

Robot as a Tool | Robot as a Service | Robots for Every Workplace

# neuromeka



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## History

- 2019
  - 12 2019 Korea Win-Win Development Award
  - 10 relocating Production and System Engineering BU in Daejeon B.O.
  - releasing IndyCARE
  - 09 releasing IndyEye
  - releasing Indy12
  - 06 relocating HQ in Seongsu (Seoul)
- 2018
  - 12 launching pilot business for IndyGo
  - releasing STEP3
  - KDB NextRound Blue Frog Award
  - Robot Company of The Year (in Industrial Robots)
  - 10 relocating Production BU (business unit)
  - starting System Engineering BU (business unit)
  - 09 Red Dot Design Award (Indy7)
  - 08 attracting series-C investment
  - 07 starting production of Indy7
  - releasing D (Delta robot brand)
  - starting System Engineering business
  - 06 establishing CILab (cobot intelligence laboratory) in POSTECH
  - establishing V-SCRC in HCMC (Vietnam)
  - 05 merging Autopower
- 2017
  - 12 Robot Company of The Year (in Industrial Robots)
  - 09 releasing Indy7
  - 07 setting up Production BU in SCRC
  - 06 relocating SCRC (Smart Connected Robot Center) in POSTECH, C5 (Pohang)
  - attracting series-B investment
  - 04 relocating HQ in Apgujung (Seoul)
  - 03 releasing Indy3/5/10
  - 02 INNOBIZ certification
- 2016
  - 11 establishing SCRC (Smart Connected Robot Center)
  - 10 releasing Indy RP
  - 07 releasing STEP2
  - 05 attracting series-A investment
- 2015
  - 08 releasing IGoT/WSN
  - 07 releasing CONTY app
- 2014
  - 12 releasing STEP/iMX and STEP/HPC
  - 10 releasing IGoT/HUB
  - 09 releasing STEP/PC and STEP/BBB
  - 07 relocating HQ in Seongsu (Seoul)
  - 01 installing R&D center
  - Venture Company certification
- 2013
  - 10 releasing NRMKPlatform SDK
  - 07 releasing NRMKFoundation SDK
  - 02 founding Neuromeka at Namyangju (Gyeonggi)

## Robot as a Tool Robot as a Service Robots for Every Workplace

Neuromeka supports automation for small and medium-sized manufacturers using easy-to-use and economic cobots (collaborative robots). Neuromeka's cobots can cowork with people safely and be programmed easily to apply a variety of applications. Neuromeka is constructing ecosystem for RaaS (Robot-as-a-Service) platform business based on cobots which helps small and medium-sized companies to deploy and operate robot automation without in-house robot experts. We are to contribute our robot technology to improve every client's productivity.

Your first industrial robot for small and medium sized manufacturers

# Collaborative Robot | Indy

'Indy' is Neuromeke's flagship robot model we designed and manufactured. Guaranteeing workers' safety based on innovative collision detection algorithms, 'Indy' supports more intuitive direct teaching by impedance control as well as online and offline programming with the teach pendant app running on android tablets. 'Indy' series consists of five models in terms of payload, e.g. 'Indy3/5/7/10 and 12' (3kg, 5kg, 7kg, 10kg and 12kg), and there is also 'Indy-RP2', 7 DOF model. 'Indy' can be equipped with standard tools, such as grippers, vision sensors, etc., through standard extension port at its wrist link.

