

OVERVIEW

FEATURES

Easy use of hydraulic control systems

Compact sized controller for modular design

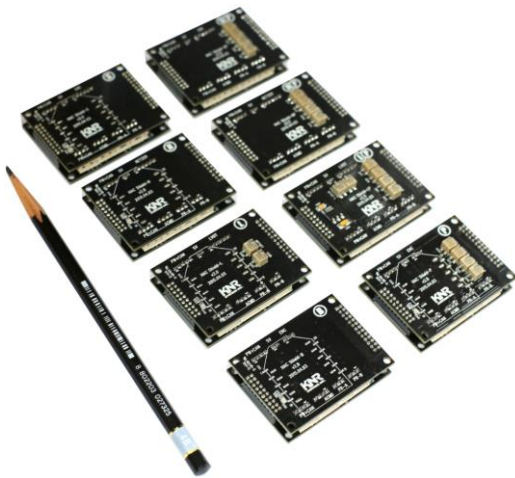
Open-source firmware for various applications

Analog communication interface

Optional shield boards available for different feedback sensors

HAC (Hydraulic Actuator Controller) allows the users to easily control a hydraulic actuator in a way similar to that of a motor. Combination of HAC and servo valve simplifies the process of controlling an actuator down to a basic level.

HAC is open-source to benefit the expanding interest in hydraulic robotics. It can be programmed using Arduino IDE, as the board was based on Arduino. The controller comes with a default software installed, in which the control loop update rate is set to 5 kHz and contains compliance control mode, making the use of the board accessible for students and users new to hydraulic robotics.



In addition, there are several different shield boards that can go on top of the HAC; the user can select the type of shield board that best fits their application. The HAC v2 shield board comes in 8 different types, all supporting serial and CAN interfaces by default. Except for SP, NP and LP shield boards, all other shields can adopt a wireless Zigbee module (option).

We provide I/O pin mapping for the development of user-built customized shield.

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HYDRAULIC ACTUATOR CONTROLLER

Selection Guide

Supports	Zigbee	■	■	■	■	■			
	Strain Gauge type Pressure sensor					■	■	■	■
	A/O Pressure Sensor	■	■	■	■				
	SSI/SPI type Encoder				■		■		
	LVDT			■					■
	Sin/Cos Encoder		■					■	
	A/O Encoder	■				■			
		B	N	L	S	P	SP	NP	LP
HAC Shield Board Type									

The standard HAC supports 1 channel of hydraulic servo valve, 1 external command signal (analog input), 1 feedback sensor monitoring signal (analog output), 1 position sensor input and 2 pressure sensor input as input & output signal channels. And HAC offers a CAN communication, a serial communication and an optional wireless communication. Variety in I/O channels makes this open source controller compatible with analog voltage displacement sensors, pressure sensors, encoder, etc., leading to easy implementation of speed, displacement, and torque control of an actuator.

HYDRAULIC ACTUATOR CONTROLLER

Technical Data

BASE BOARD	
Processor	ARM Cortex M4 32bit Clock : 72MHz
Input / Output Signal	Servo Valve Output 1Ch - 33mA (Series resistor of coils is 150Ω) <ul style="list-style-type: none"> ▪ External Command Signal (Analog Input) 1Ch (0~5V) ▪ Feedback Sensor Monitoring Signal (Analog output) 1Ch (0 ~5V) ▪ Position Sensor Input 1Ch ▪ Pressure Sensor Input 2Ch (Please refer to specifications table of shield boards shown below)
Communication	<ul style="list-style-type: none"> ▪ CAN 1Ch, 500kpbs ▪ Serial Communication (for using HAC parameters setup) ▪ (Option) Wireless Communication (ZigBee) (HAC-B, N, L, S, P)
Control Loop Update Rate	7 EA 0 – 5 Vdc 16bits
Input Power	Input Voltage : 7.5Vdc (HAC-B, P, N, S, SP, NP) ±15Vdc (HAC-L, HAC-LP) Current Consumption : < 100mA
Size (W x D x H)	55 x 40 x 8 mm

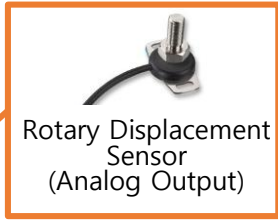
	SHIELD BOARD							
	B	N	L	S	P	SP	NP	LP
Communication	CAN, ZigBee, USB-to-Serial					CAN, USB-to-Serial		
Command I/O	Analog voltage(0~5Vdc) and all communication channels							
Control Servo Valve	o	o	o	o	o	o	o	o
Displacement sensor Input Type	Analog voltage*	Sine & cosine wave**	LVDT (5-, 6- wire)	Digital voltage (SSI, RS422)	Analog voltage*	Digital voltage (SSI, RS422)	Sine & cosine wave**	LVDT (5-, 6- wire)
Pressure sensor Input Type	Analog voltage*	Analog voltage*	Analog voltage*	Analog voltage*	Strain gauge	Strain gauge	Strain gauge	Strain gauge

* Analog voltage type is of 0~5V range of sensors.

