PRENSILIA s.r.l.

Dexterous hand
for multiple robotics and
biorobotics scenarios

Anthropomorphic
Human sized
5 active axes
Lightweight: 640g

The tool for breakthrough research

power compliant grasps

bi/tri-digital grasps

lateral grasps

IH2 AZZURRA SERIES

Revolutionize your research in a finger snap

The IH2 Azzurra series is a human-sized programmable anthropomorphic hand able to grasp a variety of objects and to sense them through multiple force and position sensors. It is also able to count and press buttons.

The hand is totally self-contained, and weighing 640g is among the lightest available for research. It contains a CPU, firmware, sensor acquisition electronics, communication electronics, servo-controllers, and 5 brushed electrical motors.

Communicating through a standard interface (RS232 or USB), the hand is ready to be easily integrated with your application within multiple research scenarios ranging from prosthetics to neuroscience, human-robot interaction, rehabilitation, etc...

The IH2 Azzurra series firmware routines allow to perform grasps automatically, by just sending a single byte from your application. Alternatively advanced users may implement completely customized control schemes, taking advantage of the embedded 1 kHz servo-control loops.

Azzurra series is the perfect tool for boosting your revolutionary idea: *are you ready for it?*

Easy: count up to 3

ONE - Customize
Starting from your requirements and field of application Prensilia will manufacture your robotic hand customizing (both software and hardware) it to your needs. Firmware code is also available for research purpose, allowing complete user customization. All of this at rapid delivery and competitive prices!

TWO - Connect
Just plug-in the USB cable to your PC, or use the RS232 connection. Take advantage of the firmware and control functions provided with the Azzurra hand series. Building your application has never been so easy!

THREE - Maintain
Able to use a screw-driver? The IH2 series target are researchers working in laboratories: whenever needed it will be extremely easy and fast to tune and maintain the hand by means of repeatable calibration procedures. Just a quick break before restarting your experiments!
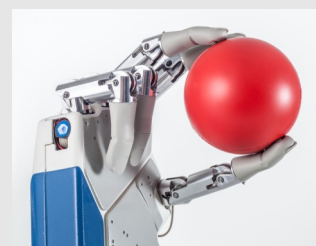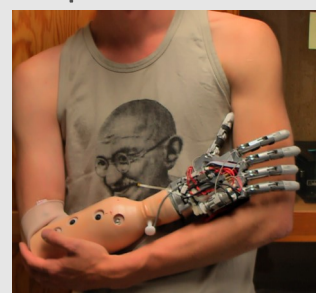
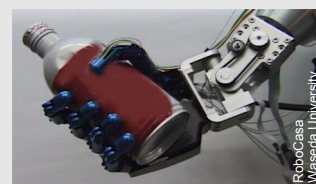### Proposed scenarios

prosthetics, neuroscience

humanoid & assistant robotics

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Boost your research potential contact us on www.prensilia.com

Independent thumb, index & middle flexion/extension: ①,②,③

Grasp-force[1], position and motor current sensors on each active axis

Tendon actuation in adjustable Bowden cable transmission

Independent thumb ab-duction/adduction: ⑤

3-wire communication bus based on 115200 Baud rate RS232 protocol (USB compatible)

Ring and little f/e (④) coupled via adaptive grasping mechanism

The last two fingers open and close together, though each finger will adapt on the object

Compliant fingertips

Underactuated self-adaptive fingers with manually adjustable stiffness

Fingers automatically wrap around objects

Embedded CPU with **1kHz** current and position servo-control loops. Sensor reading delays **< 1ms**

Different wrist connections available on request

IH2 Specifications

Weight	Fully self-contained hand	640 g
Speed	Full flexion from full extension	1 sec
	Full abduction from full adduction	1 sec
Grasp ability	Tendon max active force	40 N
	Cylindrical power grasp	35 N
	Lateral grip	7 N
	Lifting	5 kg
Kinematics	Total fingers	5
	Opposing fingers	1
	Total degrees of freedom	11
	Total hand motors (axes)	5
	Coupled fingers	Ring-little
Range of motion	PID - DIP Joint	110 deg
	MCP Joint	90 deg
Actuation	Type	Brushed DC motors with non-back-drivable mechanism (failsafe, object remains secure without power)
	Transmission	Steel tendons (180 N max force) and Bowden cables
Sensory system	Total force sensors[1]	4
	Total position sensors	5
	Total current sensors	5
	Total limit switch sensors	10
Embedded controller	Implemented control loops	Position, Current, Force[1] (1kHz) for each axis
	Reading delays	< 1 ms
	Total preset grasps	10 Completely programmable by the non-expert user
	Security features	Logic electronics with fuses; continuous motor over-current monitoring and shut-off
Communication	Enjoy the plug and play features!	RS232 / USB Plug and play robot: controllable by all kind of PC or micro-controller based devices
Power requirements		8 V, 5 A (full strength grip)

Sensory System

	Number and location	Type	Max resolution	Notes
Grasp force[1]	4 thumb, index, middle, and one on RL fingers	Analog	~200 mN (10 bit)	Detect force applied on the tendon, thus gives an objective measure of the grasping force applied by the hand
Position	5 (one on each active axis)	Digital encoder	1000 pulses/deg	Digital encoder to monitor the amount of tendon released proportional to the degree of flexion/extension of the fingers For thumb abduction axis measures the angle abduction
Motor Current	5 (one on each active axis)	Analog	1 mA (10 bit)	Analog sensors to monitor motor current consumption
End sensors	10 (two on each active axis)	Digital	-	Detect when motor axis is fully flexed or extended

14° 10° 10° 55°

213 [8,4"] 116 [4,6"]

102 [4"]

mm [in]

45 [1,8"]

25 [1"] 13 [,5"] Thread 20°
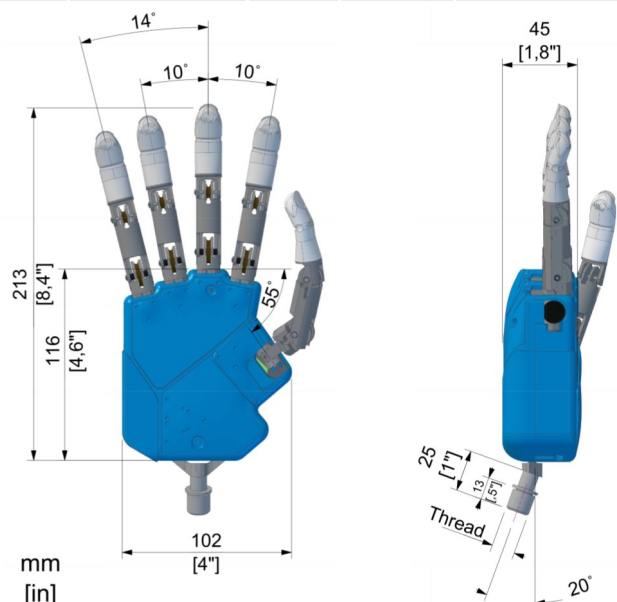
[1] Four grasp-force sensors will soon be included in the IH2 Azzurra hand series: one each for the thumb (flexion/extension), index (f/e), middle (f/e) and a fourth one interchangeable with the ring, and little fingers.