Ultrasonic Sensor Module for a Robot

(HG-M40 Series, HG-L40 Series)

Leading Company of Advanced Sensors

HAGISONIC Co., Ltd.

Sensors & Application Systems for Robots, AGVs, Automobiles, Automations and Energy-Saving Apparatus

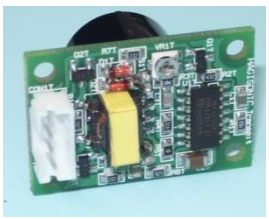
Hagisonic Co., Ltd. ..... www.hagisonic.com / hagisonic@hagisonic.com
Tel : +82-42-936-7740 / Fax : +82-42-936-7742

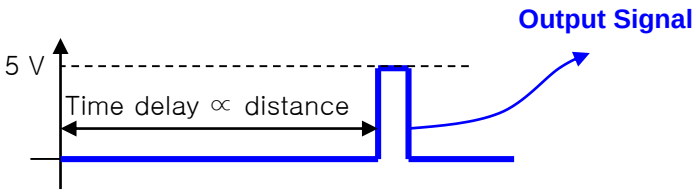
Ultrasonic Sensor Module for a Robot

■ Model : HG-M40 Series, HG-L40 Series

▣ Features

- Object Detector and Range Finder
- Medium Range
- Various Directivities
- Low 'Click Noise'
- Indoor Environment
- Minimum Dead Zone
- Real-Time Signal(5V TTL)
- Operates at 40kHz
- 3 types of Modules
  - Transceiver(D)
  - Transmitter(T)
  - Receiver(R)





▣ Specifications

Frequency (KHz)	40±2
Input Pulse	TTL or Pulse (2 V ~ 10 V)
Repetition Rate of Input Pulse	10 Hz ~ 30 Hz
Input DC Power (Vdc)	10 V ~ 16 V
Driving Voltage for Sensor	60~70 Vpp at 12V Vdc
Output Signal	5 V TTL
Available for a transmitter only, a receiver only or a dual type (both a transmitter and a receiver)	

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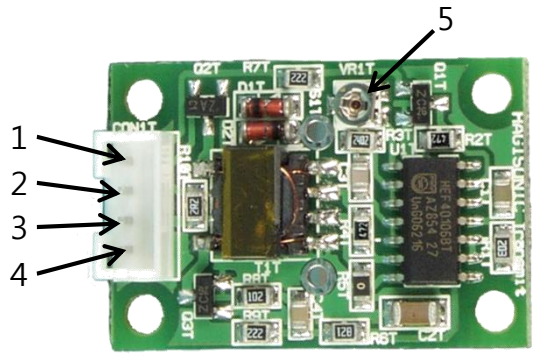
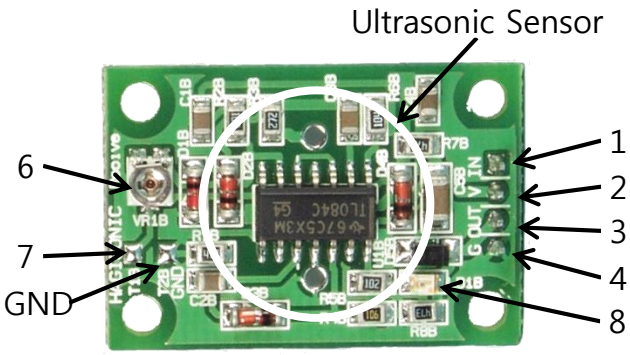
■ Model : HG-M40 Series, HG-L40 Series

▣ Terminals & Parts Description (HG-M40 Series Trigger Input)



< Transmitter(T) >



< Receiver(R) >

① **Pulse input terminal :** The input voltage level of a pulse should be ranging from +2V to 10 V.

- The ultrasonic transmission part is driven at its rising edge whenever an input pulse is applied.
- The recommended period of input pulses ranges from 10 Hz to 50 Hz. (Available from 0 to Max. 200 Hz)
- Available for several pulse shapes such as TTL signals, impulses, square waves, sinusoidal waves or triangular waves.

② **DC input power terminal :** The recommended voltage ranges from +DC 10 V to 16 V.

③ **Signal output terminal :** The square pulse is obtained in a receiver part and its level is 5 V.

- The time delay of the received signals is proportional to the distance between a sensor and an obstacle.
- The pulse width tends to be proportional to the size of an obstacle.
- The other output levels can be given by an order production. E.g.) 3.5V, 10V, etc.

④ **GND terminal :** Electrical ground level for signals and a power.

⑤ **Frequency fine adjustment part :** The frequency of driving signals can be finely adjusted in the range from 38 kHz to 42 kHz. (Recommendation: please do not fix it because it has been optimized when the module was delivered out of a factory.)

⑥ **Receiver gain control part :** Sensitivity (Gain) is controlled by fixing a trimmer. The gain of analog amplifier ranges from 33 dB ~ 59 dB.

