



Electrical Documents Supplied with Escalator/ Moving Sidewalk

D10C704.V1.0

Canny Elevator Co., Ltd.

July 2012

Document Memo

Version	Chapter	Description of Modification		Modified Document No.	Date of modification
		Before modification	After modification		

Description:

This manual is subject to change without further notice in case of product improvements.

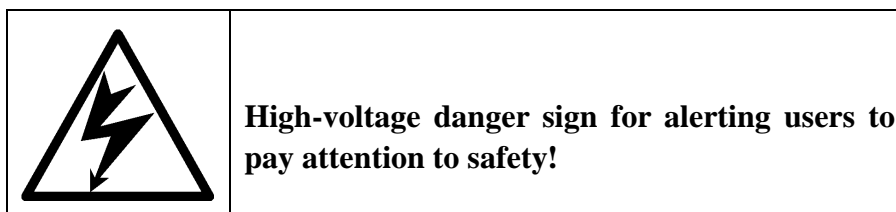
Contents

1	Notes	- 1 -
1.1	Safety Warning	- 1 -
1.2	Application Environment	- 1 -
1.3	Compliance and regulations	- 2 -
2	Summary and Model Definition	- 2 -
3	Control System Introduction	- 3 -
3.1	Overview	- 3 -
3.2	Primary Functions	- 3 -
3.3	Auxiliary functions.....	- 4 -
3.4	Safety Circuit	- 4 -
3.5	Monitoring	- 5 -
3.6	Escalator and Sidewalk Safety Protection Device	- 5 -
3.7	Advantages of Smart Escalators.....	- 7 -
3.8	Escalator Functional safety board	- 7 -
4	Operating Instructions	- 9 -
4.1	Escalator operating modes	- 9 -
4.2	Brief Analysis of the Operation Procedure.....	- 9 -
4.3	Running Direction Light	- 11 -
4.4	Brake Mode.....	- 11 -
5	D10C704 Electrical Commissioning Instructions.....	- 11 -
5.1	PLC and functional safety board I/O port definitions	- 11 -
5.2	Escalator and Sidewalk Overspeed and Reverse Running Detection.....	- 14 -
5.3	Escalators and Sidewalks Cascade Missing Deletion	- 15 -
5.4	Handrail under-speed detection.....	- 16 -
5.5	Escalator Overspeed, Anti-reverse Running, Missing, Handrail Under-speed Protection Function On-site Detection Method.....	- 17 -
5.6	Fault Display Board (XS-B).....	- 19 -
5.7	Ex-works, Transportation and On-site Construction	- 19 -
5.8	Escalator Operation Status	- 19 -
5.9	Other Explanation	- 20 -
6	Electrical Maintenance Instructions	- 23 -
6.1	Escalator Routine Maintenance.....	- 23 -
6.2	Simple Maintenance Method	- 25 -
7	Table of Control System Components	- 26 -

8	Table of Fault Code.....	- 29 -
8.1	Table of fault codes in the safety circuits (for the 8-pin maintenance connector)..	- 29 -
8.2	Table of Fault Codes of the Functional Safety Board	- 30 -
9	Electrical schematic diagrams and wiring diagrams	- 30 -

1 Notes

1.1 Safety Warning



The voltage used in this equipment may cause serious electric shocks and/or burns or even death. When you are using or closing to the device, you need to maintain high vigilance at any time.

The equipment as a component is specially designed for providing multiple safety functions as well as monitoring and protection for escalators or moving sidewalks. If not properly installed, the escalators or moving sidewalks may have potential safety hazards. The control power supply of the device is DC24V switching power supply. However, the input of the switching power supply is AC220V. It is a high voltage; the output of the device is in series into the safety circuits of the escalators or moving sidewalks and the voltage used is AC110V voltage. Improper operation of equipment controlled by the device may cause injury to humans.

The personnel for system design, installation, commissioning operation and maintenance must have received necessary training and be with corresponding experience. They must read this manual and *User Manual for Escalator Functions and Safety Protection Devices* carefully.

Never rely on shutdown, start-up or input signals of this device to ensure safety of the personnel. They cannot isolate dangerous voltage and the output device. Before getting contact with electrical wiring, ensure to use recognized insulation elements to disconnect power supply of the moving sidewalks or the escalators.

1.2 Application Environment

Transportation, storage and application of electronic and electrical equipment of the escalators and moving sidewalks must follow relevant instructions and specific environmental requirements specified in the documents supplied with machines and the user manual. No excessive external force

shall be applied to avoid damage!

Application environment of electronic and electrical equipment of the escalators and moving sidewalks must meet the following conditions:

- Operating temperature: $-5^{\circ}\text{C} \sim +60^{\circ}\text{C}$
- Operating humidity: 25%RH ~ 85%RH
- Storage temperature: $-10^{\circ}\text{C} \sim +60^{\circ}\text{C}$
- Storage humidity: 10%RH ~ 85%RH

In addition, keep away from conducting materials, corrosive gases, flammable gases, metal powder, oil mist, dust etc.

1.3 Compliance and regulations

- Installers shall have responsibility to follow all the relevant regulations: such as national wiring regulations, accident prevention regulations and electromagnetic compatibility (EMC) regulations. Special attention should be paid to selection of section area of wires, fuses and other protection devices as well as connections of protective grounding.
- The design of safety devices involved in this documents supplied with machines has followed the safety grade stipulated in latest safety standards for escalators, GB16899-2011 and GB/ T20438, including safety devices with SIL2 grade overspeed and reverse running protection functions, upper/lower cascade missing monitoring and protection functions as well as safety devices with SIL1 grade handrail and band-type brake monitoring functions.

2 Summary and Model Definition

This document supplied with machine includes electrical schematic diagram and wiring diagram of D10C704 control system as well as unreeling diagram of safety switch, giving comprehensive and systematic descriptions on installation, application and maintenance of the control systems of frequency conversion smart escalators and sidewalks. It can be served as an operating instruction on system installation, commissioning and maintenance.

D10C704 stands for a PLC controller and is driven by frequency conversion.

1. PLC is OMRON CP1E—30DR or CP1E—40DR (operating mode monitoring).

2. The motor is a single winding one. Start winding delta connection and control escalator operation speed by outputting frequency controlled by converter.

3. Operating Mode

(1) Simple operation: it always runs with one-way rated speed, applicable for both ordinary escalators and smart escalators.

(2) Economical operation: it will run with 1/5 of rated speed when nobody is riding and it will run in one-way at full speed when somebody is riding.

(3) One-way smart operation: it will stop when nobody is riding and it will start automatically when somebody is riding but only for one-way starting and stopping.

3 Control System Introduction

3.1 Overview

The control system consists of the drive station control box, the steering station distribution box, lighting, safety switches, and control buttons, monitoring devices and connecting cables. This system meets the design and production requirement of the national standard GB16899-2011.

(1) PLC program control is adopted for control system. The PLC machine is the core of the control system. Main control devices and main drive controlling parts are in the upper control box. See “Table of Control System Components” for detail.

(2) The power supply should adopt the three-phase, five-wire system, with the phase voltage of 380V (+7% ~ -7%) and the grounding resistance not greater than 4Ω.

3.2 Primary Functions

- a) Normal operation;
- b) Maintenance operation;
- c) Smart operation (optional);
- d) Phase missing and phase failure protection;
- e) Motor overheating protection;

3.3 Auxiliary functions

- a) Safety brake;
- b) Central lubricating system;
- c) Cascade running speed monitoring (overspeed) , non-manipulation reverse running monitoring;
- d) Cascade missing monitoring;
- e) Fault display function;
- f) Handrail speed monitoring (under speed);
- g) Status monitoring on band-type brake;
- h) Running direction indicator;
- i) Additional brake (for lifting height of greater than 6 meters or according to user requirements).

3.4 Safety Circuit

- a) Terminal numbers of A34, B09, A35, B10, A75, A37 and B11 are basic safety circuits which cannot have cross-over optionally.
- b) Terminal numbers starting from A15 through A16, A17, A18, A19, A20, A21, A22, A23, A24, A25, A26, A27, A28, A29, A30, A32, A33 and H01 are conventional safety circuits. When carrying out maintenance operation, the special shorting stubs can be used temporarily as cross-over for troubleshooting (the shorting stubs have labels that are apparently inconsistent with ordinary wires). Cross-over with ordinary wires is strictly prohibited. During normal operation, the special shorting stubs must be dismantled.
- c) After all conventional safety circuits and basic safety circuits are connected, contactor KC of the safety circuits can be connected and after the start button is pushed, the main contactor KC1 will pick up.

Note: when the electrical commissioning personnel is carrying out maintenance work and the safety circuits need cross-over, the “Special Shorting Stubs for Commissioning” provided by the company must be used and they should be removed after the maintenance work is over to ensure normal operation of the safety circuits.

3.5 Monitoring

The following monitoring functions are realized using KLE-MSU-01A functional safety board:

- a) Cascade missing monitoring;
- b) Cascade running speed monitoring (overspeed);
- c) Non-control reverse running monitoring;
- d) Handrail running speed monitoring (under speed);
- e) Status monitoring on band-type brake.

Running status monitor (optional) is realized by using the PLC.

3.6 Escalator and Sidewalk Safety Protection Device

- 1) Power supply system phase loss and phase failure protection:

Due to phase loss or phase failure of the power supply system, the phase sequence protection relay will be actuated and the escalator cannot run.

- 2) Electric motor overload protection:

When the motor is overloaded and the current in the main circuit is increased, the overload protection function will be actuated and the escalator will stop.

- 3) Cascade traction chain breakage or elongation protection:

When the cascade traction chain is broken or excessively elongated during application, the protection system will be actuated and the escalator will stop.

- 4) Coxcomb protection:

When the cascade comes into the coxcomb and it is caught by foreign matters, the protection system will be actuated and the escalator will stop.

- 5) Handrail entrance protection:

When a finger or any foreign matter is stuck to the entrance at the turning end of the handrail, the protection system will be actuated and the escalator will stop.

- 6) Cascade caving protection:

When caving in of any part of the cascade leads to gearing between the access and the coxcomb not meeting the clearance required, the protection system will be actuated and the escalator will stop.

7) Apron Board Clearance Protection:

When the edges of apron board and cascade are stuck by foreign matters, the protection system will be actuated and the escalator will stop.

8) Speed Monitoring Device:

When running speed has reached 120% of the rated speed or 80% of the rated speed and non-controlled reverse running, the escalator will stop and it cannot be restarted.

9) Emergency button:

Emergency stop buttons are installed in escalator access and the place with large lifting height in the middle of the escalator.

10) Driving chain breakage or elongation protection:

When the driving chain is broken or excessively elongated, the safety switch will be actuated and the escalator will stop.

11) Additional Brake:

A motion feedback switch is installed on the additional brake. When the additional brake is actuated, the motion feedback switch will cut off the safety circuit. Only when the additional brake is reset, can the system be re-started. If the lifting height is greater than 6m, it must be installed.

12) Cascade Clearance Illumination:

In the level transitional parts at the upper and lower ends of the cascade, to prevent passengers from stepping into the junction between two cascades to cause danger when getting in and out, green lighting is installed under the cascade to remind passengers.

13) Cascade Yellow Frame:

It is set to guide passengers to step in the yellow frame. Stepping outside the yellow frame will cause danger.

14) Handrail running speed protection:

When the escalator is running normally and the running speed of the handrail is 15% lower than the running speed of cascades and if the condition lasts for 15 seconds, the escalator will stop.

15) Escalator and sidewalk cascade or pedal missing protection:

When the cascades or pedals of the escalator and sidewalk are missing, the protection system will be actuated and the escalator will stop and it cannot be restarted. The system will get into the fault locking state.

16) Service brake:

An action feedback switch is installed in the service brake. After escalator start-up, if the service braking system is not released, the escalator shall be prevented from starting, the system will get into a fault locking state; when operation of the escalator is being monitored and the order of band-type brake disagrees with the feedback logic of band-type brake, the power supply in the safety circuit of the escalator will be cut off and the escalator will stop to get into a fault locking state.

17) Stopping distance detection:

If the stopping distance has exceeded 1.2 times of the specified maximum value (the maximum value for escalators and sidewalks with rated speed of 0.5m/s is 1m and the maximum value for escalators and sidewalks with rated speed of 0.65m/s is 1.3m), the escalator will stop immediately. Only after the fault locking is reset, can it be re-started. Maintenance personnel should carry out inspection for braking system and take corrective measures before the fault is reset.

3.7 Advantages of Smart Escalators

Under normal circumstances, the manned running time of the escalator accounts for about 50% of actual running time and the other 50% running time is invalid time with no body. After using the automatic running mode, the waste of the 50% invalid time during escalator operation can be avoided to make the entire running time close to the manned running time. The actual runtime of the escalator is decreased, thereby running cost and wear of wearing parts of the escalator are decreased and the service life of the escalator can be increased.

