

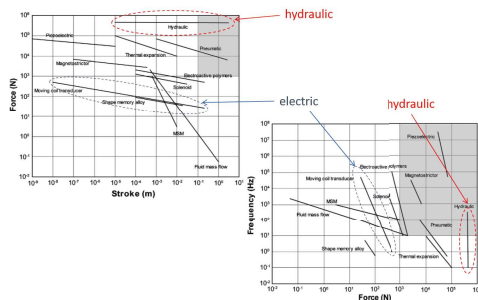
ALL COMPONENTS FOR HYDRAULIC ROBOTS

POWERFUL HYDRAULIC MANIPULATORS
FIELD ROBOT APPLICABLE TO EXTREME ENVIRONMENT

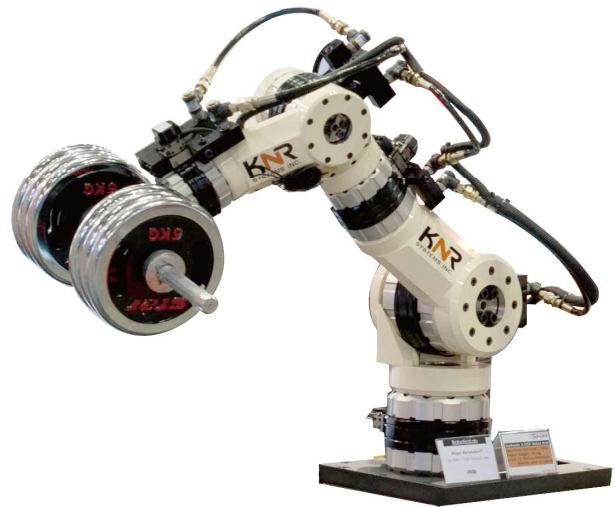


Advantages of Hydraulic Robot

Hydraulic robot is useful for **Dynamic, High power, High torque** systems.



* Design methodology and case studies in actuator selection, Mechanism and Machine Theory 46, 2011



A system capable of flexible processing of diversified designs, high payload & extensive operation domains without any restrictions

Whereas hydraulic actuators & components have no restrictions and allow extensive design & flexible processing of payloads & operation spaces, motor-driven systems have limitations in payload ratio based on the size, with the payload being proportional to size in general.

Since KNR's hydraulic actuator has an excellent power in reference to weight of more than 10 times compared with standard motors coupled with harmonic gear, it is suitable for robots handling heavy weights.

	Electric	Hydraulic
Power/mass [w/kg]	200	600
Torque/mass [Nm/kg]	15	120
Output force	not so high	higher than

An optimum system applicable to hazardous environments.

Hydraulic system is suitable for dangerous environments such as underwater, high temperature, etc. that are normally inaccessible by humans.

A system allowing application of a small controller irrespective of actuator's capacity.

Hydraulic System allows high-precision control, with a **remarkably small control system** compared with Electrically driven motors, and allows **application of small products irrespective of capacity**. Power supply & signal line also allow small & simple configuration irrespective of actuator's capacity, making it particularly advantageous for application of Multi Axis or Articulated Robots such as Manipulator or Walking Robots.

A system suitable for high-speed & high-frequency response performance.

Robot driving element with application of KNR's hydraulic servo valve has a speed & frequency response performance of a few 10Hz to a maximum of 100Hz, which is a range sufficient for application to robots.

Advantages of KNR Robotics

SIMPLICITY!

UNIQUE TECHNOLOGY!

CUSTOMIZATION!

RAPID DEVELOPMENT!

SAVING TIME & COST!

KNR is retaining independent technology such as rotary actuator, mobile power apparatus, etc.. Also, we are the only supplier retaining all components for hydraulic robots.

KNR provides customers requiring customization with prompt development as well as saving effects of both time & cost.

