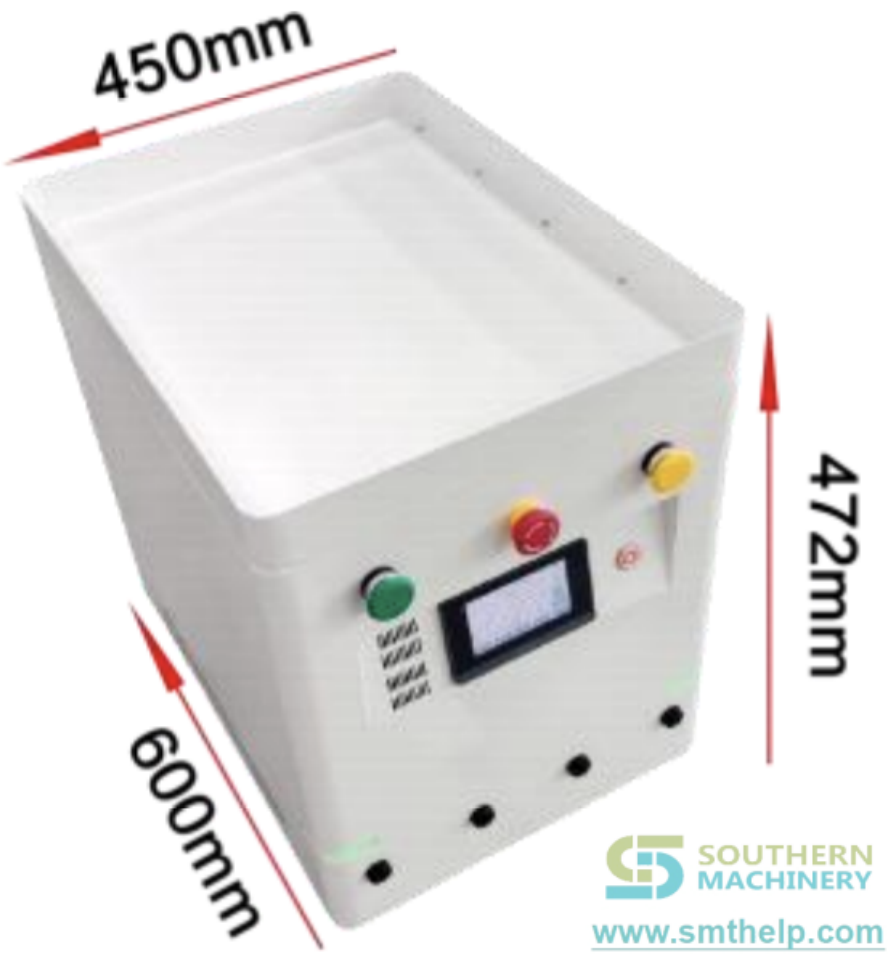
SOUTHERN MACHINERY

SMT INTELLIGENT LOGISTICS / AGV

SFY03 Magnetic Navigation AGV

Operation Manual



Your Trusted Partner for SMT & THT Solutions

Rev. 2025

Shenzhen Southern Machinery Sales and Service Co., Ltd
www.smthelp.com | info@SMThelp.com | WhatsApp +86 136 0256 2576

Contents

1 Safety Information 4
1.1 Safety Symbols 4
1.2 General Safety Rules 4
1.3 Prohibited Actions 4

2 Product Overview 6
2.1 Purpose 6
2.2 Features 6
2.3 Main Components 6
2.4 Safety Components 8

3 Technical Specifications 10

4 Installation and Commissioning 12
4.1 Site Requirements 12
4.2 Environmental Requirements 12
4.3 Unpacking and Inspection 13
4.4 Laying the Magnetic Navigation Strip 13
4.5 Placing RFID Site Cards 13
4.6 Battery and Charging 13
4.7 Commissioning 14

5 Operation 15
5.1 Daily Start-up 15
5.2 Stopping and Shutdown 15
5.3 Touch-Screen (HMI) Operation 15
5.4 Moving the AGV by Hand (Cart Mode) 20
5.5 Sound and Light Signals 20

6 Programming / Software 23
6.1 Routes, Sites and Operations 23
6.2 Site Editing (Writing RFID Cards) 23
6.3 Typical Route Layouts 24
6.4 Operation Code Table 24
6.5 Programming Example: Slow-down Section 26

7 Maintenance 27
7.1 Maintenance Schedule 27
7.2 Precautions for Use 27

8 Troubleshooting 29
8.1 HMI Scroll-bar Messages 29
8.2 Common Problems 30

10 Warranty and Service Contact 32

1 Safety Information

Read this manual completely before operating the SFY03 Magnetic Navigation AGV and keep it near the vehicle for reference. Only trained and authorised personnel may operate, program or maintain the AGV.

1.1 Safety Symbols

WARNING Indicates a hazard that can cause serious injury, electric shock, fire or major equipment damage.

CAUTION Indicates a situation that can cause minor injury, malfunction or reduced service life.

NOTE Indicates important information for correct use.

1.2 General Safety Rules

- The equipment must be operated only by trained, authorised personnel.
- Do not touch non-operating parts while the AGV is running.
- Select the running route according to the actual production requirements. Unauthorised operators must not change the route.
- Pedestrians must give way to a running AGV and keep a safe distance of at least 1 m.
- Strictly follow this manual and the equipment operating procedures.
- Before work each day, inspect the AGV according to the equipment spot-inspection checklist and confirm that all safety devices work correctly.
- Do not place objects on the AGV path or in sheltered areas along it. A collision will stop the system.
- Do not park the AGV on a slope. It may slip or run out of control.
- Keep oil and water off the AGV path. A wet or oily floor can cause the AGV to skid, stray from the path or collide.
- Keep water and oil off the AGV body. Liquid can cause malfunction, unexpected start-up, electric shock, derailment or collision.
- Mark the AGV path clearly with barriers, floor paint or zoning lines so that people can identify it.
- Safety sensors have blind spots. Pedestrians and other vehicles must not enter the AGV path. Take special care where the route has sudden turns.
- Charge the battery only with the standard charger supplied with the AGV.
- Do not connect other equipment to the AGV without professional guidance.
- When the battery is low (models without automatic charging), replace or charge it promptly and stop operation. Continuing to run on a low battery shortens battery life.
- Maintain the AGV regularly (see Section 7).

1.3 Prohibited Actions

WARNING Do not change the AGV program settings, disassemble the AGV or replace components without authorisation from Southern Machinery. Failures caused by such actions are not covered by the warranty.