3.8 Escalator Functional safety board

KLE-MSU-01A/02 (without additional brake) or KLE-MSU-01A/04 (with additional brake) functional safety boards have overspeed, reverse running, missing protection devices for cascade or pedal of escalator and moving sidewalk. They are functional safety devices of SIL2 grade meeting the safety standards of GB16899-2011 and GB/T20438; the handrail speed protection and band-type brake monitoring devices are functional safety devices with SIL1 grade meeting the safety standards of GB16899-2011 and GB/T20438. Safety functions of the system include:

- 1.2 times overspeed protection: it monitors the escalator and the moving sidewalk. When the speed exceeds 1.2 times of the rated speed, the 1.2 times safety relay will be disconnected to cut off power supply to the service brake, the safety circuit and the control circuit of the escalator or moving sidewalk to make it stop running immediately.
- 1.4 times overspeed protection: it monitors the escalator and the moving sidewalk. When the speed exceeds 1.4 times of the rated speed, the 1.2 times safety relay and the 1.4 times safety relay will be disconnected to cut off power supply to the service brake, the additional brake, the safety circuit and the control circuit of the escalator or moving sidewalk to make it stop running immediately.
- Reverse running protection: it monitors the escalator and the inclined moving sidewalk ($\alpha > 6^\circ$). When the running direction is not consistent with the specified running direction, the 1.2 times safety relay will be disconnected to cut off power supply to the service brake, the additional brake, the safety circuit and the control circuit of the escalator or moving sidewalk to make it stop running immediately.
- Cascade missing protection: Cascade or pedal missing detection devices are installed in the escalator drive station and the steering station. once pedal missing is detected, the 1.2 times safety relay will be disconnected to cut off power supply to the service brake, the additional brake, the safety circuit and the control cable to make the escalator stop before the gap (caused by cascade or pedal missing) appears in the position of the coxcomb.
- Handrail protection: it monitors speed of the escalator and the moving sidewalk. When the speed is lower than 15% of the rated speed of the cascade, the 1.2 times safety relay will be disconnected to cut off power supply to the service brake, the safety circuit and the control circuit of the escalator or moving sidewalk to make it stop running immediately.
- Band-type brake monitoring: after escalator or moving sidewalk start-up, if the brake system is not released, the escalator cannot be started; When the escalator and moving sidewalk are monitored running but the band-type brake order disagrees with the feedback logic of band-type brake, the 1.2 times safety relay will be disconnected to cut off power supply to the service brake, the safety circuit and the control cable of the escalator or moving sidewalk to make it stop running immediately.

To meet above requirements, sensor sub-systems which are capable of monitoring escalator

speed and running direction, handrail speed, cascade missing and band-type brake state are needed; logical decision sub-systems which are capable for judging above safety functions such as calculating escalator running speed and whether the instructed direction agrees with the running direction are needed; output sub-systems which can make the escalator and the moving sidewalk stop and be maintained in safe state under fault conditions are needed. Therefore, the safety system is divided into three sub-systems, namely, sensor system, logic system and actuators to meet functional requirements of the safety standards.

Refer to *User Manual for Escalator Functions and Safety Protection Devices -KLE-MSU-01A Function Safety Protection Systems* for detail.

4 Operating Instructions

4.1 Escalator operating modes

The start-up mode of the escalator described in this manual is direct driving by converter and without star delta converting contactor.

4.2 Brief Analysis of the Operation Procedure

a) Maintenance Operation:

(1) Unplug the additional plug in the upper or lower control box and plug in the maintenance plug. Hold and control the maintenance box (the plug is the multi-core aviation plug).

(2) Check fuses in cabinets of FU1 - FU6 and turn on power switch QS1.

(3) If the whole circuit is clear and PC power supply is normal, under “RUN” state, press down running button (SQ). Inch the up or down button (SU or SD) in the maintenance box, the contactor shall work according to the following order: main contactor KC1 and band-type brake KMB pick up, band-type brake response switch SGB is actuated, and KMU/KMD and KMC pick up at the same time. The escalator runs according to the set operating mode.

(4) During maintenance operation, speed monitoring and non-controlled reverse running are still functioning.

b) Normal operation:

(1) Plug in upper and lower additional plugs for maintenance.

(2) Check fuses in cabinets of FU1 - FU6 and turn on power switch QS1.

(3) If the safety circuit is clear and power supply to PC is correct, under “RUN” status, plug in operation start-up key switch, the running procedure sequence is as follows: the main contactor KC1 picks up, and KMB, KMU/KMD and KMC pick up at the same time, the band-type brake response switch SGB is actuated, the escalator will run according to the set operating mode.

c) Smart Operation:

(1) Simple Operating Mode:

Such mode is the operating mode of ordinary escalators without smart self-starting sensors. Plugging in the key and turning once according to the running direction, the escalator will run according to the set operating mode until the stop button is pushed.

(2) Economical operation mode:

This operating mode needs self-starting sensors. Plugging in the key and turning twice according to the running direction, the escalator will be started at low speed and turn to fast operation later. The escalator will run at fast speed when somebody is riding and it will become slow running at 1/5 of rated speed when there is nobody riding for 60 seconds. It will not stop until the stop button is pushed.

(3) One-way smart operation mode:

This operating mode needs self-starting sensors. Plugging in the key and turning three times according to the running direction required, the escalator will be started at slow speed and turn to fast operation later. If nobody rides within 60 seconds, the escalator will stop automatically. When there is somebody riding along the running direction, the escalator will slow start and fast operation; when there is somebody riding along the reverse direction, the escalator will slow run for 15 seconds and then stop automatically and inform the passenger that the riding direction is wrong. If manual stop is carried out when the escalator is running, only when the stop button is pressed can the escalator be completely stopped and the smart function can be cancelled.

Note: Operating modes can only be changed according to the order of simple operation, economical operation and one-way smart operation and it cannot be changed to reverse direction. Entering low-level operation modes can only be realized by pressing the stop button and re-starting the escalator.

4.3 Running Direction Light

If direction indicators are equipped on both sides of the escalator, passengers should ride correctly according to meanings of the indicators. If it is red light, it indicates riding is forbidden; if it is green light, it indicates that riding is permitted.

4.4 Brake Mode

(1) Emergency brake: When the escalator is running and stop button, safety circuit contact is actuated and under normal operation, the cascade missing monitoring, escalator speed monitoring are activated, the escalator will apply emergency brake. When emergency brake is applied, while putting on the band-type brake, the power supply of the motor will be cut off.

(2) Sequential brake (smart stop): In case the escalator is in the one-way smart operation mode, if it is in smart stop or smart slow running originally and there is nobody riding in some time, the control system of the escalator will cut off power supply to the motor and it will stop operation; if the escalator is in high speed running mode originally and there is nobody riding in some time, the escalator will slow down first and run slowly, then make the band-type brake to stop, at the same time, cutting off power supply to the motor and stopping running.

5 D10C704 Electrical Commissioning Instructions

5.1 PLC and functional safety board I/O port definitions

Working status of various controlling and actuating (input/output) signals of the system will be displayed on the PLC controller in the system control screen. Various controlling and actuating signals have corresponding indicators. Turning on and off of the indicators represent whether input/output of every control and actuating signal is available.

PLC input and output (controlling and activating) points setting status:

PLC input	Signal definition	Status
0000	Main engine speed measurement (stopping distance detection)	Flickering
0001	Up starting	Up indicator on

0002	Down starting	Down indicator on
0003	Maintenance signal	Maintenance indicator off
0004	Contactor detection signal	Running indicator off
0005	Safety contactor detection signal and converter fault signal	Safety circuit clear and indicator on
0006	Water level detection signal	Lower engine room water level indicator on
0007	Functional safety board OUT1	The indicator is on normally; It displays a code in case of fault
0008	Functional safety board OUT2	
0009	Functional safety board OUT3	
0010	Functional safety board OUT4	Flickering
0011	Upper access diffuse reflection photoelectricity	Blocking indicator on
0100	Upper access opposite-type photoelectricity	Blocking indicator off
0101	Lower access diffuse reflection photoelectricity	Blocking indicator on
0102	Lower access opposite-type photoelectricity	Blocking indicator off
0103	Converter operation signal	On normally
0104	Additional brake contactor	Running indicator off
0105	Additional brake switch	Running indicator on
PLC output	Signal definition	Status
1000	Functional safety board fault reset signal output	Motion indicator on
1001	Running contactor output (KC1)	Running indicator on
1002	Bell output	Bell ringing and indicator on
1003	Oil pump output	Working indicator on
1004	Up contactor output (KMU)	Up indicator on
1005	Down contactor output (KMD)	Down indicator on
1006	Operation auxiliary contactor (KMC)	Running indicator on
1007	High-speed contactor (KMT)	High-speed indicator on
1100	The upper direction light relay output (KFU)	Down indicator on
1101	The lower direction light relay output (KFD)	Up indicator on
1102	Additional brake contactor output (KZY)	Running indicator on
1103	Additional brake 1 contactor output (KZY1)	Running indicator on
1104	Up monitoring	Up indicator on
1105	Down monitoring	Down indicator on
1106	Maintenance monitoring	Maintenance indicator on
1107	Fault monitoring	Fault indicator on

KLE-MSU-01A/02 or 04 board input, output (controlling and activating) points setting

status:

Terminal	Terminal No.	LED	Function	Remarks	
JP1	JP1.1	X1	Upper cascade missing signal 1 input	Active low level	
	JP1.2	X2	Standby	Active low level	
	JP1.3	X3	Lower cascade missing signal 1 input	Active low level	
	JP1.4	X4	Standby	Active low level	
	JP1.5	X5	Handrail tachometer signal 1 input	Active low level	
	JP1.6	X6	Handrail tachometer signal 2 input	Active low level	
	JP1.7		CVCC	Input port +24V power supply	
	JP1.8		COM0 common port	GND	
JP2	JP2.1	X7	Cascade tachometer signal 1 input	Active low level	
	JP2.2	X8	Cascade tachometer signal 2 input	Active low level	
	JP2.3	X9	High speed end tachometer signal input	Active low level	
	JP2.4	X10	Manual reset signal input	Active low level	
	JP2.5	X11	Running contactor detection KC1 signal input	Active low level, indicator on when it stops	
	JP2.6	X12	Up contactor detection KMU signal input	Active low level, indicator off when up	
	JP2.7	X13	Down contactor detection KMD signal input	Active low level, indicator off when down	
	JP2.8	X14	Rated speed contactor detection KMT signal input	Active low level, indicator off in rated speed operating mode	
	JP2.9	X15	Band-type brake feedback detection 1 signal input	Active low level, indicator off when it stops	
	JP2.10	X16	Band-type brake feedback detection 2 signal input	Active low level, indicator off when it stops	
JP3	JP3.1		Service brake safety circuit contact 1A output	Relay output	Connected to the safety circuit in series
	JP3.2		Service brake safety circuit contact 1B output		
	JP3.3		Additional brake safety circuit contact 2A output	Relay output	
	JP3.4		Additional brake safety circuit		

			contact 2B output		
JP4	JP4.1		+24V power supply	Printing plate power supply	
	JP4.2		+24V power supply		
	JP4.3		GND		
	JP4.4		GND		
JP5	JP5.1		DGND	Output common port	
	JP5.2		OUT1	MOS transistor output	It sends fault code to the control system of the escalator
	JP5.3		OUT2	MOS transistor output	
	JP5.4		OUT3	MOS transistor output	
	JP5.5		OUT4	MOS transistor output	
	JP5.6		DVCC	Output +24V power supply	
CAN	CAN.1		TXV+	CAN communication	
	CAN.2		TXV-		
	CAN.3		CANH		
	CAN.4		CANL		
JTAG1	1-14		Download program for the main chip	Program burning port	
JTAG2	1-14		Download program for the sub chip	Program burning port	

5.2 Escalator and Sidewalk Overspeed and Reverse Running Detection

(1) Install two cascade tachometer sensor (CS0 and CS1) on the escalator cascade guide rail or large chain wheel of moving sidewalk cascade and connect their signal lines to functional safety boards, JP2.1 and JP2.2 respectively. When the escalator cascade wheel or the sidewalk sprocket is close to the transducer, indicators X7 and X8 on the functional safety board will be turned on.

(2) During normal operation, the cascade speed tachometer sensor will generate one to two tachometer pulses per second.

(3) When running overspeed, the interval of generating pulses by the tachometer sensor will become shorter. The functional safety board will calculate pulse time according to input points JP2.1 and JP2.2. It will cut off output before the interval has reached 80% of the normal interval and the escalator will stop. Display on functional safety board LED will be "9" for 1.2 times overspeed or "D" for 1.4 times overspeed. When it is started next time, if the escalator cannot run, remind the

staff of the cascade speed measurement being in fault.

(4) Overspeed, non-operating reverse protection functions cannot be invalid in maintenance state.

(5) The escalators have passed cascade speed measurement and reverse running protection tests when leaving the factory. For vibration and bump during transportation and loading processes, it may cause shifting of the photoelectric switch leading to malfunction during on-site application. The specific inspection method is as follows:

Static checking: when the tachometer sensor (CS0 and CS1) are blocked by the cascade roller or metal of the large chain hook, the indicators (X7 and X8) at corresponding input points will be on; when they are not blocked, there is some time difference between the two sensors (or actuating time difference) and some time for simultaneous movement is needed.

Dynamic check: When the escalator is running, indicators (X7, X8) in corresponding input points on the safety board should be flickering and the flicker frequency should be consistent with the frequency of the cascade roller or large sprocket teeth passing through the sensors.

If the sensors do not meet the above operating conditions, the commissioning personnel on site shall carry out photoelectric position correction.

There may be a difference between the power supply voltage on site and the voltage for factory test, if the on-site power supply voltage is too low, it may cause insufficient traction of the escalator during overload or full load operation, and generate the reverse running and sliding danger.

Note: Be sure to guarantee the stability of power supply, whose fluctuation range should be -7 % to +7 %.

5.3 Escalators and Sidewalks Cascade Missing Deletion

(1) Install a cascade missing detection sensor (CQ1, CQ3) at the turning ends of upper and lower cascades of the escalator or sidewalk respectively. Their signal lines are connected to functional safety boards, JP1.1, JP1.3. The output line of a main engine high speed shaft tachometer sensor (CS8) is connected to the functional safety board JP2.3. When the escalator cascade clearance passes the sensors, indicators X1 and X3 on the functional safety boards will be turned on.

(2) When the photoelectricity is blocked by the cascade, it will have high level; when the photoelectricity is not blocked by the cascade, it will have low level. Under normal circumstances, the cascade tachometer sensor generates one to two tachometer pulses per second. In the cascade returning position, when the escalator is running, the photoelectricity is only not blocked in the cascade clearance; it is blocked in most other positions. When the cascade is missing, the entire cascade distance cannot be blocked. Therefore, with the help of the main engine speed detection photoelectric signals, the moving distance of the escalator can be converted. It is calculated that the distance for the photoelectricity not blocked has exceeded the cascade clearance. Thereby it is estimated that the cascade is missing and the escalator will stop. When "8" is displayed on the functional safety board, it indicates cascade missing fault. If the escalator cannot run in the next start-up, remind the staff of paying attention to cascade missing fault.