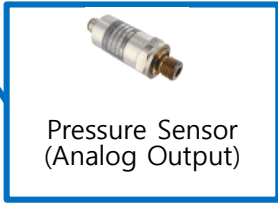
** Sine & cosine wave input type is used to adopt the Netzer sensor.

HYDRAULIC ACTUATOR CONTROLLER

HAC Shield-B



Rotary Displacement Sensor (Analog Output)



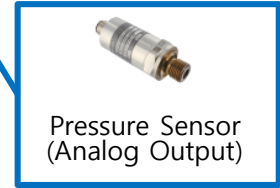
Pressure Sensor (Analog Output)

The HAC Shield-B is the Basic board, which supports the analog voltage output type position or pressure sensors.

HAC Shield-N



Rotary Displacement Sensor (Analog sin/cos-type)



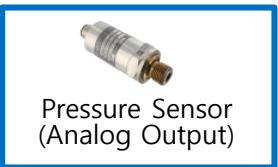
Pressure Sensor (Analog Output)

The HAC Shield-N can support an analog sin/cos-type output encoder, as well as an analog voltage output pressure sensor.

HAC Shield-L



Linear Displacement Sensor (LVDT)



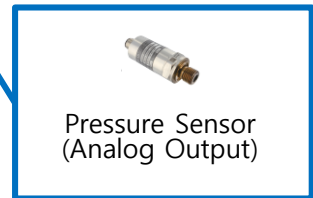
Pressure Sensor (Analog Output)

The HAC Shield-L can support an AC output LVDT or RVDT (5-6 wire) displacement sensor, as well as an analog voltage output pressure sensor.

HAC Shield-S



Rotary Displacement Sensor (Digital Output)



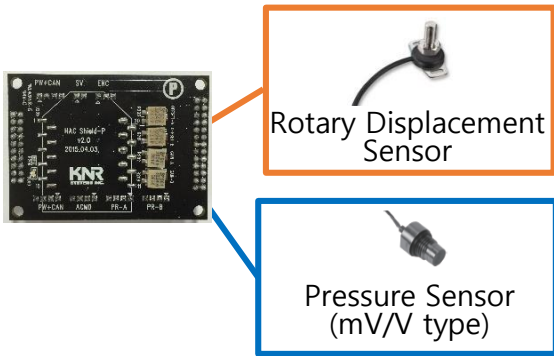
Pressure Sensor (Analog Output)

The HAC Shield-S supports a digital output type (SSI, RS422) encoder, as well as an analog voltage output pressure sensor.

* Every image of sensors is from internet

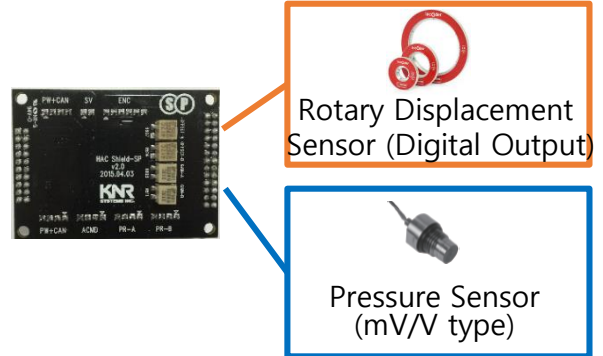
HYDRAULIC ACTUATOR CONTROLLER

HAC Shield-P



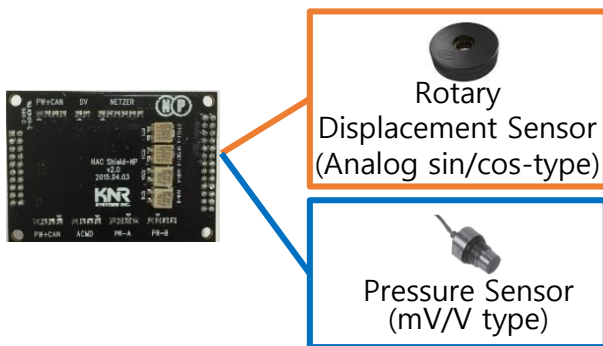
The HAC Shield-P is made to support analog voltage output position sensor, as well as the mV/V-type strain gauge based pressure sensor or load cell.

HAC Shield-SP



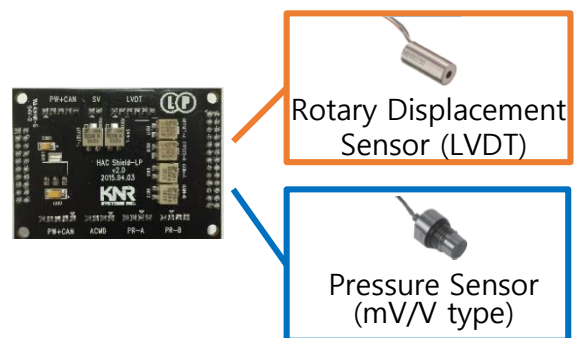
The HAC Shield-SP is a combination of S and P boards. It support a digital output type (SSI, RS422) encoder, as well as the mV/V-type strain gauge based pressure sensor or load cell.