Components

- Compact design
- Flexibility
- Smart

Manipulator

- Higher payload for its weight
- High precision

Robot System

- Rapid Development
- Harsh Environment



1. KRH



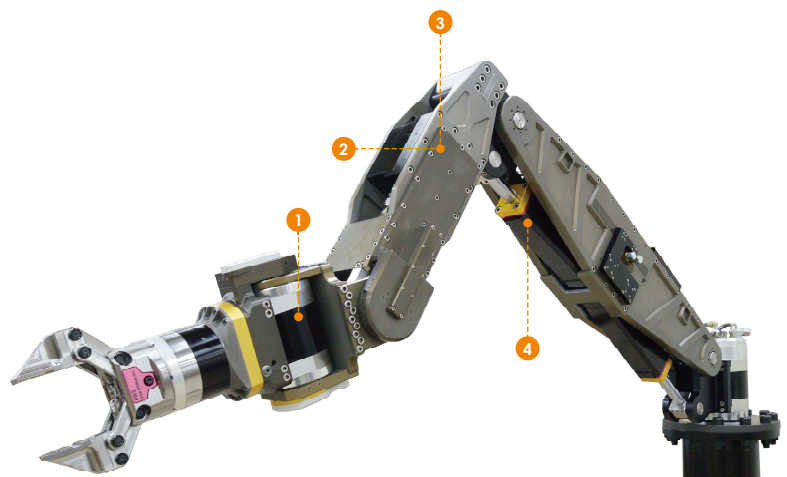
2. KSV



3. HAC



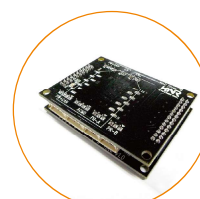
4. KLH



1. mHPU



2. KSV



3. HAC



4. KRH

All components for hydraulic robots

HYDRAULIC ACTUATOR (KRH & KLH)



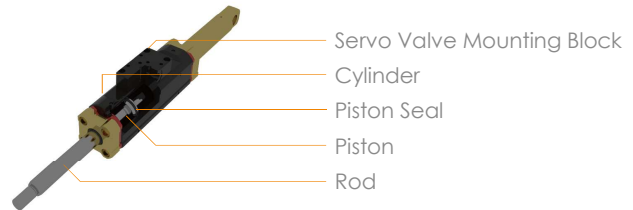
SMALL & COMPACT PRODUCT!

Suitable for hydraulic robot or field robot.



CUSTOMIZATION SERVICE!

Allows users to obtain necessary products by defining desired specifications.



KNR provides two types of key products for hydraulic actuator such as KRH series & KLH series. We have developed actuators with a High power for the size, & concentrated in customization of size & power according to the requests from customers

- **High “Force to Weight” ratio** - Heavy load carrying capacity
- **Precision control** - Able to perform high precision closed loop feedback control
- **High efficiency** by low internal leakage & High controllability by low friction



All components for hydraulic robots

Hydraulic Rotary Actuator(KRH Series)

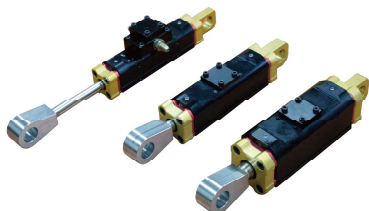
- "Force to Weight" ratio that is 10 times as high as standard motor & harmony drive combination
- Simple connection & integration



STANDARD PRODUCT	
Capacity	
100/300/500/1000[Nm] (@210bar)	
Rotation Range	
Single Vane Type : 270[deg]	
Double Vane Type : 100[deg]	

Hydraulic Linear Actuator(KLH Series)

- Can be produced to meet user's application
- (Optional) Embedded sensor (position sensor)



STANDARD PRODUCT	
Capacity	
5/10/20[kN] (@210bar)	
Stroke	
50 ~ 150mm	

Customized products



Accessory - PRESSURE SENSOR



We provide pressure sensor of strain gauge type.