(3) The cascade missing protection function can be disabled in maintenance state.

(4) The escalators have passed cascade missing protection test when leaving the factory. For vibration and bump during transportation and loading processes, it may cause shifting of the photoelectric switch leading to malfunction during on-site application. The specific inspection method is as follows:

Static checking: the flywheel tachometer sensor (CS8) should have changes in state when passing by the flywheel opening and the corresponding indicator X9 on the safety board may also have on and off changes. When the cascade missing sensors (CQ1 and CQ3) are located in the escalator cascade clearance (the sensors are exposed to the reflector), corresponding indicators (X1, X3) in the input points on the safety board will be turned on.

Dynamic check: When the escalator is running, indicators (X1, X3, and X9) in corresponding input points on the safety board should be flickering and the flicker frequency should be consistent with the frequency of the cascade speed or flywheel rotating speed respectively.

If the sensors do not meet above operating conditions, the commissioning personnel on site shall carry out photoelectric position correction.

5.4 Handrail under-speed detection

(1) Tachometer sensors (CS2, CS3) are installed on left and right handrail. Their signal lines

are connected to the functional safety boards JP1.5 and JP1.6 respectively. When the concave hole in the tachometer wheel of the handrail passes the sensor, indicators X5 and X6 on the functional safety board will be turned on. When the running speed of the handrail is 15% lower than the cascade speed and it is kept for 15min, safety circuits of the escalator or moving sidewalk will be cut off to make the system stop running immediately and the functional safety board will display "7", indicating handrail speed too low fault, thereby realizing handrail speed detection protection.

(2) The handrail under-speed protection function can be disabled in maintenance state.

(3) The escalators have passed handrail under-speed protection test when leaving the factory.

For vibration and bump during transportation and loading processes, it may cause shifting of the photoelectric switch leading to malfunction during on-site application. The specific inspection method is as follows:

Static checking: there should be state changes when the handrail tachometer sensors (CS2 and CS3) passes by the handrail tachometer wheel and corresponding indicators (X5, X6) on the safety board will have on and off changes.

Dynamic check: When the escalator is running, indicators (X5, X6) in corresponding input points on the safety board should be flickering and the flicker frequency should be related to the flywheel rotating speed.

If the sensors do not meet the above operating conditions, the commissioning personnel on site shall carry out photoelectric position correction.

5.5 Escalator Overspeed, Anti-reverse Running, Missing, Handrail Under-speed Protection Function On-site Detection Method

Refer to the *User Manual for Escalator Functions and Safety Protection Devices -KLE-MSU-01A Function Safety Protection Systems* for detail.

(1) Overspeed detection: After the escalator has run normally and entered rated speed, the proximity photoelectric switch (it is on the large chain wheel of cascade for a sidewalk) on the escalator cascade wheel will be blocked quickly. The system will cut off the safety circuit in overspeed mode and the escalator will stop, while the functional safety board will display "9" for 1.2 times fault or "D" for 1.4 times fault.

(2) Anti-reverse running detection: Only when there are two tachometer signals participating in detection and the phase difference is 90° can the reverse running function be realized. Under the escalator stopping status, terminal wires A02 and A03 in the control cabinet are exchanged (namely the phase difference defined is destructed), after starting and running, the system will stop automatically. The functional safety board will display "E" for cascade reverse running fault. If additional brake is deployed, it will be actuated. This fault will be kept when power is cut off and the escalator cannot run before the fault is reset. After exchanging A02 and A03 again, the fault status needs to be cancelled and fault reset should be implemented. Press emergency stop and keep the key down direction until the bell rings, the system can be returned to normal.

(3) Cascade missing detection: when running, the escalator will stop once cascade or pedal missing is detected. When carrying out on-site detection, removing one or N cascades or pedals deliberately, when the escalator runs to the place with cascade missing, it will stop and the functional safety board will display "8" for cascade missing fault. This fault can be kept when power is off and the escalator cannot run before the fault is reset. After putting back the cascade removed, the fault should be cancelled. Implement fault reset and press the emergency stop button while turning the key down direction until the bell rings, it can be returned to normal.

(4) Handrail under-speed: There is a tachometer sensor installed on each handrail to carry out monitoring for running speed of the handrail. During normal operation, if the running speed of the handrail is detected to be 15% lower than the cascade speed and it has lasted for 15 seconds, the escalator will stop. The handrail can be loose or with enough external force applied to make it partly skidding deliberately for on-site detection to reach to the under-speed status, after the escalator is started and it has reached the rated speed, if handrail under-speed is detected, the escalator will stop and the functional safety board will display "7" for handrail speed too low fault.


(5) If the signals flutter or there is no signal for the photoelectric switch elements' own fault or improper installation, the system can determine which photoelectricity for the safety function has fault according to the signal input status of the photoelectric switch, the escalator will stop and the functional safety board will display "2" for cascade missing photoelectricity or main engine speed detection photoelectricity fault, or "3" for handrail photoelectricity fault, or "4" for cascade speed detection photoelectricity fault or "A" for cross short circuit fault. After the photoelectricity is modified and adjusted, the fault should be cancelled, implement fault reset and press emergency

stop button, while turn the key down direction until the bell rings, it can be returned to normal.

Note: During on-site detection, pay attention to safety; return all signal lines and sensors to normal state after the test is completed.

5.6 Fault Display Board (XS-B)

(1) The working voltage of the fault display is AC8V and AC110V.

(2) When the monitor displays “”, it represents that all the safety circuits are completed.

(3) When the switch of the safety circuit is actuated, the fault display board will display the corresponding fault code. See the table below for the fault codes.

5.7 Ex-works, Transportation and On-site Construction

Electrical components such as apron clearance, apron board switch, forefront board comb, comb switch, cascade missing photoelectricity, cascade speed detection photoelectricity, main engine speed detection photoelectricity and handrail speed detection photoelectricity etc. must be re-adjusted before construction site installation, acceptance and application for the escalator will be affected by transportation, lifting and getting in level place on the construction site and other factors.

5.8 Escalator Operation Status

a) Normal state operation: plug in the key and turn it according the required direction until the bell rings. Release the key, the bell will not ring while the escalator starts to run. While the escalator is running, plug in the key and turn (regardless of upper and lower directions) it will make the bell ring. Release the key the bell will not ring, indicating that there is a malfunction in the key switch; press the stop button, the escalator will stop.

b) Maintenance status operation: hold down the running button. If it is the first time holding up (down) the button, the bell will ring but the escalator will not move; if it is the second time holding up (down) the button, the bell will not ring but the escalator runs. Release the button, the escalator will stop. To make it run again, repeat the operation. The interval between pressing the button for the first time and the second time should not exceed 3 seconds. If the interval is exceeded, the memory of the first time will be canceled automatically.

c) Smart status operation: plug in the key and turn according to the required direction, the bell will ring; release the key, the bell will not ring but the escalator starts to get into simple operation; then turn and release the key (in the direction of running) once, the escalator will be economical operation; then turn and release the key again (in the running direction), the escalator will get into the one-way smart operation state. It can only be realized when the escalator is equipped with smart function, or it will keep simple operation. If the escalator needs to be stopped artificially, press the stop button when it is running, it can be stopped completely and the smart function is cancelled.

5.9 Other Explanation

1) Functional safety board fault display: The functional safety board has dual channel detection. In case of a fault to any channel, the escalator will stop and the channel will display the fault causing the escalator to stop, whereas for the other channel, as the fault for causing the escalator to stop has stopped, it can still get into the fault display status by comparing the status passing through the dual channels,. The channel will display "C" for dual channel comparison fault. It can be cancelled by resetting the fault to make the escalator return to normal.

2) Band-type brake response protection: A band-type brake response switch is installed in the working brake. In case of brake power off and the escalator is stopped, the response switch is OFF; when the brake is powered on and the escalator is running, the response switch is ON. Check if the band-type brake response signal is OFF when the escalator is started, or the escalator cannot be started and the functional safety board will display "6" for band-type brake switch fault; when the escalator is running, if the response signal is detected as OFF, the escalator will stop and the functional safety board will display "6" for band-type brake switch fault, the protection status will be self-locked. Only when the fault is reset, can the band-type brake response protection be cancelled.

3) Contactor adhesion protection: when the system has stopped the escalator (normal stopping and abnormal stopping), various contactors will be in off-position, PLC detection signal will be ON, or the system will get into a protection status and it is self-locked, all operations are invalid. Only use power off restoration can the contactor adhesion protection be cancelled.

4) Fault power off saving and not saving: after the escalator has stopped automatically, if the

stopping is caused for "6" band-type brake monitoring, "7" handrail under-speed, "8" cascade missing, "9" 1.2 times overspeed of the cascades, "D" 1.4 times overspeed of the cascades, "E" cascade reverse running faults as displayed, the stopping status and fault display will be saved after power off (if it is powered on again after power off it will keep self-locking status), normal starting operation will be invalid. The fault can only be released by manual fault reset. The operating method is as follows: hold down the stop button and turn the start key switch down direction until the bell rings in 10 seconds. If the stopping is caused by faults of "1" running signal disagreement, "2" cascade missing photoelectricity or main engine speed detection photoelectricity fault, "3" handrail photoelectricity fault, "4" cascade speed detection photoelectricity fault, "5" running direction not detectable, "A" cross short circuit fault, "B" safety relay fault, "C" dual channel comparison fault, the stopping status and fault display will not be saved (if it is powered on after power off, the fault will be released). After power on the escalator can be started and run. However, as the fault is not eliminated actually, the escalator will get into the fault stopping status again soon.

5) As related parameters such as cascade pedal width, speed and whether additional brakes are available for different types of escalators and moving sidewalks are different, the jumper pin P3 on the functional safety printing board of different escalators shall be set correspondingly. See the table below for specific settings: (when setting every type of escalator, the following four items should be set comprehensively and caution must be taken for operation, or the functional safety printing board will report a fault and the escalator cannot run normally!)

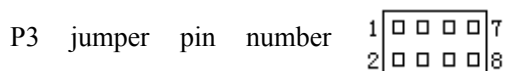


diagram is as follows:

No.7-No.8 jumper pins need to be set as follows according to whether the escalator has additional braking function set on the printing board:

No.7 -No.8 jumpers pins	Short connection cap unplugged	○	Printed board without additional braking function
	Short connection cap plugged in	●	Printed board with additional braking function

● No.5-No.6 jumpers and Port JP1.2 need to be set as follows according to the rated speed of the escalator set on the printing board:

No. 5- No. 6 jumper pins	Port JP1.2	Applicable escalator / moving sidewalk speed specifications
--------------------------	------------	---

Short connection cap unplugged	○	Not connected	○	For escalators with rated speed of 0.65m/s
Short connection cap plugged in	●			For escalators with rated speed of 0.65m/s and high-speed running speed of 0.65m/s
Short connection cap unplugged	○	Connected to low level (active low level)	●	For moving sidewalks with rated speed of 0.75m/s
Short connection cap plugged in	●			For escalators with rated speed of 0.5m/s and high-speed running speed of 0.5m/s

- When the printing board is used for escalators or for moving sidewalks, No.3-4 jumper pins are set as follows:

No. 3-4 jumper pin	Short connection cap unplugged	○	This function board is set for escalators.
	Short connection cap plugged in	●	This function board is set for moving sidewalks

- When No.3-4 jumper pins are set for escalators and the tachometer sensor is set for the measurement of cascade wheels, No.1-2 jumper pins are meaningless and not setting is needed;
- When No.3-4 jumper pins are set for escalator and the tachometer sensor is set for the measurement of large sprocket gear of the driving wheel, No.1-2 jumper pins are set for chain model (moving a tooth is equivalent to the moving distance of a cascade);

No.1-2 jumper pins	Short connection cap unplugged	○	For the escalators with model of 20A for cascade chain (with cascade moving distance of 33mm/tooth)
	Short connection cap plugged in	●	For the escalators with model of 24A for cascade chain (with cascade moving distance of 39mm/tooth)

- When No.3-4 jumper pins are set for moving sidewalks, No.1-2 jumper pins are set for selecting cascade pedal width, they are set as follows:

No.1-2 jumper pins	Short connection cap unplugged	○	For moving sidewalks with cascade pedal width of 133mm
	Short connection cap plugged in	●	For moving sidewalks with cascade pedal width of 266mm

Mode selection function: Working modes can be switched by the mode selection pin.

- ① When the mode selection pin (integrated logic signal) has received 10 pulses with frequency of 1HZ continuously, it gets into maintenance mode under which handrail protection, band-type brake protection and cascade missing protection will be shielded.
- ② When the escalator is in halted state and the mode selection pin (integrated logic signals) is connected for 2 ~ 10s, then keep it disconnected for over 0.5s, then reset. The fault status will be removed after it is reset.
- ③ When the signals received by the mode selection pin (integrated logic signals) do not meet above two states, the system will get into automatic mode under which all safety functions and diagnostic functions will be implemented.

If it is reset after a fault occurred in the escalator, the FLASH will save a no-fault state after reset.

6 Electrical Maintenance Instructions

6.1 Escalator Routine Maintenance

In order to ensure that the escalator can run normally and improve its service life, services and periodic maintenance must be carried out for the escalator. Therefore, the following recommendations are offered to users:

- Daily maintenance must be carried out at least once every day.
 - 1) Clean at least once every day. Foreign materials got into cascade pedals and kick plate slots must be cleared out;
 - 2) The handrail, the tempered glass or other prominent positions are cleaned of dirt;
 - 3) Check escalator appearance. If any damage is found, measures should be taken for timely treatment;
 - 4) Observe and diagnose whether there is any abnormal phenomenon or sound when the escalator is turning every time it starts;
 - 5) Special persons must be assigned to establish escalator operating records for a purpose of shift changes and future reference.
- Inspection and adjustment must be carried out once in three months after it is put into operation;
 - 1) Carry out regular inspection and adjustment for safety switches;
 - 2) Carry out periodical dedusting and maintenance for the control panel and relevant electrical contacts inside;

3) Carry out reliability inspection for grounding terminals and periodic inspection for static brushes.

