters normal speed running state.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
Fb-05	Pulse interval of step loss detection	0.00–10.00s 0: No detection	0.01s	0

This parameter is set based on the rated escalator speed. If the interval exceeds the value of this parameter, the controller alarms.

If Fb-05 is 0, the controller does not detect the step loss pulse signal.

In bypass variable frequency mode, you can press ▷ to view the actual pulse interval of handrail speed detection after the controller enters normal speed running state.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
Fb-06	Automatic oiling holding time	0–999s	1s	72s
Fb-07	Automatic oiling cycling time	0–9999 h	1 h	167 h

The NICE2000new provides the automatic oiling function. When the accumulative working time exceeds the time set in Fb-07, the NICE2000new outputs the oiling signal, and cancels this signal after the time set in Fb-06.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
Fb-08	Buzzer tweet holding time	0–99s	1s	5s

It sets the buzzer tweet time each time the direction is changed.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
Fb-09	Normal speed running time	10–3000s	1s	40s
Fb-10	Low speed running time	10–3000s	1s	40s

The NICE2000new can switch over between normal speed, low speed, and stop states to achieve energy saving. These two parameters set the time in different running states. The controller switches over to low speed running state after the normal speed running time set in Fb-09 is reached. If there is no passenger in the time set in Fb-10, the controller stops.

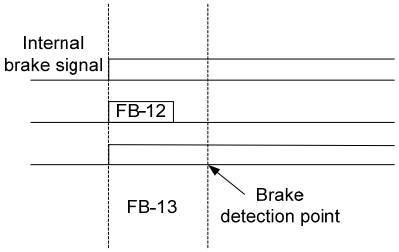
Function Code	Parameter Name	Setting Range	Min. Unit	Default
Fb-11	Reversal time	10–30s	1s	10s

In energy saving running, the escalator accelerates to the normal speed and the buzzer tweets if a passenger rides the escalator in the reverse direction. If there is no passenger, within the time set in this parameter, the escalator enters low speed running state or stops.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
Fb-12	Auxiliary brake action time	0.1–9.9s	0.1s	0.5s
Fb-13	Brake release detection time	0.5–9.9s	0.1s	1.5s

Fb-12 sets the time that the auxiliary brake signal remains active. After the controller outputs the brake release signal, it reports the brake fault if detecting that the brake is not actually released after the time set in Fb-13.

Figure 6-6 Brake output time sequence



Function Code	Parameter Name	Setting Range	Min. Unit	Default
Fb-14	Stop delay before entering inspection running	0–9.9s	0.1s	1.5s

If the escalator is in Y-Δ drive mode, it can enter the inspection running state only after the time in Fb-14 upon each stop. This is to prevent damage to the motor due to frequent startup and stop at inspection.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
Fb-15	Oiling-related interval	0–5s	1s	0

The oiling interval is dependent on the oil pump type.

Oil Pump Type	Fb-15 Setting	Description
Oil pump always energized	Fb-15 = 0	The oiling time and interval are completely controlled by the oil pump rather than the NICE2000new.
Oil pump working upon being energized	Fb-15 = 0	The oiling time and interval is controlled by the NICE2000new.
Oil pump powered in pulses	Fb-15 = 1–5	The oiling time and interval is completely controlled by the NICE2000new. Fb-15 sets the pulse interval of the oil pump during oiling. It is used together with Fb-06 and Fb-07. For example, if Fb-15 = 2, Fb-06 = 60, and

		Fb-07 = 48, the controller outputs the oiling signal after the escalator works for continuous 48 hours; the oil pump is energized for 1s and re-energized for 1s after an interval of 2s; this process cycles for 60s and the oiling ends. During this process, the oil pump becomes energized for 20 times.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
Fb-16	Energy saving mode	0: Invalid 1: Normal speed-stop cyclic 2: Normal speed-low speed cyclic 3: Normal speed-low speed-stop cyclic	1	2

It sets the escalator switchover mode if there is no passenger after a certain time.

The Y-Δ drive mode supports only normal speed-stop cyclic mode (Fb-16 = 1). The bypass and full variable frequency drive modes support all the three modes.

FB-16 is used together with the terminal with "Energy-saving switch signal".

Function Code	Terminal with "Energy-Saving Switch Signal"		Terminal without "Energy-Saving Switch Signal"
	Energy-saving switch signal active	Energy-saving switch signal active	
Fb-16 = 0	No energy saving	No energy saving	No energy saving

Fb-16 = 1	Normal speed-stop cyclic	No energy saving	Normal speed-stop cyclic
Fb-16 = 2	Normal speed-low speed cyclic	No energy saving	Normal speed-low speed cyclic
Fb-16 = 3	Normal speed-low speed-stop cyclic	No energy saving	Normal speed-low speed-stop cyclic

Function Code	Parameter Name	Setting Range	Min. Unit	Default
Fb-18	Y running time	0.0–9.9s	0.1s	3.0s

It sets the Y running time in Y-Δ drive mode. After the escalator starts up, the controller releases the Y contactor after the time in Fb-18.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
Fb-19	Safety brake action selection	0–9999	1	0

Each bit of the function code defines a function,

Bit0 and Bit1 set the action mode of the safety brake.

Bit1	Bit0	Action Mode
0	0	Not working
0	1	Continuous working
1	0	Transient working

The controller enables the safety brake to act according to the setting of Bit0 and Bit1 after faults 1.4 times overspeed, reversal, or drive chain broken occurs.

Bit2 to Bit5 set the action mode of the safety brake in other conditions, as described in the following table.

Bit	Value	Function
Bit2	0	The motor speed is irrelative to the safety brake.

	1	The safety brake acts if the motor speed is abnormal.
Bit3	0	The handrail speed is irrelative to the safety brake.
	1	The safety brake acts if the handrail speed is abnormal.
Bit4	0	The step speed is irrelative to the safety brake.
	1	The safety brake acts if the step speed is abnormal.
Bit5	0	The controller does not release the safety brake after stop.
	1	The controller releases the safety brake 10s after stop.

The setting of Bit0 and Bit1 takes precedence over the setting of Bit2 to Bit5. If Bit0 and Bit1 are set to 0, the controller does not perform safety braking even if it detects speed abnormality.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
Fb-20	Safety brake action holding time	0–10s	1s	4s

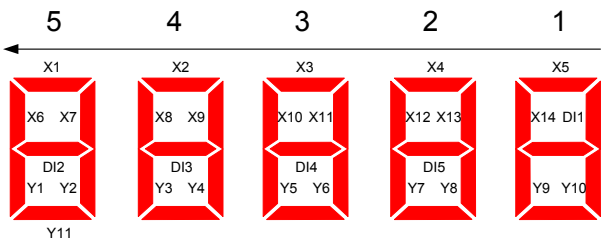
It sets the holding time of the safety brake in transient working mode (Fb-19 = 2).

Function Code	Parameter Name	Setting Range	Min. Unit	Default
Fb-21	Input/Output terminal state	*	*	*

It displays the input and output terminal states of the controller.

The LEDs are arranged as 5, 4, 3, 2, 1 from left to right. Each segment expresses a terminal, and ON indicates that the terminal expressed by this segment is active.

Figure 6-7 LED display of input/output terminal state



Group FC: Additional Function Parameters

Function Code	Parameter Name	Setting Range	Min. Unit	Default
FC-00	Motor pulse interval	0.00–10.00	0.01s	0.00s

If the rated motor pulse frequency is low, the controller can detect the motor speed better by detecting the motor pulses at an interval rather than in seconds.

If FC-00 ≠ 0, the controller detect motor pulses at the interval set in FC-00.

If FC-00 = 0, the controller detect motor pulses according to the value of Fb-03 (Rated motor pulses).

Function Code	Parameter Name	Setting Range	Min. Unit	Default
FC-01	Handrail speed detection fault delay	0–15	1s	10s

The controller reports the handrail speed fault if the handrail speed is abnormal and the duration lasts the time set in this parameter.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
FC-02	Input filter time 2	1–20	1 ms	2 ms

It sets the filter time for motor pulses and AB signal. Increasing the value can improve the anti-interference capacity.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
FC-03	Reversal detection delay	0–10	1s	3s

If the anti-reversal switch is used for reversal detection, upon starting running in the up direction, the system starts to detect the anti-reversal switch signal after the time in this parameter. If the signal is active, the system reports the reversal fault.

If the AB signals are used for reversal detection, upon retaining constant speed in the up direction, the system starts to detect the anti-reversal switch signal after the time in this parameter.

A total of three reversal detection methods are supported, as described in the following table.

Reversal Detection Method	Description	Priority
Anti-reversal switch detection	Allocate with the input terminal with "Anti-reversal detection" signal.	Low
AB signal detection	Set the terminal for AB pulse input in F4-21	Medium
Special-purpose reversal detection	Allocate with the input terminal with "Special-purpose reversal detection" signal.	High
Note that if the method of the higher priority is used, the method of the lower priority will become invalid.		

Function Code	Parameter Name	Setting Range	Min. Unit	Default
FC-04	Reversal detection judging times	0–10	1	5

It is applied only to the AB signal reversal detection method. The system reports the reversal fault after detecting that the consecutive reversal times exceed the value of this parameter.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
FC-05	AB pulse loss time	0–6000 ms	1 ms	3000 ms

It sets the maximum period of AB signals when they are used for reversal detection. The system reports the reversal fault if it does not detect the A or B signal within the time set in this parameter.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
FC-06	Time from B pulse to A pulse	0–65535	1	0
FC-07	Time from A pulse to B pulse	0–65535	1	0

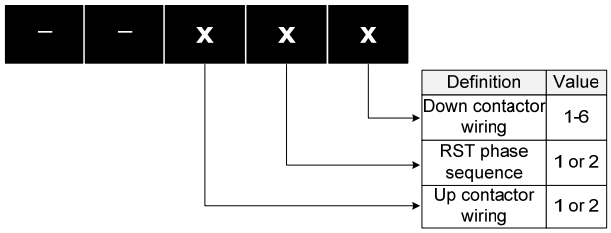
You can view these parameters when AB signals are used for reversal detection.

