涌现集团
YONGXIAN GROUP

MCTC-PES-E1 Programmable Electronic System

User Manual

MON-CM-A03-2025-0040

Preface

Thank you for purchasing the MCTC-PES-E1 system.

MCTC-PES-E1, independently developed and produced by Suzhou Monarch Control Technology Co., Ltd., is a programmable electronic system in safety related applications for escalators and moving walks (PESSRAE).

The MCTC-PES-E1 adopts dual-CPU control and provides multiple safety monitoring protections for escalators and moving walks. The system satisfies the GB/16899-2011 Safety Rules for the Construction and Installation of Escalators and Moving Walks.

This guide describes the correct use of the MCTC-PES-E1 system. System installation, commissioning and maintenance must be performed only by qualified personnel with related experience.

It introduces the construction, features, safety prompts, design & installation, operation & maintenance, and faults & solutions of the MCTC-PES-E1 system. Read and understand the guide before use, and keep it properly for future reference.

Notes
◆ To describe product details, this guide provides diagrams showing the status without a housing or safety cover. Before using this product, install the housing or safety cover as required and refer to the instructions in this guide. ◆ Diagrams in this document are used only for function description. The product structure shown in the diagrams may be different from the structure of the product that you purchase. ◆ When the product is upgraded or the specifications change, this guide will be updated in a timely manner to improve its accessibility and accuracy. ◆ If you need to purchase this guide in case that the original copy is damaged or lost, contact our local agent or our customer service center. ◆ If you have any questions regarding the usage of this product, contact our customer service center.

Contents

Safety Instructions

Safety Precautions

1) Before installing, using, and maintaining this equipment, read the safety information and precautions thoroughly, and comply with them during operations.
2) To ensure the safety of humans and equipment, follow the signs on the equipment and all the safety instructions in this user guide.
3) "CAUTION", "WARNING", and "DANGER" items in the manual do not indicate all safety precautions that need to be followed; instead, they just supplement the safety precautions.
4) Use this equipment according to the designated environment requirements. Damage caused by improper usage is not covered by warranty.
5) Inovance shall take no responsibility for any personal injuries or property damage caused by improper usage.

Safety Levels and Definitions

DANGER	indicates that failure to comply with the notice will result in severe personal injuries or even death.
WARNING	indicates that failure to comply with the notice may result in severe personal injuries or even death.
CAUTION	indicates that failure to comply with the notice may result in minor personal injuries or damage to the equipment.

Safety Instructions

Unpacking
CAUTION ◆ Check whether the packing is intact and whether there is damage, water seepage, damp, and deformation. ◆ Unpack the package by following the package sequence. Do not hit the package with force. ◆ Check whether there are damage, rust, or injuries on the surface of the equipment or equipment accessories. ◆ Check whether the number of packing materials is consistent with the packing list.

WARNING

- Do not install the equipment if you find damage, rust, or indications of use on the equipment or accessories.
- Do not install the equipment if you find water seepage, component missing or damage upon unpacking.
- Do not install the equipment if you find the packing list does not conform to the equipment you received.

Storage and Transportation

CAUTION

- Store and transport this equipment based on the storage and transportation requirements for humidity and temperature.
- Avoid transporting the equipment in environments such as water splashing, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Avoid storing this equipment for more than three months. Long-term storage requires stricter protection and necessary inspections.
- Pack the equipment strictly before transportation. Use a sealed box for long-distance transportation.
- Never transport this equipment with other equipment or materials that may harm or have negative impacts on this equipment.

WARNING

- Use professional loading and unloading equipment to carry large-scale or heavy equipment.
- When carrying this equipment with bare hands, hold the equipment casing firmly with care to prevent parts falling. Failure to comply may result in personal injuries.
- Handle the equipment with care during transportation and mind your step to prevent personal injuries or equipment damage.
- Never stand or stay below the equipment when the equipment is lifted by hoisting equipment.

Installation

WARNING

- Thoroughly read the safety instructions and user guide before installation.
- Do not modify this equipment.
- Do not rotate the equipment components or loosen fixed bolts (especially those marked in red) on equipment components.
- Do not install this equipment in places with strong electric or magnetic fields.
- When this equipment is installed in a cabinet or final equipment, protection measures such as a fireproof enclosure, electrical enclosure, or mechanical enclosure must be provided. The IP rating must meet IEC standards and local laws and regulations.

DANGER

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals.
- Installation, wiring, maintenance, inspection, or parts replacement must be performed by only experienced personnel who have been trained with necessary electrical information.
- Installation personnel must be familiar with equipment installation requirements and relevant technical materials.
- Before installing equipment with strong electromagnetic interference, such as a transformer, install an electromagnetic shielding device for this equipment to prevent malfunctions.

Wiring

DANGER

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals.
- Never perform wiring at power-on. Failure to comply will result in an electric shock.
- Before wiring, cut off all equipment power supplies. Wait at least 10 minutes before further operations because residual voltage exists after power-off.
- Make sure that the equipment is well grounded. Failure to comply will result in an electric shock.
- During wiring, follow the proper electrostatic discharge (ESD) procedures, and wear an antistatic wrist strap. Failure to comply will result in damage to internal equipment circuits.

WARNING

- Never connect the power cable to output terminals of the equipment. Failure to comply may cause equipment damage or even a fire.
- When connecting a drive with the motor, make sure that the phase sequences of the drive and motor terminals are consistent to prevent reverse motor rotation.
- Wiring cables must meet diameter and shielding requirements. The shielding layer of the shielded cable must be reliably grounded at one end.
- After wiring, make sure that no screws are fallen and cables are exposed in the equipment.

Power-on

DANGER

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

Operation

DANGER

- Do not touch any wiring terminals during operation. Failure to comply will result in an electric shock.
- Do not remove any part of the equipment during operation. Failure to comply will result in an electric shock.
- Do not touch the equipment shell, fan, or resistor for temperature detection. Failure to comply will result in heat injuries.
- Signal detection must be performed by only professionals during operation. Failure to comply will result in personal injuries or equipment damage.

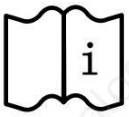
WARNING

- Prevent metal or other objects from falling into the device during operation. Failure to comply may result in equipment damage.
- Do not start or stop the equipment using the contactor. Failure to comply may result in equipment damage.

Maintenance
DANGER ◆ Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals. ◆ Do not maintain the equipment at power-on. Failure to comply will result in an electric shock. ◆ Before maintenance, cut off all equipment power supplies and wait at least 10 minutes.
WARNING ◆ Perform daily and periodic inspection and maintenance for the equipment according to maintenance requirements and keep a maintenance record.
Repair
DANGER ◆ Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals. ◆ Do not repair the equipment at power-on. Failure to comply will result in an electric shock. ◆ Before inspection and repair, cut off all equipment power supplies and wait at least 10 minutes.
WARNING ◆ Require for repair services according to the product warranty agreement. ◆ When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record. ◆ Replace quick-wear parts of the equipment according to the replacement guide. ◆ Do not operate damaged equipment. Failure to comply may result in worse damage. ◆ After the equipment is replaced, perform wiring inspection and parameter settings again.
Disposal
WARNING ◆ Dispose of retired equipment by following local regulations or standards. Failure to comply may result in property damage, personal injuries, or even death. ◆ Recycle retired equipment by following industry waste disposal standards to avoid environmental pollution.

Safety Signs

■ Description of safety signs in the user guide



Read the user guide before installation and operation.

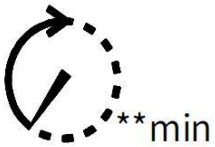
Reliably ground the system and equipment.

Danger!

High temperature!

Prevent personal injuries caused by machines.

High voltage!



Wait xx minutes before further operations.

■ Description of safety signs on the equipment

For safe equipment operation and maintenance, comply with safety signs on the equipment, and do not damage or remove the safety labels. The following table describes the safety signs.

Safety Sign	Description
	◆ Read the user guide before installation and operation. Failure to comply will result in an electric shock. ◆ Do not remove the cover at power-on or within 10 minutes after power-off. ◆ Before maintenance, inspection, and wiring, cut off input and output power, and wait at least 10 minutes until the power indicator is off.

Service life

The service life of the MCTC-PES-E1 is 15 years. To ensure normal use and safety, you need to replace the product that has been used for approximately 10 years (calculated from delivery) or return them to Monarch for repair and maintenance.

1 Product Information

1.1 Introduction

The MCTC-PES-E1 is designed to provide multiple safety monitoring protections for escalators and moving walks. It adopts dual-CPU control and judges the signals related to the escalator or moving walks simultaneously. Once detecting a fault, the two CPUs instruct the safety relays to act and output the fault signal.

Furthermore, the two CPUs monitor each other. If one CPU breaks down or is damaged, the other instructs the safety circuits to act immediately and output the corresponding fault signal. The MCTC-PES-E1 has an LED operation panel, on which you can perform operations such as parameter modification and working status monitoring.

The following figure shows the physical appearance of the MCTC-PES-E1.

Figure 1-1 Physical appearance of the MCTC-PES-E1 (a control board fixed inside the black housing)

1.2 System Components

The MCTC-PES-E1 is configured with a control board, a protective guard, and a switching-mode power supply (the models are introduced in Table 1-1).

When installing the MCTC-PES-E1, six sensors and seven detection switches are required. The sensor models are designated and sold by Monarch, while the detection switches are decided by the customer. The recommended models of the sensors and detection switches are introduced in Table 1-2.

Caution

- The MCTC-PES-E1 system is installed in the machine room of the escalator or moving walk. The installation environment must satisfy the requirements described in Table 1-2. Monarch will assume no risk or responsibility if a fault occurs in the system because the installation environment requirements are not satisfied.
- The switching-mode power supply provides power supply only to the components of the MCTC-PES-E1 (including the control board and the connected sensors and detection switches). It is prohibited to provide power supply to any other devices.

Table 1-1 Models of switching-mode power supply

Component	Quantity	Compatible Model			Remark
Switching-mode power supply	1	ECU EPR-35-24 EPR-35-24 (35W，DC24V)	Schneider ABL2REM24015H (35W，DC24V)	Mean Well LRS-35-24 (35W，DC24V)	The switching-mode power supply of MCTC-PES-E1 is provided by Monarch.