Size	Ø12mm × 18mm
Pressure	Max. 3000psi

* Visit md.knrsys.com for more information

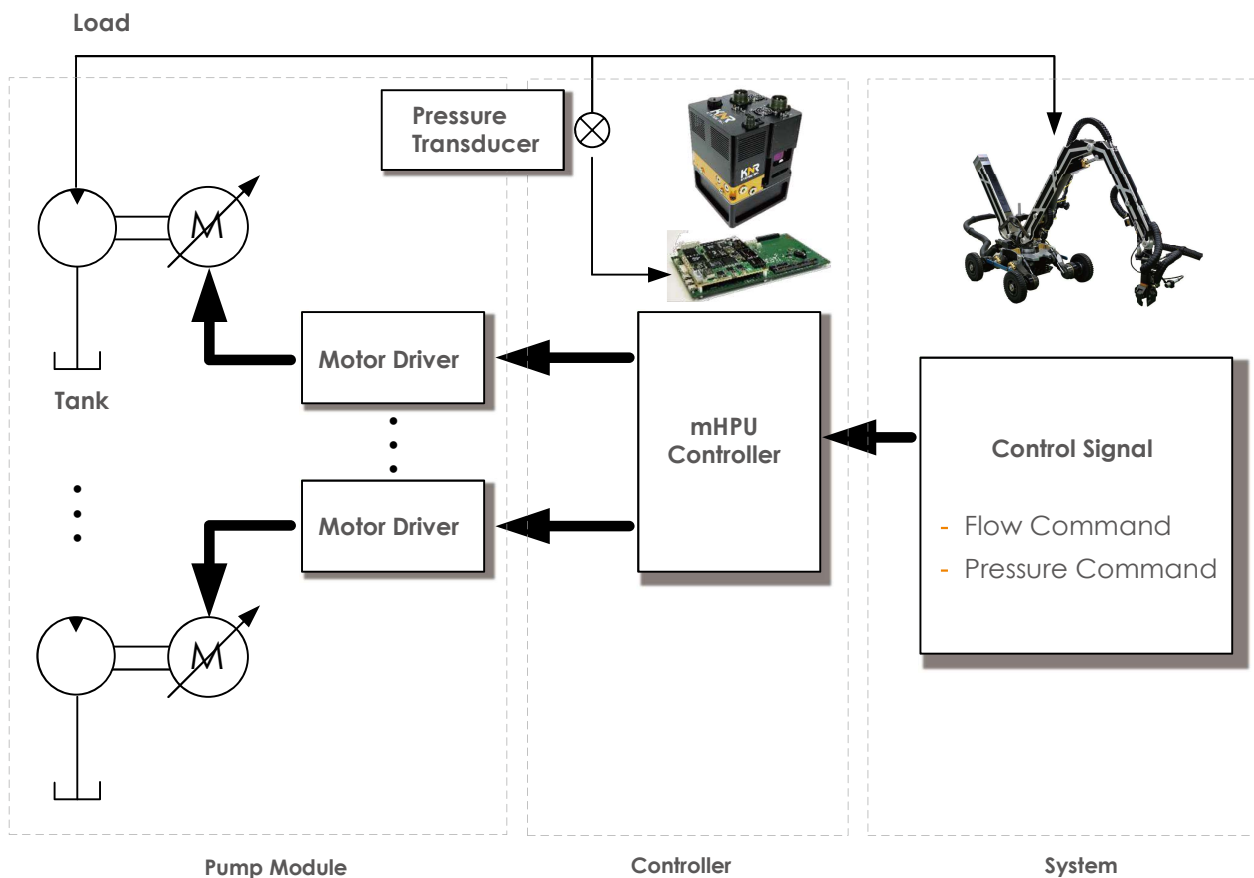
All components for hydraulic robots

HYDRAULIC POWER UNIT (mHPU & LHPU)

SMALL!
EFFICIENT!
MODULARIZED!

Configuration of power unit mountable to robot is being required more frequently. We provide portable power units that are smaller & allow modularization & IoT as needed.

- Stable pressure control system
- High-efficiency system
- Suitable for mobile robots (small size & compactness)
- High-performance CPU included for stable system control
- Real-time control of operating pressure & flow through communication interface
- Portable hydraulic power unit with state-monitoring function



