

IT  Robot

6DOF Intelligent Technology
Robotic Arm System

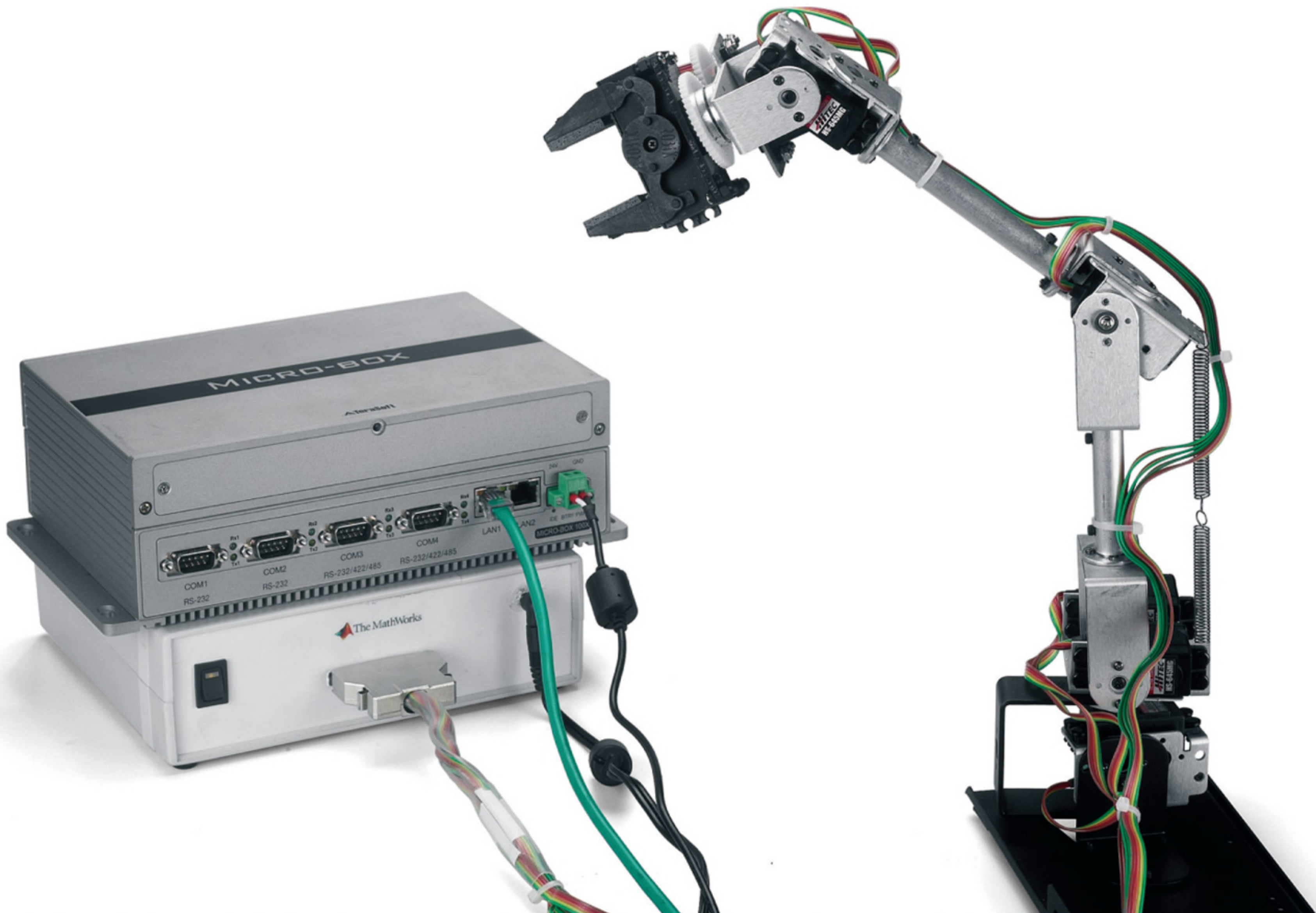
TeraSoft
www.terasoft.com.tw



Is a high reliability, high accuracy multi-mode robotic arm system that is used to simulate big, sophisticated and complicated mechanical arm motions. IT-ROBOT combines the outstanding motion control technology with advanced educational concept and fulfills both the industrial needs as well as the education and research needs in motion planning and industrial system design.

