HD HYUNDAI XITESOLUTION


The forklift in the photo may differ from the standard model.

# RS010A-9

Hyundai self-driving forklift


## HIGH COST-EFFECTIVENESS & PRODUCTIVITY BEYOND YOUR IMAGINATION!

The repetitive and simple task of pick-up and drop-off, which had been performed by manned forklifts, could hardly generate significant productivity growth due to continued alertness, fatigue, frequent breaks and shift changeovers of human operators. Now, Hyundai's autonomous forklift is here to deliver everything that had been hoped for at all worksites!

### Specification (RS010A-9)

| No. | Item | Unit | Dimensions |
|---|---|---|---|
| 1 | Load capacity / Rated load | kg | 1,000 |
| 2 | Service weight (unloaded, battery included) | kg | 3,576 |
| 3 | Load center | mm | 600 |
| 4 | Wheelbase | mm | 1,160 |
| 5 | Tire size, front (Φ*width) | mm | 305x140 |
| 6 | Tire size, rear (Φ*width) | mm | 285x100 |
| 7 | Mast lowered height (TF670) | mm | 2,853 |
| 8 | Maximum fork height | mm | 6,705 |
| 9 | Maximum height lifted (with load backrest) | mm | 7,772 |
| 10 | OHG height (NAV sensor height) | mm | 2,116 (2,956) |
| 11 | Overall length, reach in, fork end | mm | 2,628 |
| 12 | Width (front/rear) | mm | 1,279 / 1,372 |
| 13 | Turning radius | mm | 1,455 (min) |
| 14 | Fork dimensions (hook type) | mm | 40x100x1,200 |
| 15 | Reach stroke | mm | 263 |
| 16 | Ground clearance | mm | 63 |
| 17 | Drive motor (S2 60min rating) | kW | 7.5 |
| 18 | Hydraulic motor (S3 15%) | kW | 14 |

### Options

- **Fork(mm) :** 1,200(STD) / 1,600 / 2,400
- **Battery :** Lead Acid (48V / 300, 310Ah), Lithium (51, 52V / 282Ah)

### Performance (reach truck)

| No. | Item | Dimensions |
|---|---|---|
| 1 | Motor encoder | 64 pulse (gear reduction ratio 14.5:1) |
| 2 | Fork position sensor | Sideshift(1ea), Lift(1ea), Reach(1ea) |
| 3 | Navigation sensor | NAV350 |
| 4 | Pallet hole detection sensor | TIM571 |
| 5 | Front/rear obstacle detection sensor | TIM561, WT100, MICS3 |
| 6 | Signal lamp | 3colors (Red, Yellow, Green) |
| 7 | Sound | MP3 type (audio guidance for each situation) |
| 8 | Emergency stop button | 3 buttons (front, left, right) |
| 9 | Contact-sensitive bumper | cushion-type, safety sensors embedded |
| 10 | Monitor | touch panel, 12-inch monitor |
| 11 | Manual operation | joystick (USB) |
| 12 | Maximum travelling speed (manual) | 1.0m/sec (max) |
| 13 | Maximum turning speed (manual) | 30°/sec (max) |
| 14 | Maximum travelling speed (autonomous) | 1.0m/sec |
| 15 | Maximum turning speed (autonomous) | 30°/sec (max) |
| 16 | Height of load during travel | 650mm |
| 17 | Loading accuracy | ±60mm(left / right) ±7°(rotation) |
| 18 | Loading time | 30sec |
| 19 | Unloading accuracy | ±30mm(left / right) ±2°(rotation) |
| 20 | Unloading time | 27sec |
| 21 | Pose accuracy (travel) | ±50mm to the left/right during travel |
| 22 | Pose accuracy (stop) | ±50mm(front/rear), ±30(left/right) |
| 23 | Decelleration distance | 1,300mm |
| 24 | Stop range (front / rear) | 100mm |
| 25 | Stop range (left / right) | 400mm |
| 26 | Low voitage (battery) alarm (Battery control system) | 48.8V or below (Li-ion) 46.56V or below (Lead Acid) |

The appearance and options of the model featured in the catalog are subject to change.

