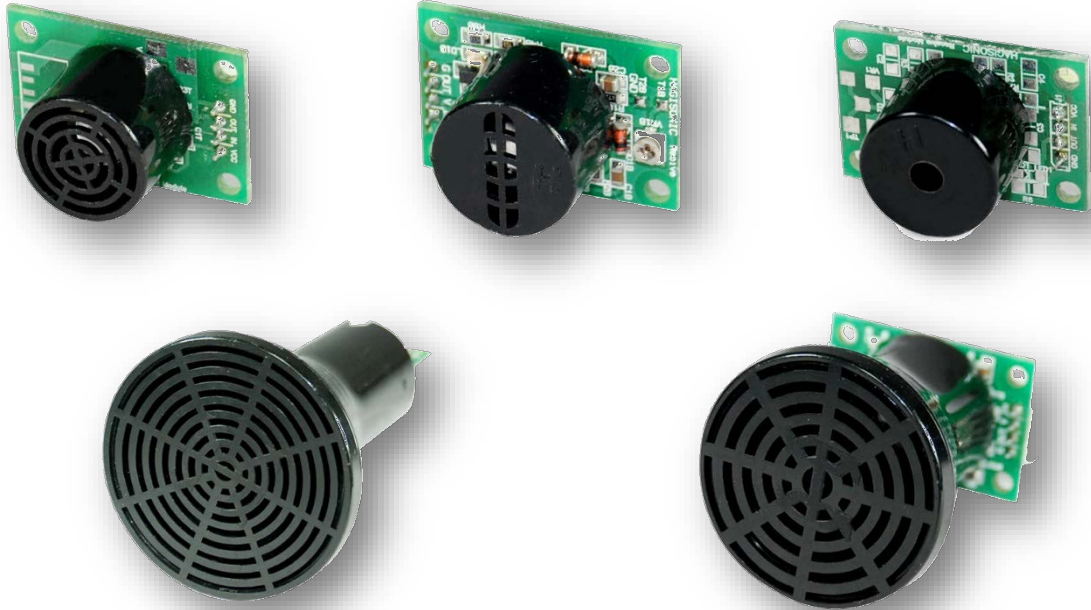


# Ultrasonic Sensor Module for a Robot

*(HG-M40 Series, HG-L40 Series)*

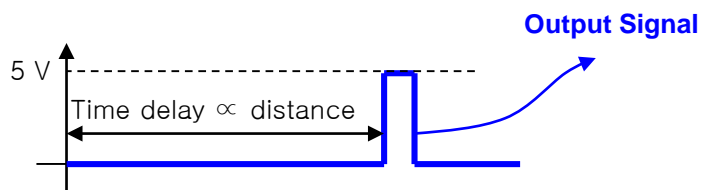
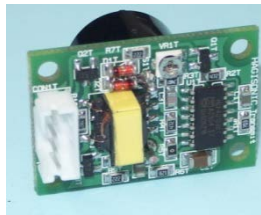


# Ultrasonic Sensor Module for a Robot

## ■ 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(HG-M40D)
  - Transmitter(HG-M40T)
  - Receiver(HG-M40R)



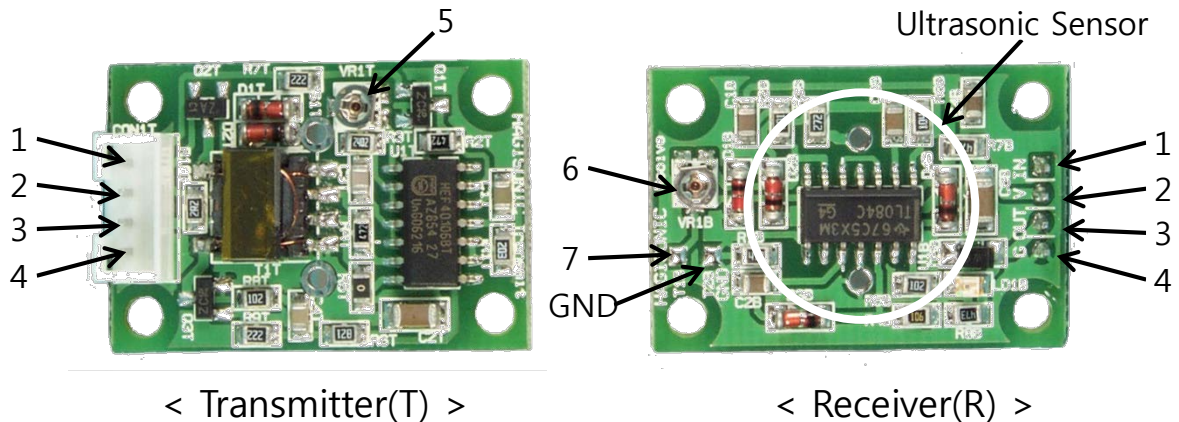
### ■ Specifications

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)	

