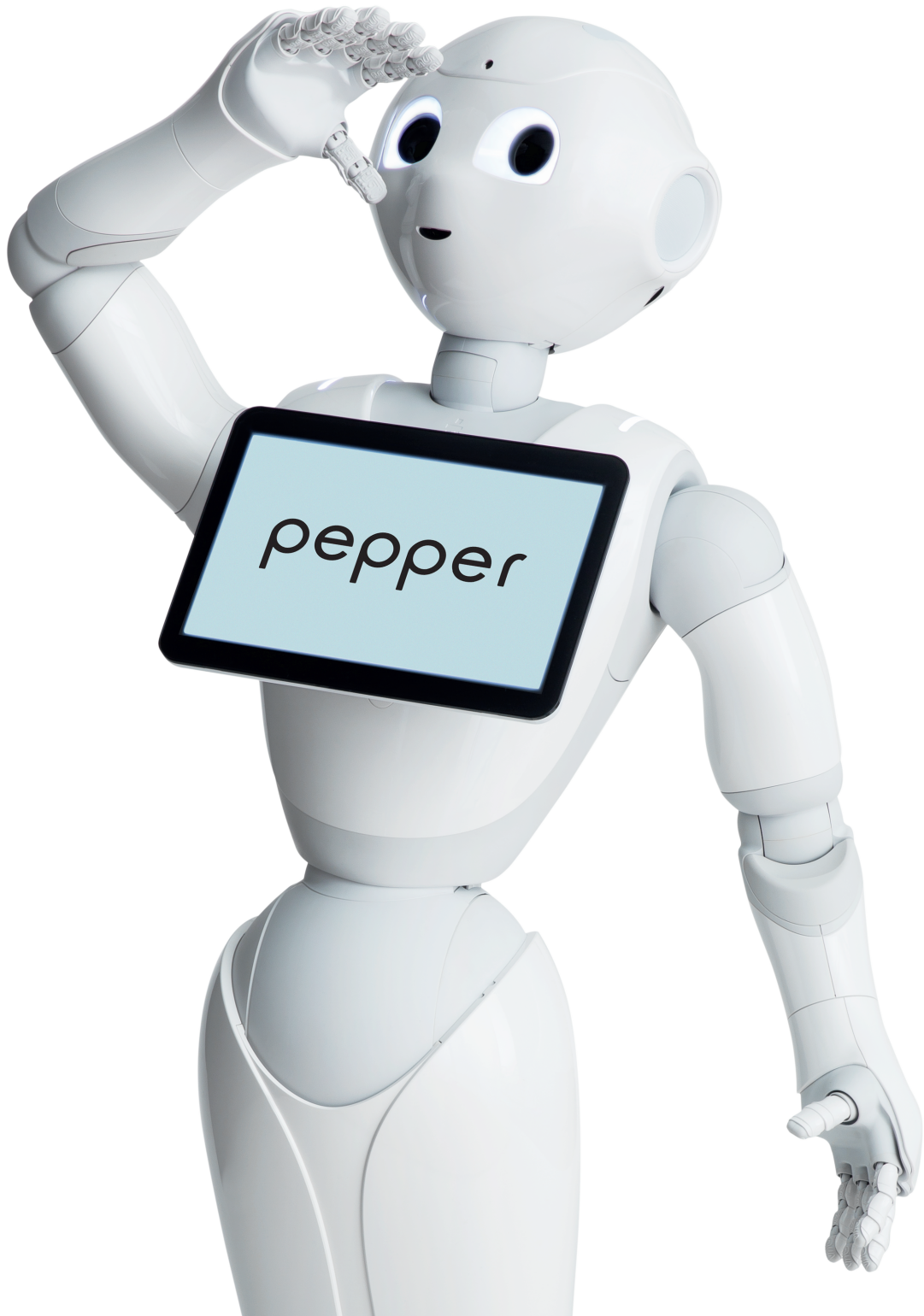


pepper

Technical Datasheet 1.8
Version 2



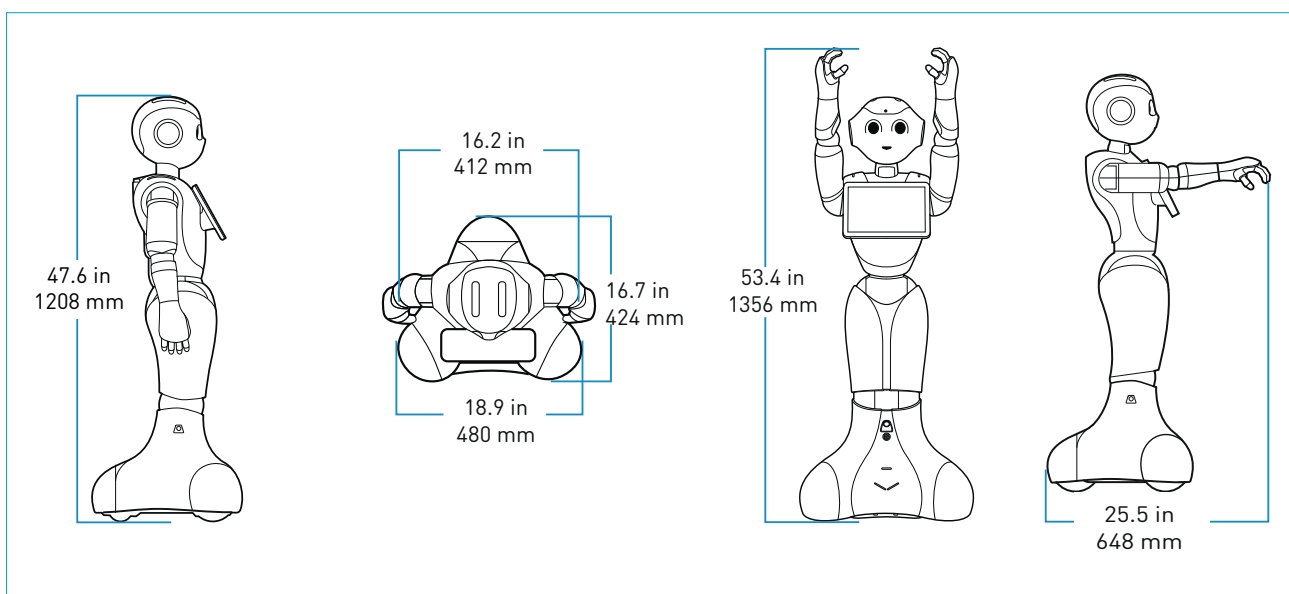
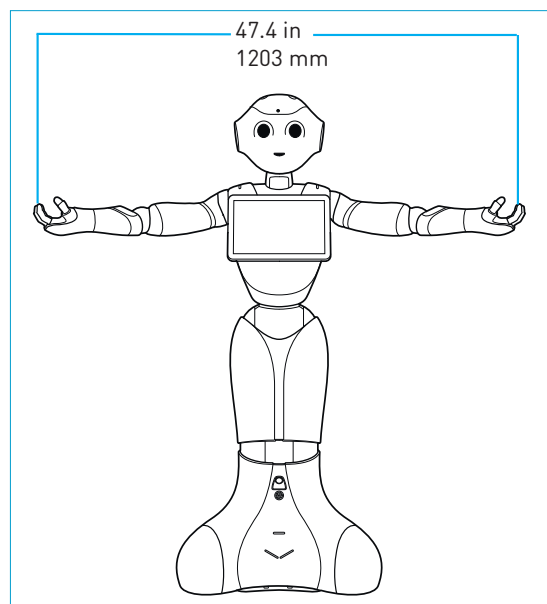
GENERAL

Physical information	Robot size	See diagrams	
	Packaging size (HxWxL)	1400 x 580 x 580 mm 55.1 x 22.8 x 22.8 in	
	Weight	29.6 kg / 65.2 lb Robot only	
Working environment	Weight including packaging	+ 0.295 kg with Plate 180° + 1 kg with Plate 360° + 1.280 kg with Tentoboshi	
	Working temperature range	5 °C to 35 °C 41 °F to 140 °F	
	Working humidity range	20% to 80%	
Storage conditions	IP protection class	IPX0	
	Storage temperature range	5 °C to 45 °C 41 °F to 113 °F	
Battery use environment	Robot storage at 25°C	Battery run time loss	20% / year
		Self discharging	3.5% / month
	Battery run time	Minimum	7 hours
		Typical	12 hours
		Maximum	20 hours
Charging duration when the robot is off (approx. starting from low battery level)	0 to 100%	8 hours and 20 min	

BRAIN SYSTEM

CPU MODULE

Processor	Intel ATOM® E3845 Formerly Bay Trail
CPU	Quad core
Clock speed	1.91 GHz
Adjusted Peak Performance (APP)	0.00344 WT
RAM	4 GB DDR3
Flash memory	32 GB eMMC



The latest version of this document is available at <https://www.softbankrobotics.com/support>.

