

GENERAL FEATURES

Height	Weight	Footprint
110 - 145 cm	70 kg	Ø54 cm

DEGREES OF FREEDOM (DoF)

Torso Lift	Mobile Base	Arm (0/2X)	Head
1	2	7	2

Build your own TIAGo



TIAGo[®]
LITE



TIAGo[®]



TIAGo[®]
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	LITE	TIAGo	++
Differential drive	✓	✓	✓
Omnidirectional drive	Optional	Optional	Optional
Navigation laser	5.6 m <i>(upgradable to 10 m, 25 m)</i>	5.6 m <i>(upgradable to 10 m, 25 m)</i>	5.6 m <i>(upgradable to 10 m, 25 m)</i>
Lifting torso	✓	✓	✓
Pan-tilt head	✓	✓	✓
7 DoF arm	—	1	2
Default end-effector	—	Parallel Gripper	Parallel Gripper
Force/Torque sensor	—	Optional	Optional
Touchscreen monitor	Optional	—	Optional

* Upgrade kits available in order to evolve your version. The robot's configuration may change without previous notice

BODY	Arm payload (at full extension)	3kg <i>(without end-effector)</i>
	Arm reach	87 cm <i>(without end-effector)</i>
	Torso lift	35 cm
MOBILE BASE	Drive	Differential / Omnidirectional <i>(optional)</i>
	Max. speed	1.5 m/s
	Operational environment	Indoor
CONNECTIVITY	Wireless connectivity	802.11ax Wi-Fi 6 Bluetooth 4.0
ELECTRICAL FEATURES	Battery 36V 20Ah	1 battery / 2 batteries
	Battery autonomy	4 - 5 h / 8 - 10 h
SENSORS	Base	Laser 5.6 m / 10 m / 25 m range, rear sonars 3x1m range
	IMU (Base)	6DoF
	Motors	Actuators current feedback
	Head	RGB-D camera
AUDIO	Speakers	2 x 5 W audio speaker
	Microphone	2x microphone array with stereo output 50-8000Hz
COMPUTER	CPU	Intel i5 / i7
	RAM	8 GB / 16 GB
	SSD	250 GB / 500 GB
SOFTWARE	OS	Ubuntu LTS 64-bits, RT Preempt
	Open source middleware	ROS LTS
	Periodic update/patches	✓
	Arm control mode	Position / velocity / effort control
SUPPORT	Training and maintenance	On demand
	Online helpdesk	✓
EXTENSIBILITY	Laptop tray	✓
	Mounting points	On head, laptop tray and mobile base
	USB ports	1x USB 3.0, 1x USB 2.0
	Ethernet ports	2x GbE (Gigabit Ethernet)
	Power supply	12 V / 5 A
	Service panel	HDMI, USB 3.0
OPTIONALS	End-effector	Hey5 Hand / PAL gripper / Robotiq™ 2F 85 / 140 / EPick / Your own
	Wrist sensor	6 axis Force/Torque sensor
	Dock station	✓
	Touchscreen	✓
	AI Kit	NVIDIA® Jetson™ TX2 Add-on

CORE SOFTWARE

Operating system

Ubuntu LTS 64-bit
 RT Preempt RT framework

Middleware

Orocos
 Robot Operating System (ROS) LTS

USER INTERFACES

Web-Based Interface

Diagnosis of software, actuators and sensors
 Text-to-speech triggering
 Execution of pre-recorded motions
 Execution of demonstrations

Joystick teleoperation

Mobile base control
 Head control
 Torso lift control
 Execution of pre-recorded motions

NAVIGATION

Core Navigation package

Laser based self-localization and mapping (SLAM)
 Navigation to a point of a map
 Obstacle avoidance using laser sensors
 Available RViZ Plugin to navigation to a point in a map

HUMAN-ROBOT INTERACTION

Text-to-speech

TTS software with one language and one voice
 Triggered via Web-Based GUI

Robot Sensor visualization

Available RViZ Plugins for camera, lasers and sonars
 Available RViZ Plugins for IMU and Force/Torque sensors



CONTROL

ros_control

Full ros_control compatibility
Hardware-agnostic controller written as ros_control plugins
Point level control in position, velocity and effort
Supported hardware interfaces: position and effort

ros_controllers

Joint trajectory controller (default):

Command joint-wise trajectories to groups of joints
(arm, head and torso)

Default stack of controllers

Command individual joints
Available QT-based GUI

Gravity compensation controller:

Arm position maintained compensating gravity
Compliant behaviour of the arm

Differential drive controller:

Velocity-based controller for the mobile base
Available RViz Plugin to navigation to a point in a map

Upper body motions

play_motion

Pre-recorded motions handling
Allows execution with planning and self-collision avoidance

play_motion_builder

Generation of pre-recorded motions
Available QT-based GUI

MoveIt!