In up direction, FC-06 > FC-07, in down direction FC-06 < FC-07

If the actual condition is reverse to this relationship, AB signals are connected in incorrect sequence, and you need to exchange the cables or change the setting of F4-21.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
FC-08	Auto-tuning result	0–999	1	0

It displays the auto-tuning result. If the value of any digit is 0, it indicates that the required data is not obtained, and you need to check the wiring, set FC-08 to 0 and perform auto-tuning again.



For details on auto-tuning, see section 7.1.5.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
FC-09	Up switchover time compensation	0–200 ms	1 ms	80 ms
FC-10	Down switchover time compensation	0–200 ms	1 ms	80 ms

These parameters set the compensation time of relay and contactor action. Generally, you need not modify them.

The motor jitter disappears basically after auto-tuning. If the up/down direction switchover effect is not satisfactory, modify these parameters respectively to within 40–120.

For more details, see section 7.1.5.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
FC-11	Stop over-distance detection delay	0.0–5.0s	0.1s	3.0s

FC-12	Stop pulse limit	0–9999	1	0

When the system stops and releases the brake, it starts to detect motor pulses after the time set in FC-11. If the detected pulses reach the value of FC-12, it reports fault Err43.

If FC-12 is 0, this function is invalid.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
FC-13	Buzzer tweeting time	0–60	1s	0

After reporting a fault, the system outputs the buzzer tweet signal. If FC-13 ≠ 0, the system stops output of the buzzer tweet signal after the buzzer keeps tweeting for the time set in this parameter.

If FC-13 is 0, the buzzer tweet signal remains active.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
FC-18	Manual test oiling	0–1	1	0

After you change this parameter from 0 to 1, the system outputs the oiling signal once. The oiling mode is determined by Fb-06 and Fb-07.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
FC-19	Logic state information	0–65535	-	0

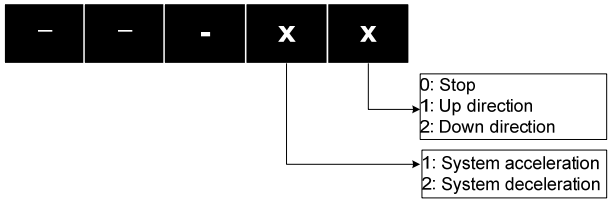
Digit	Definition	Value
Unit's digit	Reserved	-
Ten's digit	System action at running state	At normal running: 0: Initialization before normal running 1: Waiting for direction command 2: Buzzer tweeting before running 3: Waiting for optoelectric signal at energy saving
Hundred's digit		

Digit	Definition	Value
		4: Zero speed holding 5: Checking whether the brake is released 6: Y running 7: Δ running 8: Variable frequency normal speed running 9: Bypass variable frequency switchover to Δ running 10: Bypass Δ running switchover to VVVF 11: Variable frequency low speed running 12: Stop At inspection running 0: Initialization before inspection running 1: Alarming at switchover to inspection 2: Waiting for startup 3: Zero speed holding 4: Waiting for brake release 5: Inspection running 6: Inspection stop
Thousand's digit	System state	0: System initialization 1: Faulty state 2: Inspection state 3: Normal running state 4: Elevator lock state 5: Operation panel control 6: Auto-tuning state
Ten thousand's digit	Running mode	0: Operation panel control 1: Bypass variable frequency

Digit	Definition	Value
		2: Full variable frequency 3: Y-Δ direct startup

Function Code	Parameter Name	Setting Range	Min. Unit	Default
FC-20	Direction and speed change	0–65535	-	0

This function code provides two digits to indicate the escalator states, as shown in the following figure.



Function Code	Parameter Name	Setting Range	Min. Unit	Default
FC-21	Frequency reference	0.00–99.00	0.01 Hz	0.01 Hz
FC-22	Feedback frequency	0.00–99.00	0.01 Hz	0.01 Hz
FC-23	Bus voltage	0–999.9	0.1 V	0.1 V
FC-24	Output voltage	0–999	1 V	1 V
FC-25	Output current	0.00–655.00	0.01 A	0.01 A
FC-26	AI1	0.00–10.00	0.01 V	0.01 V
FC-27	AI2	0.00–10.00	0.01 V	0.01 V

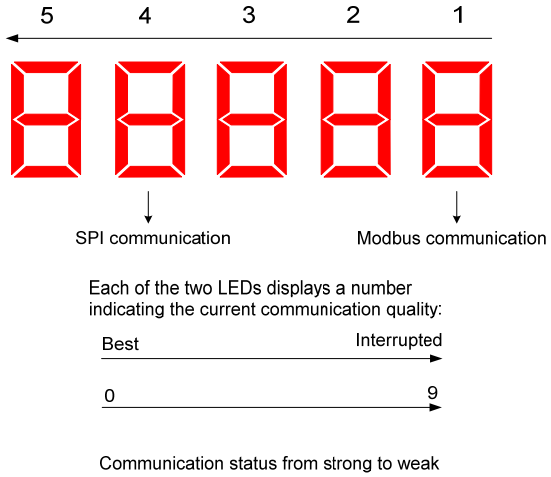
These parameters display the present running parameters.

Function Code	Parameter Name	Setting Range	Min. Unit	Default

FC-28	Communication interference	0–9999	-	0

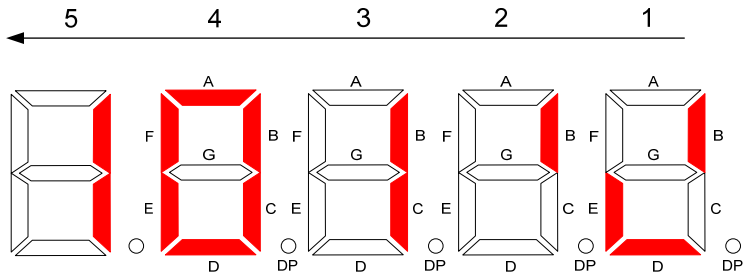
The following figures shows the communication interference display.

Figure 6-? LED display of communication interference



Function Code	Parameter Name	Setting Range	Min. Unit	Default
FC-29	Input state 1	0–65535	-	0
FC-30	Input state 2	0–65535	-	0
FC-31	Input state 3	0–65535	-	0
FC-32	Output state 1	0–65535	-	0
FC-33	Output state 2	0–65535	-	0

Figure 6-8 Example of input state display



As shown in the preceding figure, the LEDs from right to left are numbered 1, 2, 3, 4, and 5. For FA-29 to FA-33, LEDs 5 and 4 show the signal No.; LED 3 shows whether the signal is active (1) or inactive (0); the 16 segments of LEDs 1 and 2 show the states of the 16 signals in this parameter. According to the figure, LEDs 5, 4, and 3 show that signal 10

(Up photoelectric signal) is 1 (active); LEDs 1 and 2 show that besides signal 10, signals 2 (Inspection signal), 4 (Inspection down signal), and 5 Motor speed detection signal feedback) are also active.

FC-29 Input state 1

No.	Signal	No.	Signal
0	Reserved	8	Brake detection signal
1	Safety circuit signal	9	Anti-reversal detection signal
2	Inspection signal	10	Up photoelectric signal
3	Inspection up signal	11	Down photoelectric signal
4	Inspection down signal	12	Energy-saving switch signal
5	Motor speed detection signal	13	Left handrail speed detection signal
6	Contact stuck signal	14	Right handrail speed detection signal
7	Drive chain broken detection signal	15	Up step loss signal

FC-30 Input state 2

No.	Signal	No.	Signal
16	Down step loss signal	24	Reserved
17	Variable frequency speed selection signal	25	Reserved
18	Drive mode selection signal	26	Reserved
19	Fire emergency signal	27	Reserved
20	Fault reset signal	28	Reserved

21	Stop signal	29	Reserved
22	Reserved	30	Reserved
23	Motor overheat signal	31	Reserved
FC-31 Input state 3			
No.	Signal	No.	Signal
48	Reserved	56	Reserved
49	RUN contactor feedback	57	Reserved
50	Δ contactor feedback	58	Reserved
51	Special-purpose reversal detection signal	59	Reserved
52	Reserved	60	Reserved
53	Reserved	61	Reserved
54	Auxiliary brake micro switch feedback	62	Reserved
55	Reserved	63	Reserved
FC-32 Output state 1			
No.	Signal	No.	Signal
0	Reserved	8	Safety brake contactor output
1	RUN contactor output	9	Up direction indication output
2	Up contactor output	10	Down direction indication output
3	Down contactor output	11	Buzzer tweet
4	Y contactor output	12	Oiling output

5	Δ contactor output	13	Fault output
6	Brake contactor output	14	Controller ready output
7	Auxiliary brake contactor output	15	Controller running start output
FC-33 Output state 2			
No.	Signal	No.	Signal
16	Normal speed running output	24	Reserved
17	Low speed running output	25	Reserved
18	Special-purpose anti-reversal relay	26	Reserved
19	Reserved	27	Reserved
20	Reserved	28	Reserved
21	Reserved	29	Reserved
22	Reserved	30	Reserved
23	Reserved	31	Reserved

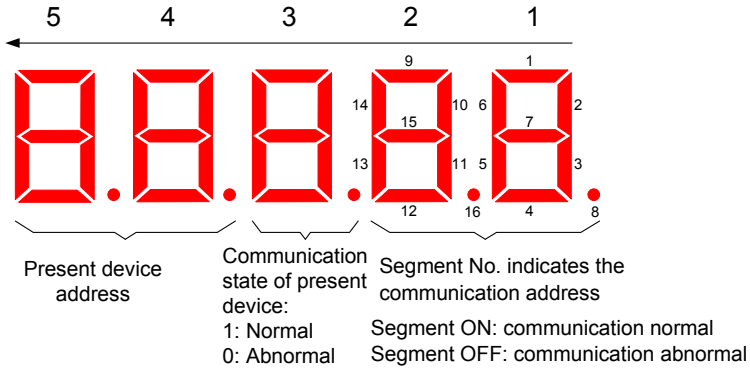
Function Code	Parameter Name	Setting Range	Min. Unit	Default
FC-34	Motor pulses	0–65535	-	0
FC-35	Motor pules interval	0.00–655.35	0.01s	0
FC-36	Left handrail pulse interval	0.00–655.35	0.01s	0
FC-37	Right handrail pulse interval	0.00–655.35	0.01s	0
FC-38	Up step pulse interval	0.00–655.35	0.01s	0

FC-39	Down step pulse interval	0.00–655.35	0.01s	0
FC-40	Up machine room fault code	0–65535	-	0
FC-41	Down machine room fault code	0–65535	-	0
FC-42	Safety board fault code	0–65535	-	0

They display the detection result of the controller.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
FC-43	Modbus device communicaiton state	0–65535	-	0

It is used to monitor the Modbus communication state of the related deivces.



