OVERVIEW

The LC-075 Smart Keypad Adapter module simplifies the use of 3x4 or 4x4 dome keypad matrix modules with microcontrollers or SBCs like Arduino and Raspberry Pi. The LC-075 is designed to achieve 3 important results:

1. Reduce pin usage from 7-8 pins to 1-2 pins
2. Simplify programming with analog voltage output, I2C or UART("Serial") outputs
3. Reduce code footprint – no libraries required.

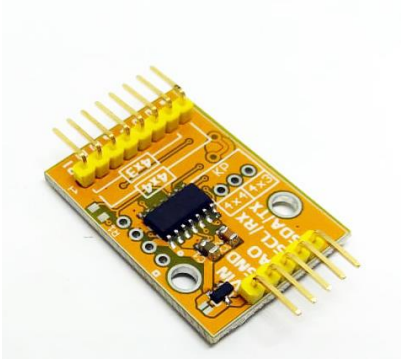

Figure 1: The LC-075 Smart Keypad Adapter module

FEATURES

- 3.3-5V input power and logic operation
- Only 1 or 2 pins required from host
- 3 outputs: Analog Voltage, I2C and UART (Serial)
- Reverse polarity protection
- Low power consumption < 30mA
- Simple programming – no library required
- Compatible with Arduino/Raspberry Pi

PIN FUNCTIONS

The module has a 4 pin 2.54mm pitched header with the following functions.

Pin Label	Function/Operation/Remarks
VCC	3.3Vdc to 5Vdc power input pin.
GND	Ground pin.
A0	0-2.5V analog voltage output pin. The output voltage corresponds to key pressed and is distributed equally throughout the range.
SCL/RX	Shared pin with I2C SCL and UART receive signal. See SELECTING I2C OR UART MODE Section. In UART mode, this pin is reserved for the future.
SDA/TX	Shared pin with I2C SDA and UART transmit. See SELECTING I2C OR UART MODE Section.

SELECTING I2C OR UART MODE

1. Remove power.
2. Insert a 3x4 or 4x4 matrix keypad in the assigned pin header
3. Press and hold the *** and 4** key for UART/"Serial" mode or *** and 1** for I2C mode
4. Apply power while still holding the key combination selected.
5. After one second, from power up, release the keys.
6. Power cycle or reset the host microcontroller
7. Done. Test to confirm. Repeat if operation failed.

KEYPAD INSTALLATION

Follow indicated installation area labelled on the board. 4x3 keypads are installed between R1 and C3 pins and facing up. While 4x4 keypads are installed between R1 and C4 and also facing up. See figure 2 for details.

Layad Circuits Electronics Engineering Supplies & Services, B314 Lopez Bldg., Session Rd. cor. Assumption Rd., Baguio City, Philippines
General inquiries: info@layadcircuits.com Sales: sales@layadcircuits.com FB: facebook.com/layadcircuits Mobile: +639164428565

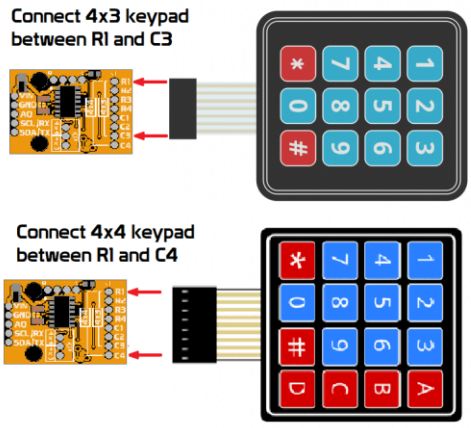

Figure 2: 4x3 and 4x4 keypad installation

PIN USAGE

The table below shows the pin requirements for each output mode:

Output Mode	Pin Requirement
Analog Voltage Output	One analog pin. Raspberry Pi users should use I2C or UART instead or use an external ADC module to use this pin
I2C Output	Two I2C pins required – SDA and SCL pins
UART/"Serial" Output	One UART receive pin required. This connects to the TX pin of the LC-075 board. The RX pin of the LC-075 need not be connected.

