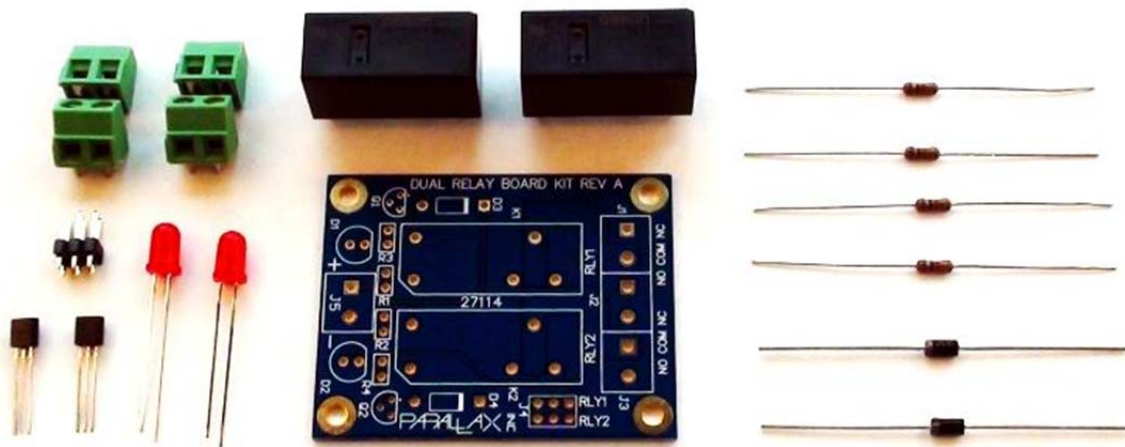


Dual Relay Board Kit (#27114)

The Dual Relay Board can be used to turn lights, fans and other devices on/off while keeping them isolated from your microcontroller. Once properly assembled, the Dual Relay Board Kit allows you to control two high-power devices (up to 8 A) via the included Omron mechanical relays. Independent control of each relay is provided via a 2 x 3 header — friendly to servo cables and convenient connection to many development boards, such as the Board of Education, Propeller Board of Education, Professional Development Board and Propeller Professional Development Board. LEDs indicate relay status.



Features

- Control two high-power devices at up to 8 A each with one kit
- Provides isolation between microcontroller and device being controlled
- Screw terminals for relay connections
- 3-pin servo-style headers for signal interface
- LED indicators for each relay

Key Specifications

- Power Requirements: 12 VDC @ 85 mA (nominal)
- Communication Interface: Logic (3.3 V/5 V) High/Low
- Operating temperature: -40 to +185 °F (-40 to +85 °C)
- Dimensions: 2.3" L x 1.8" W x 0.7" H (58.4 x 45.8 x 1.8 cm)

Application Ideas

- 120 VAC brushless lighting/fan control
- 12 VDC automotive applications

Bill of Materials

Designator	Description	Quantity	Part #
J1-J4	2 Position Screw Terminal Block	4	452-00012
J5	Connector, Header, 2x3, 0.1", Straight	1	450-00105
K1-K2	Omron Relay G2RL-14-DC12, SPDT, 12A, 12VDC	2	400-00052
R1-R4	Resistor, 1K, 5%, 1/4W, CF	4	150-01020
D1-D2	LED, Red, T1-3/4	2	350-00006
D3-D4	1N4004 Diode, Rectifier, 1V, 400V, 1A, Axial	2	501-00006
Q1-Q2	2N3904 NPN Transistor, TO-92	2	500-00008
PCB1	Raw PCB, Dual Relay Board	1	300-27114

Additional Items Required

- Soldering iron
- Solder
- Diagonal cutters
- Safety glasses

Assembly Instructions

Step 1

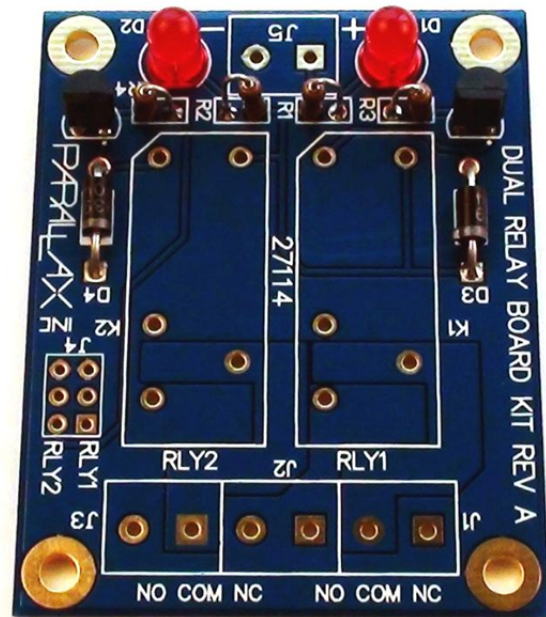
Install the lower profile components first (D1-D2, D3-D4, R1-R4 and Q1-Q2).

When installing D1-D2 (Red LED), be sure the flat side of the LED lines up with the flat side on the silkscreen.

When installing D3-D4 (1N4004 Diode), be sure the stripe lines up with the stripe on the silkscreen.

When installing Q1-Q2 (2N3904 NPN Transistor), be sure the flat face lines up with the flat side on the silkscreen.

Resistors R1-R4 are not polarized and can be mounted in either direction, however you will have to bend one lead over to install the resistors upright. See the photo at right for details.