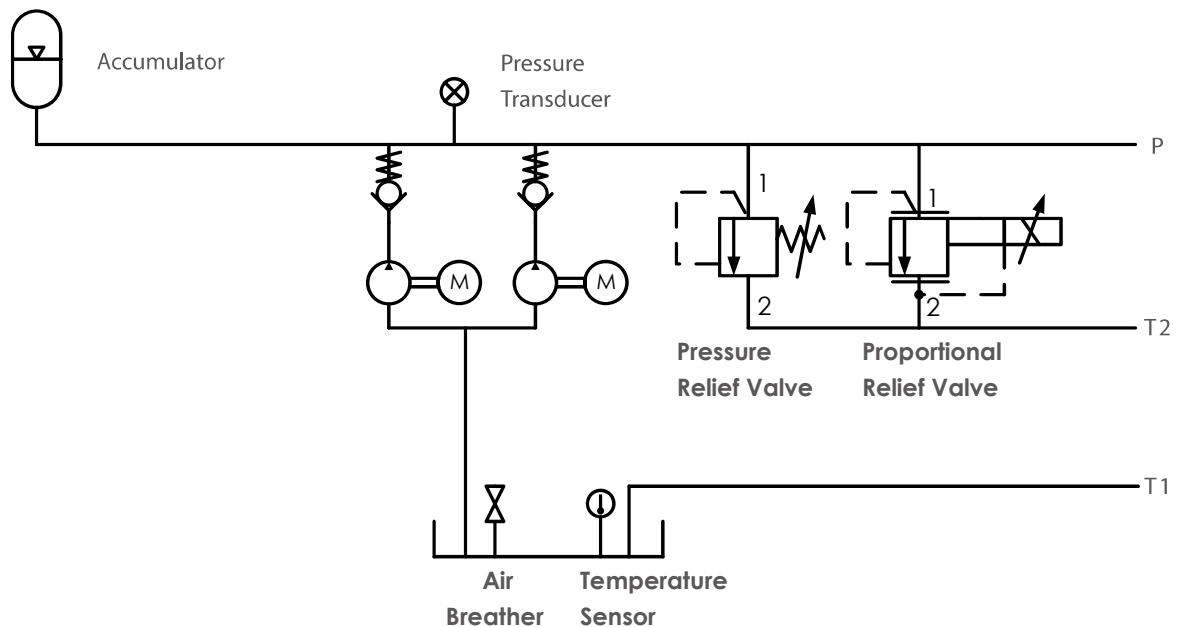
All components for hydraulic robots

Mobile Hydraulic Power Unit(mHPU)

- Expandable module system: User can configure special mHPU with different sizes & shapes depending on use conditions.
- (Optional) Bootstrap for a pressurized reservoir



- A variety of combinations are possible in addition to the displayed figures.



Laboratory Hydraulic Power Unit (LHPU)

- Stable hydraulic supply system
- High-efficiency hydraulic power unit through IoT-based smart sensor technology



* Visit md.knrsys.com for more information

All components for hydraulic robots

Hydraulic Servo Valve

COST-EFFECTIVENESS! **MINIATURE DESIGN FOR ROBOTS!**

We provide hydraulic servo valves that are inexpensive and suitable for robots.

- 2-stage nozzle flapper type
- High responsiveness
- Customization



Flow Rates
Up to 6.5Lpm
Internal Leakage
≤0.7Lpm
Bandwidth
≥ 150Hz @Magnitude -3dB

Hydraulic Actuator Controller(HAC)

HAC is a hydraulic actuator controller designed for easy control of actuator. Basically, it allows control of position, speed, & torque, also allowing compliance control.

SMART! EASY!



Supports	Wireless communication	●	●	●	●	●			
	Strain Gauge type pressure sensor					●	●	●	●
	A/O Pressure sensor	●	●	●	●				
	SSI/SPI type Encoder				●		●		
	LVDT			●					●
	Sin/Cos Encoder		●					●	
	A/O Encoder	●				●			
HAC Shield Board Type									
		B	N	L	S	P	SP	NP	LP

- Easy use of hydraulic control system
- Embedded control algorithm
- Compact controller for module-type application
- Digital and analog communication interface (CAN/AIO/Serial Communication)
- Shield board allowing selection for diversified feedback sensors

Hydraulic Manipulators

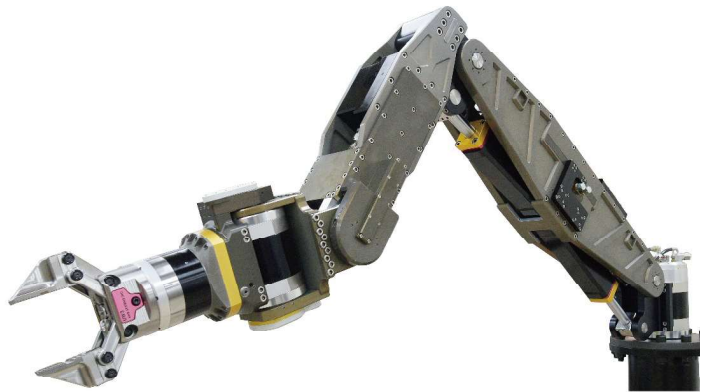
THE MOST POWERFUL MANIPULATOR!

HYDRA-UW(Hydraulic Robot Arm – Underwater)

For operations requiring waterproofing, disaster prevention robot, & underwater operations such as construction of offshore plant, etc. hydraulic robot arm is an essential operation tool. HYDRA-UW series have been developed as an hydraulic robot arm for underwater operation that allows remote control in underwater environments, & deep-sea hydraulic robot arm version enabling remote control by being actually attached to Work Class ROV is in development.

HARSH ENVIRONMENT!

- Robot arm for underwater operation that enables remote control in underwater environments
- Application of 2500msw possible
- Stiffness improved by minimization of hydraulic hose
- Robot arm usable in harsh environments



HYDRA-MP (Hydraulic Robot Arm – Manipulator)

Configuration of module is relatively simple, & more actuators & links can be added for a higher degree of freedom. We have completed development up to version 3, and are planning to sell version 4.

EASY TO MODULARIZE!

