DLP-TH1C

**** PRELIMINARY DOCUMENT-SUBJECT TO CHANGE ****

USB-BASED SENSOR MODULE

1.0 INTRODUCTION

The DLP-TH1C is a USB-based module for acquiring temperature, humidity, pressure, sound, tilt, vibration and light data. A rudimentary host app and its source-code project (Visual Studio, Visual C++) is provided with the DLP-TH1C to demonstrate host communication via Virtual COM Port (VCP). All features of the DLP-TH1C can be accessed via single-byte commands from the host application.

The DLP-TH1C uses a fully-calibrated sensor for temperature, relative humidity and pressure. Calibration coefficients for this sensor are permanently stored within the sensor and cannot be changed so that the module can be fully interchangeable with any other DLP-TH1C.

Note: The DLP-TH1C is not intended to be a used as a calibrated standard for measuring light, tilt, vibration or sound levels.

The tilt sensor (accelerometer) has four user-selectable scales: 2G, 4G, 8G and 16G. This sensor can report X, Y and Z axis tilt as affected by earth gravity. Vibration frequency can also be measured from 25-2500Hz (20Hz resolution). Data points reported for vibration are the fundamental frequency (at max peak level) and the five next-highest peaks that may lie above and below the fundamental frequency.

Ambient light that enters an opening in the DLP-TH1C's plastic enclosure is measured by an on-board light sensor. A single 8-bit byte is returned indicating the ambient light level (ranging from 0-255) reporting the light level to the host app.

Sound is measured by an on-board microphone and preamplifier. Sound frequency and amplitude can be measured from 25Hz-10KHz (78Hz resolution). Data points reported for sound are the fundamental frequency (at max peak level) and the five next-highest peaks that may lie above and below the fundamental frequency. An additional measurement for broadband ambient sound level is also provided.

The most recent versions of application software for the DLP-TH1C are available for download from www.dlpdesign.com/usb/th1c.php.

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No external power source is required. All power (~50mA @ 5V) is taken from the USB port via the included 6-foot USB cable.

2.0 ASCII VS. BINARY

The DLP-TH1C firmware can return either ASCII or binary data to the host app. (Lowercase commands return ASCII data; uppercase commands return binary.)

A terminal-emulator program (HyperTerminal, Docklight, etc.) can be used to operate the DLP-TH1C in ASCII mode. If a custom app is used, the binary mode of operation may be more efficient for processing of the return data in the host app.

3.0 QUICK-START GUIDE

This guide requires the use of a Windows PC that is equipped with at least one available USB port.

Connect the DLP-TH1C sensor to your PC via the provided USB cable. This action initiates the loading of the USB drivers (which are part of the Windows 10 operating system--previous versions of Windows may need an internet connection in order for the drivers to load). A Virtual COM Port will appear under Ports in Device Manager. At this point, the DLP-TH1C is ready for use.

Run the provided application program software acquired from the DLP-TH1C product page at www.dlpdesign.com, and begin acquiring sensor data in either ASCII or binary mode. Conversely, run your terminal emulator of choice, open the COM Port and acquire sensor data in ASCII mode using the provided single-byte commands. (The host baud rate setting has no affect on communication with the DLP-TH1C.)

4.0 SPECIFICATIONS

Temperature	°C
Range	0 to 65°C
Accuracy	±1.0°C (0 to 65°C)
Resolution	0.01°C

Humidity	
Range	0-100% RH (0-60°C)
Accuracy	±3% RH (20-80% RH @ 25°C)
Resolution	0.01% RH
Stability	0.5% RH/Year
Response Time	1 Sec. (0-90% or 90-0% RH @ 25°C)

Pressure

Range	300-1100 hPa (0-65°C)
Accuracy	±1 hPa (300-1100 hPa @ 0-65°C)
Resolution	0.18% Pa
Stability	±1.0 hPa/Year

Tilt

Range	±128 (2G Mode: X, Y and Z Axis)

Vibration

Frequency Range	25-2500Hz (20HZ Resolution)
Measurement Range	2G, 4G, 8G, 16G
Reading Rate	~1 Reading/Second (Binary Mode)

Light

Range	0-255

Sound

Range	20-10,000Hz (78Hz Resolution)
Reading Rate	~1 Reading/Second (Binary Mode)

5.0 DEMONSTRATION GUI

5.1 DEMONSTRATION GUI 1

This GUI is provided for basic demonstration of the DLP-TH1C sensor module and to help the user learn the programming interface.