### Feature

- Easy** easily installed and programmed
- Safe** safely cooperate with people
- Connected** connected always everywhere



### Specification

ITEM	Indy7	Indy12	Indy-RP2 (controlled by STEP3)
DOF	6 (all revolute)	6 (all revolute)	7 (all revolute)
Payload	7kg	12kg	5kg
Joint Motion Range	1,2,3,4,5 : ±175deg   6 : ±215deg	1,2,3,4,5 : ±175deg   6 : ±215deg	±175deg for all joints
Maximum Joint Velocity	1,2,3 : 150deg/s   4,5,6 : 180deg/s	All joints : 150deg/s	1,2,3,4 : 150deg/s   5,6,7 : 180deg/s
Maximum Tool Speed	1m/s	1m/s	1m/s
Maximum Reach	800mm (from 2nd joint to 5th joint)	1200mm (from 2nd joint to 5th joint)	800mm (from 2nd joint to 6th joint)
Repeatability	100µm	100µm	100µm
Weight	28kg	53kg	30.5kg



ITEM	Indy3	Indy5	Indy10
DOF	6 (all revolute)	6 (all revolute)	6 (all revolute)
Payload	3kg	5kg	10kg
Joint Motion Range	±175deg for all joints	±175deg for all joints	±175deg for all joints
Maximum Joint Velocity	90deg/s	90deg/s	1,2 : 60deg/s   3,4,5,6 : 90deg/s
Maximum Tool Speed	1m/s	1m/s	1m/s
Maximum Reach	590mm (from 2nd joint to 5th joint)	800mm (from 2nd joint to 5th joint)	1000mm (from 2nd joint to 5th joint)
Repeatability	100µm	100µm	100µm
Weight	17kg	25kg	40kg

ITEM	IndyCB
Controller	STEP2
Interfaces	EtherCAT, EtherNet, USB CAN, RS232, RS485
I/O	DI/O 32ch, AI/O 4ch
Control Box Size	420 x 360 x 222 mm
Power	max.700w (avg.~350w)
Weight	~ 15.5kg
Supply Voltage	100~240 Vac, 50~60hz



## Realtime embedded EtherCAT master robot controller

# Robot Controller | STEP

'STEP' comes with NRMKPlatform SDK, a software framework for development of realtime control applications on Linux/Xenomai environment which is the hard realtime OS. Development environment running on MS Windows® is also provided in order for engineers unfamiliar with Linux environment to develop embedded control applications.

'STEP' is integrated with EtherLab, which has been proven open-source EtherCAT master stack for many systems, for multi-axes synchronized high-speed realtime distributed control. Development of standard EtherCAT based realtime control applications is supported by CoE (CANopen-over-EtherCAT) protocol based programming interface. Software tools are provided for automatic generation of basic CoE based application codes. Legacy devices with RS485 or CAN interfaces can be connected for standard ports. In order to facilitate CAN based applications NRMKPlatform SDK has RT CAN and CanFestival (open-source CANOpen framework software) installed.

'STEP2' is the default controller responsible for realtime control of 'Indy' lineup, and runs 4kHz model-based impedance control algorithms. 'STEP3', a performance model intended for advanced research and development, is integrated with a high-performance GPU card and NVIDIA TensorRT library which facilitates development of a variety of algorithms based on high-speed deep learning inference computation.

### Feature

**Powerful** based on high performance realtime OS

**Industrial** implementing high-speed, realtime, multi-axes, and synchronized distributed control

**Versatile** integrating a variety of open source libraries and device interfaces



### Specification

ITEM	STEP2	STEP3
Platform	Fanless Braswell Industrial PC	Skylake Industrial PC
CPU	Intel Celeron Braswell soc(4X,1.6ghz)	Intel Skylake i7-6700K(3.4ghz)
RAM	4GDDR3	8GDDR4
Storage	128G SSD(SATA3)	128G SSD
Ethernet	1port	1port
EtherCAT	1port	1port
GPIO	16pin	N/A
RS485/422	1port	1port
RS232	2port	1port
CAN	1port	N/A
Dim	204 × 185 × 52	350 × 265 × 182
Optional	-	Geforce GTX 1080 Ti

## Control engine for cobots

# Robotics SW | IndyFramework

'IndyFramework 2.0' is the Neuromeka's proprietary software framework developed for efficient development of effective cobot applications. Operating on robot controller 'STEP' environment, it is capable of controlling a robot at maximum 8kHz (in case of 'STEP3' controller). Thanks to general-purpose robust control algorithm library for articulated robots coping with kinematic singularity and model uncertainties as well as innovative collision detection algorithm a variety of robotic tasks can be implemented safely and stably. Furthermore, its software architecture is designed to accommodate extension for more features because a number of system functions necessary for automation system deployment and remote connected maintenance are included.

