

OVERVIEW

The LC-018 Kimat Mobile Robot Shield is a compact, Arduino – Compatible, motor driver shield for 2 DC motors and with pin headers for IR sensors, Ultrasonic sensors and a Servo motor. The motor driver has 2 individual channels and can accommodate a 2- or 4-wheeled robot. Each channel can deliver up to 1.2A per channel.

This shield was designed with ease of use in mind: all the essential parts of a mobile robot have been assigned a connector onboard the shield, thereby eliminating the need for another PCB, breadboard or “Sensor Shield”. This greatly simplifies wiring, eliminates the need for soldering and solves electrical connection issues. The LC-018 is designed and made by Layad Circuits Electronics Engineering as part of its Kimat series of rapid prototyping products.



The LC-018 Kimat MoBot Shield Mark 3

FEATURE HIGHLIGHTS

- Integrated motor driver and connectors for a maximum of 5 IR sensors and maximum of 3 Ultrasonic Sensors and 1 Servo motor.
- Motor Driver: two parallel L293D channels per motor terminal
- Number of Channels: 2
- Recommended Max. Motor Voltage = 12V

- Max. Current per Channel = around 1.2A
- Max. Surge Current per Channel = around 2.4A
- Arduino Compatible

PIN ASSIGNMENTS

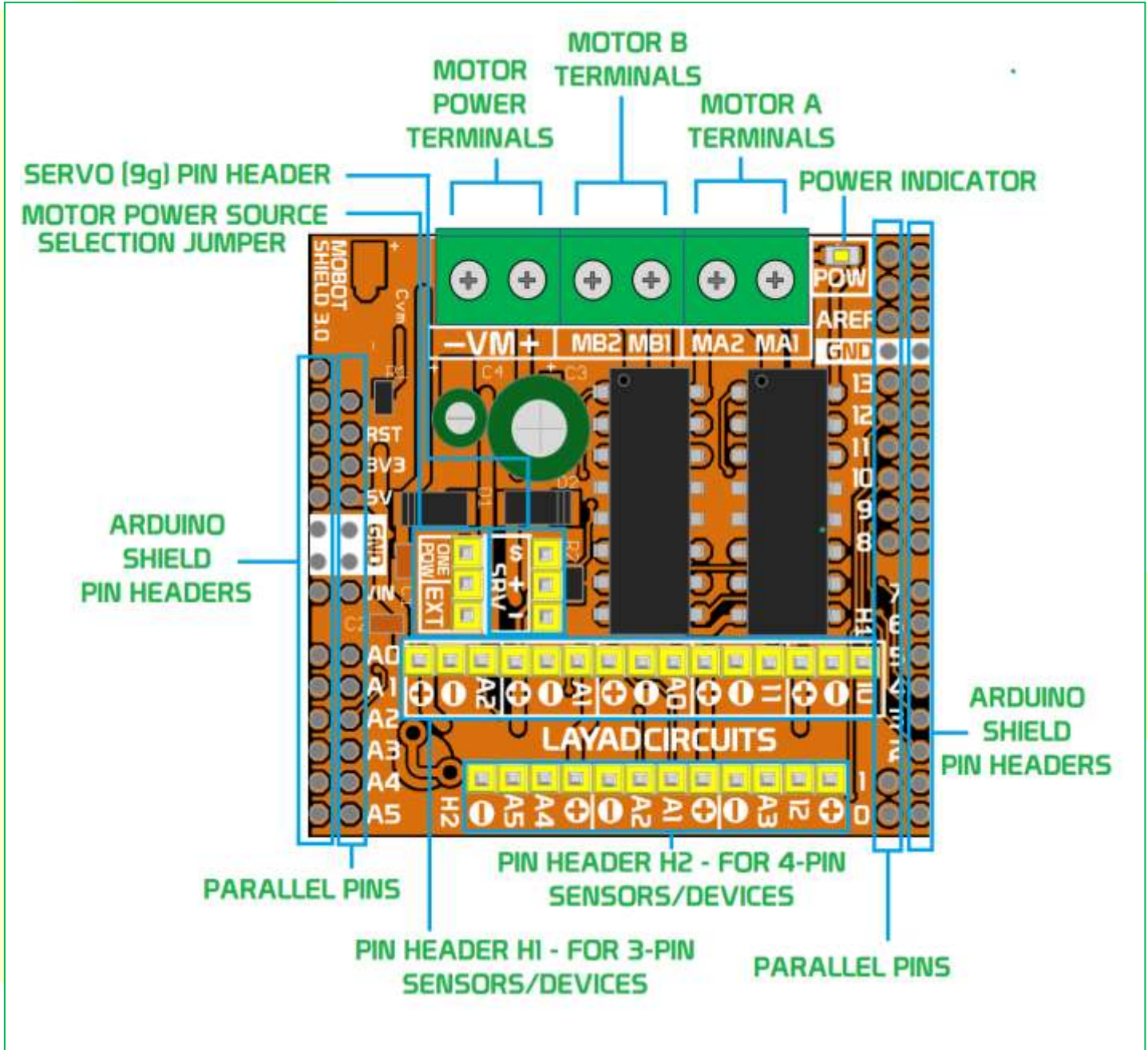
| LC-018 Shield Label | Description | Arduino Pin |
|---------------------|--|-------------|
| - | EN of L293D for motor A. Not available for other purposes | 3 |
| - | IN1 of L293D for motor A. Not available for other purposes | 2 |
| - | IN2 of L293D for motor A. Not available for other purposes | 4 |
| - | EN of L293D for motor B. Not available for other purposes | 6 |
| - | IN1 of L293D for motor B. Not available for other purposes | 7 |
| - | IN2 of L293D for motor B. Not available for other purposes | 5 |
| “8” | unused | 8 |
| “5” and “9” | servo signal, if used | 9 |
| “10” | For sensors/external devices, also found on header H1 | 10 |
| “11” | For sensors/external devices, also found on header H1 | 11 |
| “12” | For sensors/external devices, also found on header H1 & H2 | 12 |
| “A0” | For sensors/external devices, also found on header H1 | A0 |
| “A1” | For sensors/external devices, also found on header H1 & H2 | A1 |
| “A2” | For sensors/external devices, also found on header H1 & H2 | A2 |
| “A3” | For sensors/external devices, also found on header H2 | A3 |
| “A4” | For sensors/external devices, also found on header H2 | A4 |
| “A5” | For sensors/external devices, also found on header H2 | A5 |
| “0” | unused | D0 |
| “1” | unused | D1 |
| “13” | unused | D13 |
| ⊕ | 5V pin of the Arduino | 5V |
| ⊖ | Ground | GND |
| “- VM+” | Motor Power Terminals | - |
| “MA1” | OUT1 of L293D for motor A | - |
| “MA2” | OUT2 of L293D for motor A | - |
| “MB1” | OUT1 of L293D for motor B | - |
| “MB2” | OUT2 of L293D for motor B | - |

