

Ultrasonic Range Finder Sensor & Module(UART) *(HG-C40U)*



Ultrasonic Range Finder Sensor & Module(UART)

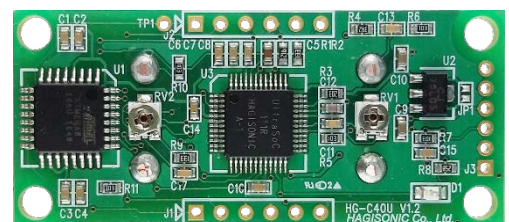
■ Model : HG-C40U

■ Description

- ATmega 8 MCU
- Measures distance from the obstacle and sends the data using UART communication.
- Within 5mm Resolution
- Optional two transmitting mode for various use.
 - Free Run : With a power supply, sensor transmits trigger and burst signal by itself (for basic application)
 - External Trigger : External system(controller or processor circuit) controls the trigger signals – for advance application
- Two types of input power – Low(5V) for processor circuit usage and High(12V) for controllers. **※ Factory Default : 12V**
- Various Setting Option
 - Free Run / UART Trigger / External Trigger setting
 - Ring buffer use or not use setting
 - UART communication baudrate setting
 - Free Run Trigger interval
- Output Signal
 - Distance Data using UART(ASCII, mm)
 - Real time ultrasonic wave amplified from actually received ultrasonic.
 - Real time TTL level square signal(Square Wave) of detection signal.
- High performance ASIC Chip for stable transmission and sensitive reception.
- Sensor to PC communication using 'Interface Board'(RS232, Power regulator)
- Data display using monitor program from PC(Hyperterminal available)

■ Specification

Communication	UART(TTL)
Input Voltage	5V, 12V(default)
Current Consumption	20mA(Typ) ~ 30mA(Max)
Frequency	40kHz
Max. distance	3.5m (at 5V) 5m (at 12V)
Min. distance	2cm
Resolution	5mm
Size	Module : 50x22x25(mm) Sensor : Φ16

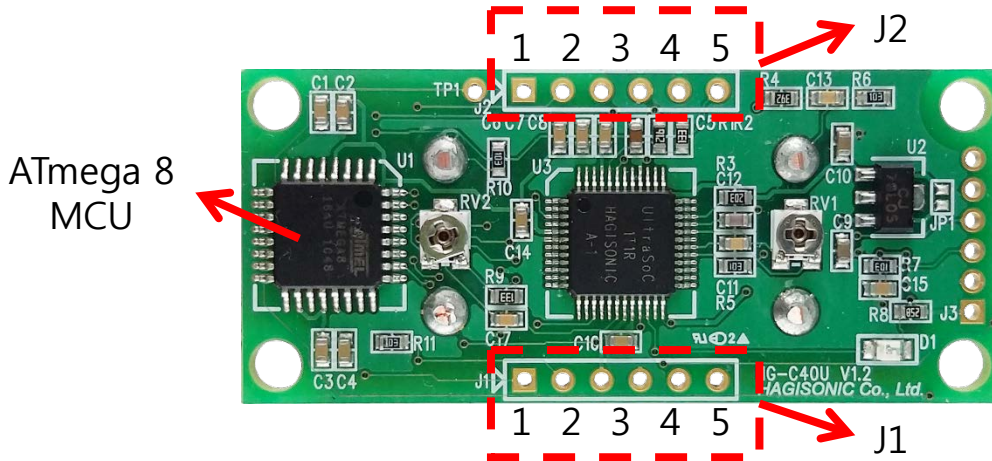


HG-C40U
(Conventional)
Approx. 65° Directivities

Ultrasonic Range Finder Sensor & Module(UART)

■ Model : HG-C40U

■ Connector Configuration



J1	
1	DISTANCE
2	TRIGGER
3	+5V / +12V
4	GND
5	TxD
5	RxD

J2	
1	ANALOG
2	NC
3	+5V / +12V
4	GND
5	TxD
5	RxD

■ UART Setting

I/O Level	TTL 5.0V
Baudrate	9,600bps ~ 38,400bps (Default : 38,400bps)
Data Bit	8bit
Stop Bit	1bit
Parity Bit	None
Flow Control	None

Ultrasonic Range Finder Sensor & Module(UART)

■ Model : HG-C40U

▣ Communication Protocol

a) Received Data (Distance Data)

STX (0x02)	^	Distance Data	ETX (0x03)
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Ex) ^400

b) Parameter Setting

STX (0x02)	Type	Command	[[Data]	ETX (0x03)
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Type	# @ \$!	Set Get Return Value ACK
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Command	Version	Firmware Version
	Mode	0:Free Run, 1:UART Trigger, 2:External Trigger(default : 0)
	RingBuff	Ring Buffer Usage for Shift Average (0: Not Use, 1: Use; Default : 1)
	BaudRate	Comm. Speed (9600~38400; Default : 38400)
	Period	Ultrasonic Sensor Trigger Interval (measure: ms; default 50)
	Trigger	External Trigger / Free Run

1) Operation Mode : Operation Mode for Ultrasonic Sensor Module There are three operation modes, Free Run, UART Trigger and External Trigger Mode.

- ❖ Free Run Mode : Triggers ultrasonic in regular interval
- ❖ UART Trigger Mode : external ultrasonic trigger using UART(Trigger Command) periodic or randomly.
- ❖ External Trigger Mode : Outside Trigger signal is needed for regular or irregular interval trigger signals

① Display Operation Mode

- Transmit : @Mode
- Receive : !Mode -> @Mode|0

② Operation Mode setting(UART Trigger)

- Transmit : #Mode|1 (to change to UART Trigger mode)
- Receive : !Mode|1 -> !Data Set Complement

Ultrasonic Range Finder Sensor & Module(UART)

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▣ Communication Protocol(Cont.)

