

LD Series

LD-60, LD-90, LD-90x, LD-60 ESD, LD-90 ESD, and LD-90x ESD

Item		LD-60	LD-90	LD-90x
Weight (with Battery)		62 kg		
Environment	Ambient temperature	5 to 40°C		
	Ambient humidity	5 to 95% (non-condensing)		
	Operating Environment	Indoor usage only, no excessive dust, no corrosive gas or liquid. Floor must be free of water, oil, dirt, and debris. Direct sunlight may cause safety laser false positives.		
	Ingress Protection Class	IP20		
	Cleanroom rating	ISO 5 / Class 100		
Floor	Minimum floor flatness	F _r 25 (ACI 117 standard)		
	Traversable step	15 mm max. *1	10 mm max. *1	
	Traversable gap	15 mm max. *2		
	Maximum Slope	Up to 60 kg: 4.8° / 8.3% incline Over 60 kg: Level floor only		
	Minimum floor	5 Mpa		
Navigation	Routing	Autonomous routing by localizing with safety scanning laser based on environment mapping		
	Environmental map	Scan by walking the AMR through the environment, and upload the scan data to the MobilePlanner software		
	Low Front Laser	One Class 1 laser at front of AMR with a 126° field of view		
	Side Laser (optional)	Two Class 1 lasers with a 270° field of view on the sides of payload structure, user-mounted		
Visual Indicators		Light discs are located on the sides of the AMR. Additional indicators can be added.		
Payload	Maximum Weight	60 kg	90 kg	
Mobility	Run time (no payload)	15 h approx.		20 h approx.
	Run Time (full payload)	12 h approx.		15 h approx.
	Maximum Speed	1800 mm/s	1350 mm/s	900 mm/s
	Maximum Rotation Speed	180 °/s		
	Stop Position Repeatability (single AMR) *3	<ul style="list-style-type: none"> · To a position: ±65 mm · To standard target: ±25 mm, ±2° · With CAPS: ±8 mm, ±0.5° · With HAPS: ±8 mm, ±0.4° 		
	Stop Position Repeatability (Fleet) *3	<ul style="list-style-type: none"> · To a position: ±85 mm · To standard target: ±35 mm, ±2° · With CAPS: ±12 mm, ±0.5° · With HAPS: ±10 mm, ±0.5° 		
Drive wheels	Materials	Solid aluminum with non-marking, non-conductive, foam-filled rubber		
Passive casters	Materials	Conductive thermoplastic rubber on polyolefin		
Auxiliary Power		5 VDC±5%, 1 A switched Aux power 12 VDC±5%, 1 A switched Aux power 20 VDC±5%, 1 A switched Aux power 22 to 30 VDC, 4 A switched 22 to 30 VDC, 10 A switched 22 to 30 VDC, 10 A safe, switched 10 A switched and 10 A safe switched are from the same source and pass through the same 10 A fuse, so the sum of their current must be less than 10 A.		
Standard	AMR	EN ISO 12100, EN ISO 13849-1, EN 60204-1, EN 1525, ANSI B56.5, ISO 10218/CSA Z434, EN 61000-6-2, EN 61000-6-4		

	Battery	EN ISO 12100, UN 38.3, EN 61000-6-2, EN 61000-6-4, UL 2271
	Docking Station	EN ISO 12100, UL1012/CSA C22.2.107.2, IEC 60204-1, EN 61000-6-2, EN 61000-6-4
	Wireless	IEEE 802.11 a/b/g
Safety Features	Safety Scanning Laser	One at front of AMR Class 1 PLd safety per ISO13849-1 240° field of view
	E-STOP Buttons	One on Operator Panel, additional E-STOP buttons can be added to the payload structure
	Rear Sonar	Two at rear of AMR, 2 m range. Each pair includes one emitter and one receiver working together.
	Front Bumper	Two pairs of sensors at the front of the AMR
	Audible Indicators	Two speakers are included. Additional buzzers can be added.
Operator	Display	8.89 cm diagonal TFT, 320 x 240 pixels, color screen
	Button	ON button, OFF button, Brake-release button, and keyed mode selection
User Interface	Wireless	802.11 a/b/g
	Ethernet	One TCP/UDP interface (maintenance LAN), Auto-MDIX
	Serial	Two serial communication interfaces
	Digital I/O	16 inputs, 16 outputs
	Audio	Digital audio in / out

*1. A speed of 250 mm/s is recommended for traversing steps, and routine driving over steps should be avoided. Lower speeds may not traverse the step. Faster or frequent driving over steps will shorten the lifespan of the drivetrain components. All steps should have smooth, rounded profiles.