- Do not open the electrical control box while the AGV is running. The control board can be damaged and the system will stop working.
- Do not let water or other conductive liquids contact the AGV. They can cause short circuits.
- Do not let corrosive substances (for example sulfuric acid) contact the AGV.
- Keep the AGV, and especially the battery, away from open flames, high temperatures and high pressure.
- Do not touch the equipment with wet hands or wet clothing. There is a risk of malfunction and electric shock.
- Only authorised professionals may remove or open the electrical control box or change the wiring.
- Do not use the AGV outdoors.
- Do not sit on, lean on or stand on any part of the AGV body. You may fall and be injured.
- Do not push or move the AGV by force while it is powered on. This can damage the control board and other control components. Use cart mode (see Section 5.3.1) to move it by hand.
- Do not maintain or repair the AGV while it is powered.
- Do not use the AGV battery to power other equipment.

2 Product Overview

2.1 Purpose

The SFY03 Magnetic Navigation AGV (Automated Guided Vehicle) is a mobile robot that navigates autonomously along a magnetic strip laid on the floor. It follows a predetermined path and automatically stops, turns or unloads where required. A laser range sensor provides obstacle detection, and multi-state sound and light signals together with a touch-screen interface make operation simple.

Typical application: transporting goods in factories, warehouses and similar indoor sites, for example moving materials and PCB assemblies between SMT and assembly lines.

2.2 Features

- Complete stand-alone system covering the common AGV functions. No external system is required.
- All functions are available on the touch screen: equipment monitoring, system settings, operation monitoring, route editing, site (station) editing and selectable parking stations.
- Stores multiple routes, multiple sites per route and multiple operations per site (more than 200 routes and more than 200 sites per route; up to 10 operations per site).
- 13.56 MHz high-speed RFID reader identifies site cards on the floor; each card number can trigger user-defined operations.
- Single-point laser obstacle sensor that is insensitive to target colour, with multiple alarm distances and dynamic switching.
- Full-colour LED status lights and a multi-channel voice module for alarms, running sounds and station announcements.
- Brushless DC motor drive with hollow-shaft reducer for high overload capacity.
- Independent battery compartment for quick battery exchange.
- Expandable vehicle controller with multiple protection mechanisms that prevent a local error from affecting the whole system.

2.3 Main Components

The side carrying the touch screen is defined as the **front** of the AGV.

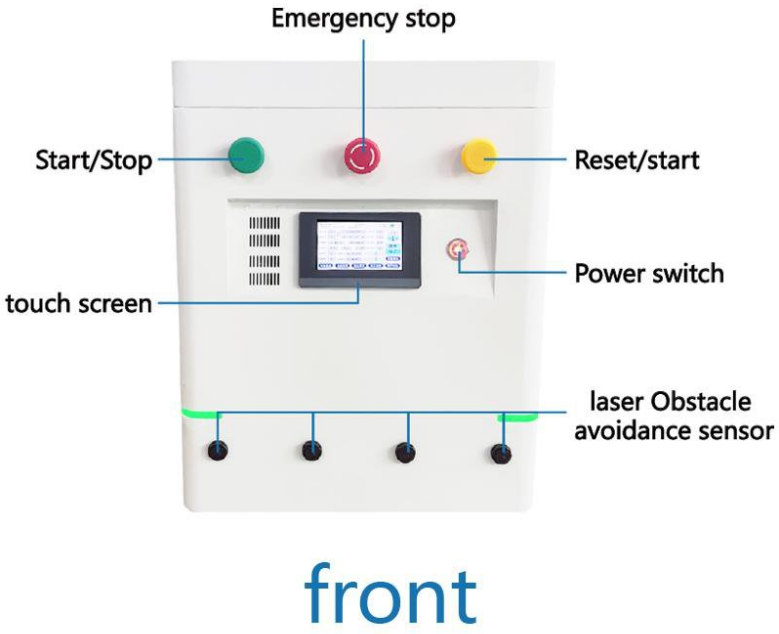


Figure 2-1 SFY03 front view

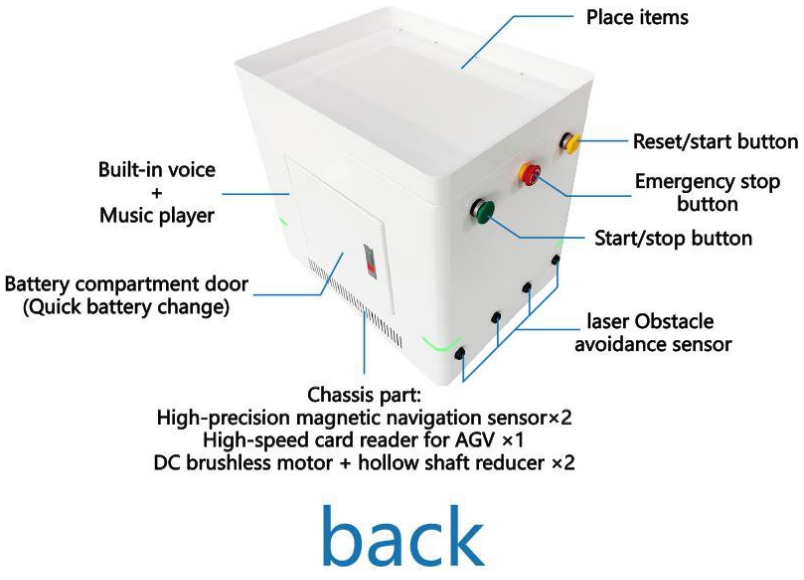


Figure 2-2 SFY03 rear view and chassis components

2.3.1 Front Panel

Component	Function
Power switch	Pull up to switch the AGV power on; push down to switch it off.
Touch screen	Industrial touch screen for monitoring the current operating status, parameters and control data, and for editing routes. See Section 5.3.
Front laser obstacle sensor	Detects obstacles in front of the AGV when the front sensor is enabled.
Front full-colour status light	Shows the current operating status of the AGV. See Section 5.5.2.
Front reset/release button	After a fault has been corrected, press to clear the AGV fault.
Front emergency stop knob	Press at any time to stop the AGV immediately. To release, turn the knob in the direction of the arrow until it springs up, then press the reset button to clear the emergency-stop alarm.

2.3.2 Rear Panel

Component	Function
Rear laser obstacle sensor	Same as the front sensor; detects obstacles behind the AGV.
Rear full-colour status light	Same as the front status light.
Rear reset/release button	Same as the front reset/release button.
Start/Stop button	Toggles the running state. Press while running to stop; press while stopped to start.
Rear emergency stop knob	Same as the front emergency stop knob.

2.3.3 Other Components

- **Battery compartment door**: To open, press the PUSH mark on the door to release the lock; the battery can then be exchanged directly. To close, swing the door shut and press the latch until it locks.
- **Voice module**: Built-in voice and music player for spoken prompts and music signals.
- **Cargo platform**: Full-size top platform that gives the maximum load area.