### Specification

Division	Feature
High-speed control on hard RT OS	<ul style="list-style-type: none"> <li>- Native EtherCAT master running on realtime OS Xenomai optimized for 'STEP'</li> <li>- Robot control frequency of maximum 8kHz (4kHz for 'STEP2')</li> </ul>
General-purpose articulated robot control library	<ul style="list-style-type: none"> <li>- Efficient kinematics and dynamics algorithm for a variety of robot structures</li> <li>- Nonlinear H-infinity optimal control based robust control algorithm</li> <li>- Stable task control capability near kinematic singularities</li> <li>- Impedance control algorithm in three-dimensional space</li> <li>- A variety of path planning algorithms and trajectory interpolation algorithms in joint and task space</li> </ul>
Safety and convenience by operation without fences	<ul style="list-style-type: none"> <li>- Collision detection based 'power and force limiting' feature</li> <li>- Realtime monitoring and limitation of joint velocities and currents</li> <li>- Online programming for joint and frame moves by 'CONTY'(Android teach pendant app)</li> <li>- Direct teaching for joint move programming by physically moving robot joints</li> <li>- Impedance teaching for frame move programming by physically moving the robot end-effector in selected translation and/or orientation directions</li> </ul>
System utility functions to facilitate automation system implementation	<ul style="list-style-type: none"> <li>- Standard tool modules such as electrical grippers, electro-magnetic grippers, vacuum suction tools, automatic bolt runners</li> <li>- Fully isolated DIO (each 16 channels) and high-performance AIO (each 2 channels)</li> <li>- Independent EtherCAT port for interface of external slaves (via internal EtherCAT hub)</li> <li>- TCP/IP, Modbus, and OPC-UA for interfacing external PLCs and/or controllers (SDK programming may be necessary)</li> <li>- Standard IoT protocols such as MQTT</li> </ul>
Smart Connected Maintenance	<ul style="list-style-type: none"> <li>- Remote online SW update ('CONTY' app, realtime robot control runtime, and motor driver firmware)</li> <li>- Log file transfer for remote diagnosis for system malfunction</li> <li>- Webcam based operation black-box feature for remote site monitoring</li> </ul>
Extendable robot SW architecture	<ul style="list-style-type: none"> <li>- Plugin structure for control logic extension</li> <li>- Python-based robot motion script programming</li> <li>- SDK for extension of robot functionalities and algorithms</li> </ul>

Everyone's teach pendant for cobot programming

# Teach Pendant | CONTY

'CONTY' is the teach pendant app (running on Android OS) developed independently to program every cobot of Neuromeka. As such it runs on every standard android tablet. Communicating with the robot controller 'STEP' in wired or wireless manner, it supports online and offline programming of 'Indy' lineup as well as direct teaching. Thanks to abundant features designed intuitively anyone can program Neuromeka's cobot.

\*Available with exclusive tablet for 'CONTY'

## Feature

**Friendly** like typical Android app

**Light** using Android Tablet. light, portable and cordless

**Economic** unnecessary purchasing of teach pendant, just install 'CONTY' app on Android Tablet



## Specification

ITEM	CONTY
CPU	MediaTek Deca-Core MT6797T (10-core)
Display	10.1inch / 2560 X 1600 (WQXGA)
OS	Android
Memory / Storage	4GB / 64GB eMMC
Battery	8000mAh
Network	Wi-Fi 2.4GHz/5GHz (IEEE 802.11 ac/a/b/g/n) / GPS
Size / Weight	239mm × 166.9mm × 7.5mm / 550g
Camera	1,300 megapixel (Front, Rear)
Components	Tablet, Charger, Cable, Cover case

Integrated module for your own cobot

# Smart Actuator | CORE

Neuromeka's smart actuators 'CORE' are joint driving modules with frameless motor, harmonic drive, magnetic brake, multi-turn absolute encoder, EtherCAT slave board, and motor driver integrated through a common hollow axis structure. Hollow axis design enables aesthetic robot design for motor power lines and EtherCAT control lines go through the hole.