**** Please note that on over-amplification of the receiver gain, interference noise signals might be shown by ultrasonic waves passing over directly from a transmitter to a receiver.***

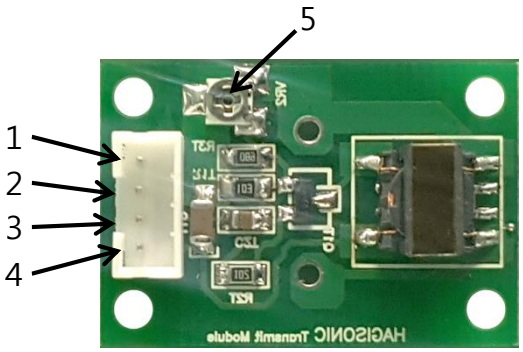
⑦ **Analog signal test point :** At the point, analogue signals (full waveforms) can be observed.

⑧ **Working Indicator :** A red LED lights when a transmitter is driven or a receiver perceives a signal.

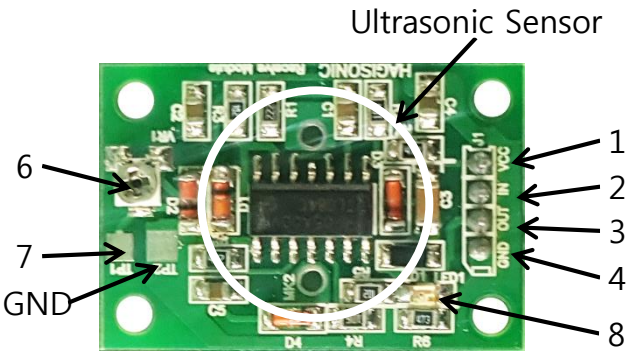
Ultrasonic Sensor Module for a Robot

■ Model : HG-M40 Series, HG-L40 Series

▣ Terminals & Parts Description (HG-L40 Series Burst Input)



< Transmitter(T) >



< Receiver(R) >

① **DC input power terminal :** The recommended voltage ranges from +DC 10 V to 16 V.

② **Pulse input terminal :** + 2 to 10 V. The signal should be amplified and ultrasonic on each application in real time. On the other hand, the Burst signal is also made available in 40 kHz, but its duration is approximately 0.5~1ms (Recommended interval : 10 to 30 time/sec, C.W. operation)

③ **Signal output terminal :** The square pulse is obtained in a receiver part and its level is 5 V.

- The time delay of the received signals is proportional to the distance between a sensor and an obstacle.
- The pulse width tends to be proportional to the size of an obstacle.
- The other output levels can be given by an order production. E.g.) 3.5V, 10V, etc.

④ **GND terminal :** Electrical ground level for signals and a power.

⑤ **Transmission output fine adjustment :** Adjust the amplification to fine tune the transmitting power.

**** The purpose of equalization by compensating for deviation from sensor efficiency, but the range of adjustment is not large.***

⑥ **Receiver gain control part :** Sensitivity (Gain) is controlled by fixing a trimmer. The gain of analog amplifier ranges from 33 dB ~ 59 dB.

**** Recommended for use, adjusted according to the detected object and range (increased sensitivity in CW direction)***

⑦ **Analog signal test point :** At the point, analogue signals (full waveforms) can be observed.

⑧ **Working Indicator :** A red LED lights when a transmitter is driven or a receiver perceives a signal.

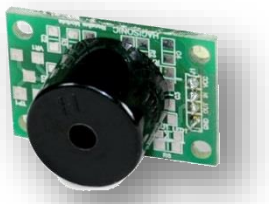
Ultrasonic Sensor Module for a Robot

■ Model : HG-M40 Series, HG-L40 Series

▣ Product Line-Up

Conventional (C)

Anisotropic (A)



Broad (B)

Narrow Type1 (N1)

Narrow Type2 (N2)

Type	Mode	Module	Model Name	Directivity (°)	Distance (m)
Conventional (C)	Trigger Input	Transceiver Transmitter Receiver	HG-M40DC HG-M40TC HG-M40RC	65	0.4 ~ 4.5m 0 ~ 6m 0 ~ 6m
	Burst Input	Transceiver Transmitter Receiver	HG-L40DC HG-L40TC HG-L40RC		0.4 ~ 6m 0 ~ 6m 0 ~ 6m
Anisotropic (A)	Trigger Input	Transmitter Receiver	HG-M40TA HG-M40RA	H : 160 V : 65	0 ~ 3.5m
	Burst Input	Transmitter Receiver	HG-L40TA HG-L40RA		
Broad (B)	Trigger Input	Transmitter Receiver	HG-M40TB HG-M40RB	150	0 ~ 2m
	Burst Input	Transmitter Receiver	HG-L40TB HG-L40RB		
Narrow Type1 (N1)	Trigger Input	Transceiver	HG-M40DN1	12	0.4 ~ 9m
	Burst Input	Transceiver	HG-L40DN1		
Narrow Type2 (N2)	Trigger Input	Transceiver	HG-M40DN2	25	0.4 ~ 7m
	Burst Input	Transceiver	HG-M40DN2		