Table 1-2 Models of sensors and detection switches

Accessory	Quantity	Recommended Model		Remark
Sensor		Weton		Specify the required sensor models in your order. Monarch will deliver them (except NBN40-L2-E0-V1) together with the MCTC-PES-E1. Both low-level and high-level signals are supported.
Escalator/ Moving walk speed sensor	2	MCTC-SL08NK6 MCTC-SL08NK6-C		
Handrail speed sensor	2	MCTC-SL04NK6 MCTC-SL04NK6-C		
Missing step sensor	2	MCTC-SL15NK6 MCTC-SL15NK6-C MCTC-SL30NK6 MCTC-SL30NK6-C		
Detection Switch		Schmersal	OMRON	Customer option
Motor brake detection switch	2	TS236-02Z TS236-11Z	D4N-4132 D4NA-4131	
Auxiliary brake detection switch	1	TS236-02Z TS236-11Z	D4N-4132	
Floor plate detection switch	4	TS236-02Z TS236-11Z	D4N-4132 D4N-2B64-E1 D4NA-412G	

1.3 System Functions

The MCTC-PES-E1 is designed to ensure safe running of escalator and moving walk according to the safety grading defined in the newest escalator safety standard GB16899-2011. It has the following safety functions:

- Overspeed protection
- Unintentional reversal protection
- Handrail speed deviation protection
- Service brake and auxiliary brake monitoring protection
- Missing step or pallet protection

- Braking-to-stop distance detection and alarm
- Floor plate state monitoring

1.3.1 Working States

Table 1-3 States of the MCTC-PES-E1

State	Description
Startup	The system is being powered on and then preparing to work. In the startup process, the system completes self-check and all relays are in the OFF state.
Setting	You can modify parameters and reset faults using the external operation panel. This mode is active only when the system is in the stop state. When the system is running, you can change nothing using the operation panel.
Stop	The system is not powered on and all relays are in the OFF state.
Fault	The system itself has abnormality, such as self-check failure. In such state, all relays are cut off. You need to power on the system again.
Normal	All functions are normal during running.
Inspection	The system enters the inspection state after the inspection signal becomes active. In such state, the missing step detection function, motor braking detection function and handrail speed detection function are disabled, while the other functions are available.
Manual reset	The system enters the manual reset state after the manual reset signal becomes active. In such state, all safety functions are disabled and all relay outputs are in the OFF state.

1.3.2 Description of Safety Functions

The following table describes the safety functions provided by the MCTC-PES-E1.

Table 1-4 Description of safety functions

No.	Function Description
1	Check the speed of the escalator or moving walk and act before the speed exceeds 1.2 times of the nominal speed.
2	Check unintentional reversal of the direction.
3	Check whether the braking-to-stop distance exceeds 1.2 times of the allowable maximum value.
4	Check the action of the auxiliary brake.
5	Check whether the step or pallet is missing and prevent them from entering the comb plate.
6	Check whether the maximum deviation between the handrail speed and the actual speed of the step, pallet or belt is greater than ±15% and continues for more than 15s.
7	Check whether the service brake is released.
8	Check whether the floor plate is opened or removed.

1.3.3 Safety Measures After Safety Functions Enabled

The following table describes the safety measures after the safety functions become enabled.

Table 1-5 Safety measures after the safety functions enabled

No.	Description of Safety Function	Disconnect the Safety Circuit	Power off the Supply of Auxiliary Brake	Manual Reset
1	Check the speed of the escalator or moving walk and act before the speed exceeds 1.2 times of the nominal speed.	Yes	No	Yes
2	Check unintentional reversal of the direction.	Yes	Yes	Yes
3	Check whether the braking-to-stop distance exceeds 1.2 times of the allowable maximum value.	Yes	No	Yes
4	Check the action of the auxiliary brake.	Yes	No	No
5	Check whether the step or pallet is missing and prevent them from entering the comb plate.	Yes	No	Yes
6	Check whether the maximum deviation between the handrail speed and the actual speed of the step, pallet or belt is greater than ±15% and continues for more than 15s.	Yes	No	No
7	Check whether the service brake is released.	Yes	No	Yes
8	Check whether the floor plate is opened or removed.	Yes (see the note below.)	No	No

NOTE

- The safety circuit of the escalator or moving walk is cut off after the floor plate is opened or removed. After the system enters the inspection state, the fault is reset automatically.

2 Installation and Wiring

2.1 Mechanical Installation

2.1.1 Installation environment requirements

The MCTC-PES-E1 system is installed in the main control cabinet of the machine room of the escalator or moving walk. Keep the installation room clean, well ventilated and free from dust & moisture. when only the control board without the protective guard is installed, take other dust & moisture prevention measures. The installation environment must satisfy the requirements described in Table 2-1. Monarch will assume no risk or responsibility if a fault occurs in the system because the installation environment requirements are not satisfied.

Table 2-1 Installation environment requirements

Item	Requirements
Ambient temperature	-20° C to 65° C
Humidity	Less than 95% RH, without condensing
Mounting location	Free from conducting materials, corrosive gas, combustible gas, metal powder, oil dirt and dust
IP rating	IP00 (no IP requirement on board) IP5X (with housing) Note: The MCTC-PES-E1 system has the IP5X housing. If you purchase the board only, install the board in the control cabinet or other IP5X housing.

2.1.2 Installation Dimensions

The following figure shows the dimensions of the MCTC-PES-E1 system.

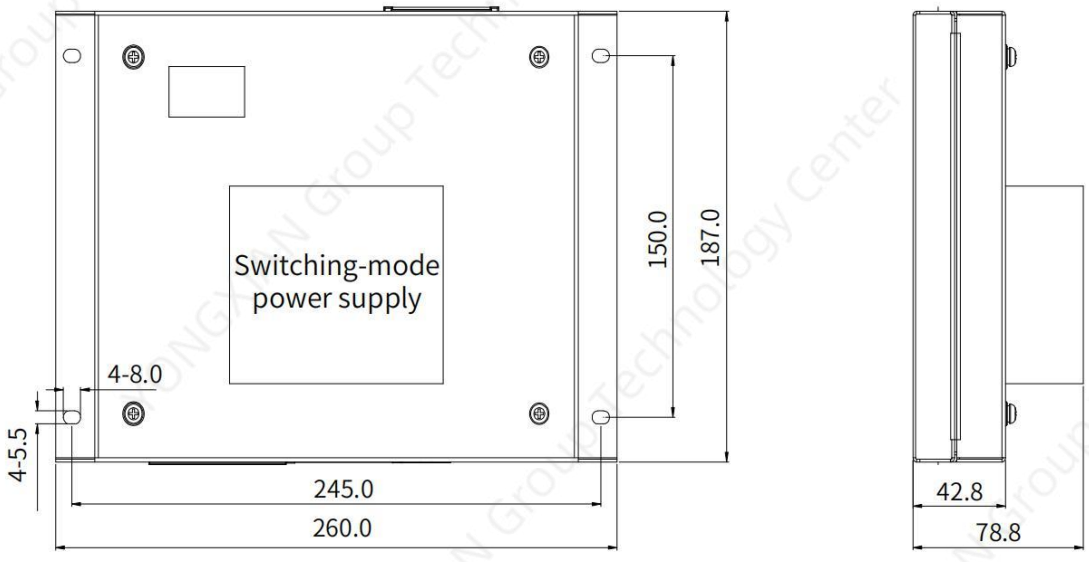


Figure 2-1 Dimensions of the MCTC-PES-E1 system (Unit: mm)

Only the control board (without the protective guard) is required in some applications. The following figures show the physical appearance and installation dimensions of the control board.

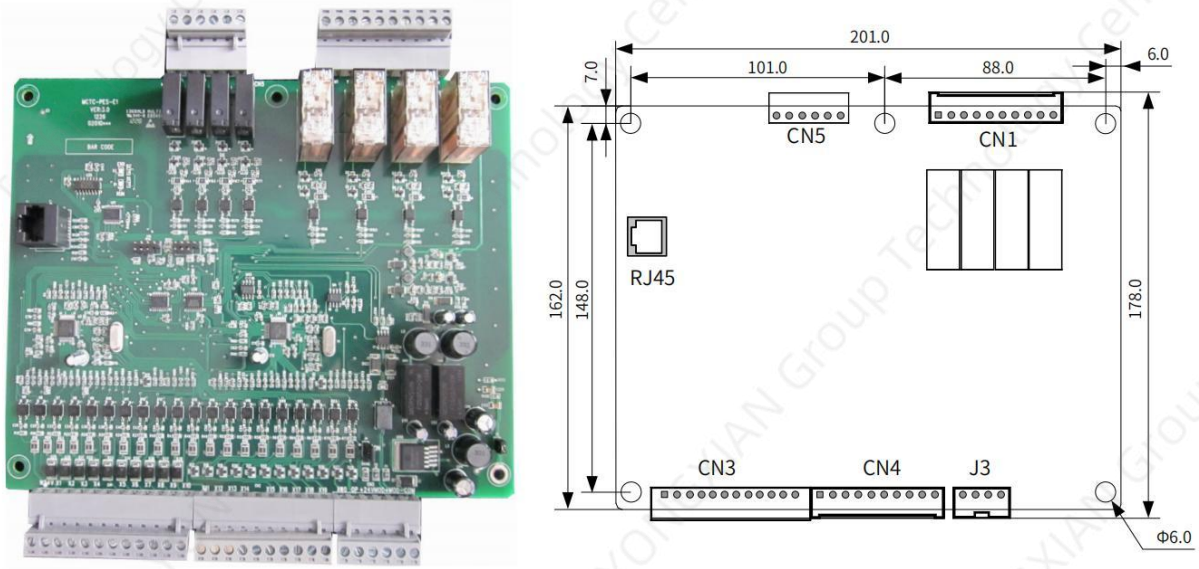


Figure 2-2 Physical appearance of the control board (Unit: mm)

2.1.3 Installation Instructions

To install the MCTC-PES-E1 system, do as follows:

1) Process the installation side in the main control cabinet. For the processing dimensions, refer to Figure 2-1.

2) Mount the MCTC-PES-E1 on the installation side and fix it with screws.

If only the control board (without the protective guard) is required, do as follows:

1) Process the installation side in the main control cabinet. For the processing dimensions, refer to Figure 2-2.

2) Mount the control board on the installation side and fix it with screws.

Caution

- The switching-mode power supply has been fixed on the protective guard of the MCTC-PES-E1 system upon delivery.
- The screws for fixing the protective guard are not delivered together with the MCTC-PES-E1 and you need to prepare them yourself. When selecting screws, consider the plate thickness of the installation side, the thickness of the protective guard and the dimension of the hole in Figure2-1.

2.2 Installation of Sensors

2.2.1 Technical Data

Table 2-2 Parameters of the escalator speed sensor

Model	MCTC-SL08NK6	MCTC-SL08NK6-C
Detection distance	8 mm ± 5%	
Setting distance	0–8 mm	
Standard detector	Inductive iron, not less than 25 x 25 x T1 mm	
Accuracy	The distance between the sensor and the driving chain sprocket teeth is 0.04 mm or less	
Action time	The sensor becomes ON when it detects the driving chain sprocket teeth.	
Max. response frequency	600 Hz	
Indicator	Yellow LED	
Operating temperature	-25°C to 60°C	
IP rating	IP67	
Housing material	Nickel-plated brass	
Power supply (DC)	12–30 V	
Output	NPN	
Definition of pins	Brown cable (BN): +24 V Blue cable (BU): -0 V Black cable (BK): Output signal cable	
Picture		

Table 2-3 Parameters of the handrail speed sensor

Model	MCTC-SL04NK6	MCTC-SL04NK6-C
Detection distance	4 mm ± 5%	
Setting distance	0–4 mm	
Standard detector	Inductive iron, not less than 20 x 20 x T1 mm	
Accuracy	The distance between the sensor and the driving chain sprocket teeth is 0.04 mm or less	
Action time	The sensor becomes ON when it detects the driving chain sprocket teeth.	