Step 2

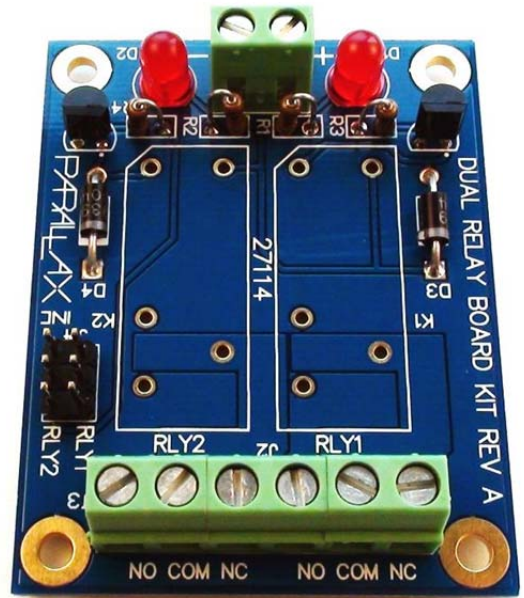
Install the connectors next (J1-J3, J4 and J5).

When installing J1-J3 (green terminal blocks), be sure to connect these three together by sliding them into each other using the tab/groove before installing onto the PCB. Wire holes should be facing the outside of the PCB.

J5 (remaining green terminal block) is by itself at the opposite end of the board. Wire holes should be facing the outside of the PCB.

J4 should be installed with the shorter end of the pins being inserted into the PCB.

See the photo at right for details.

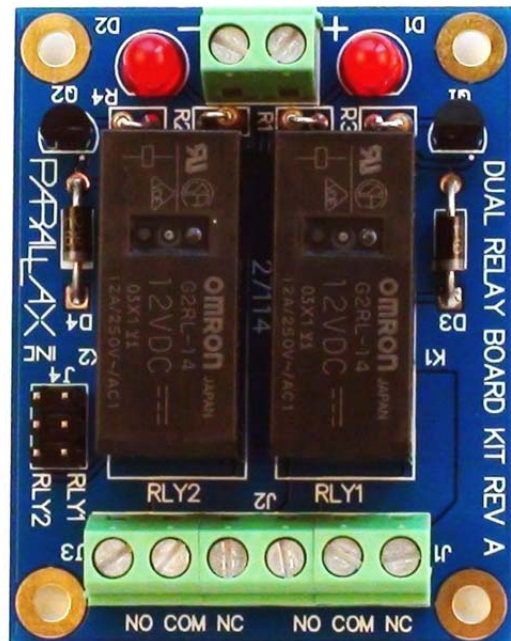


Step 3

Install the relays last (K1-K2).

Be sure the relays are fully seated into the holes before you begin soldering.

See the photo at right for details.



Precautions

As with any device capable of switching high voltages, precautions should always be taken to avoid damage and/or injury. The following precautions are recommended in addition to any precautions by the manufacturer of any equipment connected to this device.

- Always disconnect main power when connecting circuits to the Dual Relay Board.
- Download and read the relay datasheet from the 27114 product page before using the relays.
- When using with high-power circuits, mount the Dual Relay Board inside a suitable enclosure or electrical panel using standoffs. The board should not be able to move.
- Secure all electrical connections to the board so they cannot move; provide strain relief for any wires extending outside the enclosure.
- Fuse any incoming voltage rails that are to be switched by the relays, prior to entering the Dual Relay Board.
- Always be sure any incoming voltage rails are powered off prior to connecting them to the Dual Relay Board.
- Observe Max Switching Current listed below! The Relays are capable of switching more current than the Terminal Blocks and PCB can handle.
- While mechanical relays provide physical electrical isolation from control circuits, it is possible for EMF generated by high-power devices to affect the control circuits. This is especially true if the control wires and/or power leads are longer than 6". Always try to keep wires as short as possible and avoid running high-power leads near or across control lines.

Pin Definitions and Ratings (J4)

Pin	Name	Type	Function
1	Relay 1	I	Relay 1 Signal Input (3.3V/5V)*
2	Relay 2	I	Relay 2 Signal Input (3.3V/5V)*
3	NC	—	No Connection
4	NC	—	No Connection
5	GND	G	Signal/Relay Coil Ground
6	GND	G	Signal/Relay Coil Ground

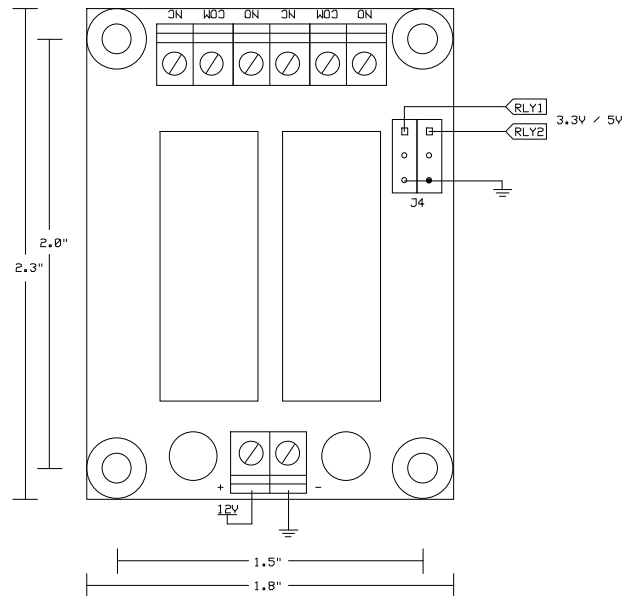
Pin Type: P = Power, G = Ground, I = Input, O = Output

*Inputs signals on pin 1 and 2 are typically 3.3 V or 5 V but are independent and do not need to be the same. For example Relay 1 could be switched via a 3.3 V control signal while Relay 2 could be switched via a 5 V control signal.