IT-ROBOT is a comprehensive intelligent robotic system which makes it being so unique. It not only includes a six-degree-of-freedom robotic arm but also equips with controller box, driver box and motion control models, as well as model building instruction which are based on the worldwide leading engineering control technology provider MathWorks™ and its product family, MATLAB® & Simulink®. The seamless integration of 6DOF robot and the advanced control algorithm, models and control modeling guidance enables the users easy to program, simulate and implement their control theory in a flash without hand coding by using C or VB results in saving lots of time and cost.

Robots have become important over a wide range of applications—from manufacturing, to surgery, to the handling of hazardous materials. Consequently, it's important to understand how they work, and what problems exist in designing effective robots. Motion control model set up guidance make the IT-ROBOT being a terrific simulation and experimental platform for robotic arm teaching and training.



Features and Benefits



1.High Reliability

- IT-ROBOT is built on standard industrial mechanical arms with a high degree of reliability that enables to simulate large work and complicated mechanical robot arm locomotion.
- The six degree of freedom are base rotation, single plane shoulder, elbow, wrist motion, an optional gripper, and optional wrist rotate.
- High speed movement.

2.Simple to Use

- The robot is controlled by the newly developed controller named Micro-Box which integrates Simulink control design technology, logic control and motion control to achieve high speed, high accuracy control of the robot.
- Easy to communicate with a computer. Powerful communication capability allows IT-ROBOT to communicate relevant process data to a computer via ethernet or RS-232 through the Micro-Box.
- Detailed model set up manual for motion control and standard teaching/training instruction.

3.Easy to Build Your Own Control Models

- Based on Simulink software, the world leading user friendly environment for control design, real-time control and automation system development.
- Intuitive user interface, users can control robot arm, change the angle as well as the position via PC directly.
- Allow users to build their own control theory and models easily, no need to construct extra hardware environment.
- One single and simple platform to develop control algorithm, create models, simulate, adjust and create control theories.

