

Development of Ultra-Low-Platform (Under Trolley) Automated Guided Vehicle (AGV), 3MS-S8

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Abstract

With the expansion of e-commerce, the volume of freight is increasing year by year, and the construction of logistics warehouses is booming. In new logistics warehouses, automation equipment is being actively introduced.

Therefore, we have developed a new ultra-low-platform (under trolley) Automated Guided Vehicle (AGV), 3MS-S8, as an automated equipment for advanced logistics warehouses.

The big feature is that the vehicle height is kept low at 132 mm. The AGV can go under roll box pallets or pallets set on a loading platform, lift up the transported items with a lifter mounted on the AGV, and transport them automatically. It can also be used for various purposes, such as transporting workpieces between processes at production sites.

1 Preface

Our Automated Guided Vehicles (AGVs) began development and production to meet the demand for automated production lines in the automotive industry, and are now used to automatically transport a variety of items at various manufacturing sites. In recent years, the expansion of online shopping has accelerated the construction of logistics centers, and there is a growing demand for labor-saving automated transport.

In the logistics industry, people often transport goods using roll box pallets (hereinafter referred to as “roll pallets”), but this is unskilled labor and physical labor that involves walking long distances. In addition, securing enough forklift drivers is an issue when transporting goods using pallets. Under these circumstances, the demand for automated transport is increasing in the logistics industry.

To meet this demand, we have developed a new type of ultra-low-platform (under trolley) AGV, 3MS-S8. This paper introduces the specifications and features of the 3MS-S8.

2 Specifications

Fig. 1 shows the names of the 3MS-S8 parts. **Fig. 2** shows its external view. **Table 1** shows the specifications. The vehicle dimensions are W510 ×

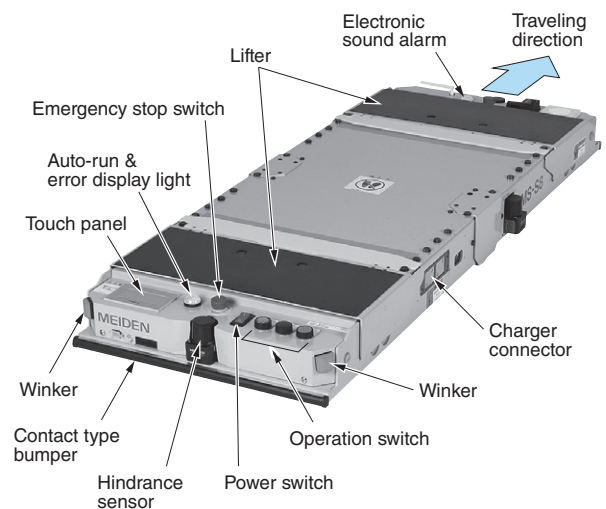
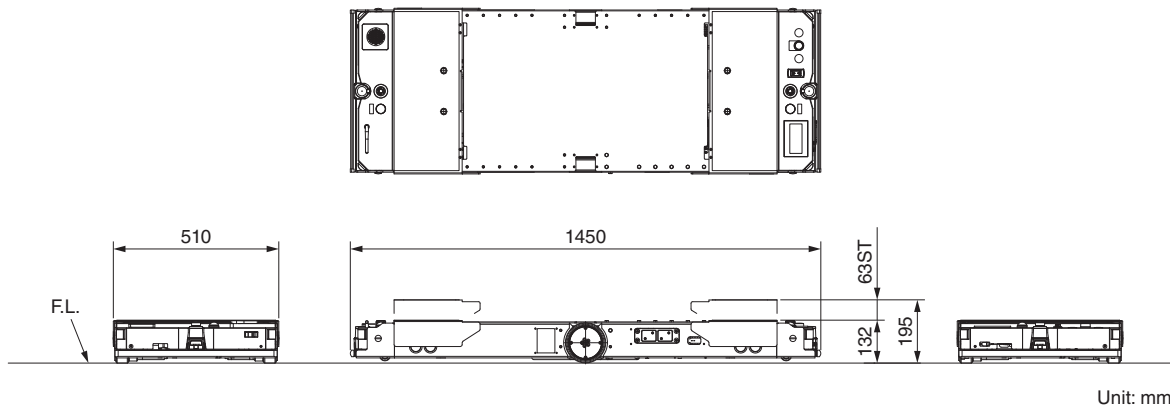


Fig. 1 Names of 3MS-S8 Parts

The 3MS-S8 is equipped with the lifter, various safety devices, and an operation controller.

H132 × L1450 mm, making it one of the smallest in the industry. The maximum load capacity is 800 kg, a significant improvement over our previous model, 3MS-3.5E.

The drive and steering are driven by a two-wheel speed differential system, and a brushless DC motor is used. The use of lithium-ion batteries also makes the vehicle both smaller and lighter.



Unit: mm

Fig. 2 External View of 3MS-S8

The vehicle body is made compact with a low platform. The vehicle height is 132 mm.

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Table 1 Specifications

Specifications are shown for the 3MS-S8 and the former 3MS-3.5E model.