Ultrasonic Sensor Module for a Robot

■ Model : HG-M40 Series, HG-L40 Series

▣ Module and Mode Description

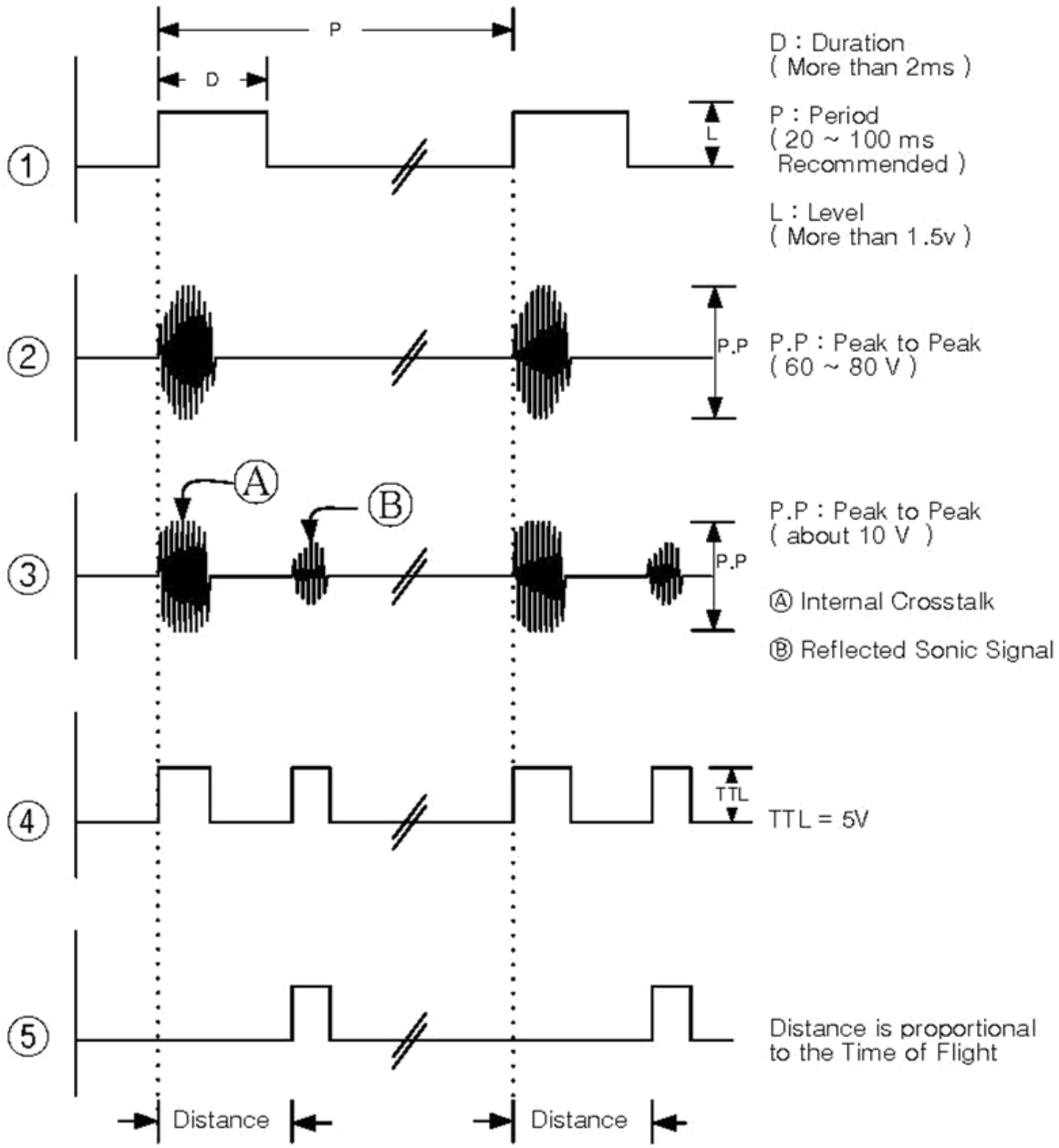
- **Option 1) Type of Mode**
  - **Trigger Input Mode (M-type) :**
    - → Built-in ultrasound frequency 40 kHz oscillator and is always STAND BY.
    - → The sound waves are fired once per trigger pulse, with external input.
    - → Pulse is free to use, but the size of the sound waves and duration (approx. 1ms) are fixed.
  - **Burst Input Mode (L-type) :**
    - → A relatively simple structure, with no oscillator and only an amplification and output circuit.
    - → Operation by external input is required to apply the BURST signal itself at 40 kHz (signal must be generated using a separate oscillator or software).
- **Option 2) Type of Modules**
  - **Transceiver(D) :**
    - → Not only it works as Transceiver module but also it can be used as transmitter or receiver with different wire connection. Transceiver can detect from 30cm~40cm and farther since it has to transmit the ultrasonic waves and wait until it returns. However, it is possible to perceive whether objects are there or not.
  - **Transmitter(T) :** Only transmits the ultrasonic waves.
  - **Receiver(R) :** Only receives the ultrasonic waves.
- **Difference between M-type and L-type.**

