

## OVERVIEW

The Layad Circuits' SETH Gun or Serial Contactless Thermometer Gun is a UART interfaceable thermal reader designed mainly for human body temperature. The unit is similar to a regular non-contact thermal gun with the exception of having a serial UART interface via its wired headers. It is designed to be integrated into a larger system with a host microcontroller. As such, the power is also exposed with a pair of wired headers for an external 5V power source.



Figure 1: The SETH Gun

The readings are sent to the UART serial interface port real time while also showing the same on the LCD. A reading is initiated by either pressing the read button or by issuing a serial command to automatically take readings. This command is useful for applications that require no human intervention.

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This is a low cost solution when compared with sensors that offer contactless temperature readings for human body and surface temperatures with narrow field of views that is required for accurate human body temperature sensing. The ready-made enclosure, buttons and display adds to the ease of use and quick integration feature of the device.

## FEATURES

- Ready interface port for microcontrollers via UART serial interface at 5V logic.
  - 9600 baud rate, 8 databits, No parity, 1 stop bit
  - Simple serial text protocol
- Automatic or Manual triggering
- Accurate to  $\pm 0.2^{\circ}\text{C}$  in human body mode and  $\pm 0.3^{\circ}\text{C}$  in surface mode
- 1-3cm measurement distance
- Integrated casing, LCD readout and buttons
- Simple operation using a single manual trigger button or a single serial command
- 5V power and logic, Arduino compatible
- Low power consumption: <40mA in sleep and standby states, <200mA during conversions
- Fast conversion, typical 1-2 seconds, maximum 3 seconds
- Power saving feature
- Compact body dimension: 150x100x50mm

## APPLICATIONS

- Automatic temperature logger
- Remote or auto triggered thermometer
- Automated health screening
- Surface temperature monitoring
- IOT integrated thermometer
- Kiosk/self-service temperature readers

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Figure 2: SETH Gun with Wired Headers

### PIN FUNCTIONS

There are two sets of color codes for the wired header port of the device. Your unit should come in either one of them. Refer to the tables below.

#### Code 1: Brown-Red-Orange-Yellow

Wire Color	Function
Brown	GND: (-) Ground
Red	VCC: (+) 5Vdc power
Orange	TXD: Serial Transmit Pin. Connect to Receive pin of the host MCU.
Yellow	RXD: Serial Receive Pin. Connect to Transmit pin of the host MCU.

#### Code 2: Black-White-Gray-Violet

Wire Color	Function
Black	GND: (-) Ground
White	VCC: (+) 5V power
Gray	TXD: Serial Transmit Pin. Connect to Receive pin of the host MCU.
Violet	RXD: Serial Receive Pin. Connect to Transmit pin of the host MCU.

### POWER REQUIREMENTS

The unit should be powered from a regulated 5V power source that can reliably deliver up to a current of 200mA. We recommend using at  $\geq 500\text{mA}$ , 5V regulator such as

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the LM7805 or the 5V of your host Arduino if using one. Refer to the current consumption table below:

Device State	Current Consumption
Sleep state, LCD is off	Less than 30mA
Idle state, LCD is on	Less than 50mA
Peak current while in active operation	200mA

### USER BUTTONS

The user buttons and their functions are described in the table below.

User Button	Character Sent when Pressed
Read	For reading temperature or for menu operation
Set	Menu operation
Plus (+)	Menu operation or for displaying historical readings
Minus (-)	Menu operation or for displaying historical readings

### DEVICE OPERATION

#### 1. Manual Triggering

- Aim at the target ensuring that the sensor is 1-3cm away and perpendicular to the target surface/skin.
- Press the read button and maintain position until reading is confirmed
- A beep is generated indicating a conversion
- Data is transmitted to the serial port

#### 2. Serial Command Triggering

- Before use, ensure sensor is 1-3cm away and perpendicular to the target for the duration of the conversion.

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- Host MCU sends the serial command (refer to Serial Command Reference Section)
- A beep is generated indicating a conversion
- Data is transmitted to the serial port

### PRECAUTIONS

- This device is meant for educational purposes only and cannot be used for life support, medical or mission critical applications
- Before reading, the device must be in the environment where it shall be used at least 5 minutes prior usage to assimilate the device with the ambient temperature.
- Hair, sweat, dirt and presence of air conditioning, fan or heating devices can affect readings.
- It is recommended to read at the forehead or behind the ear.
- Do not touch sensor.
- Disinfect the outside of the thermometer with 70% alcohol regularly
- Allow for some differences in readings affected by skin color and thickness.
- Use level shifters when using 3.3V microcontrollers to safely connect the device to your host controller.
- The unit is NOT waterproof. Store in a dry place.
- Avoid direct sunlight

### MENU OPERATION

The device has a builtin menu system that is accessible from the buttons and display LCD. **Other than the target type menu (body vs surface), all other settings in the menu does not affect the serial data.** High temperature thresholds are not indicated in the serial data nor does the temperature unit (°C/°F) affect the actual serial output. Note that the temperature readings read from the serial port are always in Celsius.