❖ UART Trigger Mode only sends the data if trigger command is generated by UART.

① Operation Mode setting(External Trigger)

- Transmit : #Mode|2 (Change to External Trigger Mode)
- Receive : !Mode|2 -> !Data Set Complement

❖ External Trigger Mode only sends the data if outside trigger is generated

❖ Trigger: Trigger pulse to J1 2nd pin or Trigger command to UART

2) RingBuff : Use 'Ring Buffer' in Ultrasonic sensor module's internal algorithm.

※ When using External Trigger Mode and the trigger interval is late, using 'Ring Buffer' will delay the data gathering that use of 'Ring Buffer' is not recommended. However, resolution will be dropped.

① Display RingBuff Mode

- Transmit : @RingBuff
- Receive : !RingBuff -> @RingBuff|1

② RingBuff Setting

- Transmit : #RingBuff|0 (set 'Ring Buffer' to not use)
- Receive : !RingBuff|0-> !Data Set Complement

3) BaudRate : It indicates communication speed of ultrasonic sensor module.

① Display BaudRate

- Transmit : @BaudRate
- Receive : !BaudRate -> @BaudRate|38400

② BaudRate Setting

- Transmit : #BaudRate|9600 (Change Comm. Speed to 9600)
- Receive : !BaudRate|9600-> !Data Set Complement

4) Period : It indicates trigger intervals of ultrasonic sensor module.

① Display Period

- Transmit : @Period
- Receive : !Period -> @Period|50

② Period Setting

- Transmit : #Period|20 (Change trigger intervals to 20ms)
- Receive : !Period|20-> !Data Set Complement

5) Trigger : Triggers ultrasonic sensor module

- Transmit : #Trigger (triggers ultrasonic)
- Receive : ^365 (Distance 365mm, ASCII)

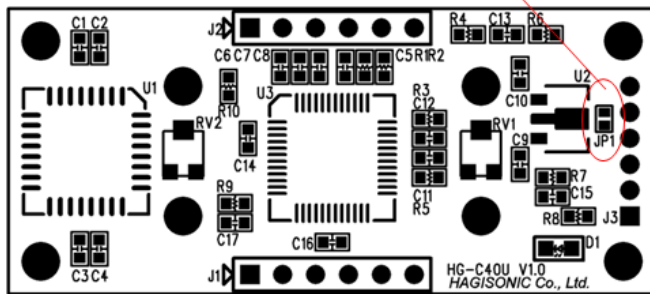
Ultrasonic Range Finder Sensor & Module(UART)

■ Model : HG-C40U

▣ Method to change input voltage (12V → 5V)

- HG-C40U has two input voltage, 5V and 12V. Factory default is 12V. If user wants to change, user can short(solder) JP1 to change to 5V.

12V : Open
5V : Short(Soldering)



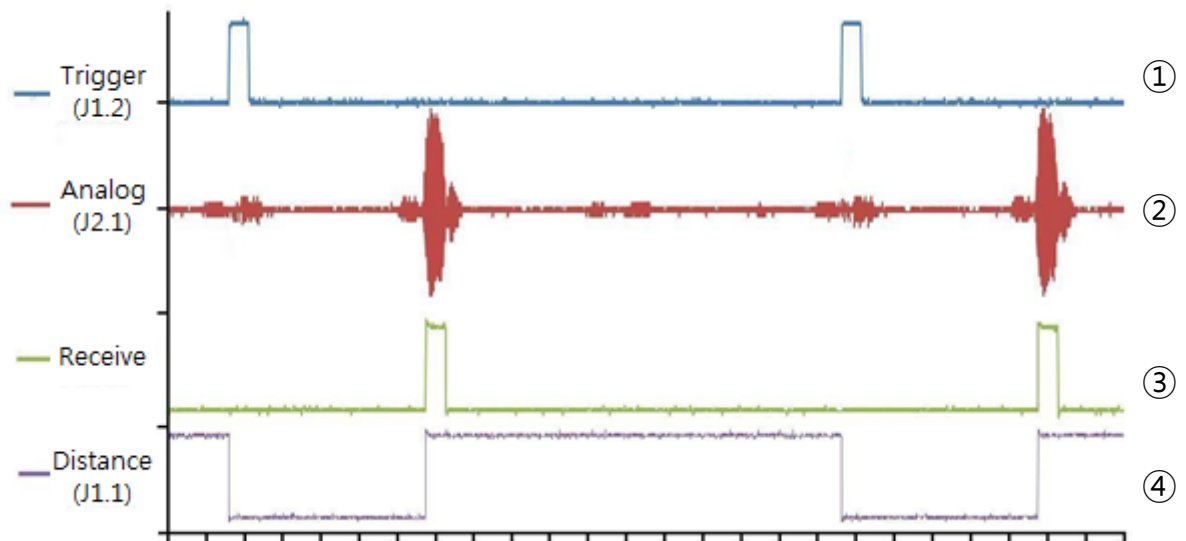
12V(Default)
(Open)



5V
(Soldering)

* Caution : Using 12V on 5V(Soldered) PCB will burn and damage the Module and this will not be covered by factory warranty.