Fully integration that works off-the-shelf
Motion generation with path planning and self-collision avoidance

Available RViz Plugins



USER INTERFACES

Leap motion

Fully integrated Leap motion sensor

Allows to teleoperate:

7 DoF Arm

Torso

Hey5-hand / parallel / Robotiq / other grippers

CONTROL

Whole body
control package

Controller based on a quadratic solver that solves a hierarchical set of tasks

Provides on-line inverse kinematics of the robot's upper body (arm, torso, head)

Default stack of tasks contains:

Self-collision avoidance

Joint limit avoidance

Allows for:

Cartesian Gaze control

Cartesian control of end-effector

Admittance compliant control (if there is F/T sensor)

Joint space control of upper body

Compliant behaviour of the arm

NAVIGATION

Advanced navigation
package

Obstacle avoidance using RGB-D head camera

Navigation to points of interest (PoI) or through a sequence of PoI

Detection of regions of interest (RoI) (topological localization)

Avoidance of virtual obstacles / forbidden regions

Map Editor:

Download / Upload maps in the robot

Add virtual obstacles, forbidden regions, PoI, RoI

Graphical joystick to control the robot in the map

HUMAN-ROBOT INTERACTION

Text-to-speech

Add extra languages and voices

Facial perception
package

Face detection, face matching, face tracking

Recognition of 6 basic emotions

Recognition of Facial features

Automatic speech
recognition package

Google Cloud Speech API off-the-shelf integration

Provides ASR for over 125 languages and variants

ONE ROBOT, ENDLESS POSSIBILITIES

Adapt TIAGo to your research needs by customizing it from start with its countless expansion possibilities. PAL Robotics offers a catalog of add-ons to expand TIAGo's capabilities and opens the door to let you easily connect your own devices on it. Adjust your robot to your needs, and turn TIAGo into your best research companion!



ARTIFICIAL INTELLIGENCE KIT

NVIDIA[®] Jetson[™] TX2

The perfect kit for Artificial Intelligence applications or Machine Learning developments. Integrate an NVIDIA[®] Jetson[™] TX2 Kit into TIAGo and benefit from one of the fastest and most power-efficient computing devices so nothing stops your algorithms. Explore the potential of the AI and robotics synergy.

Start implementing AI-based applications with TIAGo!

YOUR WAY OF SENSING

Equip TIAGo with the sensors and devices needed to easily perceive the environment as you require. We know each research field demands a specific way of seeing the world.

GRIPPER CAMERA

THERMAL CAMERA

YOUR OWN SENSORS

GRAPHICAL INTERFACE

Broaden TIAGo's applications and interaction skills with a graphical interface!



TOUCHSCREEN

An integrated touchscreen can be a useful means for commanding TIAGo, interacting with it, or checking the robot's state.

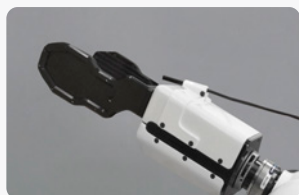


ANDROID TABLET

An Android tablet installed on top of TIAGo's head. Android apps and web-based interfaces open new possibilities to give orders to TIAGo, trigger a task or understand the robot's status.

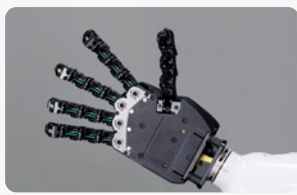
TAILORED GRASPING

Use the End-effector that fits your needs:



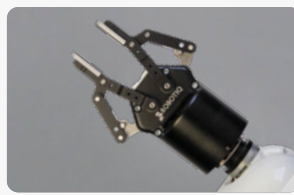
Parallel Gripper

- Current limit control
- 2 DoF
- Gripper camera optional



Hey5 Hand*

- Current limit control
- 19 DoF (3 actuated)



Robotiq™ 2F 85/140

- Current limit control
- Gripper encompass objects
- No current consumption to stay in fixed position



Robotiq™ EPick

- Electrical vacuum generator
- Standard suction cups

(*) Developed by PAL Robotics S.L., with contributions from QBrobotics srl. The Hey5 hand is a derivative of the "Pisa/IIT SoftHand" open source project by M. G. Catalano, G. Grioli, E. Farnioli, A. Serio, C. Piazza and A. Bicchi, distributed under Creative Commons Attribution 4.0 International License and available at NaturalMachineMotionInitiative.com

ADD YOUR ADD-ON!

Expansion Panel

Connect microphones, cameras, any sensor or device you want to TIAGo, and widen your robot's abilities right the way you need it.



Mounting Points

TIAGo has mounting points on its head, laptop tray and mobile base to handily fix the equipment on its body.



Laptop Tray

Connect your laptop to its onboard computer through the expansion pane. The tray is also an adequate surface to permanently add new devices.



TIAGo OMNI BASE

TIAGo Omni Base is available with 4 drive mecanum wheels, and 2 LiDAR Sensor for an unobstructed 360° FOV secure movement, it can include autonomous navigation, obstacle detection and path planning. Move and navigate the omnidirectional base with ease thanks to its precision positioning in constrained environments.

