

General Guidelines for Electronic Kits and Assembled Modules

Thank you for choosing one of our products. Please take some time to carefully read the important information below concerning use of this product. The assembly and operating instructions are on the following pages. Help with component identification can be found on our website at www.quasarelectronics.co.uk/component-identification-help. If you are unsure about any aspect of the assembly or use of this product please contact our Support Team before proceeding.



WEEE Directive (Waste Electrical and Electronic Equipment)

Notice To All European Union Citizens: Important environmental information about this product.

The crossed out wheeled bin symbol on this product, package or documentation indicates that disposal of this product after its lifecycle could harm the environment. Do not dispose of this product (or batteries if used) as unsorted municipal waste. It should be disposed by a specialized company for recycling.

The unit should be returned to your distributor or to a local recycling service. Please respect the local environmental rules. If in doubt contact your local authorities about waste disposal rules.

Safety: General rules concerning safe use of our Kits or Modules.

To ensure your safety, please observe these safety measures. In no way are these complete. As safety requirements vary, please check with your local authorities, in order to comply with local requirements. If in doubt, seek the help of a qualified person.

Battery or wall-adaptor operated devices are safe devices. They do not require special attention unless mains voltage is connected to an output e.g. a relay.



To ensure electrical safety, and also protection from fire or personal injury, make sure your mains operated equipment complies with these safety hints:

- Use a suitable plastic enclosure. If a metal enclosure is used, make sure it is properly earthed.
- Use a power switch if the device consumes more than 10W. Use a double pole switch for mains operated, transformer-less kits.
- Mount a fuse in series with the mains switch. Use a slow blow (T) 50mA fuse for transformers up to 10W and a 100mA fuse for transformers up to 20W.
- Use a mains input connector, or a robust power cord with a clamp.
- Internal wiring carrying mains voltages must have a minimum cross-sectional area of 0.5mm^2 .

If supplied, attach the power rating label near the power cord of the device and fill-out the mains voltage, frequency, power consumption and fuse values.

Troubleshooting and Support

90% of non-working kits are due to poor soldering.

We operate a Get-You-Going service for non-working kits but there is a charge based on the time and components needed to complete the repair. Quite often it is not economically viable for us to repair and it is cheaper to supply a new ready-made product at full cost.

Disclaimer

Quasar Electronics reserves the right to change product specifications or to discontinue products without notice. Quasar Electronics cannot be held responsible for any loss or damage, direct or indirect, which might occur from the use of a product. Quasar Electronics Kits or Modules are intended for educational and demonstration purposes only. They are not intended for use in commercial applications. If they are used in such applications the purchaser assumes all responsibility for ensuring compliance with all local laws. In addition, they are not suitable for use as or as a part of life support systems, or systems that might create a hazardous situation of any kind.

QUASAR ORDER CODE AS3108 - 8-Ch Serial Relay Controller Isolated IO

INTRODUCTION

Designed for control and sensing applications, this board provides 8 relay outputs and 4 optically isolated digital inputs. It can be used in various applications including load switching, external switch input sensing, contact closure and external voltage sensing. It is controlled via a serial port using a set of simple text commands. After programming the PC can be disconnected from the unit without affecting the state of the relays. However, the board is **not programmable in itself**. It requires an external controller such as a PC to send it commands to control the relays and monitor the inputs.

The eight relay channels provide output control and are independent of the digital input channels giving you the flexibility to setup the linkage any way you choose in the control software.

The serial port has several advantages:

1. Only three wires are actually needed (TX, RX, DCD)
2. Cables can be up to 30 metres long, allowing "remote" control
3. Can be used with any computer or operating system

High quality components are used throughout. Pluggable screw terminal blocks for the relays and inputs. The board is housed in a UL94 rated ABS enclosure 140(W) x 110(D) x 35(H)mm. Front and rear fascia panels are screen-printed.