www.layadcircuits.com

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](https://www.facebook.com/layadcircuits) Mobile: +639164428565

An IMPORTANT NOTICE: at the end of this guide addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers.

SHIELD LAYOUT



MOTOR DRIVER PINS

The Arduino pins 2-7 are permanently connected to the L293D motor driver chips and are not available for other use. All other Arduino GPIO pins may optionally be used for external devices such as sensors and communications modules.

- Pins 3 (PWMA) and 6(PWMB) are the pins used to control the speed of the motors. Applying PWM signals via `analogWrite()` on pins 3 and 6 controls the speed of the motors. If speed control is not needed, simply set pins 3 and 6 HIGH using `digitalWrite()` to keep the motors at full speed.
- Pins 2 and 4 control the direction of motor(s) A while pins 5 and 7 control the direction of motor(s) B. Follow the table below:

| xIN1 (pins 2/5) | xIN2 (pins4/7) | Motor Reaction |
|--------------------|-------------------|----------------------------|
| LOW | HIGH | Move in One Direction |
| HIGH | LOW | Move in Opposite Direction |
| LOW | LOW | Motor Stops |
| HIGH | HIGH | Short Break, Motor Stops |

TERMINAL BLOCKS

The screw terminals labelled **-VM+** is for the motor power when the EXT (not One POW) option is selected. The voltage applied will depend on the requirements of your motor. It is recommended to limit the power applied to this terminal at 12V. The absolute limit is 24V. However, >12V is not recommended and care should be taken when using higher voltages as this approaches the maximum limit.

Ensure that the negative wire goes to the “-” terminal and positive to the “+” terminal.

The screw terminals labelled MA1 and MA2 are for the terminals of motor A. MB1 and MB2 are for motor B.

| Terminal Block Label | Purpose |
|-------------------------|---|
| “-VM+” or “MOTOR POWER” | This is the power source of the motors. If the single source jumper is installed, the motor power is derived from the VIN pin of the Arduino/Shield |
| “MA1 MA2” or “MOTOR A” | Connector for DC Motor A |
| “MB1 MB2” or “MOTOR B” | Connector for DC Motor B |

ARDUINO SHIELD PIN HEADERS

These pins headers are at the bottom of the PCB and is arranged to interface directly with Arduino R3 boards such as Arduino Uno, Arduino Mega, Arduino Leonardo and the like.