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### Setting the measurement type

- In the start up state, short press the set button to switch between body temperature and object surface temperature measurement mode.
- Body temperature range: 32 – 42.9 °C
- Object temperature range: 0-60°C

### Other settings

- Long press the Set button
- Cycle through F1 to F4 function menu by short pressing the set button. Release to enter that function menu
- Use the +/- button to select the option
- Long press the read button to exit the menu
- Power cycle

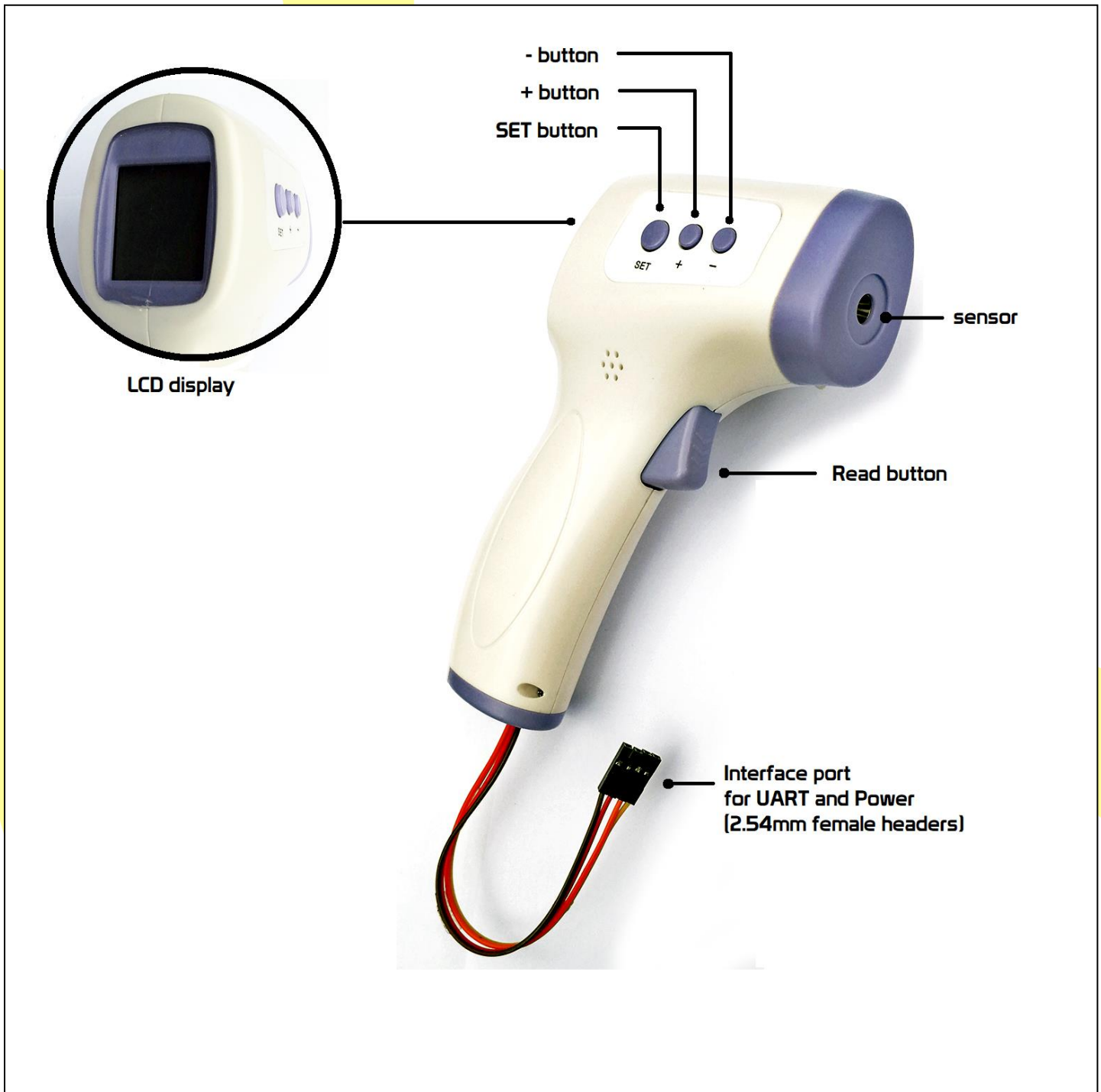
Function Menu	Options
F1	Temperature unit: degree Celsius or Fahrenheit (°C/°F)
F2	Enable/Disable the buzzer sound
F3	High fever threshold – use the +/- button to set the temperature considered as high fever
F4	Enable/Disble the LCD backlight

