

Item		Details
<b>Weight (with Battery)</b>		506.5 kg
<b>Environment</b>	<b>Ambient temperature</b>	5 to 40°C
	<b>Storage temperature</b>	-20 to 60°C
	<b>Ambient humidity</b>	5 to 95% (non-condensing)
	<b>Operating environment</b>	Indoor usage only, no excessive dust, no corrosive gas or liquid
	<b>Altitude</b>	2000 m maximum
	<b>Ingress Protection Class</b>	IP20
	<b>Enclosure Rating</b>	Type 1
	<b>Cleanroom Rating</b>	ISO 6 / Class 1000
<b>Floor</b>	<b>Floor requirements</b>	No water, no oil, no dirt
	<b>Minimum floor flatness</b>	F <sub>r</sub> 25 (ACI 117 standard)
	<b>Traversable step *1</b>	10 mm max.
	<b>Traversable gap</b>	20 mm max.
	<b>Maximum Slope</b>	Max. 1.8° / 3% incline
	<b>Minimum floor compressive</b>	5 Mpa
	<b>Minimum coefficient of friction</b>	0.6
<b>Navigation</b>	<b>Routing</b>	Autonomous routing by localizing with safety scanning laser, based on environment mapping
	<b>Environmental map-making method</b>	Scan by driving the AMR through the environment, and upload the scan data to the MobilePlanner
	<b>Low Lasers</b>	Two Low Lasers are provided to detect obstacles below the scanning plane of the Safety Laser Scanners.
	<b>Side Lasers (optional)</b>	Two optional Side Lasers can be added for object detection in the vertical plane.
<b>Visual Indicators</b>		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.
<b>Maximum Payload Capacity</b>		1500 kg
<b>Mobility</b>	<b>Run Time *2</b>	12.5 h (no payload), 9 h (full payload)
	<b>Maximum translational speed (forward and reverse)</b>	1800 mm/s
	<b>Maximum rotational speed *3</b>	60 °/s
	<b>Swing radius</b>	982 mm
	<b>Turn radius</b>	0 mm
	<b>Maximum translational acceleration</b>	900 mm/s <sup>2</sup>
	<b>Maximum rotational acceleration/deceleration</b>	150 °/s <sup>2</sup>
	<b>Maximum moment of inertia</b>	490 kg-m <sup>2</sup>
<b>Stop position repeatability (single AMR) *4</b>	To a position: ±50 mm To standard target: ±25 mm, ±2° With HAPS: ±8 mm, ±0.4° With CAPS: ±8 mm, ±0.5°	

	<b>Stop position repeatability (Fleet) *4</b>	To a position: $\pm 70$ mm To standard target: $\pm 35$ mm, $\pm 2^\circ$ With HAPS: $\pm 10$ mm, $\pm 0.75^\circ$ With CAPS: $\pm 16$ mm, $\pm 0.5^\circ$
<b>Drive wheels</b>	<b>Materials</b>	Non-marking, static dissipative polyurethane on steel rim
<b>Passive casters</b>	<b>Materials</b>	Non-marking polyurethane on cast iron rim.
<b>Auxiliary Power</b>	<b>Unregulated</b>	48 to 57 VDC (52.8 nominal); 50 A fused
	<b>Regulated</b>	23.0 to 25.2 VDC; two channels fused at 1.85 A
<b>Standard</b>	<b>AMR</b>	EN ISO 12100, EN ISO 13849-1, EN 60204-1, ISO 10218-1/ CSA Z434, UL 3100, EN 61000-6-2, EN 61000-6-4
	<b>Battery</b>	UL2271, UN 38.3
	<b>Charging Station</b>	UL1012/CSA C22.2.107.2, EN 61204-7 used in conjunction with EN 62477-1
	<b>Wireless</b>	IEEE 802.11 a/b/g
<b>Signal Interfaces</b>	<b>Wireless</b>	Two integrated wireless antennas
	<b>Ethernet port</b>	Two RJ-45 ports included for maintenance and access to the internally mounted NX102 unit.
	<b>Digital I/O</b>	Eight PNP (sourcing) inputs Eight PNP (sourcing) outputs
	<b>Analog I/O</b>	Eight PNP (sourcing) inputs Eight PNP (sourcing) outputs
	<b>Audio</b>	Digital audio out
<b>Safety Features</b>	<b>Safety Scanning Lasers</b>	Two Safety Scanning Lasers are included to provide a $360^\circ$ detection area around the AMR. The scanning plane is positioned 175 mm above the floor. Lasers are rated as Class 1, eye-safe, PLd Safety per ISO 13849-1.
	<b>E-STOP Buttons</b>	Five E-STOP buttons are located on the AMR (sides and Operator Panel). Additional E-STOP buttons can be added to the payload structure.
	<b>Audible Indicators</b>	Two speakers are included. Additional buzzers can be added.
	<b>Emergency Stop Interface</b>	Dual channel emergency stop inputs and outputs.
	<b>Safety Outputs</b>	Dual channel safety outputs.
	<b>Protective Stop Interface</b>	Dual channel protective stop inputs.
<b>Operator</b>	<b>Display</b>	7-inch diagonal LCD.
	<b>Controls</b>	<ul style="list-style-type: none"> <li>• E-STOP button</li> <li>• ON/OFF buttons</li> <li>• Brake release button</li> <li>• Pendant port</li> <li>• Maintenance port</li> <li>• Main disconnect switch</li> </ul>

\*1. A speed of 500 mm/s in the forward direction and 400 mm/s in the reverse direction is recommended for traversing steps. 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. Auxiliary power draw will impact these times.

