

Item		Details	
Model		MD-650	MD-900
Weight (no battery or accessories)		220 kg	
Envi-	Ambient temperature	5 to 40°C	
	Storage temperature	-20 to 60°C	
	Ambient humidity	5% to 95% (non-condensing)	
	Operating environment	Indoor usage only, no excessive dust, no corrosive gas or liquid	
	Altitude	2000 m maximum	
	Pollution degree	2	
	Ingress Protection Class	IP22 *1 (IP10 for charging pads)	
	Enclosure Rating	Type 2	
	Atmospheric	Non-hazardous environments (no explosive gas and oil mist).	
Floor	Floor requirements	No water, oil, or dirt	
	Minimum floor flatness	F _F 25 (ACI 117 standard)	
	Minimum floor levelness	F _L 25 (ACI 117 standard)	
	Maximum step traversal (speed limited *2)	10 mm / 15 mm	
	Maximum gap traversal *3	20 mm / 30 mm	
	Maximum Slope	Max. 5° / 8.75% incline	
	Minimum floor compressive strength	7.2 MPa	9.4 MPa
	Minimum coefficient of friction	Flat surfaces: 0,6; Inclined surfaces: 0,8	
Navigation	Routing	Autonomous routing by localizing with Safety Laser Scanners, based on environment mapping.	
	Environmental map-making method	Scan by driving the AMR through the environment and uploading the scan data to the MobilePlanner.	
	Low Lasers	Two Low Lasers are provided to detect obstacles below the scanning plane of the Safety Laser Scanners.	
	Side Lasers (optional)	Two optional Side Lasers can be added for object detection in the vertical plane.	
Visual Indicators		Light discs are located on the sides of the AMR. Light strips are located on the front and back of the AMR. Additional indicators can be added.	
Maximum Payload Capacity		650 kg	900 kg
Mobility	Run Time *4	10 h (no payload); 8 h (full payload)	
	Swing radius	729 mm	
	Turn radius	0 mm	
	Maximum translational speed (forward and reverse)	2200 mm/s	1800 mm/s
	Maximum translational acceleration	900 mm/s ²	
	Maximum translational deceleration	1300 mm/s ²	
	Maximum rotational speed *5	60 °/s	
	Maximum rotational acceleration	100 °/s ²	

	Maximum rotational deceleration	150 °/s ²	
	Maximum moment of inertia	250 kg-m ²	300 kg-m ²
	Stop position repeatability (single AMR) *6	To a position: ±70 mm, ±2° To standard target: ±25 mm, ±2° With HAPS: ±8 mm, ±0.5° With CAPS: ±4 mm, ±0.4°	
	Stop position repeatability (Fleet) *6	To a position: ±75 mm, ±2° To standard target: ±35 mm, ±2° With HAPS: ±10 mm, ±0.5° With CAPS: ±16 mm, ±0.5°	
Drive wheels	Materials	Steel wheels with ESD tread	
Passive casters	Materials	Cast iron wheels with polyurethane tread	
Auxiliary Power	Unregulated	40 to 57 VDC (51.2 VDC nominal); 40 A fused	
	Regulated	23 to 25 VDC; 1 A fused	
Standards	AMR	EN ISO 12100, EN ISO 13849-1, EN 60204-1, ISO 10218-1/CSA Z434, EN ISO 3691-4, EN 12895, EN 61000-6-4, EN 61000-6-2	
	Battery	UL2271, UN 38.3	
	Charging Station	UL1012/CSA C22.2.107.2, EN 61204-7 used in conjunction with EN 62477-1	
	Wireless	IEEE 802.11 a/b/g	
Signal Interfaces	Wireless	Fleet communication and other maintenance functions	
	RJ-45 Ports	Four ports for connections to internal devices	
	Digital I/O	Eight PNP / sourcing inputs; Eight PNP / sourcing outputs	
	Safety	Emergency stop and protective signals, alternate safety zone switching, and no-motion output	
	Lights	Connects user-supplied visual signal devices	
	Buzzer	Connects user-supplied audible signal devices	
Safety Features	Safety Laser Scanners	Two Safety Laser Scanners are included to provide a 360° detection area around the AMR. The scanning plane is positioned 175 mm above the floor. Lasers are rated as Class 1M, eye-safe, per IEC 60825-1 and 21 CFR 1040.10 and 1040.11.	
	Safety Laser Scanner Zone Sets	A pair of safety-rated alternate safety zone inputs can toggle the Safety Laser Scanner zones between a default configuration or an alternate configuration.	
	E-STOP Buttons	Five E-STOP buttons are located on the AMR (sides and Operator Panel). Additional E-STOP buttons can be added to the payload structure.	
	Audible Indicators	Two speakers are included. Additional buzzers can be added.	
	Emergency Stop	Stops the AMR and requires user intervention to resume operation.	
	Protective Stop	Stops the AMR temporarily and automatically resumes operation when safety conditions are met.	
Operator Panel	Display	7-inch diagonal LCD	
	Controls	<ul style="list-style-type: none"> • E-STOP button • ON/OFF buttons • Brake release button • Pendant port • Keyed Mode Selection Switch 	

*1. The supplied Top Plate Plugs must be inserted to achieve an IP22 rating.

