Rail communication signal and control computer interlocking training system

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1. Design scheme

The communication signal and control microcomputer interlocking training system is a simulation platform that uses the mainstream urban rail transit Siemens microcomputer interlocking signal system architecture, hardware appearance, and functions to develop a set that is completely consistent with the appearance, light display, and logical relationship of real equipment. This product integrates many functions such as hardware device recognition, disassembly and installation, board replacement, maintenance, and fault diagnosis. At the same time, it adds fault injection and script execution functions. It can quickly change the panel indicator status according to the script of the training scenario. The training supporting functions that are inconvenient to experience on real devices, such as the status of outdoor equipment, meet the maintenance and training requirements of signal workers for indoor and outdoor and vehicle-mounted signal equipment.

The system uses the basic idea of "training students' vocational skills and cultivating professional qualities" as the basic idea, and uses "teaching, learning, training, and exams" as the main line, and builds a training course system based on the work process, according to the real work scene , Real equipment and interface, real operation process to build a training site, to meet the requirements of students' training environment and work environment full simulation. It also has the following equipment and functional characteristics:

(1) The training module is designed to construct a set of computer traffic interlocking and ATS control systems for rail transit communication signals; a 1: 2 physical turnout signal system is equipped with corresponding physical signal lights, switch machines, physical appliances, track circuits, and display indicators And axle counting devices.

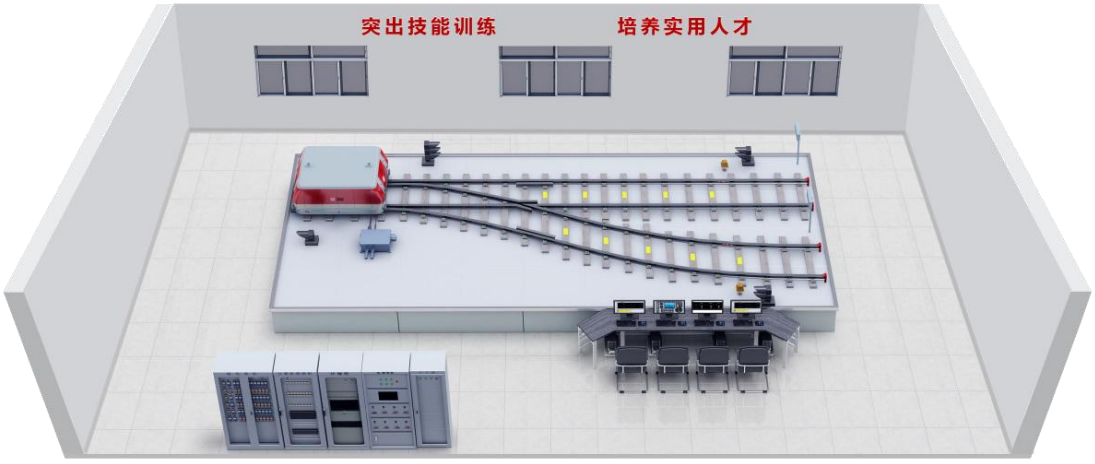
(2) It has a signal system man-machine interface, hardware equipment appearance, panel instructions, electrical and physical measurements, and provides the same operating experience as real equipment. The system provides complete signal system functions to facilitate the theoretical teaching of professional students' signal system equipment.

(3) Provide a full set of indoor and outdoor simulation equipment for the signal system, to facilitate cognitive teaching and to train the ability of signal maintenance personnel to find and handle various equipment failures, and improve the daily work level of maintenance personnel.

(4) It is convenient to inject various faults, and can simulate and superimpose faults that are difficult to reproduce by real equipment, effectively strengthening the emergency handling ability of students in abnormal situations.

(5) Support fast switching of line scenes and scripting of complex scenes, greatly improving the efficiency of teaching and training.

2，Layout



3. Equipment composition and technical parameters

3.1. Equipment composition:

(1) 1 set of No. 5 single turnout (about 8.6 meters × 4 meters × 0.5 meters);