# Unparalleled technology and exceptional innovation!

## Hyundai launches its own self-driving forklift, RS010A-9!

Hyundai launched the RS010A-9 forklift to enhance value of the IoT-based automation platform, respond to increased attention to logistics automation and fulfill growing needs for self-driving forklifts that are cost effective and reliable.
It will help you navigate through the 4th Industrial Revolution successfully!

**Effective operation**
- Automated procedure linked to WMS (Warehouse Management System)
- Scalable operation through autonomous control system
- Wireless charger station (OPT)
- Li-ion battery (OPT)

**Safety**
- Assure collision safety from pedestrians or facilities
- Provide real time monitoring and management
- Cope with erroneous cases such as confusion caused by manned forkllift, wrong job order
- Multi emergency switch
- Blue spot & Red zone light

**Economy & Productivity**
- Increase production with multiple forklifts and autonomous control system
- Enhance productivity by finding optimized route and fast work speed
- Enable forklift to work seamlessly by the use of scheduling and auto charging

**Accuracy**
- Obtain consistent and stable positional accuracy less than 10mm and 0.5deg.

You can see the video by scanning the QR code.

The forklift in the photo may differ from the standard model.

Reasonable & Intuitive

# Compelling logic & intuitive sensing

This forklift has a function of self-driving which finds optimized route by itself.
It is also equipped with safety, position sensors that increase productivity and safety.


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## From manual to autonomous Hardware & software

In the warehouse, forklift operators are responsible for moving and staging loads in a constantly changing work environment. Operators need to make quick decisions and responses based on their experience and intuition.
For autonomous forklifts to complete these tasks & respond effectively to the changing environment, they come with forklift control software and nine different sensors, which eliminate the need for human assistance.



**Landmark (Reflector)**
The reflector, linked to the location sensor, is installed on the pillars or walls of the worksite to set the route and identify real-time location.


**Safety sensor**
The sensor can slow the forklift down and brake to a complete stop to prevent frontal collision, if approaching a tall obstacle

**Fork sensor**
The sensor detects frontal objects or the slots on the pallet where the fork should be inserted.

**Pallet hole detection sensor**
The sensor defects the position of the pallet hole, volume of the cargo and its distance to the forklift in order to prevent any accidents caused by errors.

**Fork position sensor (Lift, Reach, S/S)**
The fork height sensor using wires controls the relative position of forks precisely when handling palettes. Also, the fork position is detected by additional wire sensors for reach and side shift.

**Control software & UI**
The embedded software, which processes information from various sensors integrated to the forklift, sets the optimal route and working conditions to transmit commands to the driving system and machinery

**Wireless communication system**
The wireless terminal works in a Wi-Fi connected environment in order to enable communication between the autonomous forklift and the central control system.

**Navigation sensor**
The sensor identifies the location of the reflector installed on the walls or pillars of the site, sets and registers it to the map, and detects the forklift location through reflectors within a 70m distance (driving error 10mm, angle error 0.5 degree)

**Front laser sensor & Safety bumper**
The sensor detects the obstacles when driving. If any obstacles is found, the machine automatically stops to prevent a collision. In addition, the controller's power is automatically shut off when the bumper comes into contact with something.

**Side laser sensor**
The sensor detects the distance between the autonomous forklift and structures/ obstacles on the left, right or in front of the equipment, and measures the distance to racks.