SPECIFICATIONS

RELAY OUTPUTS	
Number of relays	8
Type	Form C, SPDT
Max. Rated Load (Resistive or Inductive)	5 Amps Maximum (limit of circuit board)
Max. Switching Voltage (Resistive or Inductive)	240Vac** (see note below) 28Vdc
Min. Switching Voltage	28Vdc
Min. Switching Current	15mA
Contact Resistance	100mΩ
Operating / Release Time	15ms / 10ms (typical)
Rated Surge Voltage	4,000V (1.2 / 50μs)
Insulation Resistance	250Ω (500V DC, 60s)
Coil/Contact Dielectric Strength	2,500Vac (type of insulation: basic)
Relay Life (Mechanical)	10 million operations
Relay Life (Electrical/Load dependent)	100,000 operations
ISOLATED INPUTS	
Number of inputs	4
Type	Polarised, opto-isolated (Not TTL/CMOS compatible)
Voltage Range	5 - 24V dc
Isolation (min.)	2500V peak 1775V RMS (1 sec.)

**** The maximum output load is 48Vac unless the screw terminal block connectors are insulated to prevent exposure to hazardous voltages.**

CIRCUIT DESCRIPTION

This product started out as an extension of our popular Kit 3074 "PC Printer Port Relay Board". The idea was to redesign the PCB to fit into a plastic case and add some inputs as well. At the same time a "latch" was added so that the PC could be switched off without affecting the relays. This proved to be difficult due to the PC's POST (Power-On Self-Test) function, which would operate and release relays during power up. The easiest solution was to use the serial port.

The circuit is very simple and straightforward. The brain of the board is IC1, an 89C2051 microcontroller from Atmel. This was chosen because it has the required number of I/O pins and a built in serial port. It is pre-programmed to process all commands received via the serial port, control the relays and monitor the inputs.

IC8 provides conversion between TTL and RS232 signals. IC2 is an octal relay driver, ULN2803A, and is used to drive each of the relays. The opto-couplers, IC4-7, are used to provide electrical isolation between the inputs and the rest of the circuitry.

At power-up, all relays are off (released) and the data LED is off. A reset switch is provided for manually turning off all relays. The data LED flashes whenever a valid command is received.

CONNECTIONS

You will need:

- A 12Vdc centre positive 500mA minimum power supply (our Order Code [660.446UK](#) is suitable). NB Some cheap switch-mode power supplies can be so noisy that the board will not work with them
- A **straight through 9 pin serial cable** (our Order Code [LDC441](#)) or a USB to Serial converter lead (like our Order Code [PCUSB6](#))

You will need to make a note of the COM port number your OS has allocated. You can check this in Windows under the "Ports (COM & LPT)" heading in Device Manager.

If you use a USB to serial converter please bear in mind that the COM port number can change each time you plug in the USB lead. This is especially true if you use a different USB socket each time so try to always plug into the same one.

OPERATION

There are four ways to communicate with the board:

1. Our free Windows software interface
2. A terminal emulator program like HyperTerminal
3. DOS type batch files
4. Writing your own software

WINDOWS SOFTWARE

The easiest way to get started is to download our Windows software interface (tested on Windows 10, 7, 2K, XP, NT and 9x) from:

www.quasarelectronics.co.uk/software/3108.zip

Once you have installed the software, connect the board as described above. Start the 3108 software program and enter the correct COM port number (under the Port menu option).

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Press the “Activate” button to connect the software to the hardware. If everything is correct you will see the Data LED start to rapidly flash. If nothing happens, check the COM port number is correct, the power LED is lit and the cable.

Press the square “SET” button for Relay 1 followed by the “Write” button. You should hear relay 1 click on. Play with the interface buttons to get a feel for how it works. Apply a voltage of 5-24Vdc to each of the inputs and see their status update on the interface. Press the “Activate” button again to disconnect from the hardware.

Detailed information on using the software can be found under the Help menu.

TERMINAL EMULATOR PROGRAM

If you are running a pre-Windows 7 PC, “HyperTerminal” is supplied free with the operating system (you may need to install it from the system disk). For those running later versions of Windows, you can download and use a free third party program like Tera Term or PuTTY (www.putty.org). If you run a different OS then you can Google an equivalent program.

Regardless of the OS used, the communication parameters need to be set for 9600 baud, 8 data bits, 1 stop bit, no parity and no flow control (or **9600,8,N,1** for short).