PARALLEL PIN HEADERS

The parallel pin header slots that are beside the shield pin headers are provided for additional connection points when those pins are needed. The slots are connected to the shield pins beside them. Pins 2-7 does not have parallel slots as these pins cannot be used for other purposes other than for the motor driver chips.

PIN HEADER H1

H1 is a 15-pin connector arranged in 5 groups of 3 pins. Each group of 3 pins has one pin connected to an Arduino GPIO pin, another pin labeled as \ominus is connected to ground and the other pin labeled \oplus is connected to the 5V pin of the Arduino.

Each group of pins is meant for 3-pin devices such as IR sensors, temperature sensors, potentiometers and others.

Line tracing sensors and IR distance sensors will typically be connected in this header.

www.layadcircuits.com

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

An IMPORTANT NOTICE: at the end of this guide addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers.

PIN HEADER H2

H2 is a 12-pin connector arranged in 3 groups of 4 pins. Each group of 4 pins has two pins connected to Arduino GPIO pins, another pin labeled as \ominus is connected to ground and the other pin labeled \oplus is connected to the 5V pin of the Arduino.

Each group of pins is meant for 4-pin devices such as ultrasonic sensors, Bluetooth modules, wifi modules, RF modules, LCD displays and others.

SERVO PIN HEADER

The 3-pin header labeled SRV is for the connection of a small servo motors such as a 9g micro servo motor. Note that the servo motor power pin is connected to the 5V pin of the Arduino, hence, larger motors should not be powered from this header.

SINGLE POWER SOURCE OPTION

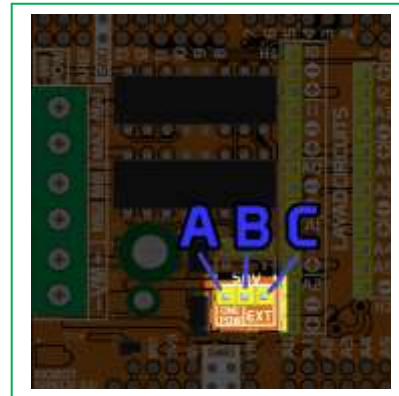
The Mobile Robot Shield has a pin header labeled “ONE POW / EXT” with a microjumper provided.

This is shown in the figure below:



If the micro jumper is installed between the middle pin and the ONE PWR pin (pins A and B), the Arduino VIN pin and the Motor Power Supply are connected via a diode. This simplifies wiring since the user only need to

apply power at the Arduino DC Jack. The same power is then transferred to the shield via the VIN pin. The only limitation is that the total power flowing through the DC jack of the Arduino should be within 1A.



If the micro jumper is installed between the middle pin and EXT pin (pins B and C), apply power to the motors via the terminal blocks labeled VM / MOTOR POWER. This will separate the power source for the motors and the Arduino. This is ideal when the voltage or current requirements of the motors exceed that of the Arduino.

When using the single power source option (ONE PWR), please take note of the following

- **When micro jumper is installed at the ONE PWR side, DO NOT connect anything in the VM terminals.** Motor power is taken from Vin pin of the Arduino.
- **If external power source is desired, set the microjumper to the EXT position first.**
- Motor voltage must match Arduino Voltage (6-12V) when using ONE PWR option
- There is a 1A power diode between the DC jack and VIN pin of the Arduino. This can take in larger surge current but make sure your motors and Arduino do not exceed 1A continuous current. This is not a problem if using the Saleng Uno. The Saleng Uno uses a 5A diode instead of 1A and hence is able to handle small and large motors and other circuits.
- While the Arduino board will have a circuit to handle when both DC Jack and USB are

www.layadcircuits.com

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

An IMPORTANT NOTICE: at the end of this guide addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers.

Copyright 2023 © Layad Circuits All Rights Reserved

powered, it is always safer to perform the programming with the DC jack disconnected or battery power turned off

MOTOR POWER CAPACITOR SLOT

If for some reason you need to add additional large capacitor at the motor power source line, there is a slot ready made for this close to the Motor Power terminal block.



Capacitor slot for the motor power line

FREQUENTLY ASKED QUESTIONS:

Q: My motors turn in just one direction, what is wrong?