- Clean and arrange upper and lower engine rooms once for every half month of operation;
- Check whether there is lubricating oil in the lubricating oil pump and refuel the pump periodically for every month of operation;

If a self-oil feeder is applied, the PC will accumulate working hours automatically based on the running time of the escalator. Automatic oiling will be carried out once when the accumulated time (lubrication interval) is up to 24 hours. Manual button oiling can also be carried out according to maintenance demand. Users can add lubricating oil to the oil tank according to escalator application conditions.

- Carry out an overhaul for every 12 to 18 months of operation;

The overhaul should be a complete overhaul to the equipment according to the plan. The equipment after the overhaul should meet technical requirements on new equipment when leaving the factory. In case some items cannot meet the requirement as they are used too long, under the precondition of keeping safe operation, the requirement may be relaxed but the maintenance work shall not be ignored and the escalator cannot be used as a makeshift escalator.

Safety and preventive measures during the maintenance work:

- 1) Prepare the maintenance site and clear out sundries to guarantee a clear work passage for the maintenance personnel;
- 2) Set safety fences and warning signs of "Escalator Under Maintenance" around the maintenance site;
- 3) Before the maintenance is carried out, turn off the master electrical switch and hang a warning sign of "Under Maintenance" on the master switch. To guarantee safety, the master electrical switch should be locked;
- 4) The escalator must not be rotated manually except for the turning wheel;
- 5) Carry out careful inspection after the inspection work is over. Tools or other objects shall not be left in the escalator. In particular, pay more attention to the places between parts with relative movement.

6.2 Simple Maintenance Method

(1) The escalator cannot be started and run: first inspect if various supply voltages are normal. If so, carry out the following inspections: start the escalator with normal operation, after the start-up operation is completed (or the start-up key is released), the bell will ring once, then it indicates that the last fault is self-locking for fault caused by cascade speed detection fault. If the bell rings twice, it indicates that the last fault is self-locking for fault caused by reverse running fault. Then trouble shooting operation can be carried out and check the corresponding escalator speed circuit. If it still cannot be started, carry out the following inspection.

(2) 0005 of PLC input point should be ON, otherwise check the safety circuit (check the fault code table and the functional safety board fault code).

(3) 0003 of PLC input point under non-maintenance state should be ON, otherwise check the maintenance circuit.

(4) 0004 of PLC input point should be ON, otherwise check whether various contactors are reset and whether the detection circuit is normal.

(5) If the above circuits are normal, send up (down) start signals and check whether 0001 (002) of PLC input point is ON, otherwise check the start-up circuit.

(6) If items (1)-(5) are normal and the escalator still cannot be started, turn off power and reset. After it is reset if it can be started, the malfunction of not starting is caused by the contactor adhesion protection or band-type brake response protection; if it still cannot be started, carry out the following inspection.

① Cancel self-locking protection for cascade overspeed, anti- reverse running, missing, handrail under-speed and band-type brake fault, then start the escalator. If it can be started, then the fault is caused by cascade overspeed, anti-reverse running, missing, handrail under-speed and band-type brake fault protection; if it still cannot be started, please check the wiring in accordance with the drawings.

② If smart photoelectricity is deployed in the escalator or sidewalk but there is no smart functions, carry out the following inspection: ensure that there is no signal getting into the photoelectricity without a cover of any object.

(7) Refer to *KLE-MSU-01A Functional Safety Device User Manual* to solve cascade overspeed,

handrail under-speed, cascade missing, cascade reverse running, band-type brake monitoring problems specifically.

Danger: Any personnel without professional training are strictly prohibited from carrying out maintenance to the escalator; Unskilled electrician or non-electrical workers are strictly prohibited from operating to avoid damage and personal injury.

7 Table of Control System Components

Code	Name	Model specification	Qty	Mounting position
KMU	Up contactor	AC110V Fuji or Schneider	1	Upper control box
KMD	Down contactor	AC110V Fuji or Schneider	1	Upper control box
KMS	Star start-up contactor	AC110V Fuji or Schneider	1	Upper control box
KC1	Main circuit contactor	AC110V Fuji or Schneider	1	Upper control box
KMT	Triangle start-up contactor	AC110V Fuji or Schneider	1	Upper control box
KPH	Phase sequence relay	STEP-SW11	1	Upper control box
FRT	Motor thermo-relay	3UA59/40A-2E	1	Upper control box
FU1-FU6	Fuse	4A、10A	6	Upper control box
XSZ-U	Three-pole flat socket	S2006/2A	1	Upper control box
XSZ-D	Three-pole flat socket	S2006/2A	1	Lower control box
XS-B	Fault display board	XS-B	1	Upper control box
PC	PLC	Omron CPM1E-20/30/40	1	Upper control box
QS1	Main power switch	JFD11-40 (LS-32)	1	Upper control box
KC	Safety circuit contactor	Fuji or Schneider	1	Upper control box
TC1	Operating transformer	BK-200 output 110/8V, input 380V	1	Upper control box
MT	AC motor	AC380 three-phase	1	Upper machine room
ZPQ/ZPQ1	Brake electric motor	AC220V single-phase	1	Upper machine room
KZD	Additional brake	AC220V	1	Upper machine room
XPI	Additional plug for maintenance	WS/WP-9A	1	Socket for maintenance
JUZ	Self-oil feeder	VERSA	1	Within the metallic framework
XIB	Operating handle for maintenance	LA-4H	1	Manual inspection set
SXI-U	Socket for maintenance	BF25-8SN	1	Upper control box
SXI-D	Socket for maintenance	BF25-8SN	1	Lower control box
IU	Upper box emergency stop button	LAY37/PBC-CR01	1	Upper control box

RC1—RC6	RC absorption module	HD1.211	6	Control cabinet
SRT	Heating stop switch		1	Lower apron board
SRQ	Heating start switch		1	Lower apron board
KJR	Heating contactor	LC1-D32F7C AC110V	1	Control cabinet
RJR1-RJR3	Heating resistor		3	Within the metallic framework
ID	Lower box emergency stop button	LAY37\PBC-CR01	1	Lower control box
DU	Upper end emergency stop button	LAY33.14	1	Upper end of the escalator
DD	Lower end emergency stop button	LAY33.14	1	Lower end of the escalator
SRST-U	Upper end key switch	LAY3-Y	1	Upper end of the escalator
SRST-D	Lower end key switch	LAY3-Y	1	Lower end of the escalator
UL	Upper cascade illumination	AC220 20W	1	Within the upper truss
DL	Lower cascade illumination	AC220 20W	1	Within the lower truss
KRD	Upper left access switch	TR231/TRA236	1	Upper left apron board
KLD	Upper right access switch	TR231/TRA236	1	Upper right apron board
KLV	Lower right access switch	TR231/TRA236	1	Lower right apron board
KRV	Lower left access switch	TR231/TRA236	1	Lower left apron board
WRU	Upper right apron board switch	Z15G-10B	1	Upper right apron board
WLU	Upper left apron board switch	Z15G-10B	1	Upper left apron board
WRD	Lower right apron board safety switch	Z15G-10B	1	Lower right apron board
WLD	Lower left apron board safety switch	Z15G-10B	1	Lower left apron board
KDD	Driving chain safety switch	Z1R236	1	Beside the driving chain
CR	Right cascade chain safety switch	Z1R236	1	Lower right cascade chain
CL	Left cascade chain safety switch	Z1R236	1	Lower left cascade chain
SLD	Upper right comb	Z1R236	1	Right side of the

	anomaly switch			upper forefront board
SRD	Upper left comb anomaly switch	Z1R236	1	Left side of the upper forefront plate
SRU	Lower right comb anomaly switch	Z1R236	1	Right side of the lower forefront plate
TU	Upper cascade caving in switch	Z1R236	1	Cascade bend-up
SLU	Lower left comb anomaly switch	Z1R236	1	Left side of the lower forefront plate
TD	Lower cascade caving in switch	Z1R236	1	Cascade kick-down
CS0/CS1	Cascade speed detection photoelectricity	Simider LJ30-Z15NK-KL	2	Truss
CS2/CS3	Handrail speed detection photoelectricity	Simider SMLJ12- Z4NK-KL	2	Handrail tightening place
CS4/CS5	Upper / lower access photoelectricity	Simider SXSA50- R2ZNK-KL	2	Access
CS6/CS7	Upper / lower access photoelectricity	ELS263	2	Entrance apron board
CS8	Main engine speed detection photoelectricity	Simider SMLJ12- Z4NK-KL	1	Below the flywheel of the main engine
CQ1/CQ3	Upper / lower cascade missing photoelectricity	Simider XS18- T4ZNH-KL	2	Cascade turning end
TPB	Stabilized voltage supply	NES-35-24	1	
SU	Maintenance box upward button			
SD	Maintenance box downward button			
ST	Maintenance box stop button			
SQ	Maintenance box running button			
DF	Bell	75mm-220VAC	1	Control cabinet
KQU/KQD	Upper/lower forefront plate switch	TR231	2	
KZY/KZY1	Additional brake contactor		1	Upper control cabinet
UFC-RO1	Converter fault signal		1	Upper control cabinet
UFC-RO2	Converter operation signal		1	Upper control cabinet

8 Table of Fault Code

8.1 Table of fault codes in the safety circuits (for the 8-pin maintenance connector)

Code	Name of electrical safety switch	Code
29	Driving chain safety switches of main engine	KDD、KDD1
28	Upper comb anomaly safety switches (left and right)	SRU、SLU
27	Upper access safety switches (left and right)	KRU、KLU
26	Upper right apron board or middle right apron board safety switches	WRU、WRR
25	Upper left apron board or middle left apron board safety switches	WLU、WLL
24	Upper cascade caving in, upper cascade de-bouncing, upper missing pedal safety switches, middle emergency stop (left and right)	TU、TTU、WQU、WMU、LZT、RZT
23	Lower cascade caving in, lower cascade de-bouncing, lower missing pedal safety switches	TD、TTD、WQD、WMD
22	Lower apron board safety switch (left)	WLD
21	Lower apron board safety switch (right)	WRD
19	Lower access safety switches (left and right)	KLD、KRD
18	Lower comb anomaly safety switches (left and right)	SLD、SRD
17	Lower cascade chain safety switch (right)	CR
16	Lower cascade chain safety switch (left)	CL
14	Motor thermal protection, phase sequence, fire control anomaly	KPH、FRT、KXF
13	Upper additional plug, upper box or upper emergency stop actuating, upper forefront board opening	SXI-U、IU、DU、KQU
12	Lower additional plug, lower box or lower emergency stop actuating, lower forefront board opening	SXI-D、ID、DD、KQD

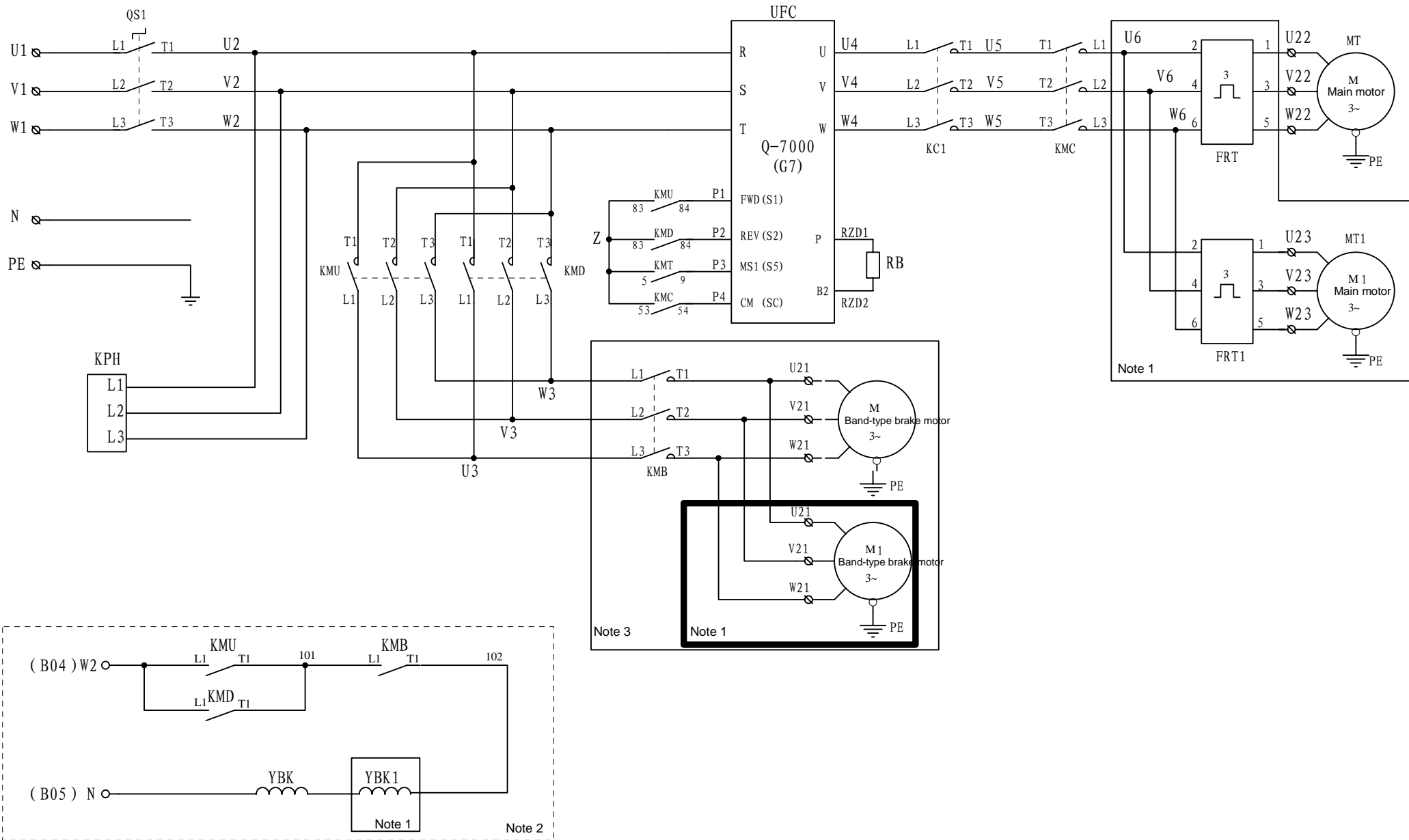
8.2 Table of Fault Codes of the Functional Safety Board

LED display	Fault description
0	Fault free
1	Inconsistent running signals
2	Cascade missing photoelectricity or main engine speed detection photoelectricity malfunction
3	Handrail photoelectricity fault
4	Cascade speed detection photoelectricity malfunction
5	Incapable of detecting the running direction
6	Band-type brake switch fault
7	Handrail speed too low malfunction
8	Cascade missing
9	1.2 times overspeed
A	Cross short circuit fault
B	Safety relay fault
C	Dual channel comparison fault
D	1.4 times overspeed
E	Cascade reverse running

Note: Only faults with codes of 6, 7, 8, 9, D and E can be saved after power off. They can be only cancelled through fault reset.