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# Exceptional Control

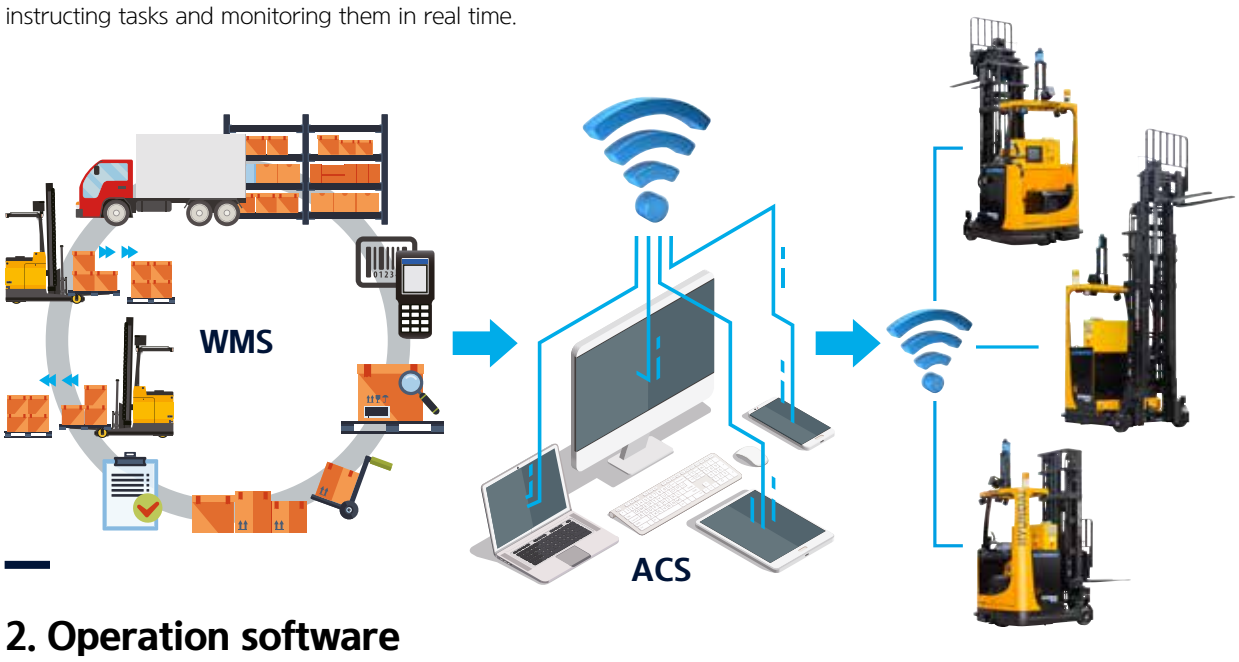
The central control system maximizes operational efficiency of Autonomous forklifts.

## Autonomous control system & operation software

Multiple autonomous forklifts equipped with accident prevention programs & automated charging system, can identify the shortest distance and optimal working hours, while picking up and dropping off heavy loads all day under the central control system. Moreover, they maximize productivity by contributing to efficient instructions and scheduling of each task, collision prevention & recharging.

### 1. Autonomous control system

Linked to the warehouse management system, the central control system keeps forklifts in perfect control by instructing tasks and monitoring them in real time.




### 2. Operation software

**Forklift control software & system**

- Link the forklift's electronic hardware, telecommunications & I/O
- Control driving and process the sensor system
- Autonomous operation enabled by standalone or central control
- Real-time telecommunication with the control software via wireless communication

**Environmental set-up & mapping**

- Utilize navigation sensor (NAV-350) to acquire information on local driving environment
- Create and store map data
- The map data can be manually updated

**Autonomous driving & routing**

- Location sensing
- Detect & avoid obstacles
- Plan and follow driving routes

**Work sequence scheduling**

- Arrange a sequence of actions, i.e. driving, loading, unloading, turning, advancing and reversing
- Ensure scheduling and formation control of individual operations through central control

## Automated energy supply system to complete the autonomous system

The autonomous system is completed only when the battery control is automated in addition to the automated operation by the WMS command.

**Convenient manual control system**

When operating the machine manually, the driver can use the multifunctional joystick to adjust the equipment easily. In addition, it is not fixed to allow the driver to change the direction of lever according to his or her habit.

**Automated wireless charging system**

When the battery life drops below the pre-set value or is suspended for over the pre-set period of time, the forklift automatically connects to the automated wireless charging system to recharge the battery.

**Li-ion battery**

A lead-acid battery needs to have distilled water refilled manually and requires maintenance and resting of equipment as it needs 8 hours for recharging. A lithium-ion battery, on the other hand, does not require regular maintenance and can be recharged fast to complete the automation system and enhance the efficiency of operation.

# Advanced Safety

The safety program prevents collisions in a changing environment.