This Windows software will automatically search all COM Ports at startup looking for the DLP-TH1C, and will open the port when found.

The ASCII buttons simply display the actual ASCII data returned from the DLP-TH1C. The BINARY buttons retrieve raw data from the DLP-TH1C and calculate the values for temperature, humidity, etc. that are then displayed.

Note: When the Tilt Function is selected, the accelerator force level is automatically set to 2G. (This is a feature of the DLP-TH1C; not this GUI.)

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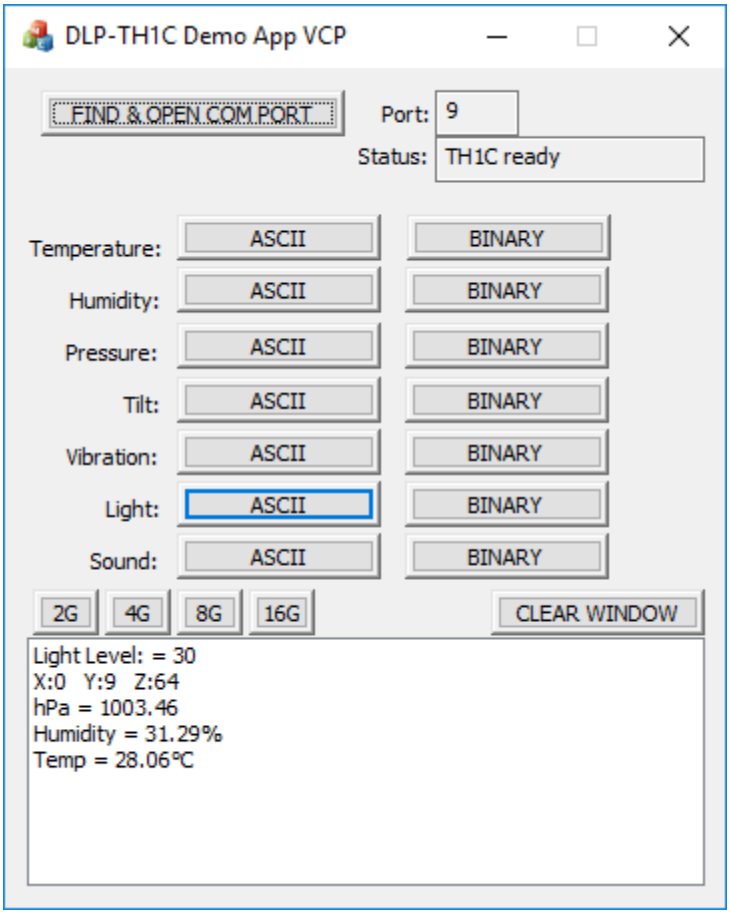

5.2 DEMONSTRATION GUI 2

This GUI is provided for basic demonstration of the DLP-TH1C sensor module and to provide continuously updated sensor data to the user. This app also logs data to the local hard drive (tab separated) using the user-provided file name.

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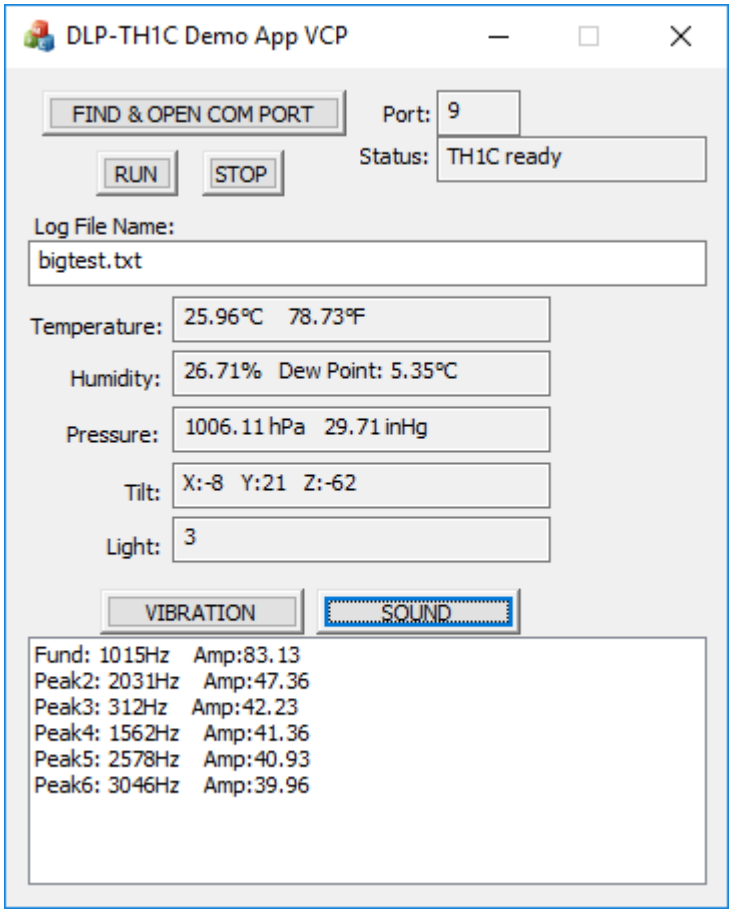