Group FP: User Parameters

Function Code	Parameter Name	Setting Range	Min. Unit	Default
FP-00	User password	0–65535 0: No password	1	0

It is used to set the user password.

If it is set to any non-zero number, the password protection function is enabled. After a password has been set and taken effect, you must enter the correct password in order to enter the menu. If the entered password is incorrect, you cannot view or modify

parameters.

If FP-00 is set to 00000, the previously set user password is cleared, and the password protection function is disabled.

Remember the password that you set. If the password is set incorrectly or forgotten, contact Monarch for help.

Function Code	Parameter Name	Setting Range	Min. Unit	Default
FP-01	Parameter update	0–2	1	0

It is used to set processing on the parameters.

The values are as follows:

0: No operation

1: Restore default settings

2: Clear fault records

Function Code	Parameter Name	Setting Range	Min. Unit	Default
FP-02	User-defined parameter display	0: Invalid 1: Valid	1	0

It is used to set whether to display the parameters that are modified.

When it is set to 1, the parameters that are different from the default setting are displayed.

Chapter 7 Typical Application and Commissioning

7.1 Typical Application of Bypass Variable Frequency

The escalator bypass variable frequency technology integrates the advantages of variable frequency drive and mains frequency drive:

- Variable frequency drive: During startup, the controller adjusts the frequency of the motor gradually to the mains frequency. This features smooth motor speed change and small motor current impact, reducing mechanical wearing

- Mains frequency drive: After reaching the rated speed and runs at a constant speed, the controller switches over the motor to mains frequency control and automatically enters the bypass standby state. The electric energy generated by the motor at escalator braking can be fed back to the grid, implementing energy feedback in the simplest way, saving energy and eliminating the use of the regen. resistor.

With the bypass variable frequency technology, the controller is used only for a short time during startup and running, and therefore can be used at de-rating, reducing the whole system cost.

The NICE2000new also provides a traditional Y-Δ standby control system, reducing escalator stop upon fault to the minimum.

7.1.1 Wiring

Figure 7-1, Figure 7-2, and Figure 7-3 shows the wiring of the bypass variable frequency system.

Figure 7-1 Wiring of main circuit

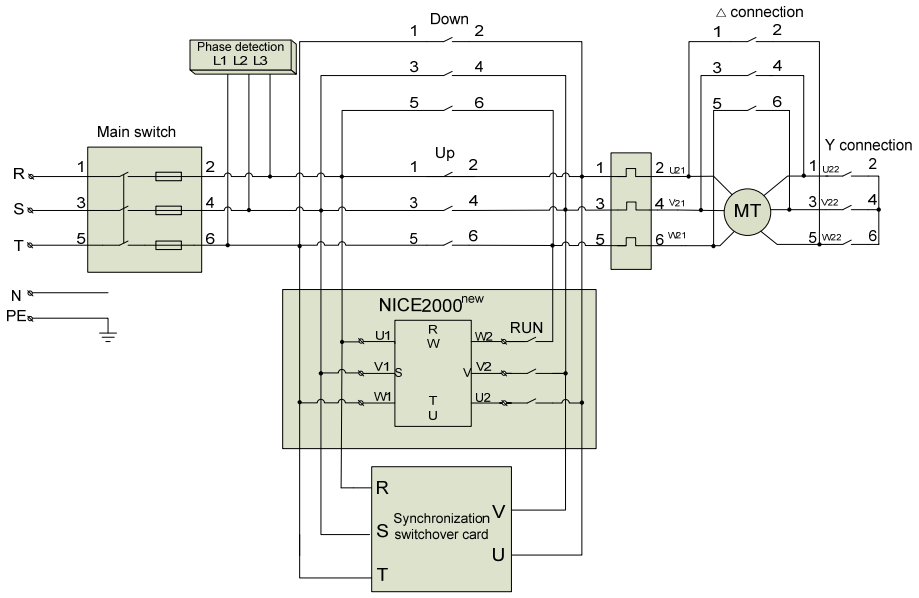


Figure 7-2 Wiring of I/O board

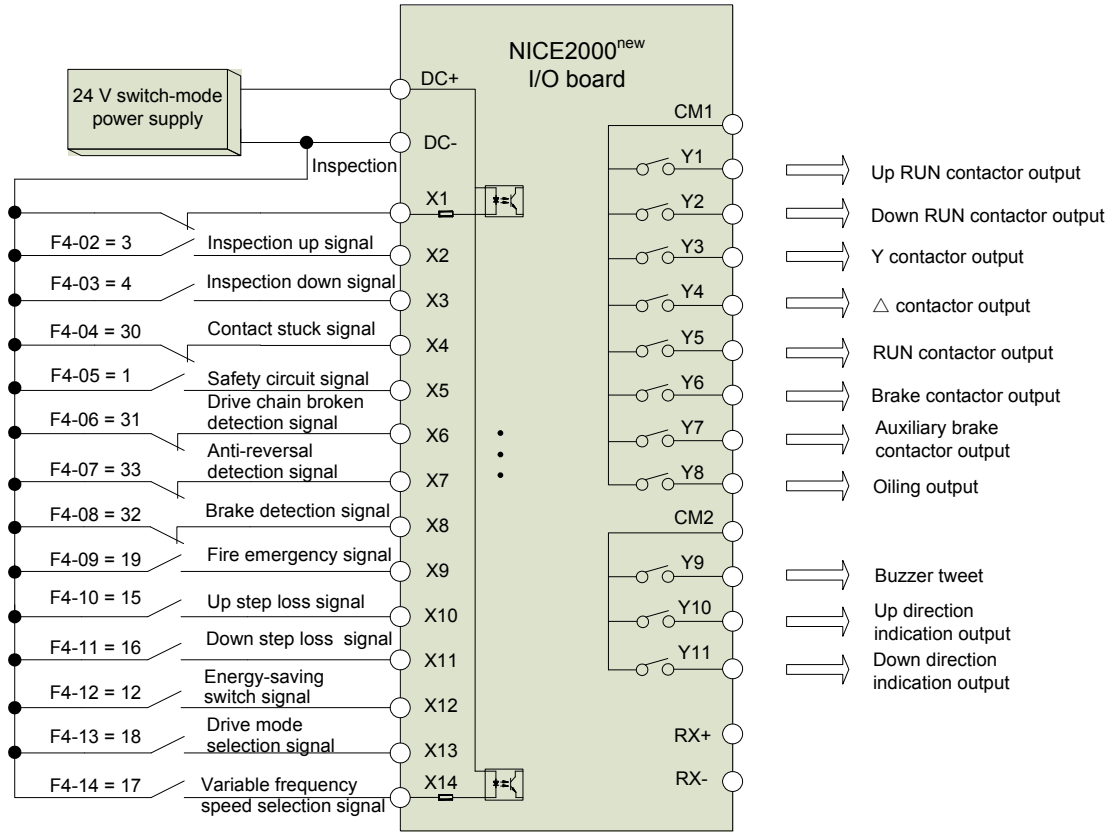
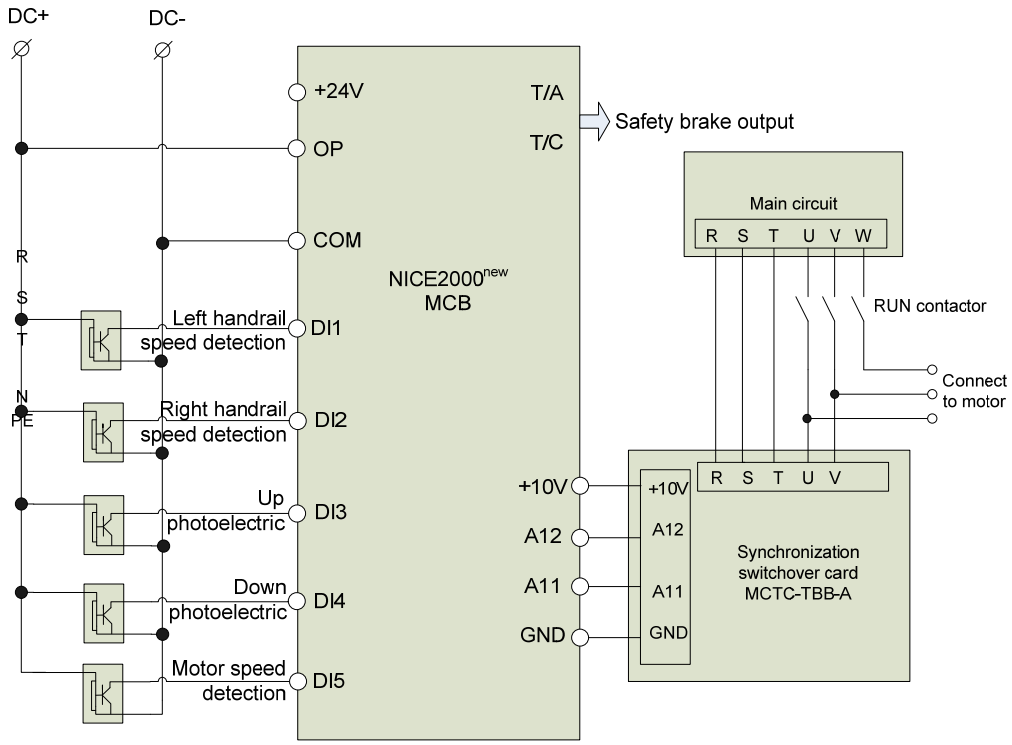


Figure 7-3 Wiring of MCB (including synchronization switchover card)



7.1.2 Parameter Setting

Set F0-01 (Running mode) to 1 (Bypass variable frequency). The parameters for the bypass variable frequency function are set already at delivery, and you can directly use the default setting. You only need to enter the motor data on the nameplate in group F1 parameters.