▣ Output signal pattern



- Trigger signal(①) is outputted(displayed) only on External Trigger mode. UART Trigger mode or Free Run mode will not output the signal(Internal operation only)
- Receive Signal(③) will not be outputted (Internal operation only)

Ultrasonic Range Finder Sensor & Module(UART)

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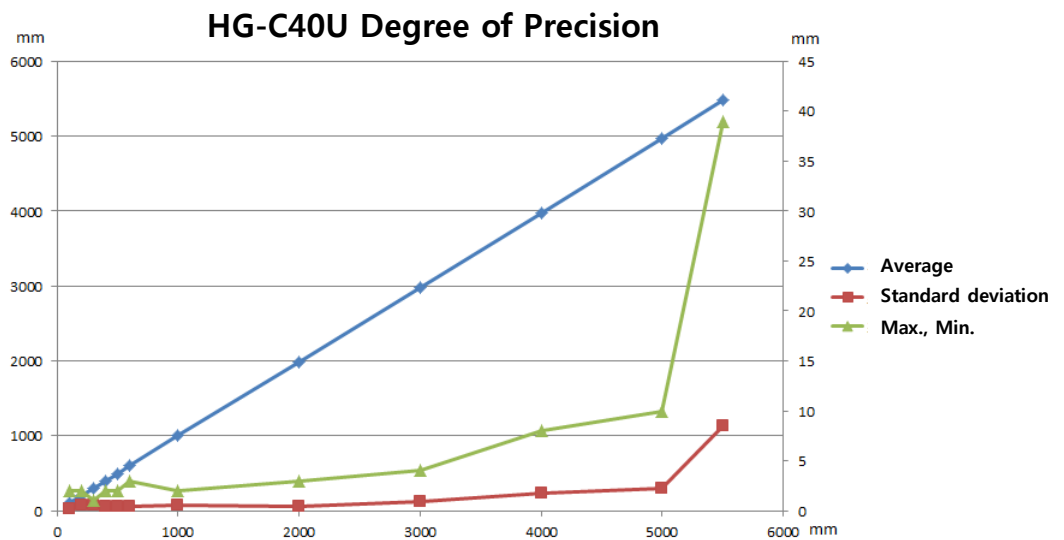
▣ Degree of Precision

a) By distance

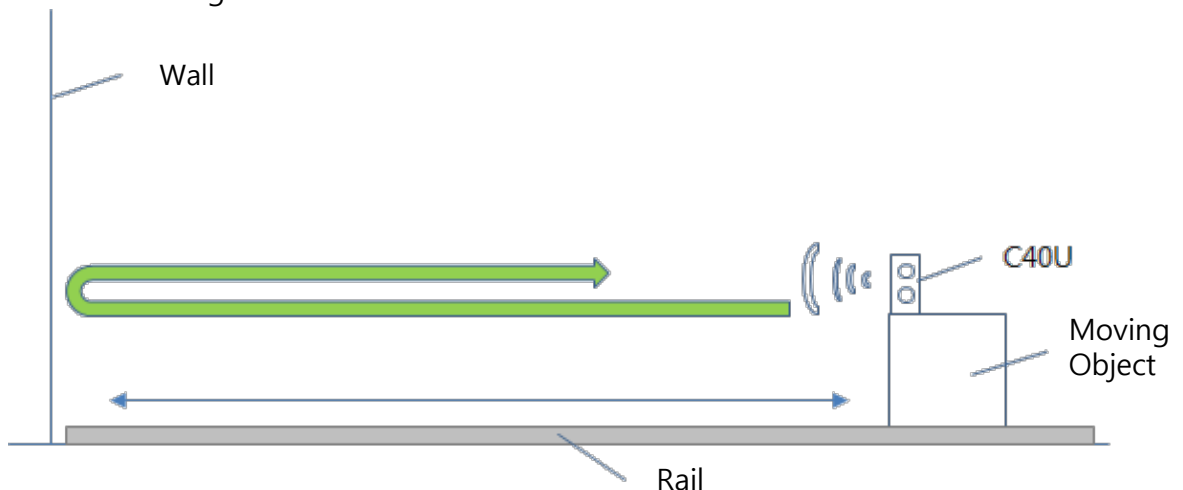
(mm)

Distance	100	200	300	400	500	600
Average	100.0025	201.5175	299.4401	400.2974	498.7754	600.8672
Standard deviation	0.23321	0.562792	0.496606	0.459127	0.493257	0.374544
Max., Min.	2	2	1	2	2	3

Distance	1000	2000	3000	4000	5000	5500
Average	998.3231	1983.847	2978.858	3970.667	4964.257	5480.61
Standard deviation	0.552759	0.433792	0.854845	1.711037	2.268125	8.444806
Max., Min.	2	3	4	8	10	39



b) Distance Measuring Method



Ultrasonic Range Finder Sensor & Module(UART)

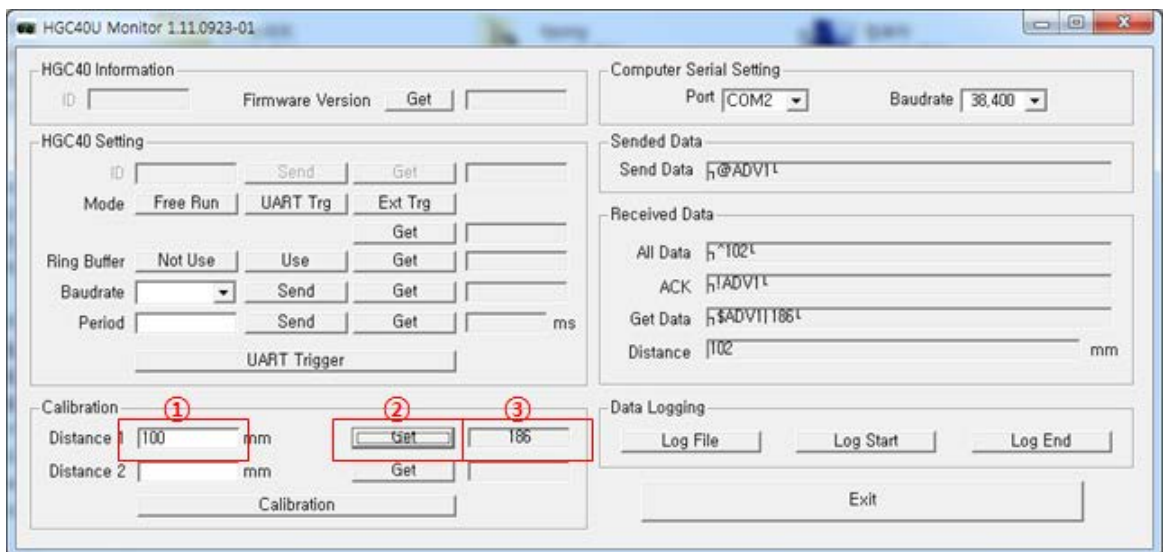
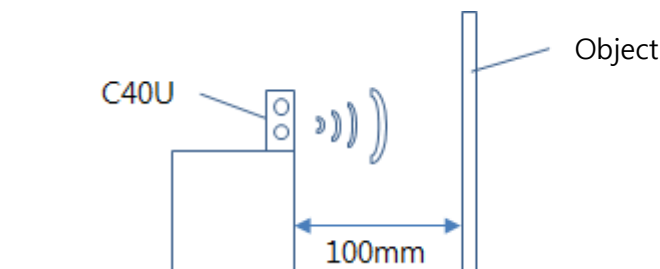
■ Model : HG-C40U