*2. AMR maximum speed is recommended for traversing gaps, and routine driving over gaps should be avoided. Lower speeds may not traverse the gap. Faster or frequent driving over gaps will shorten the lifespan of the drivetrain components.

*3. Stop position repeatability values were obtained using default AMR parameters and a map created by the LD-series AMR.

LD-250, LD-250 ESD Specifications

Item		LD-250
Weight (with battery)		148 kg
Environment	Ambient temperature	5 to 40°C
	Ambient humidity	5 to 95% (non-condensing)
	Operating Environment	Indoor usage only, no excessive dust, no corrosive gas or liquid. Floor must be free of water, oil, dirt, and debris. Direct sunlight may cause safety laser false positives.
	Ingress Protection Class	IP20
	Cleanroom rating	ISO 5 / Class 100
Floor	Minimum floor flatness	F _r 25 (ACI 117 standard)
	Traversable step	10 mm max. *1
	Traversable gap	15 mm max. *2
	Maximum Slope	Max. 1.7° / 3% incline
	Minimum floor	5 Mpa
Navigation	Routing	Autonomous routing by localizing with safety scanning laser based on environment mapping
	Environmental map	Scan by manually driving the AMR through the environment, and upload the scan data to the MobilePlanner for map creation.
	Low Front Laser	One Class 1 laser at front of AMR with a 126° field of view
	Side Laser (optional)	Two Class 1 lasers with a 270° field of view on the sides of payload structure, user-mounted

Visual Indicators		Light discs are located on the sides of the AMR. Additional indicators can be added.
Payload	Maximum Weight	250 kg
Mobility	Run time (no payload)	13 h approx.
	Run Time (full payload)	10 h approx.
	Maximum Speed	1200 mm/s
	Maximum Rotation Speed	120 °/s
	Stop Position Repeatability (single AMR) *3	<ul style="list-style-type: none"> · To a position: ±75 mm · To standard target: ±25 mm, ±2° · With CAPS: ±8 mm, ±0.5° · With HAPS: ±8 mm, ±0.4°
Stop Position Repeatability (Fleet) *3	<ul style="list-style-type: none"> · To a position: ±100 mm · To standard target: ±35 mm, ±2° · With CAPS: ±14 mm, ±0.6° · With HAPS: ±10 mm, ±0.6° 	
Drive wheel	Materials	Aluminum with polyurethane tread
Passive caster	Materials	Elastomer (Polyurethane)
Auxiliary Power		5 VDC±5%, 1 A switched Aux power 12 VDC±5%, 1 A switched Aux power 20 VDC±5%, 1 A switched Aux power 22 to 30 VDC, 4 A switched × 2 22 to 30 VDC, 10 A switched 22 to 30 VDC, 10 A safe, switched 10 A switched and 10 A safe switched are drawn from the same source, and pass through the same 10 A fuse, so the sum of their current must be less than 10 A.
Standards	AMR	EN ISO 12100, EN ISO 13849-1, EN 60204-1, EN 1525, ANSI B56.5, ISO 10218/CSA Z434, EN 61000-6-2, EN 61000-6-4
	Battery	EN ISO 12100, UN 38.3, EN 61000-6-2, EN 61000-6-4, UL 2271
	Docking Station	EN ISO 12100, UL1012/CSA C22.2.107.2, IEC 60204-1, EN 61000-6-2, EN 61000-6-4
	Wireless	IEEE 802.11 a/b/g
Safety Features	Safety Scanning Laser	One at front of AMR Class 1 PLd safety per ISO13849-1 240° field of view
	E-STOP Buttons	One at Operator Panel, one on each side. Additional E-STOP buttons
	Rear Sensing	Time of flight (TOF) sensors
	Audible Indicators	Two speakers are included. Additional buzzers can be added
Operator	Display	3.5 inch TFT, 320 x 240 pixels, color screen
	Button	ON button, OFF button, Brake-release button, and keyed mode selection
User Interface	Wireless	802.11 a/b/g
	Ethernet	One TCP/UDP interface (maintenance LAN), Auto-MDIX
	Serial	Two serial communication interfaces
	Digital I/O	16 inputs, 16 outputs
	Audio	Digital audio in / out

*1. A speed of 600 mm/s is recommended for traversing steps, and routine driving over steps should be avoided. Lower speeds may not traverse the step. Faster or frequent driving over steps and gaps will shorten the lifespan of the drivetrain components. All steps should have smooth, rounded profiles.

*2. AMR maximum speed is recommended for traversing gaps, and routine driving over gaps should be avoided. Lower speeds may not traverse the gap. Faster or frequent driving over gaps will shorten the lifespan of the drivetrain components.