- Bits per second : 9600
- Data bits : 8
- Parity : None
- Stop bits : 1
- Flow control : None

You also need to ensure you are creating a connection using the **correct COM port number**. Search YouTube for a tutorial if you need help setting up the connection.

Communicating with the Board

Once you have set up the software connection you can test it works with the board. Connect the board to the serial port on your PC. Switch on the power. The hardware outputs a ‘#’ character as a prompt to indicate it is waiting to receive commands.

Type the command “N1” (or “n1”) to turn on Relay 1. You should hear a faint click as the relay activates. Send the command “f1” to turn it off. The command “rff” turns on all the relays and “r00” will turn them all off. Send the command “t0” to toggle all the relays. Press the hardware Reset button and you will hear them release.

Enter “i0”. You should get “00” in response. Connect between 5 – 24Vdc to the 2-pole connector of Input 1 (note the correct polarity on the fascia panel). Enter “i0” again. You should get “01” as the status. In position 2 you should get “02”, position 3, “04”, position 4, “08”. With all inputs positive you should get “0F” as the input status.

IF IT DOES NOT WORK

- Check power supply. Is the red Power LED is lit?
- Is the green Data LED flashing?
- Is the serial cable connected?
- Is the correct COM port selected?
- Are you using a straight through serial cable?
- Is the serial port configured correctly?
- Is other software currently using the serial port?

COMMANDS

A set of simple text commands is used to control the relays, return their status or read the inputs. Each command consists of a string of ASCII characters followed by carriage return (Enter).

The ‘#’ character is output as a prompt to indicate the board is waiting for a command. It should be on your screen. Each character received is echoed back. On completion of each command, good or bad, a carriage return/line feed combination is output followed by the ‘#’ prompt. If the command or parameter is invalid, the command is ignored and a ‘?’ is output before the next ‘#’ prompt.

Note:

- Commands are not processed until the carriage return character is received
- Commands can be in upper or lower case
- Relays are numbered 1 to 8. Relay number ‘0’ (zero) indicates ALL relays
- Inputs are numbered 1 to 4. Input number ‘0’ (zero) indicates ALL inputs
- Where a hex byte is used, each bit within the byte indicates its corresponding relay or input. Bit 0 indicates relay or input 1, bit 1 indicates relay or input 2, etc.

Nx – Turn a relay ON (where x = relay number)

E.g. “N3” – turn on relay 3
“N0” – turn on ALL relays

Fx – Turn a relay OFF (where x = relay number)

E.g. “F3” – turn off relay 3
“F0” – turn off ALL relays

Tx – TOGGLE a relay on/off (where x = relay number)

Changes the state of a relay (ON to OFF, OFF to ON)

E.g. “T3” – toggle relay 3
“T0” – toggle ALL relays

Rhh – Set ALL relays directly

“hh” is a hexadecimal byte. Each bit within the byte indicates whether the corresponding relay is operated or not. If the bit is ‘1’ then the relay is operated, if the bit is ‘0’ then the relay is released.

E.g. “R55” – relays 1,3,5,7 ON, all others OFF
“R0F” – relays 1-4 ON, all others OFF

Sx – relay STATUS (where x = relay number)

A ‘0’ (zero) is returned if the relay is released, ‘1’ if operated.

The command “S0” returns the status of ALL relays. In this case a hex byte is returned. Each bit within the byte indicates the status of the corresponding relay.

E.g. “S3” – returns the status of relay 3
“S0” – returns the status of ALL relays

Ix – INPUT status (where x = input number)

A ‘1’ is returned if the input is active or enabled, ‘0’ if it is off.

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The command "I0" returns the status of ALL inputs. As with the 'S' command, a hex byte is returned. Bits 0-3 indicate the status of inputs 1-4. Bits 4-7 are unused and are set to '0'.

E.g. "I1" – returns the status of input 1
"I0" – returns the status of ALL inputs

Note the output is in ASCII hex, not ASCII decimal.

A0 – COMBINED RELAY & INPUT status – returns the status of all relays and inputs in the format "RRII"

A **special command, '?'**, will print the firmware version information.

BATCH FILES

It is possible to control the board using batch files. However batch files can only send data to the board, they **cannot** process any data received back from the board. Therefore it is possible to operate and release relays but not to read the status of the relays or the **inputs**.