■ Ultrasonic Sensor Calibration

- HG-C40U is calibrated from our factory. However, if users change the input voltage from 12V to 5V or vice versa, new calibration is necessary for precise data reception.

1. Distance1 measurement.

- 1) Place an object apart from HG-C40U by 100mm (try to measure as close as possible with ruler or any measuring devices)



2) Open HGC40U Monitor 1.11.0923- 01 program

3) Input exact distance(100mm) in ① 'Distance 1' box in 'Calibration' section.

4) Click ② 'Get' button.

5) Confirm ③ shows the data

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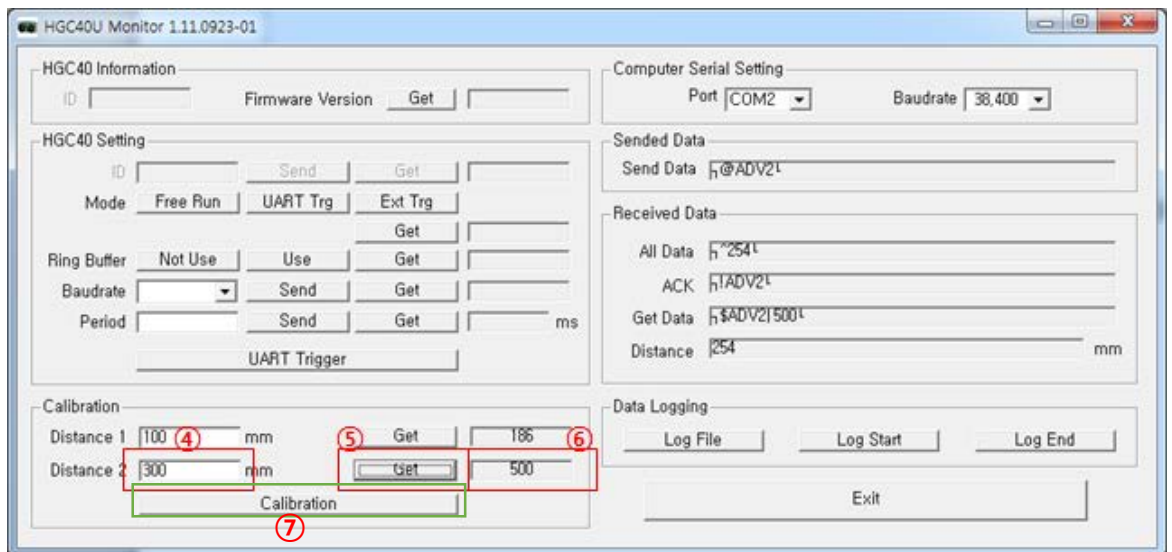
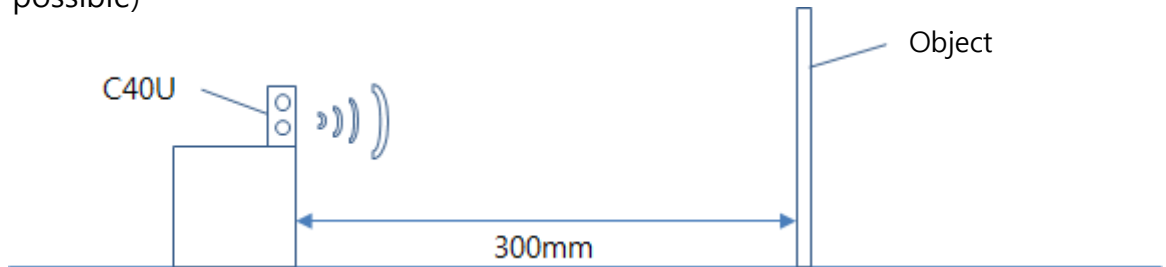
Ultrasonic Range Finder Sensor & Module(UART)

■ Model : HG-C40U

▣ Ultrasonic Sensor Calibration(Cont.)

2. Distance2 measurement.

- 1) Move the object apart from HG-C40U to 300mm (try to measure as close as possible)



- 2) Input exact distance(300mm) in ④ 'Distance 2' box in 'Calibration' section.

- 3) Click ⑤ 'Get' button.

