

Omnidirectional mobile base

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TIAGo's mobile base is provided with a omnidirectional drive mechanism and contains an onboard computer, batteries, power connector, two laser range-finders, a user panel, a service panel and wireless connectivity. Furthermore, the version of TIAGo with a docking station has a charging plate on the front.



Figure: Mobile base front view #



Figure: Mobile base rear view

Robot's main specifications

The robot features an omnidirectional drive system. It is powered by two batteries, ensuring robust performance for various tasks.

Dimensions

Height	31 cm
Weight	48 Kg
Base footprint	72 * 50 cm

Mobile base

Drive system Omnidirectional

Max speed	1 m/s
Payload	150 Kg

Electric features	
Battery	2 x 36 V, 20 Ah

Features of the omnidirectional mobile base

Onboard computer

The specifications of TIAGo 's onboard computer depends on the configuration options you have ordered. The different possibilities are shown in table below:

Onboard computer main specification

Component	Description
CPU	Intel i5 / i7
RAM	8 / 16 GB
Hard disk	250 / 500 GB SSD
Wi-Fi	802.11 a/b/g/n/ac
Bluetooth	Smart 4.0 Smart Ready

Battery

The specifications of the battery supplied with TIAGo are shown in table below:

Battery specifications

Type	Li-Ion
V_nominal	36.0 V
V_max	42.0 V
V_cutoff	30.0 V
Nominal capacity	20 Ah
Nominal energy	720 Wh
Max. continuous discharge current	20 A
Pulse discharge current	60 A
Max. charging current	15 A
Charging method	CC/CV
Weight	7.5 kg

TIAGo's base can be equipped with two batteries. In this case, the *total Nominal capacity is 1440 Wh.*

Power connector

TIAGo must only be charged only with the supplied charger. To insert the charger connector, open the lid located on the rear part of the robot, as shown in *Figure: Connector entry*.

Connection Insert charging connector with metal lock facing up and push it, as shown in *Figure: Connector entry b*, until you hear a 'click'.

Disconnection Once charge is completed, connector can be removed. In order to remove it, press metal lock and pull the connector firmly, see *Figure: Connector entry*.



Figure: Connector entry

Laser range-finder

The specifications of the laser on the front part of the mobile base depend on the configuration options you have ordered. The lasers supported are shown in table:

Lasers range-finder specifications

Manufacturer	Hokuyo
Model	URG-04LX-UG01
Range	0.02 - 5.6 m
Frequency	10 Hz

Manufacturer	Hokuyo
Field of view	180 degrees
Step angle:	0.36 degrees

Manufacturer	SICK
Model	TIM561-2050101
Range	0.05 - 10 m
Frequency	15 Hz
Field of view	180 degrees
Step angle:	0.33 degrees

Manufacturer	SICK
Model	TIM571-2050101
Range	0.05 - 25 m
Frequency	15 Hz
Field of view	180 degrees
Step angle:	0.33 degrees

IMU

The Inertial Measurement Unit is mounted at the center of the mobile base and may be used to monitor inertial forces and attitude. The specifications are presented in the table:

IMU's main specifications	
Manufacturer	InvenSense
Model	MPU-6050
Gyroscope	3-axis

Manufacturer
Accelerometer

InvenSense
3-axis

User panel

The user panel is on the top, rear part of TIAGo mobile base. It provides the buttons to power up and shutdown the robot, and a screen to give visual feedback on the robot's status. All the specific elements of the user panel are shown in the figure below and the description of each element is presented in the table below:



Figure: User panel

User Panel description

Number	Name / Short description
1	Electric switch
2	Information display (optional)
3	On / Off button
4	Emergency stop

Electric switch The electric switch is the main power control switch. Before turning TIAGo ON make sure first that this switch is ON, i.e. its red light indicator is ON. On the other hand, when TIAGo is not going to be used for a long period, please press the switch so that its red light indicator turns OFF. Note that this switch should not be turned OFF before using the On/Off button to turn OFF the onboard computer of the robot. Turning OFF this switch will cut instantaneously the power supply to all the robot components, including the onboard computer. Do not use this switch as emergency stop. For the emergency stop please refer to the next section.

Emergency stop When pushed, motors are stopped and disconnected. The green indicator of the On/Off button will blink fast in order to notify the user of the emergency state.

To start normal behaviour again, a two step validation process must be executed: the emergency button must be released by rotating clockwise, and then the On/Off button must be pressed for one second. The green light indicator of the On/Off button will change to a fixed state.

Information display 320x240 Color TFT display shows the battery level on the top right corner.

On / Off button The standby control button is a pushbutton with a green light that indicates the system's current status.

Green light indicator possible modes		
Light	State	Name / Short description
Off	Fixed	Standby
On	Fixed	Running
On	Slow-Blink	System in process of shutdown
On	Fast-Blink	Emergency state

After main power is connected, i.e. electric switch is ON (*Figure: User panel*), user must press this button during 1 second in order to start the TIAGo.

To re-set the system in standby mode when the robot is running, press the button again. The green light will blink slowly during shutdown procedure and light-off when standby mode reached.

Service panel

It is possible to access the service panel by removing the cover behind the laser (see figure *Figure: Service panel*).

This service panel gives access to video, usb and On/Off button of the robot's computer. It can be used for reinstallation or debug purposes.