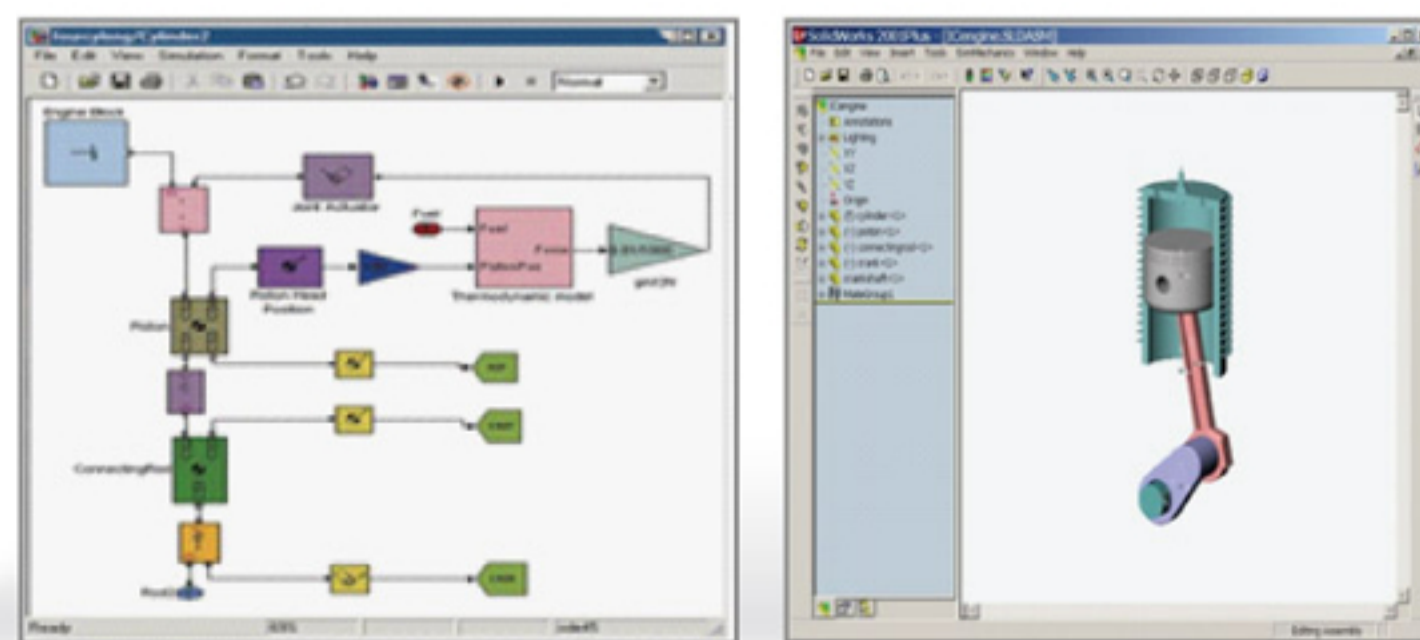
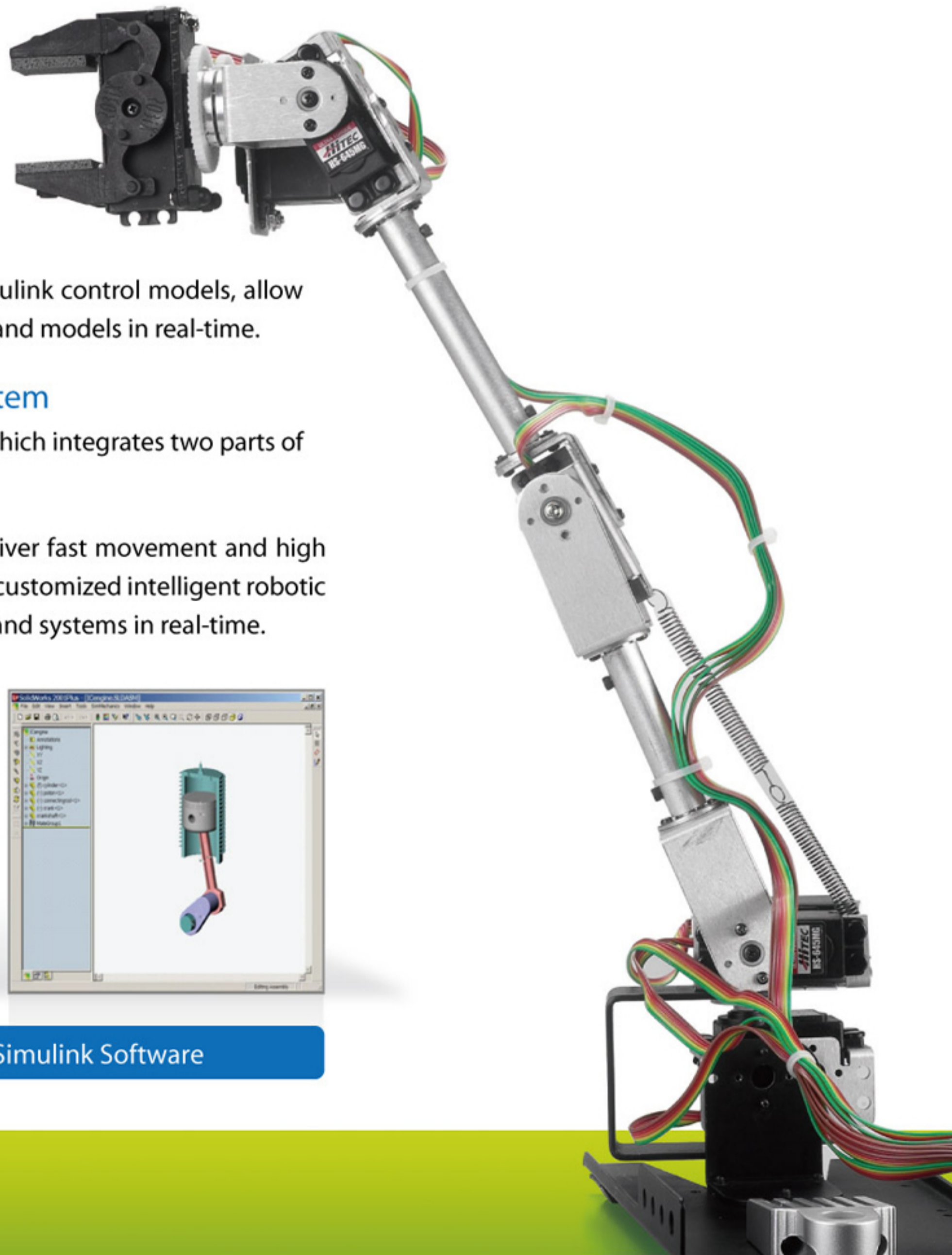
4.Agile, Real-Time and Multi-Functional

- Driven by servo motor (PM DC motor), with high precision.
- IT-ROBOT provides multi-axis motion capabilities via using the position feedback and close-loop control, such as curve-dynamic motions and linear motions etc.
- Equips with Micro-Box(controller) and detailed Simulink control models, allow users to customize and adjust the control program and models in real-time.