Specifications

Symbol	Quantity	Minimum	Typical	Maximum	Units
12V	Relay Supply Voltage	7	12	—	V
—	Relay Supply Current	—	85	—	mA
—	Max Switching Current	—	—	8	A

Module Dimensions / Connection Diagram



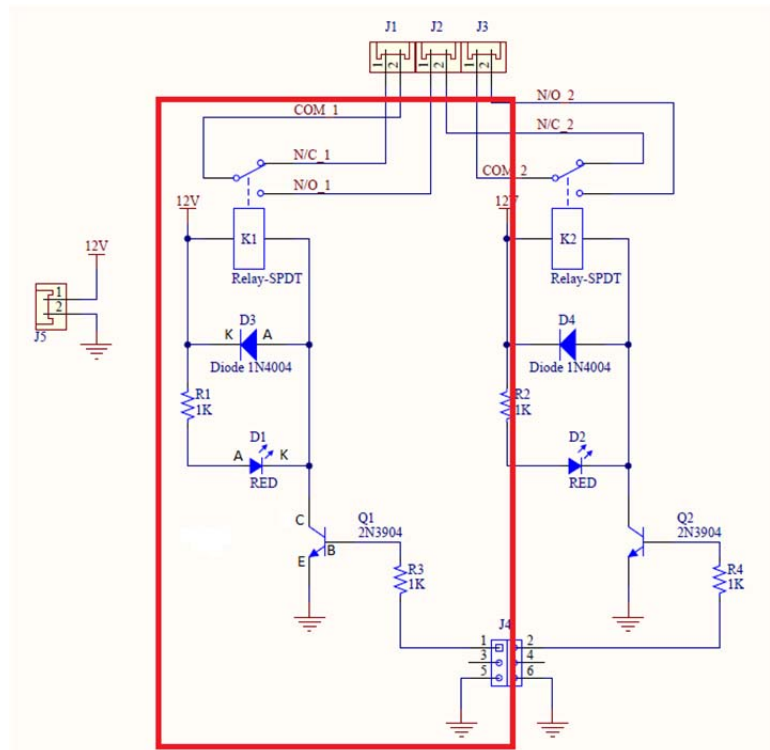
Note: The two pins at the J4 (pins 5/6) label are both ground pins, while the pins labeled RLY1 and RLY2 (pins 1/2) are the signal/control pins. Pins 3 and 4 are no connected but allowed you to connect a powered servo cable without a conflict with the servo supply.

Theory of Operation

In the schematic details to the right the red box is intended to encapsulate one complete relay circuit to help show how the relay driver circuit is built and what components are required.

One complete relay circuit consists of 1/2 of J4, R3, Q1, D1, R1, D3 and K1. J5 supplies voltage to K1 at port 12 V. The relay (K1) requires approximately 33 mA to activate. This is more than most I/O pins on a microcontroller can source/sink, so a transistor (Q1) is used to drive the relay.

Q1 is a standard NPN switching/amplifier transistor with a usable current rating of 100 mA, which is well within the requirements for the relay (~33 mA) and LED (~10 mA). The gain (h_{FE}) of this transistor may vary but is typically 100, while the minimum is 30. The V_{BE} (forward voltage) of Q1 is about 0.7 V, so to allow a range of control voltages the resistor (R3) must be chosen carefully.



In order to fully saturate (turn on) and provide the necessary current across the C-E junction the transistor's B-E junction draws a relative amount of current based on the minimum gain (h_{FE}). It is a good idea to limit the control current to a few mA at most and allow a range of control voltages from at least 3.3 V through 5 V. The formula to calculate the base current is $I_B = (V_{DD} - V_{BE}) / R_B$, where V_{DD} is the control voltage, V_{BE} is the forward voltage of the transistor and R_B is the resistance in ohms. If the control signal is 3.3 V, with R3 being 1 K then $(3.3 - 0.7) / 1000 = 3$ mA. At 5 V the current is ~4 mA.

Three additional components make up one relay circuit (R1, D1 and D3). R1 is the current limiting resistor for D1, which is a Red LED to indicate when the relay is energized. The value of 1K has been chosen to allow the LED to operate at a safe minimum current when the relay voltage is a little high or low from the nominal 12 V. D3 is designed to snub back EMF from the relay coil when the relay turns off. This protects Q1 from potentially damaging voltage transients caused by K1. Note the position of the Anode (A) and Cathode (K) of D3. It is designed not to conduct during normal operation (when the relay is powered). Q1 is switching the relay (K1 in parallel with D3) as well as the red LED (D1 / R1).

The relay output is SPDT (single-pole, double-throw), which means it has a single common lead (COM) that can connect to one of two switched leads, NO (normally open) or NC (normally closed). The normal state is in reference to the off state of the relay. When the relay is off, COM is connected to NC while NO is disconnected. When the relay is energized, COM is connected to NO and NC is disconnected. The typical way to turn on a device with the relay board is to connect the power source you want to switch to the COM connection on one of the relays and the NO connection to the power (hot) lead of the device being switched. A mechanical relay provides physical isolation of the switching circuit and the circuit being switched since there is no electrical connection between the two circuits.

The output terminals of each relay are electrically equivalent to a SPDT switch and can be used in the same manner. You can also switch two devices that use the same power source by connecting the power source to the COM connections on both relays.

Resources and Downloads

Check for the latest version of this document, schematic diagram and relay datasheet from the Dual Relay Board Kit product page. Go to www.parallax.com and search 27114.