2.3.4 Chassis

- **High-precision magnetic navigation sensors (×2)**: The core navigation components, mounted under the AGV at the front and rear. They detect the magnetic strip with high precision to ensure accurate, stable navigation.
- **Dedicated high-speed RFID card reader**: Mounted in the middle of the underside. It reads and writes the card number of RFID site cards. Each card number can be assigned its own user-editable functions.
- **Drive unit**: Brushless DC motor with hollow-shaft reducer driving the power wheels. Its overload capacity is much higher than comparable products.

2.4 Safety Components

2.4.1 Emergency Stop Knob

When the AGV behaves abnormally, or when you need to stop it urgently, press the emergency stop knob. The AGV brakes quickly. To release, turn the knob until it springs up, then press the reset button.

2.4.2 Obstacle Sensor

The obstacle sensor is a single-point laser covering a 15° detection angle. The detection distance can be set up to 1.2 m. Because it uses time-of-flight (TOF) measurement, it is insensitive to the colour of the target and performs clearly better than diffuse-reflection infrared switches. Several alarm distances can be set and the active alarm distance can be switched dynamically; settings are changed in the system software.

CAUTION No obstacle detection method can fully protect against unknown obstacles. Stay alert and keep clear of the AGV while it is running.

NOTE Strong light or highly reflective objects can cause false detection by the laser. This is normal sensor behaviour.

2.4.3 Anti-collision Sensor (Optional)

The anti-collision sensor is a rubber bumper strip with an internal detection circuit. When the AGV makes mechanical contact with an object, the electrical signal changes, an anti-collision alarm is generated and the AGV stops. After confirming that it is safe, press the reset button to clear the alarm.

3 Technical Specifications

Item	Specification	Remarks
Navigation mode	Magnetic strip navigation	
Load mode	Backpack (load carried on top platform)	
Magnetic strip	50 mm / 30 mm, N pole / S pole	Default: 30 mm, N pole facing up
Overall dimensions	600 mm (L) × 450 mm (W) × 472 mm (H)	
Cargo platform size	600 mm (L) × 450 mm (W)	
Ground clearance	25 mm	
Rated load	50 kg	50 % overload allowed
Vehicle weight	< 50 kg	
Maximum speed	0.8 m/s	
Navigation speed	0.7 m/s	
Direction of motion	Forward, backward, spin in place	
Turning radius	0 m (spin in place) / 1 m (navigation turn)	
Navigation accuracy	±10 mm	
Card-read stop accuracy	±10 mm	
Precise stop accuracy	±5 mm	With secondary positioning
Climbing capacity	< 1 %	
Drive motor	Brushless DC motor	
Battery	24 V / 12 Ah	Optional 24 V / 20 Ah
Battery exchange	Independent battery compartment	Quick battery exchange
Rated working time	Full load 6 h, typical working conditions 8 h	24 V / 20 Ah battery: 10 h
Obstacle sensor	Single-point laser	Software-adjustable distance, insensitive to colour
Anti-collision sensor	Not fitted as standard	Optional
Status lights	Full-colour LED light set	Multiple status displays
Sound	Multi-channel voice module	Alarm sounds, running sound, station sound, etc.
Human-machine interface	4.3 inch touch screen	
System communication interface	Reserved	
Site card reader	13.56 MHz high-speed RFID reader	
Site editor	Supported	Operated from the touch screen
Route editor	Supported	Operated from the touch screen
Number of routes	> 200	
Number of sites	> 200 per route	

Item	Specification	Remarks
Operations per site	10	
Body material	Q235A + SUS 304	
Operating temperature	-10 °C to 45 °C	No condensation
Operating humidity	Below 80 %	No condensation
Operating environment	No corrosive or flammable gas, no metal dust	Not for environments with radioactive substances, strong magnetic fields or vacuum
Storage temperature	-25 °C to 80 °C	No condensation
Storage humidity	Below 85 %	No condensation



Figure 3-1 SFY03 overall dimensions (600 × 450 × 472 mm)

4 Installation and Commissioning

4.1 Site Requirements

4.1.1 Floor Flatness

Flatness is the difference between the highest and lowest point within a reference area. When flatness is within the allowed value, the AGV can run at a controlled rated speed.

- Maximum allowed flatness deviation: 3 mm or less within 1 m².
- The floor must be clean, free of particles and dirt, and non-slip.

4.1.2 Floor Slope

The slope (H/L) is the maximum ratio of height difference to route length measured over 100 mm of route. When the slope is within the allowed value, the AGV can run at a controlled rated speed.

- Maximum allowed slope of the floor: 0.05 or less; for the AGV, the slope must be 0.01 or less.

4.1.3 Step Height

Step height is the maximum height difference of the floor within 100 mm.

- Maximum allowed step height: 5 mm or less. Within this limit the AGV can run at a controlled rated speed.
- No steps are allowed at AGV parking positions.

4.1.4 Groove Width

- Maximum allowed groove (trench) width in the floor: 10 mm or less. Within this limit the AGV can run at a controlled rated speed.
- No grooves are allowed at AGV parking positions.
- Where a groove is wider than 10 mm, treat it according to the step-height requirement.

4.2 Environmental Requirements

Item	Requirement
Site	Flat, wear-resistant floor, indoors only
Ambient temperature	-10 °C to 45 °C
Humidity	15 % to 80 %, no condensation
Air	No dust, no flammable, explosive or corrosive gas
Power supply (charger)	220 V ±10 %, 50 Hz ±2 %
Static electricity	The floor material should allow static electricity to discharge easily
Path	No magnetic tape or magnetic material on the driving path other than the navigation strip

- Where electromagnetic interference, stray light, ultrasonic noise or static electricity is present, the user and Southern Machinery must jointly confirm in advance whether it affects normal AGV operation.

CAUTION Operating outside the site and environmental requirements above may shorten the AGV service life or cause unstable operation.

4.3 Unpacking and Inspection

1. Check the packing for transport damage before opening.
2. Remove the AGV and accessories and check them against the packing list (AGV, battery, charger, magnetic strip, RFID site cards and any ordered options).
3. Inspect the body, buttons, touch screen, sensors and wheels for damage.
4. Report any damage or missing parts to Southern Machinery immediately.

4.4 Laying the Magnetic Navigation Strip

The AGV follows a magnetic strip attached to the floor. It reads the strip signal and continuously corrects its running direction, so the strip must be laid carefully. The default strip for the SFY03 is 30 mm wide with the N pole facing up.

1. Plan the route the AGV must follow.
2. Clean the floor along the route with a dry cloth. Make sure there is no oil or grease and that the floor is dry.
3. Peel off the backing paper. Attach the adhesive S-pole side to the floor, with the smooth N-pole side facing up.
4. **Straight sections**: Two people are needed. Fix one end of the strip first. One person pulls the strip firmly to keep it straight while the other peels off the backing paper and presses the strip down. Keep the line as straight as possible.
5. **Curves**: First draw the arc on the floor with a pen, then attach the strip along the line while peeling off the backing paper. The arc radius must not be smaller than the navigation turning radius of the AGV (see Section 3); use a larger radius where space allows.
6. **Closed loops**: Join the strip into a continuous closed circuit.
7. Press the strip down firmly over its whole length and check that no section is loose.