9 Electrical schematic diagrams and wiring diagrams

The diagrams are as follows



Note 1: Add the main engine when using dual drives

Note 2: It is required that the brake motor with AC220V should be connected with W1/N, and the brake motor with AC110V should be connected with B04/B05.

设计		单位	康力电梯股份有限公司	
工艺		标准化	图名	Power line
校对		审定	图号	D10C704.V1.0
审核		日期	页号	1/14

1

2

3

4

D

D

C

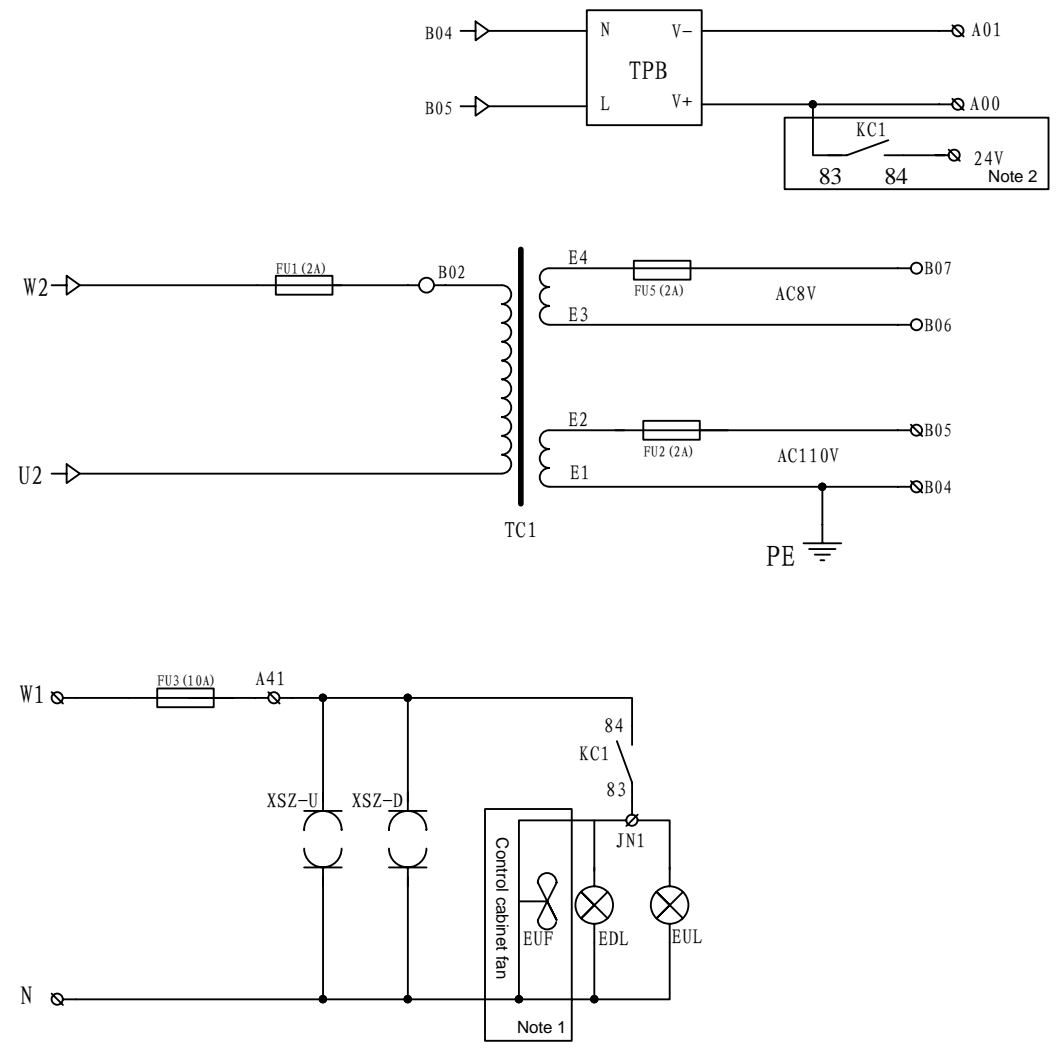
C

B

B

A

A



Note 1: Control cabinet fan is used for waterproof type escalator.
 Note 2: Connect this switch if it is equipped with comb lighting lamp.

设计		单位	康力电梯股份有限公司	
工艺		标准化	图名	Control PS and lighting PS
校对		审定	图号	D10C704.V1.0
审核		日期	页号	2 / 14

1

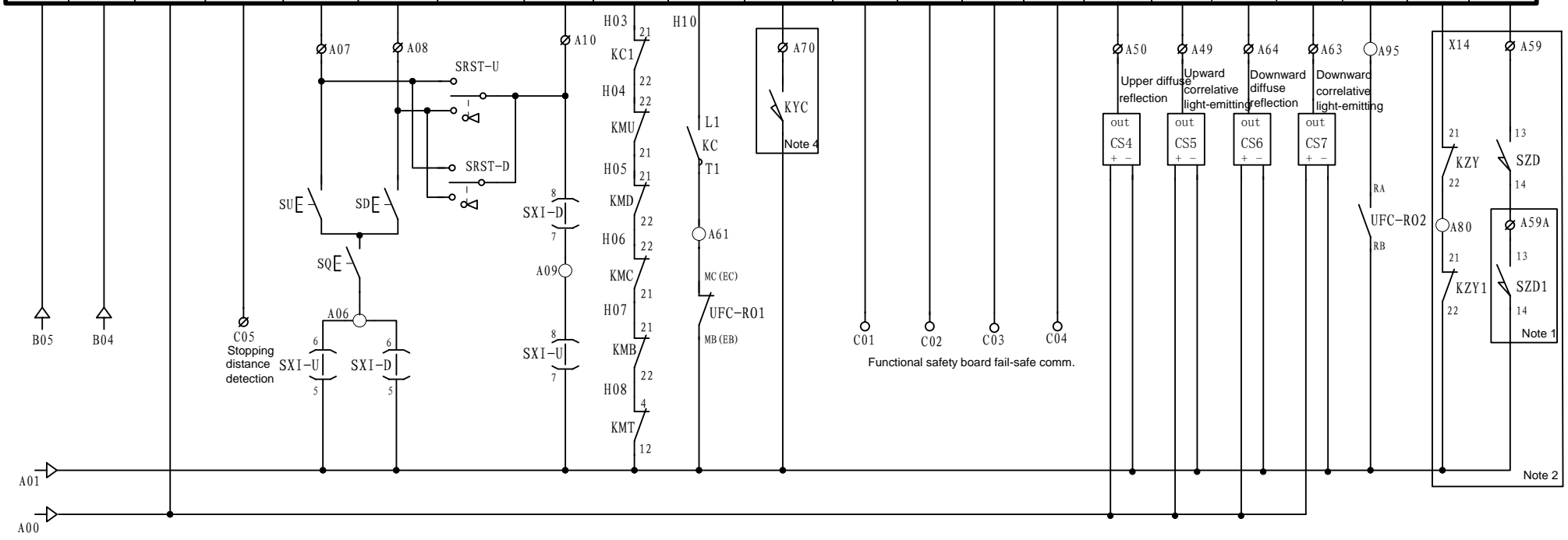
2

3

4

OMRON (CP1E-E20DR/E30DR/E40DR)

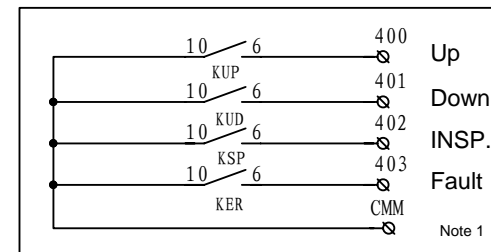
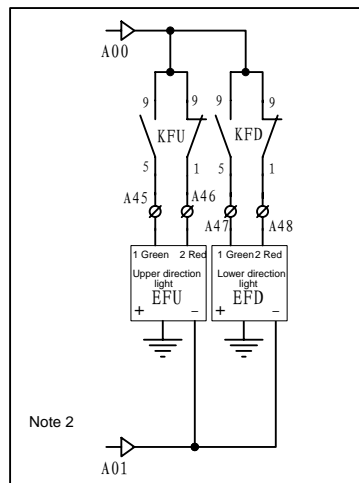
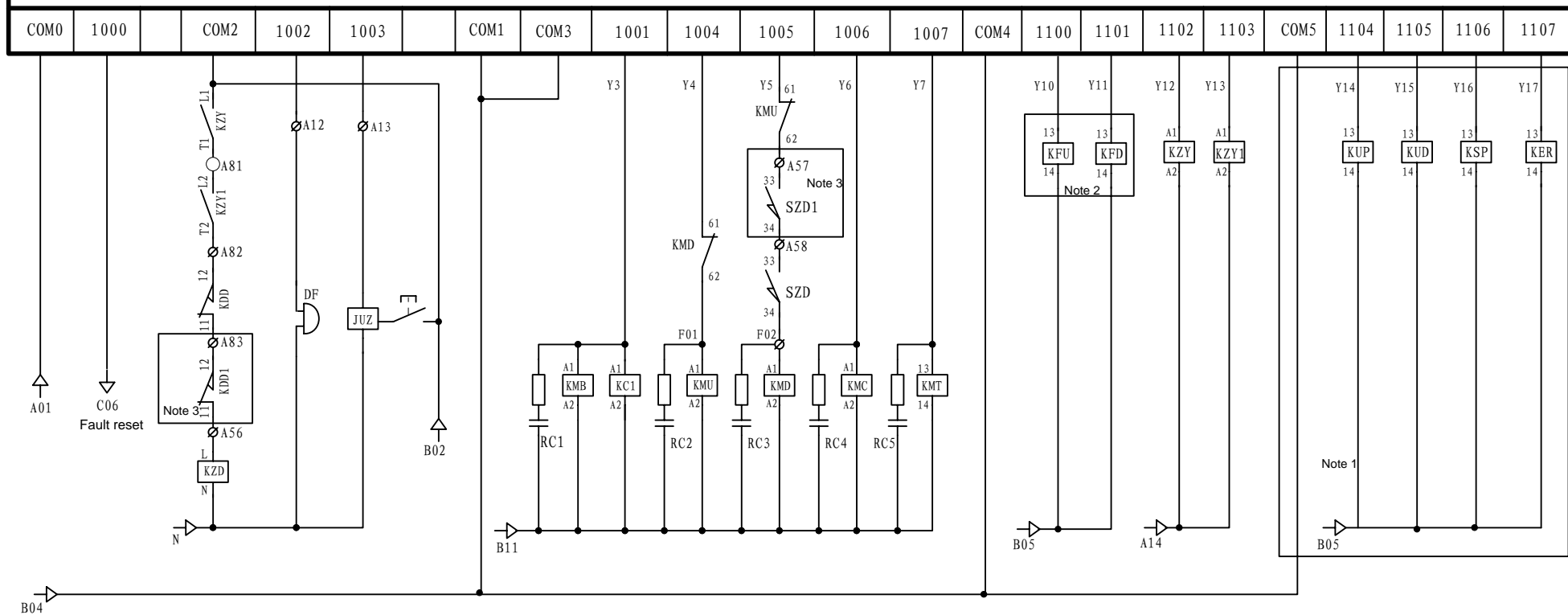
L	N	COM0	0000	0001	0002		0003	0004	0005	0006	0007	0008	0009	0010	0011	0100	0101	0102	0103	0104	0105
---	---	------	------	------	------	--	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------



- Note 1: Used for dual drives.
- Note 2: It is used when equipped with additional brake.
- Note 3: It is used when equipped with middle braking main engine.
- Note 4: Water level detection switch, optional and not connected when it is not used.