6.0 HOST COMMAND SET

COMMAND	MODE	COMMAND BYTE	COMMENTS
Ping	ASCII	‘ (0x27) (Apostrophe)	Returns “Ping OK” if the DLP-TH1C is found. A carriage return and line feed are appended to the ASCII string.
	Binary	0x22	Returns 0x5A if the DLP-TH1C is found.
Help	ASCII	?	ASCII mode only. Returns a list of ASCII commands to the terminal emulator.
Temperature	ASCII	t	Returns temperature in degrees C. Ex: Temp = 28.75°C. A carriage return and line feed are appended to the ASCII string.
	Binary	T (0x54)	Returns two bytes for temperature; MSB first. Bitwise OR the two bytes together and divide by 100.0 for temperature in degrees C.

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Humidity	ASCII	h	Returns humidity as a percentage. Ex: Humidity = 31.42%. A carriage return and line feed are appended to the ASCII string.
	Binary	H (0x48)	Returns three bytes for humidity; MSB first. Bitwise OR the three bytes together and divide by 1024.0 for humidity as a percentage.
Pressure	ASCII	p	Returns pressure in hPa. Ex: hPa = 957.49. A carriage return and line feed are appended to the ASCII string.
	Binary	P (0x50)	Returns four bytes for pressure; MSB first. Bitwise OR the four bytes together and divide by 25600.0 for pressure in hPa.
Tilt	ASCII	a	Returns three 8-bit values for X, Y and Z axis. Ex: X:-23 Y:42 Z:43 A carriage return and line feed are appended to the ASCII string.
	Binary	A (0x41)	Returns three binary bytes for X, Y, and Z axis.
Vibration X	ASCII	x	Returns the fundamental (peak-amplitude) frequency of vibration and five lower-amplitude peaks. (Note that lower-amplitude peaks can be above or below the fundamental.) For example: Fund: 195Hz Amp: 24.68 Peak2: 117Hz Amp: 22.42 Peak3: 507Hz Amp: 20.79 Peak4: 664Hz Amp: 18.78 Peak5: 800Hz Amp: 17.78 Peak6: 273Hz Amp: 17.17
	Binary	X (0x58)	Frequency: Returns two bytes for each frequency; MSB first. Bitwise OR these two bytes together for 16-bit frequency. Amplitude: Returns two bytes for each amplitude; MSB first. Bitwise OR the two bytes together and divide by 100.0 for a floating-point amplitude.
Vibration Y	ASCII	v	Same as Vibration X but for the Y axis.
	Binary	V (0x56)	Same as Vibration X but for the Y axis.
Vibration Z	ASCII	w	Same as Vibration X but for the Z axis.
	Binary	W (0x57)	Same as Vibration X but for the Z axis.