'CORE' series (adopted to Indy lineup) consists of four models in terms of rated power, e.g. 'CORE100/200/500 and 1000' (100W, 200W, 500W, and 1300W, respectively). Every 'CORE' module supports torque command update up to 8kHz, and users can implement customized servo algorithm at the user application level. As 'CORE' modules are provided without outer frame by default, it helps to design users' custom robot.

## Feature

**All in one** all components integrated, i.e. Harmonic drive, motor, brake, encoder, drivers, and EtherCAT controller

**Design-centric** hollow axis design for maximizing joint travel range and aesthetic link design

**Compatible** CoE protocol for standard EtherCAT master controllers

## Specification

ITEM	CORE100	CORE200
Rated Power	100W	200W
Rated Voltage	48V	48V
Maximum Continuous Current	3.8A	4.8A
Rated Output Torque	21Nm	50Nm
Rated Output Speed	180deg/s	150deg/s
Size	Φ80 x 135mm	Φ90x 145mm
Weight	1.3kg	1.65kg

ITEM	CORE500	CORE1000
Rated Power	500W	1300W
Rated Voltage	48V	48V
Maximum Continuous Current	11.7A	29.4A
Rated Output Torque	121Nm	425Nm
Rated Output Speed	150deg/s	150deg/s
Size	Φ142 x 155mm	Φ178 x 195mm
Weight	4.2kg	8.9kg

Reasonable price and reliable performance, ideal vision solution for Cobot

# Vision Solution | IndyEye

Deep learning based, high-performance vision solution 'IndyEye' offers affordable solutions through low-cost vision sensor and deep learning server sharing.

Unlike former vision sensors that require demanding working conditions, 'IndyEye' can be applied flexibly to any working environment without large space or bright lights, and deep learning server sharing can store working objects data to respond to customer requests. In small and medium-sized manufacturer that require variants of manufacturing lines frequently, 'IndyEye' enables a variety of tasks and quick application.

### Feature

- High-performance** vision solution with deep learning
- Reasonable** reasonable price via low-cost vision sensor and shared deep learning server
- Flexible** various applications without installation obstacle



### Specification

ITEM	IndyEye
Size	67mm x 67mm x 74.4mm
Weight	135g
Detection Rate	97.6%
Processing Time	250~1500 ms
Horizontal FOV	94 °

Robot as a Tool

# Standard Tools for Cobots | IndyTools

Neuromeka offers a variety of tools that are required for cobots at an economical price. By collaborating with tool manufacturers used in industrial robots, we provide optimum tools that cobot users need. Gripper for easy transportation of heavy objects during work, low-cost 6-axis F/T sensor that can measure robot's dynamical load robot, movable base for , and more.



### Specification

ITEM	Gripper 'MPLM 1630'
Gripping Force	63N
Stroke	2x15mm
Jw Closing Time	0.37s
Power Supply	24Vdc
Nominal Current	0.3A
Weight	263g
Feature	Optimized electric gripper for collaborative robots

ITEM	Gripper 'IndyHand'
Finger	Fully acuated robot hand(3-finger)
Weight	1.7kg
DOF	11
Algorithm	Advandced blind grasping algorithm
Control	Torque control
Actuator	DYNAMIXEL (ROBOTIS)
Feature	Flexible grip with three fingers and eleven DOF