Model	MCTC-SL04NK6	MCTC-SL04NK6-C
Max. response frequency	800 Hz	
Indicator	Yellow LED	
Operating temperature	-20°C to 55°C	
IP rating	IP67	
Housing material	Nickel-plated brass	
Power supply (DC)	12–36 V	
Output	NPN	
Definition of pins	Brown cable (BN): +24 V Blue cable (BU): -0 V Black cable (BK): Output signal cable	
Picture		

Table 2-4 Parameters of the missing step sensor

Model	MCTC-SL15NK6	MCTC-SL15NK6-C (connector)
Detection distance	15 mm ± 5%	
Setting distance	0–15 mm	
Standard detector	Inductive iron, not less than 35 x 35 x 1 mm	
Accuracy	The distance between the sensor and the driving chain sprocket teeth is 0.04 mm or less	
Action time	The sensor becomes ON when it detects the driving chain sprocket teeth.	
Max. response frequency	400 Hz	
Indicator	Yellow LED	
Operating temperature	-25°C to 60°C	
IP rating	IP67	IP64
Housing material	Nickel-plated brass	
Power supply (DC)	10–30 VDC	
Output	NPN	
Definition of pins	Brown cable (BN): +24 V Blue cable (BU): -0 V Black cable (BK): Output signal cable	

Model	MCTC-SL15NK6	MCTC-SL15NK6-C (connector)
Picture		

2.2.2 Installing the Speed Sensor and Running Direction Sensor for Escalator/Moving Walk

1 Installation

1) Installation position

Align the center of the sensing face of one sensor with the center of one tooth on the driving chain sprocket and align the sensing edge of the other sensor with the center of the neighboring tooth on the driving chain sprocket, as shown in the following figure.

2) Installation distance

3mm ⩽ LA=LB ⩽ 8mm

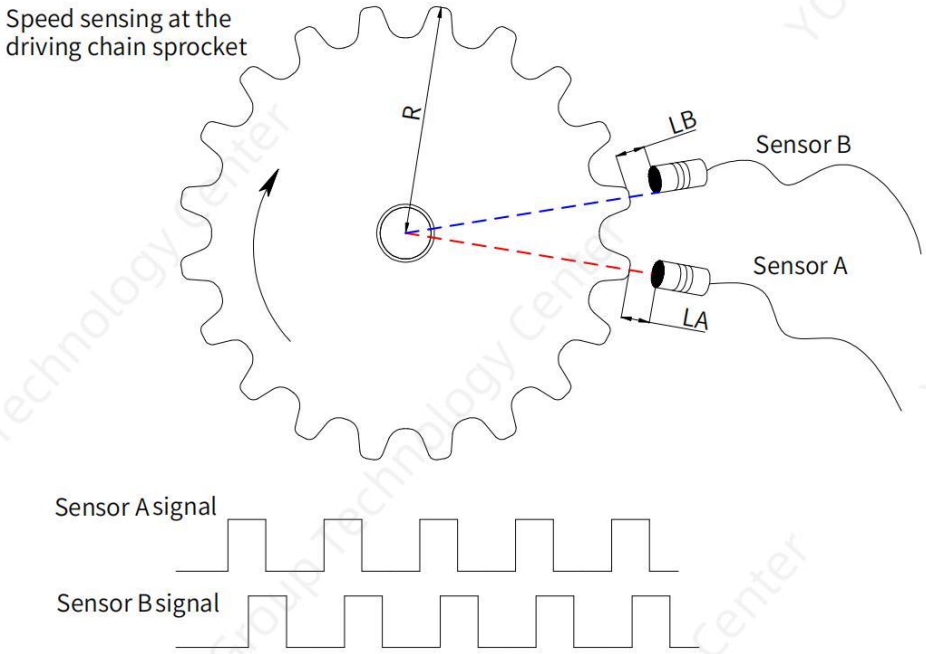


Figure 2-3 Installation of the escalator/moving walk speed sensor and running direction sensor

2 Detection Principle

1) Overspeed protection function

By measuring the speed of the driving chain sprocket through sensor A and sensor B, the MCTC-PES-E1 system judges whether the running speed of the escalator/moving walk exceeds the allowable speed. If yes, the MCTC-PES-E1 system will perform overspeed protection.

When the driving chain sprocket rotates, every time a sensor detects a tooth, the sensor sends a pulse. The MCTC-PES-E1 system calculates the running speed of the escalator/moving walk based on the time interval of detected pulses.

Sensor A and sensor B are redundant speed measuring channels for each other. By setting a certain pulse cycle or frequency threshold, 1.2 times or 1.4 times overspeed can be detected.

2) Unintentional reversal protection

By fixing the relative positions of the two sensors correctly, make the phase of sensor A in advance of the phase of sensor B and ensure that the two sensors have overlapping pulse part. In this case, the MCTC-PES-E1 system detects the logic sequence of the two sensors and judges the actual running direction of the escalator/moving walk through the logic sequence, preventing reversal running.

2.2.3 Installing the Handrail Speed Sensor

1 Installation

1) Installation position

Align the sensor with the inductive part on the tachometer wheel.

If the tachometer wheel is made of plastic, use a ferric device as the inductive part. If the tachometer wheel is ferric, drill a hole as the inductive part in the wheel. The section size of the inductive part should be approximate to that of the sensing face of the sensor.

2) Installation distance

1 mm ⩽ L3 = L4 ⩽ 4 mm

The following figure shows the installation position of the handrail speed sensor.

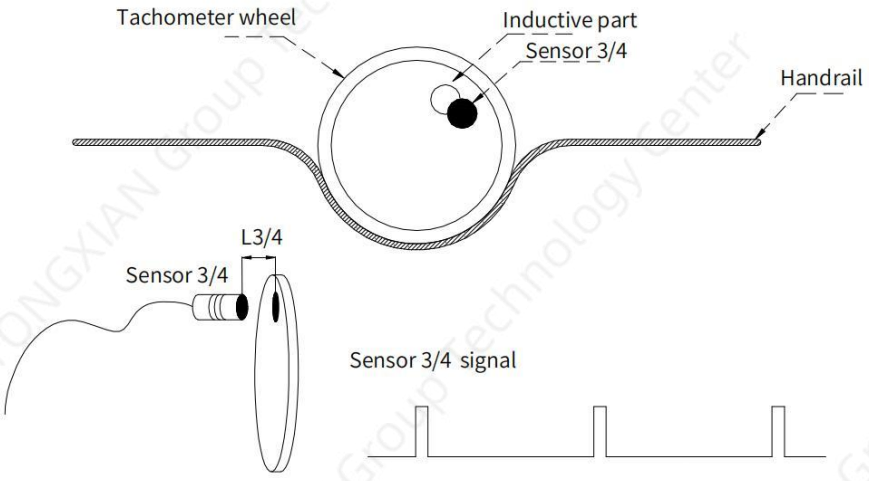


Figure 2-4 Installation position of the handrail speed sensor

2 Detection Principle

Sensor 3/4 is used to measure the left/right handrail speed. The tachometer wheel is driven by the handrail to rotate and its linear speed is basically consistent with the handrail speed. An inductive part is set on the tachometer wheel to mount sensor 3/4 on a fixed mechanical structure with the sensing face toward the inductive part.

When the tachometer wheel follows the handrail to rotate, sensor 3/4 outputs pulses, as shown in Figure 3-5. A pulse is output every one revolution of the tachometer wheel.

With the pulses and radius of the wheel, the system can measure the rotational speed of the tachometer wheel. Then the system calculates the handrail speed and compares it with the escalator/moving walk speed. If the handrail speed is lower than 85% of the corresponding escalator/moving walk speed and the handrail underspeed continues for 15s, the system cuts off the power supply to the safety circuit of the escalator/moving walk to stop the running, implementing protection.

2.2.4 Installing the Missing Step/Pallet Sensor

1 Installation

1) Installation position

For aluminum step or pallet, it is suggested to select NBN40-L2-E0-V1 (P+F), whose detection distance is long and signal is reliable. Each missing step/pallet sensor is required for the top and bottom machine rooms respectively. Install the sensor with the sensing face toward the step beam to be detected.

2) Installation distance

5 mm ⩽ L5 = L6 ⩽ 15 mm

The following figure shows the installation position of sensor (5/6) for the escalator.

Figure 2-5 Installation position of the missing step/pallet sensor

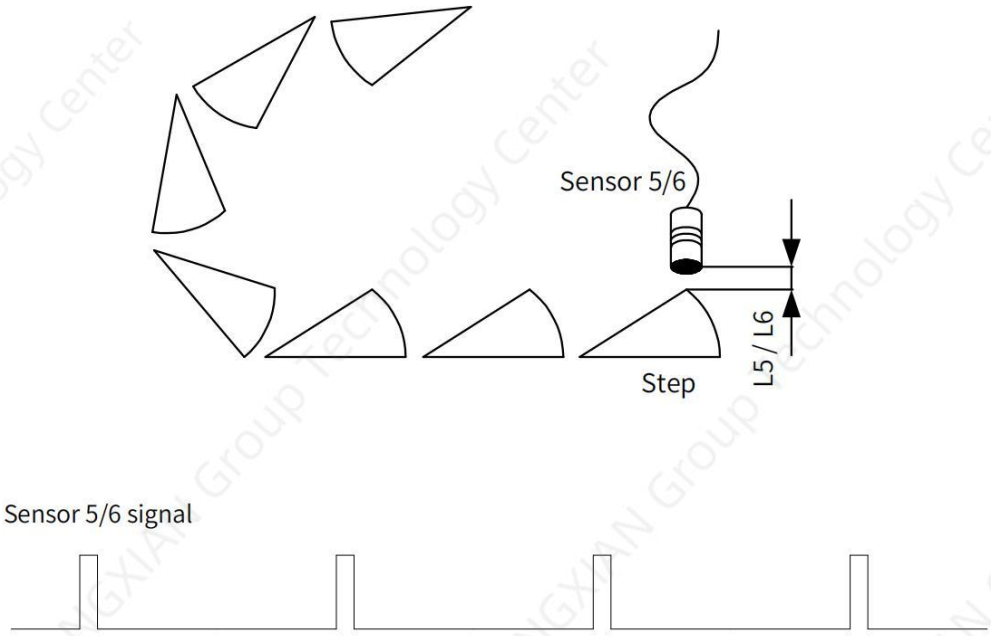


Figure 2-6 Installation position of the missing step/pallet sensor for escalator

2 Detection Principle

Each sensor (5/6) is installed in the return/driving station in the top/bottom machine room, respectively to detect missing step. Based on signals of speed sensor A/B for the motor, the system calculates the number of pulses of sensor A/B between two adjacent pulses of sensor 5/6 to judge whether missing step/pallet occurs.