5.Comprehensive Robot Arm Modeling System

- IT-ROBOT is a complete intelligent control system which integrates two parts of mechanic robot arm and control systems.

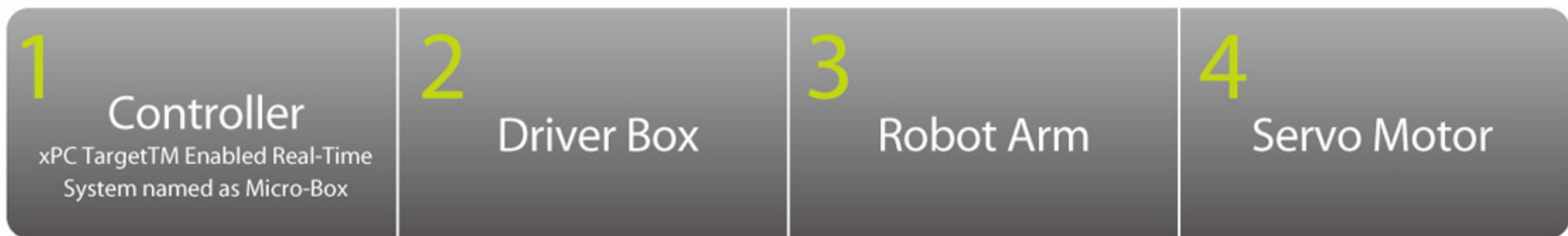
In summary, IT-ROBOT is an affordable structure to deliver fast movement and high precision and repeatable position. Moreover, it is a fully customized intelligent robotic system allows users to development their own models and systems in real-time.



IT-ROBOT Based on Simulink Software



IT-ROBOT is an Intelligent Robotic Arm System with Four Parts :



MICRO-BOX

1 Controller

Micro-Box is an affordable and robust platform for rapid control prototyping applications. Developed by TeraSoft Inc, a leading professional engineering solutions provider based in Taipei, Taiwan, Micro-Box works seamlessly with the MathWorks family of products including MATLAB, Simulink, xPC Target™ and Real-Time Workshop® (RTW), enabling engineers to model physical systems and execute them in real-time under harsh environmental conditions.

Micro-Box is also a rugged, high-performance, industrial PC with no internal moving parts. The product supports all standard PC peripherals including video, mouse, and keyboard. Micro-Box provides IT-ROBOT the agile, real-time and fast customized functionality. Micro-Box is the standard equipment of IT-ROBOT, it is also available for extra procurement.