- 4) Confirm ⑥ shows the data

3. Calibration

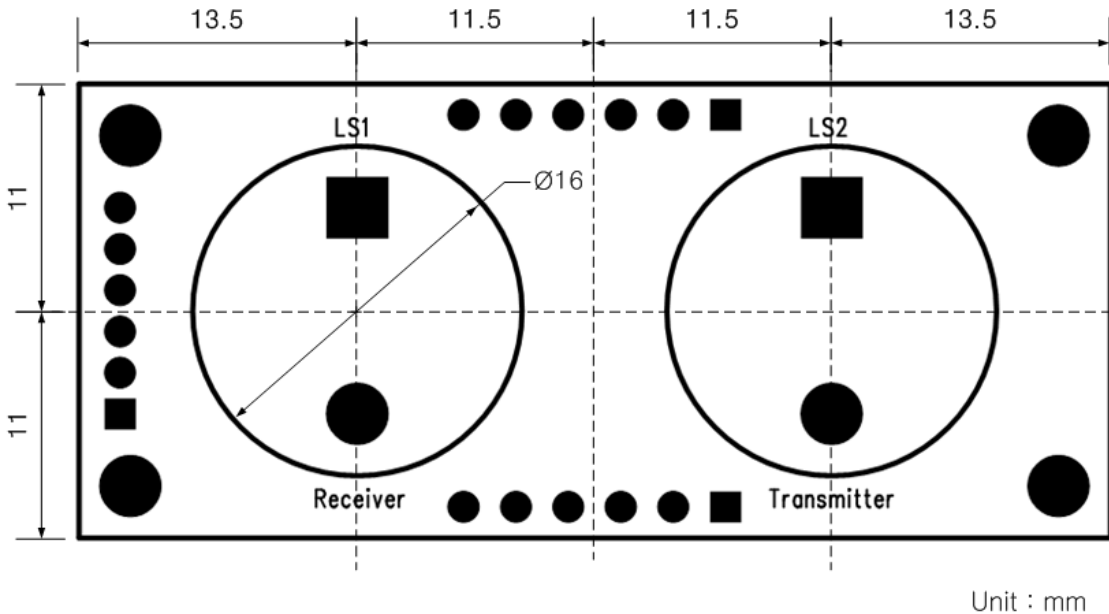
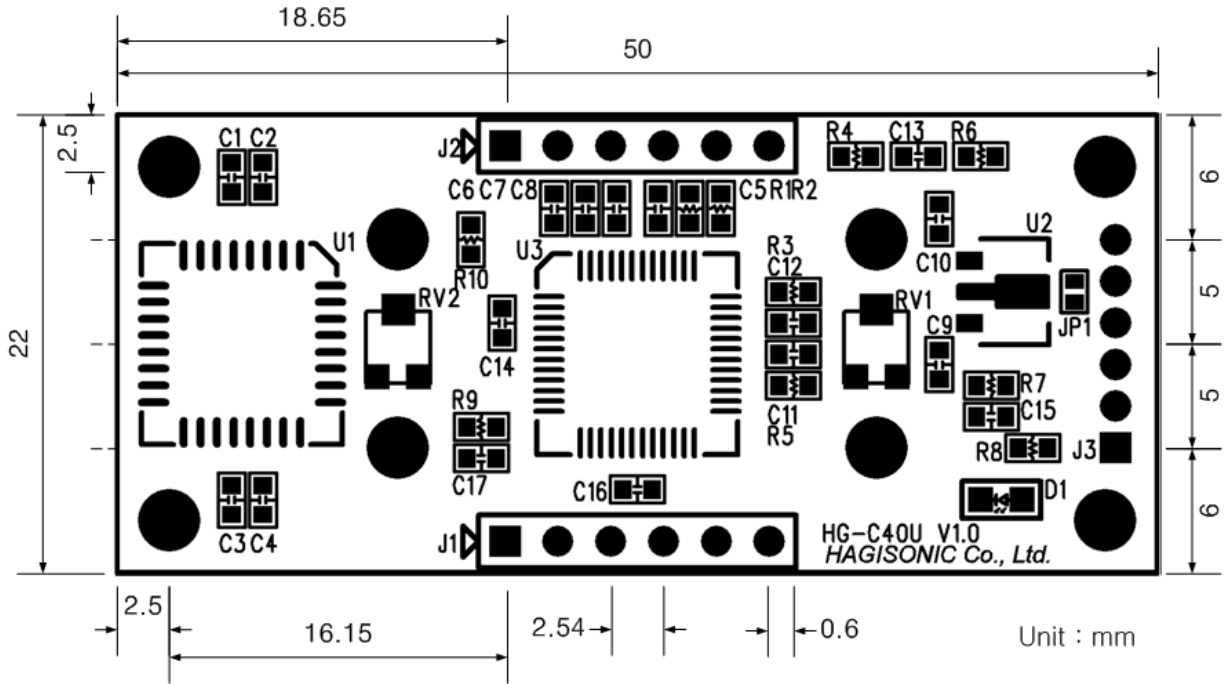
- 1) Click ⑦ 'Calibration' button.

- 2) Calibration process is done. Please make sure the distance is correct by measuring object's distance with HG-C40U.

Ultrasonic Range Finder Sensor & Module(UART)