# Ultrasonic Sensor Module for a Robot

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

### ▣ Terminals & Parts Description



< Transmitter(T) >

< Receiver(R) >

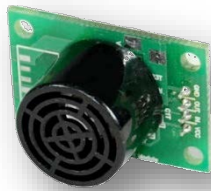
- ① **Pulse input terminal** : The input voltage level of a pulse should be ranging from +2V to 10 V.
  - The ultrasonic transmission part is driven at its rising edge whenever an input pulse is applied.
  - The recommended period of input pulses ranges from 10 Hz to 50 Hz. (Available from 0 to Max. 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

### ▣ 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	Duplex Transmitter Receiver	HG-M40DC HG-M40TC HG-M40RC	65	0.4 ~ 4.5m 0 ~ 6m 0 ~ 6m
	Burst Input	Duplex 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	Duplex	HG-M40DN1	12	0.4 ~ 9m
	Burst Input	Duplex	HG-L40DN1		
Narrow Type2 (N2)	Trigger Input	Duplex	HG-M40DN2	25	0.4 ~ 7m
	Burst Input	Duplex	HG-M40DN2		

# Ultrasonic Sensor Module for a Robot

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

### ▣ Module and Mode Description

#### 1. Module

##### ① 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.

##### ② Transmitter(T) : Only transmits the ultrasonic waves.

##### ③ Receiver(R) : Only receives the ultrasonic waves.

※ 1~2cm of close detection is available when 2 or more sets of transmitters and receivers are used.

※ In the same way, even in the case of Transceiver, when it is used as either Transmitter or Receiver independently, it can measure an obstacle as nearest as 1~2Cm.

#### 2. Mode

##### ① Trigger Input Mode (M-type)

##### ② Burst Input Mode (L-type)

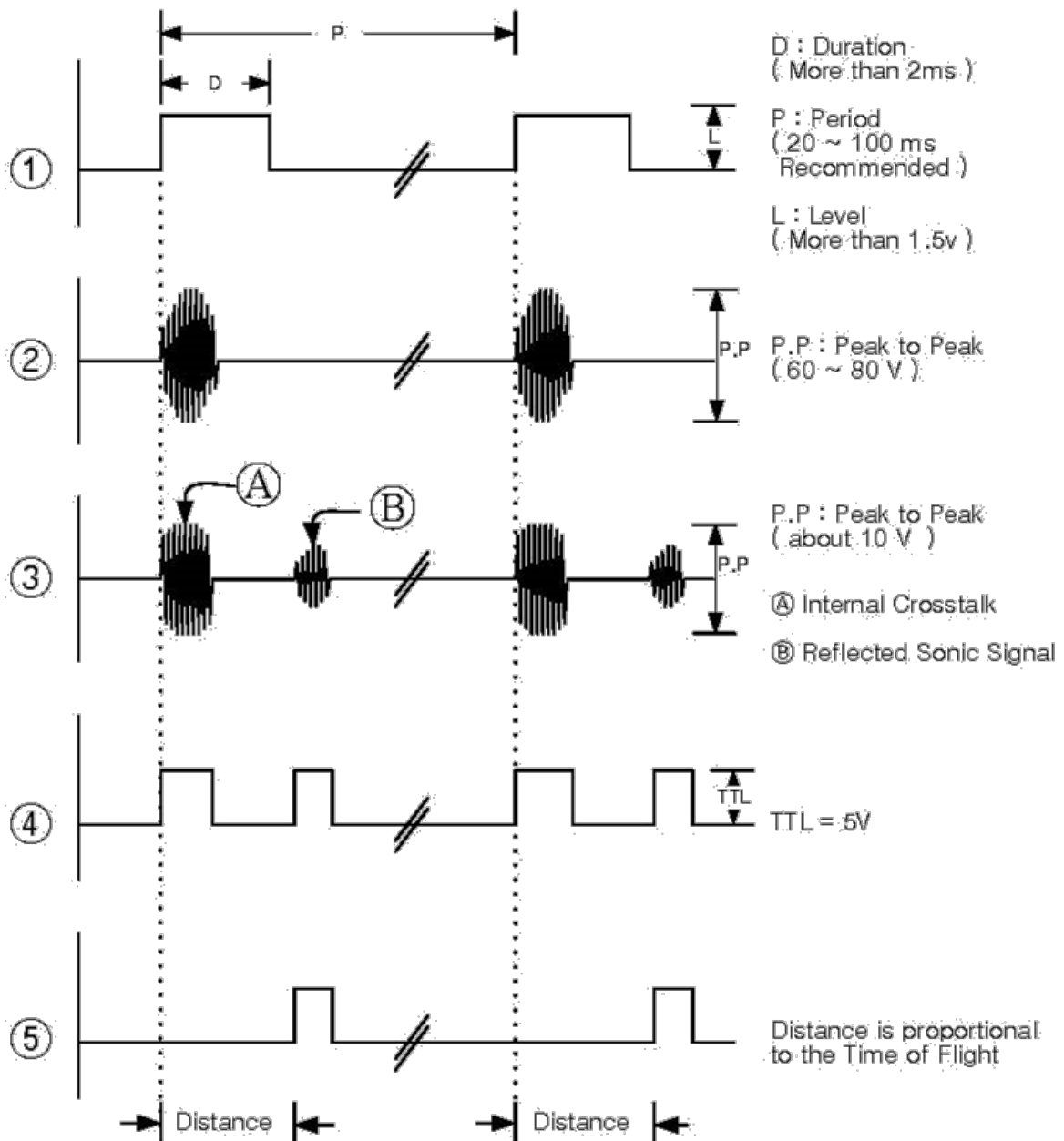
#### 3. Difference between M-type and L-type.