7.1.3 Running Curve

The following figures show the running curves during energy saving running.

Figure 7-4 Running curve of normal speed-low speed cyclic process

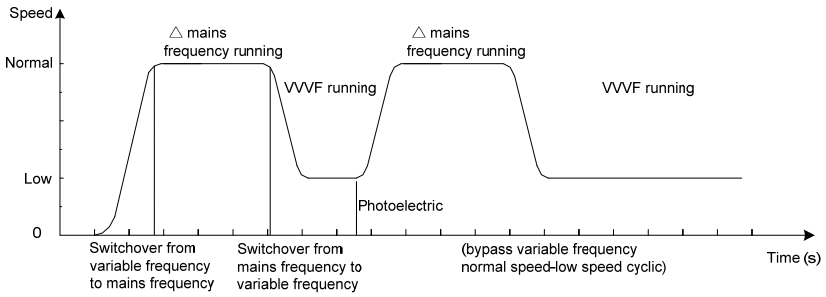


Figure 7-5 Running curve of normal speed-low speed-stop cyclic process

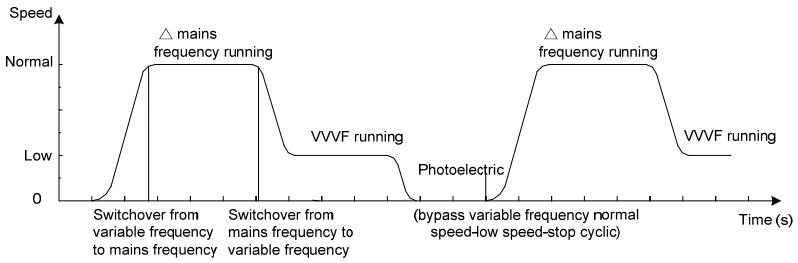
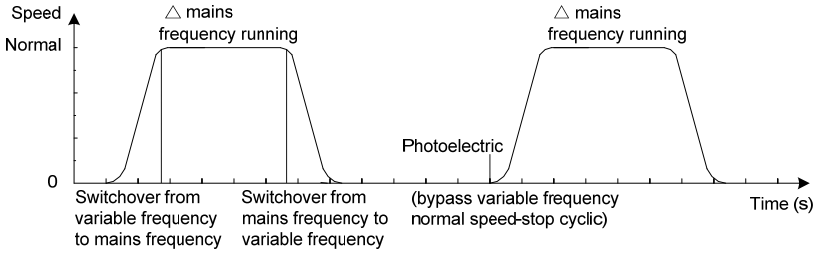


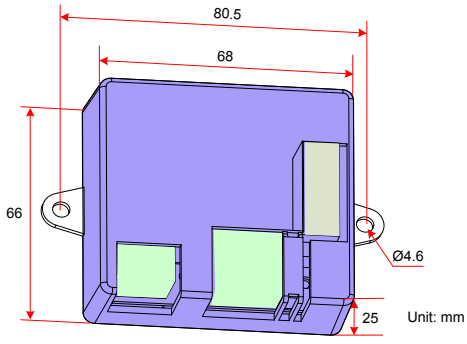
Figure 7-6 Running curve of Normal speed-stop cyclic process



7.1.4 Use of the Synchronization Switchover Card

The following figure shows the dimensions of the synchronization switchover card MCTC-TBB-A.

Figure 7-7 Dimensions of MCTC-TBB-A (with shell)

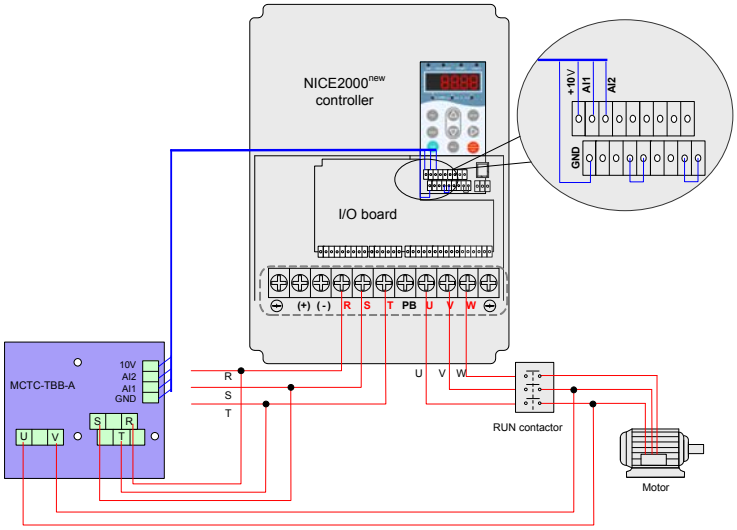


The connection of the terminals on the MCTC-TBB-A and the terminals on the controller are as follows.

Terminal on MCTC-TBB-A	Connected Terminal on Controller
R, S, T	R, S, T
U, V	Any two terminals on back side of RUN contactor (side connected to motor)
10V, AI1, AI2, GND	+10V, AI1, AI2, GND on MCB of the controller

The following figure shows the wiring between the MCTC-TBB-A and the controller.

Figure 7-8 Wiring of the MCTC-TBB-A



7.1.5 Auto-tuning Procedure

1. Software setting

Set F0-01 (Running mode) to 1 (Bypass variable frequency).

2. Operation procedure

After performing the wiring and setting the function codes, you can start auto-tuning.

Step 1: Set FC-08 (Auto-tuning result) to 0.

Step 2: Start UP running of the escalator. The system switches over to △ state running, and then stop the controller.

Step 3: Start DOWN running of the escalator, switches over to △ state running, and then stop the controller.

Step 4: View the value of FC-08. If any digit of FC-08 is 0, the auto-tuning fails. Repeat steps 1 to 4.

When neither digit of FC-08 is 0, the auto-tuning is successful. The motor will not jitter at startup again.

The auto-tuning is completed. Start the escalator and observe the switchover effect.

Note

After you exchange the UVW or RST cables or the power cable of the contactor, perform auto-tuning again.

7.2 Typical Application of Full Variable Frequency

Full variable frequency control means that the controller keeps controlling the motor during acceleration, constant-speed running, and deceleration of the motor.

This running mode is different from the bypass variable frequency control in which the motor is driven by the mains power during constant-speed running.

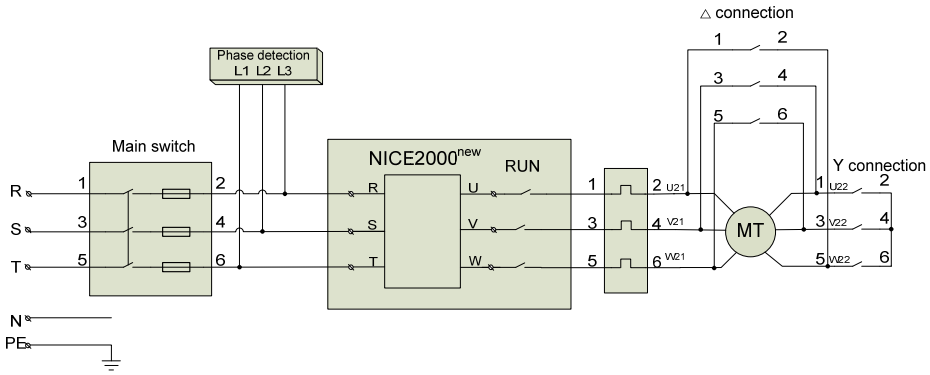
Full variable frequency control requires a regen. resistor for the down direction of the escalator.

It can implement multi-speed function. When a DI with the function "Variable frequency speed selection signal" is active, the escalator uses normal speed 2 as the target frequency to meet requirements of different users.

7.2.1 Wiring

The following figure shows the system wiring diagram.

Figure 7-9 Main circuit wiring of full variable frequency control



For the terminal wiring, refer to Figure 7-2 and Figure 7-3.

7.2.2 Parameter Setting

Set F0-01 (Running mode) to 2 (Full variable frequency), and enter the motor data on the nameplate in group F1 parameters.

7.2.3 Running Curve

Figure 7-10 Running curve of normal speed-low speed cyclic process

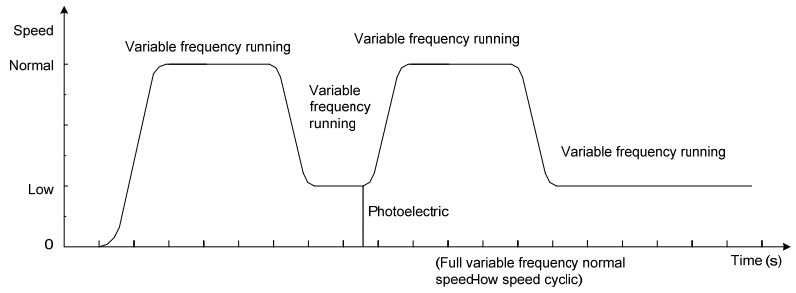


Figure 7-11 Running curve of normal speed-low speed-stop cyclic process

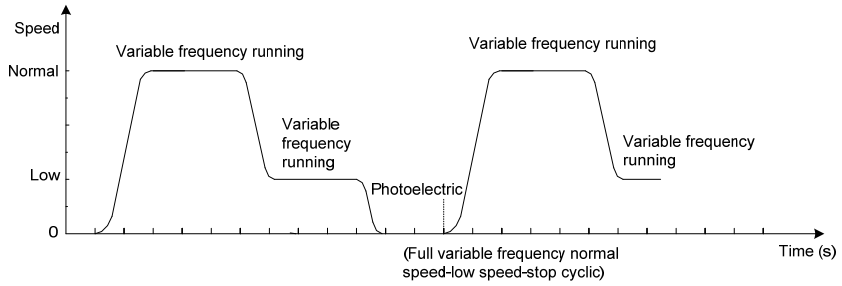
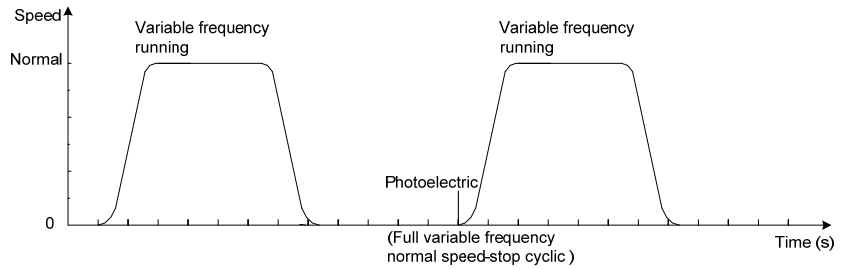