BASIC Stamp[®] Example Code

This program activates each relay and then turns them both off at one second intervals. RLY1 should be connected to P14 and RLY2 to P15. If you're using the Board of Education you can use servo cables and plug them directly into the X4 headers on the board. If you're powering your Board of Education with a 9 V or 12 V power supply (or a 9V battery) you can get the relay power from V_{IN} and V_{SS} to J5 + and - on the Dual Relay Board. The relays are rated to operate at 70% of the nominal supply voltage or 8.4 V.

```
' {$STAMP BS2}
' {$PBASIC 2.5}

RLY1  PIN 14
RLY2  PIN 15

DO
  HIGH RLY1
  PAUSE 1000
  HIGH RLY2
  PAUSE 1000
  LOW RLY1
  LOW RLY2
  PAUSE 1000
LOOP
```

Propeller P8X32A Example Code

This program activates each relay and then turns them both off at one second intervals. RLY1 should be connected to P0 and RLY2 to P1. J5 of the Dual Relay Board should be supplied with 12 VDC. Depending on the Propeller board used, if you are powering the board with a 9 V or 12 V power supply (or a battery) you can get the relay power from VIN and VSS to J5 + and - on the Dual Relay Board. The relays are rated to operate at 70% of the nominal supply voltage or 8.4 V.

```
'' 27114 Dual Relay Board Kit   Spin Example

CON

  _CLKMODE = XTAL1 + PLL16X      ' Use crystal x 16
  _XINFREQ = 5_000_000          ' 5 MHz crystal (system clock = 80
MHz)

CON

  RLY1 = 0                      ' Propeller pin connected to RLY1
  RLY2 = 1                      ' Propeller pin connected to RLY2

PUB Main

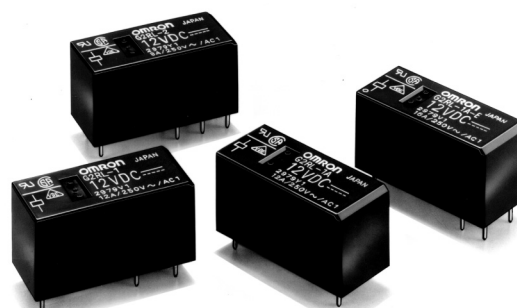
  dira[RLY2..RLY1] := %11      ' Set P0/P1 to output

  repeat                       ' Loop indefinitely
    outa[RLY1]~~              ' Turn on Relay 1
    waitcnt(clkfreq + cnt)    ' Pause 1 second
    outa[RLY2]~~              ' Turn on Relay 2
    waitcnt(clkfreq + cnt)    ' Pause 1 second
    outa[RLY1]~               ' Turn off Relay 1
    outa[RLY2]~               ' Turn off Relay 2
    waitcnt(clkfreq + cnt)    ' Pause 1 second
```


PCB Relay G2RL

A Power Relay with Various Models

- High-sensitivity (250 mW) and High-capacity (16 A) versions.
- Designed for cooking and HVAC controls: blower motor, damper, active air purification, duct flow boost fans, etc.
- Conforms to VDE (EN61810-1). UL recognized/ CSA certified
- Meets EN60335-1 requirements for household products.
- Clearance and creepage distance: 10 mm/10 mm.
- Tracking resistance: CTI>250
- Coil Insulation system: Class F.
- RoHS Compliant



Ordering Information

Classification	Enclosure ratings	Contact form			
		SPST-NO	SPDT	DPST-NO	DPDT
General-purpose	Flux protection	G2RL-1A	G2RL-1	G2RL-2A	G2RL-2
	Fully sealed	G2RL-1A4	G2RL-14	G2RL-2A4	G2RL-24
High-capacity	Flux protection	G2RL-1A-E	G2RL-1-E	---	---
	Fully sealed	G2RL-1A4-E	G2RL-14-E	---	---
High-sensitivity	Flux protection	G2RL-1A-H	G2RL-1-H	---	---

Note: When ordering, add the rated coil voltage to the model number.

Example: G2RL-1A DC12

Rated coil voltage

Model Number Legend

G2RL-□□□□-□
1 2 3 4

1. Number of Poles

- 1: 1 pole
- 2: 2 poles

2. Contact Form

- None: □PDT
- A: □PST-NO

3. Enclosure Ratings

- None: Flux protection
- 4: Fully sealed

4. Classification

- None: General purpose
- E: High capacity (1 pole)
- H: High sensitivity (1 pole)

Specifications

Coils Ratings for General-purpose and High-capacity Models

Rated voltage	5 VDC	12 VDC	24 VDC	48 VDC
Rated current	80.0 mA	33.3 mA	16.7 mA	8.96 mA
Coil resistance	62.5 Ω	360 Ω	1,440 Ω	5,358 Ω
Must operate voltage	70% max. of the rated voltage			
Must release voltage	10% min. of the rated voltage			
Max. voltage	180% of rated voltage (at 23°C)			
Power consumption	Approx. 400 mW			Approx. 430 mW

Note: The rated current and coil resistance are measured at a coil temperature of 23°C with a tolerance of ±10%.

■ Coils Ratings for High-sensitivity Models

Rated voltage	5 VDC	12 VDC	24 VDC
Rated current	50.0 mA	20.8 mA	10.42 mA
Coil resistance	100 Ω	576 Ω	2,304 Ω
Must operate voltage	75% max. of the rated voltage		
Must release voltage	10% min. of the rated voltage		
Max. voltage	180% of rated voltage (at 23°C)		
Power consumption	Approx. 250 mW		

Note: The rated current and coil resistance are measured at a coil temperature of 23°C with a tolerance of ±10%.