Trigger Input Mode	Burst Input Mode
<ul style="list-style-type: none"> <li>- Built in 40kHz oscillator</li> <li>- Always 'Standby'</li> <li>- Wave occurs one by one with external trigger pulse.</li> <li>- Pulse frequency is adjustable but trigger burst and duration time(approx. 1mS) are fixed.</li> <li>- Strong ultrasonic wave with low click noise.</li> </ul>	<ul style="list-style-type: none"> <li>- Simple structure with only amplifier and output circuitry (No oscillator).</li> <li>- External 40 kHz burst signal must be given to operate. (external oscillator or software is needed to make signal)</li> <li>- Changeable pulse frequency, duration time and radio frequency at user's convenience.</li> <li>- Multi channel available with CPU circuit or S/W.</li> </ul>

# Ultrasonic Sensor Module for a Robot

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

### ■ Timing Chart

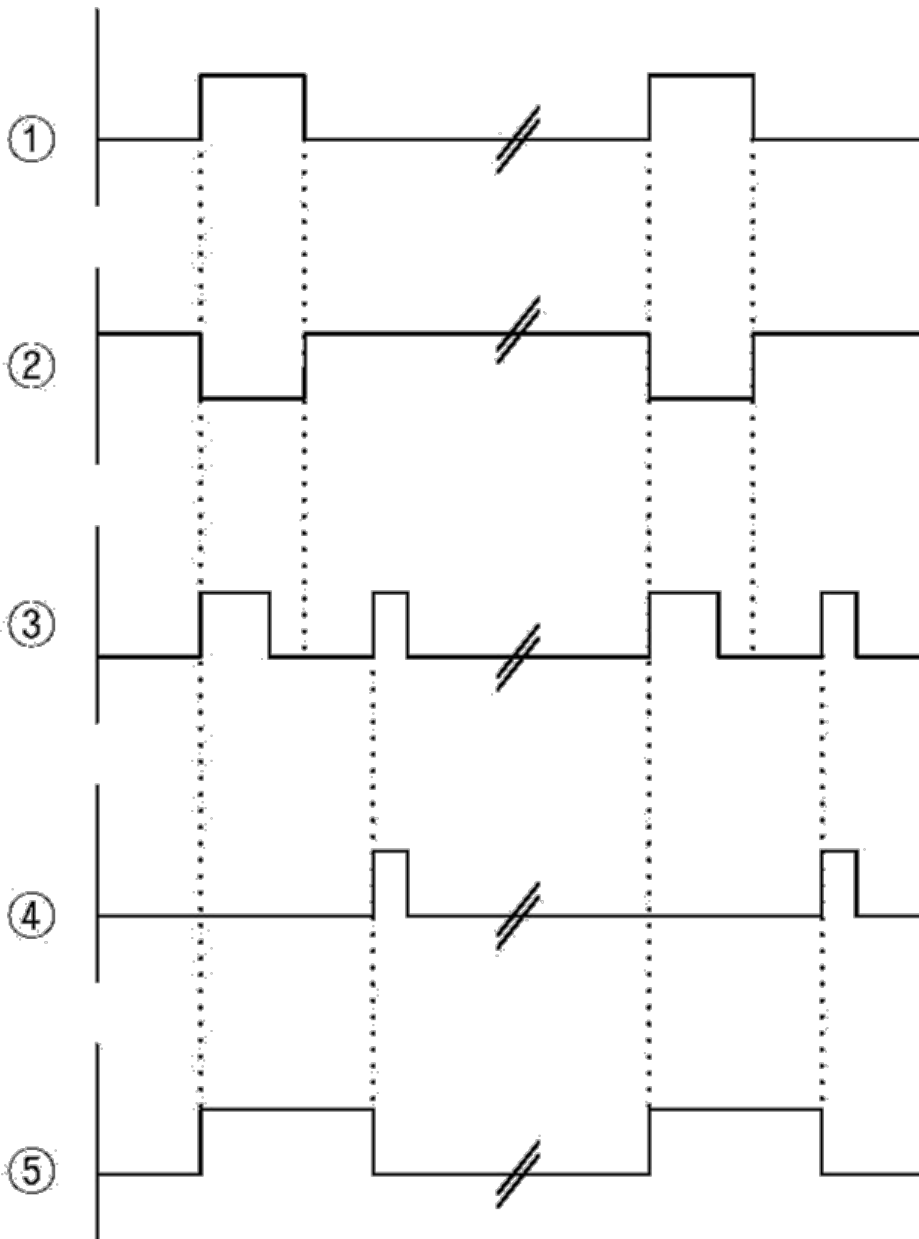


- ① Trigger Pulse input waveform
- ② Transmit power output to sensor unit
- ③ Amplified signal in receiver circuit ( at TP1 )
- ④ Final output waveform in receiver circuit
- ⑤ Object detected signal excluding the internal crosstalk

# Ultrasonic Sensor Module for a Robot

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

## ■ Timing Chart of Range Finder



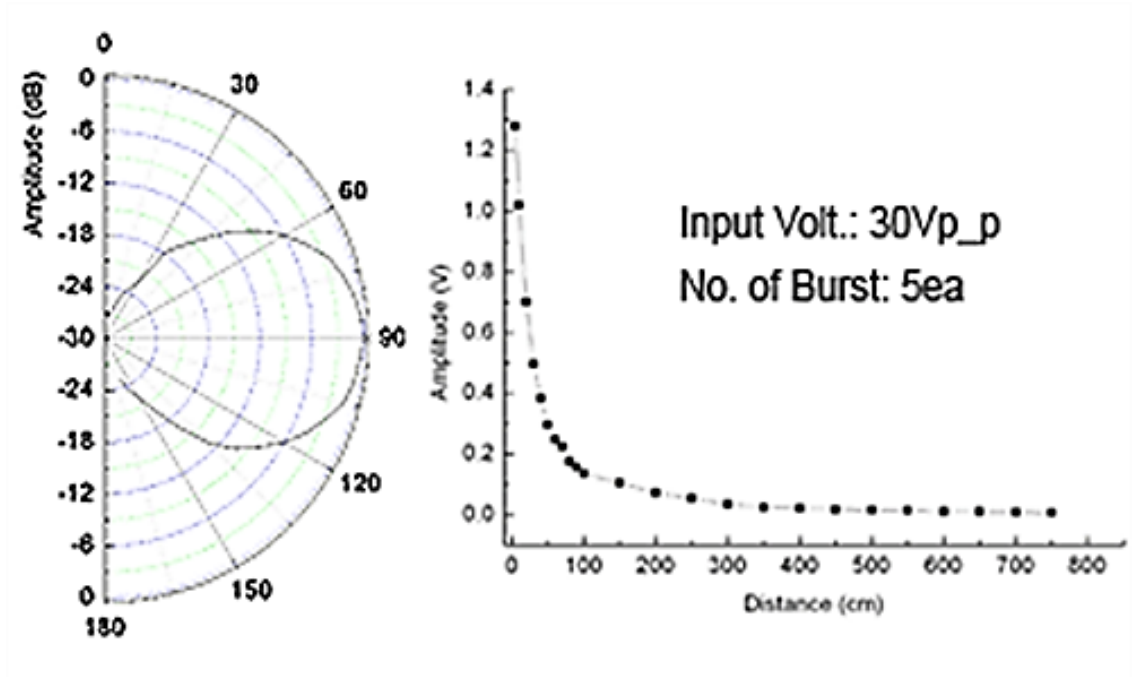
- ① Trigger Pulse ( The pulse width must be adjustable )  
( 1.5ms ~ 2.5ms )
- ② Inverted Waveform of ①
- ③ Receiver Output Signal
- ④ Actual Receive Signal ( After excluding the internal crosstalk )
- ⑤ Distance Pulse Output  
( The pulse width is proportional to the distance )