APPLICATION NOTES

The LC-075 can be interfaced to an Arduino board using any of the 3 available outputs discussed below. The code examples demonstrate the very basic usage of the device and are intended for a quick test of the capabilities or of the product. For practical examples, please contact us or search through our Github page.

Analog Output

The pin AO outputs a voltage that corresponds to the keypresses. Releasing the key will pull the AO pin to 0V. The table below summarizes the output voltage to be expected along with values expected from a 10-bit ADC board such as the Arduino Uno / Nano / Mega / ProMini / Leonardo and other boards. The table is for reference only there may be slight deviations in each board.

Keypad Key	Approximate AO Output Voltage (V)	Arduino ADC Value (5V reference)
No key	0 – 0.05	0 -10
1	0.16 ±0.05	32 ±10
2	0.32 ±0.05	63 ±10
3	0.48 ±0.05	93 ±10
4	0.64 ±0.05	123 ±10
5	0.80 ±0.05	154 ±10
6	0.96 ±0.05	184±10
7	1.12 ±0.05	216 ±10
8	1.28 ±0.05	247 ±10
9	1.44 ±0.05	277 ±10
*	1.60 ±0.05	308 ±10
0	1.76 ±0.05	339 ±10
#	1.92 ±0.05	370 ±10
A	2.08 ±0.05	401 ±10
B	2.24 ±0.05	432 ±10
C	2.40 ±0.05	463 ±10
D	2.50 – 2.55	492 ±10

Circuit

Layad Circuits Electronics Engineering Supplies & Services, B314 Lopez Bldg., Session Rd. cor. Assumption Rd., Baguio City, Philippines
General inquiries: info@layadcircuits.com Sales: sales@layadcircuits.com FB: facebook.com/layadcircuits Mobile: +639164428565

