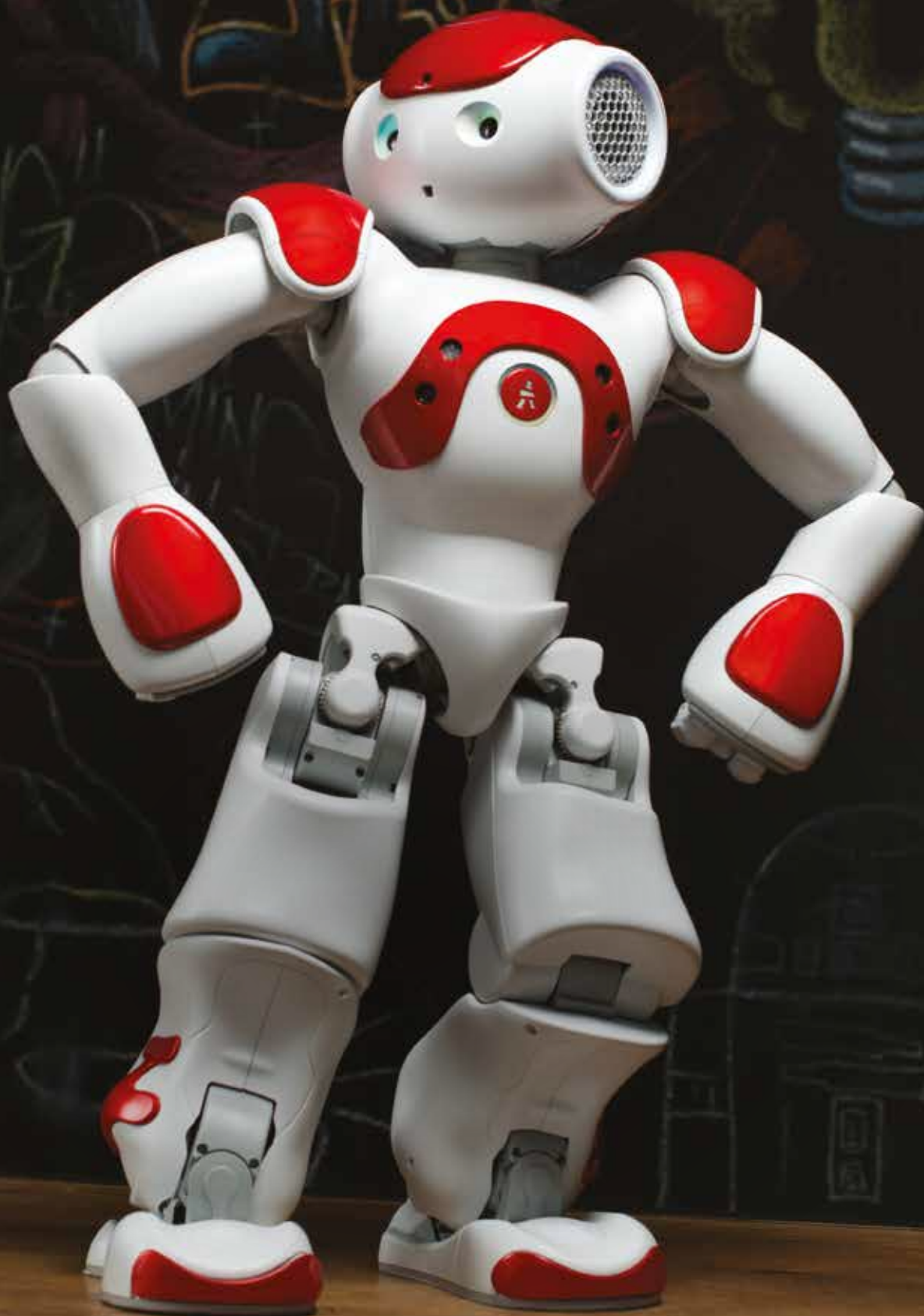


六 NAO





ELECTRICAL

Input	100 to 240 Vac – 50/60Hz – Max 1.2A	
Output	Max 1.2A 25.2 Vdc – 2A	
Battery	Type	Lithium-Ion
	Nominal voltage/capacity	21.6V / 2.25
	Max charge voltage	25.2V
	Recommended charge current	1.8A
	Max charge / discharge current	2.3A / 2.0A
	Energy	48.6Wh
	Charging duration	3h
	Autonomy	60min (Active use) 90 min (Normal use)