# Ultrasonic Sensor Module for a Robot

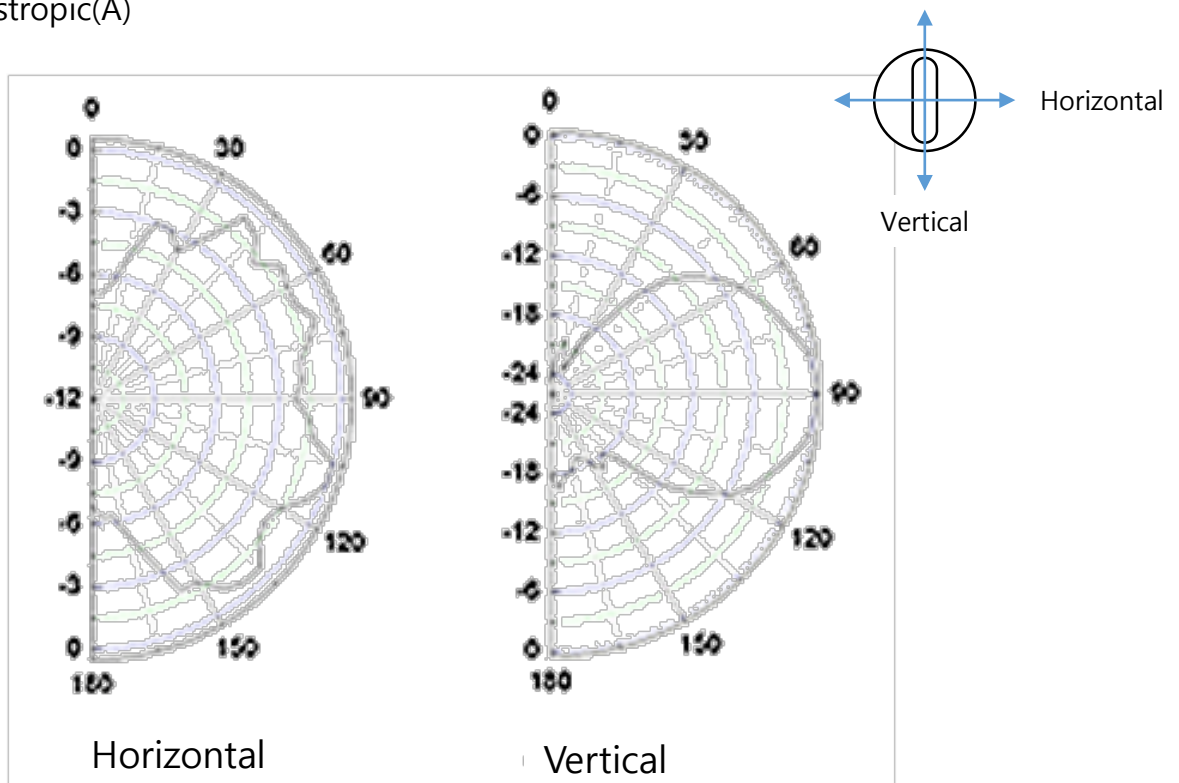
## ■ Model : HG-M40 Series, HG-L40 Series