> **NOTE** Keep the floor dry. A strip that is nicked, deformed, worn or loose must be repaired or replaced before operation.

4.5 Placing RFID Site Cards

RFID site cards mark the characteristic points of a route (start/terminal stations, forks, charging station, entry and exit of slow-down sections, etc.). The card number is the site number.

1. Write the required site numbers to the cards (see Section 6.2).
2. Place the cards on the navigation strip in the planned order. On a loop route, place cards in ascending order of card number.
3. Keep a distance of at least 1 m between neighbouring stations.
4. At turns, place a speed-reduction site 0.5 m before the turn and another 0.5 m after the turn, and program a slow-down operation for them (see the example in Section 6.5). Running into a curve at high speed can cause the AGV to leave the strip.

4.6 Battery and Charging

- Charge the battery in a dry, well-ventilated place away from flammable or explosive materials, warehouses for dangerous goods, garages and other hazardous areas.
- Use only the matching charger supplied by Southern Machinery.
- Avoid excessive charging and over-discharging.

- Check the charger and battery regularly and replace them promptly if anything is abnormal.
- It is recommended to charge the battery when the remaining capacity falls below about 20 %.

4.6.1 Charging Procedure

1. Switch the AGV off.
2. Plug the DC plug of the charger into the AGV charging socket (or into the removed battery).
3. After the DC plug is connected, plug the charger into the 220 V mains supply.
4. The charger LED is red while charging and turns green when charging is complete.
5. Unplug the charger from the mains first, then remove the DC plug.

4.6.2 Battery Exchange

1. Switch the AGV off.
2. Press the PUSH mark on the battery compartment door to open it.
3. Exchange the battery and reconnect it.
4. Close the door and press the latch until it locks.

4.7 Commissioning

1. Check that the magnetic strip, RFID site cards and environment meet the requirements above.
2. Switch on the AGV with the power switch and check that the touch screen starts and no alarm is shown.
3. Set the car number and parameters (Section 5.3.3).
4. Program the routes, sites and operations (Section 6).
5. Run the route at low speed under supervision and check stopping positions, turns, obstacle detection and emergency stops before normal production.

5 Operation

5.1 Daily Start-up

1. Carry out the daily spot inspection (Section 7.1) and make sure the path is clear.
2. Place the AGV on the magnetic strip with the navigation sensors over the strip.
3. Pull up the power switch. Wait until the touch screen shows the main page.
4. Check the battery level and that no alarm is shown in the alarm bar.
5. In **Operation monitoring**, select the current route and site (Section 5.3.5).
6. Press the Start/Stop button (or **Start/Stop** on the touch screen) to start.

5.2 Stopping and Shutdown

- **Normal stop**: Press the Start/Stop button or **Start/Stop** on the touch screen.
- **Emergency stop**: Press either emergency stop knob. To release, turn the knob until it springs up and press the reset button.
- **Shutdown**: Stop the AGV, then push the power switch down. Switch off the power during holidays and long breaks.

> **CAUTION** Always stop the AGV with the Start/Stop button or, in an emergency, the emergency stop knob. Never stop it by dragging it, blocking it with your body or using force.

5.3 Touch-Screen (HMI) Operation

The HMI supports several user accounts with passwords. Some pages are shown only after logging in with a higher permission level. The factory user names and passwords for Level 1 (maintenance) and Level 2 are provided by your Southern Machinery service engineer. Use the **User switch** page to log in.

> **NOTE** The screenshots in this section show the Chinese-language interface; English names of all labels are given in the tables.

Every page has a title bar showing the system time, the page title, battery level and voltage, and a scrolling system alarm bar.

5.3.1 Main Page



Figure 5-1 Main page

Item	Description
Title bar	System time, equipment model (SFY03-XXX), battery level and voltage, system alarm bar
Current route	Number of the route currently in use
Current site	Site the AGV is at or most recently passed
Current operation	The single-step operation currently being executed within the operation series of the current site, with the operation name and its four parameters
Total operations	Number of single-step operations in the series for the current site
Operation index	Number of the single-step operation being executed at this moment
Operation status	Idle, Run, Pause or Finish (execution status of the operation series)
Operation wait	Real-time display of the remaining wait when the series includes a "Wait" operation
Motion state	Box 1: Stop, Emergency stop, Navigation, Offline, Remote control. Box 2: Forward, Backward. Box 3: Left fork, Middle fork, Right fork
Front / rear obstacle	Active obstacle area value
Set speed	Set travel speed
Current speed	Actual travel speed
Front / rear magnetic navigation	Magnetic sensor offline/online indication
Car number	User-defined AGV number (set under Parameter setting > Car number)
Cart mode button	Activates cart mode: releases the motor holding brake so the AGV can be pushed by hand without damage
Start/Stop button	Starts or pauses the AGV
Function page buttons	**Equipment monitoring**, **Parameter setting**, **Route editor**, **Operation monitoring**, **Optional parking**, **User switch**

5.3.2 Equipment Monitoring



Figure 5-2 Equipment monitoring page

The sub-menu buttons open the detailed monitoring page of each device:

Button	Function
IO monitoring	Input/output status
AD/DA monitoring	Analogue input/output values
Battery monitoring	Battery level, voltage and status

Button	Function
Magnetic navigation monitoring	Magnetic sensor readings
Obstacle monitoring	Obstacle sensor readings
Motor monitoring	Drive motor status
Card reader monitoring	Current card number and card writing (see Section 6.2)
Odometer monitoring	Travelled distance
Home / Return	Go to the main page / previous page

5.3.3 Parameter Setting



Figure 5-3 Parameter setting page

Button	Function
Battery parameters	Battery settings, including low-battery thresholds
Car number	Set the user-defined AGV number
Authorization	Authorisation (licence) settings
Debug mode	Debugging functions (for service personnel)
Home / Return	Go to the main page / previous page

5.3.4 Route Editor (Forward / Backward)



Figure 5-4 Route site operation editor - forward



Figure 5-5 Route site operation editor - backward

Item	Description
Title	"Route site operation editor - forward" or "- backward"
Route	Route number being edited
Site	Site number being edited
Operation code - forward	Series of operations executed when the AGV on this route reads this site card while travelling forward
Operation code - backward	Series of operations executed when the AGV on this route reads this site card while travelling backward
Rows 0 to 9	Up to 10 operations per site, executed in order from 0 to 9; each has an operation code and parameters D0 to D3
Site edit	Opens the card reader / site edit page (Section 6.2)
Forward/backward switch	Switches between editing the forward and backward series
Erase operation	Asks for confirmation, then erases all operations (forward and backward) of the current route site. Erased data cannot be restored
Save operation	Saves the operation series to flash memory; data is kept after power-off
Home	Returns to the main page

To enter an operation, tap the operation field and select the instruction from the pop-up list, or type the operation code directly. The available operations are listed in Section 6.4.