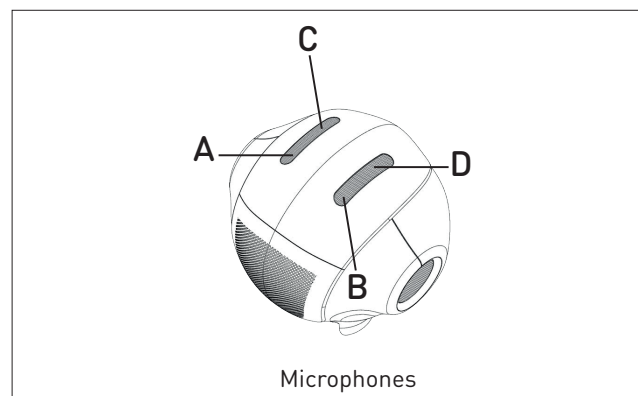
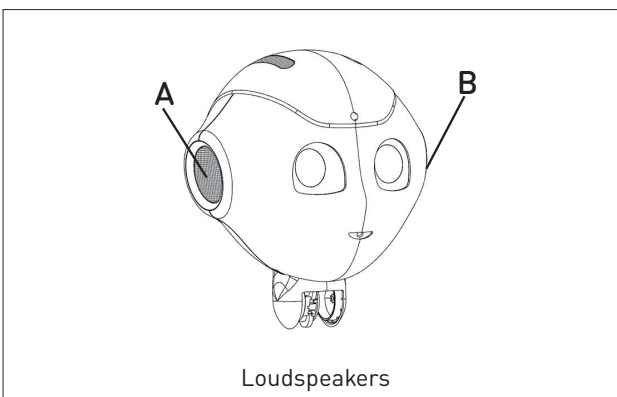
HUMAN INTERACTION

SCREEN

Size	246 x 175 x 14.5 mm 9.68 x 6.89 x 0.57 in	
CPU	1.3 GHz quad-core ARM Cortex-A7	
Adjusted Peak Performance (APP)	0.003156 WT	
DDR3 SDRAM	1 GB	
Flash memory	32 GB eMMC	
LCD	Type	IPS
	Resolution	1280 x 800 pixels
	Colour	24 bit true colour
Touch Panel	Capacitive Multi-Touch (5 simultaneous points)	
Camera	2 megapixels	
Sensor	Ambient light	
	Acceleration	
	<3%	
	Magnetic	
Operating System	Android	

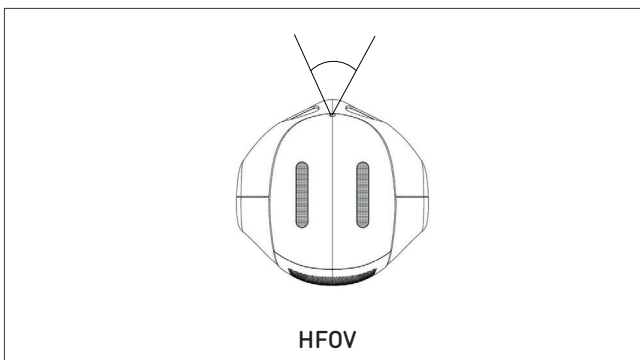
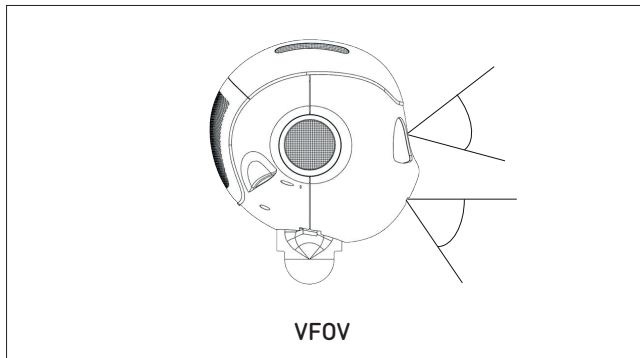
AUDIO