### DEVICE LAYOUT

Figure3: SETH Gun Layout

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**HISTORY VIEW**



- The device can store the last 32 most recent readings. Older readings beyond 32 are discarded.
- History is cleared on power cycle.
- Values can be accessed from the menu using the – button and viewed from the LCD.
- Memory location 1 is the latest reading

### SERIAL COMMANDS REFERENCE

Name	Temperature						
Description	This message is sent out by the device to the serial port in response to a read temperature command or when the read button was pressed.						
Direction	Device to host						
Syntax	@,<nn.n>,<t>,#\r\n						
Parameter/s	<p>&lt;nn.n&gt; is the temperature in degrees Celsius.            &lt;t&gt; is the type of the target, which can be any of the following:</p> <table border="1"> <thead> <tr> <th>Target Type</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>B</td> <td>Human body</td> </tr> <tr> <td>S</td> <td>Surface</td> </tr> </tbody> </table> <p>The type of the target is configured thru the menu.</p>	Target Type	Description	B	Human body	S	Surface
Target Type	Description						
B	Human body						
S	Surface						
Notes	<ul style="list-style-type: none"> <li>• The temperature reading from the serial port is always in degree Celsius and is unaffected by the display unit configured in the function menu.</li> <li>• This response is typically issued after around 1 second from the last Read Temperature command or last press of the read button. However, external factors may affect the conversion time and may extend up to around 3 seconds. In the rare case that there be no response after more than 3 seconds, consider re-issuing the command.</li> </ul>						
Example	@,36.5,B,# <CR> <NL>						

Name	Read Temperature
Description	This command triggers a temperature read. This command is sent by the host to the device.
Direction	Host to device
Syntax	@,r,#
	@,R,#
Response	@,<nn.n>,<t>,#\r\n if the command was successfully executed (see Temperature message).
Notes	The device might take up to 3 seconds to reply with a reading.  This command must be sent only when the device is idle (not being operated thru the user buttons).
Example	<code>Serial.print(F("@,r,#"));</code> // or <code>Serial.print(F("@,R,#"));</code>

#### ARDUINO REFERENCE EXAMPLE

This demo prints the temperature readings on the Serial Monitor of the Arduino IDE. Also, a temperature read can be triggered by sending the correct command thru the Serial Monitor.

#### Setup procedure:

1. Connect pin 10 of the Arduino Uno to pin TX of the Seth Gun.
2. Connect pin 11 of the Arduino Uno to pin RX of the Seth Gun.
3. Connect a GND pin of the Arduino Uno to a GND pin of the Seth Gun.
4. Compile and upload this demo to the Arduino Uno.
5. Remove then apply power from and to the Arduino Uno and the Seth Gun at the same time.
6. Open the Serial Monitor at 9600 baud to see the results.

#### Wiring:

Arduino Uno	SETH Gun
5V	VCC (red or white)
GND	GND (brown or black)
10	TX (orange or gray)
11	RX (yellow or violet)

**Code:**

```

/*****
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*****/

#include <SoftwareSerial.h>
const uint8_t PIN_OU_LED_HB = 13;
SoftwareSerial mySerial(10, 11); // RX, TX

void ou_hbLed(){
  static uint32_t tRef;
  if(millis() - tRef < 500) return;
  tRef = millis();
  digitalWrite(PIN_OU_LED_HB, !digitalRead(PIN_OU_LED_HB));
}

void setup() {
  pinMode(PIN_OU_LED_HB, OUTPUT);
  Serial.begin(9600);
  mySerial.begin(9600);
}

void loop() { // run over and over
  if (mySerial.available()) {
    Serial.write(mySerial.read());
  }
  if (Serial.available()) {
    mySerial.write(Serial.read());
  }
  ou_hbLed();
}

```

**ORDERING INFORMATION**

Ordering Code	Description	Revision
LC-069	Seth Gun	v.1.0.0

**TECHNICAL SPECIFICATIONS**

Parameter	Minimum Value	Typical Value	Maximum Value
Supply Voltage		5 Vdc	
Typical Current Draw		20-40mA	200mA
Measurement Distance	1 cm		3 cm
Length		150 mm	
Width		100 mm	
Thickness		40 mm	
Conversion Time		1 - 2 sec	3 sec
LCD power saving feature timeout	10 sec		20 sec
Operating Environment Ambient Temperature	10 C		35 C
Operating Environment Relative Humidity			85 %
Operating Environment Atmospheric Pressure	70 kPa		106 kPa

**DOCUMENT REVISION HISTORY**

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