MOTHER BOARD

CPU	CPU processor	ATOM Z530
	Cache memory	512KB
	Clock speed	1.6GHz
	FSB speed	533MHz
RAM	1GB	
Flash memory	2GB	
Micro SDHC	8GB	

CONNECTION

Ethernet	1×RJ45 - 10/100/1000 BASE T
WIFI	IEEE 802.11a/b/g/n

AUDIO

Loud Speakers	×2 lateral	
	Diameter	36mm
	Impedance	8ohms
	Sp level	87dB/w +/- 3dB
	Freq range	up to ~20kHz
	Input	2W
Microphones	×4 on the head	
	Sensitivity	20mV/Pa +/-3dB at 1KHz
	Frequency range	150Hz-12kHz

CONSTRUCTION

Dimension (HxDxW)	574x275x311mm / 22.6x10.8x12.2 inch
Weight	5.4kg / 11.9 lb
Construction material	ABS-PC/PA-66/XCF-30

LANGUAGES

Text to speech & Automatic speech Recognition	Czech, Danish, Dutch, English, Finnish, French, German, Italian, Japanese, Korean, Polish, Portuguese, Spanish, Swedish, Russian, Turkish, Arabic, Brazilian, Chinese
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VISION

Cameras	×2 on front	
Sensor model	MT9M114	
Sensor type	SOC Image Sensor	
Imaging array	Resolution	1.22MP
	Optical format	1/6inch
	Active Pixels (H×V)	1288×968
Sensitivity	Pixel size	1.9µm
	Dynamic range	70dB
	Signal/Noise ratio (max)	37dB
	Responsivity	2.24 V/lux-sec (960p) 8.96 V/lux-sec (VGA)
Output	Camera output	1280×960 @30fps
	Data Format	YUV422
	Shutter type	ERS (Electronic Rolling Shutter)
View	Field of view	72.6°DFOV (60.9°HFOV, 47.6VFOV)
	Focus range	30cm ~ infinity
	Focus type	Fixed focus

Framerate

Resolution	Embedded	Gigabit Ethernet	100Mb Ethernet	Wifi g
160×120px	30fps	30fps	30fps	30fps
320×240px	30fps	30fps	30fps	11fps
640×480px	30fps	30fps	12fps	2.5fps
1280×960px	29fps	10fps	3fps	0.5fps

Note: using the video stream in remote highly depends on the network and the video resolution chosen. All frame rates depend on the CPU usage. Values are calculated with a CPU fully dedicated to images gathering.

IR

Number	×2 on front
Wavelength	940nm
Emission Angle	+/-60°
Power	8mW/sr

FSR (FORCE SENSITIVE RESISTORS)

Range	0 to 110N
	×4 per feet

POSITION SENSORS

MRE (Magnetic Rotary Encoder)	×36 Using hall effect sensor technology Precision: 12bits / 0.1°
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SOFTWARE

Open Nao	Embedded GNU/Linux Distribution based on Gentoo
Architecture	×86
Programming	Embedded: C++ / Python Remote: C++ / Python / .NET / Java / MatLab

CONTACT SENSOR

Chest Button	✓
Foot Bumper	✓
Tactile Head	✓
Tactile Hand	✓

SONAR

Emitters	×2 on front
Receivers	×2 on front
Frequency	40kHz
Resolution	1cm
Detection Range	0.05m to 3m
Effective Cone	60°

INERTIAL UNIT

Gyrometer	×1	
Axis		3
Precision		5%
Angular speed		~500°/s
Accelerometer	×1	
Axis		3
Precision		1%
Acceleration		~2g

LEDs

Placement	Quantity	Description
Tactile Head	×12	16 Blue levels
Eyes	2×8	RGB FullColor
Ears	2×10	16 Blue levels
Chest button	×1	RGB FullColor
Feet	2×1	RGB FullColor