Loudspeakers	Location	The two loudspeakers are located in each ear (A-B).
	Impedance	8 Ω
	Max. SPL	74 dB/W/m
	Frequency response	400 Hz to 9 kHz (-6 dB)
	Output power	7 W RMS
Microphones	Location	The four microphones are located on the head (A-B-C-D).
	Sensitivity	-12 dBV (0.71 Vpp) @ 1 kHz
	Distorsion	<3%
	Frequency range	200 Hz to 7 kHz (-6 dB)
	Max. SPL	110 dB
	Type	Omnidirectional



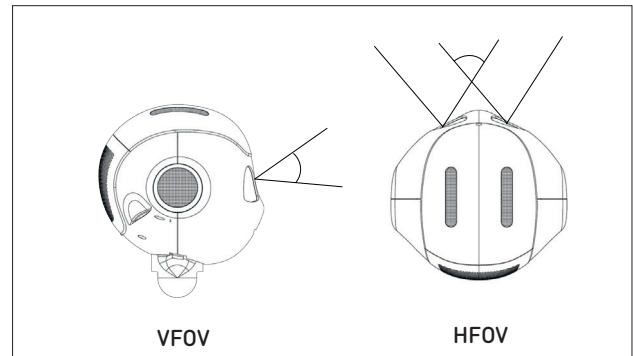
FLAT IMAGING (2D)

Location	The two cameras are located in the mouth and on the forehead.	
Imaging array	Model	OV5640
	Type	SOC Image Sensor
	Resolution	5 megapixels
	Size	¼ inch
	Active Pixels	2592 x 1944
	Pixel size	1.4 x 1.4 µm
	Dynamic range	68 dB @8x gain
	Signal/Noise ratio	36 dB (maximum)
	Responsivity	600 mV/Lux-sec
Output	Shutter type	Rolling shutter / frame exposure
	Camera output (Values may vary depending on NAOqi version)	2592x1944 @15 fps 1920x1080 @30/15 fps 1280x960 @30/15 fps 640x480 @30/15 fps 320x240 @30/15 fps
	Field of view	54.4° HFOV 44.6° VFOV
	Focus type	Autofocus 10 cm to ∞



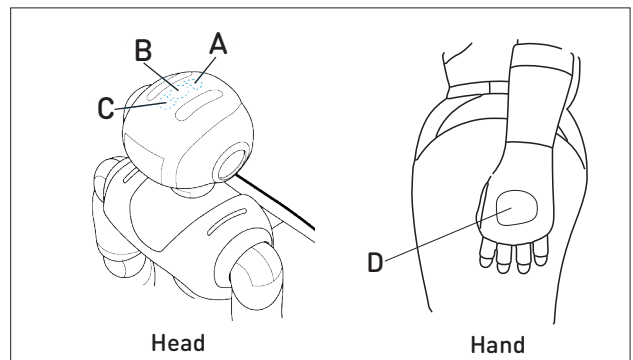
DEPTH AND STEREO IMAGING

Location	Stereo image is provided by a pair of 2D cameras, located behind the eyes.	
Imaging array	Model	OV4689
	Type	CMOS Image Sensor
	Size	⅓ inch
	Active Pixels (Values may vary depending on NAOqi version)	1280 x 720
Output	Shutter type	Rolling shutter / frame exposure
	Camera output	2560 x 720 @15 fps
View	Focus type	Fixed focus 40 cm to ∞
Stereovision	Field of view	90.6° HFOV, 56.3° VFOV
3D sensor	Field of view	57.2° HFOV, 44.3° VFOV



TOUCH SENSITIVE AREA

Head	Three on the top of the head (A-B-C)
Hand	Two on the back of each hand (D)