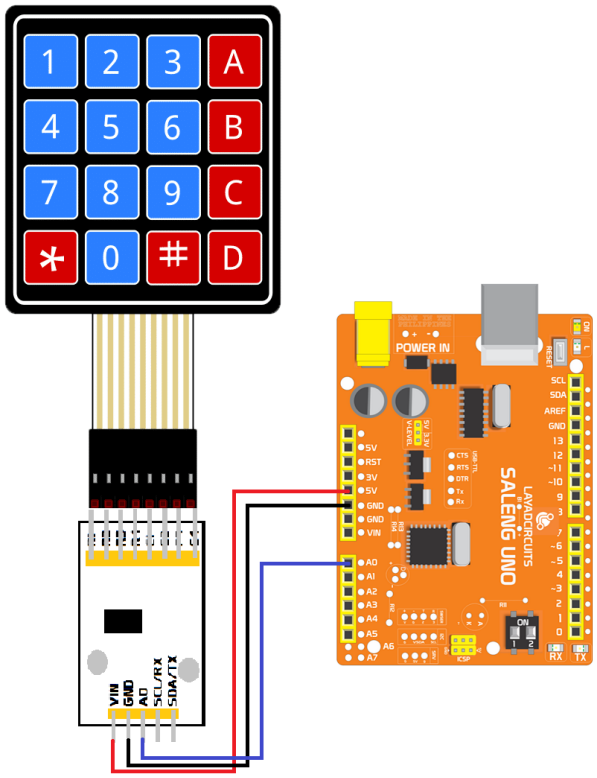

Figure 4 Analog Circuit

Arduino Analog Voltage example

```
void setup() {
  Serial.begin(9600);
}

void loop() {
  int val = analogRead(A0);
  if (val>(32-10)&&val<(32+10)){
    Serial.println("1");
  }
  else if (val>(63-10)&&val<(63+10)){
    Serial.println("2");
  }
  else if (val>(93-10)&&val<(93+10)){
    Serial.println("3");
  }
  else if (val>(123-10)&&val<(123+10)){
    Serial.println("4");
  }
  else if (val>(154-10)&&val<(154+10)){
    Serial.println("5");
  }
  else if (val>(184-10)&&val<(184+10)){
    Serial.println("6");
  }
  else if (val>(216-10)&&val<(216+10)){
    Serial.println("7");
  }
  else if (val>(247-10)&&val<(247+10)){
    Serial.println("8");
  }
  else if (val>(277-10)&&val<(277+10)){
    Serial.println("9");
  }
  else if (val>(308-10)&&val<(308+10)){
    Serial.println("*");
  }
  else if (val>(339-10)&&val<(339+10)){
    Serial.println("0");
  }
  else if (val>(370-10)&&val<(370+10)){
    Serial.println("#");
  }
  else if (val>(401-10)&&val<(401+10)){
    Serial.println("A");
  }
  else if (val>(432-10)&&val<(432+10)){
    Serial.println("B");
  }
  else if (val>(463-10)&&val<(463+10)){
    Serial.println("C");
  }
  else if (val>(492-10)&&val<(492+10)){
    Serial.println("D");
  }
}
```

I2C Mode

The I2C address is 0x50. There is only one data byte corresponding to the key pressed. If no key is pressed, 0x00 is received. When a key is on hold, the data remains while a key is on hold. Therefore, the host must implement a form of polling method to monitor key changes.

Layad Circuits Electronics Engineering Supplies & Services, B314 Lopez Bldg., Session Rd. cor. Assumption Rd., Baguio City, Philippines
General inquiries: info@layadcircuits.com Sales: sales@layadcircuits.com FB: facebook.com/layadcircuits Mobile: +639164428565

Circuit

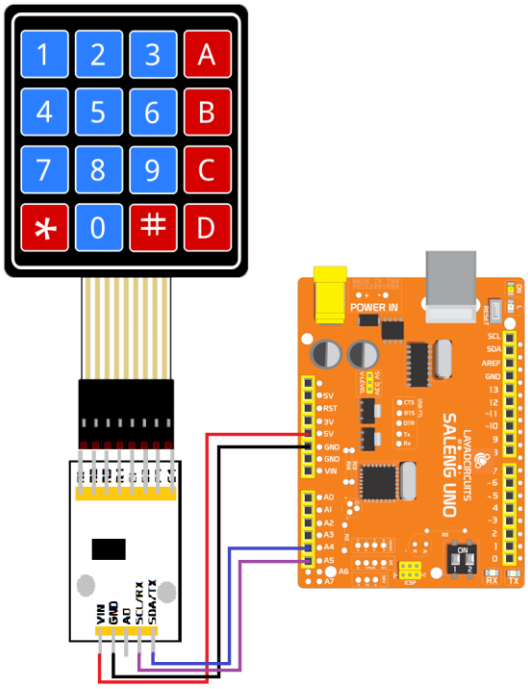

Figure 2 I2C Circuit

Arduino I2Cexample

The example below uses the I2C pins of the LC-075 with a host Arduino to poll for the key every 1ms. The key pressed is printed on the serial monitor set to 9600 baud.

```
#include <Wire.h>

void setup() {
  Wire.begin();
  Serial.begin(9600);
}

void loop() {
  Wire.requestFrom(0x50, 1);
  while (Wire.available()) {
    char c = Wire.read();
    Serial.print(c);
  }
  delay(1);
}
```

UART / "Serial" Mode

The output is a single character at 9600 baud rate. The received data is the key pressed. Example, if key 8 is pressed, expect the character '8' (0x38). As long as the key is pressed the UART also sends the data.