(2) One display of short moment signal and three display of two moment signal

(3) 1 ZD6 electric switch machine;
(4) 1 computer simulation software system;
(5) 4 microcomputer interlocking computers;
(6) 1 set of relay combination cabinet;
(7) 1 set of railway power supply screen;
(8) 1 set of microcomputer interlocking simulation cabinet;
(9) 1 set of axle counter;
(10) 1 set of axle counter;
(11) 1 set of AP cabinet;
(12) 2 sets of transponders;
(13) 1 set of DCS communication network cabinet;
(14) 1 set of CBTC full simulation system software;
(15) 2 sets of advanced plastic-sprayed steel computer operation consoles (dual-connected);
(16) 4 sets of operating seats;
(17) One all-steel bogie;
(18) 1 set of switch and LAN wiring;
(19) One batch of design and construction and electrical materials.
3.2. Equipment technical parameters:
(1) No. 5 single turnout:
1) Turnout material: steel rail 25Kg / m, with wooden sleepers according to the actual proportion;
2) Turnout length: 8.6 meters, using actual ratio sleeper fasteners to fix the track;
3) Turnout ratio: the single turnout No. 5 is made according to the gauge of 1: 2;
4) Turnout composition: It is simulated and manufactured according to the real track turnout, which consists of basic rails, sharp rails, root structure, rail support, front pad removal, sliding bed plate, rear cut plate, top iron, connecting rod, tie rod, sleeper rail, buckle Components, etc., standard parts are used for the action lever, indicator lever and screws;
5) Turnout base: The base is welded with 80 × 80 square steel into a 2m × 1.07m × 0.4m three-dimensional frame structure, and 16 three-dimensional frame structures are combined into a 8.6m × 4m × 0.4m turnout base. The surface of the three-dimensional frame is Plastic spraying and anti-rust treatment. The table top is made of high-density board with a thickness of more than 15mm. The surface of the density board is laid with an overall 2 mm thick floor glue. The fire protection standard implements the national standard of the standard exhibition hall to ensure that no deformation or cracking occurs during use. The skirt is made of 2mm cold-rolled steel plate, spray-painted surface, the skirt of the base can be opened sideways for cleaning, the lower part is well sealed, the equipment is easy to maintain, and it has functions of preventing rodent and fire. The entire base is made of stainless steel.

(2) Signal:

1) 1 shunting signal (low), 1 outbound and shunting signal (low), 1 stop signal (short), using real real signal. Railway signals are instructions and orders issued to the relevant traffic and shunting operators. Signals are an important part of railway signals. The signal system of this training system can indicate the opening position of the turnout;

2) Equipment parameters:

Rated working current of LED luminous tube ... 20mA;

Light source rated input current ... 120mA;

Light source rated input voltage ... DC39.5V;

Light source rated power ..... <8w;

Light source power supply voltage adjustment range AC: 43V-52V;

Electrical fast transient pulse group anti-interference ... 3 levels;

Electrostatic discharge immunity ... Class 3;

The luminous intensity of the light source conforms to ... TB / T2353-93;

The spectrum meets ... TB2081-89;

Combined weight ... short 15Kg.

3) Basic function: One of the signal machines is controlled by the signal combination in the relay combination cabinet, and the signal lighting conditions are driven by the signal combination. It can realize the test of the primary voltage, secondary voltage and bulb terminal voltage of the signal transformer, and it can also realize the wire break experiment of the signal. The remaining two signals are equipped with a base, switch control, and are not included in the interlock.

(3) ZD6 electric switch machine:

1) One ZD6 electric switch machine, the switch machine is the actuator of the turnout control system. It is used to switch the lockout point or core rail of the turnout, and indicates the position and status of the turnout point or core rail in the interlocking area.

2) Equipment parameters:

Rated voltage DC: 160 V;

Rated conversion force: 2450 (250) N (kgf);

Action stroke: 135 ～ 185mm;

Indicating the stroke of the rod: 135 ～ 185mm;

Conversion time: ≤3.8 S;

Working current: ≤2.0A;

Anti-crushing force of action lever and main and auxiliary pins: main pin 29420 ± 1961

auxiliary pin 29420 ± 1961N;

Ground foot mounting hole: 610mm × 360mm;

Dimensions: 1100mm × 725mm × 258mm.

3)Basic functions: It has the functions of a turnout converter, a lock and a supervising indicator. The microcomputer interlock controls the positioning and inversion of the switch.

(4) Computer interlocking simulation control software system:

The computer interlocking control software implements the control and self-blocking functions of the semaphores, track circuits, and turnout switches in the turnout training system through the simulation control of the physical appliances in the turnout training system through the interlocking drive equipment. Lock control degraded mode with fixed blocking train interval and interlock protection function.

At the same time, it can realize the analog operation when the signal equipment fails, and analyze and deal with the failure. Realize the function of the signal device fault operation panel.

The display color of each signal element of the system's man-machine interface should be consistent with the field system equipment; the system's operation interface, operation commands, operation dialogue information, and operation process should be consistent with the field equipment operation.