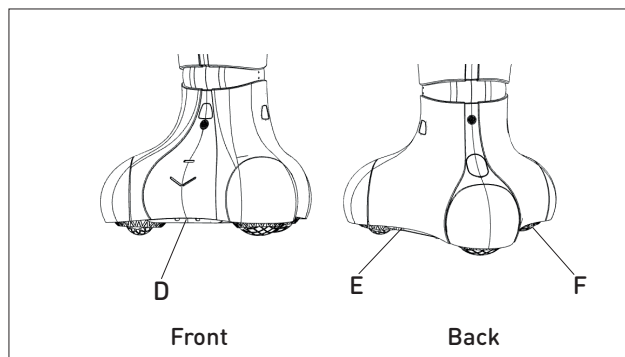
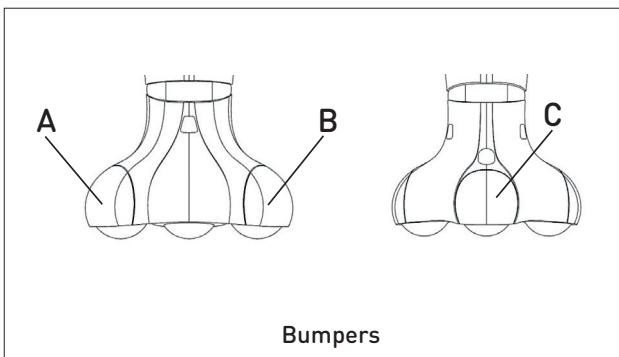
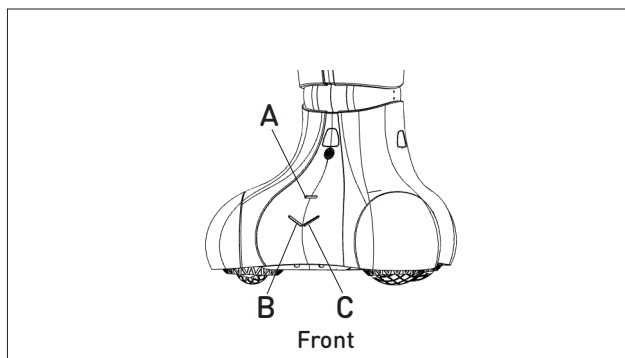
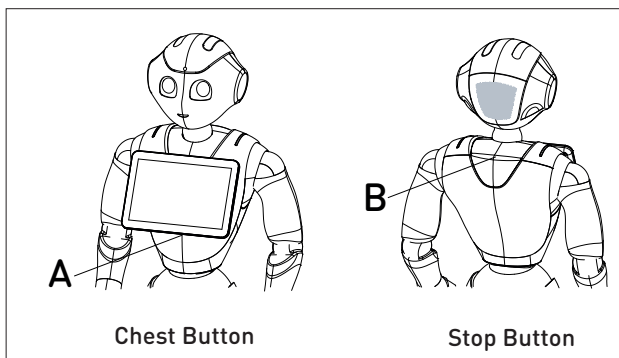
ENVIRONMENT SENSORS

BUTTONS

Chest button	Location	Located on the chest under the tablet (A)
Stop button	Location	Located behind the neck (B)
Wheel bumpers	Location	Two in the front and one at the back of the base (A-B-C)

LASERS

Location	There is one laser located on each side of the base (D-E-F) and three in the front of the base (A-B-C).
Class	1M
Wavelength	808 nm
Mode of operation	Pulsed
Framerate	6.25 Hz



LEDS

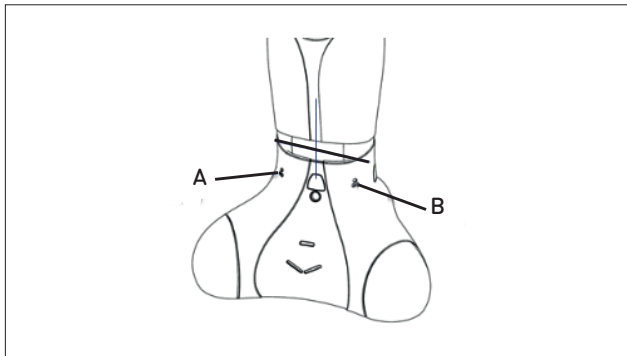
Eye LEDs	Location	There are eight LEDs per eye
	Colour	Full Colour RGB
Ear LEDs	Location	There are ten LEDs per ear
	Colour	16 levels of blue
Shoulder LEDs	Location	There is one LED unit per shoulder
	Colour	Full colour RGB