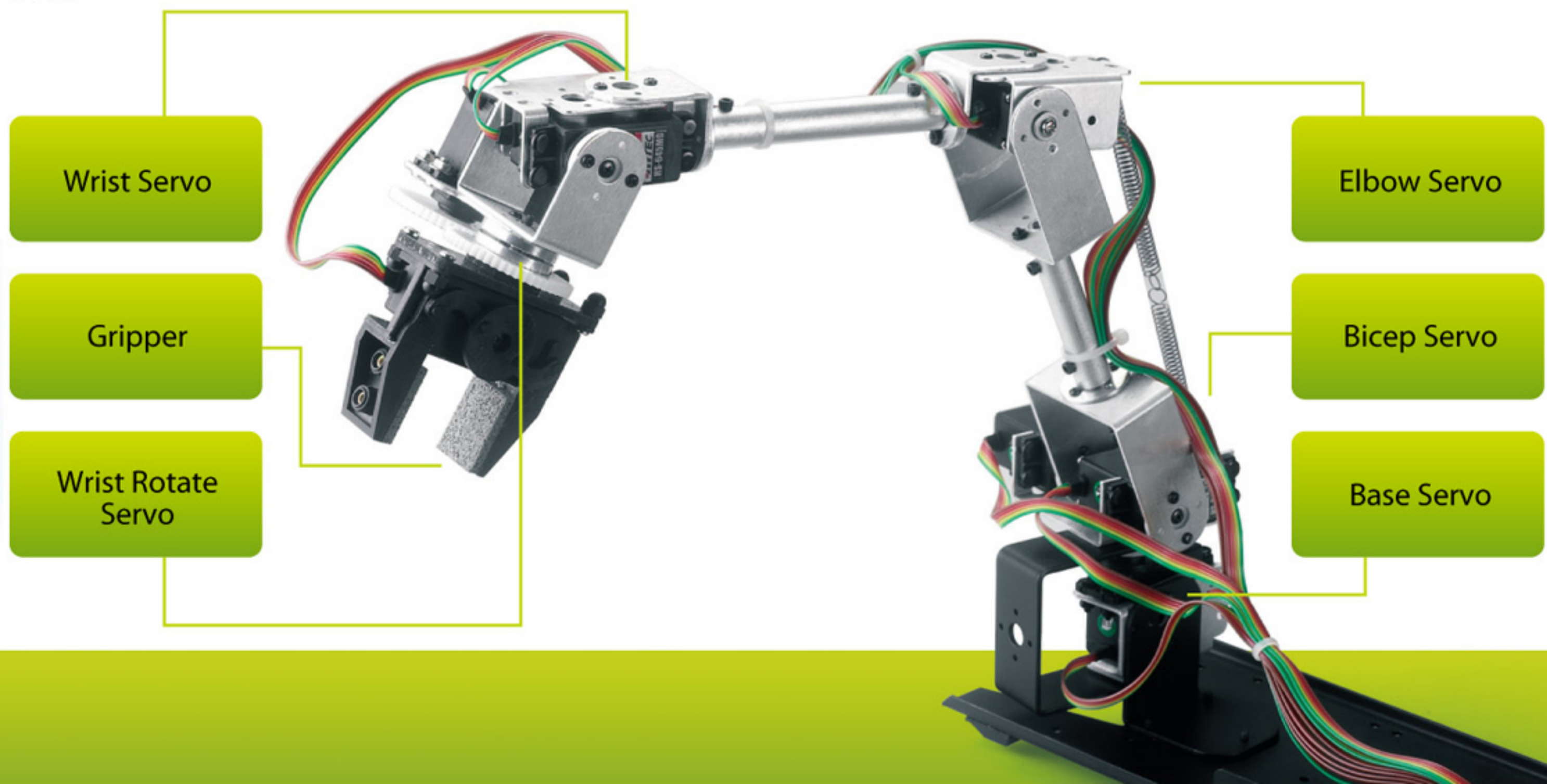
2 Driver Box

- With four H-Bridge Driver IC, affords to control eight motors maximum.
- Peak output current for each axis is 1.2A.