■ Contact Ratings

Item	General-purpose Models		High-capacity Models	High-sensitivity Models
Number of poles	1 pole	2 poles	1 pole	1 pole
Contact material	Ag Alloy (Cd free)			
Load	Resistive load (cosφ=1)			
Rated load	12 A at 250 VAC 12 A at 24 VDC (See note.)	8 A at 250 VAC 8 A at 30 VDC (See note.)	16 A at 250 VAC 16 A at 30 VDC (See note.)	10 A at 250 VAC 10 A at 24 VDC (See note.)
Rated carry current	12 A (See note.)	8 A (70°C)/5 A (85°C) (See note.)	16 A (See note.)	10 A (See note.)
Max. switching voltage	440 VAC, 300 VDC			
Max. switching current	12 A	8 A	16 A	10 A
Max. switching power	3,000 VA (4,000 VA)	2,000 VA	4,000 VA	2,500 VA

Note: Contact your OMRON representative for the ratings on fully sealed models.

■ Characteristics

Item	General-purpose (High-capacity) Models	General-purpose Models	High-sensitivity Models
Number of poles	1 pole	2 pole	1 pole
Contact resistance	100 mΩ max.		
Operate (set) time	15 ms max.		
Release (reset) time	5 ms max.		
Max. operating frequency	Mechanical:18,000 operation/hr Electrical:1,800 operation/hr at rated load		
Insulation resistance	1,000 MΩ min. (at 500 VDC)		
Dielectric strength	5,000 VAC, 1 min between coil and contacts 1,000 VAC, 1 min between contacts of same polarity	5,000 VAC, 1 min between coil and contacts 2,500 VAC, 1 min between contacts of different polarity 1,000 VAC, 1 min between contacts of same polarity	5,000 VAC, 1 min between coil and contacts 1,000 VAC, 1 min between contacts of same polarity
Impulse withstand voltage	10 kV (1.2×50 μs) between coil and contact		
Vibration resistance	Destruction:10 to 55 to 10 Hz, 0.75 mm single amplitude (1.5 mm double amplitude) Malfunction:10 to 55 to 10 Hz, 0.75 mm single amplitude (1.5 mm double amplitude)		
Shock resistance	Destruction:1,000 m/s ² (approx. 100 G) Malfunction:100 m/s ² (approx. 10 G)		
Endurance (Mechanical)	20,000,000 operations (at 18,000 operations/hr)		
Ambient temperature	Operating:−40°C to 85°C (with no icing) Storage:−40°C to 85°C (with no icing)		
Ambient humidity	5% to 85%		
Weight	Approx. 12 g		

Note: Values in the above table are the initial values.

■ Approved Standards

UL Recognized (File No. E41643) / CSA Certified (File No. LR31928) - - Ambient Temp. = 40°C

Model	Contact form	Coil ratings	Contact ratings	Number of test operations
G2RL-1A	SPST-NO	3 to 48 VDC	12 A at 250 VAC (General use)	100,000
G2RL-1	SPDT		12 A at 24 VDC (Resistive)	50,000
G2RL-1A-E	SPST-NO	3 to 48 VDC	16 A at 250 VAC (General use)	100,000
G2RL-1-E	SPDT		16 A at 24 VDC (Resistive)	50,000
G2RL-1A-H	SPST-NO	5 to 24 VDC	10 A at 250 VAC (General use)	50,000
G2RL-1-H	SPDT		10 A at 24 VDC (Resistive)	
G2RL-2A	DPST-NO	3 to 48 VDC	8 A at 277 VAC (General use)	100,000
G2RL-2	DPDT		8 A at 30 VDC (Resistive)	

Note: Consult Omron for additional UL / CSA ratings

VDE (EN61810-1) (License No. 119650)

Model	Contact form	Coil ratings	Contact ratings
G2RL-1(A)	1 pole	5, 12, 18, 22, 24, 48 VDC	12 A at 250 VAC (cosφ=1) 12 A at 24 VDC (L/R=0 ms) AC15: 3 A at 240 VAC DC13: 2.5 A at 24 VDC, 50 ms
G2RL-1(A)-E	1 pole	5, 12, 18, 22, 24, 48 VDC	16 A at 250 VAC (cosφ=1) 16 A at 24 VDC (L/R=0 ms) AC15: 3 A at 240 VAC (NO) 1.5 A at 240 VAC (NC) DC13: 2.5 A at 24 VDC (NO), 50 ms
G2RL-1(A)-H	1 pole	5, 9, 12, 24 VDC	10 A at 250 VAC (cosφ=1) 10 A at 24 VDC (L/R=0 ms)
G2RL-2(A)	2 poles	5, 12, 18, 22, 24, 48 VDC	8 A at 250 VAC (cosφ=1) 8 A at 24 VDC (L/R=0 ms) AC15: 1.5 A at 240 VAC DC13: 2 A at 30 VDC, 50 ms

Note: To achieve approved life cycles on sealed models, the relay should be vented by removing the “knock off vent nib” on top of relay case after the soldering/washing process.

Electrical Life Data

G2RL-1-E	16 A at 250 VAC (cosφ=1)	30,000 operations min.
	16 A at 24 VDC	30,000 operations min.
	8 A at 250 VAC (cosφ=0.4)	200,000 operation min. (normally open side operation)
	8 A at 30 VDC (L/R=7 ms)	10,000 operation min. (normally open side operation)
G2RL-1	12 A at 250 VAC (cosφ=1)	50,000 operations min.
	12 A at 24 VDC	30,000 operations min.
	5 A at 250 VAC (cosφ=0.4)	150,000 operation min. (normally open side operation)
	5 A at 30 VDC (L/R=7 ms)	20,000 operation min. (normally open side operation)
G2RL-1-H	10 A at 250 VAC (cosφ=1)	100,000 operations min.
	10 A at 24 VDC	50,000 operations min.
G2RL-2	8 A at 250 VAC (cosφ=1)	30,000 operations min.
	8 A at 30 VDC	30,000 operations min.