### ▣ Each product-oriented graph

- Conventional(C)



- Anisotropic(A)



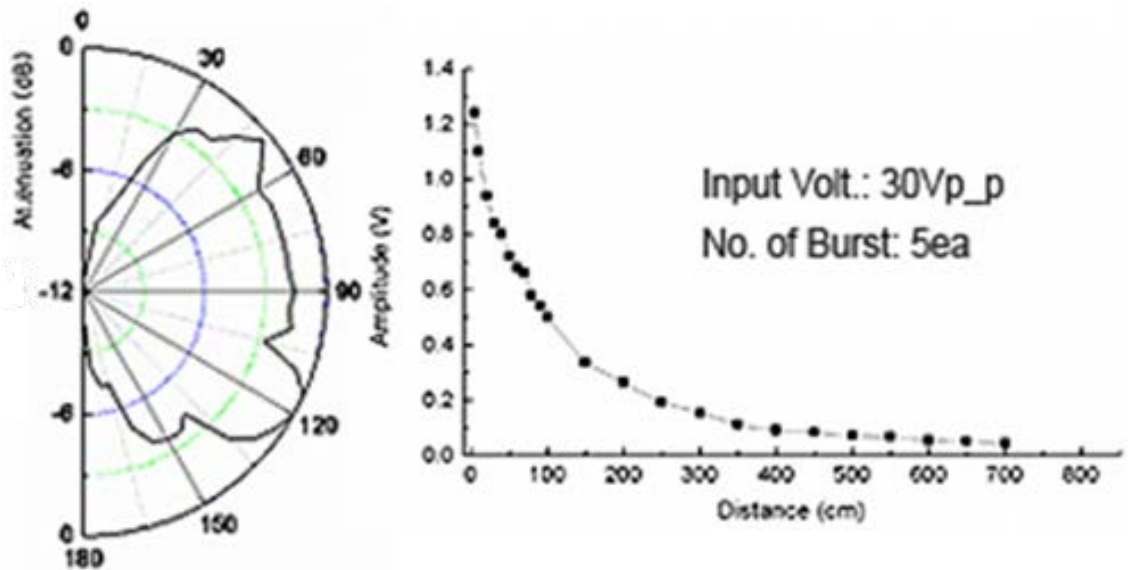


# Ultrasonic Sensor Module for a Robot

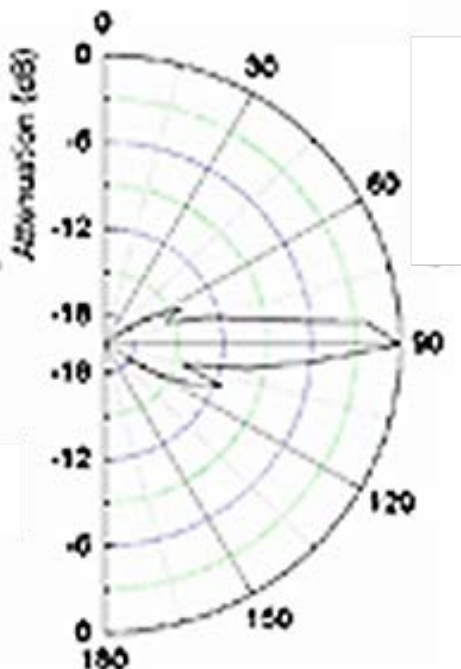
## ■ Model : HG-M40 Series, HG-L40 Series

### ▣ Each product-oriented graph

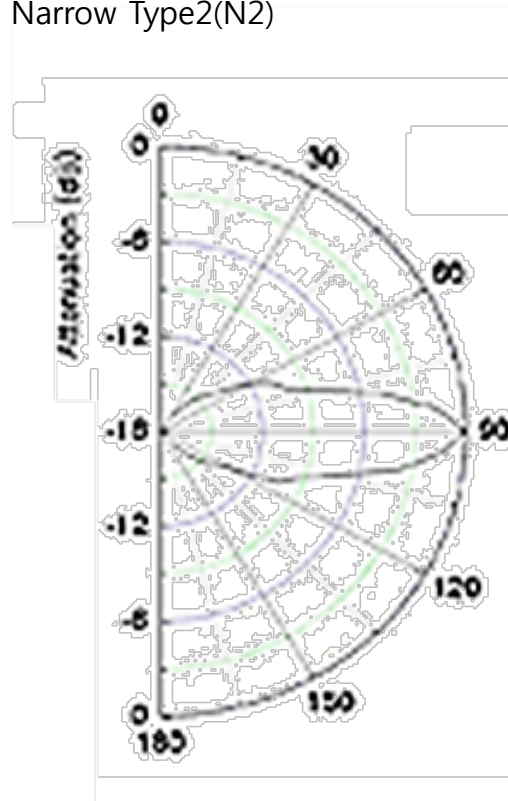
- Broad(B)