设计		单位	康力电梯股份有限公司	
工艺		标准化	图名	PLC input
校对		审定	图号	D10C704.V1.0
审核		日期	页号	3 / 14

OMRON (CP1E-E20DR/E30DR/E40DR)

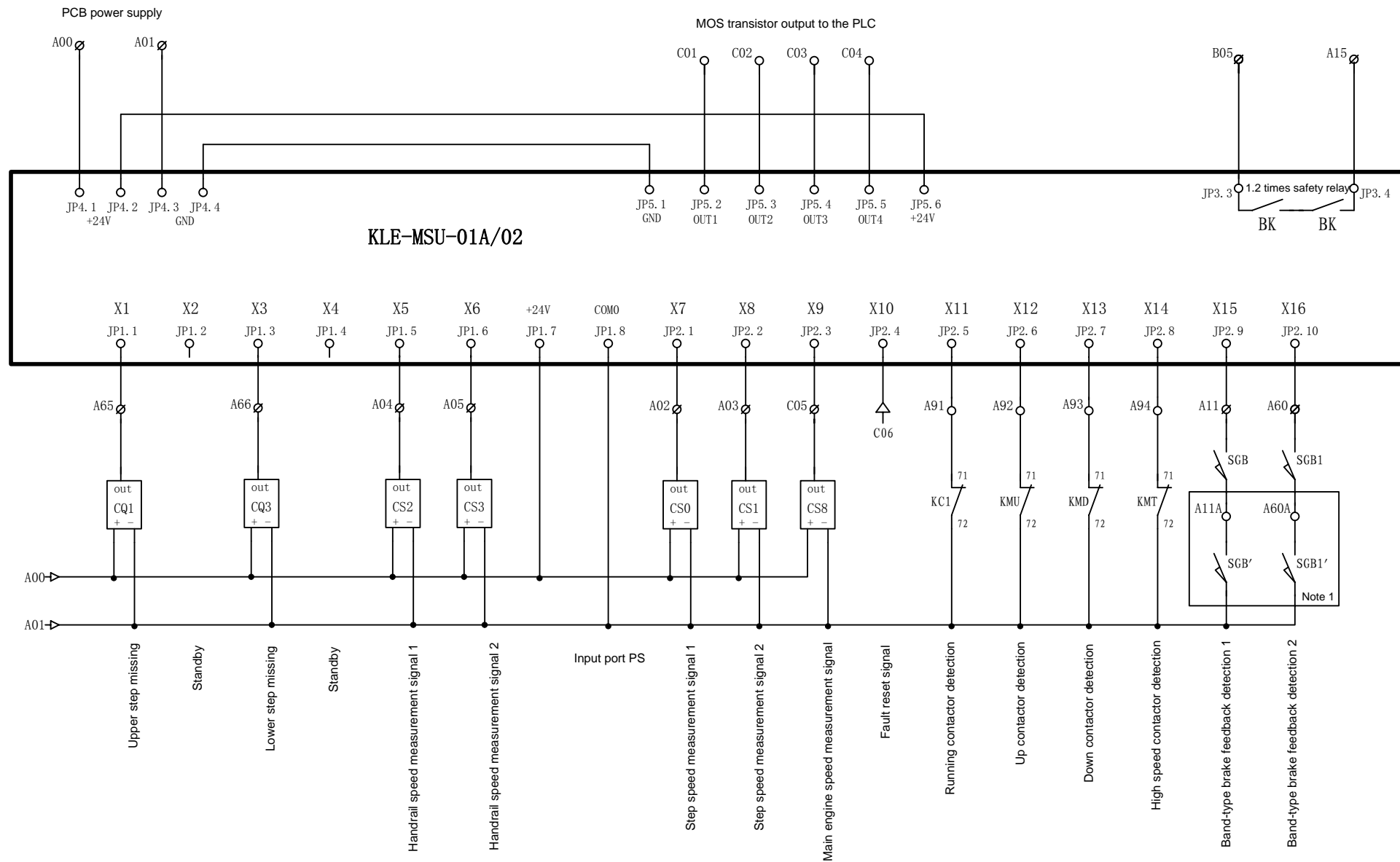


Note 1: Optional operation of monitoring function.

Note 2: It is connected when equipped with operation direction lights.

Note 3: Used in for dual drives, Short connection for not-used signal for single drive.

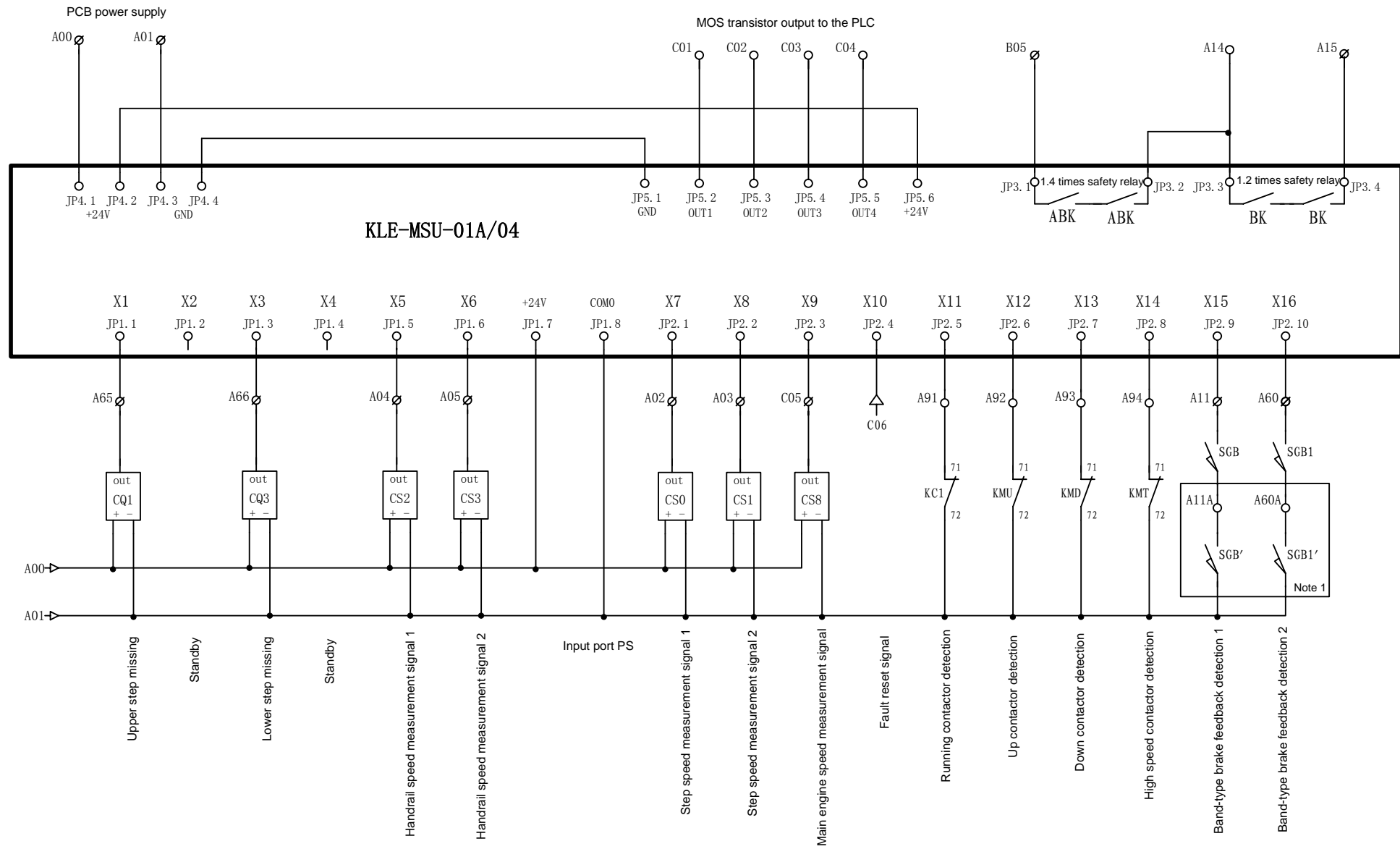
设计		单位	康力电梯股份有限公司	
工艺		标准化	图名	PLC output
校对		审定	图号	D10C704.V1.0
审核		日期	页号	4 / 14



Note: This diagram is used without additional brake;

Note 1: Connect a switch to A11 / A60 respectively when it is equipped with a middle brake type main engine single drive and connect 2 switches to 1 signal point in the same main engine in case of dual drives.

设计		单位	康力电梯股份有限公司	
工艺		标准化	图名	Functional safety board
校对		审定	图号	D10C704.V1.0
审核		日期	页号	5 / 14-1

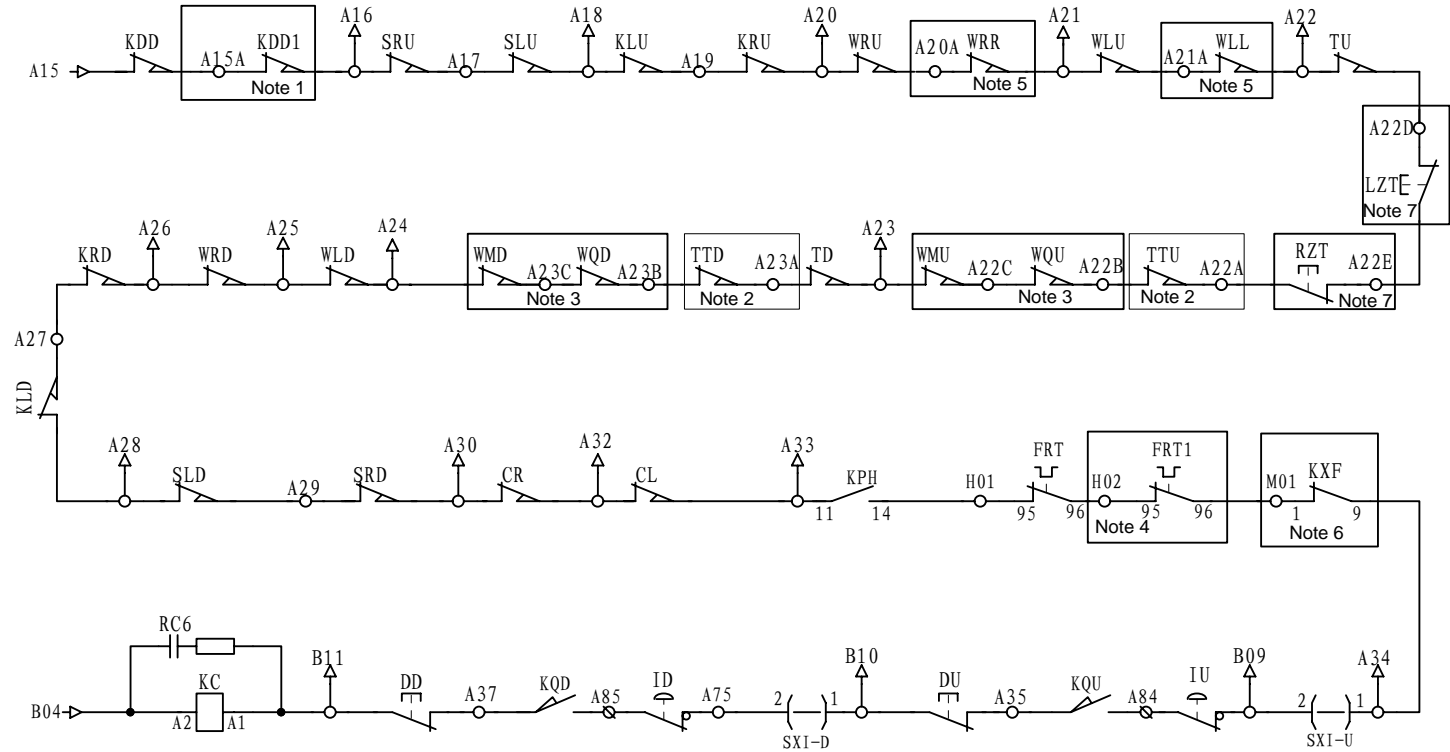


Note: This diagram is used without additional brake;

Note 1: Connect a switch to A11 / A60 respectively when it is equipped with a middle brake type main engine single drive and connect 2 switches to 1 signal point in the same main engine in case of dual drives.

设计		单位	康力电梯股份有限公司	
工艺		标准化	图名	Functional safety board
校对		审定	图号	D10C704.V1.0
审核		日期	页号	5 / 14 - 2

No.	Safety switch name	SW code	Fault Code
1	Main engine driving chain	KDD	29
2	Dual drive main engine driving chain	KDD1	29
3	Additional brake response SW	SZD	29
4	Upper left and right combs	SLU、SRU	28
5	Upper left and right handrail access	KLU、KRU	27
6	Upper right apron board	WRU	26
7	Middle right apron board	WRR	26
8	Upper left apron board	WLU	25
9	Middle left apron board	WLL	25
10	Upper step caving in	TU	24
11	Middle emergency stop	LZT、RZT	24
12	Upper step de-bouncing SW	TTU	24
13	Upper missing pedal SW	WQU、WMU	24
14	Lower step caving in	TD	23
15	Lower step de-bouncing SW	TTD	23
16	Lower missing pedal SW	WQD、WMD	23
17	Lower left apron board	WLD	22
18	Lower right apron board	WRD	21
19	Lower left and right access	KLD、KRD	19
20	Lower left and right combs	SLD、SRD	18
21	Lower right cascade chain	CR	17
22	Lower left cascade chain	CL	16
23	Phase sequence protection	KPH	14
24	Thermal protection	FRT、FRT1	14
25	Fire control relay	KXF	14
26	Upper additional plug	SXI-U	13
27	Upper box emergency stop	IU	13
28	Upper emergency stop, upper forefront board opening	DU、KQU	13
29	Lower additional plug	SXI-D	12
30	Lower box emergency stop	ID	12
31	Lower emergency stop, lower forefront board opening	DD、KQD	12
32			
33			



Note: This diagram corresponds to being used for the eight-pin inspection joints.

Note 1: For single drive, use KDD switch, A15A and A16 line No. are short-connected.

For dual drives, use switches KDD and KDD1.

Note 2: For step de-bouncing switch, it is short-connected when not using this switch.

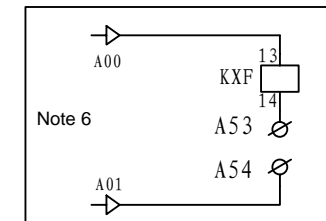
Note 3: The sidewalk is installed with a missing pedal switch for preventing pedal from loosening, it is short-connected when not using this switch.

Note 4: Used for dual drives; if not, M01 and H01 are short-connected.