When a step passes, sensor 5/6 receives the signal and outputs a pulse. Set the time interval between two adjacent pulses of sensor 5/6 as T and the pulse counting of sensor A/B within T as X. In the case of no missing step, the X value is within a certain threshold regardless of the escalator speed. If X exceeds the threshold, the system judges that missing step occurs. Then the escalator stops running immediately and enters the safety state.

NOTE

- If the detection principle is not suitable for the habit of escalator manufacturers, missing step can be monitored by using sensor 5/6 to detect the step auxiliary wheel. The prerequisite is to ensure that the auxiliary wheel gets lost with the step.

To detect whether a pallet of the moving walk is missing, install sensor 5/6 in the machine room, as shown in the following figure.

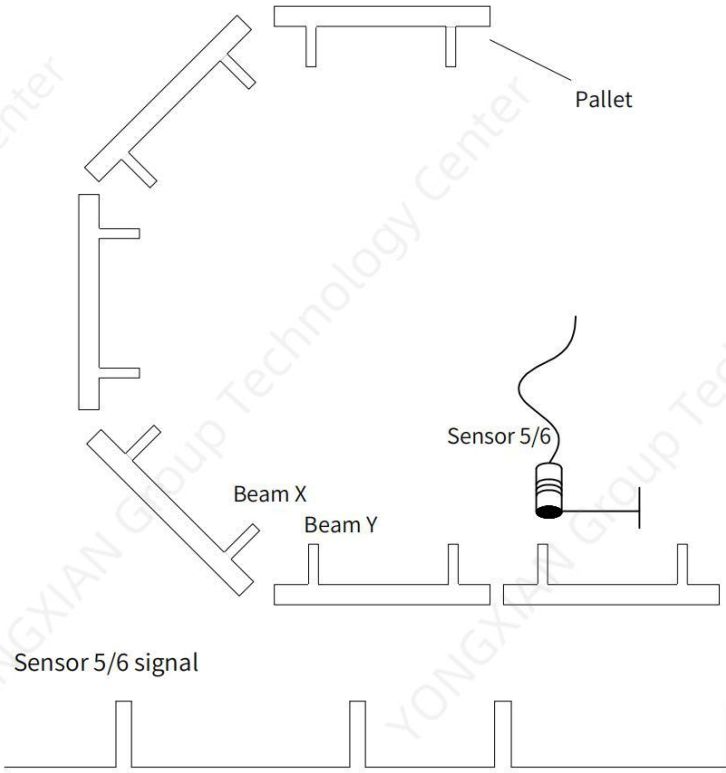


Figure 2-7 Installation position of the missing step/pallet sensor for moving walk

NOTE

◆ The sensor must be installed within the sections where the bottom steps/ pallets moves horizontally, as shown in the following figure. The upper sensor must be installed between A and A' and the lower sensor must be installed between B and B'.

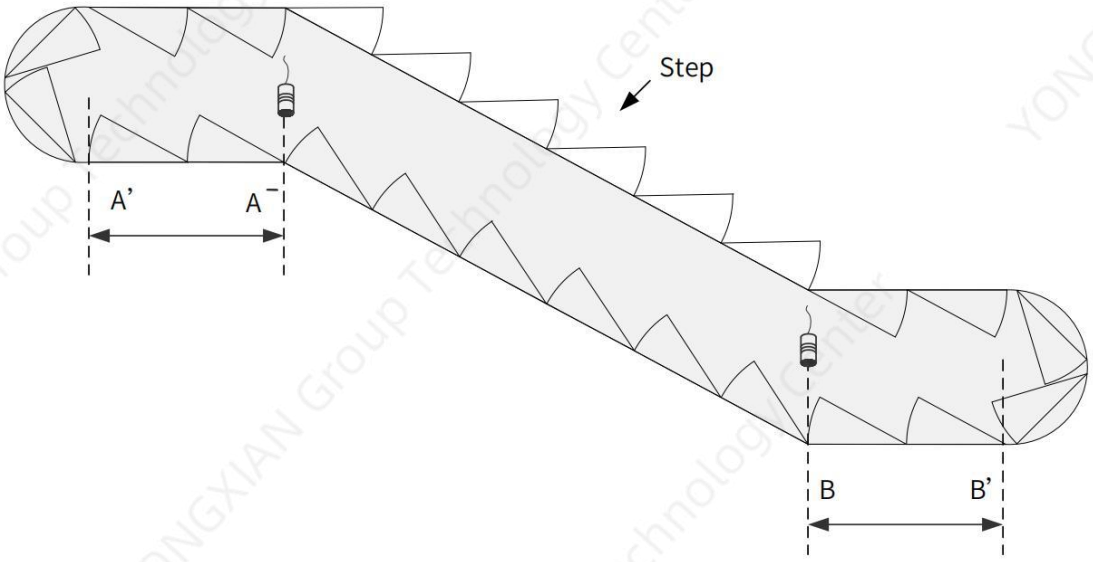


Figure 2-8 Installation positions of the sensors

NOTE

◆ Besides the MCTC-PES-E1 and the six sensors, you need to prepare the following two devices:

1) Relay at front end of signal X1 on the MCTC-PES-E1 board
2) Switch for manual fault reset

2.3 Wiring

2.3.1 Description of System Terminals

The following figure shows the layout of the system terminals.

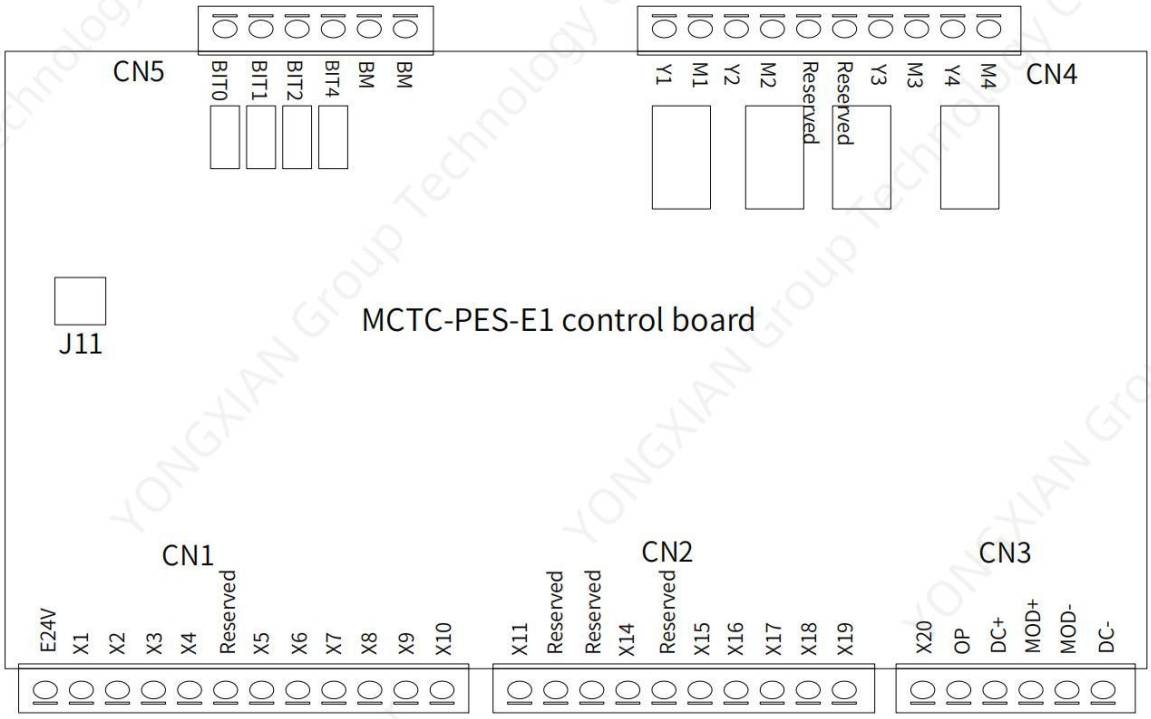


Figure 2-9 Layout of the system terminals

Table 2-5 Description of terminals of the MCTC-PES-E1

Type	Terminal Symbol	Terminal Name	Function Description	Remark
Power/Communication terminal (CN3)	DC+/DC-	+24 V power supply	The +24 VDC power is provided by specialized switching-mode power supply.	The switching-mode power supply complies with the EN60950 standard.
	MOD+/MOD-	Modbus communication	It communicates with Inovance NICE2000 integrated escalator controller. When a safety fault occurs, the NICE2000 displays the fault code.	The shielded twisted cable is suggested.

Type	Terminal Symbol	Terminal Name	Function Description	Remark
Digital input terminal (CN1/2)	E24V	External 24 V power supply	It is connected to the input terminal +24 V of the control system when X1 to X4 are connected with corresponding signals of the control system in parallel.	1) Optical coupling isolation, low level input active 2) Input impedance: 3.3 kΩ 3) Input voltage range: 0–30 V
	X1	Normally open (NO) inspection signal	They are connected to the inspection signal input terminals of the control system. When X1/ X2 becomes ON, the related functions of the MCTC-PES-E1 are disabled according to China's standard.	
	X2	Normally closed (NC) inspection signal		
	X3	Up signal	It receives the up signal of the control system and is edge-triggered.	
	X4	Down signal	It receives the down signal of the control system and is edge-triggered.	
	X5	Service brake signal	It is connected to the auxiliary contact of the service brake.	
	X6	Service brake action detection 1	It is connected to the action switch of the service brake.	
	X7	Service brake action detection 2	It is used in the dual-motor application. It is shorted with X6 in the single-motor application.	
	X8	Auxiliary brake signal	It is connected to the auxiliary contact of the auxiliary brake.	
	X9	Auxiliary brake action detection	It is connected to the action switch of the auxiliary brake.	
	X10	Floor plate switch 1	It is connected to the floor plate switch. This signal must be active during normal running and can be inactive during inspection.	
	X11	Floor plate switch 2	It has the same function as the X10.	
	X12	Drive chain fault detection	If a fault occurs in the drive chain, the auxiliary brake acts to disconnect Y3 and Y4. The fault can be manually reset after the broken drive chain switch is reset, but it cannot be reset at power failure.	