Circuit

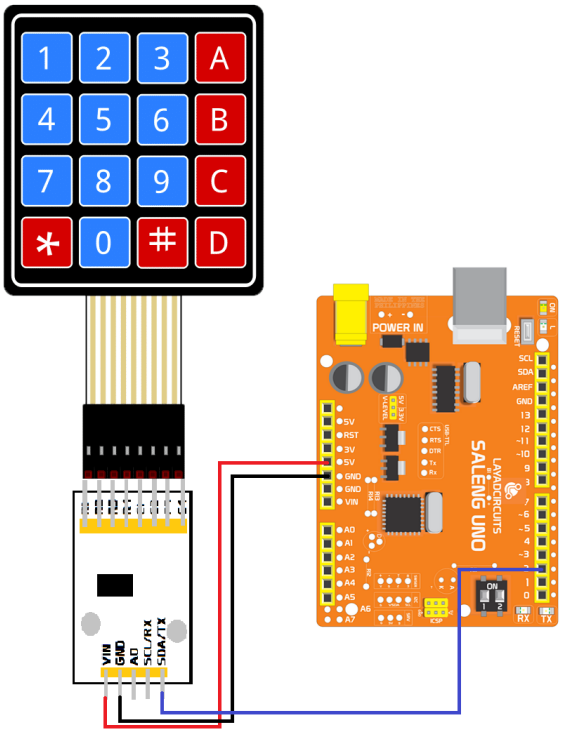

Figure 3 UART Circuit

Arduino Serial example

The example below uses the Arduino's software serial port as interface to the LC-075. You may also use hardware serial.

Layad Circuits Electronics Engineering Supplies & Services, B314 Lopez Bldg., Session Rd. cor. Assumption Rd., Baguio City, Philippines
General inquiries: info@layadcircuits.com Sales: sales@layadcircuits.com FB: facebook.com/layadcircuits Mobile: +639164428565

```
#include <SoftwareSerial.h>

SoftwareSerial mySerial(2, 3); // RX, TX

void setup() {
  Serial.begin(9600);
  mySerial.begin(9600);
}

void loop() {
  if (mySerial.available()) {
    char c = mySerial.read();
    Serial.println(c);
  }
}
```


Layad Circuits Electronics Engineering Supplies & Services, B314 Lopez Bldg., Session Rd. cor. Assumption Rd., Baguio City, Philippines
General inquiries: info@layadcircuits.com Sales: sales@layadcircuits.com FB: facebook.com/layadcircuits Mobile: +639164428565

DOCUMENT REVISION HISTORY

Revision:

v1.0.1 / 28 Aug 2021 / EABinayan / CDMalecdan

IMPORTANT NOTICE

Layad Circuits Electronics Engineering Supplies & Services (Layad Circuits) reserves the right to make corrections, enhancements, improvements and other changes to its products, services and documentations, and to discontinue any product or service. Buyers or clients should obtain the latest relevant information before placing orders and should verify that such information is current and complete. Additional terms may apply to the use or sale of Layad Circuits products and services.

Reproduction of significant portions of Layad Circuits information in Layad Circuits datasheets or user guides is permissible only if reproduction is without alteration, displays the Layad Circuits logo and is accompanied by all associated warranties, conditions, limitations, and notices. Layad Circuits is not responsible or liable for such reproduced documentation. Information of third parties may be subject to additional restrictions. Resale of Layad Circuits products or services with statements different from or beyond the parameters stated by Layad Circuits for that product or service voids all express and any implied warranties for the associated Layad Circuits product or service. Layad Circuits is not responsible or liable for any such statements.

Buyers and others who are developing systems that incorporate Layad Circuits products (collectively, “Designers”) understand and agree that Designers remain responsible for using their independent analysis, evaluation and judgment in designing their applications and that Designers have full and exclusive responsibility to assure the safety of Designers' applications and compliance of their applications (and of all Layad Circuits products used in or for Designers’ applications) with all applicable regulations, laws and other applicable requirements. Designer represents that, with respect to their applications, Designer has all the necessary expertise to create and implement safeguards that (1) anticipate dangerous consequences of failures, (2) monitor failures and their consequences, and (3) lessen the likelihood of failures that might cause harm and take appropriate actions. Designer agrees that prior to using or distributing any applications that include Layad Circuits products, Designer will thoroughly test such applications and the functionality of such Layad Circuits products as used in such applications. Layad Circuits’ provision of technical, application or other design advice, quality characterization, reliability data or other services or information, including, but not limited to, reference designs and materials relating to evaluation modules, (collectively, “Layad Circuits Resources”) are intended to assist designers who are developing applications that incorporate Layad Circuits products; by downloading, accessing or using Layad Circuits Resources in any way, Designer (individually or, if Designer is acting on behalf of a company, Designer’s company) agrees to use any particular Layad Circuits Resource solely for this purpose and subject to the terms of this Notice.