5.3.5 Operation Monitoring

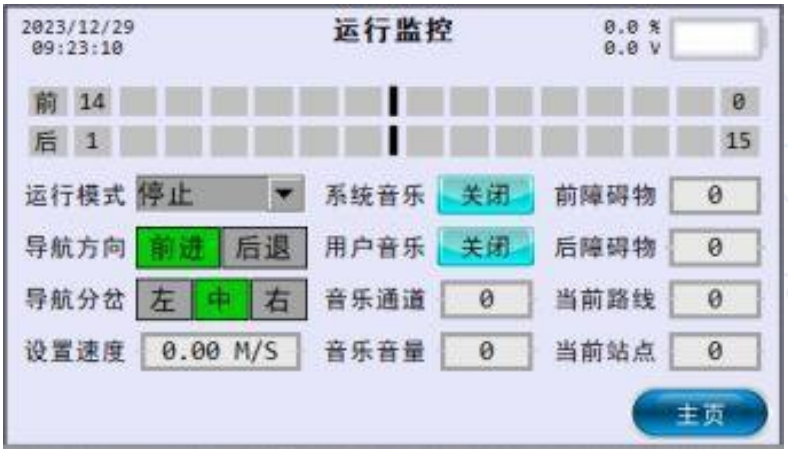


Figure 5-6 Operation monitoring page

Item	Description
Double bar indicator	Strip position detected by the front and rear magnetic sensors; detected positions are shown in green
Operation mode	Stop, Emergency stop, Navigation, Offline, Manual control
Navigation direction	Travel direction: Forward / Backward
Navigation fork	Branch selected at a fork: Left / Middle / Right
Set speed	Travel speed
System music	System sounds on/off
User music	User music on/off
Music channel	Manually select the music track number (0 to 29, see Section 5.5.1)
Music volume	Not used on this model; adjust the volume manually inside the battery compartment
Front / rear obstacle	Obstacle working area: 0-15 = automatic (areas 0-15, from far to near); 50 = forced off; 100-115 = forced on with area 0-15
Current route	Sets the route number the AGV runs on
Current site	Sets the current site number on the route
Home	Returns to the main page

5.3.6 Optional Parking



Figure 5-7 Optional parking page

Item	Description
Optional stop - forward	Card numbers of stations at which the AGV stops when travelling forward (when parking is enabled)
Optional stop - backward	Card numbers of stations at which the AGV stops when travelling backward (when parking is enabled)
Parking enable	Master switch: whether the AGV stops at the selected stations
Reset release	Whether the stop can be released by pressing the reset button
Stop time	Waiting time at all selected stops
One-key erase	Clears all selected parking stations
Save parameters	Saves the parking stations to flash memory; data is kept after power-off

5.4 Moving the AGV by Hand (Cart Mode)

1. Stop the AGV.
2. On the main page, tap **Cart mode**. The motor holding brake is released and the scroll bar shows "Cart mode".
3. Push the AGV to the required position.
4. Tap **Cart mode** again to exit before starting the AGV.

CAUTION Never push the AGV while it is powered on unless cart mode is active.

5.5 Sound and Light Signals

When the AGV status changes or a fault occurs, the voice player plays the corresponding prompt, the light bar changes and a message appears in the HMI scroll bar.

5.5.1 Voice Channels

Voice prompts and music files are called by channel number. System prompts play automatically when a fault or state occurs. When user sound is enabled, the player plays the selected user music channel. System prompts have priority over user music.

Channel	Sound	Cause	Recovery
1	"Warning, emergency stop knob abnormal"	1. Emergency stop pressed; 2. Emergency stop signal line disconnected or poor contact	Reset
2	"Warning, collision sensor abnormal"	1. Bumper strip has hit an object; 2. Sensor signal line short-circuited	Reset
3	"Warning, your device has expired"	Authorisation invalid	Apply for authorisation
4	"Warning, magnetic navigation sensor abnormal"	1. Magnetic navigation sensor damaged; 2. Poor communication or power line of the sensor	Reset
5	"Warning, obstacle sensor abnormal"	1. Obstacle sensor damaged; 2. Poor communication or power line of the sensor	Reset
6	"Warning, card reader abnormal"	1. Card reader damaged; 2. Poor communication or power line of the card reader	Reset

Channel	Sound	Cause	Recovery
7	"Warning, motor control abnormal"	1. Motor drive alarm; 2. Poor communication or power line of the motor drive	Reset
8	"Warning, magnetic navigation derailment"	Maximum derailment distance exceeded during navigation	Reset
9	"Warning, signal light abnormal"	1. Light controller damaged; 2. Poor communication or power line of the light controller	Automatic recovery
10	"Warning, display instrument abnormal"	1. Display instrument damaged; 2. Poor communication or power line of the instrument	Automatic recovery
11	"Warning, extension device failure"	1. Extension device damaged; 2. Poor communication or power line of the extension device	Reset
12	"Warning, route error"	Current route number is incorrect	Enter the correct route number
13	"Warning, site error"	Current site number is incorrect	Read the correct site number
14	"Warning, operation error"	1. Invalid operation code executed; 2. Operation process error	Reset
15-17	None	-	Reset
18	"Warning, low battery stop"	Battery level below the stop threshold	Replace or charge the battery
19	"Warning, obstacle stop"	Obstacle distance below the stop threshold	Remove the obstacle
20	"Warning, AGV failure"	Other AGV fault or alarm	Reset
21	Warning tone	1. Cart mode active; 2. Other AGV warning state	Exit the state
22	"AGV has arrived at the station"	Optional parking station detected and AGV stopped	Exit the state
23	To Alice (user music)	User switch	-
24	Opening Titles (user music)	User switch	-
25	Sax Voyage (user music)	User switch	-
26	Phoenix Tail Bamboo in the Moonlight (user music)	User switch	-
27	Going Home (user music)	User switch	-
28	Sax Jasmine (user music)	User switch	-
29	The Spanish Matador March (user music)	User switch	-
0	None	User switch	Turns user sound off