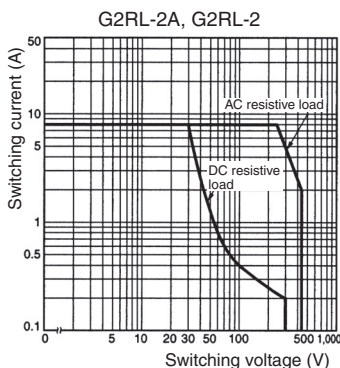
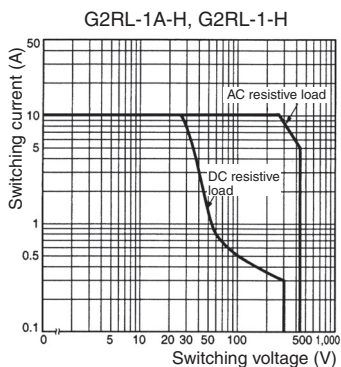
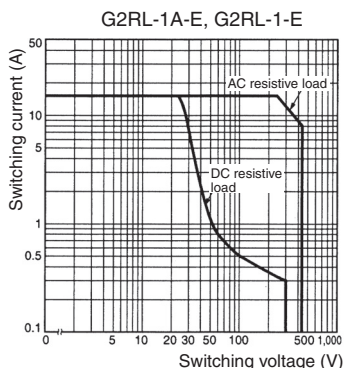
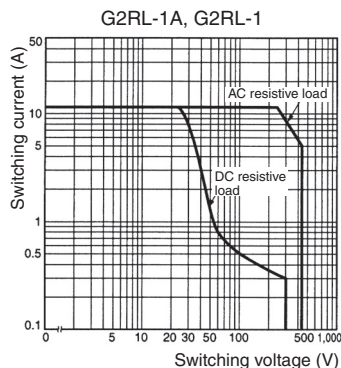
Note: 1. The results shown reflect values measured using very severe test conditions i.e., Duty: 1 s ON/1 s OFF.

2. In order to obtain the full rated life cycles on the fully sealed models, the relay should be properly vented by removing the “knock off vent nib” on top of the relay case after the soldering/washing process.

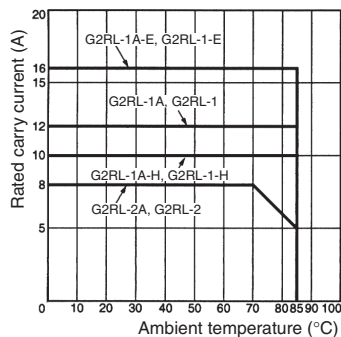
3. Electrical endurance will vary depending on the test conditions. Contact your OMRON representative if you require more detailed information for the electrical endurance under your test conditions.

Engineering Data

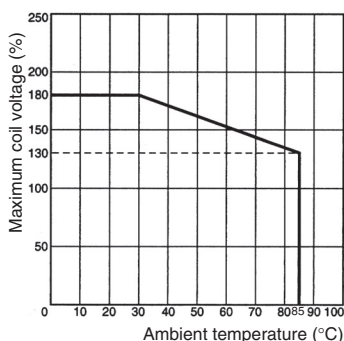
Maximum Switching Capacity



Ambient Temperature vs Rated Carry Current



Ambient Temperature vs Maximum Coil Voltage



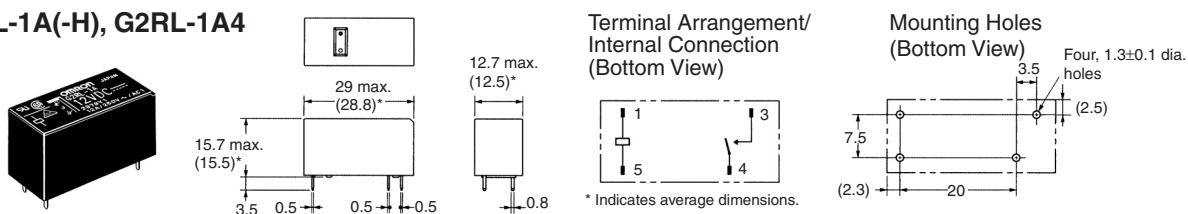
Note: The maximum coil voltage refers to the maximum value in a varying range of operating power voltage, not a continuous voltage.

Note: Contact your OMRON representative for the data on fully sealed models.

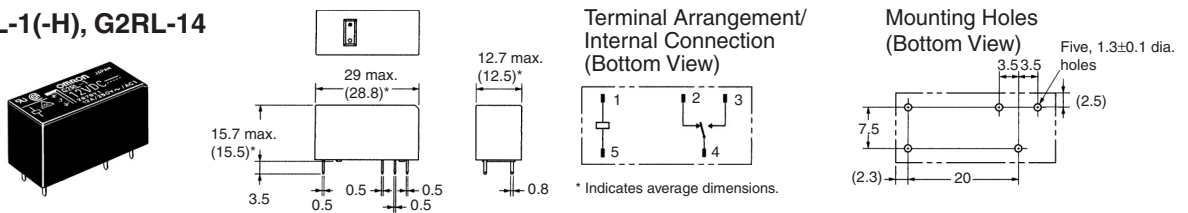
Dimensions

Note: All units are in millimeters unless otherwise indicated.