If controlling relays is all you need to do then using batch files is a simple way to do it. Maybe get our Kit 3074 or 3165 which are specifically designed for batch control.

The following example shows the batch file commands required to send commands to the board (assuming the board is connected to COM2)

```
MODE COM2: BAUD=96 PARITY=N DATA=8 STOP=1  
ECHO "N3" >COM2
```

The "MODE" command sets up the serial port to the required communication settings.

The "ECHO" command is normally used to write text to the screen. Using the output re-direction operator ">" causes the text to be sent to the serial port.

The second line sends the command "N3" to COM2 which causes relay 3 to turn on. Just keep adding ECHO commands to send further commands to the board.

WRITING YOUR OWN SOFTWARE

As previously mentioned the board is controlled via a set of simple text commands. Similarly all responses output by the board are in text format. This makes it quite easy to communicate with the board.

Using the serial port also makes it easier to write your own software to operate the board. Visual Basic comes with a full set of functions to use with the serial port, as do most high level languages.

QBasic is freely available online for Windows and DOS based operating systems and is quite easy to use. The following QBasic example shows how to access the serial port and send commands to and receive data from the board. The 'Line Numbers' are for explanation purposes only and are not required.

This sample program configures the serial port and reads the status of inputs 1-4. It then sets relays 1-4 accordingly. For example, if input 1 is 'high' and inputs 2-4 are not then relay 1 will be operated and all the other relays released. In other words relays 1-4 are set according to the condition of inputs 1-4.

```
1. OPEN "COM2:9600,N,8,1" FOR RANDOM AS 1  
2. PRINT #1, "I0"  
3. INPUT #1, A$  
4. INPUT #1, A$  
5. PRINT "Input Status: "; A$  
6. PRINT #1, "R"; A$  
7. INPUT #1, A$  
8. PRINT #1, "S0"  
9. INPUT #1, A$  
10. INPUT #1, A$  
11. PRINT "Relay Status: "; A$  
12. CLOSE #1
```

Line 1 configures COM2 for 9600 baud, 8 data bits, 1 stop bit and no parity. The COM port is assigned 'channel #1'. Change it to whatever COM port you wish to use.

Line 2 sends the command 'I0'. This command returns the status of ALL the inputs. Output is in ASCII HEX.

Line 3 reads a line of characters and assigns them to variable A\$. Since the board echos back all commands sent to it, this is simply reading back the previous command string, 'I0'. It is ignored.

Line 4 reads the status of the ALL inputs (the output of the 'I0' command). The input status is contained in variable "A\$".

Line 5 prints the input status to the screen.

Line 6 sends the 'R' command letter followed by the input status contained in "A\$". The 'R' command sets ALL relays directly according to the following hex byte. In this case the hex byte is the input status just read.

Line 7 reads in the 'R' command letter and hex byte that was echoed back by the board, as in line 3.

Line 8 sends the command 'S0'. This command returns the status of ALL the relays.

Line 9 reads in the echoed command, as in lines 3 and 7.

Line 10 reads the status of the ALL relays (the output of the 'S0' command).

Line 11 prints the relay status byte to the screen. It should be the same as the input status byte.

Line 12 closes the COM port opened at the start of the program.

Note:

The module echoes all characters received back to the host computer. These characters must be processed or input overrun errors will occur. In QBasic, a statement such as INPUT (or LINE INPUT) will do that and should be used after each command is sent to the board.

PURCHASING & SUPPORT

You can order this product online at:

www.quasarelectronics.co.uk/3108.htm

Please send support requests, comments and error reports to support@quasarelectronics.co.uk

Please see our website for our full range of products:

www.quasarelectronics.co.uk

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GENERAL RELAY INFORMATION

Warning! Risk of Electric Shock!