Type	Terminal Symbol	Terminal Name	Function Description	Remark
Digital input terminal (CN1/2)	X13	Reserved		1) Optical coupling isolation, low level input active 2) Input impedance: 3.3 kΩ 3) Input voltage range: 0–30 V
	X14	Manual reset signal	It is used for manual fault reset. The input becomes active after the terminal keeps ON for more than 2s and then keeps OFF for more than 2s.	
	X15	Escalator speed detection phase A signal	They are used for input of escalator speed detection pulses The MCTC-PES-E1 detects the overspeed fault based on the frequency or cycle of two pulses, and detects the unintentional reversal fault based on the pulse phase.	
	X16	Escalator speed detection phase B signal		
	X17	Upper missing step detection	It detects the A/B pulses. If the pulse counting exceeds the threshold, the MCTC-PES-E1 judges that it is missing step.	
	X18	Lower missing step detection	It uses the same detection mode as X17.	
	X19	Left handrail speed detection	It uses the same detection mode as X17.	
	X20	Right handrail speed detection	If the MCTC-PES-E1 detects that the handrail speed is 15% lower than the actual speed of the step, pallet or step chain and the duration exceeds 15s, it reports the handrail underspeed fault.	
	OP	X15 to X20 polarity selection	When X15 to X20 are connected to sensors of low level active, OP is shorted to DC+. When X15 to X20 are connected to sensors of high level active, OP is shorted to DC-.	Shorting OP and DC+/DC- is effective for X15 to X20 only.

Type	Terminal Symbol	Terminal Name	Function Description	Remark
Relay output terminal (CN4)	Y1/M1	Fault output	It becomes OFF when a fault occurs. It is connected to the system safety circuit with Y2/M2.	Rated voltage: 250 VAC Rated current: 6 A
	Y2/M2		It becomes OFF when a fault occurs. It is connected to the system safety circuit with Y1/M1.	
	Y3/M3	Aulixiary brake output	It becomes OFF when unintentional reversal occurs, when the speed of the escalator or moving walk exceeds 1.4 times of the nominal speed, or when a fault occurs in the drive chain. It is connected with Y4/M4 to control the auxiliary brake.	
	Y4/M4		It becomes OFF when unintentional reversal occurs, when the speed of the escalator or moving walk exceeds 1.4 times of the nominal speed, or when a fault occurs in the drive chain. It is connected with Y3/M3 to control the auxiliary brake.	
Power/Communication terminal (CN3)	BIT0	Fault binary code	It outputs the current fault code using the 8421 code and can be connected to the external LED display. It supports both common anode LED display and common cathode LED display.	A common relay is used.
	BIT1			
	BIT2			
	BIT3			
	BM	Common terminal		
Interface for operation panel (J11)	RJ45	Interface for the operation panel	It is connected to the operation panel for modifying parameters or viewing the status.	-

NOTE

- If there is no auxiliary brake in the system, short X8 and X9 to DC-.
- If the floor plate switches in the system have the compulsory break-off function, the related function of this system can be disabled. In this case, short X10 and X11 to DC-.

2.3.2 Wiring of the MCTC-PES-E1

The following figure shows wiring of the MCTC-PES-E1 system.

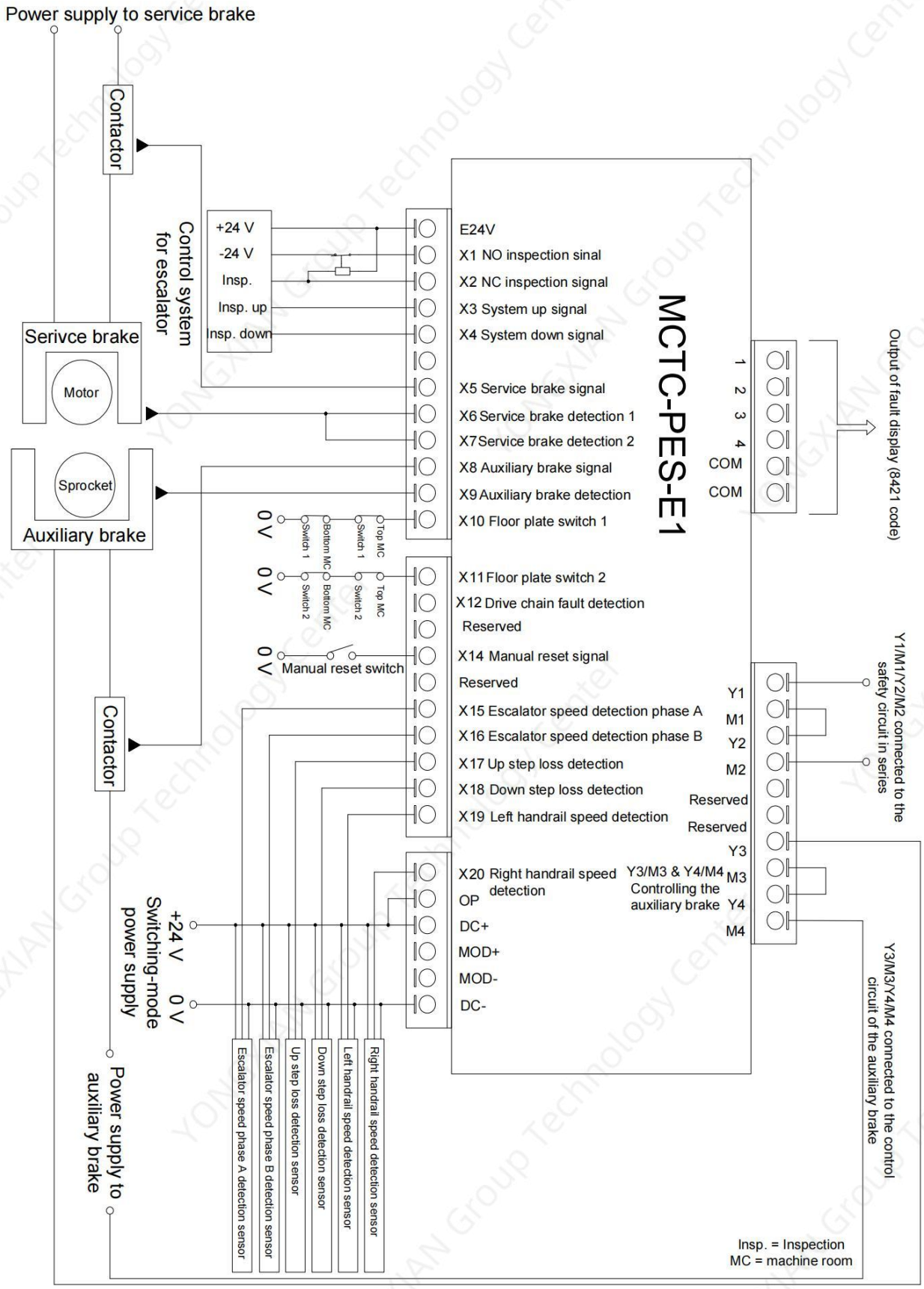


Figure 2-10 Wiring of the MCTC-PES-E1 system

The precautions on electrical wiring are as follows:

1) All input signals are low level active.

2) E24V is connected to the +24 V power supply of the escalator control system. DC+/DC- is connected to the switching-mode power supply of the MCTC-PES-E1. The X1 to X4 terminals are connected to the +24 V power supply of the escalator control system and cannot use the power supply of the MCTC-PES-E1.

3) X1, X3 to X9 and X14 are NO signals by Factory Setting, while X2, X10 and X11 are NC signals by Factory Setting. The NO/NC feature of X1 to X5, X8 and X14 cannot be modified.

4) Because X1 is NO and X2 is NC, you need to install an NC relay before X1. The wiring method is shown in Figure 3-8. If X1 and X2 open or close simultaneously, the MCTC-PES-E1 reports a fault.

Caution

- The inspection signal connecting to the relay before X1 and that connecting to X2 must be obtained separately from the inspection switch and cannot share one cable.

5) If there is no auxiliary brake, short X8 and X9 to 0 V. If the service brake uses an inspection switch, short X6 to X7.

6) If the floor plate switches have the compulsory break-off function, the function of X10 and X11 can be disabled. In this case, X10 and X11 must be active, which can be implemented by shorting them or modifying their NO/NC feature.

7) OP is active only for X15 to X20. For low-level active signals (NPN output), short OP to +24 V. Otherwise, short OP to 0 V.

2.3.3 Connecting the Floor Plate Switches

The system can detect opening or removal of the floor plate. If the floor plate detection function is enabled, a total of four floor plate switches are required. The top machine room and bottom machine room respectively need to install two detection switches. The following figure shows connection between the four detection switches and the system.

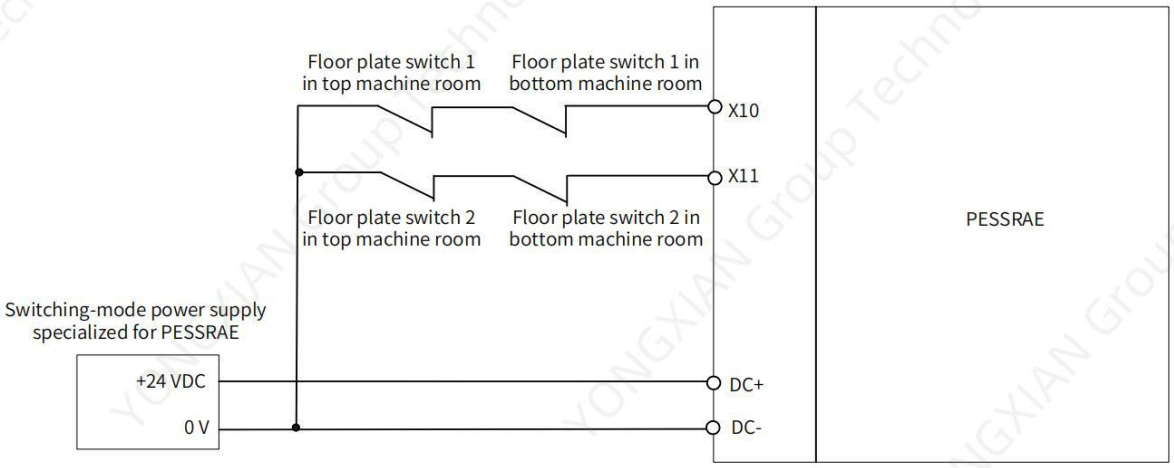


Figure 2-11 Connection of the four floor plate switches

As shown in Figure 2-10, the two switches in the top machine room must be connected to the two switches in the bottom machine room in series. The two signals are respectively connected to X10 and X11. Thus, if any floor plate is removed, both signals have a change.

2.3.4 Connecting Brake Detection Switches in Dual-Motor Application

In the application of dual motors and dual brakes, to satisfy China's GB standard, obey the following instructions:

1) Each of the dual motors has a service brake. The two brakes can be controlled by the same contactor. The contactor is connected to the NO auxiliary contact of the service brake signal X5

2) The two auxiliary brakes can also be controlled by a contactor. The contactor is connected to the NO auxiliary contact of the auxiliary brake signal X8.

