

六 NAO



Robots **LAB**

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	5h
	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 802.11b/g/n

AUDIO

Loud Speakers	×2 lateral	
	Diameter	36mm
	Impedance	8ohms
	Sp level	87dB/w +/- 3dB
	Freq range	up to ~20kHz
	Input	2W
	Microphone	×4 on the head
Sensitivity		43 db +/-3dB
Frequency range		150Hz-12kHz
Signal/noise ratio		58dBA

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
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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	960p@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.

NAO

| EVOLUTION

IR

Number	x2 on front
Wavelength	940nm
Emission Angle	+/-60°
Power	8mW/sr

FRS (FORCE SENSITIVE RESISTORS)

Range	0 to 110N
	x4 per feet

POSITION SENSORS

MRE (Magnetic Rotary Encoder)	x36
	Using hall effect sensor technology
	Precision: 12bits / 0.1°

SOFTWARE

Open Nao	Embedded GNU/Linux
	Distribution based on Gentoo
Architecture	x86
Programming	Embedded: C++ / Python
	Remote: C++ / Python / .NET / Java / MatLab

CONTACT SENSOR

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

SONAR

Emitters	x2 on front
Receivers	x2 on front
Frequency	40kHz
Sensitivity	-86dB
Resolution	1cm
Detection Range	0.05m to 3m
Effective Cone	60°

INERTIAL UNIT

Gyrometer	x1
Axis	3
Precision	5%
Angular speed	-500°/s
Accelerometer	x1
Axis	3
Precision	1%
Acceleration	-2g

LEDS

Placement	Quantity	Description
Tactile Head	x12	16 Blue levels
Eyes	2x8	RGB FullColor
Ears	2x10	16 Blue levels
Chest button	x1	RGB FullColor
Feet	2x1	RGB FullColor

CONTACT SENSOR

Head	x2 dof
Arm (in each)	x5 dof
Pelvis	x1 dof
Leg (in each)	x5 dof
Hand (in each)	x1 dof

MOTOR SPECIFICATIONS

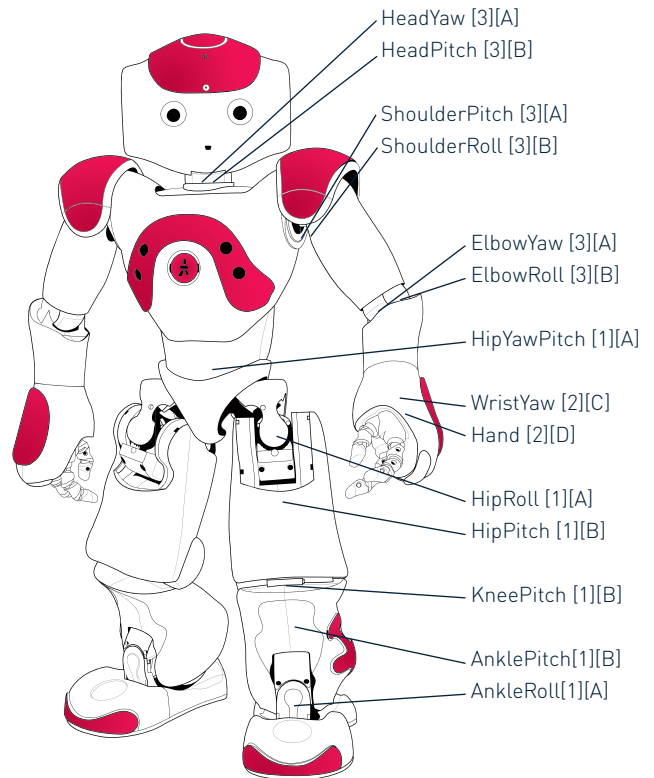
Motor type Brush DC Coreless

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 ±10%	8400rpm ±12%	10700rpm ±10%
Stall torque	68mNm ±8%	9.4mNm ±8%	14.3mNm ±8%
Continuous torque	16.1mNm max	4.9mNm max	6.2mNm max



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

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

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

CERTIFICATIONS & APPROVALS

Region	Classification	Electromagnetic compatibility	EN 301-1 / EN 301 489-17 / EN 300 328 EN 62311 : 2008 / FCC PART15, Class B
Europe	CE (Attestation of conformity)	Safety	IEC 60950-1 : 2005 (2nd edition)
USA	FCC		

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