1) The computer interlocking system uses a computer as the main technical means to realize station interlocking signal equipment. Computer interlocking can meet the needs of various station (field) scales and transportation operations, ensure driving safety, and have a large amount of information and networking capabilities. The computer interlocking system meets the following conditions;

The computer interlocking system meets the relevant technical requirements of TB / T3027-2002 "Computer Interlocking Technical Conditions" or equivalent international

standards;

2) The computer interlock must work reliably and meet the failure-safety principle;

3) The computer interlock can be combined with other signal systems and can exchange data with other management information systems;

4) When the computer interlock communicates with other equipment, follow the prescribed communication protocol;

5) The computer interlocking control and display mode is mouse + display mode. Concise graphics or text for the operation of trains and shunts, the operating process of operators and the status of interlocking equipment, equipped with the necessary sound and voice alarms; and can meet the requirements of field communication, signal process image reproduction and printing functions ;

6) The station computer interlocking system can simulate Siemens computer interlocking system-SICAS. It can fully implement functions such as route arrangement / cancellation / manual delayed unlocking, turnout single operation / single lock / close, section failure unlocking, station / field contact, etc .; train training system, signal sandbox, training system platform, etc. The analog devices are connected, the status of the analog signal devices is collected, and control instructions are issued after interlocking calculations. Realize the same interlocking function, interface structure and operation mode as the field equipment;

7) The microcomputer interlocking simulation system can macro-control the turnout switch, signal lights and other equipment, so as to achieve the purpose of platooning and unlocking the route, and provide a path for the operation of the train. Specific functions should include, but are not limited to:

a) The microcomputer interlocking system can receive the exhaust route command transmitted by the ATS system, and at the same time, it can transfer the state of the turnouts, signal lights, and track circuits to the ATS system and other systems in real time;

b) The line display part of the station interlocking system is consistent with the line of the turnout. The operation interface should be consistent with the actual situation of rail transit;

c) Check the interlocking conditions automatically according to the exhaust route command. When the conditions are met, automatically control the route and lock the route, and open the corresponding signal lights; if the conditions are not met, the system will give a prompt, and the turnout and Signal lights do not perform any control;

d) The exhaust route can be performed manually through the interlocking system. After manually entering the exhaust route command, the interlocking system should check the interlocking conditions. When the conditions are met, the approach is automatically controlled and locked, and the corresponding signal lights are opened; if the conditions are not met, the system gives a prompt and does not perform any control on the turnouts and signal lights;

e) Able to realize automatic unlock, fault unlock, manual unlock and other functions;

f) Regardless of the success of the exhaust route, the interlocking system needs to transmit the results to the operator and the corresponding system;

g) The interlocking system shall have the function of preventing misoperation;

h) give tips for equipment failure or important information;

8) The functions of the vehicle segment simulation system include, but are not limited to;

a) An interlocking simulation system is installed in the vehicle depot, and the functions of the interlocking simulation system are the same as those of the station interlocking simulation system;

b) The line display in the interlocking simulation system of the vehicle section should be consistent with the on-site line;

c) The vehicle depot simulation system should be able to perform operations such as shunting, entering and exiting;

d) The microcomputer interlock of the vehicle section shall simulate the following functions:

Route alignment;

Reopen signal;

manually cancel the approach;

Manual delay unlocking approach;

Guided approach;

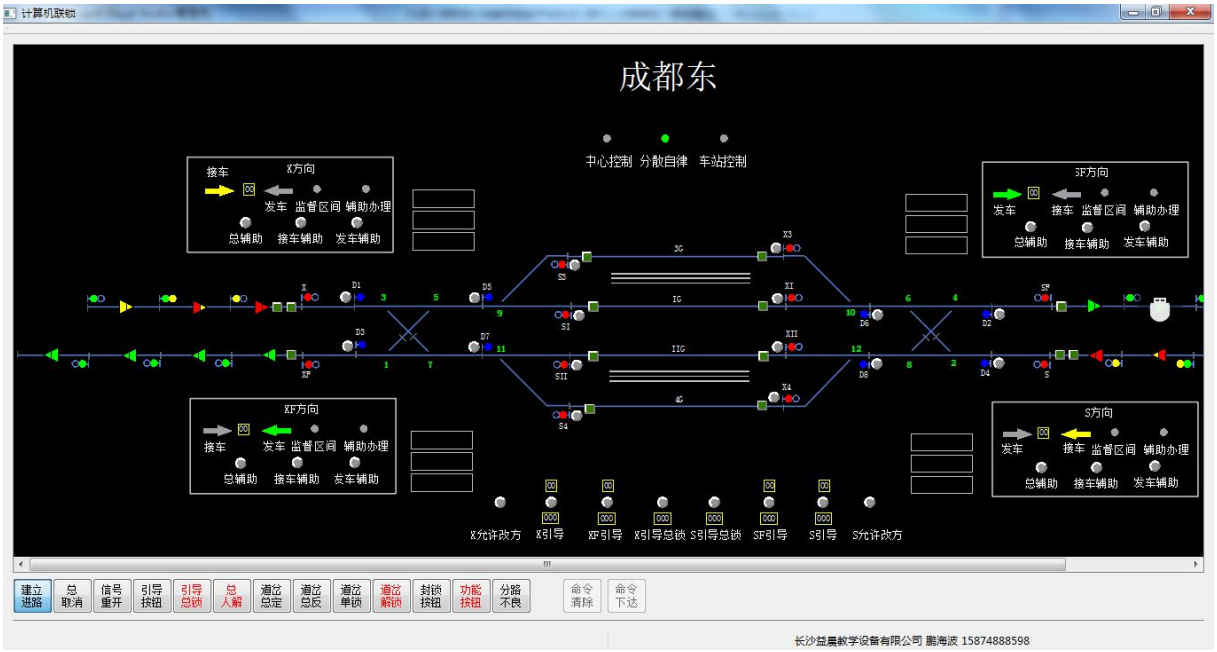
Guide the total lockout;