Trigger Input Mode	Burst Input Mode
– Built in 40kHz oscillator – Always 'Standby' – Wave occurs one by one with external trigger pulse. – Pulse frequency is adjustable but trigger burst and duration time(approx. 1mS) are fixed. – Strong ultrasonic wave with low click noise.	– Simple structure with only amplifier and output circuitry (No oscillator). – External 40 kHz burst signal must be given to operate. (external oscillator or software is needed to make signal) – Changeable pulse frequency, duration time and radio frequency at user's convenience. – Multi channel available with CPU circuit or S/W.

Ultrasonic Sensor Module for a Robot

■ Model : HG-M40 Series, HG-L40 Series

▣ Timing Chart

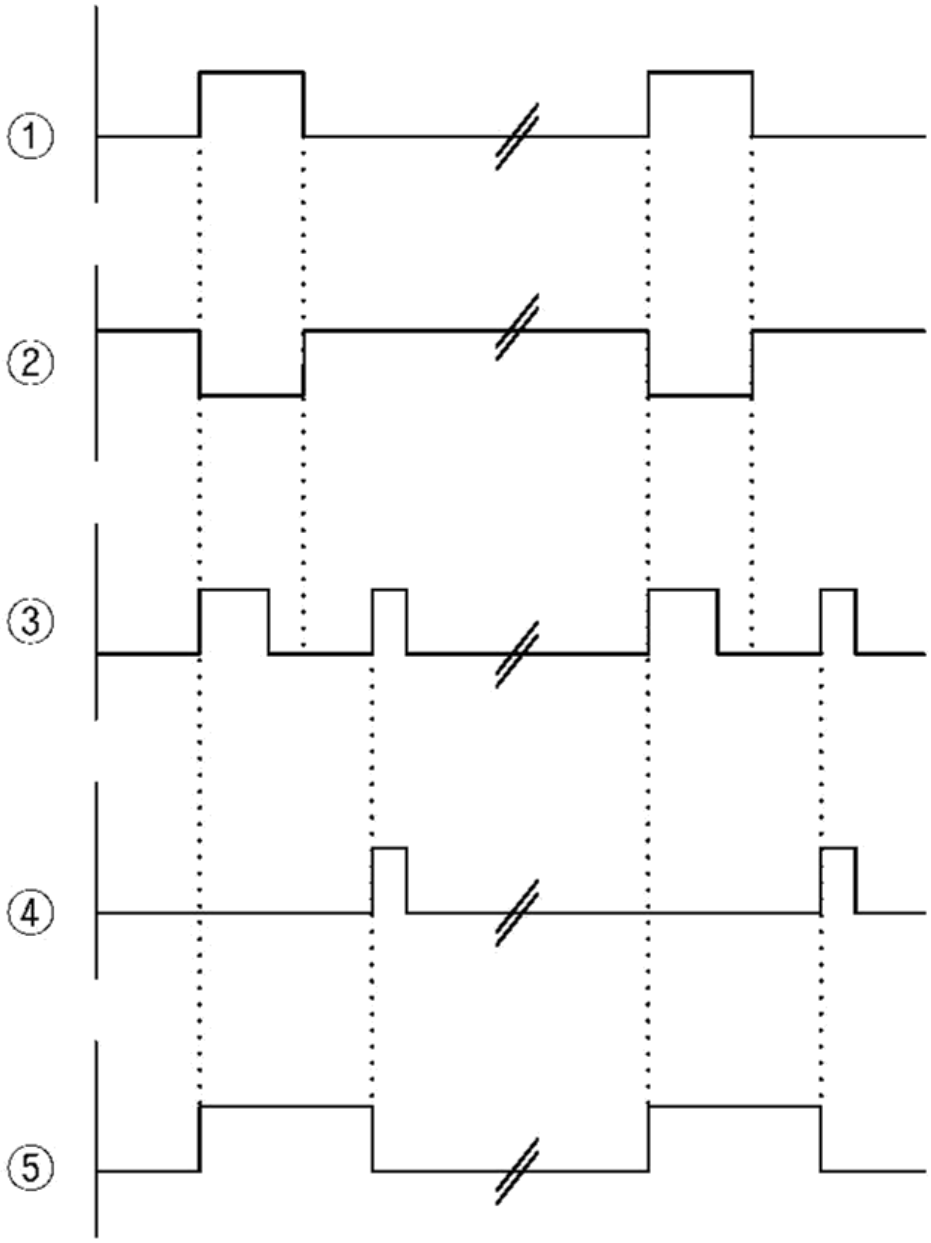


① Trigger Pulse input waveform
② Transmit power output to sensor unit
③ Amplified signal in receiver circuit (at TP1)
④ Final output waveform in receiver circuit
⑤ Object detected signal excluding the internal crosstalk