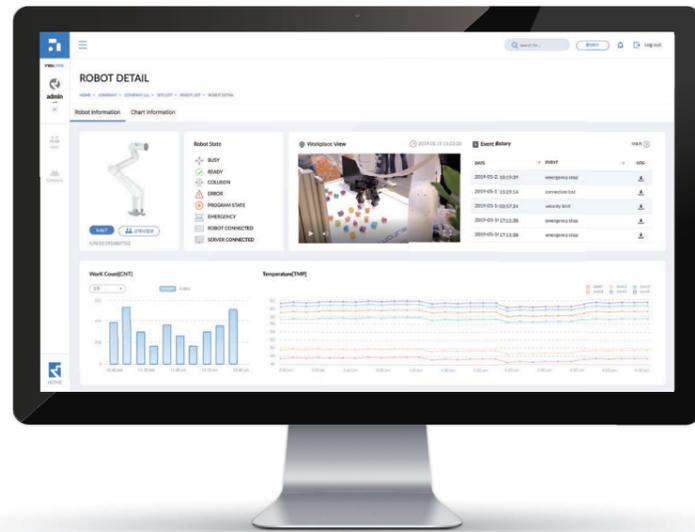
ITEM	Torque Sensor 'RFT76-HA01'
Dimension	Φ76 x 18.5mm
Weight	200g
Data Rate	max 1,000Hz
Load Capacity	300N, 8Nm(torque)
Resolution	200mN, 8mNm(torque)
Feature	Capacitance type, 6 axis force torque sensor with low price

ITEM	BASE 'Mobile Base'
Weight	about 50kg
Height	420mm, 685mm
Feature	Axial folding mobile base

The beginning of remote management of robots for smart factory

# Remote Management Service | IndyCARE

'IndyCARE' is a web service created for remote management of cobots. If you have an Internet connection, you can access the cobot's real-time status, operating data, and event logs anytime, anywhere. The operating data has three additional input channels that can be customized to fulfill the user's needs, in addition to cobot's work counts and the temperature of each joint. We also provide video streaming services of the worksite through the accompanying web camera with cobot. 'IndyCARE' stores event log files and streaming videos for all collision detection and emergency stop situations during work to help determine the causes of robot administrators and enable engineers to provide remote CS support.



Feature

- Remote** management beyond time and space limitation
- Effective** reconsideration of the time and cost efficiency required for cobot management
- Preventable** real-time monitoring to prevent malfunction of cobots



Specification

Division	Feature
Real-time monitoring of cobots	- Check whether or not operations are started - Remote management with collision and emergency stop situation monitoring (email alarm function in case of an abnormal situation)
Store work date	- Measure the productivity by collecting data on the work count by the cobots - Temperature measurement of each joint monitoring for abnormal conditions - Customizing of data values
Video streaming of worksite	- Real-time transmission of the work site situation to the robot administrator with the camera connected to the 'IndyCARE' - Visually check the status of cobot without visit each worksite
Collecting event log	- Collect log files for changes in Cobot status (collision, emergency stop, etc.) - Subsequent monitoring of missed situations by robot administrators - Fast analysis of robot anomalies to reduce maintenance time and cost

Robot as a Service

# Robot Platform Service | IndyGO

Cobots are easy- and safe-to-use industrial robots, intended to work in a common workspace as human workers by allowing direct and physical interaction with them. Contrary to those conventional industrial robots demanding safety measures and complicated robot programs, cobots aim for 'robots as smart tools', and they help to remedy insufficient labor force and guarantee workers' safe production. As such they play a major role in improving workers' productivity and enhancing operation experience. Furthermore, they make optimal solution guaranteeing faster ROI (return-on-investment), from the standpoint of managers, by resolving skill gap issue as well as relocating experience workers to more productive lines.