Turnout single operation;

Turnout single lock / single solution;

Section failure unlocking;

Equipment blocked.



(5) Microcomputer interlocking computer:

1) 2 microcomputer interlocking computers, integrating the field device status and operator operations collected by the I / O machine cage to complete the logical control of the field devices to achieve all the interlocking logic processing functions; meanwhile, the functions of the operation indicating machine are accepted Operator instructions, and display the status of field equipment and alarm information on the display;

2) Configuration:

Mainstream brand computers are used, and the technical parameters are not less than the following configuration: CPU model: Intel Core i5 4460; CPU frequency: 3.2GHz; Maximum core frequency: 3400MHz; L3 cache: 6MB; Core / thread number: quad-core / four-thread; Memory capacity: 4GB; Memory type: DDR3 1600MHz; Memory slot: 2 DiMM slots; Hard disk capacity: 1TB; Hard disk description: 7200 rpm; Graphics card type: Independent graphics card; Graphics chip: NVIDIA GeForce GT 705; Display size: 23 inches; Display description: FHD widescreen; Display resolution: 1920x1080; Memory capacity: 1GB.

(6) Relay combination cabinet:

1) 1 set of relay combination cabinet;

2) Equipped with GU relay combination cabinet and railway safety relay;

3) Technical parameter requirements:

a) The equipment should be a GU-type relay combination cabinet produced by a professional signal factory;

b) Enclosed cabinet (with front and rear doors) including combination and combination internal wiring;

c) Using circuit breakers (only the bottom plate), zero-level terminals and side terminals using WAGO terminals, placing safety relays, and simultaneously realizing the functions of cable distribution frames;

d) The control of the shunting signal switch and the switch machine is controlled by the microcomputer chain console, which controls the signal and turnout combination in the combination cabinet, and drives the lighting conditions and turnout operation conditions of each signalizer through the corresponding combination. In addition, the control of the inbound signal, outbound and shunting signal, and switch are controlled by the computer interlocking main control system to control the signal and turnout combination in the combination cabinet, and drive each signal through the corresponding combination. Lighting conditions and turnout operating conditions;

e) A turnout combination, more than one signal combination, at least one track combination, and related equipment fault setting status and status simulation control panel are installed in the combination cabinet. Each combination must adopt a computer interlocking standard combination and provide corresponding design drawings;

f) A total of not less than 20 relays are installed on the combined rack, all of which are railway

safety relays certified by the Ministry of Railways, which can implement various teaching and training functions for railway signal relays;

h) In addition to the device itself using relays, equipped with at least 4 safety relays as spare parts;

i) Experiments:

Relay principle experiment;

Relay circuit design experiment;

Relay performance test experiment.

(7) Railway special power screen:

The railway signal power supply screen should be able to provide stable AC and DC power to equipment such as signal machines, switch machines, turnout indicators, relays, and track circuits. The power supply screen should be a teaching device, and the output power should be powered by a single module, without redundant backup modules.

1) Functional requirements:

Provide DC220V, AC380V, AC220V, AC110V, DC24V, DC12V, DC5V and other AC and DC power supplies;

With turnout module supply voltage and current display function;

With the signal module module supply voltage and current display function;

With track circuit module supply voltage and current display function;

With phase failure protection function;

With over-current protection function;

With power alarm and lightning protection function.