Figure 7-12 Running curve of normal speed-stop cyclic process



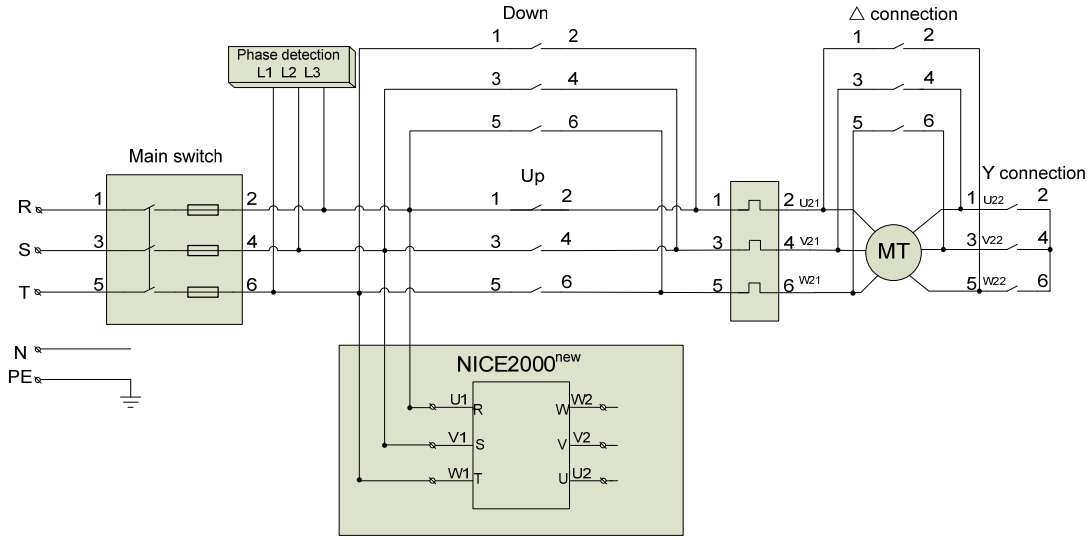
7.3 Y-Δ Application

The motor starts and runs at mains frequency. In this running mode, the NICE2000new does not drive the motor, and Y, Δ startup and up/down contactor (determining the running direction) are controlled by relay output.

7.3.1 Wiring

The following figure shows the system wiring diagram.

Figure 7-13 Main circuit wiring of Y-Δ running



For the terminal wiring, refer to Figure 7-2 and Figure 7-3.

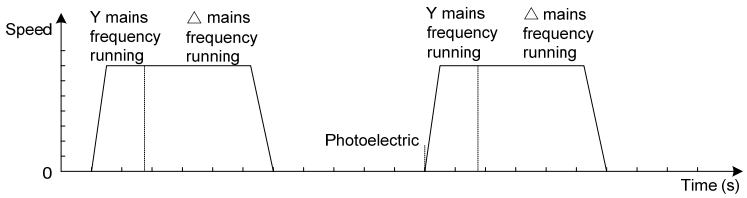
7.3.2 Parameter Setting

Set F0-01 (Running mode) to 3 (Y-Δ).

7.3.3 Running Curve

Y-Δ supports only normal stop cyclic process to implement energy-saving.

Figure 7-14 Running curve of normal speed-stop cyclic process

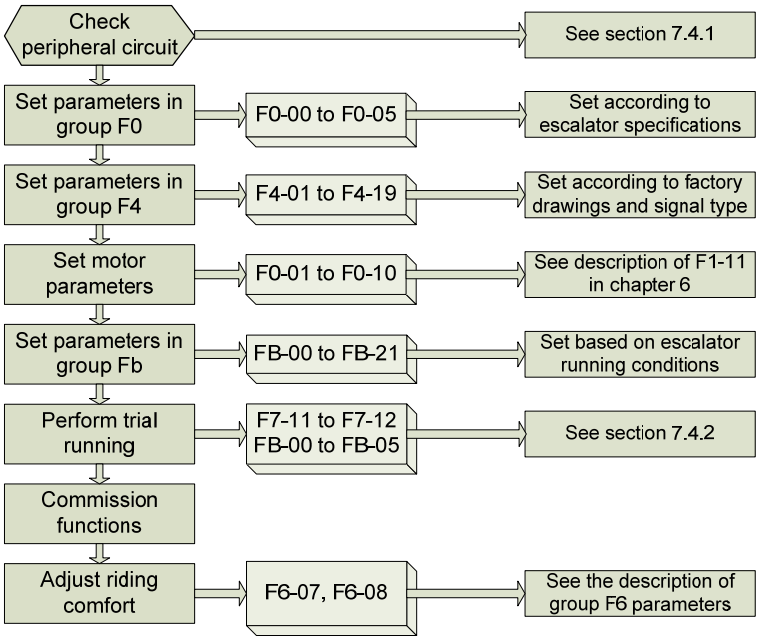


7.4 Commissioning Procedure

⚠CAUTION
During commissioning and trial running, ensure that the escalator is in inspection state and there is no passenger. Otherwise, serious accidents may occur.

When the peripheral circuit and mechanical installation are ready, perform basic commissioning and set parameters according to the steps described in the flowchart.

Figure 7-15 Commissioning flowchart



7.4.1 Check Before Inspection Speed Commissioning

The escalator needs to be commissioned after being installed; the correct commissioning guarantees safe and normal running of the escalator. Before performing electric commissioning, check whether the electrical part and mechanical part are ready for commissioning to ensure safety.

At least two persons need to be onsite during commissioning so that the power supply can be cut off immediately when an abnormality occurs.

1. Check the field mechanical and electric wiring.

Before power-on, check the peripheral wiring to ensure component and personal safety.

The items to be checked include:

1) Whether the component models are matched

2) Whether the safety circuit is conducted and reliable

3) Whether there is no passenger and the conditions for safe running are met

4) Whether the grounding is reliable

5) Whether the peripheral circuit is correctly wired according to the drawings of the vendor

6) Whether all switches act reliably

7) Whether there is short-circuit to ground by checking the inter-phase resistance of the

main circuit

8) Whether the escalator is set to the inspection state

9) Whether the mechanical installation is complete (otherwise, it will result in equipment damage and personal injury)

2. Check the power supply before power-on.

1) The inter-phase voltage of the user power supply is within (380 V±15%), and the unbalance degree does not exceed 3%.

2) The power input voltage between terminals DC+ and DC- on the interface board is 24 VDC.

Note

If the input voltage exceeds the allowable value, serious damage will be caused.

Distinguish the negative and positive of the DC power supply.

Do not run the system when there is input power phase loss.

4. Check the grounding.

1) Check that the resistance between the following points and the ground is close to infinity.

• R, S, T and PE

• U1, V1, W1 and PE

• Motor U21, V21, W21, U22, V22, W22 and PE

• 24V on the MCB and PE

• Motor U, V, W and PE

• Safety circuit, door lock circuit, and inspection circuit terminals and PE

Check the grounding terminals of all escalator electrical components and the power supply of the control cabinet.

7.4.2 Commissioning Procedure

After completing the check, remove the brake control wire, switch on the power supply, and check that the brake control terminal has no output when the escalator is not in running state (to ensure that the brake is still applied when the brake control wire is connected). Then, switch off the power supply and connect the brake control wire to prepare for the trial running at low speed.

1. Perform check after power-on.

- Check that the voltage between +24V and COM of CN2 on the MCB is within 24±0.5 VDC.
- Check that the voltage between DC+ and DC- of CN1 on the extension board is 24 V.

2. Check the function setting of terminals.

Function codes in group F4 and F5 determine the functions of the input and output terminals.

- Check whether the functions of all terminals are set correctly and whether the NO/NC feature of the terminals are set according to the actual condition.
- View the ON/OFF state of the LEDs indicating the input and output terminal state (Fb-21) to check that the terminal state is normal.

3. Perform motor auto-tuning.

Set F0-01 (Running mode) to 1 (Operation panel control), and enter the data on the motor nameplate in F1-00 to F1-05 correctly.

Perform motor auto-tuning and the NICE2000new obtains the motor data correctly.

4. Perform trial running at inspection speed.

Use the default value 25 Hz of F6-09 (Inspection frequency).

1) Check the input signals.

Check whether the action sequence of all switch signals during escalator running is correct. The major signals to be checked are safety input signal, inspection up/down input signal, contact stuck signal, anti-reversal signal, and brake release signal.

2) Check the output signals.

Check whether all output terminals allocated with related contactor signals on the extension board are correctly connected to the corresponding contactors on the controller, and whether ON and OFF states of the contactors (RUN contactor and brake contactor) are normal.

3) Check the running direction.

Press the inspection up and inspection down buttons and observe whether the actual running direction is consistent with the required directions (based on the direction flag on the motor flywheel). If not, exchange any two of motor UVW cables.

4) Check the sensors.

The normal running of the motor speed sensor, left/right handrail speed sensor, and up/down step loss detection sensor is critical to normal running of the escalator.

Check whether the power indicators of the sensors are normal or further measure whether

the output side of the sensors has voltage.

5. Perform trial running at normal speed.

Restore the escalator to the normal running state, and test whether the escalator is in normal running in manual and automatic states.

Chapter 8 Troubleshooting

8.1 Description of Fault Levels

The NICE2000new has almost 50 pieces of alarm information and protective functions. It monitors various input signals, running conditions and feedback signals. If a fault occurs, the system implements the relevant protective function and displays the fault code.