'IndyGO', which is the compound word of 'Indy' (Neuromeka's cobot) and 'go' (meaning 'go to clients sites'), stands for the total solution service providing deployment, operation as well as maintenance of cobots for clients. Customized and integrated 'IndyGO' services through thorough analysis of production process provide a most efficient robot layout and operation plan in production line. This enables cost reduction as well as productivity maximization, and can be applied actively to dynamically changing manufacturing processes. 'IndyGO' is specializing in small and medium sized manufacturing companies is provided with leasing and monthly subscription model to minimize the initial investment cost, thereby lowering the barrier to constructing robot automation production line. All costs, time, and effort for robot purchasing, system integration, maintenance, and related personnel training can be solved through 'IndyGO' service, and cobot-centered automation can be operated at a reasonable cost, which in turn guarantees quick and high return on investment.

Feature

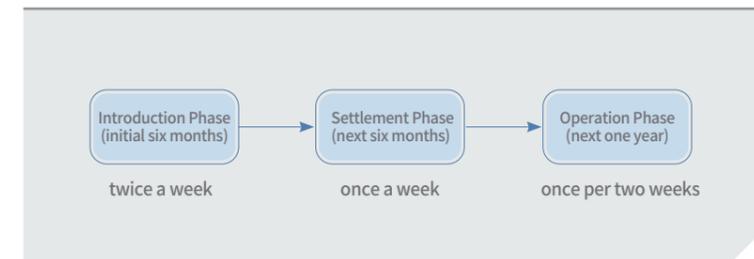
- Free of investment barrier**
  - Free of technology barrier**
  - Free of technology dependency**
- 'IndyGO' provides service covering the whole process of cobot deployment of analysis-design-installation-operation-maintenance necessary. To this end a service platform adopting 'Lean Robotics' methodology is utilized to facilitate automatic diagnosis and analysis of target manual cells. It also provides smart factory feature using industrial IoT and smart connected maintenance.



'IndyPD' is an on-site cobot specialist for the introduction, maintenance and training of cooperative robot cells.

'IndyPD', which will be dispatched to the field (initially from Neuromeka), provides the most efficient robot layout and operation plan for the production process, and communicates directly with workers to provide an immediate solution to a production process that needs to be changed. In addition, 'IndyPD' also serves as a mentor to train some of the client's employees as 'IndyPD'. He/she educates field staff on how to use cobots, and to solve problems in the field, and helps anyone new to cobots become a competent and skilled cobot specialist. In the future, customers can drive their own automation using in-house 'IndyPD's at a lower cost and can also make 'IndyGO' business by themselves to neighbor partners.

Full day dispatch schedule



Pride of Korean delta robots for high-speed automation

# Delta Robot | D

Neuromeka's 'D' is the world-class high-speed high-precision four-axes delta robot based on custom vibration suppression design. In terms of payload capacity and workspace radius two standard models are under production: 'D3' (with 3kg payload) and 'D6' (with 6kg payload). Neuromeka's delta robots provides total automation solutions with custom grippers, conveyor belts, and vision sensors integrated with PLCs in order to satisfy clients' requirement for line automation.



### Feature

- Fast** for productivity
- Precise** for a variety of tasks with precision
- Integrated** for total automation solution



### Specification

ITEM	D3	D6
Weight	60kg	80kg
Payload	3kg	6kg
DOF	4axis	4axis
Reachable Area	XY Axis	800mm
	Z Axis	300mm
	Roll Axis	±180 deg
Repeatability	±0.1mm	±0.1mm
Actuator	AC servo motor, absolute encoder	AC servo motor, absolute encoder

Cycle Time	Path	Payload	Cycle	Path	Payload	Cycle
	25X305X25	25X305X25	0kg	0.30s	25X305X25	0kg
1kg			0.45s	1kg		0.36s
2kg			0.51s	2kg		0.37s
3kg			0.55s	3kg		0.39s
4kg			0.41s	4kg		0.41s
5kg			0.43s	5kg		0.43s
		6kg	0.45s	6kg	0.45s	



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