2) It can meet the power supply needs of laboratory equipment and the capacity reaches 5kVA;
3) Able to meet the following output power voltage and rated current requirements;
a) Power supply for signal lighting in the station: AC220V ± 10V 2A;
b) 25Hz rail power: AC220V ± 6.6V 5.45A;
c) 25Hz local power supply: AC110V ± 3.3V 7.27A;
d) Turnout indicates power supply: AC220V ± 10V 1A;
e) Regulated standby power supply: AC220V ± 10V 5A (non-isolated power supply);
f) Unregulated standby power supply: AC220V (varies with input) 5A (non-isolated power supply);
g) DC switch machine power supply: DC220V (-10 ～ + 20V) 16A;
h) AC switch machine power supply: AC380V (varies with input) 5A;
i) Relay power: DC24V (0 ～ + 2V) 10A;
j) Blocked power supply: DC24V ～ 60V ± 5V 2A;
k) 50Hz rail power supply: AC220V ± 10V 2A;
l) 50HZ local power supply: AC110V ± 5V 2A;
m) indicates lamp power: AC24V ± 3V 5A;
o) Flash power: AC24V ± 3V 1A;
p) Filament alarm power: DC24-48V 2A.

(8) Microcomputer interlocking simulation cabinet:
1) 1 set of microcomputer interlocking simulation cabinet, turnout interlocking, responsible for turnout interlocking logic. The turnout is provided with an interlocking simulation system. The functions of the interlocking simulation system are the same as those of the station interlocking simulation system. The line display in the turnout interlocking simulation system is consistent with the line in the turnout;
2) Technical functions: It consists of two parts: one is the station database participating in the interlocking operation; the other is the application program that performs the interlocking logic operation to complete the interlocking function. The station database includes a station assignment table, a station interlock table, a button access table, and station display data. The application program is composed of multiple program modules, namely a system management program module, a clock interruption management program module, a presentation information

acquisition and information processing program module, an operation command input and analysis program module, a routing and switching program module, and a signal open program module , Unlock the program module and station color monitor display program module.

(9) Axle counter:

1) 1 set of axle counting cabinets, collecting the status information of the axle counting points outdoor, supervising the disturbance changes of the axle counting points, completing the online status calculation of the axle counting sections, assessing the turntable information such as occupation, disturbance and idleness of the sections;

2) Analog axle counting evaluation controller and peripheral input / output interface unit of axle counting system. The capacity is not less than 2 counting points. The evaluation unit is separated from the axle counting interface unit chassis; the evaluation unit uses an analog 2 * 2oo2 architecture.

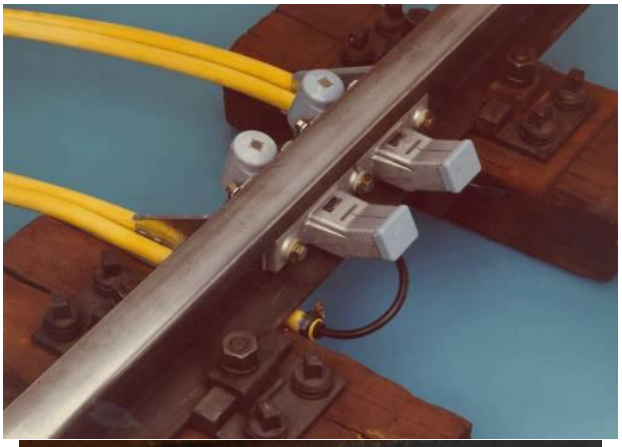
(10) Axle counter:

1) 1 axle counter, turnout training system equipped with interval control equipment for train

operation;

2) In order for students to learn the structure, principle, testing, and troubleshooting of the axle counting system, and simulate the actual installation of the circuit;

3) ZP43V axle counting point equipment is installed at each end position of the track section, and a set of each ZP43V axle counting point is used to check a closed track section. The function of ZP43V axle counting point The dual-set wheelset sensors sense the wheels in and out of the segment and their running directions, and then the sensing signals are pre-processed by receiving, amplifying, filtering, amplifying the detection voltage-frequency conversion, and band-pass filtering, and then transmitting them to the indoor computing unit via a connection cable.



(11) AP cabinet:

1) 1 set of AP cabinets to realize wireless access for on-board and railside communication;

2) Three-way wireless communication positioning with the trackside wireless communication module and control center. An analogue trackside wireless access AP device is set up in a section of the turnout. Wireless digital reading positioning beacons are used to monitor and read the train position and provide the corresponding software interface. . , AP equipment 1: 1 model (AP cabinet, AP antenna), consistent with the actual subway;

3) The antenna position is set so that the signals of adjacent APs can overlap and cover the entire line. This overlap provides redundancy of the radio signals beside the track. If one AP or alternate APs fail alternately, continuous wireless coverage can be ensured.

(12) Transponder:

1) 2 sets of transponders, including ground equipment and vehicle-mounted equipment, installed in the turnout training system, with a total of two. Simulate the requirements of the actual line pairing of transponders: one active transponder and one passive transponder. At the same time, 15 meters of inductive loop lines are installed to allow students to understand the installation and debugging methods of automatic control of outdoor equipment during train operation;

2) Ground equipment includes:

Fixed information transponder

Variable information transponder

LEU beside the track

3) Vehicle equipment:

Query the host

Car antenna

Antenna cable

4) Technical parameters:

Protection class: IP67, according to EN60529

Weight:

Fixed transponder, 3 kg;

Variable transponder, 6 kg;

(Including 9.6m cable).