Table 8-1 Fault levels

Category	Action	Remarks
Level 1	1. Display fault code. 2. Output the fault relay action command. 3. Continue normal running of the escalator.	No such level currently
Level 2	1. Display fault code. 2. Output the fault relay action command. 3. Buzzer tweet. 4. Continue normal running of the escalator.	No such level currently
Level 3	1. Display fault code. 2. Output the fault relay action command. 3. Buzzer tweet. 4. Decelerate to stop and forbid startup.	-
Level 4	1. Display fault code. 2. Output the fault relay action command. 3. Buzzer tweet. 4. Stop immediately and forbid startup.	-
Level 5	1. Display fault code. 2. Output the fault relay action command. 3. Buzzer tweet. 4. Stop immediately and forbid startup. 5. Output safety braking signal.	-

8.2 Fault Code and Troubleshooting

If an alarm is reported, the system performs corresponding processing based on the fault level. You can handle the fault according to the possible causes described in the following table.

Table 8-2 Fault codes and troubleshooting

Fault Code	Name	Possible Causes	Solution	Level
Err01	Inverter unit protection	● The output circuit is grounded or short circuited. ● The cable between the motor and the controller is too long. ● The ambient temperature is too high. ● The internal connections become loose.	● Eliminate external faults. ● Install a reactor or an output filter. ● Check that the air filter and the cooling fan work properly. ● Connect all cables properly. ● Contact the agent or Monarch for technical support.	4
Err02	Overcurrent during acceleration	● The main circuit output is grounded or short circuited. ● Motor auto-tuning is performed imp improperly. ● The load is too heavy.	● Eliminate external faults. ● Perform motor auto-tuning again. ● Reduce the sudden load.	4
Err03	Overcurrent during deceleration	● The main circuit output is grounded or short circuited. ● Motor auto-tuning is not performed properly. ● The load is too heavy. ● The deceleration rate is too short.	● Eliminate external faults. ● Perform motor auto-tuning again. ● Reduce the sudden load. ● Modify the curve-related parameters.	4

Fault Code	Name	Possible Causes	Solution	Level
Err04	Overcurrent at constant speed	● The main circuit output is grounded or short circuited. ● Motor auto-tuning is not performed properly. ● The load is too heavy. ● The encoder is seriously interfered with.	● Eliminate external faults. ● Perform motor auto-tuning again. ● Reduce the sudden load. ● Select a proper encoder and use the shielded encoder cable. ● Increase the value of F6-02 slightly.	4
Err05	Overvoltage during acceleration	● The input voltage is too high. ● The regeneration power of the motor is too high. ● The braking resistance is too large, or the braking unit fails. ● The acceleration rate is too short.	● Adjust the input voltage. ● Adjust the startup timing sequence of the escalator. ● Select a proper regen. resistor. ● Modify the curve-related parameters.	4
Err06	Overvoltage during deceleration	● The input voltage is too high. ● The braking resistance is too large, or the braking unit fails. ● The deceleration rate is too short.	● Adjust the input voltage. ● Select a proper regen. resistor. ● Modify the curve-related parameters.	4
Err07	Overvoltage at constant speed	● The input voltage is too high. ● The braking resistance is too large, or the braking unit fails.	● Adjust the input voltage. ● Select a proper regen. resistor. ● Increase the value of F6-02 slightly.	4
Err08	Control power fault	● The input voltage is too high. ● The drive board is abnormal.	● Adjust the input voltage. ● Contact the agent or Monarch for technical	4

Fault Code	Name	Possible Causes	Solution	Level
			support.	
Err09	Undervoltage	● Instantaneous power failure occurs on the input power supply. ● The input voltage is too low. ● The drive board fails.	● Eliminate external power supply faults and check whether the power fails during running. ● Contact the agent or Monarch for technical support.	4
Err10	Controller overload	● The brake circuit is abnormal. ● The load is too heavy. ● The encoder feedback.	● Check the brake circuit and power input. ● Reduce the load.	4
Err11	Motor overload	● FC-02 is set improperly. ● The brake circuit is abnormal. ● The load is too heavy.	● Adjust the parameter. ● Check the brake circuit and power supply.	4
Err12	Power supply phase loss	● The power input phases are not symmetric. ● The drive control board fails.	● Adjust the power input. ● Contact the agent or Monarch for technical support.	4
Err13	Power output phase loss	● The output wiring of the main circuit is loose. ● The motor is damaged.	● Check the wiring. ● Eliminate the motor fault.	4
Err14	Module overheat	● The ambient temperature is too high. ● The fan is damaged. ● The air filter is blocked.	● Lower the ambient temperature. ● Clear the air filter. ● Replace the damaged fan.	4
Err16	Current control fault	● Power output phase loss exists. ● The speed is abnormal.	● Check whether the RUN contactor and delta contactor can be closed properly. ● Check whether the motor power cables become loose.	4

Fault Code	Name	Possible Causes	Solution	Level
			● Check whether the motor parameters are set according to the nameplate, and whether motor auto-tuning is performed. ● Adjust the speed loop.	
Err17	Contactor faulty	● The bus voltage is abnormal. ● The drive control board is abnormal.	Contact the agent or Monarch for technical support.	4
Err18	Current detection fault	The drive board fails.	Contact the agent or Monarch for technical support.	4
Err19	Motor auto-tuning fault	● The motor cannot rotate properly. ● The motor auto-tuning times out.	● Enter the motor parameters correctly. ● Check the motor wiring. ● Check whether the brake has been released manually before complete auto-tuning.	4
Err20	Encoder faulty	● The encoder model does not match the PG card. ● The encoder wiring is incorrect.	● Use the push-pull encoder or open-collector encoder. ● Eliminate the wiring problems.	4
Err21	Parameter setting incorrect	The parameter setting is improper.	Check the setting of the maximum frequency and rated frequency.	4
Err22	Reserved	-	-	4
Err23	To-ground short circuit	The output is short-circuited to ground.	Contact the agent or Monarch for technical support.	4
Err25	Storage data abnormal	The storage data of the MCB is abnormal.	Contact the agent or Monarch for technical support.	4

Fault Code	Name	Possible Causes	Solution	Level
Err29	Motor overheat	The motor overheat signal remains valid for over 2s.	● Check whether the thermal protection relay is normal. ● Check whether the motor is used properly and whether it is damaged. ● Improve cooling conditions of the motor.	3
Err30	Safety circuit disconnected	The safety circuit signal becomes OFF.	● Check the safety circuit switches and their states. ● Check whether the external power supply is normal. ● Check whether the safety circuit contactor acts properly. ● Confirm the signal feature (NO, NC) of the feedback contact of the safety circuit contactor.	4
Err31	Drive chain disconnected	The drive chain is broken.	● Check whether the drive chain is broken. ● Check whether the protection switch of the drive chain acts.	5
Err32	Contactor contact stuck	● The contact stuck signal is active at startup. ● The mains frequency contactor is stuck during switchover from mains frequency to variable frequency. ● The variable frequency contactor is stuck during switchover from variable frequency to mains frequency.	● Check whether the contactor is damaged, causing contact stuck. ● Check whether the feedback switch is deadlocked, causing incorrect judgment of the escalator.	3

Fault Code	Name	Possible Causes	Solution	Level
Err33	Brake contactor feedback abnormal	● The feedback is incorrect when the brake is applied. ● The feedback is incorrect when the brake is released. ● When both feedback signals of the brake contactor are enabled, their states remains inconsistent over the time set in Fb-13.	● Check whether the brake really cannot be applied. ● Check whether the protection switch of the brake cannot act. ● Check whether the brake coil and feedback contact are normal. ● Check whether the signal feature (NO, NC) of the feedback contact is set correctly. ● Check whether the control circuit of the brake contactor coil is normal.	4
Err34	Left handrail speed abnormal	The left handrail detection signal indicates underspeed or overspeed.	● Check whether the left handrail runs improperly or is damaged. ● Check whether the left handrail speed sensor is faulty.	3
Err35	Right handrail speed abnormal	The right handrail detection signal indicates underspeed or overspeed.	● Check whether the right handrail runs improperly or is damaged. ● Check whether the right handrail speed sensor is faulty.	3
Err36	Up step loss	The up step pulse interval is inconsistent with (higher than or lower than) the set time threshold.	● Check whether the up step speed is abnormal or actual step loss occurs.	4

Fault Code	Name	Possible Causes	Solution	Level
			● Check whether the up step loss sensor is faulty.	
Err37	Down step loss	The down step pulse interval is inconsistent with (higher than or lower than) the set time threshold.	● Check whether the down step speed is abnormal or actual step loss occurs. ● Check whether the down step loss sensor is faulty.	4
Err38	Motor speed detection fault	The motor speed is overspeed or underspeed.	● Check whether the motor is abnormal. ● Check whether the motor speed sensor is faulty.	4
Err39	Anti-reverse fault	● The anti-reverse switch signal is active. ● AB signals are reversed.	● Check whether reversal occurs during running in the up direction. ● Check whether the anti-reversal protection switch acts properly. ● Check whether the AB signals are normal and whether they are wired reversely.	5
Err40	Pulse-to-pulse current limit fault	● The load is too heavy or locked-rotor occurs on the motor. ● The power rating of the controller model is too low.	● Reduce the load and check motor and mechanical conditions. ● Use a controller of a higher power rating.	4
Err41	Motor speed catching fault	The controller fails to catch the motor speed during switchover from	Decrease the value of F6-02 slightly.	4

Fault Code	Name	Possible Causes	Solution	Level
		△ control to variable frequency control.		
Err42	Direction signal abnormal	● Both the up and down signals are active. ● When the down RUN command needs to be sent at first-time running after switchover from inspection to normal, the up RUN command is sent. ● When the up RUN command needs to be sent at first-time running after switchover from inspection to normal, the RUN command is sent.	● Check whether both the up and down signals are active. ● Set the setting of F3-08 at switchover from inspection to normal, and perform operations according to the actual setting.	4
Err43	Braking-to-stop distance exceeding limit	After the delay in FC-11 upon brake release, the accumulative pulses detected within 10s exceed the limit set in FC-12.	● Check whether the braking-to-stop distance is too long. ● Check whether the motor pulse signal after stop is abnormal.	5
Err44	RUN and up/down contactors feedback abnormal	● The RUN contactor has output but the feedback is inactive. ● The up contactor has output but the feedback is inactive. ● The down contactor has output but the feedback is inactive. ● Neither of the three contactors	● Check whether the contactor acts according to the output signal of the MCB. ● Check whether the feedback contact is wired correctly. ● Check whether the signal feature (NO, NC) of the	4