Layad Circuits' provision of Layad Circuits Resources does not expand or otherwise alter Layad Circuits’ applicable published warranties or warranty disclaimers for Layad Circuits products, and no additional obligations or liabilities arise from Layad Circuits providing such Layad Circuits Resources.

Layad Circuits reserves the right to make corrections, enhancements, improvements and other changes to its Layad Circuits Resources. Layad Circuits has not conducted any testing other than that specifically described in the published documentation for a particular Layad Circuits Resource.

NO OTHER LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE TO ANY OTHER LAYAD CIRCUITS INTELLECTUAL PROPERTY RIGHT, AND NO LICENSE TO ANY TECHNOLOGY OR INTELLECTUAL PROPERTY RIGHT OF LAYAD CIRCUITS OR ANY THIRD PARTY IS GRANTED HEREIN, including but not limited to any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which Layad Circuits products or services are used. Information regarding or referencing third-party products or services does not constitute a license to use such products or services, or a warranty or endorsement thereof. Use of Layad Circuits Resources may require a license from a third party under the patents or other intellectual property of the third party, or a license from Layad Circuits under the patents or other intellectual property of Layad Circuits. Layad Circuits RESOURCES ARE PROVIDED “AS IS” AND WITH ALL FAULTS. LAYAD CIRCUITS DISCLAIMS ALL OTHER WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, REGARDING RESOURCES OR USE THEREOF, INCLUDING BUT NOT LIMITED TO ACCURACY OR COMPLETENESS, TITLE, ANY EPIDEMIC FAILURE WARRANTY AND ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF ANY THIRD PARTY INTELLECTUAL PROPERTY RIGHTS. LAYAD CIRCUITS SHALL NOT BE LIABLE FOR AND SHALL NOT DEFEND OR INDEMNIFY DESIGNER AGAINST ANY CLAIM, INCLUDING BUT NOT LIMITED TO ANY INFRINGEMENT CLAIM THAT RELATES TO OR IS BASED ON ANY COMBINATION OF PRODUCTS EVEN IF DESCRIBED IN LAYAD CIRCUITS RESOURCES OR OTHERWISE. IN NO EVENT SHALL LAYAD CIRCUITS BE LIABLE FOR ANY ACTUAL, DIRECT, SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF LAYAD CIRCUITS RESOURCES OR USE THEREOF, AND REGARDLESS OF WHETHER LAYAD CIRCUITS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. Unless Layad Circuits has explicitly designated an individual product as meeting the requirements of a particular industry standard, Layad Circuits is not responsible for any failure to meet such industry standard requirements. Where Layad Circuits specifically promotes products as facilitating functional safety or as compliant with industry functional safety standards, such products are intended to help enable customers to design and create their own applications that meet applicable functional safety standards and requirements. Using products in an application does not by itself establish any safety features in the application. Designers must ensure compliance with safety-related requirements and standards applicable to their applications. Designer may NOT use any Layad Circuits products in life-critical applications. Life-critical medical equipment is medical equipment where failure of such equipment would cause serious bodily injury or death (e.g., life support, pacemakers, defibrillators, heart pumps, neurostimulators, and implantables). Designers agree that it has the necessary expertise to select the product with the appropriate qualification designation for their applications and that proper product selection is at Designers’ own risk. Designers are solely responsible for compliance with all legal and regulatory requirements in connection with such selection. Designer will fully indemnify Layad Circuits and its representatives against any damages, costs, losses, and/or liabilities arising out of Designer’s noncompliance with the terms and provisions of this Notice.

Layad Circuits Electronics Engineering Supplies & Services, B314 Lopez Bldg., Session Rd. cor. Assumption Rd., Baguio City, Philippines
General inquiries: info@layadcircuits.com Sales: sales@layadcircuits.com FB: facebook.com/layadcircuits Mobile: +639164428565

Layad Circuits Electronics Engineering Supplies & Services, B314 Lopez Bldg., Session Rd. cor. Assumption Rd., Baguio City, Philippines
General inquiries: info@layadcircuits.com Sales: sales@layadcircuits.com FB: facebook.com/layadcircuits Mobile: +639164428565