Item		3MS-S8 (New product)	3MS-3.5E (Former product)
Major dimensions	Body length (mm)	1450	1650
	Body width (mm)	510	380
	Body height (mm)	132	180
	Self-weight (kg)	150	
Performance	Induction system	Magnetic bar, magnetic tape (thin type)	Magnetic bar, magnetic tape
	Driving and steering system	Powered wheels steering	Front wheel driving and steering
	Traveling direction	Forward and backward moving, spin turn	Forward moving, simplified backward moving, and spin turn
	Permissible load (kg)	800	350
	Maximum driving speed (m/min)	60	
	Minimum turning radius (mm)	700 (Velocity 30 m/min)	800 (Velocity 30 m/min)
	Stopping accuracy (mm)	±10	
	Gradability (%)	2 (5 m continuously)	

Two lifters are independently located at the front and rear of the vehicle, and together they can lift up to 800 kg. These also use brushless DC motors. The front and rear loading platforms are W510 × L160 mm, with a pitch between the platforms of 960 mm. The workpiece to be transported must be able to be supported by the two loading platforms.

3 Features

The 3MS-S8 is equipped with the functions necessary to build a transportation system. The main standard functions are as follows.

3.1 Automatic Charging Function

The 3MS-S8 is equipped with an automatic charging terminal on the side of the vehicle body. By installing an automatic charging device on the ground, the AGV can automatically charge and operate 24 hours a day. The AGV receives wireless instructions from the AGV control panel and heads to charge, so when the required transportation volume is large, transportation is prioritized, and when the demand is small, automatic charging is performed at an appropriate time. The AGV monitors the remaining battery level by itself, and when the battery level is low, it can be controlled to charge for longer than usual.

3.2 Safety Device

The AGV is equipped with the following functions to ensure safety against the potential collision risk with people.

3.2.1 Approach Detection Device (Obstacle Detection Sensor)

Non-contact approach detection devices are installed at the front and rear of the vehicle body to monitor the direction of travel of the AGV. If a person or obstacle approaches, the vehicle will slow down to a safe speed or come to a stop before contact. When making a spin turn, there are blind spots that cannot be detected by the front and rear sensors alone, so sensors can be added to both sides of the vehicle as an option.

3.2.2 Obstacle Contact Bumper

Pressure-sensitive bumpers are attached to the front and rear of the vehicle frame to detect contact and collision. The AGV is supposed to slow down and stop with the obstacle detection sensor, but in unforeseen circumstances, such as when a person suddenly jumps out, the contact-type bumper will make an emergency stop, so thorough safety measures are taken to prevent damage from spreading.

3.2.3 Load Detection Device

If the workpiece to be transported is not properly positioned, there is a risk that the transported object will fall or tip over during lift-up or travel. For this reason, a sensor is installed on the loading platform to check that the lift-up is normal. If an abnormality is detected during lift-up, an interlock is installed to sound an alarm and stop the vehicle. Safety is further enhanced by checking for sensor failures every time before lifting up.

In addition to the above devices, an electronic sound alarm and blinkers are installed to inform people in the vicinity of the approach and the direction of travel of the AGV. Attention is alerted both audibly and visually.

3.3 Wireless Local Area Network (LAN)

A wireless LAN unit is installed on the AGV, and multiple AGVs can be operated efficiently by wirelessly communicating with the AGV system control panel on the ground. The AGV control panel manages the AGVs, for example giving destination instructions, standby control to prevent AGVs from colliding with each other at intersections, and linking with customer equipment such as automatic shutters and elevators can be performed automatically via wireless communication. In addition, the status of the AGV can be monitored in real time, so even if the AGV stops abnormally, the position and status

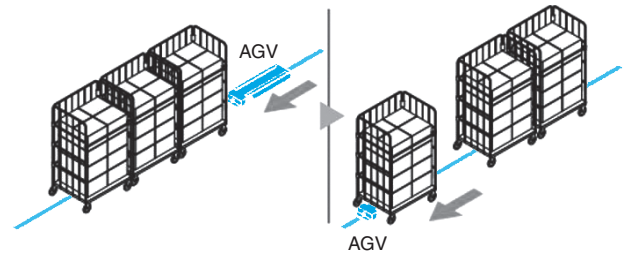


Fig. 3 Example Layout

The AGV is capable of going under the cargo bed (cart). It is, therefore, possible to let multiple carts stay in line. The AGV can pass through under the multiple carts staying in line (left diagram) and move the cart staying in the recess of the line (right diagram).

of the AGV can be immediately grasped, and recovery work can be performed quickly.

3.4 Going-Under-A-Cart Function

Fig. 3 shows an example layout. The 3MS-S8 has a low-platform with a vehicle height of 132 mm, so it can go under a cart, lift it up for transportation, and then pass under the cart after transportation. By lining up multiple carts in a narrow space and waiting, an efficient layout can be achieved even in a small space.

4 Postscript

We introduced our new product, the ultra-low-platform (under trolley) AGV, 3MS-S8.

In the future, we aim to expand the range of applications by taking advantage of the low-platform and compact features of the 132 mm vehicle height. We intend to further improve usability and provide our customers with a better transport system.

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