5.5.2 Status Lights

No.	Light	Meaning	Type
1	Off	Shut down	State

No.	Light	Meaning	Type
2	Green, breathing	Standby / idle	State
3	Green, steady	Travelling straight	State
4	Lights 1 and 4 running / flashing	Left turn / left branch	State
5	Lights 2 and 3 running / flashing	Right turn / right branch	State
6	Lights 1 and 3 running / flashing	Rotating anticlockwise	State
7	Lights 2 and 4 running / flashing	Rotating clockwise	State
8	Blue, flashing	Busy	State
9	Red, steady	General fault	Warning
10	Red, flashing	Emergency fault	Warning
11	Yellow, steady	Warning stop (obstacle / low battery stop)	Warning
12	Yellow, flashing	Warning slow-down (obstacle / low battery slow-down)	Warning
13	White, steady	Card number 0 read	State
14	Green, flashing	Start-up / traffic control / user pause	State
15	Sky blue, steady	Site switched / valid card read	State
16	Purple, steady	Route switching	State
17	Yellow, breathing	Waiting for release	State

6 Programming / Software

6.1 Routes, Sites and Operations

- **Route**: Several guide routes can be laid in a factory. The AGV stores multiple routes; the user enters the current route number manually (Operation monitoring > Current route).
- **Site**: Each route can have several characteristic points such as forks, charging stations or the entry and exit of slow-down sections. An RFID card with a unique card number is placed on the strip at each point. When the AGV reads the card, the card number becomes the current site number automatically. The current site can also be set manually.
- **Operation**: For each route, each site and each direction, the AGV stores a series of up to 10 operations. When the AGV on route X reads the card of site Y while travelling forward, it executes the forward operation series of route X / site Y; when travelling backward, it executes the backward series.

Forward and backward operations for each route are edited under Home > Route editor (Section 5.3.4). Each operation consists of one operation code and four parameters (D0, D1, D2, D3).

6.2 Site Editing (Writing RFID Cards)

Open the site editor from Home > Equipment monitoring > Card reader monitoring, or from Home > Route editor > Site edit. The site number is the RFID card number.

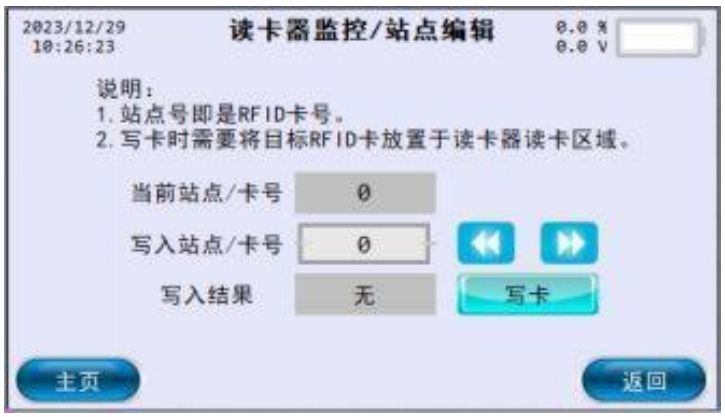


Figure 6-1 Card reader monitoring / site edit page

Item	Description
Current site / card number	Number of the card currently read
Write site / card number	Target number to write to the card
Write card	Writes the number; the result shows "Write success" or "Write failure"

1. Place the RFID card on level floor free from interference.
2. Push the AGV over the card until the card reader beeps.
3. Tap the number field after "Write site / card number" and enter the target card number.
4. Tap **Write card**. Check that the result shows "Write success".
5. Wherever this card is placed becomes a site; its card number is the site number.

6.3 Typical Route Layouts

- **Single line (back and forth)**: Lay a straight or curved strip and place site cards in sequence, at least 1 m apart. Use forward and backward operation series to define what the AGV does at each end and at each station.
- **Closed loop**: Lay the strip as a closed circuit and place site cards in ascending order, at least 1 m apart. Add slow-down sites before and after each curve.
- **Branch route**: At a fork, the AGV selects the left, middle or right branch according to the fork setting (operation code 3, parameter D1, or Operation monitoring > Navigation fork). Place a site card before the fork and program the required fork direction for it. Use separate route numbers (operation code 40) where different branches form different tasks.

6.4 Operation Code Table

All operation codes and parameters (D0, D1, D2, D3) are decimal. "/" means the parameter is not used.

Operation	Code	Parameters (D0, D1, D2, D3)	Description
No operation	0	/	Empty instruction (skipped)
Motion stop	1	/	Stops motion
Navigation (no parameters)	2	/	Starts navigation with the existing parameters
Navigation (with parameters)	3	D0: direction (0 forward, 1 backward); D1: fork (-1 left, 0 middle, 1 right); D2: speed in mm/s; D3: /	Starts navigation with the set parameters
Switch navigation direction	4	/	Reverses direction: forward to backward, backward to forward
Offline (no parameters)	10	/	Starts offline (non-strip) motion with the existing parameters
Offline (with parameters)	11	D0: forward/backward speed in mm/s; D1: /; D2: rotational speed in rad/s; D3: /	Starts offline motion with the set parameters
Spin left, then forward	15	D0: target magnetic sensor (1 front, 2 rear); D1: speed leaving the strip in rad/s; D2: speed approaching the strip in rad/s; D3: navigation speed after completion in mm/s	Rotates in place left/right until the new strip is detected, then travels forward/backward at the set navigation speed
Spin right, then forward	16	As code 15	As code 15
Spin left, then backward	17	As code 15	As code 15
Spin right, then backward	18	As code 15	As code 15
Set obstacle area	20	D0: front obstacle area / off; D1: rear obstacle area / off; D2, D3: /	0-15 = automatic area, from far to near; 50 = forced off
Set user music	25	D0: music control 0-3; D1: music channel 0-255; D2: volume 0-28; D3: /	Music control: 0 all on, 1 system sound off, 2 user sound off, 3 all off. Volume adjustment is not available on some models
Set alarm mask	30	D0: mask bits, low 16 bits; D1: mask bits, high 16 bits; D2, D3: /	Writing 1 to a bit ignores the corresponding alarm
Switch route	40	D0: target route number; D1-D3: /	Switches to and runs the target route