\*3. The maximum rotational speed is reduced to 45 °/s when the AMR is traveling at speeds over 300 mm/s.

\*4. Stop position repeatability values were obtained using default AMR parameters and a map created by the HD AMR.

## MobilePlanner Software Requirements

<b>MobilePlanner, PC</b>	<b>Operating System</b>	Windows 10 (32-bit/64-bit version)
	<b>CPU</b>	1.5 GHz dual-core CPU recommended
	<b>Main Memory</b>	1.5 GB min. (4 GB min. recommended)
	<b>Hard Disk</b>	At least 200 MB of available space
	<b>Video Memory</b>	256 MB min.
	<b>Display</b>	XGA 1024 × 768, 16 million colors minimum
<b>MobilePlanner, Tablet Edition</b>	<b>Operating System</b>	Android OS, Version 9 or newer, minimum 2 GB of RAM
		iOS, Version 10 or newer
<b>Supported Languages</b>		English, German, Japanese, French, Italian, Korean, Spanish, Simplified Chinese and Traditional Chinese.

## Virtual Fleet Manager Software Minimum Hardware Requirements

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

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

## EM2100 Appliance

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

## Charging Station

<b>Maximum Current</b>	Input current: 25 A Output current: 120 A (nominal)
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<b>Input Voltage</b>	3-phase 200 to 240 VAC, 50/60 Hz (Delta/Wye) 380 to 415 VAC, 50/60 Hz (Wye only)
<b>Output voltage</b>	40 to 57 VDC
<b>Power Consumption</b>	7.75 kW
<b>Maximum Power Output</b>	6.84 kW
<b>Humidity</b>	5 to 95%, non-condensing
<b>Ambient Operating Temperature</b>	5 to 40°C
<b>Storage Temperature</b>	-20 to 60°C
<b>Ingress Protection Class</b>	IP20 (IP10 for charging pads)
<b>Pollution degree</b>	2
<b>Equipment Class</b>	1
<b>Weight</b>	Power Supply Box: 108 kg Docking Target: 27.5 kg
<b>Docking Target Mounting</b>	To floor and/or wall

\* Fused at 150 A

### High Accuracy Positioning System

<b>Ingress Protection</b>		IP64
<b>Environment</b>		-40 to 85°C
<b>Magnetic Tape</b>	<b>Width</b>	25 mm
	<b>Orientation</b>	South up
<b>Markers (Magnetic Tape)</b>	<b>Width</b>	25 mm
	<b>Length</b>	300 mm min. for 500 mm/s drive speed
	<b>Orientation</b>	North up
	<b>Separation from tape</b>	20 to 30 mm
<b>Protective covering tape (recommended)</b>		Mighty Line Safety Floor Tape, Solid (102 mm width)
<b>Stop Position Repeatability *</b>	<b>Single AMR</b>	±8 mm position, ±0.4° rotation
	<b>Fleet</b>	±10 mm position, ±0.75° rotation

\* Stop position repeatability values were obtained using default AMR parameters and a map created by the HD AMR.

### Cell Alignment Positioning System (CAPS)

<b>Stop Position Repeatability - Single AMR *</b>	±8 mm position, ±0.5° rotation
<b>Stop Position Repeatability - Fleet *</b>	±16 mm position, ±0.5° rotation
<b>Type</b>	Software license

\* Stop position repeatability values were obtained using default AMR parameters and a map created by the HD AMR.

### Pendant

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

### Battery

<b>Type</b>	Lithium-Ion (LiFePO4)
<b>Voltage</b>	48 to 57 VDC (52.8 nominal)
<b>Capacity</b>	68 Ah nominal
<b>Recharge Time</b>	21 min. (20% to 80% charge)
<b>Charge Cycles</b>	Approximately 8000 cycles *
<b>Charging Method</b>	Automatic or manual
<b>Ambient Operating Temperature</b>	5 to 40°C
<b>Storage Temperature</b>	-20 to 60°C (less than 2 weeks) -20 to 35°C (more than 2 weeks)
<b>Humidity</b>	5 to 95%, non-condensing
<b>Altitude</b>	4500 m, operating 15240 m, transporting
<b>Ingress Protection Class</b>	IP20
<b>Weight</b>	69.5 kg

\* Approximately 80% of nominal battery capacity will be available after using the battery at 100% depth of discharge, at a temperatures of 23°C, charging and discharging at a 1C rate.