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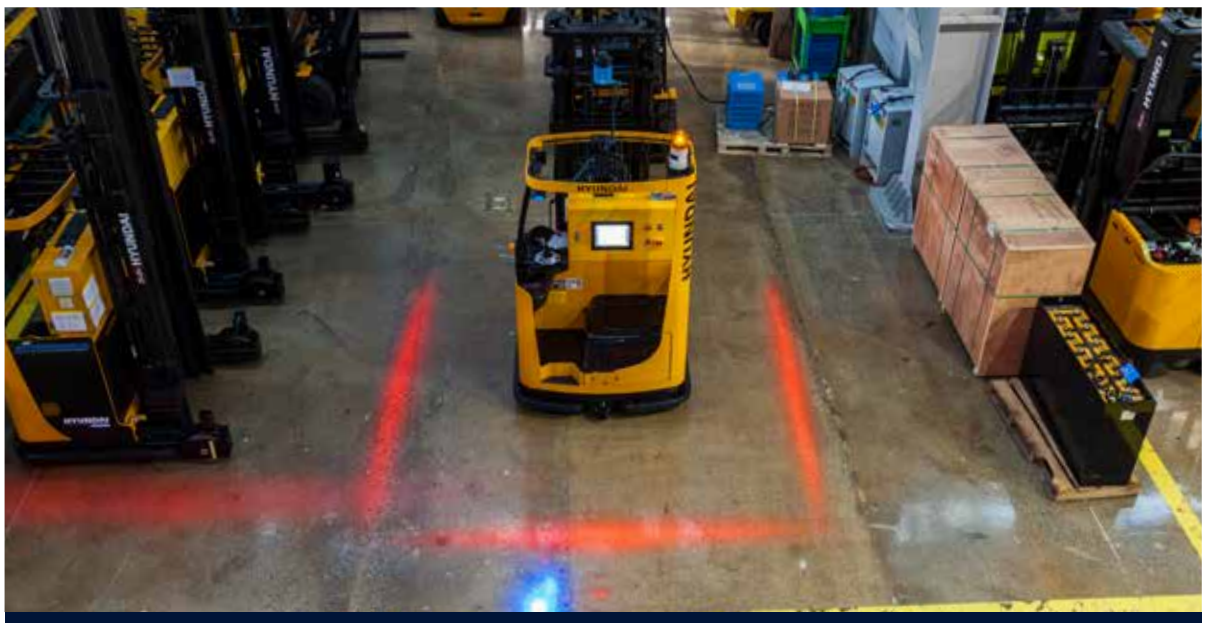
## Various safety features for safety of the warehouse

The safety of the warehouse where people and automated logistics equipment work together is ensured by the automated safety system and a warning system of self-driving forklifts.



### Blue spot & Red zone LED lamp

The forklift comes with a blue spot and red zone LED lamp as a standard feature to alert the nearby operators about the equipment's position and direction.

### Tower lamp

The tower lamp is automatically operated while operating the equipment to alert nearby operators and managers about the equipment's position and direction.
A speaker is included and the sounds are customized by operators.

### Signal lamp

The status of forklift is shown in real-time using three colors of the signal lamp for managers and operators to take action accordingly.
- Green : Operating properly
- Yellow : Problem occurred
- Red : Equipment stopped

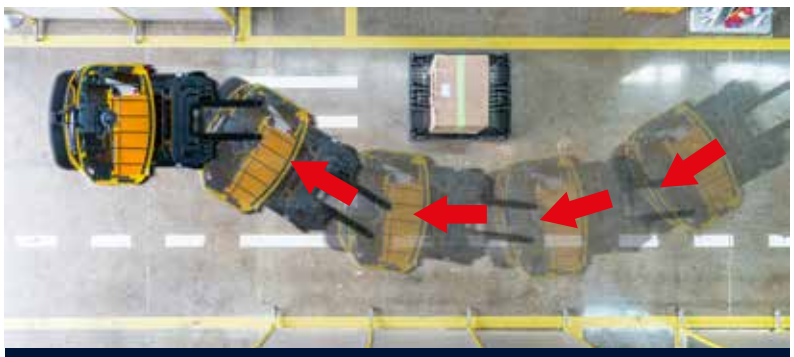
### Emergency switch

The emergency switches are placed on the left and right of the equipment and the front of the control panel.
The vehicle's movement is cut off when the switch is operated.

## Safe control to prevent collisions


### Safe stop after detecting moving obstacles

The system detects moving objects that appear in front of the forklift from 1m away, and stops 10cm from the obstacle to prevent collisions.



### Avoiding static obstacles

Create a new driving route to avoid collsions, if a stationary obstacle appears on the way.

### Safe stacking

Check each stacking job and cancel the hazardous one that was ordered incorrectly.

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