Operation	Code	Parameters (D0, D1, D2, D3)	Description
Site redo	41	D0: site number; D1-D3: /	Immediately interrupts the current operation and executes the functions of the given site on the current route
Y output bit	50	D0: Y port number (00-07 = Y00-Y07, 10-17 = Y10-Y17, 20-27 = Y20-Y27, and so on); D1: output value (0 off, 1 on); D2, D3: /	Sets the target Y output
Set Modbus data	60	D0: address; D1: length (1 = 16 bit, 2 = 32 bit); D2: low-word value; D3: high-word value	Use only under the guidance of a Southern Machinery technician
Wait time	100	D0: time in 0.1 s; D1-D3: /	Waits for the set time, then executes the next operation
Wait time or release	101	D0: time in 0.1 s (0 = wait indefinitely); D1-D3: /	Waits for the release button within the set time; continues on release or timeout
Wait time for X input	105	D0: time in 0.1 s (0 = wait indefinitely); D1: X port number (00-07 = X00-X07, 10-17 = X10-X17, 20-27 = X20-X27, and so on); D2: wait value (0 off, 1 on); D3: timeout action (0 ignore, 1 pause with alarm)	Waits for the X input to turn on/off within the set time; optional alarm on timeout
Wait time for magnetic strip	110	D0: time in 0.1 s (0 = wait indefinitely); D1: magnetic sensor (1 front, 2 rear); D2: target state (see below); D3: timeout action (0 ignore, 1 pause with alarm)	Waits for the magnetic navigation state within the set time; optional alarm on timeout
Wait distance	150	D0: distance in 0.1 m; D1-D3: /	Travels the set distance, then executes the next operation
Wait distance for X input	155	D0: distance in 0.1 m (0 = wait indefinitely); D1: X port number (as code 105); D2: wait value (0 off, 1 on); D3: timeout action (0 ignore, 1 pause with alarm)	Waits for the X input to turn on/off within the set distance; optional alarm on timeout
Wait distance for magnetic strip	160	D0: distance in 0.1 m (0 = wait indefinitely); D1: magnetic sensor (1 front, 2 rear); D2: target state (see below); D3: timeout action (0 ignore, 1 pause with alarm)	Waits for the magnetic navigation state within the set distance; optional alarm on timeout
Switch route on battery level	205	D0: battery level 0-1000 (= 0 % to 100 %); D1: route number; D2, D3: /	When the battery level is below the set value, switches to the given route

Magnetic strip target states for codes 110 and 160 (parameter D2):

Value	State
0	No magnetic strip
1	Strip entered
2	Full strip / transverse strip
3	Middle 8 points on strip
4	Middle 8 points entering strip
5	Middle 4 points on strip
6	Middle 4 points entering strip
7	Deviation less than 1 cm

6.5 Programming Example: Slow-down Section

Example: route 1 has a 3 m slow-down section in the forward direction.

1. Write an RFID card with card number 11 (Section 6.2) and place it on the strip at the entry of the slow-down section.
2. In the route editor, edit the **forward** operations of route 1, site 11:

Row	Operation	Code	D0	D1	D2	D3
0	Navigation (with parameters)	3	0 (forward)	0 (middle)	100 (0.1 m/s)	0
1	Wait distance	150	30 (3 m)	0	0	0
2	Navigation (with parameters)	3	0 (forward)	0 (middle)	700 (0.7 m/s)	0

3. Tap Save operation.
4. Set the current route of the AGV to route 1. When the AGV passes site 11, the current site switches to 11 automatically and the operations above are executed: the AGV slows to 0.1 m/s, travels 3 m and then returns to 0.7 m/s. Empty operations are skipped automatically.

7 Maintenance

WARNING Switch the AGV off before cleaning or maintenance. Never work on the AGV while it is powered.

7.1 Maintenance Schedule

Interval	Item	Action
Daily (before work)	Spot inspection	Check the AGV against the spot-inspection checklist; confirm that emergency stops, obstacle sensors and status lights work
Daily	Path	Check that the path is clear, dry and free of oil
Regularly	AGV body	Remove dust and debris; wipe the casing with a damp cloth to remove dirt, dust and liquids; check the casing for damage
Regularly	Buttons and touch screen	Check that switches and buttons work normally; clean the buttons so they operate smoothly; clean the touch screen so it remains clearly visible
At least weekly	Sensors	Check the magnetic navigation sensors, obstacle sensors, anti-collision sensor and other safety sensors; repair or replace any faulty sensor promptly
1 to 2 times a week	Lifting hook (if fitted)	Clean and lubricate
Regularly	Wheels	Check and clean the drive and support wheels under the AGV so they move smoothly
At least monthly	Drive mechanism	Clean the drive-wheel mechanism and add lubricating oil
Regularly	Battery and charger	Check battery level and service life; replace a battery that no longer holds sufficient charge; check the charger
Regularly	Magnetic strip	Check the strip for nicks, deformation, wear and loose sections; repair defects promptly; keep the floor dry
As required	Motor and shock absorbers	Keep clean and lubricated for smooth operation
Regularly	Antenna communication	Check that wireless communication works normally
After each maintenance	Maintenance record	Record the items and work done to track the AGV condition and take timely corrective action

7.2 Precautions for Use

- The touch screen, sound module and other electrical parts of the operation panel are sensitive to moisture. Keep them dry.
- Clean the operation panel with a well-wrung damp cloth. Do not use corrosive detergents or oily cleaners.
- Do not leave the AGV powered on in cart mode unattended; unexpected faults may occur.
- To stop the AGV, use the Start/Stop button; in an emergency, use the emergency stop knob. Never drag the AGV, stand in front of it or use force to stop it.
- Do not place objects on the operation panel.
- Do not step over or climb on the AGV; you may trip and cause injury or damage.
- Do not linger in the AGV running area. Keep clear of the AGV and maintain a safe distance.
- When adjusting the route, pay attention to the AGV running direction and do not let the AGV run in the wrong direction.

- Do not expose the AGV to rain or corrosive substances.
- Switch off the power supply during holidays.
- Never change program parameters during normal operation.

8 Troubleshooting

8.1 HMI Scroll-bar Messages

No.	Message	Cause	Type	Recovery
1	Emergency stop knob abnormal	1. Emergency stop pressed; 2. Emergency stop signal line disconnected or poor contact	Warning	Reset
2	Collision sensor abnormal	1. Bumper strip has hit an object; 2. Sensor signal line short-circuited	Warning	Reset
3	RTC abnormal	Button cell (backup battery) has failed	Warning	Replace the button cell
4	Your device has expired	Authorisation invalid	Warning	Apply for authorisation
5	Magnetic navigation sensor abnormal	1. Sensor damaged; 2. Poor communication or power line of the sensor	Warning	Reset
6	Obstacle sensor abnormal	1. Sensor damaged; 2. Poor communication or power line of the sensor	Warning	Reset
7	Card reader abnormal	1. Card reader damaged; 2. Poor communication or power line of the card reader	Warning	Reset
8	Motor control abnormal	1. Motor drive alarm; 2. Poor communication or power line of the motor drive	Warning	Reset
9	Magnetic navigation derailment	Maximum derailment distance exceeded during navigation	Warning	Reset
10	Voice player abnormal	1. Voice player damaged; 2. Poor communication or power line of the voice player; 3. Voice player failure	Warning	Reset
11	Signal light abnormal	1. Light controller damaged; 2. Poor communication or power line of the light controller	Warning	Automatic recovery
12	Display instrument abnormal	1. Instrument damaged; 2. Poor communication or power line of the instrument	Warning	Automatic recovery
13	Extension device failure	1. Extension device damaged; 2. Poor communication or power line of the extension device	Warning	Reset
14-19	Vehicle fault 14 to 19	Reserved	Warning	-
20	Route error	Current route number is incorrect	Warning	Enter the correct route number
21	Site error	Current site number is incorrect	Warning	Read the correct site number
22	Operation error	1. Invalid operation code executed; 2. Operation process error	Warning	Reset
23	Modbus connection abnormal	1. Modbus cable short-circuited; 2. Circuit short-circuited; 3. No response from the connected device	Warning	Automatic recovery