Fault Code	Name	Possible Causes	Solution	Level
		has output but the feedback is active. ● The feedback remains inconsistent with the output for over 2s, and a fault is reported.	feedback contact is set correctly.	
Err45	Δ contactor feedback abnormal	● The Δ contactor has output, but the feedback is inactive. ● The Δ contactor has no output. ● The feedback remains inconsistent with the output for over 2s, and a fault is reported.	● Check whether the contactor acts according to the output signal of the MCB. ● Check whether the feedback contact is wired correctly. ● Check whether the signal feature (NO, NC) of the feedback contact is set correctly.	4
Err46	Auxiliary brake feedback abnormal	The feedback signal of the auxiliary brake is inactive at startup or running.	● Check whether the auxiliary brake is released. ● Check whether the feedback contact is wired correctly. ● Check whether the signal feature (NO, NC) of the feedback contact is set correctly.	4
Err47	1.4 times overspeed	The motor speed remains 1.4 times of the set value for 2s.	● Check whether the escalator speed exceeds 1.4 times of the set value actually.	5

Fault Code	Name	Possible Causes	Solution	Level
			● Check whether the speed setting is proper.	
Err48	Input phase sequence error	The RST phase sequence detected before switchover from variable frequency to mains frequency is different from the recording value.	● Check whether the directions at variable frequency running and mains frequency running are the same. ● Perform synchronization switchover auto-tuning again.	3
Err49	SPI communication fault	1. The control board cannot receive data correctly. 2. The drive board cannot receive data correctly.	1. Check whether wiring of the control board and drive board are correct. 2. Contact the agent or Monarch for technical support.	4

8.3 Faults Without Display and Troubleshooting

No.	Fault Symptom	Causes and Solution
1	There is no display at power-on.	Measure the voltage of the controller power supply by using a multimeter, and check whether the voltage is the same as the rated voltage of the controller. If not, eliminate the power supply problems. Check whether the three-phase rectifier bridge is in good condition. If it is damaged, contact the agent or Monarch for technical support. Check whether the CHARGE indicator is ON. If the indicator is ON, the fault may occur on the rectifier bridge or snubber resistor; if the indicator is OFF, the fault may occur on the switch-mode power supply.
2	The air switch of the power supply trips	Check whether the power supply is grounded or short-circuited,

No.	Fault Symptom	Causes and Solution
	after power-on.	and eliminate the problems. Check whether the rectifier bridge is in good condition. If it is damaged, contact the agent or Monarch for technical support.
3	The motor does not rotate after the controller starts to run.	Check whether the UVW output is balanced. If yes, the cause is probably that the motor cables or the motor itself is damaged or the motor rotor is blocked due to mechanical factors. Eliminate the problems. If there is output but it is unbalanced or there is no output voltage, the cause is probably that the controller drive board or output module is damaged. In this case, contact Monarch for technical support.
4	The display after power-on is normal, but the power air switch trips after the controller starts running.	Check whether short circuit exists between output modules. If yes, contact Monarch for technical support. Check whether motor cables are short-circuited or grounded. If yes, eliminate the problems. If the trip occurs not frequently and there is a large distance between the motor and the controller, install an output AC reactor additionally.

Appendix A: EMC

A.1 Definition of Terms

1) EMC

Electromagnetic compatibility (EMC) describes the ability of electronic and electrical devices or systems to work properly in the electromagnetic environment and not to generate electromagnetic interference that influences other local devices or systems.

In other words, EMC includes two aspects: The electromagnetic interference generated by a device or system must be restricted within a certain limit; the device or system must have sufficient immunity to the electromagnetic interference in the environment.

2) First environment

Environment that includes domestic premises, it also includes establishments directly connected without intermediate transformers to a low-voltage power supply network which supplies buildings used for domestic purposes

3) Second environment

Environment that includes all establishments other than those directly connected to a low-voltage power supply network which supplies buildings used for domestic purposes

4) Category C1 Controller

Power Drive System (PDS) of rated voltage less than 1000 V, intended for use in the first environment

5) Category C2 Controller

PDS of rated voltage less than 1000 V, which is neither a plug in device nor a movable device and, when used in the first environment, is intended to be installed and commissioned only by a professional

6) Category C3 Controller

PDS of rated voltage less than 1000 V, intended for use in the second environment and not intended for use in the first environment

7) Category C4 Controller

PDS of rated voltage equal to or above 1000 V, or rated current equal to or above 400 A, or intended for use in complex systems in the second environment

A.2 Introduction to EMC Standard

A.2.1 EMC Standard

The NICE2000new controller satisfies the requirements of standard EN 61800-3: 2004 Category C2. The controller is applied to both the first environment and the second environment.

A.2.2 Installation Environment

The system manufacturer using the controller is responsible for compliance of the system with the European EMC directive. Based on the application of the system, the integrator must ensure that the system complies with standard EN 61800-3: 2004 Category C2, C3 or C4.

The system (machinery or appliance) installed with the controller must also have the CE mark. The system integrator is responsible for compliance of the system with the EMC directive and standard EN 61800-3: 2004 Category C2.

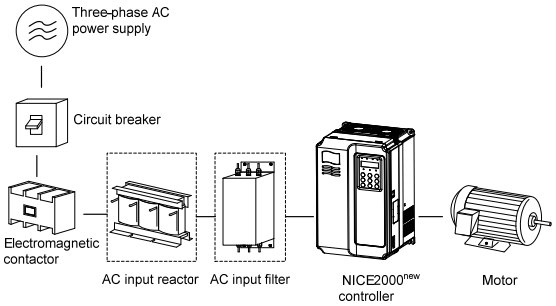
⚠WARNING
If applied in the first environment, the controller may generate radio interference. Besides the CE compliance described in this chapter, users must take measures to avoid such interference, if necessary.

A.2.3 Requirements on Satisfying the EMC Directive

1. The controller requires an external EMC filter. The recommended filter models are listed in Table A-1. The cable connecting the filter and the controller should be as short as possible and be not longer than 30 cm. Furthermore, install the filter and the controller on the same metal plate, and ensure that the grounding terminal of the controller and the grounding point of the filter are in good contact with the metal plate.
2. Select the motor and the control cable according to the description of the cable in section A.4.
3. Install the controller and arrange the cables according to the cabling and grounding in section A.4.
4. Install an AC reactor to restrict the current harmonics. For the recommended models, see Table A-2.

A.3 Selection of Peripheral EMC Devices

Figure A-1 Peripheral EMC devices (dotted block)



A.3.1 Installation of EMC Input Filter on Power Input Side

An EMC filter installed between the controller and the power supply can not only restrict the interference of electromagnetic noise in the surrounding environment on the controller, but also prevents the interference from the controller on the surrounding equipment.

The NICE2000new controller satisfies the requirements of category C2 only with an EMC filter installed on the power input side. The installation precautions are as follows:

- Strictly comply with the ratings when using the EMC filter. The EMC filter is category I electric apparatus, and therefore, the metal housing ground of the filter should be in good contact with the metal ground of the installation cabinet on a large area, and requires good conductive continuity. Otherwise, it will result in electric shock or poor EMC effect.
- The grounds of the EMC filter and the PE conductor of the controller must be tied to the same common ground. Otherwise, the EMC effect will be affected seriously.
- The EMC filter should be installed as closely as possible to the power input side of the controller.

The following table lists the recommended manufacturers and models of EMC filters for the NICE2000new controller. Select a proper one based on actual requirements.

Table A-1 Recommended manufacturers and models of EMC filters

Controller Model	Power Capacity (kVA)	Rated Input Current (A)	AC Input Filter Model (Changzhou Jianli)	AC Input Filter Model (Schaffner)
NICE-E1-B-4013	8.9	14.8	DL-16EBK5	FN 3258-16-33
NICE-E1-B-4017	11.0	20.5	DL-25EBK5	FN 3258-30-33
NICE-E1-B-4025	17.0	29.0	DL-35EBK5	FN 3258-30-33

Controller Model	Power Capacity (kVA)	Rated Input Current (A)	AC Input Filter Model (Changzhou Jianli)	AC Input Filter Model (Schaffner)
NICE-E1-B-4032	21.0	36.0	DL-50EBK5	FN 3258-42-33
NICE-E1-B-4037	24.0	41.0	DL-50EBK5	FN 3258-42-33
NICE-E1-B-4045	30.0	49.5	DL-50EBK5	FN 3258-55-34
NICE-E1-B-4060	40.0	62.0	DL-65EBK5	FN 3258-75-34

A.3.2 Installation of AC Input Reactor on Power Input Side

An AC input reactor is installed to eliminate the harmonics of the input current. As an optional device, the reactor can be installed externally to meet strict requirements of an application environment for harmonics. The following table lists the recommended manufacturers and models of input reactors.