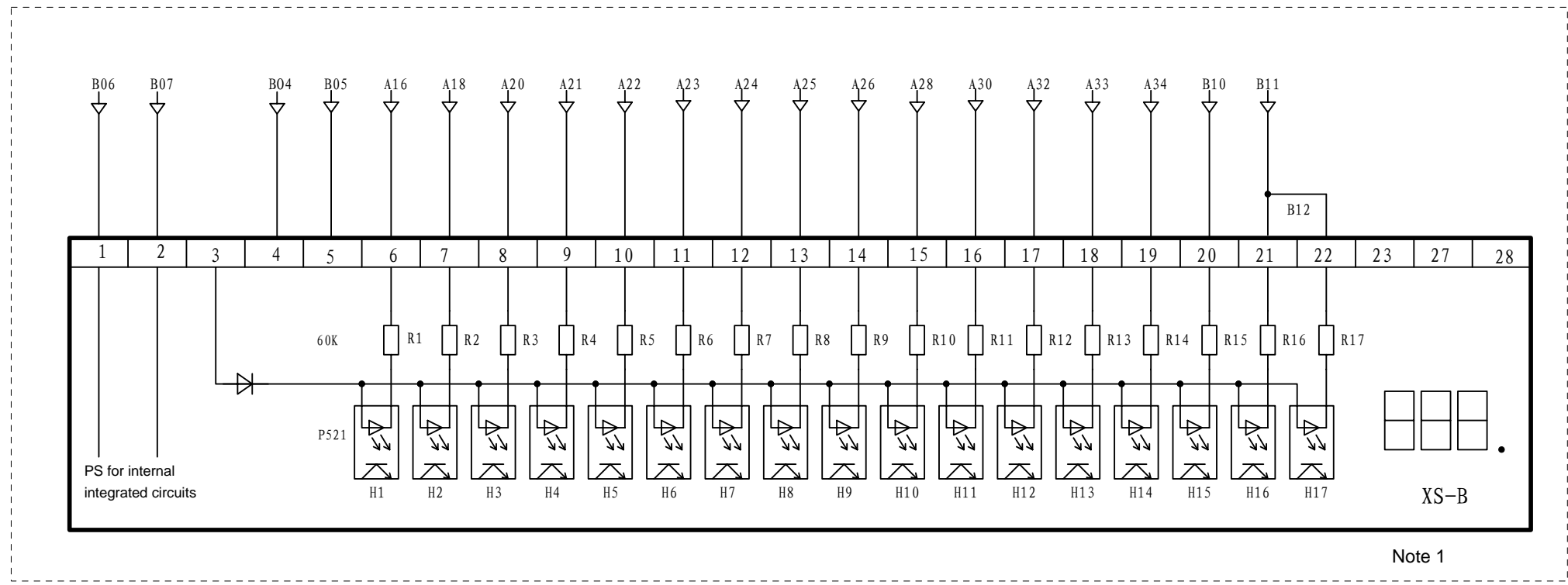
Note 5: For the middle apron board switch, it is short-connected when not equipped.

Note 6: NO fire control signals are provided to the fire control relays, A53 and A54 externally, so that fire control will functions, the escalator will stop. Without fire control function, contents of Note 2 shall be canceled, B10 and M01 line No. are short-connected.

Note 7: For the middle emergency stop switch, it is short-connected when not using this switch.



设计	单位	康力电梯股份有限公司		
工艺	标准化	图名	Safety Circuit	
校对	审定	图号	D10C704.V1.0	
审核	日期	页号	6/14-1	

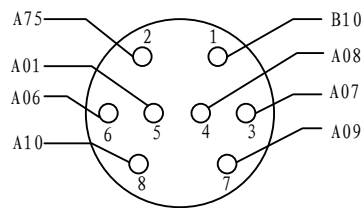


Note: This diagram corresponds to being used for the eight-pin inspection joints

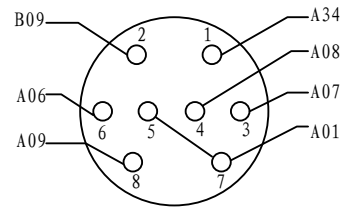
Note 1: This diagram is added if equipped with a fault display panel.

设计		单位	康力电梯股份有限公司	
工艺		标准化	图名	Fault display panel with memory
校对		审定	图号	D10C704.V1.0
审核		日期	页号	7/14-1

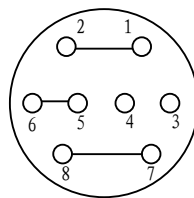
SXI-D Inspection socket



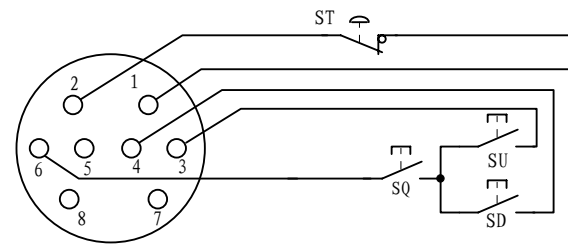
SXI-U Inspection socket



XPI-U Additional plug
XPI-D



XIB plug



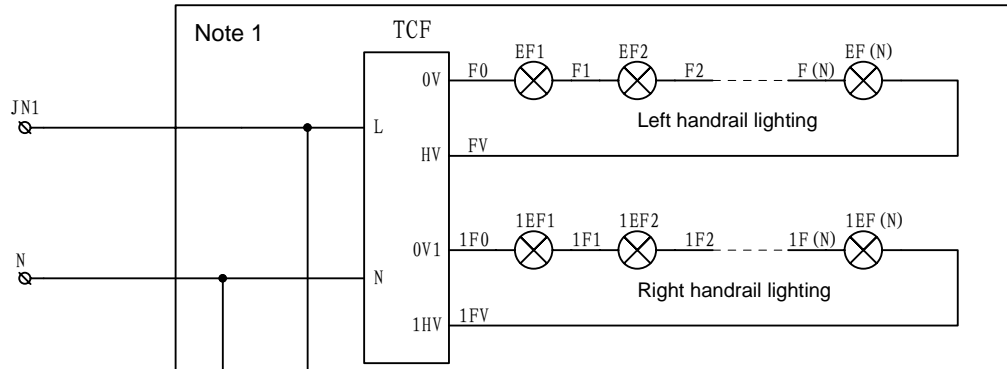
XIB inspection operating handle

Description:

1. In case of inspection operation, when the handle is inserted into the control box of upper machine room, the additional plug on the inspection socket in the lower machine room should not be un-plugged. When the handle is inserted into the control box of lower machine room, the additional plug on the inspection socket in the upper machine room should not be un-plugged, otherwise the motor cannot be started.
2. During normal running, additional plugs on upper and lower inspection sockets must be plugged in, if any additional plug for maintenance is un-plugged, the system will be turned into inspection status automatically.

Note: This diagram corresponds to being used for the eight-pin maintenance joints.

设计		单位	康力电梯股份有限公司	
工艺		标准化	图名	Inspection joint
校对		审定	图号	D10C704.V1.0
审核		日期	页号	8 / 14-1

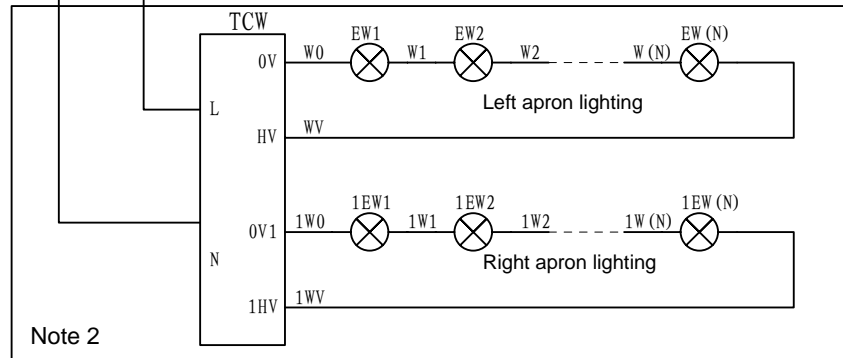


Note 1

TCF

Left handrail lighting

Right handrail lighting

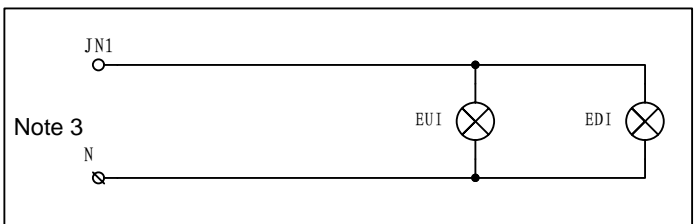


Note 2

TCW

Left apron lighting

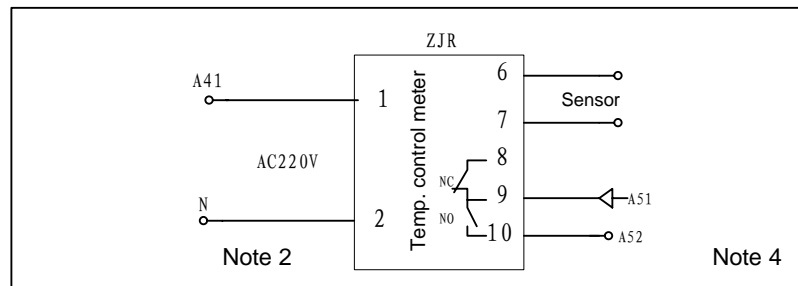
Right apron lighting



Note 3

EUI

EDI

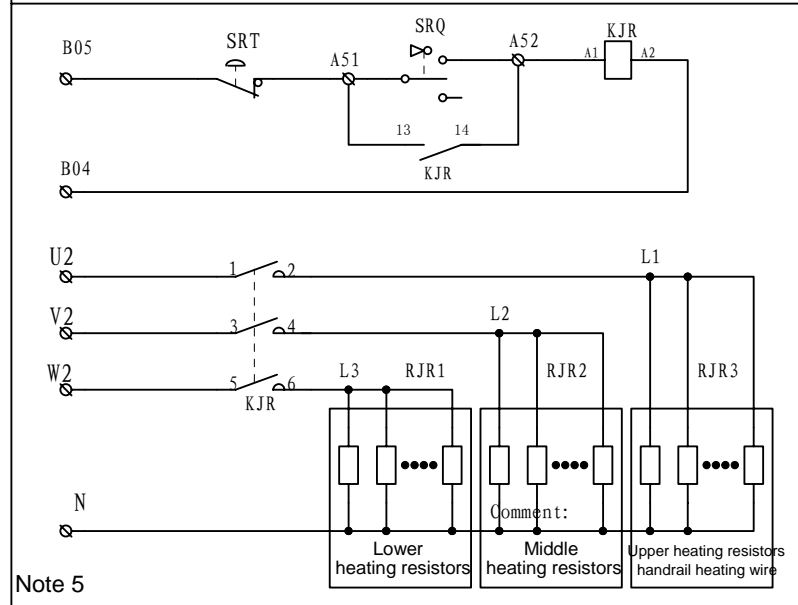


Note 2

ZJR

Temp. control meter

Note 4



Note 5

Comment:

Lower heating resistors Middle heating resistors Upper heating resistors handrail heating wire

Description:

Note 1: They are cold cathode handrail lamps. The left and right handrail lamps are connected in series respectively to the TCF cold cathode illumination boost installation.

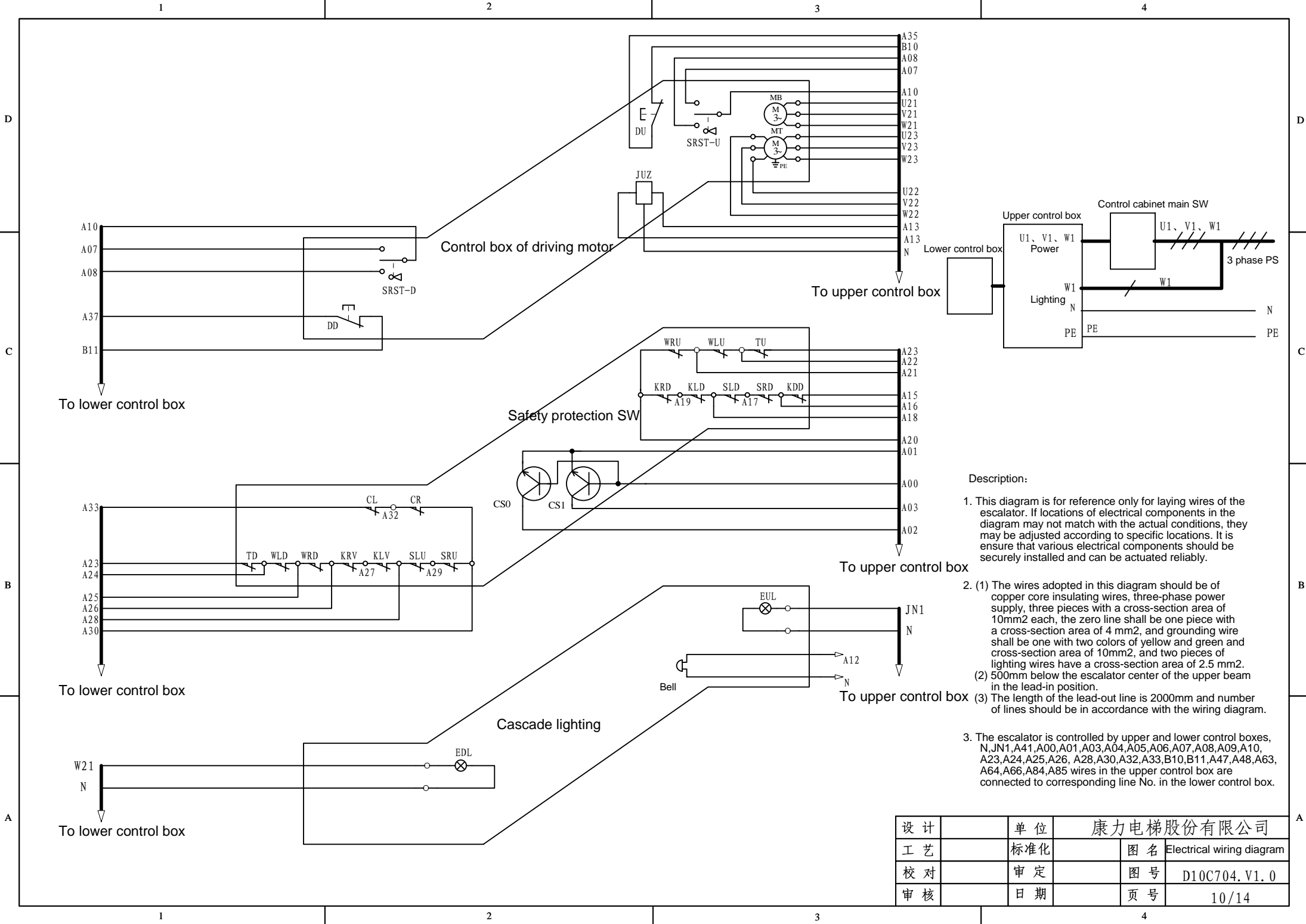
Note 2: They are cold cathode apron board lamps. The left and right apron board lamps are series connected respectively to the TCW cold cathode illumination boost installation.