3 Robot Arm

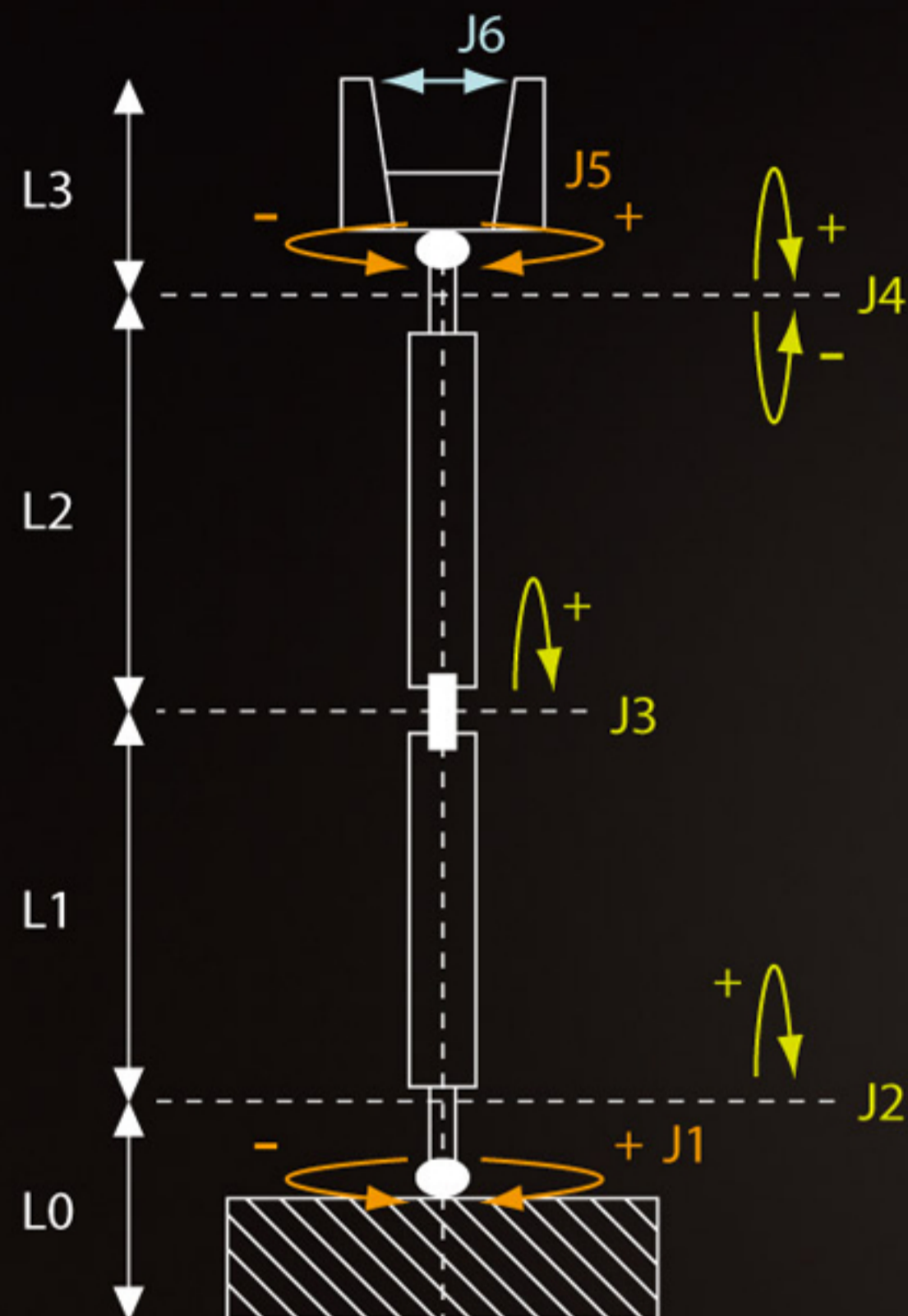
IT-ROBOT designs to imitate human joints to provide more flexibility and expandability. It uses 6-joint in serial design. Features seven motors with six axes movement, they are base, bicep, elbow, wrist, wrist rotate and gripper.

IT-Robot teaches the basic robotic sensing and locomotion principles, providing users to test motor skills, as users build and control the arm. Users can command this system with its controller, Micro-Box, to move an object in a defined space. For the educators and hobbyists, the IT-ROBOT model examples and modeling instruction manual, as well as Simulink interface(optional) are very useful tools.



Degree-Of-Freedom

- 6-axis totally, 4 of them are controlled by Micro-Box.
Wrist rotate and gripper are optional.
- 7 DC motors, 2 of them are connected to the same axis of bicep.
- Each motor has a potential meter to indicate the angular position of the motor.



Axis	Micro-Box Control	Motor Number
Base Servo	Standard	1
Bicep Servo	Standard	2
Elbow Servo	Standard	1
Wrist Servo	Standard	1
Wrist Rotate Servo	Optional	1
Gripper	Optional	1

Robot Arm Specification

Arm Length		Range of Motion		Max. Speed	
Item	Value	Item	Value	Item	Value
Total Height	495mm	J1	±90 deg	J1	0.2 sec/60
L0	85mm	J2	+80 deg	J2	0.2 sec/60
L1	155mm	J3	+80 deg	J3	0.2 sec/60
L2	155mm	J4	±45 deg	J4	0.2 sec/60
L3	100mm	J5	±90 deg	J5	0.2 sec/60
		J6	Open/Close	J6	0.2 sec/60