INERTIAL MEASUREMENT UNIT

- 3-axis gyrometer
- 3-axis accelerometer

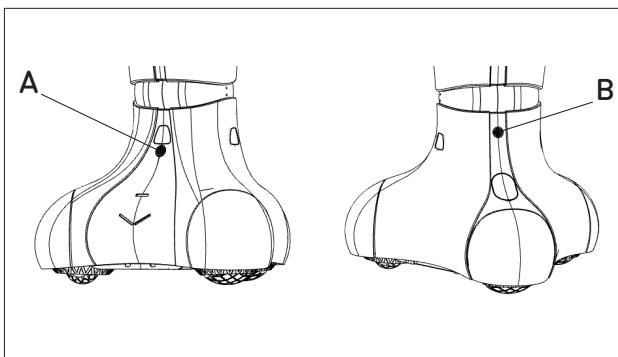
IR SENSORS

Location	The two IR sensors are located on each side of the base (A-B).
Wavelength	940 nm
Range	0 to 50 cm (19.6 in) at a height of 27 cm (10.7 in) above the ground
Angle	4°

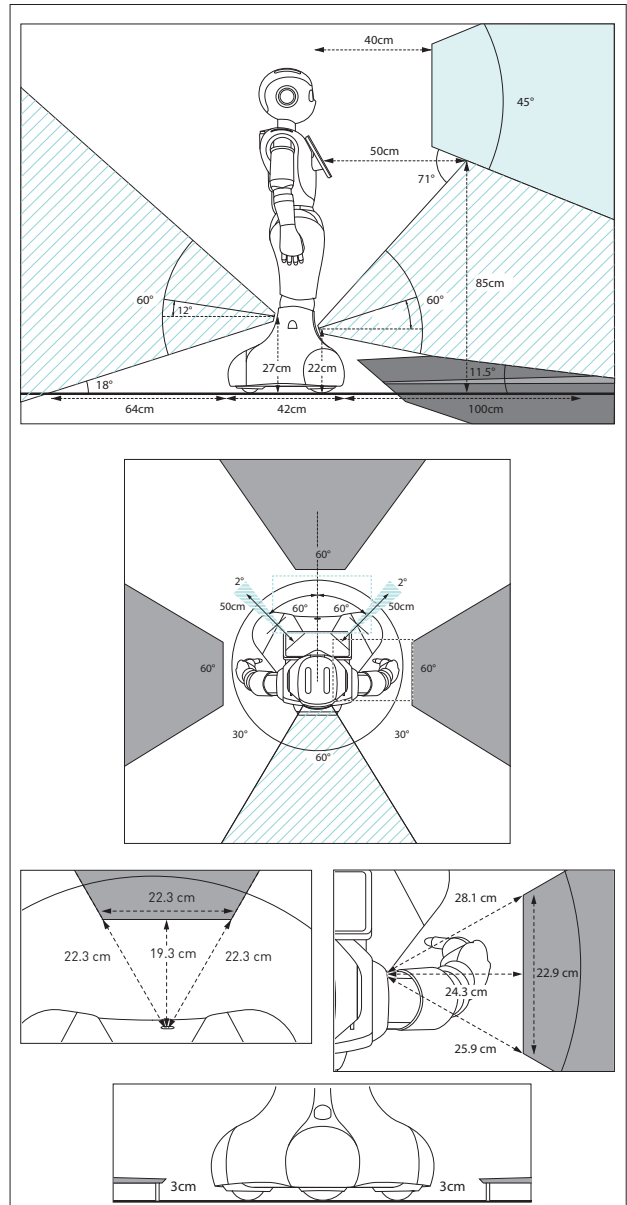


SONARS

Location	There is one sonar at the front of the base (A) and one at the back (B).
Frequency	42 kHz
Sensitivity	-86 dB
Resolution	0.03 m
Detection range	0 - 3 m 0 - 9.8 ft Objects closer than 30 cm (12 in) will be detected as being at 30 cm.
Effective cone	60°



DETECTION



- 3D SENSOR DETECTION ZONE
- SONAR DETECTION ZONES
- INFRARED DETECTION ZONES
- LASER AND SENSOR DETECTION ZONES (HORIZONTAL)
- LASER AND SENSOR DETECTION ZONES (VERTICAL)
- BLIND ZONE

Note: For readability, not all sensor information is shown here.