Ultrasonic Sensor Module for a Robot

■ Model : HG-M40 Series, HG-L40 Series

▣ Timing Chart of Range Finder



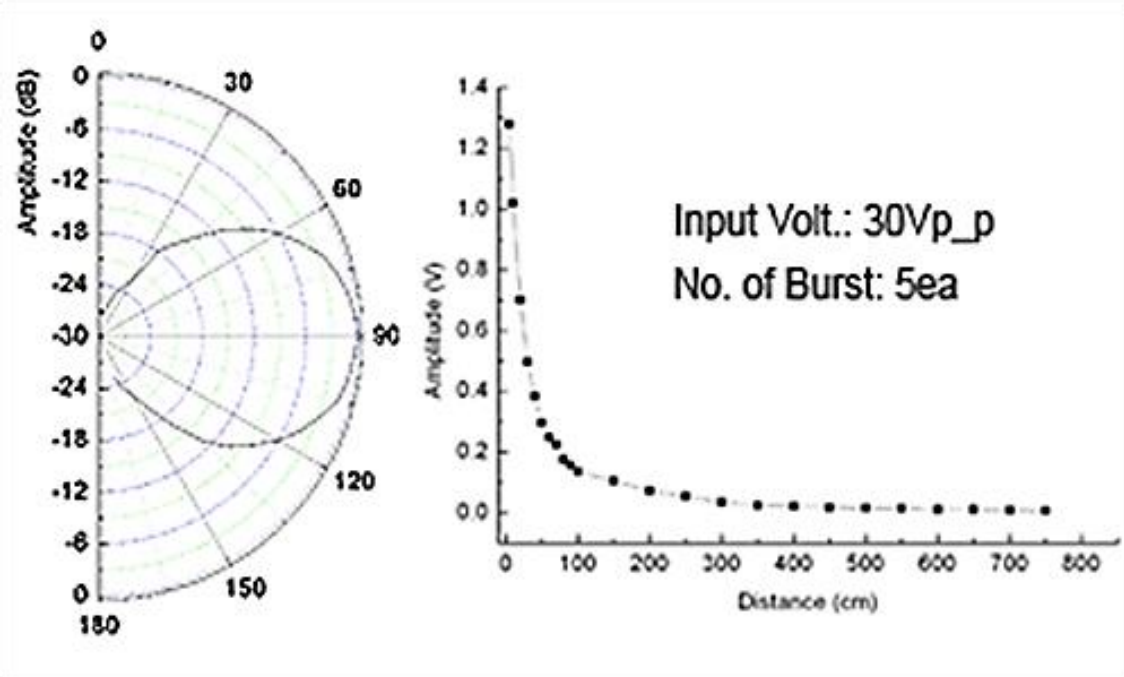
① Trigger Pulse (The pulse width must be adjustable)
(1.5ms ~ 2.5ms)
② Inverted Waveform of ①
③ Receiver Output Signal
④ Actual Receive Signal (After excluding the internal crosstalk)
⑤ Distance Pulse Output
(The pulse width is proportional to the distance)