DEGREES OF FREEDOM

Head	×2 dof
Arm (in each)	×5 dof
Pelvis	×1 dof
Leg (in each)	×5 dof
Hand (in each)	×1 dof



MOTOR SPECIFICATIONS

Motor type Brush DC Coreless

POSITION OF MOTORS

		Motor	Reduction Ratio
Head joints	HeadYaw	Type 3	Type A
	HeadPitch	Type 3	Type B
Arm joints	ShoulderPitch	Type 3	Type A
	ShoulderRoll	Type 3	Type B
	ElbowYaw	Type 3	Type A
	ElbowRoll	Type 3	Type B
	WristYaw	Type 2	Type C
	Hand	Type 2	Type D
Leg joints	HipYawPitch	Type 1	Type A
	HipRoll	Type 1	Type A
	HipPitch	Type 1	Type B
	KneePitch	Type 1	Type B
	AnklePitch	Type 1	Type B
	AnkleRoll	Type 1	Type A

DESCRIPTION OF THE MOTORS

	Motor type 1	Motor type 2	Motor type 3
Model	22NT82213P	17N88208E	16GT83210E
No load speed	8300rpm $\pm 10\%$	8400rpm $\pm 12\%$	10700rpm $\pm 10\%$
Stall torque	68mNm $\pm 8\%$	9.4mNm $\pm 8\%$	14.3mNm $\pm 8\%$
Continuous torque	16.1mNm max	4.9mNm max	6.2mNm max

Speed Reduction Ratio TYPE A

	Motor type 1	Motor type 3
Reduction ratio	201.3	150.27

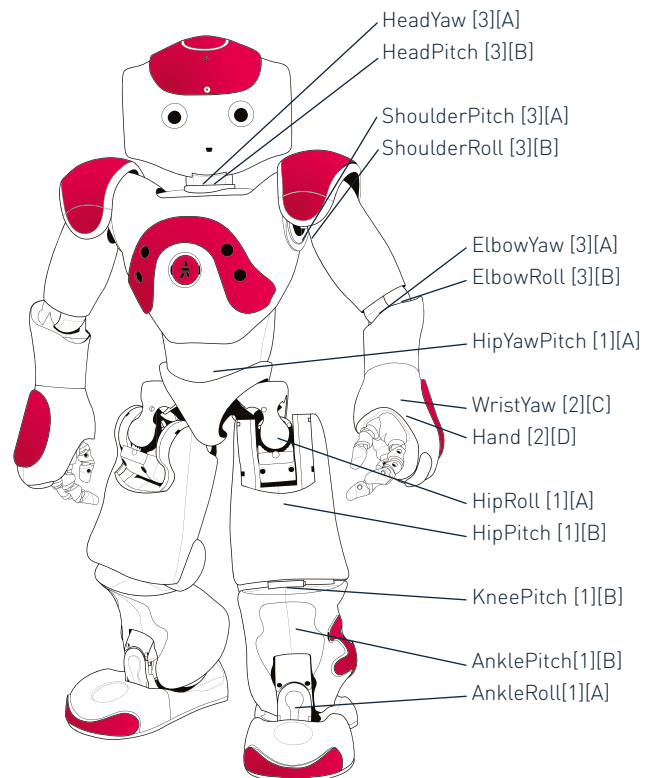
Speed Reduction Ratio TYPE C

	Motor type 2
Reduction ratio	50.61

CERTIFICATIONS & APPROVALS

Region	Classification
Europe	CE (Attestation of conformity)
USA	FCC

Electromagnetic compatibility	EN 301-1 / EN 301 489-17 / EN 300 328 EN 62311 : 2008 / FCC PART15, Class B
Safety	IEC 60950-1 : 2005 (2nd edition)



Legend:
Joint Name[Motor Type][Reductor Type]

Speed Reduction Ratio TYPE B

	Motor type 1	Motor type 3
Reduction ratio	130.85	173.22

Speed Reduction Ratio TYPE D

	Motor type 2
Reduction ratio	36.24