ENERGY

ROBOT BATTERY

Type	Cylindrical cells	Lithium-Ion (NMC)-18650 secondary cell model.
Voltage	Nominal voltage	26.46 V
	Minimum voltage	17.5 V
	Maximum charge voltage	29.4 V
Current	Typical charging current	8 A
Capacity	Typical capacity	30 Ah
Working Temperature	Charging	10 to 35 °C
		50 to 95° F

BATTERY CHARGER

Input voltage range	100-240 V AC	
Charger input frequency of AC	47 to 69 Hz	
Output voltage	28.6 V DC	
Output max. current	8 A	
Cable length	DC	1.85 m
		6.1 ft
Temperature cut off	90°C	
	194°F	
Working temperature range	5°C to 35°C	
	41°F to 95°F	
Working humidity range	80% max.	
Storage temperature range	-20°C to 70°C	
	-4°C to 158°F	
Storage humidity range	5% to 95%	

CONNECTIVITY

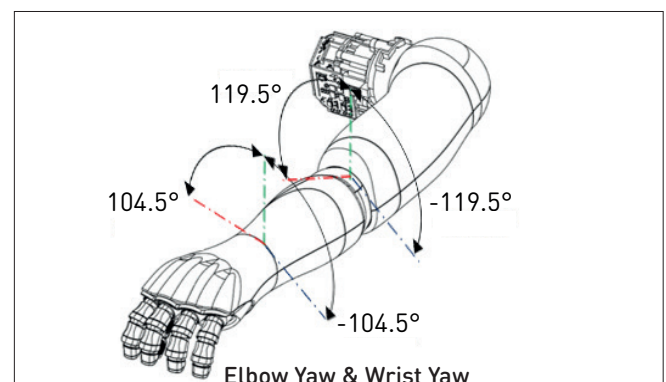
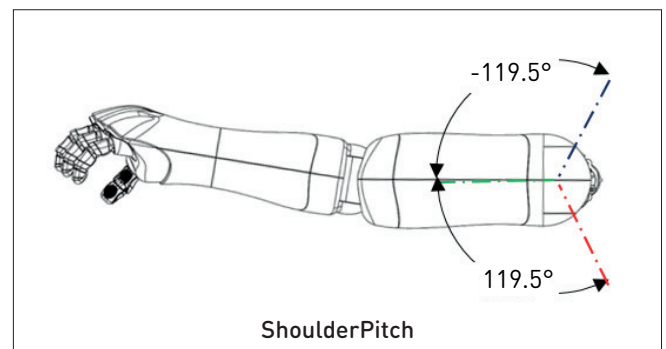
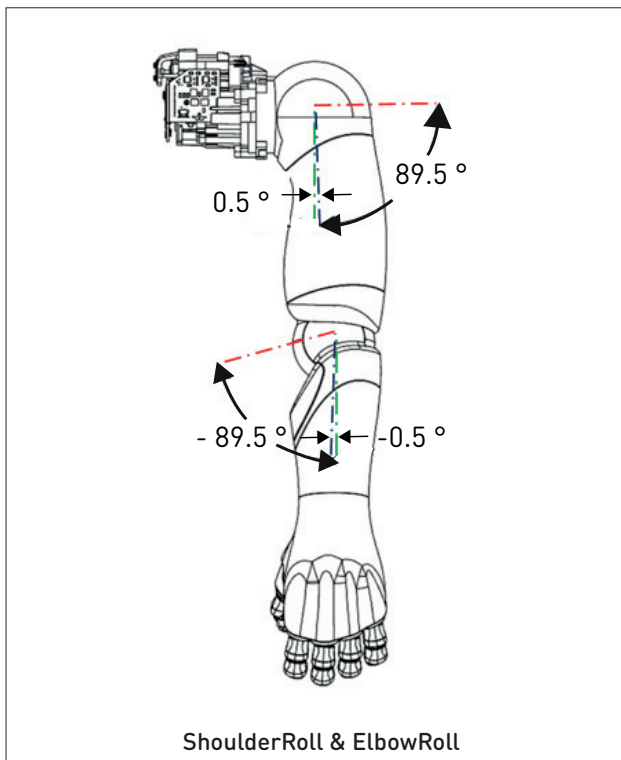
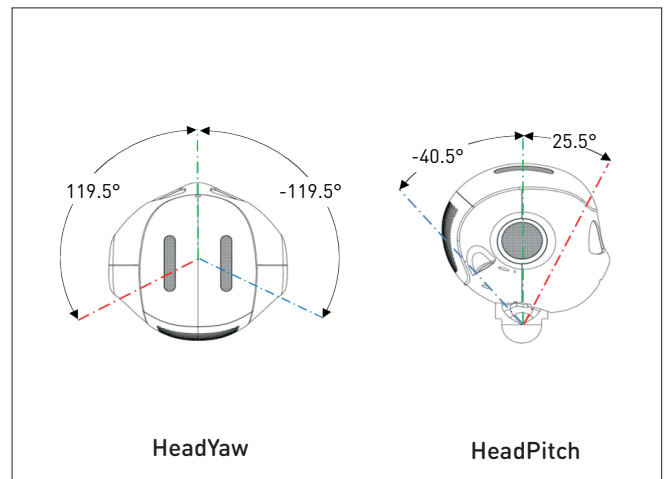
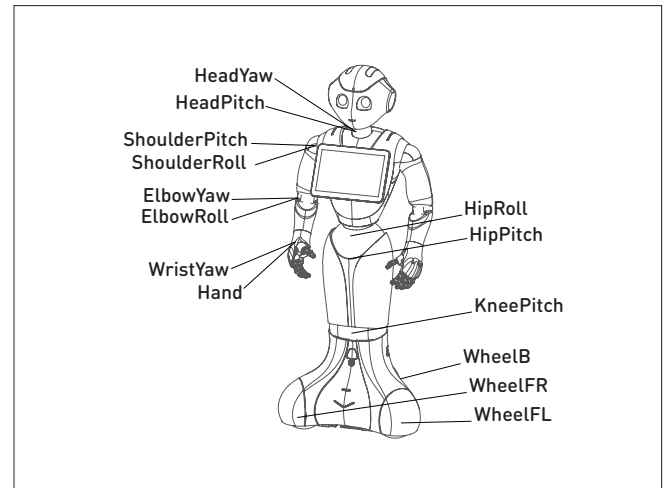
TECHNOLOGY

