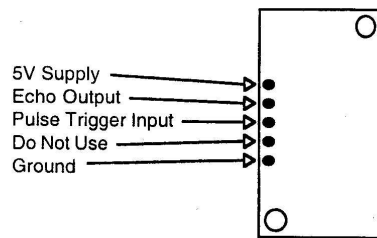# SRF04 Ultrasonic Range Finder

30th September 2003

Introduction

The Devantech SRF04 Utrasonic Range Finder offers precise ranging information from roughly 3cm to 3 meters. This range, easy interfacing and minimal power requirements make this an ideal ranger for robotics applications.

Theory of Operation

The ranger works by transmitting a pulse of sound outside the range of human hearing. This pulse travels at the speed of sound (roughly 0.9 ft/msec) away from the ranger in a cone shape and the sound reflects back to the ranger from any object in the path of the sonic wave. The ranger pauses for a brief interval after the sound is transmitted and then awaits the reflected sound in the form of an echo. The controller driving the ranger then requests a ping, the ranger creates the sound pulse, and waits for the return echo. If received, the ranger reports this echo to the controller and the controller can then compute the distance to the object based on the elapsed time.

Connections

The ranger requires four connections to operate. First are the power and ground lines. The ranger requires a 5V power supply capable of handling roughly 50mA of continious output. The remaining two wires are the signal wires.
The connections can be made by soldering wire leads to the board or header pins/sockets depending on your needs.

Basic Timing

There are a couple of requirements for the input trigger and output pulse generated by the ranger. The input line should be held low (logic 0) and then brought high for a minimum of 10 μsec to initiate the sonic pulse. The pulse is generated on the falling edge of this input trigger. The ranger's receive circuitry is held in a short blanking interval of 100 μsec to avoid noise from the initial ping and then it is enabled to listen for the echo. The echo line is low until the receive circuitry is enabled. Once the receive circuitry is enabled, the falling edge of the echo line signals either an echo detection or the timeout (if no object echo is detected).
Your controller will want to begin timing on the falling edge of your trigger input and end timing on the falling edge of the echo line. This duration determines the distance to the first object the echo is received from.
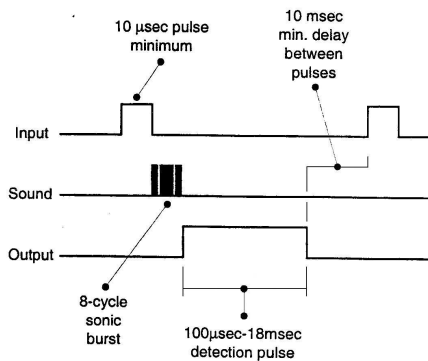
If no object is detected, the echo pulse will time-out and return an echo at approximately 36 msec.

Beam Pattern

The SRF04 has a detection cone that is roughly 30 degrees wide. Testing in a 90 degree arc at Acroname revealed the following beam pattern:
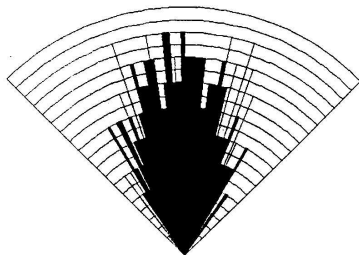
The radial lines indicate 6" distance increments.

Specifications

Voltage	5V only required
Current	30mA Typ. 50mA Max.
Frequency	40kHz
Max Range	3m
Min Range	3cm
Sensitivity	Detect 3cm diameter broom handle at > 2m
Input Trigger	$10\mu S$ Min. TTL level pulse
Echo Pulse	Positive TTL level signal, width proportional to range.

Interface Examples

Have a look at:
http://www.acroname.com/robotics/info/examples/examples.html