*2. Traversing a 10 mm step must occur at speeds below 500 mm/s in the forward direction and 400 mm/s in the reverse direction. Traversing a 15 mm step must occur at speeds below 300 mm/s in the forward and reverse directions. Frequent driving over steps will shorten the lifespan of the drivetrain components. Steps should have smooth, rounded profiles.

*3. 20 mm gaps may be traversed at any speed. Traversing a 30 mm gap must occur at speeds below 2000 mm/s for MD-650 and below 1500 mm/s for MD-900. Frequent driving over gaps will shorten the lifespan of the drivetrain components.

*4. Auxiliary power draw will impact these times.

*5. The maximum rotational speed is reduced to 45 %/s when the AMR is traveling at speeds over 100 mm/s.

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

MobilePlanner Software Requirements

MobilePlanner, PC	Operating System	Windows 10 (32-bit/64-bit version)
	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 x 768, 16 million colors minimum
MobilePlanner, Tablet Edition	Operating System	Android OS, Version 9 or newer, minimum 2 GB of RAM
		iOS, Version 10 or newer
Supported Languages		English, German, Japanese, French, Italian, Korean, Spanish, Polish, Simplified Chinese and Traditional Chinese.

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
Ingress Protection Class	IP20
Main Memory	32 GB DDR3
Storage	60 GB SSD
Archive Storage	4 TB HDD
Communication port	10/100/1000 Ethernet × 4, USB × 4, VGA
Status Display	Multi-segment LCD

Charging Station

Maximum Current	Input current: 25 A Output current: 120 A (nominal) *
Input Voltage	3-phase 200 to 240 VAC, 50/60 Hz (Delta/Wye) 380 to 415 VAC, 50/60 Hz (Wye only)
Output voltage	40 to 57 VDC
Power Consumption	7.75 kW
Maximum Power Output	6.84 kW
Humidity	5 to 95%, non-condensing
Ambient Operating Temperature	5 to 40°C
Storage Temperature	-20 to 60°C
Ingress Protection	IP20 (IP10 for charging pads)
Altitude	2000 m maximum
Pollution degree	2
Equipment Class	1
Weight	Power Supply Box: 111 kg Docking Target: 28 kg
Docking Target Mounting	To floor and/or wall

* Fused at 150 A

High Accuracy Positioning System

Ingress Protection	IP64	
Environment	-40 to 85°C	
Magnetic Tape	Width	25 mm
	Orientation	South up
Markers (Magnetic Tape)	Width	25 mm
	Length	250 mm min. for 500 mm/s drive speed
	Orientation	North up
	Separation from tape	20 to 30 mm
Protective covering tape (recommended)	Mighty Line Safety Floor Tape, Solid (102 mm width)	
Stop Position Repeatability *	Single AMR	±8 mm position, ±0.5° rotation
	Fleet	±10 mm position, ±0.5° rotation

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

Pendant

Ambient Operating Temperature	0 to 40°C
Storage Temperature	-20 to 65°C
Humidity	5 to 95%, non-condensing
Altitude	2000 m
Ingress Protection Class	IP30

Battery

Type	Lithium-Ion (LifePO4)
Voltage	40 to 57 VDC (51.2 VDC nominal)

Capacity	38 Ah nominal
Energy	2048 Wh nominal
Recharge Time	19.6 minutes (from 20% to 80%) *1
Charge Cycles	Approximately 3000 cycles *2 *3
Charging Method	Automatic or manual
Ambient Operating Temperature	5 to 40°C
Storage Temperature	< 1 month: -20°C to 45°C < 3 months: -20°C to 35°C > 3 months: 20°C to 25°C
Humidity (Storage)	65% or less
Humidity (Operation)	5 to 95%, non-condensing
Altitude	4500 m, operating 15240 m, transporting
Ingress Protection Class	IP33
Weight	29 kg

*1. Charging time can vary based on battery cell temperature and state of charge.

*2. Approximately 80% of nominal battery capacity will be available after using the battery at 100% depth of discharge.

*3. Under manufacturer's test conditions of 25°C ±3°, 25%-85% R.H., 40 A charge/discharge, 57 and 40 VDC charge/discharge, with 60 minutes of inactivity after charging/discharging. Actual cycles may vary according to the application.