Environmental conditions:

Ambient temperature: －40 ° C to + 70 ° C;

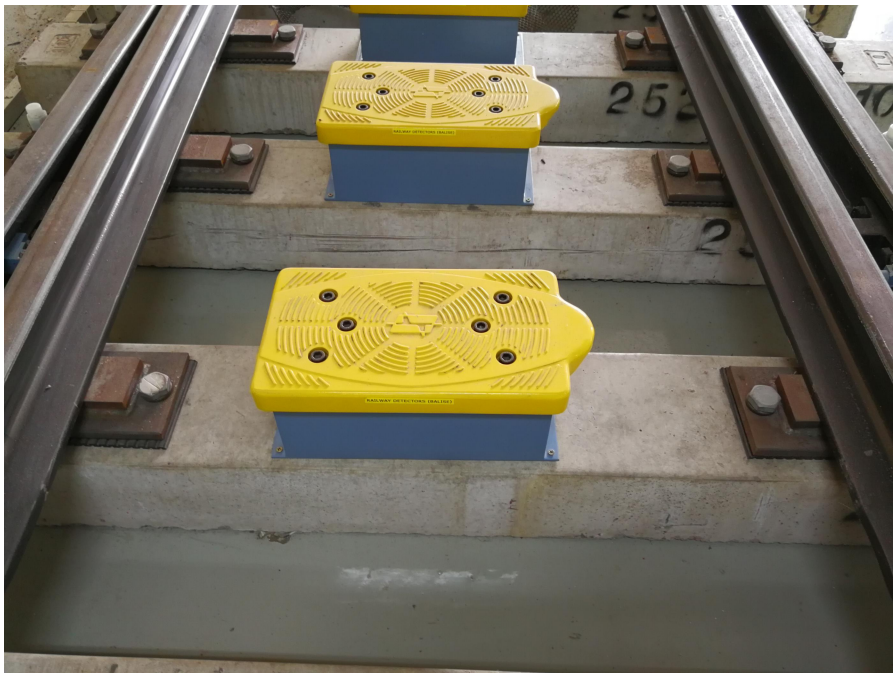
EMC: EN 50121-4;

EN 301489-1;

EN 301489-3;

Wireless: EN 300330-2;

EN 300330-1;



(13) DCS communication network cabinet:

1) 1 set of DCS communication network cabinet, which realizes the interactive communication between all systems beside the track and vehicle systems; provides the function of communication data relay for each analog subsystem, and the communication control system monitors and runs the workstations of each subsystem. Online communication status, the corresponding status is displayed on the man-machine interface, and the received transit data is displayed in real time in the information bar;

2) Simulated DCS terminal, adopting a virtual independent dual network architecture, the two networks are completely independent and have the same configuration; provide communication interfaces between ATC, interlock, AP and VOBC. Connect all railside, signal equipment room equipment and ATS equipment to ensure the core part of normal operation of each system. This software can monitor the communication status of each subsystem and display it on the interface in real time, and dynamically adjust the communication load according to the operating status. Balance.

DCS Features:

a) Mobility and anti-interference;

Based on IEEE 802.11 standard;

802.3 standard expansion of wireless communication;

The only standard that supports mobile communications.

b) security;

Unprotected 802.3 networks are untrusted;

DCS provides authentication to ensure that the system is trusted.

c) reliability;

A network without redundancy is unreliable;

DCS uses multiple redundancy mechanisms to avoid the failure of the system at any single point of failure and multiple points of failure.

d) interconnection;

Contains multiple device types from multiple vendors;
Adopt a design method based on open standards.

(14)CBTC Full Simulation System Software (see the other project solution)

(15) Advanced plastic sprayed steel computer operating table (dual connection):
1) 2 sets of high-grade plastic-sprayed steel computer operating table (dual-connected table);
2） Specifications: 1290 × 880 × 1100mm; double-connected, each console has two operating seats, each seat has a pull-type drawer to place the operation panel, and a 22-inch display size recess on the front Slot, erect display; the console requires forging with no less than 2mm thick iron plate, and the surface is painted.
(16) Operating seat
1) 4 sets of operating seats;
2) All-steel high-back seat with black leather cushion.
(17) All-steel bogies:
1) 1 all-steel bogie;
2) According to the simulation of Shanghai subway vehicle bogies. Including motor, frame, wheel set, gear box, axle box, hydraulic shock absorber and brake parts. All-steel steel wheel pair; the brake pipe is made of copper, which can simulate braking. The bogie is a bolster-free air spring bogie. The power bogie adopts full elastic suspension of transverse traction motor. The spring vibration damping device uses two series of suspension devices (one series of herringbone rubber springs and two series of air springs), hydraulic shock absorbers (two vertical and one horizontal), anti-rolling torsion bars and lateral rubber buffers Vibration system. The car body is directly supported by an air spring suspended on an air spring located on a side beam of the frame. The car body and the bogie frame are connected to each other through a central traction