This information concerns kits and modules with relay outputs. **TO USE THE RELAY OUTPUTS**

SAFELY YOU MUST OBSERVE THE MAXIMUM VOLTAGE AND CURRENT LIMITS QUOTED IN THE PRODUCT DOCUMENTATION (this is because the board design may not be rated to switch the maximum voltage and current limits printed on the relay itself or specified in the relay manufacturer's data sheet). Controlling mains equipment with relay outputs must be treated with extreme caution. Electric shocks can cause severe and permanent injury or even death. Construction, installation, testing and commissioning should only be attempted by suitably qualified persons, or under the supervision of a suitably qualified person. These products are not suitable for children. Before connecting mains powered equipment to the relay outputs please check with the relevant authorities in order to ensure compliance with all current safety regulations. Many areas of the assembly may operate at mains voltage. A suitable isolating enclosure must be used. Exposed screw terminal blocks on some products must be insulated to prevent contact with exposed metallic parts at mains potential. Connected equipment should be suitably fused.

You will find relay outputs on many of the kits and modules that we sell. A relay is an electrically operated on/off switch. The voltage and current limits specified in the product documentation generally relate to resistive or light inductive loads.

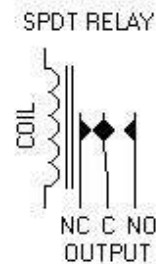
Relay Terminals

Most boards have SPDT (Single Pole Double Throw) style relays. These have three outputs:

C = Common

NO = Normally-Open contacts connect the circuit when the relay is activated; the circuit is disconnected when the relay is inactive. It is also called a Form A contact or "make" contact.

NC = Normally-Closed contacts disconnect the circuit when the relay is activated; the circuit is connected when the relay is inactive. It is also called a Form B contact or "break" contact.

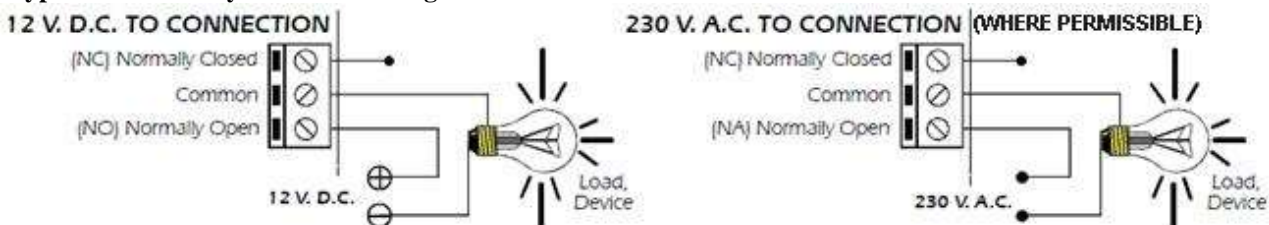


Connecting the Device you want to Control

You must provide an external power source to the device you want to control. No voltage is present at the relay terminals (remember it is just a switch). The relay is normally connected in *SERIES* with the positive (+) power wire of the device you want to control.

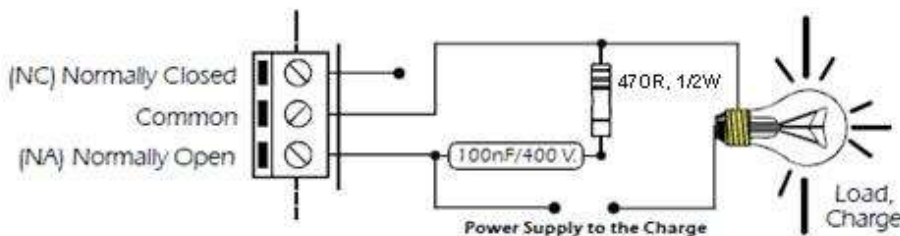
In this case, the positive wire from the power source should be connected to Common. Then either the NO or NC terminal (as appropriate for your purpose) is connected to the positive (+) wire going to the device you want to control. The negative (-) wire does not connect to the relay at all. It goes directly from the power source negative output to the device negative (-) terminal.

Typical SPDT Relay Connection Diagrams



Anti-Spark SPDT Relay Connection Diagram

Sometimes the connected equipment can cause arcing across the relay contacts. This must be corrected by installing a resistor and capacitor (not supplied) between the two contacts of the relay as shown below. Component values are for 230Vac mains.



We accept no responsibility for injury, loss, or damage of any kind caused by or resulting from improper product assembly, testing, commissioning or use.

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