A: Your power source may be unable to provide sufficient current during sudden direction changes or the some shield pins do not have secure contact with the Arduino Headers. Follow these tips:

- Use a power source with sufficient current
- Add delays in between direction changes to give time for power to stabilize
- Add a large capacitor at the VM terminals. You may directly connect it at the VM terminal block
- Detach and the re-attach the shield into the Arduino headers. Ensure they are connected all the way through

Q: My motors hum but do not rotate?

A: If you are performing PWM speed control via PWMA or PWMB, try to increase your speed (duty cycle). A low duty cycle may not have enough power to keep the motor running.

Q: What is the recommended powering option between the “ONE PWR” and “EXT” option?

A: We recommend using the EXT option. This will require your though to apply power at the DC jack of your Arduino and VM terminals. The power can be from the same source.

www.layadcircuits.com

Copyright 2023 © Layad Circuits All Rights Reserved
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

An IMPORTANT NOTICE: at the end of this guide addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers.

Q: When the microjumper is installed at the ONE PWR side of header H1, do I need power for both Arduino and Shield?

A: NO! You MUST use only one power source when the micro jumper is installed at the ONE PWR position. Apply a voltage acceptable to both Arduino and motors via the Arduino DC Jack. Note that a 1A diode is in between the Arduino's DC jack and VIN pin where the motors are powered from. This diode may be damaged if the total current drawn by the motors and Arduino exceeds this 1A rating. This is not a problem in the Saleng Uno which has a 5A diode instead of 1A.

Q: If the microjumper is at the EXT position, how do I power the shield and Arduino?

A: Power Must be applied separately at the VM terminals for the motor and at the Arduino DC jack for the Arduino. Power maybe from the same battery pack if it conforms to the limits of both motors and Arduino but must be applied at the 2 separate connectors. This means the Arduino's DC Jack and VM terminals are in parallel.

Q: What power supply / battery voltage is to be used?

A: When ONE PWR is selected, you need to fulfill the voltage requirements of both the Arduino and the motors. For example, if you are using 3-9V motors, then you may use 7-9V power source (battery) since the Arduino can operate at 7-12V. The intersection of both motor and Arduino power requirement is 7-9V.

Q: What kind of power supply/battery can be used?

A: There is nothing specific as this is mostly dependent on the motor being used and your application. Check the motor voltage required and current consumption. A good estimate is to use a power supply that can deliver, and sustain, twice the maximum current drawn by the motor. For batteries, the battery capacity will determine the running time of the robot. Choose the highest capacity that is practical. Primary (disposable) batteries like AA's in series or 9V batteries may be expensive in the long run. Secondary (rechargeable) batteries are recommended (Li Ion, Lead Acid, etc)

Q: Can I use the shield for 4-wheel and 2-wheeled robots?

A: Yes, A 4-wheeled robot has the same code as a 2-wheeled robot if both left motors are in parallel and connected to one channel of the driver and the two right motors connected in parallel to the other channel. Just make sure your combined continuous current does not exceed around 1A per channel. The common plastic geared DC motors with yellow gearbox draw some ~250mA, two of these in parallel would mean a current of ~500mA. Thus, you may use these types of motors, either as 2-wheeled or 4-wheel robots, with the shield.

Q: What powers the shield?

A: Power for the logic circuit of the driver chip is taken from the 5V pin of the Arduino, not from VM or VIN. On the other hand, the motor(s) are powered from the VM or VIN (depending on microjumper position at the ONE PWR/EXT header).

Q: Which IO pins are used by the shield?

A: The motor driver section uses pins 2-7. Do not use these pins. Pins 10,11,12 and A0-A5 have connectors routed at headers H1 and H2. If unused, these pins are free for other purposes. The rest of the pins are free.

Q: Can the shield be used as a Sumobot? Line Tracing/ Line Follower robot? Obstacle Avoidance/Maze solder Robot?

A: Of course! It was built for these applications.