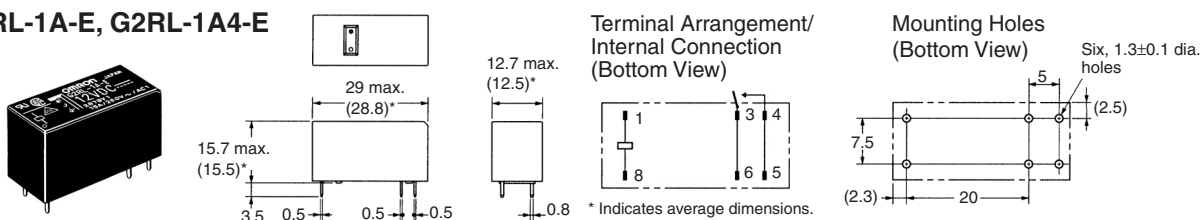
G2RL-1A(-H), G2RL-1A4



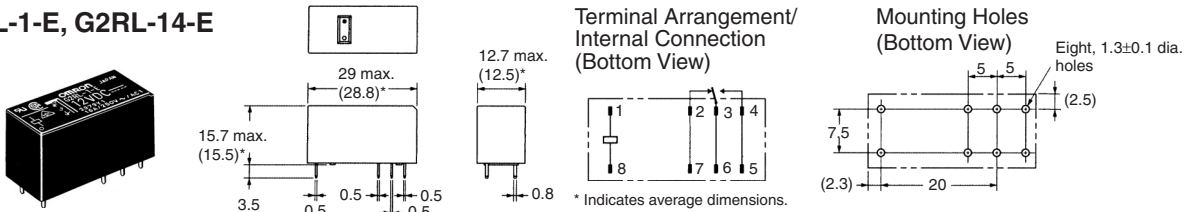
G2RL-1(-H), G2RL-14



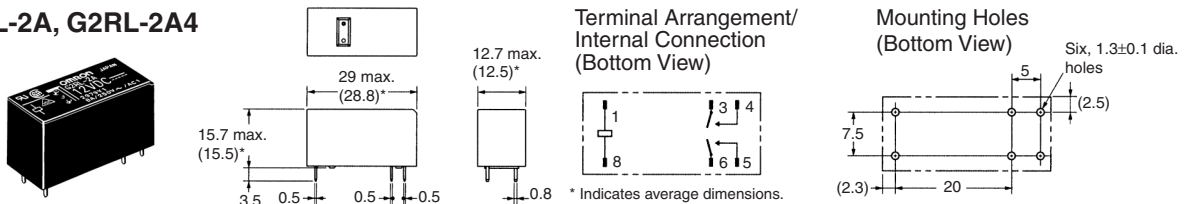
G2RL-1A-E, G2RL-1A4-E



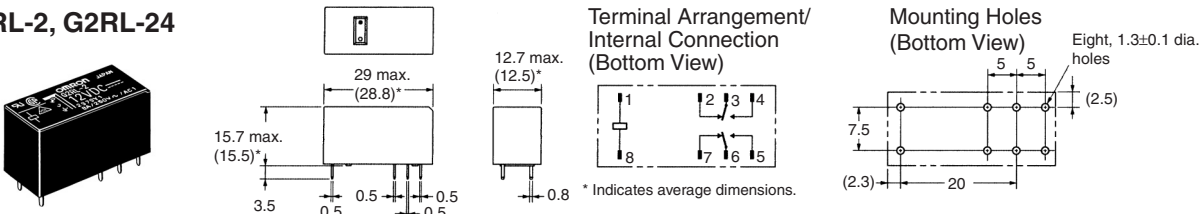
G2RL-1-E, G2RL-14-E



G2RL-2A, G2RL-2A4



G2RL-2, G2RL-24



MEMO

A large grid of dashed lines for taking notes, consisting of 20 columns and 30 rows of small squares.

Omron Electronic Components, LLC

Terms and Conditions of Sales

I. GENERAL

- Definitions:** The words used herein are defined as follows.
 - Terms:** These terms and conditions
 - Seller:** Omron Electronic Components LLC and its subsidiaries
 - Buyer:** The buyer of Products, including any end user in section III through VI
 - Products:** Products and/or services of Seller
 - Including:** Including without limitation
- Offer; Acceptance:** These Terms are deemed part of all quotations, acknowledgments, invoices, purchase orders and other documents, whether electronic or in writing, relating to the sale of Products by Seller. Seller hereby objects to any Terms proposed in Buyer's purchase order or other documents which are inconsistent with, or in addition to, these Terms.
- Distributor:** Any distributor shall inform its customer of the contents after and including section III of these Terms.