- Narrow Type1(N1)



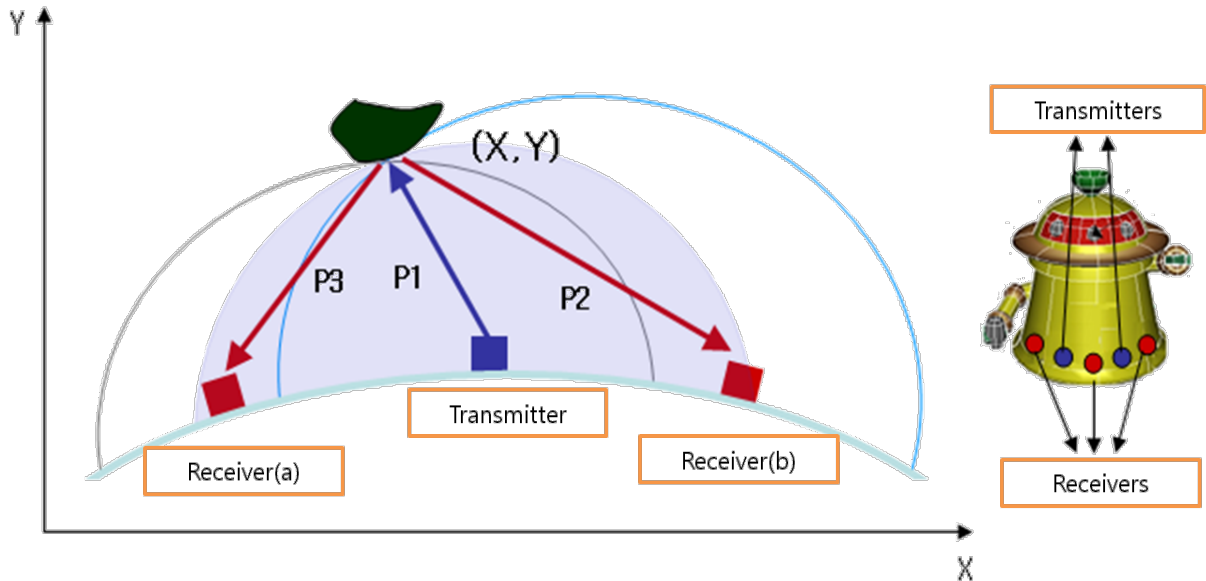
- Narrow Type2(N2)