Ultrasonic Sensor Module for a Robot

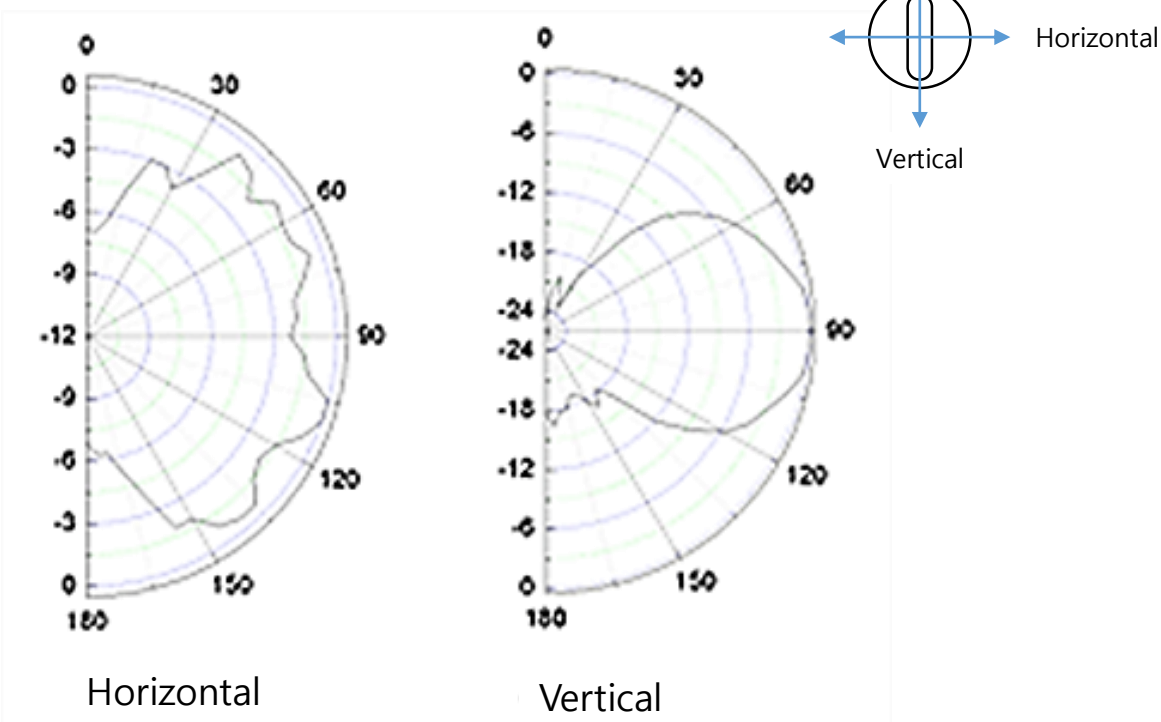
■ Model : HG-M40 Series, HG-L40 Series

▣ Each product-oriented graph

• Conventional(C)



• Anisotropic(A)

