

# Distance Measurement

Using a HC-SR04 ultrasonic sensor and this embedded C module you can measure the distance to a target.

**This CFunction provides an exact replacement for the DISTANCE function that was built into version 5.3.2 of MMBasic and earlier. Existing programs should run unchanged with this module installed on both the Micromite and Micromite+.**

## Distance CFunction

To add the DISTANCE function to MMBasic you need to insert the following code somewhere in your BASIC program (you can use copy and paste from this document). The exact spot is not important but at the end is normal.

```
CFunction DISTANCE(integer, integer) float
0000002D 27BDFFF8 AFBF0004 00852023 03E42021 ACC40000 8FBF0004 03E00008
27BD0008 27BDFFE0 AFBF001C 00002021 3C059D00 24A50040 27A60010 0411FFF1
00000000 8FA30010 3C029D00 8C4200BC 3C049D00 24840310 0040F809 00832021
8FBF001C 03E00008 27BD0020 000410C0 00041A00 00621823 00031180 00431823
00641821 00031980 3C029D00 8C420000 3C047735 34849400 8C420000 0082001B
004001F4 00002012 0064001B 008001F4 03E00008 00001012
27BDFFD8 AFBF0024 AFB40020 AFB3001C AFB20018 AFB10014 AFB00010 00809021
3C029D00 8C420000 8C430000 3C020098 34429680 0062102B 10400003 00A08821
0411FFCA 00000000 8E220000 14400003 3C109D00 8E420000 AE220000 8E020010
8E240000 24050002 0040F809 2406000E 8E02001C 8E440000 0040F809 24050005
8E020010 8E440000 24050008 0040F809 00003021 8E02001C 8E440000 0040F809
24050006 8E020004 0040F809 24040014 8E02001C 8E440000 0040F809 24050005
8E020004 0040F809 24040032 8E020010 8E240000 24050002 0040F809 2406000E
8E020004 0040F809 24040032 0411FFB1 24040005 00409821 0000A021 40944800
00008021 10000005 3C129D00 40104800 0270102B 1440001E 24050002 8E420020
0040F809 8E240000 1440FFF8 24040064 10000025 00000000 40104800 0270102B
14400013 24050002 8E420020 0040F809 8E240000 1040FFF8 24040020 1000001F
00000000 40104800 0270102B 14400008 24050001 8E420020 0040F809 8E240000
1440FFF8 00000000 1000001A 3C119D00 00052823 3C029D00 8C420080 00A02021
0040F809 00052FC3 8FBF0024 8FB40020 8FB3001C 8FB20018 8FB10014 8FB00010
03E00008 27BD0028 0411FF7A 00000000 00409821 1000FFDC 3C129D00 0411FF75
00000000 00409821 40944800 1000FFE1 3C129D00 8E320064 8E220000 3C037735
34639400 8C420000 0062001B 004001F4 00001012 72028002 24021696 0202001B
004001F4 00002012 8E220080 0040F809 00002821 00408021 8E220080 2404000A
0040F809 00002821 02002021 0240F809 00402821 1000FFD5 8FBF0024
20555043 65657073 6F742064 6F6C206F 000A0D77
End CFunction
```

## Usage

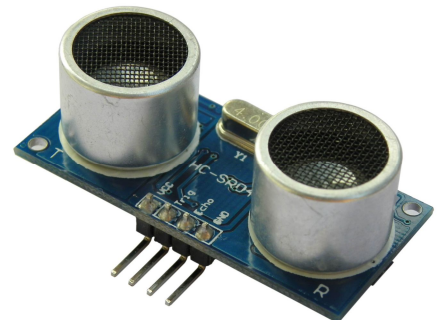
The HC-SR04 can be found on eBay for about \$4 and it will measure the distance to a target from 3cm to 3m. It works by sending an ultrasonic sound pulse and measuring the time it takes for the echo to be returned.

Compatible sensors are the SRF05, SRF06, Parallax PING and the DYP-ME007 (which is waterproof and therefore good for monitoring the level of a water tank).

On the Micromite you use the DISTANCE function as follows:

```
d = DISTANCE(trig, echo)
```

Where trig is the I/O pin connected to the "trig" input of the sensor and echo is the pin connected the "echo" output of the sensor.



Three pin sensors have a combined trigger and echo connection and in that case you only need to specify one I/O pin to interface to the sensor. For example:

```
d = DISTANCE(trig-echo)
```

The value returned is a floating point number representing the distance in centimetres to the target or -1 if no target was detected. The value -2 will be returned if the ultrasonic sensor did not respond (ie, it is faulty or not connected).

The CPU speed must be 10 MHz or higher and the measurement can take up to 32 ms to complete. If you repeatedly call this function you must arrange for a delay of at least 60ms between each call otherwise errors may occur (caused by an echo from the previous sound pulse).

The I/O pins are automatically configured by this function but note that they should be 5V capable as the HC-SR04 is a 5V device. You can use multiple sensors connected to different I/O pins or even sharing the one trigger pin if care is taken to prevent one sensor from interfering with another.

### **Adding the Distance Function to the Library**

If you add this CFunction to the MMBasic library it will act exactly the same as a built in command and you will not have to add the above code to any program that uses this function. It will take up a minimum of memory and it will not be erased when you use NEW or load a new program. To do this you can follow these steps:

- Load the CFunction code listed above into the Micromite using either AUTOSAVE, XMODEM or the MMEDIT program. Do not include any other program lines unless you also want them stored in the library.
- Enter the command LIBRARY SAVE

This will transfer the CFunction code to the library area and delete it from the main memory. You can now use the command in your programs exactly the same as if it was a built in command. The only way it can be removed is by using the command LIBRARY DELETE or by reprogramming the chip with the Micromite firmware.