■ Model : HG-C40U

▣ Module Size

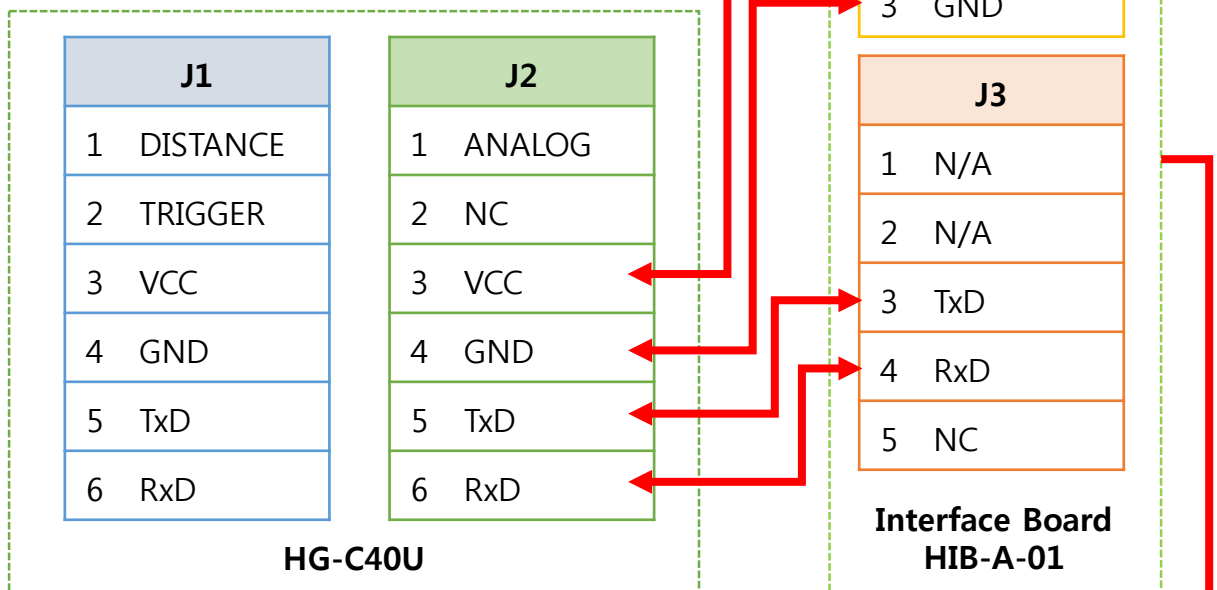
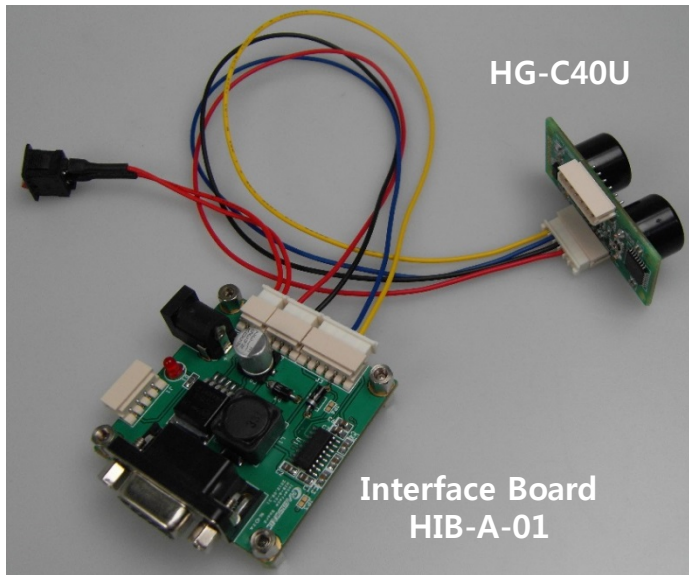


Ultrasonic Range Finder Sensor & Module(UART)

■ Model : HG-C40U

▣ RS232 Communication Interface Board

- To connect with PC, Interface Board is needed.
- Interface Board for StarGazer™(HIB-A-01) (Serial cable, adaptor, switch offers)
- Factory Default(12V)
- Only when HG-C40U and HIB-A-01 is purchased together we provide cable / connector



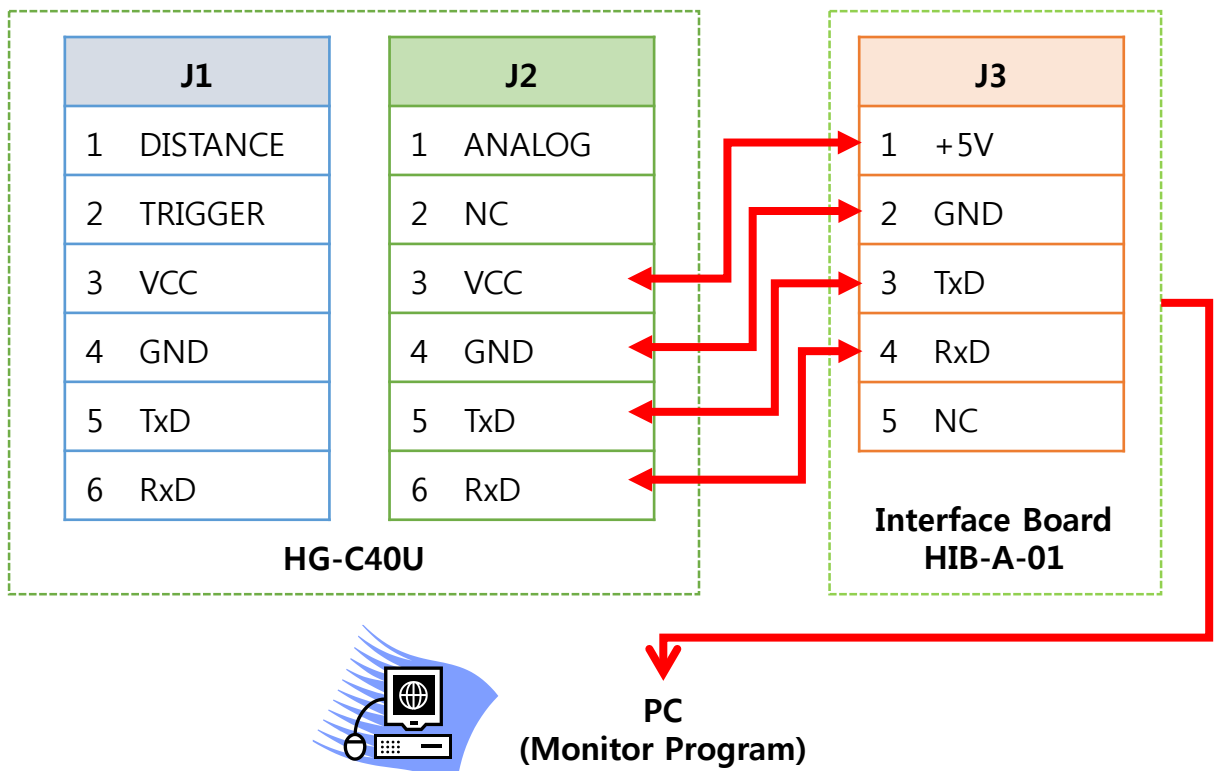
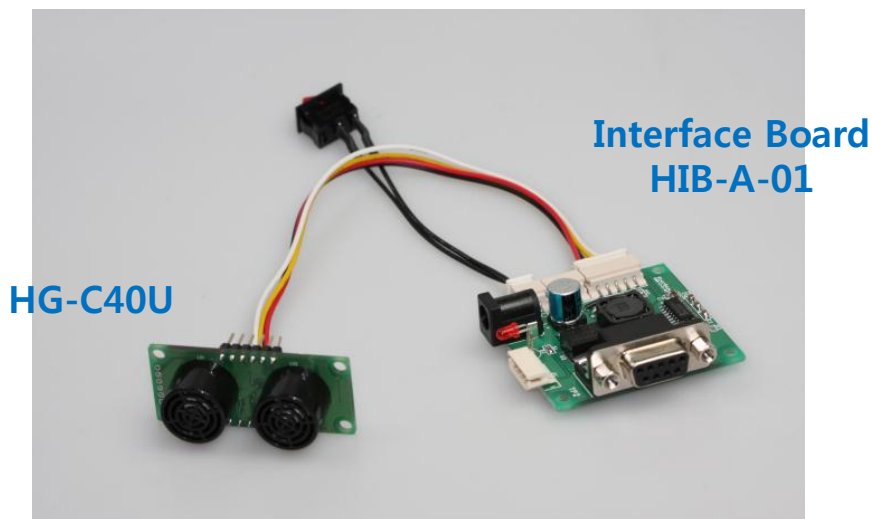
PC
(Monitor Program)