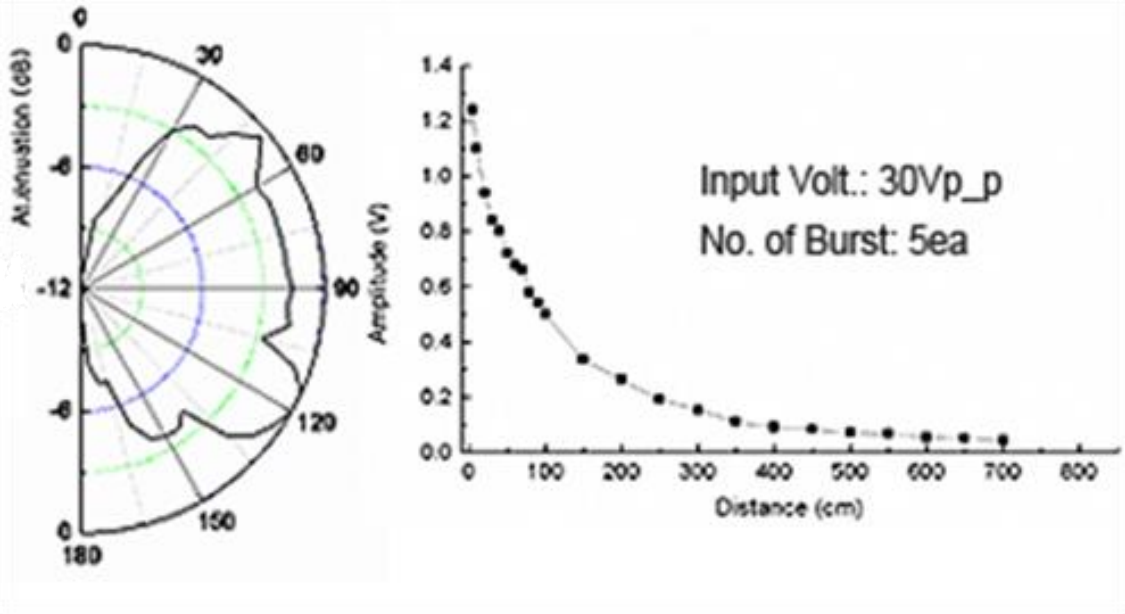


Ultrasonic Sensor Module for a Robot

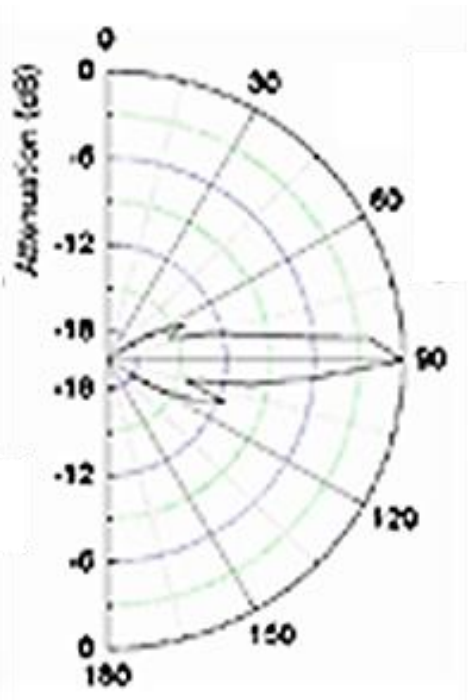
■ Model : HG-M40 Series, HG-L40 Series

▣ Each product-oriented graph

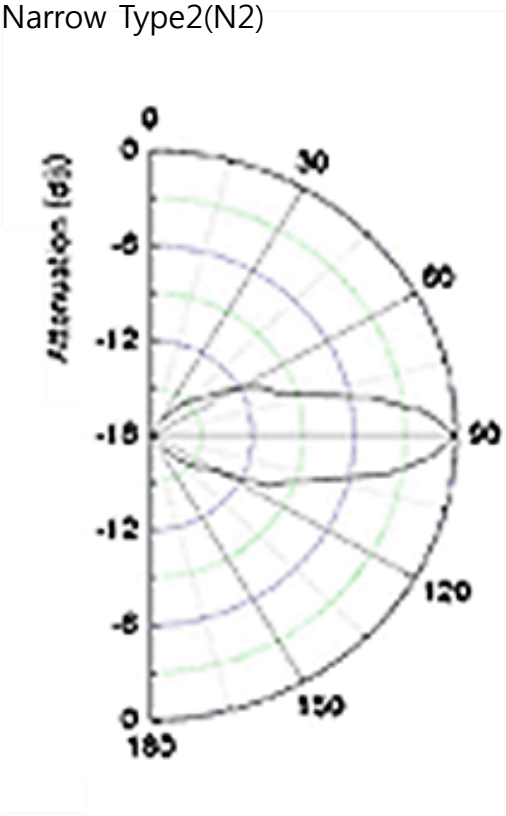
• Broad(B)



• Narrow Type1(N1)



• Narrow Type2(N2)



Ultrasonic Sensor Module for a Robot

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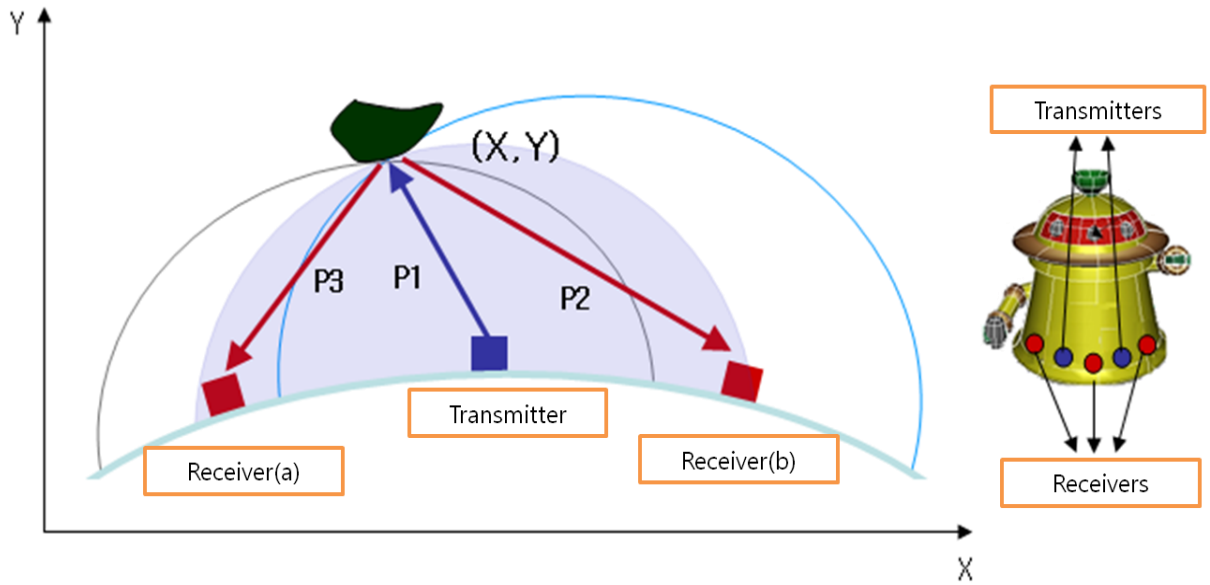
▣ Ultrasonic Distance Measuring Principle



- **Principle**
  - Ultrasonic wave, which was sent from 'Transmitter', is reflected by an obstacle.
  - Two receivers gets the reflected wave each and measures distance and time of flight proportion to each paths (P1+P2, P1+P3)
  - The obstacle's coordinate can be determined by calculating intersection points of two ovals which is correspond to length of two paths.