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Virtual Fleet Manager Software Minimum Hardware Requirements

Fleet Size / AMR Count	Small / ≤ 5	Medium ≤ 15	Large ≤ 30	X-Large ≤ 100
Virtual CPU	2 cores		4 cores	
Clockspeed	4GHz	8 GHz	12 GHz	16 GHz
Virtual RAM	8 GB	16 GB	24 GB	32 GB
Virtual Disk	512 GB			1 TB
FLOW software version	Minimum FLOW Core 4.0			

Note: The PC/IPC/Server is supplied by the user.

EM2100 Appliance

Weight	9.1 kg
Mounting method	1U rack mount in a standard 19-inch equipment rack
Power Supply	100 to 240 VAC (typical 100 W)
Power Consumption	200 W max.
Operating Temperature	10 to 35°C
Storage Temperature	-25 to 60°C
Operating Humidity	8 to 90%, non-condensing
Storage Humidity	5 to 95%, non-condensing
Chassis Ingress	IP20
CPU	Intel® Xeon® CPU
Main Memory	32 GB DDR3
Storage	60 GB SSD
Archive Storage	4 TB HDD
Communication ports	Four 10/100/1000 Ethernet Four USB One VGA
Status Display	Multi-segment LCD

High Accuracy Positioning System (HAPS)

Sensor	Depth	30 mm
	Width	160 mm
	Ingress Protection Class	IP64
	Environment	-40 to 85°C
Magnetic Tape	LEDs	Power, tape present, left marker, right marker
	Width	25 mm
Markers (Magnetic Tape)	Orientation	South up
	Width	25 mm
	Length	300 mm min. for 500 mm/s drive speed
	Orientation	North up
Connections	Separation From Tape	15 to 30 mm
	Front Sensor	RS232-1 (/dev/ttyUSB9) on the core
	Rear Sensor	RS232-2 (/dev/ttyUSB10) on the core
Stop Position Repeatability, LD-60, LD-90 *	Power, Both Sensors	Aux power using the included splitter cable
	Single AMR	±8 mm position, 0.4° rotation
	Fleet	±10 mm position, 0.5° rotation
	Single AMR	±8 mm position, 0.4° rotation

Stop Position Repeatability, LD-250 *	Fleet	±10 mm position, 0.6° rotation
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* Stop position repeatability values were obtained using default AMR parameters and a map created by the LD-series AMR.

Cell Alignment Positioning System (CAPS)

Stop Position Repeatability, LD-60, LD-90, LD-90x *	Single AMR	±8 mm position, 0.5° rotation
	Fleet	±12 mm position, 0.5° rotation
Stop Position Repeatability, LD-250 *	Single AMR	±8 mm position, 0.5° rotation
	Fleet	±14 mm position, 0.6° rotation
Type	Software license	

* Stop position repeatability values were obtained using default AMR parameters and a map created by the LD-series AMR.

Battery

Type	Lithium-Ion (LiFePO4)
Weight	19 kg
Voltage	22 to 30 VDC (25.6 VDC nominal)
Capacity	72 Ah (battery cell nominal)
Recharge Time	2 hrs. 10 min. for 20% to 80% charge
Ingress Protection Class	IP20
Recharge Cycles	Approximately 2000 cycles *
Charging Method	Automatic or manual

* Approximately 80% of nominal battery capacity will be available after using the battery at 90% depth of discharge at temperatures between 15°C to 35°C, charging and discharging at a 1C rate.

Docking Station

Current	8 A *
Power	100 to 240 VAC, 50 to 60 Hz
Power Consumption	800 W
Humidity	5 to 95L%, non-condensing
Temperature	5 to 40°C
Dimensions (W × D × H)	349 × 369 × 315 mm 495 × 495.5 × 317 mm (with floor plate)
Weight	8.2 kg
Mounting	Wall bracket, directly to floor, or on floor with floor plate
Indicators	Power on: blue Charging: yellow
Connector	For out-of-AMR battery charging

* Circuit breaker built into AC power switch

Joystick (Pendant)

Weight	0.55 kg
IP Rating	IP56

Acuity Localization

Field of View	140°
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Power Input	12 VDC ($\pm 10\%$) supplied from AMR through power connector
Power Consumption	3.3 W maximum

MobilePlanner Software

CPU	1.5 GHz dual-core CPU recommended
Main Memory	1.5 GB min. (4 GB min. recommended)
Hard Disk	At least 200 MB of available space
Video Memory	256 MB min.
Display	XGA 1024 \times 768, 16 million colors
Supported Languages	English, Japanese, German, French, Italian, Korean, Spanish, Polish, Simplified Chinese, Traditional Chinese