# Ultrasonic Sensor Module for a Robot

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

### ▣ Ultrasonic Distance Measuring Principle



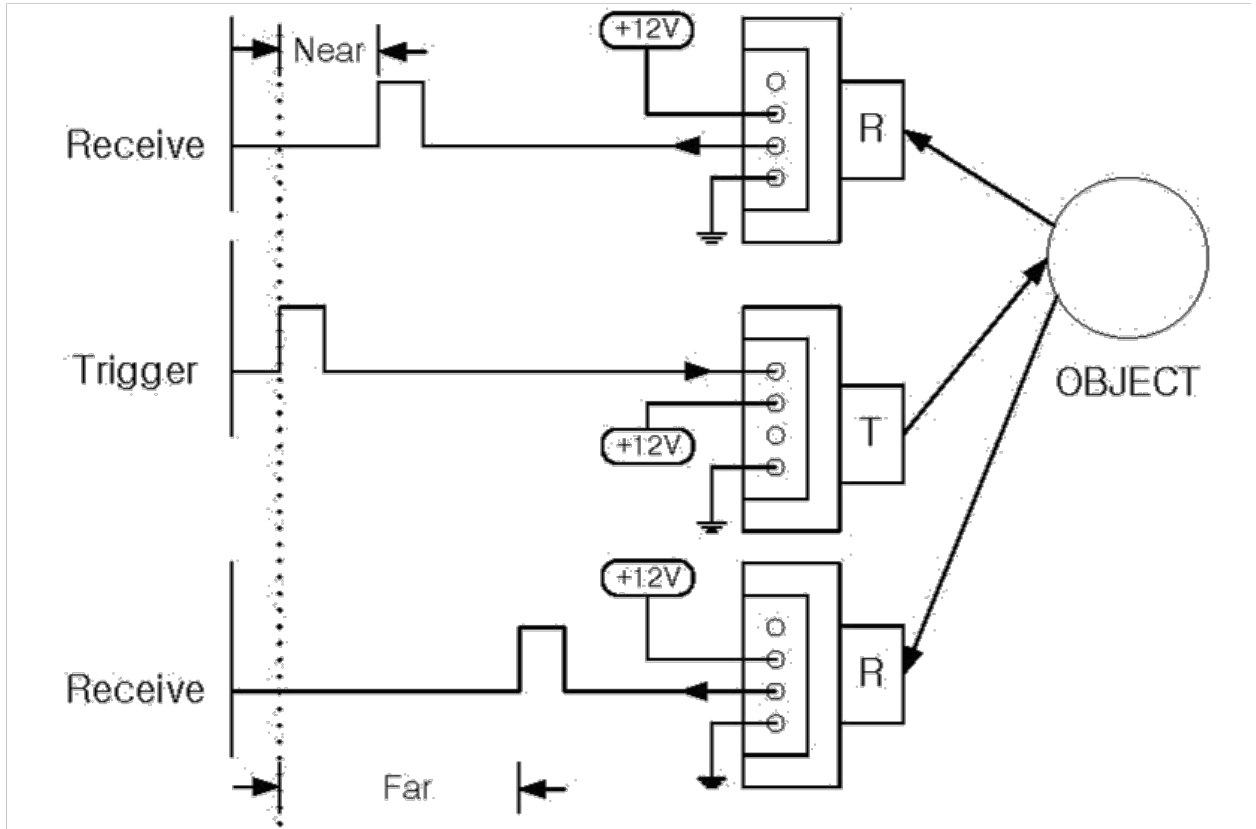
#### • Principle

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

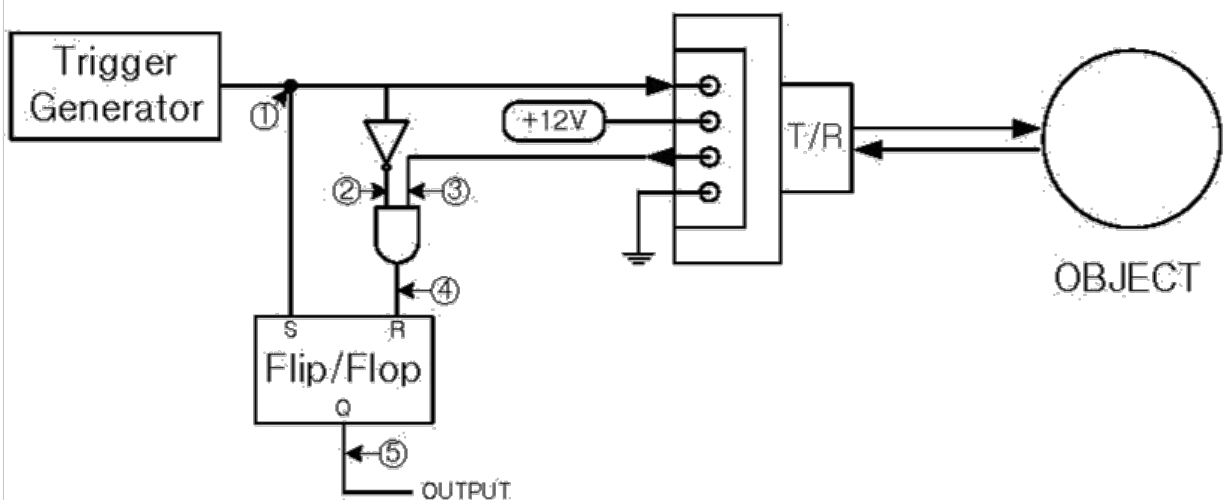
# Ultrasonic Sensor Module for a Robot

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

## ■ Application



Direction and distance finder for mobile robot



Range finder with only one module