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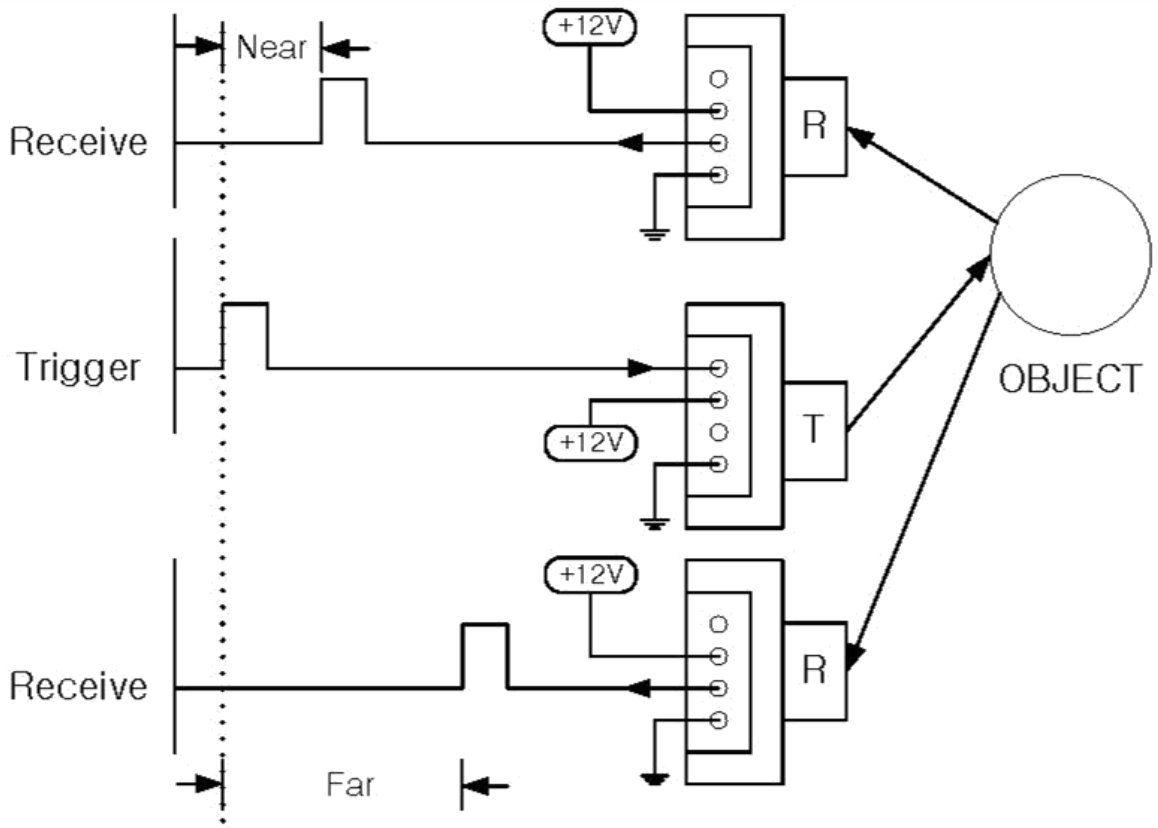
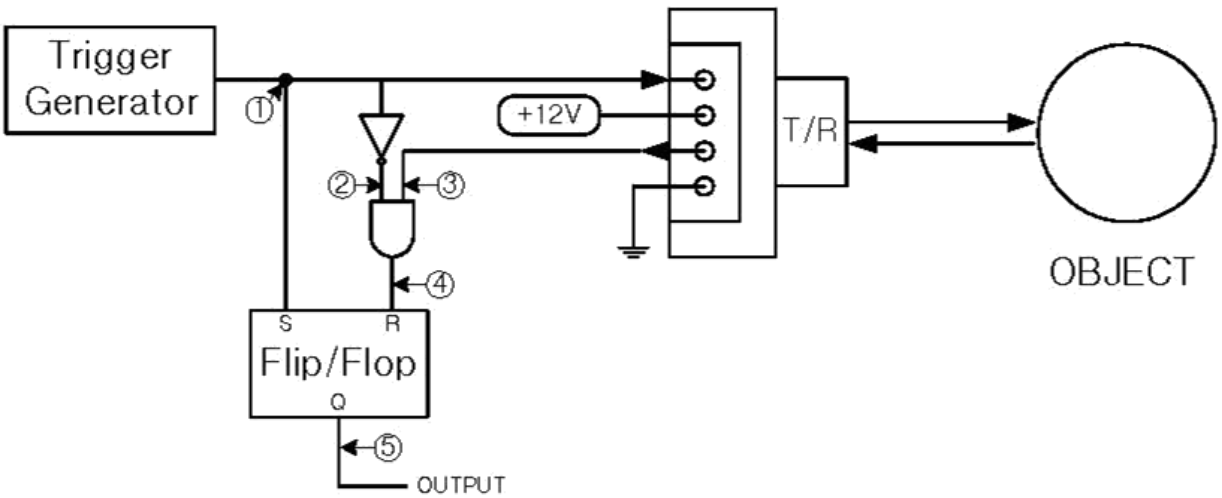
▣ Application



Direction and distance finder for mobile robot



Range finder with only one module