Ultrasonic Range Finder Sensor & Module(UART)

■ Model : HG-C40U

▣ RS232 Communication Interface Board (5V use example)

- To connect with PC, Interface Board is needed.
- Interface Board for StarGazer™(HIB-A-01) (Serial cable, adaptor, switch offers)
- Factory Default(12V)
- Only when HG-C40U and HIB-A-01 is purchased together we provide cable / connector

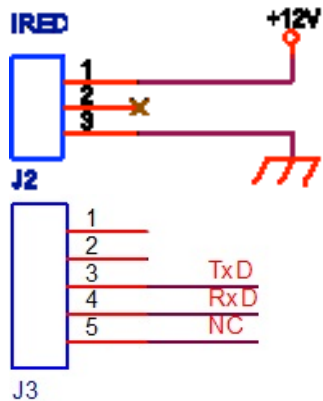


Ultrasonic Range Finder Sensor & Module(UART)

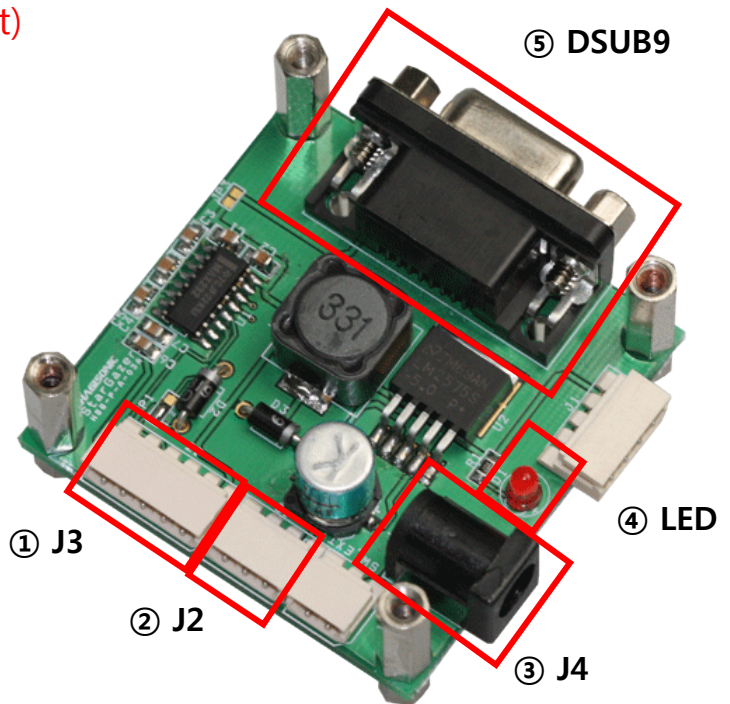
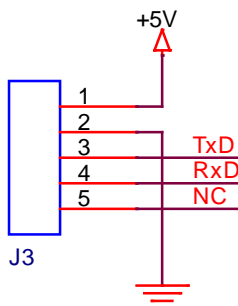
■ Model : HG-C40U

▣ Interface Board (HIB-A-01)

12V use (Factory Default)



5V use (see p6 & p12)



Model : HIB-A-01

Serial cable and Adapter included(110/220V optional)