Table A-2 Recommended manufacturers and models of AC input reactors

Controller Model	Power Capacity (kVA)	Rated Input Current (A)	AC Input Reactor Model (Inovance)
NICE-E1-B-4013	8.9	14.8	MD-ACL-15-4T-552-2%
NICE-E1-B-4017	11.0	20.5	MD-ACL-30-4T-113-2%
NICE-E1-B-4025	17.0	29.0	MD-ACL-30-4T-113-2%
NICE-E1-B-4032	21.0	36.0	MD-ACL-40-4T-153-2%
NICE-E1-B-4037	24.0	41.0	MD-ACL-50-4T-183-2%
NICE-E1-B-4045	30.0	49.5	MD-ACL-50-4T-183-2%
NICE-E1-B-4060	40.0	62.0	MD-ACL-80-4T-303-2%

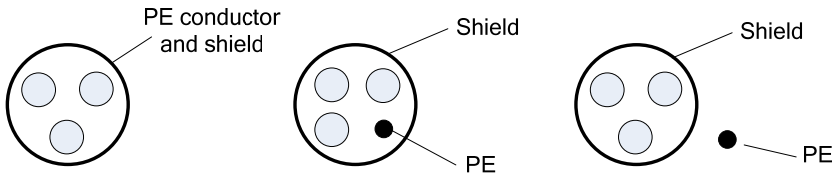
A.4 Shielded Cable

A.4.1 Requirements for the Shielded Cable

The shielded cable must be used to satisfy the EMC requirements. Shielded cables are classified into three-conductor cable and four-conductor cable. If conductivity of the cable

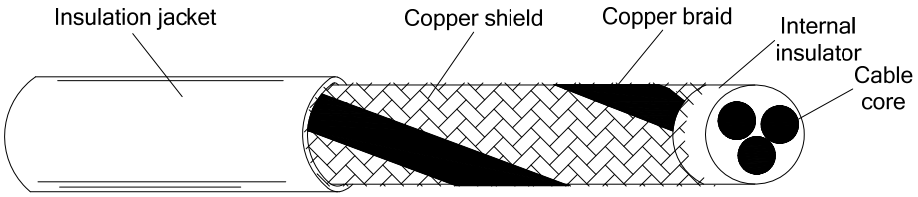
shield is not sufficient, add an independent PE cable, or use a four-conductor cable, of which one phase conductor is PE cable.

The three-conductor cable and four-conductor cable are shown in the following figure.

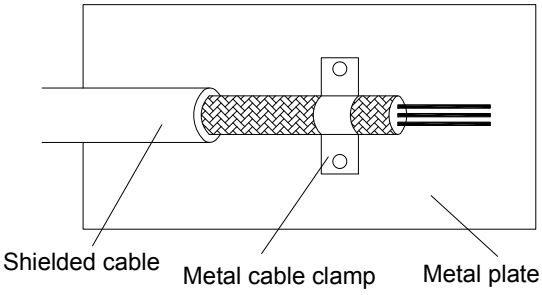


The motor cable and PE shielded conducting wire (twisted shielded) should be as short as possible to reduce electromagnetic radiation and external stray current and capacitive current of the cable.

To suppress emission and conduction of the radio frequency interference effectively, the shield of the shielded cable is cooper braid. The braided density of the cooper braid should be greater than 90% to enhance the shielding efficiency and conductivity, as shown in the following figure.

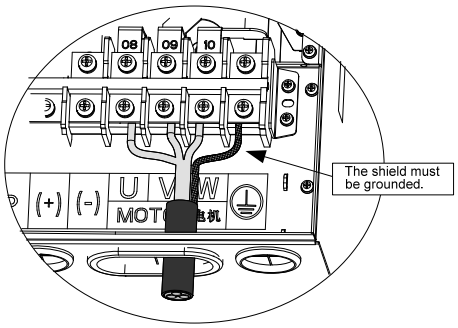


It is recommended that all control cables be shielded. The grounding area of the shielded cable should be as large as possible. A suggested method is to fix the shield on the metal plate using the metal cable clamp so as to achieve good contact, as shown in the following figure.



The following figure shows the grounding method of the shielded cable.

Figure A-2 Grounding of the shielded cable



A.4.2 Installation Precautions of the Shielded Cable

- Symmetrical shielded cable is recommended. The four-conductor shielded cable can also be used as an input cable.
- The motor cable and PE shielded conducting wire (twisted shielded) should be as short as possible to reduce electromagnetic radiation and external stray current and capacitive current of the cable. If the motor cable is over 100 meters long, an output filter or reactor is required.
- It is recommended that all control cables be shielded.
- It is recommended that a shielded cable be used as the output power cable of the controller; the cable shield must be well grounded. For devices suffering from interference, shielded twisted pair (STP) cable is recommended as the lead wire and the cable shield must be well grounded.

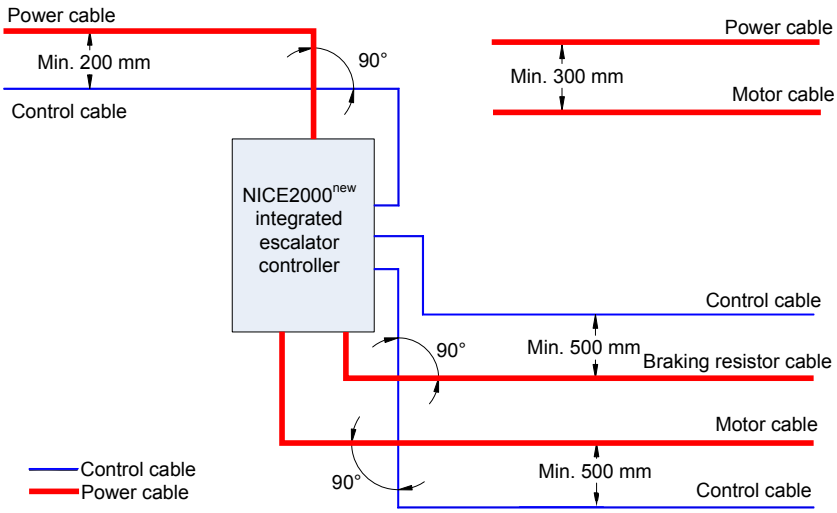
A.4.3 Cabling Requirement

1. The motor cables must be laid far away from other cables, with recommended distance larger than 0.5 m. The motor cables of several controllers can be laid side by side.
2. It is recommended that the motor cables, power input cables and control cables be laid in different ducts. To avoid electromagnetic interference caused by rapid change of the output voltage of the controller, the motor cables and other cables must not be laid side by side for a long distance.
3. If the control cable must run across the power cable, make sure they are arranged at an angle of close to 90°. Other cables must not run across the controller.
4. The power input and output cables of the controller and weak-current signal cables (such as control cable) should be laid vertically (if possible) rather than in parallel.
5. The cable ducts must be in good connection and well grounded. Aluminium ducts can be used to improve electric potential.

6. The filter and controller should be connected to the cabinet properly, with spraying protection at the installation part and conductive metal in full contact.

7. The motor should be connected to the system (machinery or appliance) properly, with spraying protection at the installation part and conductive metal in full contact.

Figure A-3 Cabling diagram



A.5 Solutions to Common EMC Interference Problems

The controller generates very strong interference. Although EMC measures are taken, the interference may still exist due to improper cabling or grounding during use. When the controller interferes with other devices, adopt the following solutions.

Interference Type	Solution
Leakage protection switch tripping	● Connect the motor housing to the PE of the controller. ● Connect the PE of the controller to the PE of the mains power supply. ● Add a safety capacitor to the power input cable. ● Add magnetic rings to the input drive cable.
Controller interference during running	● Connect the motor housing to the PE of the controller. ● Connect the PE of the controller to the PE of the mains voltage. ● Add a safety capacitor to the power input cable and wind the cable with magnetic rings. ● Add a safety capacitor to the interfered signal port or wind the signal cable with magnetic rings. ● Connect the equipment to the common ground.
Communication interference	● Connect the motor housing to the PE of the controller. ● Connect the PE of the controller to the PE of the mains voltage. ● Add a safety capacitor to the power input cable and wind the cable with

Interference Type	Solution
	magnetic rings. ● Add a matching resistor between the communication cable source and the load side. ● Add a common grounding cable besides the communication cable. ● Use a shielded cable as the communication cable and connect the cable shield to the common grounding point.
I/O interference	● Enlarge the capacitance at the low-speed DI. A maximum of 0.11 uF capacitance is suggested. ● Enlarge the capacitance at the AI. A maximum of 0.22 uF is suggested.

A.6 Solutions to Current Leakage

Type	Influencing Factor	Measure
To-ground current leakage	There is distributed capacitance between the lead wires and the ground. The larger the distributed capacitance is, the larger the current leakage is.	Shorten the distance between the controller and the motor to reduce the distributed capacitance.
	The larger the carrier frequency is, the larger the current leakage is.	Reduce the carrier frequency to reduce the current leakage. Note that reducing the carrier frequency leads to increase of the motor noise.
	The larger the circuit current is, the larger the current leakage is. Generally, there is often large current leakage for the high power motor .	Install an input reactor additionally.
Line-line current leakage	There is distributed capacitance between output cables of the controller. If the current passing the cables include high harmonics, it may result in resonance and current leakage. The thermal relay may mis-function if used at this moment.	Reduce the carrier frequency or install an output reactor. Do not install the thermal relay additionally, and use the electronic overcurrent protection function of the controller.

Warranty Agreement

The warranty period of the product is 18 months from date of manufacturing . During the warranty period, if the product fails or is damaged under the condition of normal use by following the instructions, Monarch will be responsible for free maintenance.

1. Within the warranty period, maintenance will be charged for the damages caused by the following reasons:
   A. Improper use or repair/modification without prior permission
   B. Fire, flood, abnormal voltage, other disasters and secondary disasters
   C. Hardware damage caused by dropping or transportation after procurement
   D. Improper operations
   E. Damage out of the equipment (for example, external device factors)
2. If there is any failure or damage to the product, please correctly fill out the *Product Warranty Card* in detail.
3. The maintenance fee is charged according to the latest *Maintenance Price List* of Monarch.
4. The *Product Warranty Card* is not re-issued. Please keep the card and present it to the maintenance personnel when asking for maintenance.
5. If there is any problem during the service, contact Monarch's agent or Monarch directly.
6. This agreement shall be interpreted by Suzhou MONARCH Control Technology Co., Ltd.

Service Department, Suzhou MONARCH Control Technology Co., Ltd.

Address: 16, Youxiang Rd, Yuexi Town, Wuzhong District, Suzhou 215104, China

Service Hotline: (+86) 400-777-1260

Website: http://www.szmctc.cn

Product Warranty Card

<table>
<tr><td rowspan="3">Customer information</td><td colspan="2">Add. of unit:</td></tr>
<tr><td rowspan="2">Name of unit:
P.C.:</td><td>Contact person:</td></tr>
<tr><td>Tel.:</td></tr>
<tr><td rowspan="3">Product information</td><td colspan="2">Product model:</td></tr>
<tr><td colspan="2">Body barcode (Attach here):</td></tr>
<tr><td colspan="2">Name of agent:</td></tr>
<tr><td>Failure information</td><td colspan="2">(Maintenance time and content):

Maintenance personnel:</td></tr>
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