- Expandable module system using KRH series
- Higher payload compared with motor-based robot arm
- High stiffness & high precision due to mounting of rotary actuators
- Control per axis (torque & compliance)
- End effector(End Tool) Control
- Provide communication protocol for the programming robotics
- No exterior fluid lines

Version 4.0
Coming Soon
(The first version for
commercialization)



HYDRA-MP Version 3.0

* Visit md.knrsys.com for more information

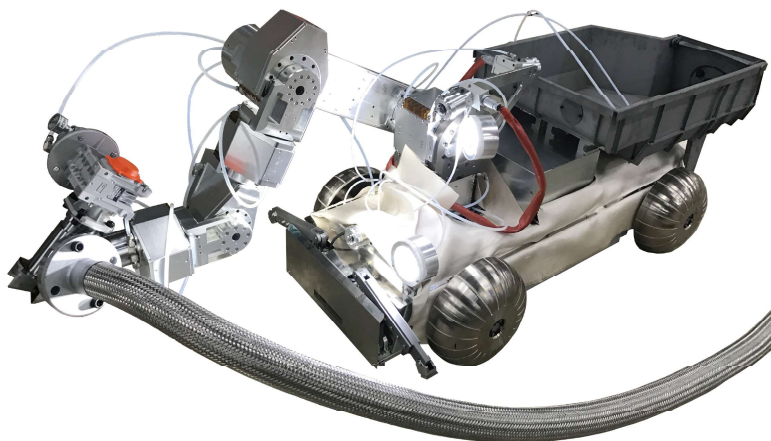
RAPID DEVELOPMENT! SAVE TIME & COST!

KNR can quickly understand customers' requirements through its diversified experience with hydraulic robots.

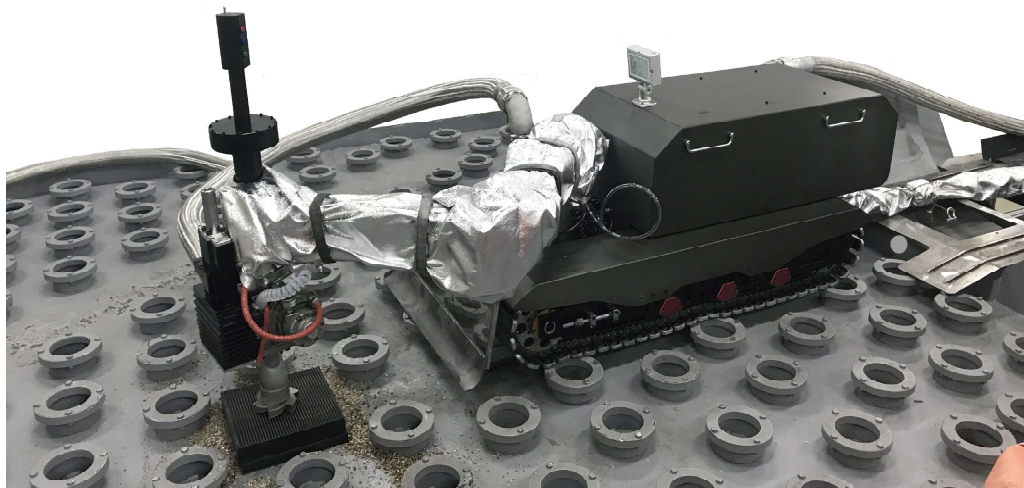
Harsh Environments

- Extreme environments such as high temperature, high dust, toxic gas, etc.
- Remotely controlled system

DCR



NCR



Nuclear Power Plant

- Environments not allowing access by human
- Easy moving & storage due to modularized structure for easy assembly/separation

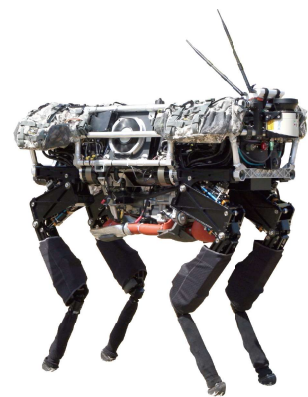
GIBBON



R&D Collaboration

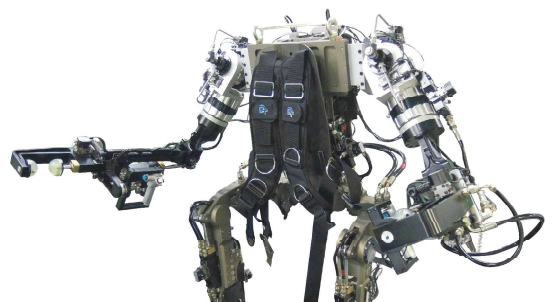
Quadruped Legged Robot

- Project supported by MKE
- (R&D Supervision Institution : KITECH)



Wearable Robot

- Project supported by MOTIE
- (R&D Supervision Institution : HYUNDAI ROTEM)



* Visit md.knrsys.com for more information



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