No.	Message	Cause	Type	Recovery
24	System connection abnormal	-	Warning	-
25	Memory failure	1. Flash memory (W25Q) fault; 2. Read/write verification failed	Warning	Apply for authorisation (contact service)
26	Low battery stop	Battery level below the stop setting; stop warning issued	Warning	Charge, then reset
27	Obstacle stop	Obstacle distance below the stop threshold; stop warning issued	Warning	Reset
28	Obstacle slow-down 1	Obstacle within slow-down area 1	Warning	Reset
29	Obstacle slow-down 2	Obstacle within slow-down area 2	Warning	Reset
30	Low battery slow-down	Battery level below the slow-down setting; slow-down warning issued	Warning	Charge, then reset
31	Your device is about to expire	Remaining authorisation time less than 7 days	Warning	Apply for authorisation
32	Cart mode	Cart mode activated on the main page	State	Automatic recovery
33	Traffic control	AGV is under traffic control	State	Reset
34	Optional stop	Optional parking station detected and AGV stopped	State	Reset
35	User stop	1. Optional parking station detected and AGV stopped; 2. Start/Stop button pressed	State	Reset
36	Operation pause	A pause is being executed in the route site operations	State	Automatic recovery
37	Motion stop	Motion mode is "stop"	State	Automatic recovery
38	Motion emergency stop	Motion mode is "emergency stop"	State	Automatic recovery

8.2 Common Problems

Problem	Cause	Solution
AGV leaves the strip at curves (derailment alarm)	Speed too high entering the curve; curve radius too small; strip damaged or loose	Add slow-down sites 0.5 m before and after the curve; re-lay the curve with a larger radius; repair the strip
AGV does not recognise a site	Card not written or damaged; card too close to another card; card reader fault	Rewrite or replace the card; keep cards at least 1 m apart; check card reader monitoring
Route error / site error	Wrong current route or site set	Set the correct route and site in Operation monitoring
Frequent obstacle stops with no obstacle	Strong light or reflective objects in the laser field; obstacle area set too far	Remove reflective objects or shield strong light; reduce the obstacle area value
AGV skids or strays	Oil or water on the floor	Clean and dry the floor and strip
AGV will not start after emergency stop	Emergency stop knob still pressed	Turn the knob to release it, then press the reset button
AGV cannot be pushed by hand	Motor holding brake active	Activate cart mode

Problem	Cause	Solution
Short working time	Battery aged or not fully charged	Charge fully; replace the battery if capacity is insufficient
RTC abnormal message	Button cell flat	Replace the button cell

10 Warranty and Service Contact

Southern Machinery provides technical support, spare parts and service for the SFY03 Magnetic Navigation AGV. Warranty terms are as stated in your sales contract. Failures caused by unauthorised program changes, disassembly or replacement of components, misuse, or operation outside the specified site and environmental conditions are not covered by the warranty.

When requesting service, please provide the AGV model and car number, the alarm message or voice channel shown, and a description or photo of the problem.

Shenzhen Southern Machinery Sales and Service Co., Ltd

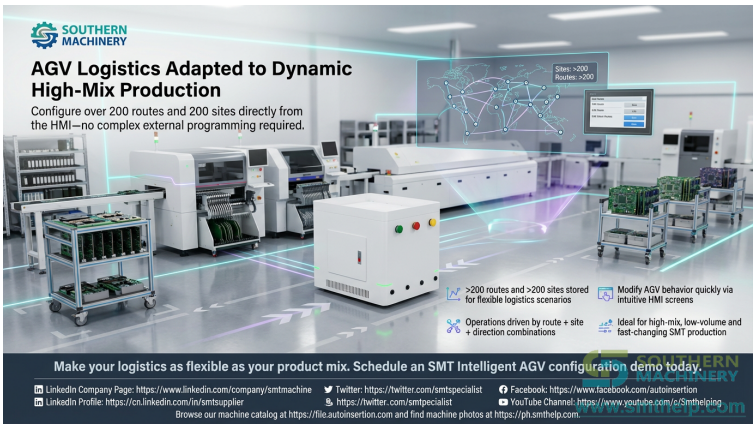
- Website: www.smthelp.com
- Email: info@SMThelp.com
- WhatsApp: +86 136 0256 2576

SOUTHERN MACHINERY

Your Trusted Partner for SMT & THT Solutions

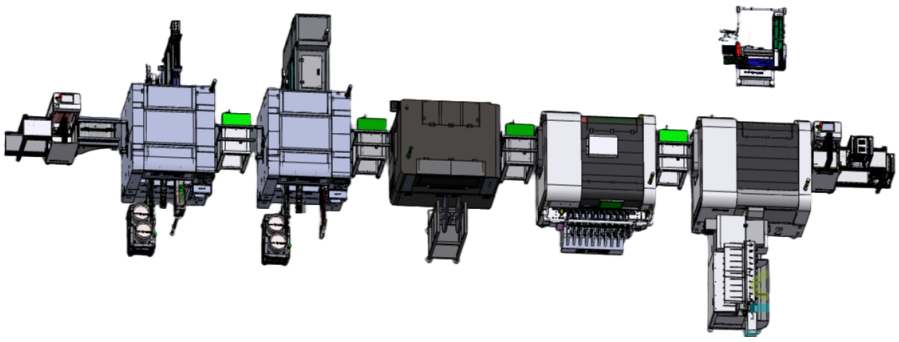
Founded in Shenzhen in 2011, Southern Machinery specializes in designing and manufacturing advanced SMT/THT machinery for PCB assembly automation. Our precision-engineered equipment delivers cost-effective, high-efficiency solutions for both high-speed mass production and delicate small-batch manufacturing, ensuring durability and user-friendly operation.

Leveraging Shenzhen's electronics manufacturing expertise, we provide not just top-tier machinery but also industry-leading knowledge and best practices to global clients.



Explore our solutions and follow our innovations

Website	www.smthelp.com
LinkedIn Company Page	linkedin.com/company/smtmachine
LinkedIn Profile	linkedin.com/in/smtsupplier
Twitter / X	twitter.com/smtspecialist
Facebook	facebook.com/autoinsertion
YouTube Channel	youtube.com/c/Smthelping
Machine Catalog	file.autoinsertion.com
Machine Photos	ph.smthelp.com



info@SMThelp.com