3) When the service brake is applied, its action switches must be in the OFF state and be connected according to Figure 3-11. That is, the two action switches of the brake for motor A are connected in series and used as the input of X6. The two action switches of the brake for motor B are connected in series and used as the input of X7.

4) When the auxiliary brake is applied, its action switches must be in the OFF state and be connected according to Figure 3-11. That is, the two action switches of auxiliary brake A and auxiliary brake B are connected in series and used as the input of X9.

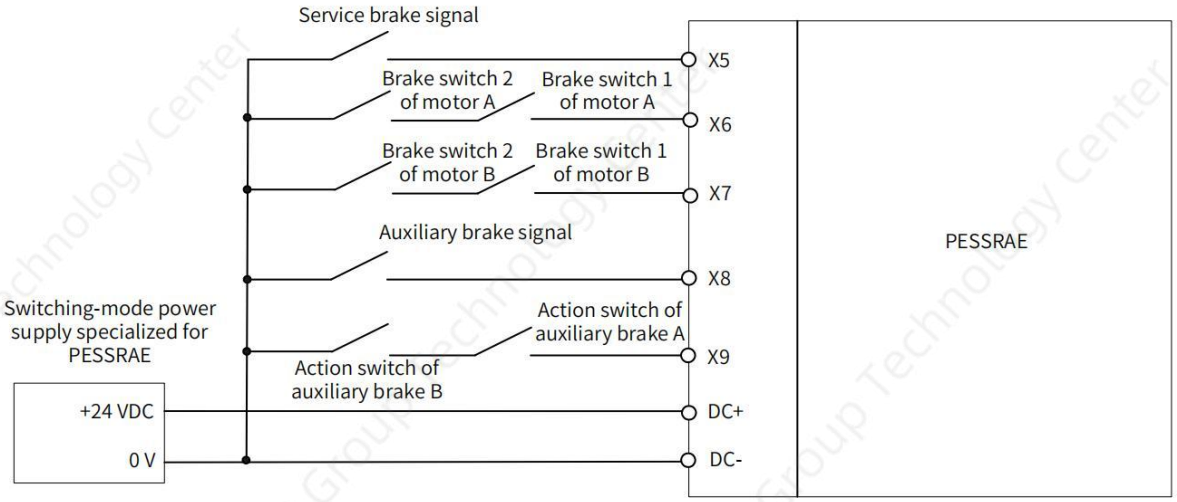


Figure 2-12 Connecting brake detection switches in the dual-motor application

3 Operation Panel

3.1 LED Operation Panel

The MCTC-PES-E1 system has a keypad with an LED display. You can use the keypad to modify the parameters, monitor operation state and check fault information. See the following figure for details.

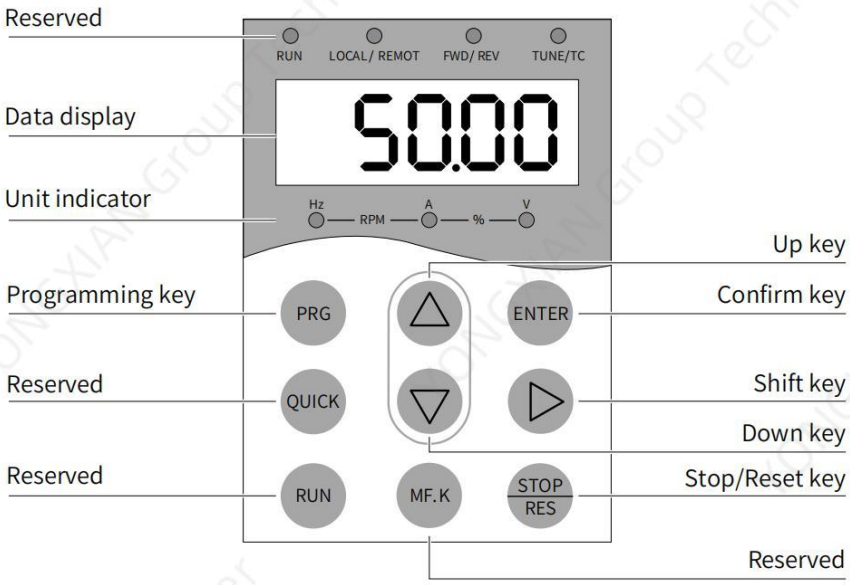


Figure 3-1 Panel description

3.1.1 Key Description

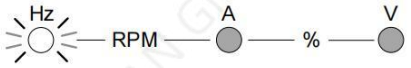
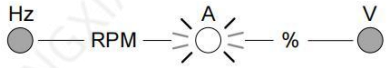
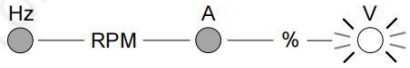
Key	Name	Function
PRG	Programming	Enter or quit level-1 menu.
ENTER	Confirm	Enter the menus level by level, and confirm the parameter settings.
△	Up	Increase data or parameter values.
▽	Down	Decrease data or parameter values.
▷	Shift	Select parameters cyclically in the stop and running status interface.
RUN	Running	Reserved
STOP/RES	Stop/Reset	Reset the system in the fault alarming state.
MF.K	Reserved	Reserved

Key	Name	Function
QUICK	Reserved	Reserved

3.1.2 Indicators

In the following table,  indicates that the indicator is on; ● indicates that the indicator is off;  indicates that the indicator blinks.

Table 3-1 Panel indicator description

Indicator Status	Description
	Frequency unit Hz
	Current unit A
	Voltage unit V
	RPM
	Percentage (%)

3.1.3 Data Display

The panel displays a 5-digit string, including set frequency, output frequency, various monitor data, and fault code.

Table 3-2 Mappings between LED display and actual data

LED Display	Actual Data	LED Display	Actual Data	LED Display	Actual Data	LED Display	Actual Data
0	0	6	6	C	C	n	N
1	1	7	7	c	c	P	P
2	2	8	8	d	D	r	R
3	3	9	9	E	E	t	T
4	4	A	A	F	F	U	U
5	5, S	b	B	L	L	u	u

3.2 Basic Operations

The operation panel uses the 3-level menu structure for the operations such as parameter settings. 3-level menus:

- Level-1: parameter group
- Level-2: parameter
- Level-3: parameter settings

After entering a level of menu, if a bit blinks, you can press the △, ▽, and ▷ buttons to set the parameter.

In level-3 menus, you can press PRG or ENTER to return to level-2 menus. The differences are as follows:

1) By pressing ENTER, you can save the parameter settings, return to level-2 menus, and switch to the next parameter.

2) By pressing PRG, you can return to the level-2 menu without saving the parameter settings.

In level-3 menus, if the parameter setting bit does not blink, this parameter cannot be modified. The possible reasons are:

1) This parameter is unchangeable, for example, the AC drive type, actual detection parameter, and running record parameter.

2) This parameter cannot be modified in the running state, and can only be modified in the stop state.

Here is an example of changing the value of F0-01 from 0.40 m/s to 0.80 m/s.

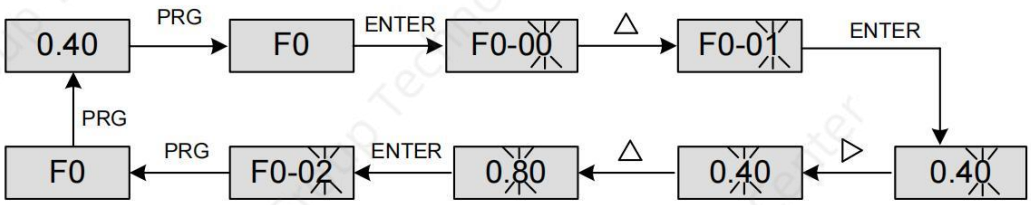


Figure 3-2 Example of changing the parameter value

4 Parameters

4.1 Parameter Description

The content in each column of the parameter table is described as follows:

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
Number of the parameter	Full name of the parameter	Valid range of the parameter value	Factory setting of the parameter	Unit of the measurement of parameter	Operation property of the parameter (operation allowed or not, and condition)

★: The parameter can be viewed but cannot be modified when the system is in the running state. It can be modified when the system is in the stop state.

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

In commissioning, you only need to adjust the parameters in group F0. Group F1 contains state parameters, group F2 contains fault parameters, group FF contains factory parameters and group FP contains the specialized application parameters.

Group F0: Basic Parameters

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
F0-00	System type	0: Escalator 1: Moving walk	0	-	★

It is used to set the system type and defines the upper limit of nominal speed (F0-01).

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
F0-01	Nominal speed	0.30–0.90	0.50	m/s	★

It indicates the nominal speed when the escalator/moving walk is in the no-load state.

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
F0-02	Radius of driving chain sprocket	0.30–0.90	0.33	m	★

It indicates the radius of the driving chain sprocket. The linear speed of the driving chain sprocket calculated based on the radius is the step running speed.

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
F0-03	PPR of driving chain sprocket	1–200	65	-	★

It is used to set the pulses per revolution (PPR) of the driving chain sprocket, namely, the number of teeth of the driving chain sprocket.

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
F0-04	Max. braking-to-stop distance	0.20–1.69	0.5	m	★

The upper limit and lower limit of this parameter are controlled by F0-01 (Nominal speed). If the system detects that the braking-to-stop distance exceeds 1.2 times of the setting of F0-04, the system reports the braking-to-stop over-distance fault.

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
F0-05	Handrail pulse time interval at nominal speed	0.01–5.00	0.68	s	★

It is used to set the time interval between handrail pulses at nominal speed. The system detects whether the handrail speed is consistent with the escalator speed based on the nominal speed, the setting of F0-05 and the actually detected escalator speed.

For example, the nominal speed is 0.5 m/s and F0-05 is set to 0.10s. When the actually detected escalator speed is 0.4 m/s, the time interval between handrail signals should be 0.5 x 0.1/0.4 = 0.125s. If the actually detected time interval between handrail signals is longer than 0.125s, it indicates that the handrail is slow. If the detected handrail speed remains 15% slower than the escalator speed for 15s, the system reports the related fault.

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
F0-06	Upper limit of phase A/B pulses between two step signals	-	0	-	★

It is used to set the upper limit of phase A/B pulses between two step signals. For every step the escalator turns, the number of teeth of the driving chain sprocket counted by the sensor is fixed.

After you set F0-06 to 0 first, the system automatically calculates the number of phase A/B pulses between two step signals and saves it. Then you can set the upper limit of phase A/B pulses between two step signals according to the following principle:

If the automatic calculation value is A, it is suggested to set 2 times value 2 x A limitation for F0-06.

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
F0-07	Lower limit of phase A/B pulses between two step signals	0 to F0-06	0	-	★

It is used to set the lower limit of phase A/B pulses between two step signals and should be a little smaller than the automatic calculation value of the system.

For the escalator, it is mainly used to filter the incorrect signal that may arise (for example, interference) between two adjacent step signals.