Note 3: Comb lamps are installed on the apron board of the entrance. AC220 lamps are set at upper, lower, left and right respectively.

Note 4: It is waterproof type escalator automatic heating device.

Note 5: It is waterproof type escalator heating device. The heating start-up and stop switches are installed on the apron board at opposite side of the upper emergency stop switch.

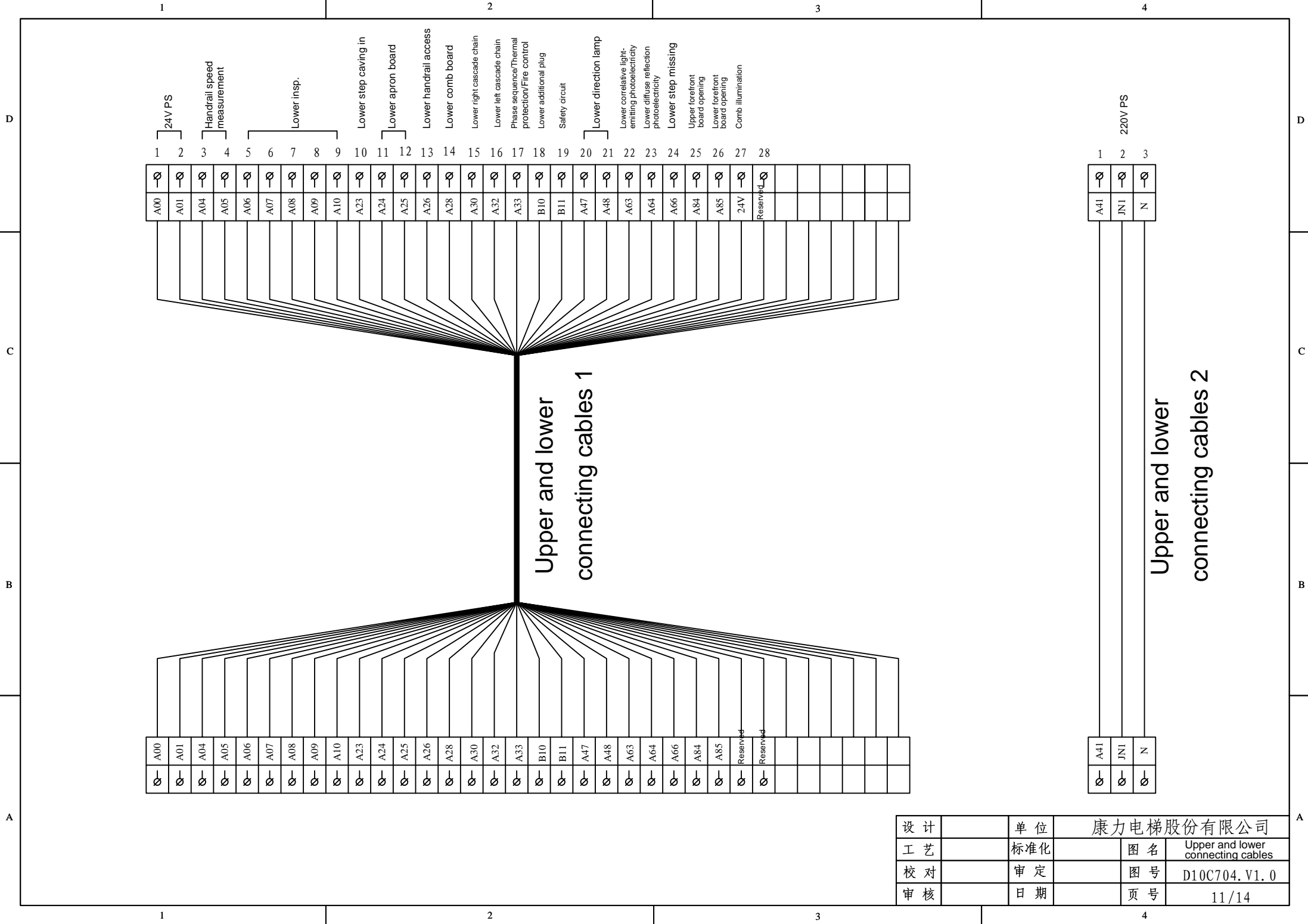
设计		单位	康力电梯股份有限公司	
工艺		标准化	图名	Optional Lighting and Heating
校对		审定	图号	D10C704.V1.0
审核		日期	页号	9 / 14



Description:

- This diagram is for reference only for laying wires of the escalator. If locations of electrical components in the diagram may not match with the actual conditions, they may be adjusted according to specific locations. It is ensured that various electrical components should be securely installed and can be actuated reliably.
- (1) The wires adopted in this diagram should be of copper core insulating wires, three-phase power supply, three pieces with a cross-section area of 10mm² each, the zero line shall be one piece with a cross-section area of 4 mm², and grounding wire shall be one with two colors of yellow and green and cross-section area of 10mm², and two pieces of lighting wires have a cross-section area of 2.5 mm².
 (2) 500mm below the escalator center of the upper beam in the lead-in position.
 (3) The length of the lead-out line is 2000mm and number of lines should be in accordance with the wiring diagram.
- The escalator is controlled by upper and lower control boxes, N, JN1, A41, A00, A01, A03, A04, A05, A06, A07, A08, A09, A10, A23, A24, A25, A26, A28, A30, A32, A33, B10, B11, A47, A48, A63, A64, A66, A84, A85 wires in the upper control box are connected to corresponding line No. in the lower control box.

设计		单位	康力电梯股份有限公司	
工艺		标准化	图名	Electrical wiring diagram
校对		审定	图号	D10C704.V1.0
审核		日期	页号	10/14



Upper and lower connecting cables 1

Upper and lower connecting cables 2

设计		单位	康力电梯股份有限公司	
工艺		标准化	图名	Upper and lower connecting cables
校对		审定	图号	D10C704.V1.0
审核		日期	页号	11/14

Display	Fault name	PLC0009	PLC0008	PLC0007	Remarks
0	Fault-free	1	1	1	
1	Inconsistent running signals	0	1	0	Running signal is inconsistent with the up and down running signals
2	Fault on step missing photoelectricity or main engine speed measurement photoelectricity	0	0	1	There is pulse when it is not running or there is no pulse when it is running or speeds are apparently inconsistent.
3	Fault on handrail speed measurement photoelectricity	0	0	1	There is pulse when it is not running or there is no pulse when it is running or speeds are apparently inconsistent.
4	Fault on step speed measurement photoelectricity	0	0	1	There is pulse when it is not running or there is no pulse when it is running or speeds are apparently inconsistent.
5	Fault of unable to detect the running direction	0	0	1	
6	Fault on band-type brake switch	0	0	0	
7	Fault on the too low handrail speed	1	0	1	
8	Fault on step missing	1	1	0	
9	1.2 times overspeed fault	0	1	1	
A	Cross short circuit fault	0	0	1	Input signals are short-connected or broken line
B	Safety relay fault	0	0	1	Safety relay or its drive circuit fault
C	Dual channel comparison fault	0	0	1	Internal failure of the PCB board
D	1.4 times overspeed fault	0	1	1	Simultaneous action of working and additional brakes
E	Step reverse running fault	1	0	0	Simultaneous action of working and additional brakes
F	Standby				

Note: When PLC input point is "1", the LED lamp is on; when "0", the LED lamp is off; in which "6, 7, 8, 9, D, E" faults are for power loss data storage.

设计		单位	康力电梯股份有限公司	
工艺		标准化	图名	Functional safety board fault code
校对		审定	图号	D10C704.V1.0
审核		日期	页号	12/14

No.	Comp. Code	Name	Model specification	Mounting position
1	TC1	Operating transformer	BK200 (380\TDB-200-33)	Upper control cabinet
2	QS1	Main PS SW	JFD11-40	Upper control cabinet
3	KPH	Phase sequence relay	STEP SW-11	Upper control cabinet
4	KMU	Up contactor	Schneider/Fuji	Upper control cabinet
5	KMD	Down contactor	Schneider/Fuji	Upper control cabinet
6	KMS	Star contactor	Schneider/Fuji	Upper control cabinet
7	KMT	Delta contactor	Schneider/Fuji	Upper control cabinet
8	KC1	Running contactor	Schneider/Fuji	Upper control cabinet
9	KC	Safety circuit contactor	Schneider/Fuji	Upper control cabinet
10	FRT、FRT1	Thermal protection for motor	Siemens 3UA59/40A-2E	Upper control cabinet
11	PLC	Program controller	CP1E-20/30/40DR	Upper control cabinet
12	FU1-FU5	Fuse	RT28-4A/10A	Upper and lower control cabinet
13	KZY、KZY1	Additional braking contactor	MY4N AC110V	Upper control cabinet
14	XSZ-D	Three-pole flat socket	AC30-3*10A	Lower control cabinet
15	XSZ-U	Three-pole flat socket	AC30-3*10A	Upper control cabinet
16	SXI-U	Inspection socket	BF25-8SN	Upper control cabinet
17	SXI-D	Inspection socket	BF25-8SN	Lower control cabinet
18	SPI-U	Inspection additional plug	BF25-8PH	Upper control cabinet
19	SPI-D	Inspection additional plug	DF20-9A	Lower control cabinet
20	IU	Upper box emergency stop button	PCB-CR11	Upper control cabinet
21	ID	Lower box emergency stop button	PCB-CR11	Lower control cabinet
22	XS-B	Fault display panel	XS-B	Upper control cabinet
23	DF	Bell	75mm-220VAC	Upper control cabinet
24	TPB	Stabilized PS	NES-35-24	Upper control cabinet
25	RC1-RC7	Arc extinguisher	K/K15/G K/K5/G	Upper control cabinet
26	SGB、SGB'	Brake response SW	ZS236-11-10001-A	Escalator or sidewalk
27	SGB1、SGB1'	Brake response SW	ZS236-11-10001-A	Escalator or sidewalk
28	KQU	Upper forefront board SW	Nantong Qimeng TR231	Escalator or sidewalk
29	KQD	Lower forefront board SW	Nantong Qimeng TR231	Escalator or sidewalk
30	KFU	Upper direction light relay	OMRON MY4N-J-AC110V	Escalator or sidewalk
31	KFD	Lower direction light relay	OMRON MY4N-J-AC110V	Escalator or sidewalk

No.	Comp. Code	Name	Model specification	Mounting position
32	KXF	Fire control relay	MY4NJ-DC24V	Upper control cabinet
33	KJR	Thermal relay	Schneider/Fuji	Upper control cabinet
34	PE	Ground row	120\16x2+4x6	Upper control cabinet
35	KCR	Water level detection relay	FKB-150-1A	Upper control cabinet
36	DDZ	Connecting terminal		Upper control cabinet
37	XDZ	Connecting terminal		Upper and lower control cabinet
38	M	Brake	3-phase AC380	Escalator or sidewalk
39	M1	Brake	3-phase AC380	Escalator or sidewalk
40	MT	Traction machine	3-phase AC380	Escalator or sidewalk
41	MT1	Traction machine	3-phase AC380	Escalator or sidewalk
42	YBK	Brake		Escalator or sidewalk
43	YBK1	Brake		Escalator or sidewalk
44	JUZ	Refueling device	VERSA	Escalator or sidewalk
45	XIB	Insp. operating handle	JX-04	Escalator or sidewalk
46	DU	Upper end emergency stop button	LAY33.14	Escalator or sidewalk
47	DD	Lower end emergency stop button	LAY33.14	Escalator or sidewalk
48	SRST-U	Upper end key switch	LAY3-Y	Escalator or sidewalk
49	SRST-D	Lower end key switch	LAY3-Y	Escalator or sidewalk
50	EUL、EDL	Upper and lower step illumination	IP21-220V-20W	Escalator or sidewalk
51	CS8	Main engine speed measurement photoelectricity	Simider SMLJ12-Z4NK-KL	Escalator or sidewalk
52	CQ1	Upper step missing photoelectricity	Simider XS18-T4ZNH-KL	Escalator or sidewalk
53	CQ3	Lower step missing photoelectricity	Simider XS18-T4ZNH-KL	Escalator or sidewalk
54	CS0、CS1	Step speed measurement photoelectricity	Simider LJ30-Z15NK-KL	Escalator or sidewalk
55	CS2、CS3	Handrail speed measurement photoelectricity	Simider SMLJ12-Z4NK-KL	Escalator or sidewalk
56	CS4、CS5	Upper access photoelectricity	Simider SXSA50-R2ZNK-KL	Escalator or sidewalk
57	CS6、CS7	Lower access photoelectricity	Simider SXSA50-R2ZNK-KL	
58	SU	Inspection box upward button	PCB-CR01	Escalator or sidewalk
59	SD	Inspection box downward button	PCB-CR01	Escalator or sidewalk
60	SQ	Inspection box running button	PCB-CR01	Escalator or sidewalk
61	ST	Inspection box emergency stop button	PCB-CR11	Escalator or sidewalk
62	EFU、EFD	Upper and lower direction light	SFT-ZSQ	Escalator or sidewalk

设计		单位	康力电梯股份有限公司	
工艺		标准化	图名	Details of components
校对		审定	图号	D10C704.V1.0
审核		日期	页号	13/14