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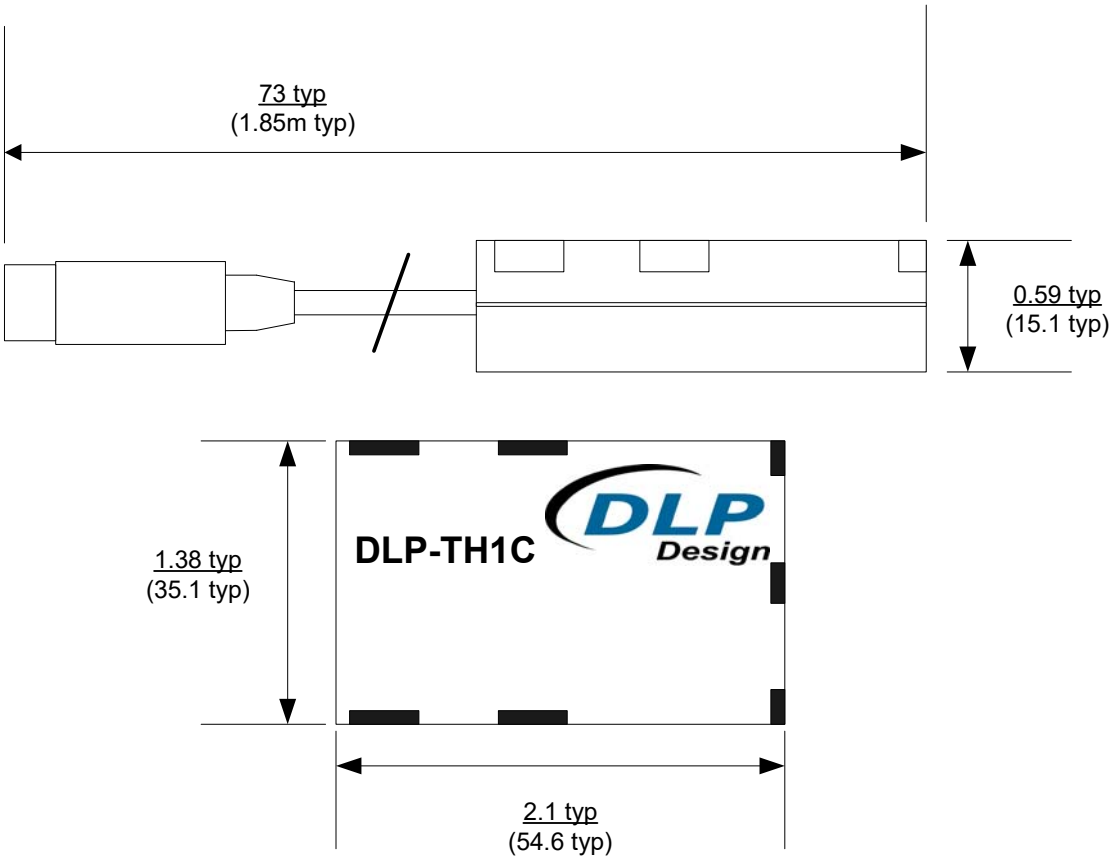
Light	ASCII	l	Returns the ambient light level as an 8-bit value. Ex: Light Level: 20. A carriage return and line feed are appended to the ASCII string.
	Binary	L (0x4C)	Returns a single binary byte for the light level.
Sound	ASCII	f	Returns the fundamental (peak-amplitude) frequency of ambient sound and five lower-amplitude peaks. (Note that lower-amplitude peaks can be above or below the fundamental.) For example: Fund: 1054Hz Amp: 73.30 Peak2: 2070Hz Amp: 45.89 Peak3: 273Hz Amp: 43.98 Peak4: 1445Hz Amp: 39.49 Peak5: 742Hz Amp: 37.69 Peak6: 1757Hz Amp: 36.83
	Binary	F (0x46)	Frequency: Returns two bytes for each frequency; MSB first. Bitwise OR these two bytes together for 16-bit frequency. Amplitude: Returns two bytes for each amplitude; MSB first. Bitwise OR the two bytes together and divide by 100.0 for the floating-point amplitude.
Sound (Broadband)	ASCII	b	Returns the broadband ambient sound level. Ex: Broadband: 33.73 A carriage return and line feed are appended to the ASCII string.
	Binary	B (0x42)	Returns two bytes for sound; MSB first. Bitwise OR the two bytes together and divide by 100.0 for the sound level.
Set 2G	ASCII	m	Returns “02G”
	Binary	0x6d	Returns 0x30, 0x32, 0x47
Set 4G	ASCII	n	Returns “04G”
	Binary	0x6E	Returns 0x30, 0x34, 0x47
Set 8G	ASCII	, (comma)	Returns “08G”
	Binary	0x2C	Returns 0x30, 0x38, 0x47
Set 16G	ASCII	. (period)	Returns “16G”
	Binary	0x2E	Returns 0x31, 0x36, 0x47

7.0 MECHANICAL DIMENSIONS IN INCHES (MM)



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9.0 CONTACT INFORMATION

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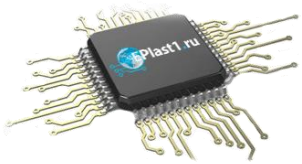

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