HAC Shield-NP



The HAC Shield-NP is a combination of N and P boards. It support an analog sin/cos-type output encoder, as well as the mV/V-type strain gauge based pressure sensor or load cell.

HAC Shield-LP

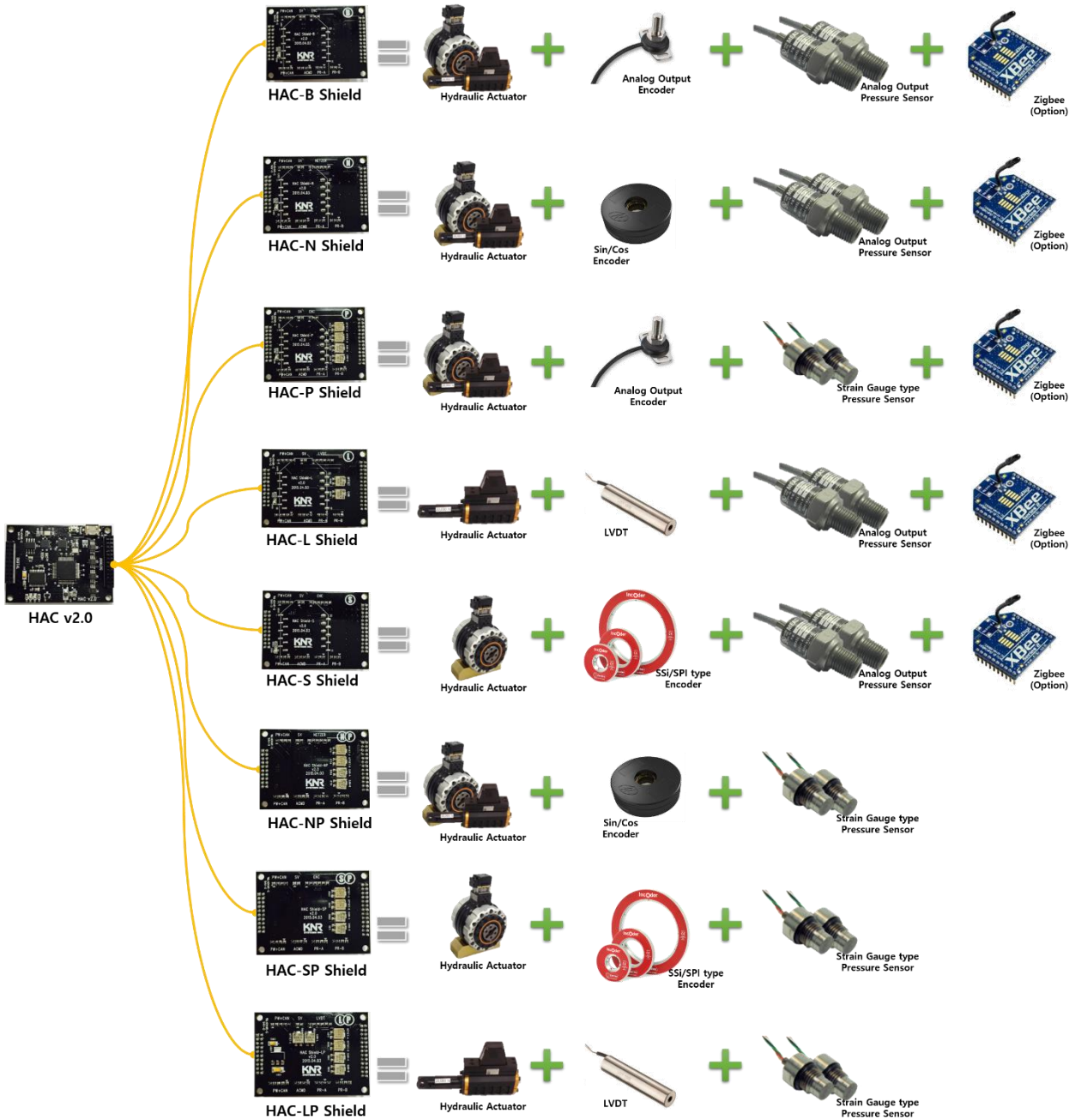


The HAC Shield-LP is a combination of L and P boards. It support an AC output LVDT or RVDT (5-6 wire) sensor, as well as the mV/V-type strain gauge based pressure sensor or load cell.

* Every image of sensors is from internet

HYDRAULIC ACTUATOR CONTROLLER

APPLICATION



* Every image of sensors and Zigbee module is from internet

HYDRAULIC SERVO VALVE

APPLICATIONS

▪ Manipulator



HYDRA-UW
(KNR's Underwater Manipulator)



HYDRA-MP3
(KNR's Multi-Purpose Manipulator)

▪ Field Robot



GIBBON
(KNR's Hydraulic Mobile Robot in a nuclear power plant)



DCR

(KNR's Hydraulic Mobile Robot in high dust & high temperature environment)



NCR