4 Servo Motor

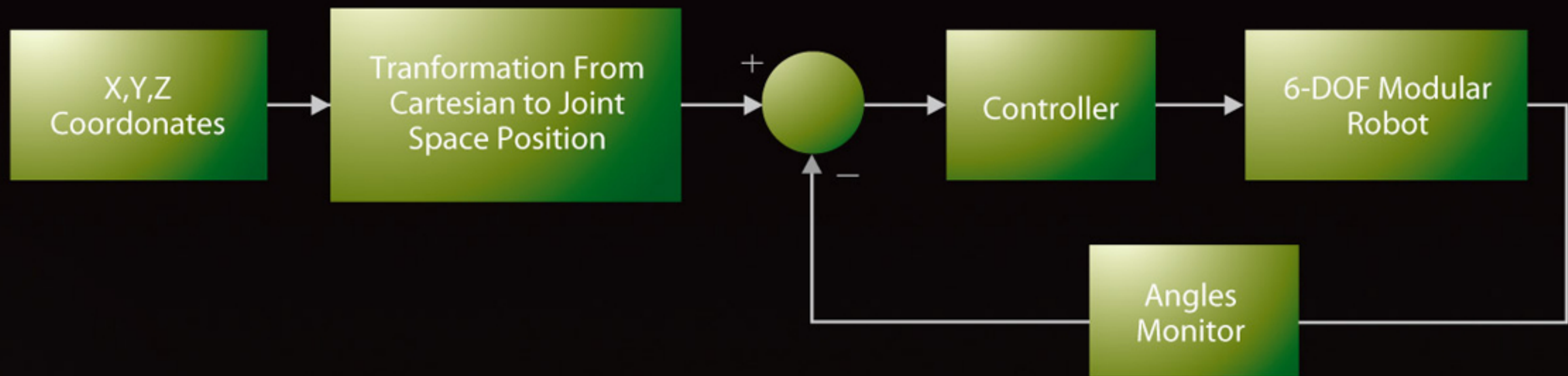
Motor Specification

Item	Value	
Operation Voltage Range	4.8V to 6.0V	
Test Voltage	At 4.8V	At 6.0V
Stall Torque	7.7kg.cm	9.6kg.cm
Operation Speed	0.24sec/60 deg (at no load)	0.2sec/60 deg (at no load)
Idle Current	8.8mA	9.1mA
Running Current	350mA	450mA
Dead Band Width	8μ sec	

Electrical Characteristics of the Input Signal

Item	Value	
	Min	Max
Input Low Voltage	-0.3	
Input High Voltage	At 4.8V	At 6.0V
Enable Low Voltage	7.7kg.cm	9.6kg.cm
Enable High Voltage	0.24sec/60 deg (at no load)	0.2sec/60 deg (at no load)

○ **IT-ROBOT Control Model and Control Architecture**



IT-ROBOT uses 6-joint in serial design. The actuators of the robot arm are the seven DC motors equipped with a potentiometer, and depending on it, the angle of the rotation can be calculated

The IT-ROBOT can be directly controlled by the controller Micro-Box through a Driver Box, to be instructed to the position or coordinates you want. The Driver Box provides the power supply and signals. RS-232C or ethernet cable links Micro-Box and Driver Box to a computer. The control environment is based on MATLAB & Simulink software, using their automatic C code generation technology and working on the xPC Target which is also the MathWorks product for real-time environment for hardware-in the loop and rapid prototyping. With Simulink, the robot can be taught sequences of motion via the mouse or joystick. Micro-Box extremely powerful function uses external digital and analog inputs/outputs to affect the robot's motion for closed loop projects.

Control Features

- Detailed Simulink robot arm models, mathematic programs.
- Micro-Box which the controller is the standard equipment.
- Users can use MATLAB/Simulink and the self created control principles to instruct robot arm to make the expected behaviors easily.
- Use RS232 or ethernet to communicate between the Micro-Box and a computer. The Micro-Box is connected to the Driver Box which is connected to the robot arm.

○ **Software Requirement**

For Basic Works (Download the Executable to the Micro-Box to Drive the Robot)

- MATLAB
- Simulink
- Real-Time Workshop
- xPC Target
- xPC Target Embedded Option

For Advanced Works (Modeling, Design, Tuning, Simulation)

- Simscape
- SimMechanics
- SimPowerSystems
- Control Toolbox
- Simulink Control Design
- Optimization Toolbox
- Simulink Design Optimization
- Simulink 3D Animation

Education Exercises

- Controller design
- Controller optimization
- Physical plant modeling
- Physical parameters tuning from real data
- Rapid control prototyping

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