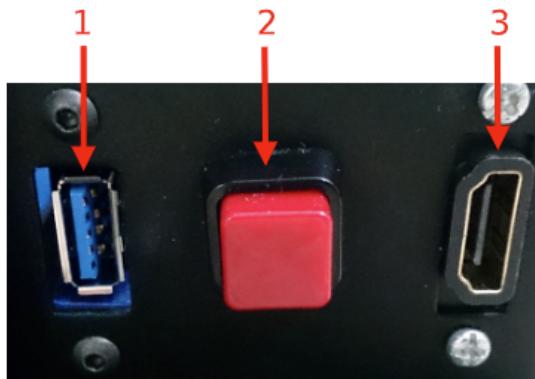


Figure: Service panel

Service panel description	
Number	Name / Short description
1	USB 3.0
2	On/Off button computer

Number	Name / Short description
3	HDMI

Expansion panel

In order to access this panel the top plate of the robot must be removed.



Figure: Expansion panel omni base access

Mounting plate must be removed in order to get access to this panel.



Figure: Expansion panel omni base detail

Expansion panel description

Number	Name / Short description
1	Power connector
2	Communications Expansion, i.e. CAN (if ordered)
3	GPIOs
4	USB 3.0
5	USB 3.0
6	USB 3.0
7	Ethernet
8	Ethernet
9	Reserved
10	Speaker
11	HDMI
12	USB 2.0

Number	Name / Short description
13	USB 2.0

Power connector

This expansion connector provides access to the battery and provide up to 360 W. Battery voltage can vary depending on actual State Of Charge in the range of 30V to 42V.

It is recommended to use the all 3 battery output pins in parallel to divide current between them. The maximum current that can be provided through these battery pins is 10 A in total, approximately.

Connector type Molex 39012101, mating part is Molex 39012100.

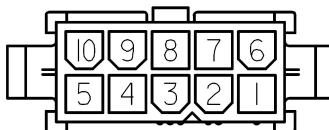


Figure: Power Expansion Connector Pinnout

Expansion panel description	
Pin	Name / Short description
1	
2	+12V output (max 4.5A shared with SICK Laser if present)
3	Battery output (max 9A/pin)
4	Battery output (max 9A/pin)
5	Battery output (max 9A/pin)
6	
7	GND of 12V output
8	Battery GND
9	Battery GND

Pin	Name / Short description
10	Battery GND

Communication expansion

This expansion connector provides access to internal communication buses of the robot. There are 2 CAN buses for motors and actuators and a proprietary bus for sensors. Only the CAN buses are available to the user. CAN bus speed is 1Mbit/s. Connector type Molex 43020-1400, mating part is Molex 43025-1400.

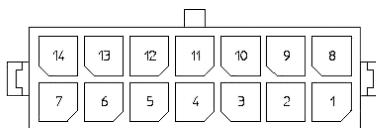


Figure: Communication expansion connector pinout

Communication expansion pin description

Pin	Name / Short description
1	CANL of LEFT bus
2	Shield of LEFT bus
3	CANH of LEFT bus
4	reserved
5	reserved
6	reserved
7	n.c.
8	CANL of RIGHT bus
9	Shield of RIGHT bus
10	CANH of RIGHT bus
11	reserved
12	reserved
13	reserved

Pin	Name / Short description
14	reserved

GPIOs

This expansion connector provides access to General Purpose Input (GPI) and Output (GPO) pins.

Connector type Molex 43020-1600, mating part is Molex 43025-1600.

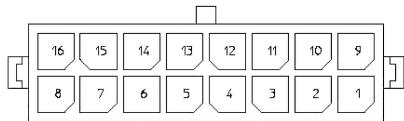


Figure: GPIOs connector pin description

Communication expansion pin description	
Pin	Name / Short description
1	
2	
3	
4	5V
5	GPO 0 (5V TTL level)
6	GPO 1 (5V TTL level)
7	GPO 2 (5V TTL level)
8	GPO 3 (5V TTL level)
9	
10	
11	
12	GND
13	GPO 0 (5V TTL level)

Pin	Name / Short description
14	GPO 1 (5V TTL level)
15	GPO 2 (5V TTL level)
16	GPO 3 (5V TTL level)

General purpose outputs are referenced to pin 12 GND and by default are set to low level. On the other hand, general purpose inputs must be set using pin 4 +5V for high level and pin 12 GND for low level, and have an internal default pull-up.

Connectivity

TIAGo is equipped with a dual band Wireless 802.11b/g/n/ac interface, plus bluetooth 4.0 and a WiFi antenna. When the WiFi interface is configured as access point, it has a 802.11g interface.

There are two Gigabit Ethernet ports, ports 2 and 3 in the expansion panel figure, that can be used to connect to the robot's internal network. For this network, the IP address range *10.68.0.0/24* has been reserved.

Caution

The IP addresses used in the building network MUST not use this range because it can interfere with the robot's services.

Electrical parts and components

Neither TIAGo OMNI Base nor any of its electrical components or mechanical parts are connected to external ground. The chassis and all electromechanical components are physically isolated from the ground by the isolation rubber under its feet. Avoid touching any metal parts directly to prevent discharges and damage to TIAGo OMNI Base's electromechanical parts.

Electrical power supply and connectors

The power source supplied with TIAGo OMNI Base is compliant with the Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment 2002/95/EC (RoHS) and with the requirements of the applicable EC directives,

according to the manufacturer. The power source is connected to the environment ground, whenever the supplied wire is used (Phase-Neutral-Earth).