II. SALES

- Prices; Payment:** All prices stated are current, subject to change without notice by Seller. Buyer agrees to pay the price in effect at the time the purchase order is accepted by Seller. Payments for Products received are due net 30 days unless otherwise stated in the invoice. Buyer shall have no right to set off any amounts against the amount owing in respect of this invoice.
- Discounts:** Cash discounts, if any, will apply only on the net amount of invoices sent to Buyer after deducting transportation charges, taxes and duties, and will be allowed only if (a) the invoice is paid according to Seller's payment terms and (b) Buyer has no past due amounts owing to Seller.
- Interest:** Seller, at its option, may charge Buyer 1.5% interest per month or the maximum legal rate, whichever is less, on any balance not paid within the stated terms.
- Orders:** Seller will accept no order less than 200 U.S. dollars net billing.
- Currencies:** If the prices quoted herein are in a currency other than U.S. dollars, Buyer shall make remittance to Seller at the then current exchange rate most favorable to Seller; provided that if remittance is not made when due, Buyer will convert the amount to U.S. dollars at the then current exchange rate most favorable to Seller available during the period between the due date and the date remittance is actually made.
- Governmental Approvals:** Buyer shall be responsible for all costs involved in obtaining any government approvals regarding the importation or sale of the Products.
- Taxes:** All taxes, duties and other governmental charges (other than general real property and income taxes), including any interest or penalties thereon, imposed directly or indirectly on Seller or required to be collected directly or indirectly by Seller for the manufacture, production, sale, delivery, importation, consumption or use of the Products sold hereunder (including customs duties and sales, excise, use, turnover and license taxes) shall be charged to and remitted by Buyer to Seller.
- Financial:** If the financial position of Buyer at any time becomes unsatisfactory to Seller, Seller reserves the right to stop shipments or require satisfactory security or payment in advance. If Buyer fails to make payment or otherwise comply with these Terms or any related agreement, Seller may (without liability and in addition to other remedies) cancel any unshipped portion of Products sold hereunder and stop any Products in transit until Buyer pays all amounts, including amounts payable hereunder, whether or not then due, which are owing to it by Buyer. Buyer shall in any event remain liable for all unpaid accounts.
- Cancellation; Etc:** Orders are not subject to rescheduling or cancellation unless Buyer indemnifies Seller fully against all costs or expenses arising in connection therewith.
- Force Majeure:** Seller shall not be liable for any delay or failure in delivery resulting from causes beyond its control, including earthquakes, fires, floods, strikes or other labor disputes, shortage of labor or materials, accidents to machinery, acts of sabotage, riots, delay in or lack of transportation or the requirements of any government authority.
- Shipping; Delivery:** Unless otherwise expressly agreed in writing by Seller:
 - All sales and shipments of Products shall be FOB shipping point (unless otherwise stated in writing by Seller), at which point title to and all risk of loss of the Products shall pass from Seller to Buyer, provided that Seller shall retain a security interest in the Products until the full purchase price is paid by Buyer;
 - Delivery and shipping dates are estimates only; and
 - Seller will package Products as it deems proper for protection against normal handling and extra charges apply to special conditions.
- Claims:** Any claim by Buyer against Seller for shortage or damage to the Products occurring before delivery to the carrier or any claim related to pricing or other charges must be presented in detail in writing to Seller within 30 days of receipt of shipment.

III. PRECAUTIONS

- Suitability:** IT IS THE BUYER'S SOLE RESPONSIBILITY TO ENSURE THAT ANY OMRON PRODUCT IS FIT AND SUFFICIENT FOR USE IN A MOTORIZED VEHICLE APPLICATION. BUYER SHALL BE SOLELY RESPONSIBLE FOR DETERMINING APPROPRIATENESS OF THE PARTICULAR PRODUCT WITH RESPECT TO THE BUYER'S APPLICATION INCLUDING (A) ELECTRICAL OR ELECTRONIC COMPONENTS, (B) CIRCUITS, (C) SYSTEM ASSEMBLIES, (D) END PRODUCT, (E) SYSTEM, (F) MATERIALS OR SUBSTANCES OR (G) OPERATING ENVIRONMENT. Buyer acknowledges that it alone has determined that the Products will meet their requirements of the intended use in all cases. Buyer must know and observe all prohibitions of use applicable to the Product/s.
- Use with Attention:** The followings are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible use of any Product, nor to imply that any use listed may be suitable for any Product:
 - Outdoor use, use involving potential chemical contamination or electrical interference.

- Use in consumer Products or any use in significant quantities.
 - Energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
 - Systems, machines, and equipment that could present a risk to life or property.
- Prohibited Use:** NEVER USE THE PRODUCT FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE PRODUCT IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.
 - Motorized Vehicle Application:** USE OF ANY PRODUCT/S FOR A MOTORIZED VEHICLE APPLICATION MUST BE EXPRESSLY STATED IN THE SPECIFICATION BY SELLER.
 - Programmable Products:** Seller shall not be responsible for the Buyer's programming of a programmable Product.

IV. WARRANTY AND LIMITATION

- Warranty:** Seller's exclusive warranty is that the Products will be free from defects in materials and workmanship for a period of twelve months from the date of sale by Seller (or such other period expressed in writing by Seller). SELLER MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, ABOUT ALL OTHER WARRANTIES, NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF THE PRODUCTS.
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V. INFORMATION; ETC.

- Intellectual Property:** The intellectual property embodied in the Products is the exclusive property of Seller and its affiliates and Buyer shall not attempt to duplicate it in any way without the written permission of Seller. Buyer (at its own expense) shall indemnify and hold harmless Seller and defend or settle any action brought against Seller to the extent that it is based on a claim that any Product made to Buyer specifications infringed intellectual property rights of another party.
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- Performance Data:** Performance data is provided as a guide in determining suitability and does not constitute a warranty. It may represent the result of Seller's test conditions, and the users must correlate it to actual application requirements.
- Change In Specifications:** Product specifications and descriptions may be changed at any time based on improvements or other reasons. It is Seller's practice to change part numbers when published ratings or features are changed, or when significant engineering changes are made. However, some specifications of the Product may be changed without any notice.
- Errors And Omissions:** The information on Seller's website or in other documentation has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical or proofreading errors or omissions.
- Export Controls:** Buyer shall comply with all applicable laws, regulations and licenses regarding (a) export of the Products or information provided by Seller; (b) sale of Products to forbidden or other proscribed persons or organizations; (c) disclosure to non-citizens of regulated technology or information.

VI. MISCELLANEOUS

- Waiver:** No failure or delay by Seller in exercising any right and no course of dealing between Buyer and Seller shall operate as a waiver of rights by Seller.
- Assignment:** Buyer may not assign its rights hereunder without Seller's written consent.
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 - (ii) Energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
 - (iii) Use in consumer products or any use in significant quantities.
 - (iv) Systems, machines and equipment that could present a risk to life or property. Please know and observe all prohibitions of use applicable to this product.

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