connection device, and can rotate relative to each other. Two traction pull rods are arranged below the crossbeam of the frame, forming a diagonal device. The two ends of the traction tie rod are embedded with rubber pieces, one end is connected to the central traction connection device, and the other end is connected to the frame beam, which is used to transmit the longitudinal force between the vehicle body and the bogie. The metal parts are not deformed and broken in various natural environments and have a long service life. Motors, frames, wheel sets, axle boxes, hydraulic shock absorbers, central suspension devices, central traction devices, braking systems, etc. can be repeatedly disassembled;

3) It can realize stepless variable speed parking and forward and backward;

4) Various bogie equipment sensors are installed on the bogie to realize ATS operation requirements;

5) The station control system can transmit train information to the ground system in real time.

(18) Switch and LAN wiring:

1) 1 set of Ethernet switches, using well-known brand switches, no less than 16 ports, with 100-1000MB adaptive switches;

2) The central LAN is a single-network platform based on the TCP / IP protocol. Through this network, the control center server, information management workstation, system interface workstation, and central network printer are connected, and then the system's network provided by communication Connected to the passenger guidance information system at each station.

(19) Design and construction and electrical materials:

1) Including various types of cables, power cords, copper-core plastic wires, 18-post terminals, resistors, diodes, etc .;

2) Design, equipment installation and electrical connection to ensure the linkage control and operation of all equipment in the system;

3) All products used should meet national standards.

4. List

No	Name	Specification	Quantity
1	No. 5 single turnout	According to the 1: 2 gauge simulation, No. 5 single turnout 8.6m × 4m × 0.5m is produced, which consists of basic rail, sharp rail, root structure, rail support, front pad removal, sliding bed pad, rear cut pad, top Iron, connecting rod, tie rod, sleeper rail, fasteners, etc.	1
2	Short moment signal three display,	Rated working current of LED luminous tube ... 20mA; Light source rated input current ... 120mA; Light source rated input voltage ... DC39.5V; Light source rated power ..... <8w; Light source power supply voltage adjustment range AC: 43V-52V; Combined weight ... short 15Kg.	1
3	Short moment signal two displays	Rated working current of LED luminous tube ... 20mA; Electrical fast transient pulse group anti-interference ... 3 levels; Electrostatic discharge immunity ... Class 3; The luminous intensity of the light source conforms to ... TB / T2353-93; The spectrum meets ... TB2081-89; Combined weight ... short 15Kg.	2
4	ZD6 electric switch machine	Rated voltage DC: 160 V; Rated conversion force: 2450 (250) N (kgf); Action stroke: 135 ～ 185mm; Indicating the stroke of the rod: 135 ～ 185mm; Conversion time: ≤3.8 S; Working current: ≤2.0A; Anti-crushing force of action lever and main and auxiliary pins: main pin 29420 ± 1961 auxiliary pin 29420 ± 1961N; Ground foot mounting hole: 610mm × 360mm;	1
5	Computer Interlocking Simulation Software System	It realizes the control and self-blocking functions of the semaphore, track circuit and turnout switch machine in the turnout training system, and can realize the fixed blocking train interval and interlocking protection function of the interlocking control degraded mode. The display color of each signal element of the system's man-machine interface should be consistent with the field system equipment; the system's operation interface, operation commands, operation dialogue information, and operation process should	1