Wi-Fi	Screen	802.11 a/b/g/n
	Head module	WNC DHXA222-802.11
Ethernet	For maintenance use only	
Bluetooth ®	Head	Bluetooth 4.0
		Bluetooth Low Energy

MOTION

DEGREES OF FREEDOM

	Axis	
Head	HeadYaw	-119.5° to +119.5°
		- 2.09 rad to +2.09 rad
	HeadPitch	-40.5° to +25.5°
		-0.71 rad to +0.45 rad
Arms (x2)	ShoulderPitch	-119.5° to +119.5°
		- 2.09 rad to +2.09 rad
	ShoulderRoll	+0.5° to +89.5°
		+0.01 rad to +1.56 rad
	ElbowYaw	-119.5° to +119.5°
		- 2.09 rad to +2.09 rad
ElbowRoll	-89.5° to -0.5°	
	-1.56 rad to -0.01 rad	
Hands (x2)	WristYaw	-104.5° to +104.5°
		-1.82 rad to +1.82 rad



MOTION

DEGREES OF FREEDOM (CONTINUED)

	Axis	
Leg	HipRoll	-29.5° to +29.5° -0.51 rad to +0.51 rad
	HipPitch	-59.5° to +59.5° -1.04 rad to +1.04 rad
	KneePitch	-29.5° to +29.5° -0.51 rad to +0.51 rad
	WheelFL WheelFR WheelB	Omnidirectional mobile base on three wheels

DISPLACEMENT

Approx. max. wheel speed	2 km/h 1.2 mph
Max. obstacle height	1.5 cm 0.6 cm with plates
Max. slope	5° (on slope at rest)

STABILITY

FALL DOWN PREVENTION

Front Coverage	Front stability upgrade
Front, Right and Left Coverage	Front left and right stability upgrade coverage