For the moving walk, the value of F0-07 should be larger than the number of phase A/B pulses between the detected beams of two adjacent pallets (for example, beams X and Y in Figure 3-7). Otherwise, the system will report fault Err12.

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
F0-08	Auxiliary function selection	0–65535	128	-	★

The auxiliary functions of the system are described in the following table.

Table 4-1 Auxiliary functions indicated by bits of F0-08

Bit	Description
Bit0	0: Escalator running not available when the auxiliary brake is applied 1: Escalator running available only in the upward direction when the auxiliary brake is applied For some escalators, the auxiliary brake has the braking effect only in the downward direction and can be released only after the escalator runs upward for a certain distance. In this case, set Bit0 to 1. The running in the upward direction can last only 10s each time. If the running times out, the MCTC-PES-E1 disconnects outputs, forces the escalator to stop running and reports fault Err10. After the fault is reset, the escalator can run upward for 10s again.
Bit1	0: Auxiliary brake available 1: Auxiliary brake unavailable Not all escalators must install the auxiliary brake. If Bit1 is set to 1, the MCTC-PES-E1 disconnects only Y3 and Y4 (the two relays stop the output).
Bit2	0: Missing step not detected during inspection 1: Missing step detected during inspection
Bit3	0: Handrail underspeed not detected during inspection 1: Handrail underspeed detected during inspection
Bit4	0: Brake not detected during inspection 1: Brake detected during inspection

China's standard (items such as h, j, k, l, m, and n in table 6 in new China's standard) clearly specifies that some functions have been invalidated during inspection. Enable the missing step detection function, handrail underspeed detection function and brake detection function during inspection by setting the values of Bit2, Bit3 and Bit4 respectively.	
Bit6	0: Y1 and Y2 disconnected simultaneously after fault detection 1: Y1 and Y2 disconnected at an interval of 30 ms after fault detection
Bit7	0: Brake feedback not detected when the escalator stops 1: Brake feedback detected when the escalator stops
Bit9	0: Unintentional reversal detection at startup enabled 1: Unintentional reversal detection at startup disabled If this function is enabled, after the escalator starts up (service brake signal by X5 active), the escalator will not stop and Err3 will not be reported when you reverse the key switch.
Bit10	0: Send all detection data, including 485 communication data, to the NICE2000^{new} integrated controller 1: Send only fault information
Bit11	0: Do not output auxiliary brake signal when Err13 to Err16 are reported 1: Output auxiliary brake signal when Err13 to Err16 are reported
Bit12	0: Drive chain fault detection disabled 1: Drive chain fault detection enabled (detected by NC terminals by default) If a fault occurs in the drive chain, the auxiliary brake acts to disconnect Y3 and Y4. The fault can be manually reset after the broken drive chain switch is reset, but it cannot be reset at power failure.
Bit13	0: Special step detection mode for moving walk disabled 1: Special step detection mode for moving walk enabled When the missing step detection switch is installed in the middle of truss to detect pallets, one pallet corresponds to two step pulses, enabling the detection of the step axle signal. Once the detection mode changes, the values of F0-06 and F0-07 will also change. The value of F0-06 equals to the AB pulses of step depth (F0-09) minus 1.

NOTE

- The signals input by X10 and X11 are not detected in the system inspection state.

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
F0-09	Step depth	100–800	400	mm	★

The step depth depends on the system type (F0-00). Generally, the step depth of an escalator is 400 mm, and that of a moving walk is 133 mm or 266 mm.

If F0-00 is set to 0 (Escalator), F0-09 will be automatically set to 400. If F0-00 is set to 1 (Moving walk), F0-09 will be automatically set to 133.

Normally, this parameter does not need to be set. If the step depth is different from the default, set F0-09 based on the actual size.

Group F1: State Parameters

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
F1-00	Phase A escalator speed	-	0	m/s	●
F1-01	Phase B escalator speed	-	0	m/s	●

They indicate the escalator speed respectively, detected by sensor A and sensor B.

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
F1-02	Number of phase A pulses/cycles for escalator speed	-	0	-	●
F1-03	Number of phase B pulses/cycles for escalator speed	-	0	-	●

If the number of phase A/B pulses per second at nominal speed (F0-01) is equal to or larger than 30, F1-02 and F1-03 display the actually detected number of phase A/B pulses. If their value is smaller than 30, the phase A/B cycles is displayed by a 3-digit decimal in the unit of second.

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
F1-04	Current running direction	-	0	-	●

It displays the escalator speed signal state. The 5-digit display is abcde from left to right.

Display	Description
a	0 indicates that the direction is not given. 1 indicates that the startup command in upward direction is given. 2 indicates that the startup command in downward direction is given.
b	0 indicates that the feedback signal is abnormal. 1 indicates that the feedback running direction is upward. 2 indicates that the feedback running direction is downward.
c, d	Reserved
e	It represents the orthogonality. 0 indicates the worst, and 9 indicates the best. Ensure the value above 5 by adjusting the position of the two speed sensors.

The parameter has three normal values: 00000, 11009 and 22009.

Parameter No.	Parameter Name	Setting Range	Default	Unit	Operation
F1-05	Braking-to-stop distance after stop	-	0	m	●

It indicates the detected braking-to-stop distance after stop.

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
F1-06	Pulse time interval of left handrail	-	0	s	●
F1-07	Pulse time interval of right handrail	-	0	s	●

They indicate the actually detected cycles of left and right handrail signals (no display during inspection).

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
F1-08	Number of phase A pulses between two upper step signals	-	0	-	●
F1-09	Number of phase B pulses between two upper step signals	-	0	-	●
F1-10	Number of phase A pulses between two lower step signals	-	0	-	●
F1-11	Number of phase B pulses between lower step signals	-	0	-	●

They indicate the actually detected number of phase A/B pulses between two step signals (no display during inspection).

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
F1-12	States of I/O terminals	-	0	-	●
F1-13	States of I/O terminal functions	-	0	-	●

F1-12 indicates the states of the I/O terminals. F1-13 indicates the states of the I/O terminal functions.

The states are displayed by the following 5-digit LEDs.

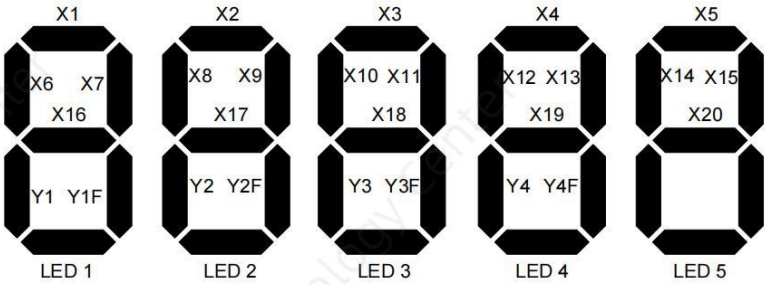


Figure 4-1 LED indicating the states of the I/O terminals and their functions

If OP is shorted to DC+, input terminals X15 to X20 are low level active. If OP is shorted to DC-, X15 to X20 are high level active. The other input terminals are low level active and become ON when they are shorted to 0 V.

The function of a terminal indicated by an LED segment in the preceding figure may be valid when this segment is ON or OFF. Whether this function is valid at segment ON or OFF is decided by the NO/NC feature of the terminal. Y1F to Y4F are detection signals and indicate the action state of the detected relays Y1 to Y4. In normal state, Y1F to Y4F are ON or FF with Y1 to Y4 simultaneously.

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
F1-14	Number of pulses per second at nominal speed	-	0	-	●

It indicates the number of phase A/B pulses per second at nominal speed, which is calculated based on parameters in group F0.

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
F1-15	Number of pulses for 1.2 times of braking-to-stop distance	-	0	-	●

It indicates the number of phase A/B pulses for 1.2 times of braking-to-stop distance, which is calculated based on parameters in group F0.

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
F1-16	Number of pulses between two adjacent step signals	-	0	-	●

It indicates the number of phase A/B pulses between two adjacent step signals, which is calculated based on parameters in group F0 and the escalator step of 40 cm wide.

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
F1-17	ER-00	-	0	-	●

It indicates the faults that have occurred and need to be reset manually. Each fault is allocated with a bit. The corresponding relationship is as follows:

Bit0: Err01; Bit1: Err02; ……Bit15: Err16

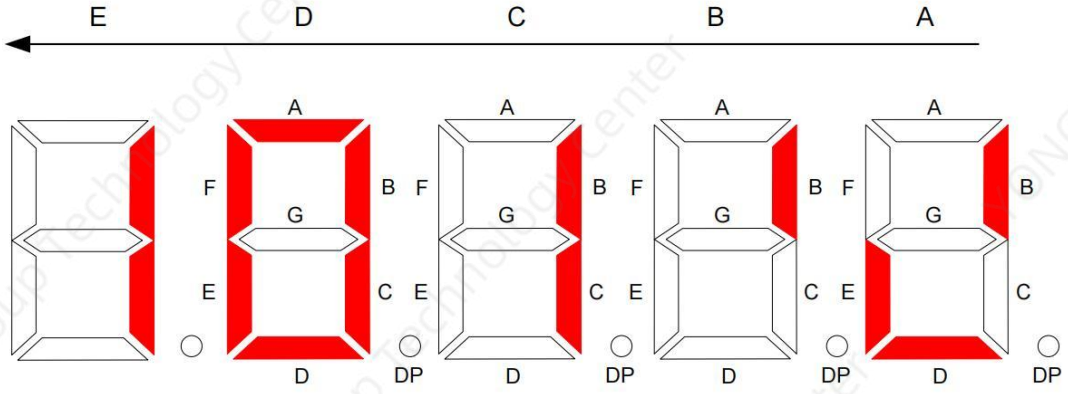
After the system reports the fault, the corresponding bit will become valid and is saved in F1-17 after being converted to a decimal number.

NOTE

◆ This parameter records only the faults that need manual reset. After the fault is reset manually, the fault record is cleared.

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
F1-18	Err Flag	-	0	-	●

It indicates the faults that have occurred. Besides the faults that need manual reset, it records the faults that can be reset at power failure.



In the figure above, the 5 LEDs are numbered as A, B, C, D and E from the right to the left. E and D indicate the fault code (for example, 03 means reverse fault); C indicates if a fault has occurred (1) or not (0); each segment of A and B indicates the status of one fault. As shown in the figure, CDE indicate that the Err10 fault has occurred and AB indicate that Err02, Err04 and Err05 faults have occurred in addition to Err10.