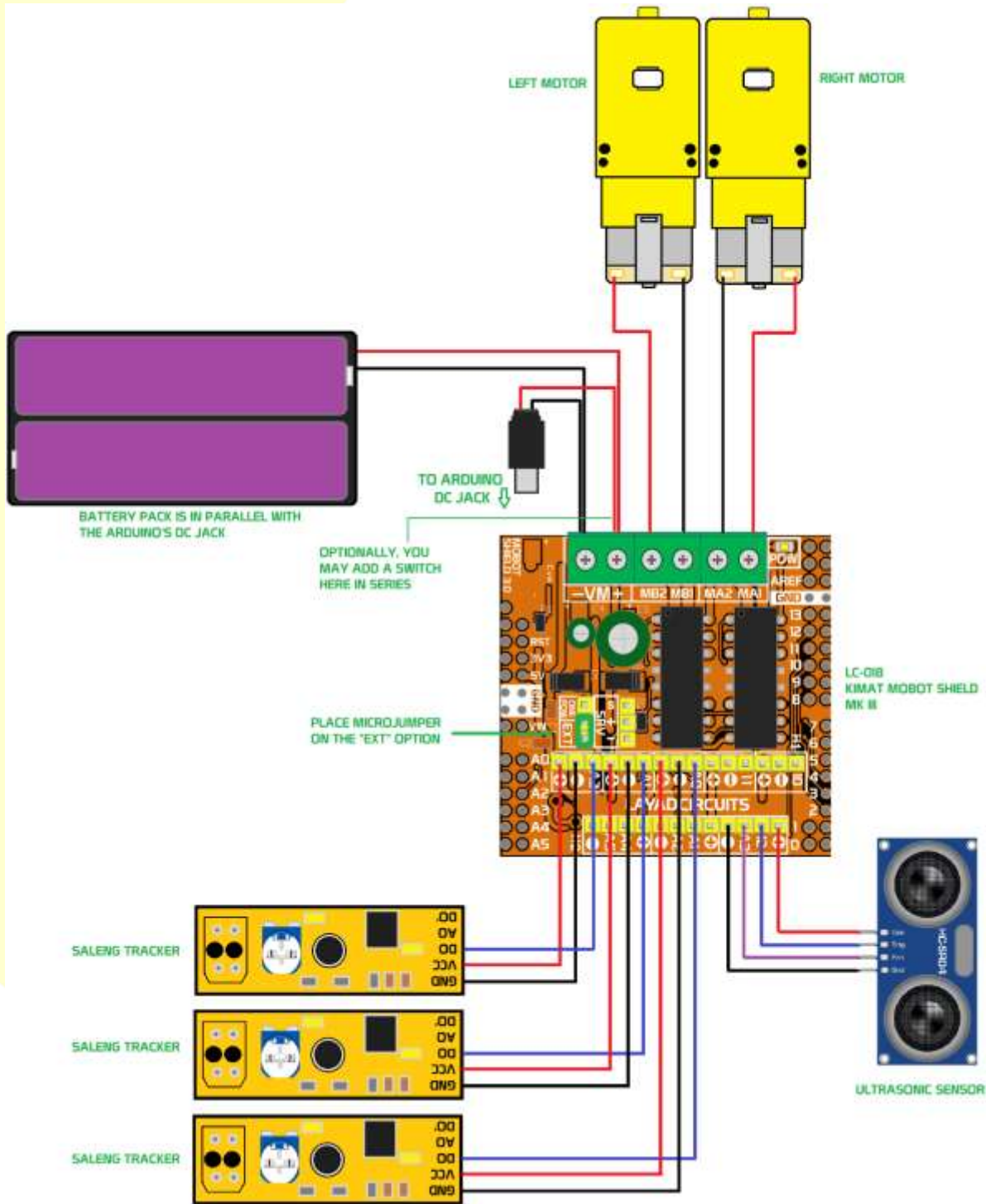
www.layadcircuits.com

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

An IMPORTANT NOTICE: at the end of this guide addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers.

Q: What is the suggested wiring?

A: for the 2WD multirole kit from Layad Circuits, you may follow the suggestion below:



www.layadcircuits.com

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

An IMPORTANT NOTICE: at the end of this guide addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers.

Q: Can I use more than 5 digital IR sensors?

A: Yes, so long as there are enough free pins. Beware of the current consumption of your IR sensors though, they might exceed the regulator rating of your Arduino (typically 1A).

Q: Will a PID algorithm work for a line tracing application?

A: Yes, use 5 IR sensors or more for a smoother PID algorithm

Q: what are the “+” and “-“ pins at the 3 or 4-pin headers on the shield?

A: “+” is internally connected to the 5V pin of the Arduino and “-“ is connected to GND. You may use them as normal “5V” or “GND” pins. These were designed in such positions to help simplify sensor wiring

VERSION HISTORY

v1.0.0 – initial creation for Mk III / 23/02/10 / CDM

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.

www.layadcircuits.com

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

An IMPORTANT NOTICE: at the end of this guide addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers.