		be consistent with the field equipment operation.	
6	Microcomputer computer	Mainstream brand computer, CPU model: Intel Core i5 4460; CPU frequency: 3.2GHz; Memory capacity: 4GB; Memory type: DDR3 1600MHz; Memory slot: 2 DiMM slots; Hard disk capacity: 1TB; Hard disk description: 7200 rpm Display size: 23 inches; Display description: FHD widescreen; Display resolution: 1920x1080; Memory capacity: 1GB;	4
7	Relay combination cabinet	The equipment should be a GU-type relay combination cabinet produced by a professional signal factory. Enclosed cabinet (with front and rear doors) contains combination and combined internal wiring. Use circuit breakers (only the bottom plate), zero-level terminals and side terminals use WAGO terminals to place safety relays, and at the same time realize the function of cable distribution frames.	1
8	Railway special power screen	Provide DC220V, AC380V, AC220V, AC110V, DC24V, DC12V, DC5V and other AC and DC power supplies; With turnout module supply voltage and current display function; With the signal module module supply voltage and current display function; With track circuit module supply voltage and current display function; With phase failure protection function; With over-current protection function; With power alarm and lightning protection function.	1
9	Microcomputer analog cabinet	It consists of two parts: one is the station database participating in the interlocking operation; the other is the application program that performs the interlocking logic operation to complete the interlocking function.	1
10	Axle counter	Collect the status information of outdoor counting points, supervise the disturbance of the counting head magnetic head, complete the online status calculation of the counting section, and evaluate the turntable information such as occupation, disturbance and idleness of the counting section.	1
11	Axle counter	The turnout training system is equipped with interval control equipment for train operation so that students can learn about the structure, principle, testing, and fault handling of the axle counting system, and simulate the actual installation of the line.	1
12	AP cabinet	Realize wireless access for on-board and railside communications. Realize three-way wireless communication positioning with the trackside wireless communication module and control center. An analogue trackside	1

		wireless access AP device is set up in a section of the turnout. Wireless digital reading positioning beacons are used to monitor and read the train position and provide corresponding software interfaces. , AP equipment 1: 1 model (AP cabinet, AP antenna), consistent with the actual subway.	
13	Transponder	Including ground equipment and vehicle equipment, installed in the turnout training system, a total of two. Simulate the requirements of the actual line pairing of transponders: one active transponder and one passive transponder. At the same time, 15 meters of inductive loop lines were installed to allow students to understand the method of automatically controlling the installation and debugging of outdoor equipment during train operation.	2
14	DCS communication cabinet	Mobility and immunity Based on IEEE 802.11 standard; 802.3 standard expansion of wireless communication; The only standard that supports mobile communications.	1
15	Electrical control system	The electrical control system can perform real-time high-precision monitoring, setting, and control of the overall equipment safety, power consumption, control status, overall equipment residual current, overvoltage, phase failure, online real-time operating temperature, and leakage current. And it can set parameters such as power consumption, leakage current, real-time online temperature of each temperature test point of the overall device, and multiple settings of APP and PC. The setting method adopts digital high-precision display and setting. After exceeding the set value, it must immediately report to the police (including: stand-alone, APP and PC) and perform real-time protection control of corresponding fault points to ensure the safety of equipment operation and the safety of students. And it can transmit the detection data to the cloud for storage, and perform remote alarm prompts and control operations on the APP side and PC side through big data analysis. It must be re-used after troubleshooting. At the same time, it can provide powerful control and analysis methods for the energy-saving and emission-reduction of later laboratories and smart laboratories. The functions of the system must be demonstrated on site.	1
16	CBTC Full Simulation System	See another project	

	Software		
17	Advanced plastic sprayed steel computer operating table (dual-connected)	Dimensions: 1290 × 880 × 1100mm; double-connected table, each console has two operating seats, each seat has a pull-type drawer to place the operation panel, and a 22-inch display size groove on the front, Set up the display; the console requires forging with no less than 2mm thick iron plate, and the surface is painted.	2
18	Operating seat	All-steel high-back seat with black leather cushions.	4
19	All-steel bogie	Including motor, frame, wheel set, gear box, axle box, hydraulic shock absorber and brake parts. All-steel steel wheel pair; the brake pipe is made of copper, which can simulate braking. The bogie is a bolster-free air spring bogie. The power bogie adopts full elastic suspension of transverse traction motor. The spring vibration damping device uses two series of suspension devices (one series of herringbone rubber springs and two series of air springs), hydraulic shock absorbers (two vertical and one horizontal), anti-rolling torsion bars and lateral rubber buffers Vibration system. The car body is directly supported by an air spring suspended on an air spring located on a side beam of the frame. The car body and the bogie frame are connected to each other through a central traction connection device, and can rotate relative to each other. Two traction pull rods are arranged below the crossbeam of the frame, forming a diagonal device. The two ends of the traction tie rod are embedded with rubber pieces, one end is connected to the central traction connection device, and the other end is connected to the frame beam, which is used to transmit the longitudinal force between the vehicle body and the bogie. The metal parts are not deformed and broken in various natural environments and have a long service life. The motor, frame, wheel set, axle box, hydraulic shock absorber, central suspension device, central traction device, braking system, etc. can be repeatedly disassembled.	1
20	Switch and LAN wiring	1 set of Ethernet switches, using well-known brand switches, no less than 16 ports, with 100-1000MB adaptive switches.	1
21	Design and construction and electrical materials	Including various types of cables, power cords, copper-core plastic wires, eighteen-post terminals, resistors, diodes, etc. Design, equipment installation and electrical connection ensure the linkage control and operation of all equipment in the system. All products used should meet national standards.	1