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
F1-19	Current MCTC-PES-E1 state	-	0	-	●

The ones position indicates the auxiliary chip state, and the tens position indicates the main chip state. On normal condition, the main chip and auxiliary chip are in the same state. The chips have a total of four states, indicated by 3, 4, 5 and 6, whose meaning is as follows:

3: MCTC-PES-E1 faulty

4: MCTC-PES-E1 in normal working state

5: Inspection state

6: Fault reset state

Group F2: Fault Information

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
F2-00	1st fault code	-	-	-	●
F2-01	1st fault sub-code	-	-	-	●
F2-02	2nd fault code	-	-	-	●
F2-03	2nd fault Sub-code	-	-	-	●
F2-04	3rd fault code	-	-	-	●
F2-05	3rd fault sub-code	-	-	-	●
F2-06	4th fault code	-	-	-	●
F2-07	4th fault sub-code	-	-	-	●
F2-08	Latest fault code	-	-	-	●
F2-09	Latest fault sub-code	-	-	-	●
F2-10	Nominal speed at latest fault	-	-	-	●
F2-11	Radius of driving chain sprocket at latest fault	-	-	-	●
F2-12	PPR of driving chain sprocket latest fault	-	-	-	●
F2-13	Max. braking-to-stop distance at latest fault	-	-	-	●

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
F2-14	Handrail pulse time interval at nominal speed at latest fault	-	-	-	●
F2-15	Upper limit of phase A/B pulses for step signals at nominal speed at latest fault	-	-	-	●
F2-16	Lower limit of phase A/B pulses for step signals at nominal speed at latest fault	-	-	-	●
F2-17	Function selection at latest fault	-	-	-	●
F2-18	MCTC-PES-E1state at latest fault	-	-	-	●
F2-19	Input state 1 at latest fault	-	-	-	●
F2-20	Input state 2 at latest fault	-	-	-	●
F2-21	Output state at latest fault	-	-	-	●
F2-22	Phase A escalator speed at latest fault	-	-	-	●
F2-23	Phase B escalator speed at latest fault	-	-	-	●
F2-24	Detected running direction at latest fault	-	-	-	●
F2-25	Left handrail pulse time interval at latest fault	-	-	-	●
F2-26	Right handrail pulse time interval at latest fault	-	-	-	●

F2-19 records the state of input terminals X1 to X16 when the latest fault occurs. Each terminal is allocated with a bit. The corresponding relationship is as follows:

Bit0: X1; Bit1: X2; …… Bit15: X16

F2-20 records the state of input terminals X17 to X20 when the latest fault occurs. Each terminal is allocated with a bit. The corresponding relationship is as follows:

Bit0: X17 Bit1: X18; Bit2: X19; Bit3: X20

F2-21 records the state of relays Y1 and Y3. Each relay is allocated with a bit. The corresponding relationship is as follows:

Bit0: Y1; Bit1: Y1F; Bit2: Y3; Bit3: Y3F

F2-22 and F2-23 record the phase A/B escalator speed when the latest fault occurs. The actual record is phase A/B pulse cycle (unit: 10 ms) or the number of phase A/B pulses a second. They can be determined based on F2-10, F2-11 and F2-12.

Group FF: Factory Parameters

Group FP: Management Parameters

Parameter No.	Parameter Name	Setting Range	Default	Unit	Property
FP-00	User password	0–6553	0	-	★
FP-01	Software version	0–6553	-	-	●
FP-02	Reserved	-	-	-	●

4.2 Examples of Commissioning Applications

Here gives some commissioning application examples, in which the rated speed is set as the actual running speed.

1) Suppose that escalator is used in the application. The rated speed of the escalator is 0.5 m/s, the radius of the driving chain sprocket is 0.3 m and the number of teeth of the driving chain sprocket is 72. Set parameters in group F0 as follows:

Parameter No.	Parameter Name	Setting Range	Setting
F0-00	System type	0: Escalator 1: Moving walk	0
F0-01	Nominal speed	0.30–0.90	0.50
F0-02	Radius of driving chain sprocket	0.30–0.90	0.30
F0-03	PPR of driving chain sprocket	1–200	72
F0-04	Max. braking-to-stop distance	1–200	Set according to China's standard

2) Generally, the step is 0.4 m wide. Set the radius of the handrail tachometer wheel to 0.05 m and there is only one inductive device on it. The following data can be obtained.

F0-05: 0.63

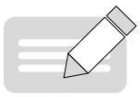
Firstly calculate the perimeter of the handrail tachometer wheel: 0.05 x 2 x π ≈ 0.314. Then calculate the value of F0-05: 0.314/F0-01 = 0.63.

F0-06: 15.27

Firstly calculate the perimeter of the driving chain sprocket: 0.3 x 2 x π ≈ 1.885. Then calculate the value of F0-06: 0.4/1.885 x 72 = 15.27. Because F0-06 must be set a little larger than the calculation value (the automatic calculation value is integer 16), you can set F0-06 to any value in the range of 18 to 32.

F0-07:

You can set F0-07 to any value in the range of 0 to 14.



NOTE

- Note that F0-06 and F0-07 must deviate from the automatic calculation result 16 must be a little large, at least by 2. For example, set F0-06 to 18 and F0-07 to 14.

Set parameters in group F0 as follows:

Parameter No.	Parameter Name	Setting Range	Setting
F0-05	Handrail pulse time interval at nominal speed	0.01–5.00	0.63
F0-06	Upper limit of phase A/B pulses for step signals	-	18
F0-07	Lower limit of phase A/B pulses for step signals	0 to F0-06	14

If the escalator does not have an auxiliary brake, set F0-08 to 2.

Parameter No.	Parameter Name	Setting Range	Setting
F0-08	Auxiliary function selection	0–65535	2

5 Troubleshooting

5.1 Fault Description

The MCTC-PES-E1 system provides a total of 16 pieces of fault information and protective functions. It monitors various input signals, running conditions and external feedback information in real time. After a fault occurs, the system implements the protection function, and displays the fault code.

You can first determine the fault type, analyze the causes, and perform troubleshooting according to the following tables.

Table 5-1 Description of the faults of the MCTC-PES-E1

Fault Code	Fault Name	Description
Err1	Overspeed of 1.2 times	The running speed exceeds 1.2 times of the nominal speed during normal running. If this fault occurs during commissioning, check whether the setting of parameters in group F0 is improper.
Err2	Overspeed of 1.4 times	The running speed exceeds 1.4 times of the nominal speed during normal running. If this fault occurs during commissioning, check whether the setting of parameters in group F0 is improper.
Err3	Unintentional reversal	Unintentional reversal occurs during the escalator running. If this fault occurs during commissioning, check whether the escalator speed detection signals (X15, X16) are reversed.
Err4	Over-braking distance	The braking-to-stop distance exceeds the requirement. If this fault occurs during commissioning, check whether the setting of parameters in group F0 is improper.
Err5	Left handrail underspeed	The left handrail speed is low. The setting of parameters in group F0 is improper. The sensor signal is abnormal.
Err6	Right handrail underspeed	The right handrail speed is low. The setting of parameters in group F0 is improper. The sensor signal is abnormal.
Err7	Upper missing step	Check whether F0-06 is set to a value smaller than the actual value.
Err8	Lower missing step	Check whether F0-06 is set to a value smaller than the actual value.
Err9	Service brake release fault	The working brake signal is abnormal.

Fault Code	Fault Name	Description
Err10	Auxiliary brake action fault	The mechanical switch feedback is inactive after braking. The auxiliary brake switch is active at startup. The auxiliary brake is not released at startup. The running in the upward direction exceeds 10s when the auxiliary brake switch is active. The auxiliary brake switch is active during running. The auxiliary brake contactor is disconnected during running.
Err11	Floor plate switch fault	The floor plate switch signal is active in normal state.
Err12	External signal abnormal	1: There are A/B pulses in the stop state. 2: There is no A/B pulse within 4s after startup. 3: The number of A/B pulses for upper step signals is smaller than the setting of F0-07. 4: The number of A/B pulses for lower step signals is smaller than the setting of F0-07. 5: The left handrail pulse signals are very quick. 6: The right handrail pulse signals are very quick. 7: The two inspection signals are inconsistent. 8: The upward and downward signals are active simultaneously. 9: Drive chain fault detections
Err13	MCTE-PES-E1 board hardware fault	1–4: The relay feedback is wrong. 5: The EEPROM initialization fails. 6: RAM check is wrong after power-on.
Err14	EEPROM data wrong	-
Err15	Main and auxiliary data check abnormal or MCU communication abnormal	The main and auxiliary chips are inconsistent in the following aspects: 1: Software versions of the main and auxiliary MCUs 2: States of the two chips 3: Signal state of terminals X1 to X4 4: Signal state of terminals X17 to X20 5: Output 6: Phase A escalator speed 7: Phase B escalator speed 9: Braking-to-stop distances detected by the main and auxiliary MCUs 8: The orthogonality of A and B pulses is not good and there is jump. 10: The left handrail signal is instable. 11: The right handrail signal is instable. 12, 13: The upper step signal is instable. 14, 15: The lower step signal is instable. 101–103: The communication between the main and the auxiliary chips is in error. 104: Communication between the main and auxiliary chips fails at power-on.

Fault Code	Fault Name	Description
Err16	Parameter abnormal	101: The calculated number of pulses for 1.2 times of max. braking-to-stop distance is wrong. 102: The calculated number of A/B pulses for step signals is wrong. 103. The calculated number of pulses a second is wrong.

5.2 System Prompt Faults

This section describes the symptoms, system prompts and protection levels related to the faults on the safety functions provided by the MCTC-PES-E1.

Table 5-2 System prompts for the faults of the MCTC-PES-E1

No.	Fault Name	Fault Code	System Symptom
1	Overspeed of 1.2 times	Err1	The LED blinks. The fault code output terminals (designated in Figure 3-9) output the fault code. If the operation panel is connected, it displays the fault code. The faults still exist after the system is powered on again.
2	Overspeed of 1.4 times	Err2	
3	Unintentional reversal	Err3	
4	Over-braking distance	Err4	
5	Missing step	Err7/8	
6	Service brake release fault	Err9	
7	Left/Right handrail underspeed	Err5/6	The system symptoms are the same as above, but the faults are reset after the system is powered on again.
8	Auxiliary brake action fault	Err10	
9	Signal abnormal or MCTC-PES-E1 faulty	Err12/13/14/15	
10	Floor plate switch fault	Err11	The system symptoms are the same as above, but the faults are reset after the system is powered on again.

Revision History

Date	Version	Revision
November 2013	V0.0	First issue.
April 2018	A01	◆ Added Omron sensors and access cover switches. ◆ Added information on Bit6, Bit7, Bit9, Bit10, and Bit11 of F0-08. ◆ Modified information on F1-04 and F1-18. ◆ Added safety information for step/pallet detection sensors. ◆ Changed the model of the switching power supply.
November 2018	A02	◆ Updated recommended sensor manufacturer and models in table 1-2. ◆ Updated tables 1-4 and 1-5. ◆ Updated section 2.2.1. ◆ Updated terminal X12 and function description of terminals Y3/M3 and Y4/M4 in table 2-5. ◆ Updated terminal X12 in figure 2-10. ◆ Updated information on Bit6 to Bit13 of F0-08, and added F0-09 in section 4.1.

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