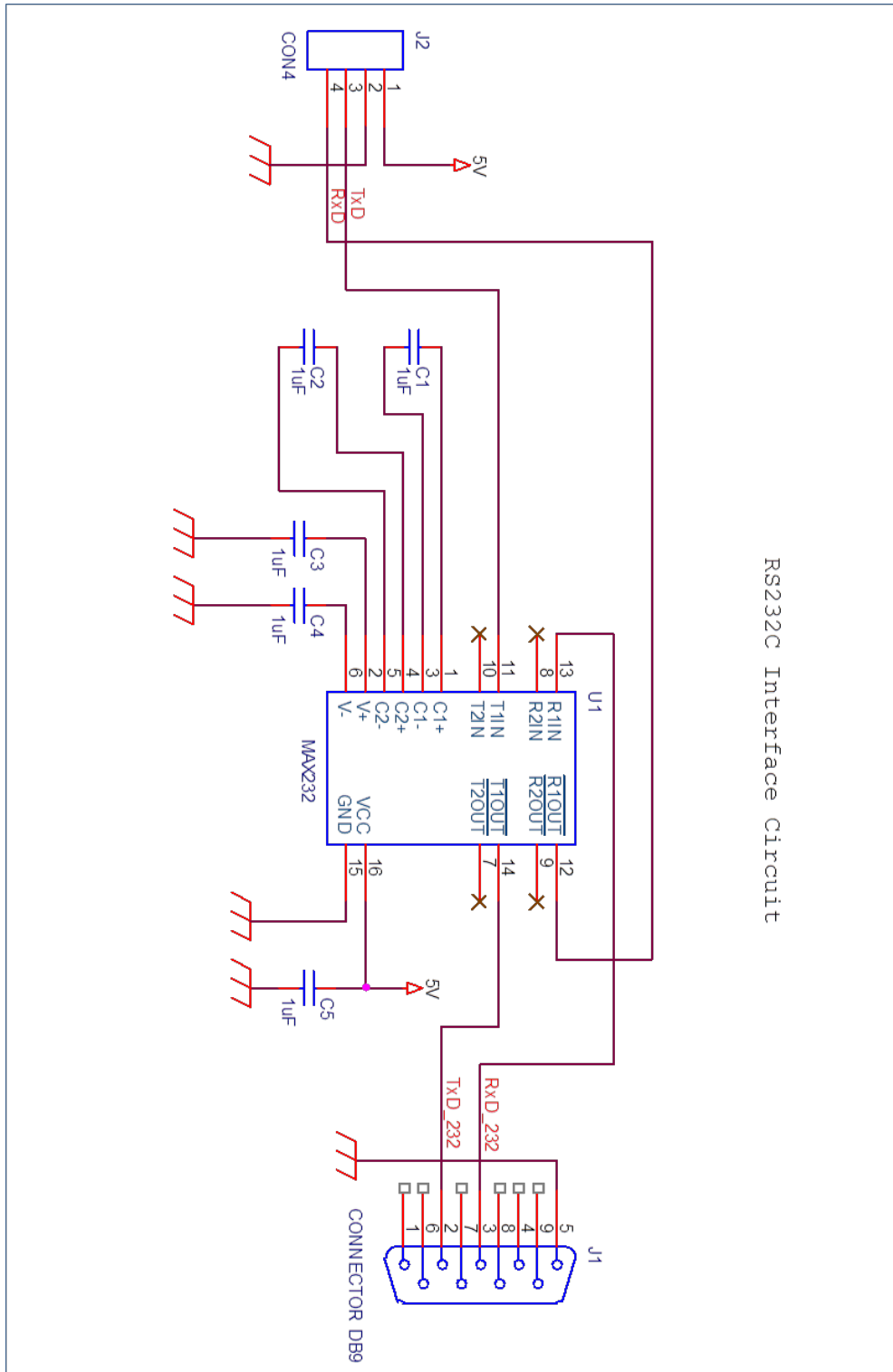
① Communication / Power	Connect to C40U's J2(5V use)
② Power	Connect to C40U's J2(12V use) -default
③ Power	DC +12V input Jack (2PI)
④ LED	LED on when power is connected
⑤ Serial Port	Serial Port (RS-232C standard)

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▣ RS232 Interface Circuit Example

- This drawing is not for Interface Board. This is only for the reference for self design

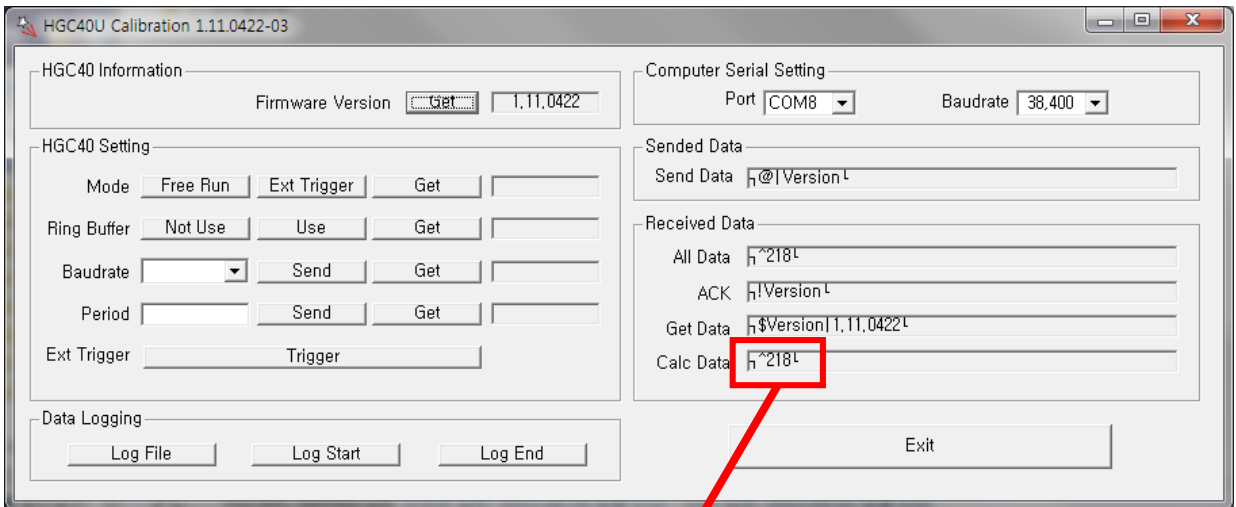


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■ Ultrasonic Range Finder Monitor Program

- Connect HG-C40U module with PC using 'Interface Board' and 'Serial Cable' and download monitor program from our webpage.
- Please set the Port first.



Data (ex. 218 mm)